2025 Update of

Russian Grip on EU Nuclear Power

Report by Patricia Lorenz

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May 4, 2022

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About the author:

Patricia Lorenz has been working as an anti-nuclear campaigner and expert for GLOBAL 2000, Friends of the Earth Europe, The Joint Project - Nuclear Risk and Public Control and published papers on a multitude of nuclear issues, including Euratom, EU Taxonomy and Stress Tests since 1992.

Contact information: patricia.lorenz@foeeurope.org

Layout:

Annika Lorenz

Contact information: annielorenz02@gmail.com

Acknowledgements:

The author wishes to thank the **Vienna Ombudsoffice for Environmental Protection (Wiener Umweltanwaltschaft - WUA)** for funding this report.

Content

1. Overview of fuel suppliers in Bulgaria, Czechia, Finland, Slovakia and Ukraine as of April 2025

1.1 European utilities and Rosatom

The overview of the fuel contract status reveals that a variety of options have been chosen. Some NPP have contracts in place for Westinghouse fuel deliveries soon; their delivery is regarded as realistic. Some utilities with VVER reactors have concluded – or announced that they are about to conclude – contracts with western suppliers in the distant future. In some instances, a switch to Westinghouse or Framatome is not yet fully assured. The reason may be economic, because Russian fuel is cheaper and the supply and service from the Russian side appears satisfactory.

The Framatome option, which is discussed in chapter two, "Fuel Factory Lingen – the Kremlin's Outpost in Germany*",* consists of two paths: licensed fuel and new design fuel. Advanced Nuclear Fuels GmbH (ANF) announced that in the period up to 2030, the fuel being sold as western-made Framatome fuel will be actually Rosatom license fuel but put together in central Europe. Starting in the 2030s, Framatome's own design of fuel is supposed to be delivered to the remaining VVER reactors. Even assuming that the operating lifetime of some VVERs is extended, the market will continue to shrink, with only Mochovce 3 and 4, and Paks 5 and 6 being, or due to be, newly connected to the grid. More VVER may be ordered and start operating outside the EU (Egypt, India, etc.) but Rosatom would not hand these markets over to Framatome. Consequently, we can conclude that there will be no "100% sovereign European technology."[1] Framatome fuel will enable Rosatom to keep its foot in the door, or rather in the heart of Europe. (See chapter two: "Lingen VVER Fuel Factory – Source of Independent VVER Fuel or Rather Kremlin's Outpost in Europe?")

1.2 Rosatom reactor exports and subsequent fuel and service

The broader overview of the situation in countries with VVER reactors and beyond in the past years was described in the report *Russian Grip on EU Nuclear Industry in 2022* with a *2024 Update*.[2] The following country updates therefore only summarize the most recent developments, in order to understand where the efforts to change the fuel supplies has led the utilities.

Bulgaria

Bulgaria is operating two VVER-1000 reactors at the Kozloduj site. Westinghouse was chosen as the future fuel manufacturer for unit 5, and the first fuel was loaded in June 2024, fulfilling a ten-year-contract[3]. Framatome was chosen to supply fuel for unit 6, and deliveries are scheduled to start in 2025. In early April 2025, media reported the final delivery of Russian fuel in Bulgaria. Experts knowledgeable about the issues confirmed that the Kozloduy NPP received two shipments of nuclear fuel from Russia for unit 6, one in March and one in April; these fuel supplies should last for several years. This could be very useful: the first "French" fuel from Framatome is not expected to be shipped for months or years, because Framatome is still waiting for its Lingen factory to receive a fuel production permit.

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[1] "EU funding Framatome VVER-440 fuel development", in: *World Nuclear News*, https://www.world-nuclear news.org/Articles/EU-funding-Framatome%C2%A0VVER-440-fuel-development, June 21, 2024 (Accessed April 11, 2025).

[2] *Russian Grip on EU Nuclear Power,* in: *Die Wiener Umweltanwaltschaft,* May 2022, updated in January 2024, https://wua-wien.at/images/stories/publikationen/russian-grip-on-eu-nuclear-power.pdf (Accessed April 10, 2025).

[3] "Bulgaria's Kozloduy using first Westinghouse fuel", in: *World Nuclear News*, https://www.world-nuclear news.org/articles/bulgaria-s-kozloduy-using-first-westinghouse-fuel, June 12, 2024 (Accessed April 10, 2025).

Czech Republic

ČEZ announced it was advancing the development of a fully European sovereign nuclear fuel product for both VVER-440 and VVER-1000 reactors, with the support and cooperation of European VVER operators. Framatome has been working on its own-design fuel for VVER reactors since 2018. The company has three nuclear fuel fabrication facilities: Romans in France; Lingen in Germany and Richland in the USA.

