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Monitored this issue:

Risks of lifetime extension in general and for NPP Borssele in particular

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Introduction

The global nuclear reactor fleet is increasingly ageing. Most reactors were designed for a lifetime of 30-40 years. When they are operated beyond their design life, it is called lifetime extension, or long-term operation. The second term is used by pro-nuclear organizations, while critical experts prefer the term "lifetime extension" to make visible that the original design life has been reached. Nevertheless, the term "lifetime extension" does not have a legal basis. This has lead to an unclear situation concerning participation of the public.

In some countries, nuclear power plants are granted unlimited operating licenses, other countries issue licenses that are limited in time, and in some countries the operating life of a nuclear power plant is regulated by law. Regular periodic safety reviews (PSR), which must be carried out every 10 years, should ensure safe operation in all cases.

The World Nuclear Industry Status Report gives a yearly up-to-date overview of the age of the global reactor fleets. In January 2025, the mean age of the global reactor fleet was 32.1 years[1]. In the European Union, the mean age is even higher, in September 2024 it was 38.4 years[2]. The world's oldest reactor is still operating in the middle of Europe – Beznau in Switzerland started in 1969 and therefore is now 56 years in operation.

One of the most recent lifetime extension project is NPP Borssele in the Netherlands. Borssele consists of one reactor with 485 MegaWatt(electric). It is in operation since 1973. According to Art. 15a of the Dutch Nuclear Energy Act, Borssele may continue to produce energy only until the end of 2033, which corresponds to a service life of 60 years. The operating life is now to be extended due to a political decision from 2021. This requires an amendment of the Nuclear Energy Act. An Environmental Impact Assessment (EIA) is being carried out for this amendment; a second EIA phase is also planned.

In this article we will discuss possibilities for public participation in life-time extension procedures and highlight the risks of lifetime extension of an old NPP in general and for Borssele in particular.

Participation in lifetime extension procedures

The majority of lifetime extensions in the EU and neighboring third countries have so far taken place without the population having a say. This contradicts the intention of important international conventions (ESPOO and Aarhus[3]) and the EU directives on

[1] WNISR 2024, https://www.worldnuclearreport.org/

[2] https://www.worldnuclearreport.org/European-Union

[3] The Espoo Convention is the legal framework for transboundary Environmental Impact Assessments (EIA); she entered into force 1997. The Aarhus Convention regulates access to information, public participation and access to justice in environmental matters; she entered into force in 2001. Both Conventions includes NPP in their scope.

environmental impact assessments (EIA) and strategic environmental assessments (SEA).

The above mentioned unclear legal situation on what is a lifetime extension and what is not was discussed in detail in the Espoo Convention Implementation Committee already more than 10 years ago. In 2014, the Implementation Committee decided that the lifetime extension of the concrete case of the Ukrainian NPPs Rivne-1&2 would have needed an EIA. Rivne-1&2 started operation in 1980/81. In 2010, their lifetime was extended by 20 years without making an EIA, which was challenged at the Espoo Convention Implementation Committee by the Ukrainian NGO Ecoclub. Both nuclear-free countries such as Austria and major international NGOs assumed after the Rivne decision in 2014 that lifetime extensions for all NPPs would from now on fall within the scope of the ESPOO Convention and would need to be subjected to a transboundary EIA. Since 2020 there is the "Guidance on the applicability of the Convention to the lifetime extension of nuclear power plants"[4] in force, but still many states take a different view and license their lifetime extensions without an EIA.

Why is it so important that an EIA takes place? In many countries, an EIA is the only legally secured participation procedure that is open for the general public, especially for NPPs outside the own country. Some countries only offer participation for the local or regional population around the NPP site, some countries conduct voluntary procedures.

Moreover, in an EIA all environmental impacts of an activity need to be assessed, this includes not only noise and dust during construction but also dangers for habitats of plants and animals, nuclear waste management, radioactive emissions during normal operation and – most important in a transboundary context – consequences of severe accidents.

Even before their lifetime extension, old European NPPs have not been subjected to an EIA at all because the first EU EIA law only came in force in 1985 (only valid for EU member states), and the ESPOO Convention in 1997 (only valid for signatory countries). A comprehensive assessment of the environmental impacts of these old NPP is therefore missing at all; a first EIA during lifetime extension is necessary to fill this gap.

NGOs complain about missing participation (esp. EIA) in the lifetime extension procedures of old NPP in different ways, by going to Court, by making a complaint at the Espoo Implementation Committee or at the Aarhus Convention Compliance Committee (ACCC).

This was also the case when the lifetime of the NPP Borssele in the Netherlands should be extended. Borssele was designed with a lifetime of 40 years. It started operation in 1973. After 40 years, in 2013, in the Nuclear Energy Act Article 15a was changed allowing the lifetime to be extended until 2033. This extension did not include an EIA. Greenpeace Netherlands made a complaint at the ACCC resulting in a decision in 2018. The ACCC *"considers it inconceivable that the operation of a nuclear power plant could be extended from 40 years to 60 years without the potential for significant environmental effects. The Committee accordingly concludes that it was "appropriate", and thus required, to apply the provisions of article 6, paragraphs 2-9, to the 2013 decision amending the licence for the Borssele NPP to extend its design lifetime until 2033."*[5] Article 6 of the Aarhus Convention regulates public participation in decisions on specific activities. The Aarhus Convention does not require an EIA as such, but

[4] https://unece.org/sites/default/files/2021-07/2106311_E_WEB-Light.pdf

[5] https://unece.org/fileadmin/DAM/env/pp/compliance/CC-63/ece.mp.pp.c.1.2019.3.en.pdf, point 71

comprehensive, comparable public participation.

In 2021, a decision of the ACCC and the Meeting of the Parties of the Aarhus Convention was taken that the public did not have sufficient participation possibilities when Art 15a was included in the Nuclear Energy Law in 2010.

In 2024, the long overdue EIA started, two phases are foreseen The first phase deals with the environmental impacts of changing Article15 of the Nuclear Energy Act. This EIA phase 1 provides the scope for environmental impacts that need to be discussed in detail in EIA phase 2. For the first EIA phase, an environmental impact report.

Technical risks of lifetime extension

As in any industrial plant, the quality of the materials used in a nuclear power plant decreases over time due to aging. In addition, the safety design of the nuclear power plant becomes outdated in relation to current safety requirements. It is not possible to replace all safety-relevant components affected by aging, nor is it possible to eliminate all design weaknesses through modernization measures.

The Borssele NPP, one of the oldest operating NPP in the world, is a 2-loop Pressurized Water Reactors (PWR) constructed by the German company Siemens/KWU. Four different constructions lines (CL) were developed and operated. The Borssele NPP belongs to the oldest CL 1, both other reactors of CL 1 have been already shut down permanently in 2003 (Stade, Germany) and 2005 (Obrigheim, Gemany), respectively. Besides three younger reactors in Spain, Switzerland and Brasilia, all KWU reactors were shut down permanently.

The original safety report of the Borssele NPP covered a 40-year operational lifetime, equating to the closure in 2013. However, in 2006, a political agreement (“Borssele Covenant”) allowed the operation to 2033 under certain conditions. One requirement is that the Borssele NPP belongs to the top 25% in safety of reactors in the EU, Canada and the USA. To assess whether Borssele NPP meets this requirement, the Borssele Benchmark Committee has been established. In its third report, the committee has selected important safety-related points of the design for comparative evaluation.[6] However, other important design features are missing, such as the thickness of the reactor building.

Apart from the fact that the Committee’s assessment is not very credible, especially in view of the results of the safety review of the German Technical Support Organisation (TSO) GRS (Gesellschaft für Anlagen- und Reaktorsicherheit, engl. *Plant and Reactor Safety* Company)[7], a comparison with the safety level of new nuclear power plants should be made to assess the safety level of the Borssele NPP.

In 2008, the German TSO GRS developed a procedure for comparing the safety of German NPPs of the different ages. The comparison showed that the NPP Neckarwestheim-1 (GKN-1), commissioned in 1976 (KWU CL 2) had a safety disadvantage in 17 of 23 assessment objects compared to GKN-2 (1989, KWU CL 4). Weaknesses were found at all levels of the defense-in-depth concept, i.e. the safety concept that is intended to prevent accidents and prevent their potential effects (conceptual outdated design).

The comparison also revealed that the average annual event rates at GKN-1 are significantly higher in the area of events with ageing relevance; actually, the number is four times

[6] Borssele Benchmark Committee (2023): Safety benchmark of Borssele, Nuclear Power Station; Report of the Borssele Benchmark Committee; November 2023.

[7] https://www.grs.de/en

higher (technical ageing). The ageing management programme of the Borssele NPP has weaknesses as the results of the current IAEA OSART mission revealed. The results of the OSART mission contradict the statements of the EIA REPORT (2024) that the ageing management effectively prevents physical ageing as well as technological ageing (obsolescence).[8]

Accident analysis

The provided EIA documents give some information about Design Basis Accidents (DBA). The information about Beyond Design Basis Accidents (BDBA), however, is very limited. Neither the accident scenarios nor the possible source terms (amount of release of radioactive substances in case of a severe accident) are provided. According to the EIA REPORT (2024), the calculated core damage frequency (CDF) has decreased due to backfitting. However, information on frequencies for large releases (LRF) is not provided. Even though the calculated probability of severe accidents with a large release is very low, the consequences caused by these accidents are potentially enormous.

Core-melt accidents can cause a failure of the containment. These scenarios are associated with large releases. In 2017, an in-vessel molten core retention by creating a cooling opportunity of the outside of the reactor vessel has been implemented. This could be an important safety improvement. But still other scenarios are possible. To assess the consequences of BDBAs, it is necessary to analyze a range of severe accidents, including those involving containment failure and containment bypass. Such severe accidents are possible for the Borssele NPP.