ČEZ – which also operates four VVER-440 reactors at its Dukovany plant – began diversifying its fuel suppliers with a 2018 tender process, with contracts signed in 2022 for Westinghouse and Framatome for Temelín, and a 2023 contract with Westinghouse for Dukovany. It has previously received fuel supplied by Russia's TVEL.[4]

In November 2024, ČEZ signed a new contract with Urenco for the supply of enriched uranium. As well as the contract with Urenco, ČEZ also has a long-term uranium enrichment contract with Orano.[5] Switching from enriched uranium from to another supplier is the necessary step before ordering nuclear fuel from a Western fuel manufacturer. However, whether Westinghouse and Framatome will be able to sufficiently supply fuel for all reactors remains unclear. While Westinghouse has the proven design for fuel for VVER-1000 reactors, the VVER-440 is still in a test phase at Rivne, Framatome has no design and still no permit for Lingen to produce fuel with Rosatom.

Finland

In Finland, NPP owner Fortum's fuel supply contract with TVEL/Rosatom runs through to 2027 and 2030 for the two units of the Loviisa NPP. However, in 2023 "[t]he Finnish government granted new operating licenses for the Loviisa reactors through to 2050, with the condition that Fortum finds alternative fuel suppliers to TVEL."[6]

Fortum, which owns the plant, said in November 2022 that it had signed an agreement with Westinghouse to develop a new type of VVER-440 fuel for Loviisa. In 2023, a test element was loaded into unit 2 and the nuclear regulator STUK confirmed in October 2024 that this batch, which did not contain uranium, had worked as expected.[7] One month earlier, Westinghouse had announced that fuel had been reloaded at the Loviisa plant.[8]

This is clearly not the end of the TVEL deliveries, although the fuel amounts have not been made public. Not only will TVEL continue deliveries until 2030: the period after 2030 has not been settled

[4] "Framatome to supply fuel for Slovak VVER reactors", in: *World Nuclear News,* https://world-nuclear-news.org/articles/framatome-to-supply-fuel-for-slovak-vver-reactors, July 24, 2024 (Accessed April 11, 2025).

[5] "Urenco and ČEZ sign supply agreement into 2030s", in: *World Nuclear News,* https://world-nuclear-news.org/articles/urenco-and-cez-sign-supply-agreement-into-2030s, November 7 2024 (Accessed April 11, 2025).

[6] "Westinghouse signs fuel contract for Fortum's Loviisa VVER-440 nuclear units in Finland", in: *Platts Nuclear News Flashes*, March 12, 2025.

[7] "Årsrevisionen vid Lovisa kärnkraftverk förflöt säkert under Strålsäkerhetscentralens tillsyn", in: *Strålsäkerhetscentralen (STUK),* https://stuk.fi/sv/-/arsrevisionen-vid-lovisa-karnkraftverk-forflot-sakert-under-stralsakerhetscentralens-tillsyn (Accessed April 13, 2025).

[8] "Westinghouse Completes First VVER-440 Fuel Reload at Finland's Loviisa Nuclear Power Plant", in: *Westinghouse,* https://info.westinghousenuclear.com/news/westinghouse-completes-first-vver-440-fuel-reload-at-finlands-loviisa-nuclear-power-plant, September 2, 2024 (Accessed April 13, 2025).

because Fortum is not being forced to replace Rosatom with a western supplier and is only required to report to the Finnish government how the fuel procurement tender will be conducted.[9]

Slovakia

Fuel supply

The reluctance of the Slovak government, and Slovak utility SE which operates five VVER units at two sites, to switch to western nuclear fuel supplies has been described in earlier reports. In light of the information on the utilities' website in April 2025, the current status is not fully clear.

On the one hand, Slovenské elektrárne SE AS[10] recalls "signing a contract with Framatome in May 2023 which created the basis for further development of long-term relations in the field of nuclear energy. The aim of the agreement is a diversification of nuclear fuel supplies for the power plants of VVER 440 design in Slovakia. The first fuel deliveries from Framatome, based on the proven, reliable, and efficient fuel used by the European VVER reactors, are expected in 2027." This memorandum of understanding (MoU) was followed up by another agreement in July 2024.[11]

The signing of the agreement follows a MoU signed by the companies in May 2023, which laid the foundations for the further development of long-term nuclear energy relations. The aim is to diversify the supply of nuclear fuel for VVER 440 power plants in Slovakia. The basis is proven, reliable and efficient fuel used in European VVER reactors, the power plant operators emphasized.

At the same time, SE AS explained that

> "Slovenské elektrárne concluded an agreement on fuel supplies with the Westinghouse company in August last year. The first fuel supplies, which are the subject of the agreement, are expected approximately one year after approval for its use in compliance with the applicable legal regulations in the Slovak Republic. The fuel will be supplied by the Westinghouse Electric Sweden AB company."