According to ANVS (2019), the probabilistic safety analyses (PSA) Level 2 demonstrated that Steam Generator Tube Rupture (SGTR) events with a dry secondary side of the steam generator could cause the largest source terms (up to 50% Cesium and Iodine inventory of the core).[9] By a backfitting measure, the possible source term could only be reduced but will still remain high. Furthermore, the function of retrofitting in an accident situation is not guaranteed.

Terror attacks and acts of sabotage

Terrorist attacks and acts of sabotage can have significant impacts on nuclear facilities and cause severe accidents – also on the Borssele NPP. Nevertheless, they are not mentioned in the provided EIA documents. In comparable EIA Reports such events were addressed to some extent. Although precautions against sabotage and terror attacks cannot be discussed in detail for reasons of confidentiality, the necessary legal requirements should be set out in the EIA documents.

This topic is in particular important because the reactor building of the Borssele NPP is vulnerable against airplane crashes. The reactor building should protect the plant against attacks from outside. This needs a wall thickness of the reactor building of almost 2 m. However, the wall thickness at the Borssele NPP is only about 0.6 m to 1.0 m.

Furthermore, a recent assessment of nuclear security in the Netherlands points to shortcomings compared to necessary requirements for nuclear security. The US Nuclear Threat Initiative (NTI) assessed the measures taken by different countries to protect against terrorist attacks and sabotage in their nuclear facilities in the so-called

[8] Environmental Impact Assessment. Amendment of the Nuclear Energy Act. Ministry of Economic Affairs and Climate Policy. 14. June 2024.

[9] Authority for Nuclear Safety and Radiation Protection (2019a): Convention on Nuclear Safety (CNS): National Report of the Kingdom of the Netherlands for the for the Eighth Review Meeting, 2019

Nuclear Security Index 2023. In the NTI Index, 100 corresponds to the highest possible score and thus to the fulfillment of the current security requirements. Low scores for "Insider Threat Prevention" (73) and "Security Culture" (50) indicate deficiencies in these issues.[10]

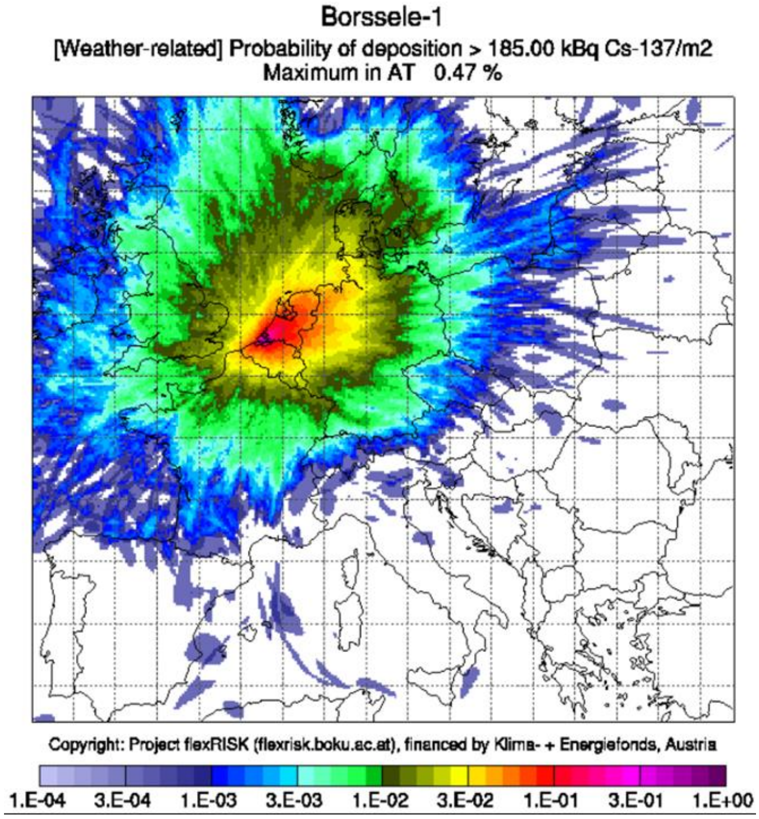
Military action against nuclear facilities is another danger that needs special attention in the current global situation. Furthermore, the increasing availability and performance of drones is raising the potential threat to nuclear facilities.

Consequences of a severe accident in Borssele

In case of a severe accident in Borssele, almost all parts of Europe could be affected, but with different probability. The project flexRISK[11] identified source terms for severe accidents, for Borssele a possible source term of 31.87 Petabecquerel Cs-137. This source term was calculated with respect to the behavior of the plant in case of a severe accident and the possible release.

Calculations of the flexRISK project can be used for the estimation of possible impacts of transboundary emission of Borssele. For about 2,800 meteorological situations the large-scale dispersion of radionuclides in the atmosphere was simulated. For example, flexRISK determined the weather-related probability for a contamination of European territory with more than 185 Kilobecquerel Cs-137/m^2 by a severe accident in Borssele. 185 kBq Cs-137/m^2 was the Belarussian threshold for zones with the right to resettlement after the accident of Chernobyl.

Results are shown in the following figure. The scale starts at 1E+00 = 1 = 100% which means that in every of the 2,800 weather situations the dark violet area will be contaminated with more than 185 kBq Cs-137/m^2 in case of such a severe accident (this is the area in the direct vicinity of the NPP). Larger parts of western Europe are in the red, orange and yellow areas, meaning that they have a weather-related probability of a few up to about 10% to be contaminated this high. Austria, which is in a larger distance, has a probability of 0.47% to be affected.



Conclusions

Lifetime extension of old nuclear power plants as the Borssele NPP increases the risk of severe accidents in Europe. The ageing of nuclear power plants possess a significantly

[10] NTI Nuclear Security Index 2023: The NTI Index for the Netherlands. https://www.ntiindex.org/

[11] http://flexrisk.boku.ac.at/en/projekt.html

risk of severe accidents and radioactive releases. This significantly increased risk is further significantly increased by the continued operation of old plants as a result of lifetime extensions. Furthermore, essential safety principles (such as protection against external events) were not applied or only to a limited extent at the time of construction. From today's perspective, old nuclear power plants such as the Borssele nuclear power plant have numerous design weaknesses. With the increasing age of the plant, these conceptual deviations from the safety level required today for new plants are becoming ever greater.

In addition, new threat scenarios have emerged. Terrorist attacks and extreme natural events, e.g. as a consequence of climate change, can no longer be neglected as real dangers. In principle, backfitting measures are limited. Significant design weaknesses of old nuclear power plants remain.

The risks of the Borssele nuclear power plant must be known to political decision-makers and the public in order to be able to assess their safety. Therefore, it is of uttermost importance that the public is involved in decision-making on lifetime extension of old NPP, it the resulting risk is acceptable for society or not.

Further reading:

INRAG: “Risks of lifetime extension of old nuclear power plants” (2021): https://www.inrag.org/risks-of-lifetime-extension-of-old-nuclear-power-plants-download

Oda Becker, Kurt Decker, Gabriele Mraz (2024): NPP Borssele LTE Phase 1. Environmental Impact Assessment. Expert statement. https://www.umweltbundesamt.at/fileadmin/site/publikationen/rep0931.pdf

Why small modular reactors do not exist - history gives the answer

David Toke

I'm the urban spaceman, baby; here comes the twist-- I don't exist (Bonzo Dog Doo-dah band)

In recent years we have seen many stories with an upbeat message about small modular reactors (SMRs) and ‘races’ to develop them. But in fact, the concept of SMR is a bogus term that tries to give the impression that something new in nuclear power is afoot. It most certainly is not. In fact what are called SMRs cannot easily be distinguished from nuclear power plants that were built in the 1940s to 1960s, long before the SMR notion was invented. The term SMR does not exist as a useful definable concept

Even examples of new so-called SMRs are practically non-existent around the world when it comes to operating projects. But there has been a tremendous amount of hype. Indeed the hype seems to grow in inverse proportion to the lack of any projects being completed. First, a definition:

According to the International Atomic Energy Agency:

‘Small modular reactors (SMRs) are advanced nuclear reactors that have a power capacity of up to 300 MW(e) per unit, which is about one-third of the generating capacity of traditional nuclear power reactors. SMRs, which can produce a large amount of low-carbon electricity, are:

Small – physically a fraction of the size of a conventional nuclear power reactor.

Modular – making it possible for systems and components to be factory-assembled and transported as a unit to a location for installation.

Reactors – harnessing nuclear fission to generate heat to produce energy.' (Ref: see HERE)

Yet the problem with this definition is that none of this represents anything new i.e. something that has not been done long ago. The term 'advanced' is vague and does not seem to exclude approaches that have been tried before. The notion of modular is even more misleading in practice. That is because having smaller reactors reduces the scope for factory production of components.

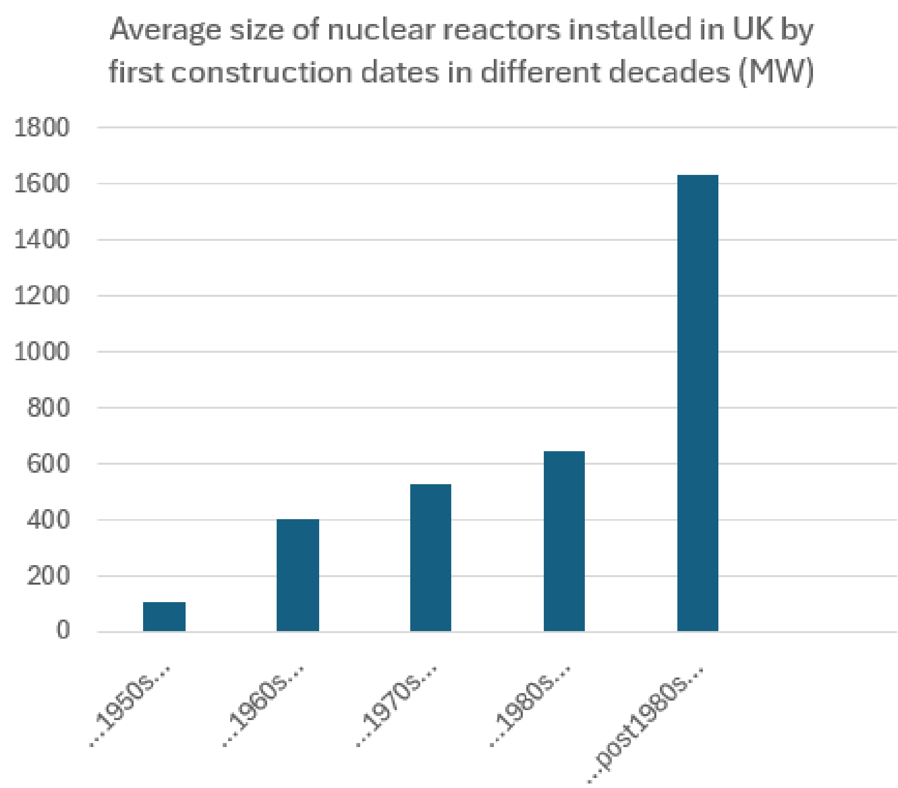
There are fewer economies of scale for small reactors compared to making parts for larger-scale reactors (which require more parts of a particular type). The word 'reactor' is not new. So what's new? Certainly nothing, in my view, to warrant the ascription of 'fourth generation' nuclear designs that these so-called SMR proposals have often been given

In practice, even projects that are called SMRs are very, very few in operation around the world. There are very few even under construction, and the ones that are seem to be taking a long time to build. That is, according to the International Atomic Energy Agency. So how can we explain this apparent contrast between, as the media stories put it 'races' to develop SMRs, and reality?

The problems with the concept of SMRs can be explained by reference to the historical development of nuclear power. In the 1950s and 1960s, the nuclear industry found that the (then) existing designs of small(er) reactors, what is now called SMRs, were uneconomic compared to larger reactors. As a result, the industry developed larger reactor types. The larger reactors, of course, have had very big construction problems and costs. However, this should not obscure the fact that in comparison the smaller reactors were even worse. Let us look at some of the reactor history in terms of size.

Reactor size and history

Chart 1



Source: International Atomic Energy Agency (See HERE)

Originally, after WW2, the first electricity-generating nuclear reactors were designed for nuclear submarines. These pressurised water reactors (PWRs) range from a few MWe to over 100MWe for the largest submarines today. I would say that they are the original small nuclear reactors. Indeed here it gets a bit confusing. Why aren't these submarine reactors called small modular reactors? Essentially, I think, because they do not fit into the current narrative which tries to give the impression that there is a new type of advanced reactor called an SMR.

Small reactors were then designed, starting in the 1950s, for land-based operations to supply mainstream electricity grids. Then design sizes increased and PWRs became the dominant technology throughout the world. Chart 1 shows how nuclear reactor sizes have increased over the decades in the case of the UK. You can see how the average design size for reactors increased from around 100 MW in the 1950s, to 400 MW in the 1960s, over 500 MW in the 1970s, and then to over 1000MW since the 1980s.

There is a very good reason that design sizes increased from the 1950s onwards. Indeed this reason seems to have been mostly overlooked in the blizzard of press releases about small modular reactors. It is all to do with the economies of scale.

There was a (at the time, well-regarded) book published in 1978 by Bupp and Derian (see later reference). This summed up the reason why the rush of ordering nuclear reactors in the USA came to an end in the 1970s. It has great relevance to the issue of small reactors today. It is all to do with the size and cost and also the safety requirements of reactors. They said:

'In 1955 a 180 MW light water reactor design called for more than 30 tons of structural steel and about one-third of a cubic yard of concrete per MW. By 1965 a much larger plant of about 550MW required less than half as much of these materials per megawatt of capacity. These efficiencies reflect classic 'economies of scale'. Then, in the late 1960s, the trend reversed. Larger light water plants began to require more, not less, structural materials per unit of capacity; by 1975, the steel and concrete needed per megawatt for 1,200 MW plant approximately equaled the 1960 requirement for a 200-300 MW design. This reversal was a direct consequence of stricter safety and environmental protection requirements laid down during this period. More stringent safety requirements meant thicker concrete walls.'1

So, essentially, nuclear power plants became bigger because of the drive for economies of scale. A big reason why nuclear power did not continue to become cheaper was because, by the 1970s, demands for stricter safety precautions were being translated into regulations. This meant that the progress in reduced costs had been reversed. More recent (so-called Generation 3) nuclear designs have been based on the hope that ever-bigger reactors with better safety designs would once again pave the way to cheaper nuclear reactors. It has not, of course, happened.

In other words, small modular reactors will not produce cheaper outcomes. Arguing for such a proposition flies in the face of history, not to mention basic engineering economic theory. That is, of course, if we assume that small reactors have to deliver the same safety levels as big reactors. Yet it is difficult to see the regulators scrapping the main safety requirements accumulated since the 1960s just for small nuclear reactors. Why would they? Having a much larger number of smaller reactors would increase the risk of there being a serious accident at one of them.

Progress in constructing new small reactors

This is extremely thin. Only two operating so-called SMRs were identified by the

International Atomic Energy Agency in 2024, and there are very few others (three in fact) listed as under construction (see HERE page 13). So far as I can see all are very well supported by direct state or research demonstration funds. That is they are nowhere near becoming commercial propositions able to survive on the promise of privately funded bank loans and equity investment.

Of the two so-called SMR plants in operation, one is a 200 MWe reactor built in China (See HERE) - which as you can see in Chart 1 is actually rather bigger than the average reactor size in the UK designed in the 1950s. Not only that, but it took a total of 12 years to construct (see HERE). The other operational project is based on a ship in Russia. This could be described as a variation on a submarine reactor built to support a very niche market, with financing details not available.

One of the three of the three so-called SMRs under construction is being built in Argentina (and whose funding stream is threatened by Government cutbacks). This has a 32MWe reactor and is a variant of a PWR. Construction began in 2014. This is oriented mainly not to electricity production but to an extremely limited market in radioactive products.

The second is a 300 MWe 'fast' reactor being built in Russia. Fast reactors are certainly not new. They have been tried in various countries before (including the UK) and have not been commercially successful.

A third, much publicised, development is the 150 MWe Kairos reactor in the USA. This power plant is sited at East Tennessee Technology Park. The US Government's Department of Energy is supporting the construction of the project. It is a 'pebble' bed high temperature, gas cooled reactor. Although called 'Advanced' pebble bed reactors were first mooted in the 1940s and have been tried and discontinued before.

Indeed, as Steve Thomas has said about the notion of 'Advanced' reactors (see HERE) 'The advanced designs are not new. For example, sodium cooled fast reactors and high temperature reactors were built as prototypes in the 1950s and 1960s but successive attempts to build demonstration plants have been short-lived failures. It is hard to see why these technologies should now succeed given their poor record. Other designs have been talked about for decades but have not even been built as prototype power reactors – so again it is hard to see why the problems that prevented their deployment to date will be overcome.'

Other variants, including thorium-based plants are proposed (most recently in China). On the one hand, all of these ideas have been tried before, but are being presented as 'new' developments. They have failed before. **These warmed-up versions of previously tried technical nuclear fission variants do not solve nuclear power's basic cost problems. These problems involve too much steel, and concrete and the need for unique, very expensive, types of parts and techniques that are too specialist to be sourced from standard industrial supply chains.**

This (Kairos) project was made famous by an announcement from Google to buy power from it. However, beyond that, I have no information about how much money Google has actually spent on the project or indeed how much it has agreed to pay for the power the reactor will produce.

Indeed the Autumn of 2024 saw a flurry of announcements of support for so-called SMRs from 'Tech Giants'. However, the terms of the financial support were generally vague. The announcements were made just prior to the General Election and seemed to respond to the rising hype about powerful AI. In a different blog post I analyse this AI over-hype, (see HERE).

Of course, we can all agree to buy power from people for a specified price by agreeing to PPAs. No commitment to part with money is necessarily required. Whether banks and equity investors are willing to lend money to the energy project in question on the basis of such PPAs is an entirely separate matter.

SMRs in the UK

There are no projects called SMRs operating in the UK. None are under construction and none are in the process of getting anywhere near construction starts. The UK Government for its part, amongst a fanfare of publicity about support for SMRs, promises an aim of 'deploying a First-of-a-Kind SMR by the early 2030s' (See HERE). Of course, as Chart 1 above implies, there used to be reactors that are small enough to fit the definition of 'SMR'. They just weren't called SMRs at the time.

Indeed, Rolls Royce, has, for several years been promoting their so-called small modular reactor (SMR) design. This is rather larger than a lot of past British nuclear power plants, albeit none still in operation. Their proposed (so-called) SMR design has gone up to 470MWe (See HERE). It uses PWR technology.

This proposed project is rather larger, for example than the 235 MW units which comprised Hinkley A nuclear power station. This power plant began construction in 1957, started generation in 1966, and stopped generating electricity to the grid in 1999. When construction of this project began such a nuclear power plant would have been called large, not small!

I do not understand the claims made by Rolls Royce for their 'SMR' to be called modular. The power plant has to be constructed on-site. As I have already stated I do not understand why there is more, or even as much, scope for mass production of parts compared to a conventional reactor such as that being built at Hinkley C.

I could say much the same about Holtec, a US nuclear services company who are promoting a 300 MW reactor - again not really that small. Like Rolls Royce, it has been exciting local people in places in Yorkshire with talk of building factories. This seems unlikely to happen without, essentially the UK Government paying for all or at least much of the project.

My prize for the most ingenious piece of SMR promotion are the claims made by 'Last Energy', who are promoting what they describe as a 20 MW PWR reactor. A headline appeared on the Data Centre Dynamics website saying 'Last Energy claims to have sold 24 nuclear reactors in the UK for £2.4 billion' (see HERE). Associated with this was another story in Power Magazine saying (see HERE) that the company had secured PPAs for 34 power plants in the UK and Poland, something that was described as 'extraordinary progress'.

I cannot see any evidence that these power plants are being constructed, ie 'concrete poured' at any site. However, it is claimed that the first project will be finished by 2027. There are reports that the company has been conducting site surveys in Wales (see HERE).

What I find especially puzzling about the Last Energy promotion is the lack of a mention on a specific page on the website of the Office of Nuclear Regulation (ONR). In order for a new design of a nuclear power plant to be licensed to generate in the UK, it has to be approved for what is a very lengthy (several years) and very expensive (many £millions) Generic Design Assessment (GDA). However, there is no mention of Last Energy on the ONR information page giving the current and completed GDAs (see HERE).

Why is all this so-called 'SMR' activity happening now?

There are two interrelated factors in operation here; material rewards and politicalpsychological pressures. Material factors include the designation of governmental programmes to fund demonstrations of so-called SMRs. The second is the possibility of raising share capital to fund projects labeled as 'SMR'.

Of course this in itself does not explain why this has happened in recent years. An excerpt from an opinion piece published in the Guardian in September 2015 can give us an important clue to the political psychology involved. In an article entitled 'We are pro-nuclear, but Hinkley C must be scrapped', written by George Monbiot, Mark Lynas and Chris Goodall, there was a subtitle: 'Overpriced, overcomplicated and overdue, the Hinkley project needs to be killed off and the money invested into other low-carbon technologies'. The authors' recommendations for alternative funding went on to say: 'We would like to see the government produce a comparative study of nuclear technologies, including the many proposed designs for small modular reactor, and make decisions according to viability and price' (See HERE)

What this looks like to me is a face-saving device. It tries to deal with the (recently re-discovered) fact that new nuclear power stations are much too expensive. I interpret this as a piece of cognitive dissonance to deal with the very apparent limitations of environmentalists trying to promote nuclear power as a response to climate change.

This is a form of cognitive denial of the obvious; that nuclear power is extremely expensive and difficult and very longwinded to deliver. SMRs have been at least partly invented to serve the purpose of shifting mental attention from this fact, a form of denial. The denial is sugar-coated with the notion that we can escape reality by embracing so-called SMRs.

This cognitive dissonance allows people to carry on believing in and promoting nuclear power in spite of reality. A new SMR alternative reality is created. This fills the void created by dull reality.

This, in practice, diverts attention from the central cost problems of nuclear power. These are the quantities of steel and concrete needed to build nuclear power stations, the need for unique types of very expensive parts, and the need for exacting, highly specialised processes of building the reactors. Making smaller nuclear plants will not solve these problems. Indeed it makes them worse insofar as this reduces the possibilities for economies of scale.

Now I am not trying to heap the blame for the SMR fantasies on Monbiot, Lynas, and Goodall - at least not entirely! There is a large well of public wishful thinking attached to things with the word 'nuclear' in them and this well can be tapped by concerted, if flimsily-based efforts. The promoters of the so-called SMR technologies are the ones who have ignored history to produce what is, in essence, a warmed-up version of a long-discarded set of nuclear technological ideas and practices. Indeed I would class this stream of historical re-interpretation as an example of the use of postmodernism in the nuclear industry.

SMRs as nuclear postmodernism

Postmodernism emerged originally in architecture. It was, put simply, about reviving ancient, or at least old, building designs and using them in contemporary building design (See HERE). The old is presented therefore as the new. For buildings, that's a pretty harmless, indeed often pleasing, pathway to adopt. However, to present old (smaller) sizes of nuclear power stations (often mixed in with long discarded design ideas) as new and call them 'Advanced' nuclear technologies is, in my view, doing a great disservice to us all. It skews public debate relatively against real green energy options by presenting an option (so-called SMRs) that does not exist.

Social scientists are often derided for talking about postmodernism. Yet here we see the apparent apotheosis of natural science, the nuclear sector, engaging in precisely this sort of approach. They are presenting the technologies of the 1940s to 1960s as 'new'. We should not have to take it seriously. Many people in the nuclear industry are either living in their own alternative postmodern reality or at least are tolerating this non-existent vision.

There may be a small number of demonstration projects constructed that are called SMRs. They are, and will be, expensive and take a long to build. But they are really just warmed-up old-style versions of the 1950s-1960s-sized reactors, mixed in sometimes with tried and failed techniques. They certainly do not represent an 'advanced' path for a nuclear-powered future. As a concept, Small Modular Reactors have no existence outside of a postmodernist nuclear industry fantasy.

I invite people to listen to Bonzo Dog's old hit 'Urban Spaceman' (see HERE). The general spirit and especially the last couple of lines of the song seem especially apposite to a discussion of so-called SMRs.

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Dutch plans for new nuclear power plants delayed before they started

Jan van Evert

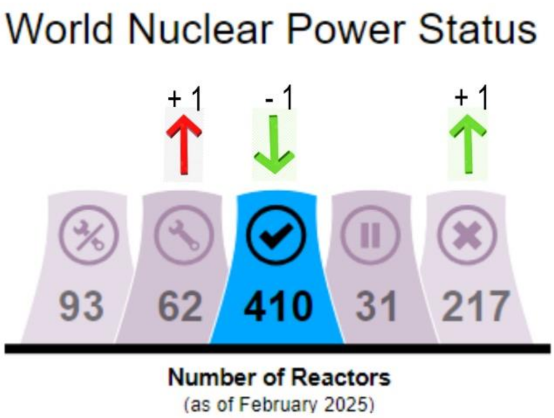
The Dutch government plans to build four large nuclear power plants by 2035. But the minister of climate and energy, Sophie Hermans, has announced in a letter to parliament that "It no longer seems realistic to have the first nuclear power plant operational by 2035." In a committee meeting on the 12th of February on the subject she refused to give a new deadline. Instead she replied that "we also use a third-party review and technical-feasibility studies". Asked by a committee member what can be done to speed up the process she warned: "If we accelerate further, it will always be a trade-off and could potentially always have a price. That could literally be in money, in public support because you have less time to set up a participation process or in risks because you have to take careless decisions".

The minister said she will send a more comprehensive progress letter to parliament in April or early May, with more details on the planning. She also mentioned that the budget of 14 billion euros for the four new plants is 'tight'. That is quite an understatement. The costs of the eight most recently built reactors worldwide averaged 20 billion euros. The construction of the Hinkley Point C nuclear power plant in Great Britain has even cost 50 billion. A recent report commissioned by the UK government concludes that it costs 15 to 17 billion euros to build just one nuclear power plant.

Asked by a member of the opposition where in the world has a nuclear power plant been built on time and within budget she replied: “In Barakah in the United
Arab Emirates, a total of four reactors were built of 1,400 megawatts each.
In the process, there was a bit of a delay and some budget overrun, but that was limited.” In reality the cost of the Barakah reactors was thirty billion euros, ten billion more than the original budget. The construction time of this project was 11 years.

The government plans are also threatened by several proposals to use part of the 14 billion euro budget to solve other problems. Three opposition parties have announced a bill to spend money from the budget to make the Dutch agricultural sector more sustainable. They may get support form the BBB, one of the coalition parties. This party was one of the parties that signed a vote in the Dutch senate to do just that. Another member of the opposition, although being in favour of nuclear energy, warned that "international investors are worried about a lot of things in Netherlands, because there is a lot of uncertainty, also about the stability of the government and so on”.
To complicate things even further, the PVV, the largest coalition party, has announced that they want to use part of the 14 billion euro budget to reduce the heating bill of Dutch citizens. The minister opposed these suggestions: "in my view, this sends a very undesirable signal to the industry. It does something to the reliability of our stated ambition” .

Earlier, minister Hermans wrote in a letter to parliament that the government had failed to find a commercial partner to invest in the construction of nuclear power plants. "Even with extensive governmental support there are no companies that want to take this responsibility”, the minister wrote. This means the for new nuclear power plants will become state owned companies.
There are even more hurdles to take. A recent report calculated that for the construction of the new plants 7000 full time jobs are required. Only 30 percent of that personnel can be recruited in The Netherlands. Minister Hermans has already warned that The Netherlands will remain dependant on foreign knowledge. "How does this relate to other policies such as more selective migration?", she asked in an earlier letter to parliament.
Last but not least the Dutch government has to find suitable locations for these four reactors. Borssele has already been chosen as preferential location for two reactors. Two other locations are being considered: the Tweede Maasvlakte near Rotterdam and Terneuzen in Zeeland. Eemshaven in Groningen is also on the list but is highly controversial due to strong local opposition. The senator of the NSC, one of the coalition parties, said Eemshaven is not acceptable for her party. The procedure of choosing sites for the reactors has already been delayed and will not be finished before the end of this year. The minister said that in the before mentioned letter to parliament in April or early May she will also reveal when this procedure will be finished.
She also announced during the debate that the government is writing a bill to extend the lifespan of the Borssele nuclear power plant to 2054.



Compared to the last edition of the Nuclear Monitor (923);

- ✓ The status of 1 nuclear power reactor (Doel-1) in Belgium has been changed from operating to closed.
- ✓ Construction of Lufeng - 1 has started in China.