SE AS indirectly mentions the unclear status of VVER-400 fuel development at Westinghouse by acknowledging that "[t]he Ukrainian company Energoatom has currently been testing the first fuel load from Westinghouse company in their VVER unit at the Rivne nuclear power plant."

The impression given that no alternative fuel will be loaded into the Slovak nuclear power plants was confirmed in April 2025 by the Slovak Nuclear Regulator ÚJD:

> "SE AS has recently notified ÚJD SR that it signed contracts for the supply of nuclear fuel with Framatome and Westinghouse. This notification does not mean the official start of the licensing process. Moreover, ÚJD SR does not license nuclear fuel, but approves its use. The process of approving the use of new nuclear fuel starts with the submission of the application by the licensee. This is expected to happen in the second half of 2026."[12]

[9] "Fortum plans tender for Loviisa fuel supplier", in: *Nuclear Engineering International*, https://www.neimagazine.com/news/fortum-plans-tender-for-loviisa-fuel-supplier-11409055/, January 3, 2024, (Accessed April 13, 2025).
[10] Website of *Slovenské elektrárne*: seas.sk (Accessed April 9, 2025).
[11] David Dalton: "Framatome Signs Agreement With Slovakia As Efforts Continue To Bypass Russia", in: *Nucnet,* https://www.nucnet.org/news/framatome-signs-agreement-with-slovakia-as-efforts-continue-to-bypass-russia-7-3-2024, July 24, 2024 (Accessed April 11, 2025).
[12] ÚJD Email to the author, dated April 4, 2025.

In the meantime, however, SE made a U-turn and accepted an offer by TVEL to extend the existing fuel delivery contract until 2030.[13]
While there is no official confirmation of this information, there is no reason to doubt it; neither Westinghouse nor Framatome are able to deliver the VVER-440 fuel in the near future, and there is no good reason why TVEL/Rosatom should not make one of its most reliable customers a good offer. Slovakia intends to remain a good customer: at around 70%, it will soon have the highest share of nuclear in its electricity mix in Europe.

New Russian-built NPP

Having won the Dukovany tender in neighbouring Czechia, in Slovak discussions the South Korean reactor builder KHNP was favoured in fall of 2024. However, KHNP is now about to leave the European market for a number of reasons.
In 2024, the Fico government officially decided to prepare for construction of another NPP with an output of 1200 MW. This is the figure also demanded by the Czech utility. However, Rosatom is the only reactor designer able to deliver the NPP with this output without having to change the design.
In April, Slovakia made it clear that they would not support any sanctions against Rosatom. According to Russian media reports,[14] Slovakia is no longer denying that it may order a Russian reactor. The status of the new reactor project at the Bohunice site has also changed recently: SR XX bought the Czech share in the JESS (Jadrová energetická spoločnosť Slovenska) project, giving the Slovak company JAVYS a 51 percent share and the Czech ČEZ the rest. The option of ordering a Russian reactor might be another reason for the Slovak side to buy the Czech shares. The tendering process for the new NPP should start in mid-2025.[15]

Hungary

From the very beginning of the war in Ukraine, Hungary made it clear that they do not intend to change their pro-Russian nuclear policy. The construction of the Rosatom reactor in Paks II is proceeding, though slowly. The issue of the Siemens delivery of the I&C has not been settled yet, the German authorities have not yet permitted the export.
Regarding sanctions, in June 2024 Hungary managed again to insist on its business with Rosatom, agreeing to the 14th package of sanctions against Russia only in exchange for assurances that no current or future measures will threaten Paks II. Therefore, the Council Decision 2024/1744 reads as follows:

> "With regard to the Paks II project, the prohibitions in this Decision shall not apply to activities necessary for the establishment, operation, maintenance, fuel supply and retreatment and safety of civil

[13] "Saková: Elektrárne majú zásoby jadrového paliva na ďalšieho 2,5 roka", in: *Teraz,* https://www.teraz.sk/priame-prenosy-a-videa-tasr-tv/sakova-elektrarne-maju-zasoby-jadro/836311-clanok.html?utm_source=teraz&utm_medium=organic&utm_campaign=click&utm_content=.%253Bw%253BwIndex%253BPriamePrenosyAVidea, November 14, 2024 (Accessed April 9, 2025).
[14] "Measures without danger: Slovakia against sanctions against the Russian nuclear industry", in: *Izvestija,* https://en.iz.ru/en/node/1867328, September 4, 2025 (Accessed April 9, 2025).
[15] "Slovakia aims to release nuclear power unit tender by mid-2025", in: *Energy News,* https://energynews.oedigital.com/power-markets/2024/11/20/slovakia-aims-to-release-nuclear-power-unit-tender-by-mid2025, November 20, 2024 (Accessed April 9, 2025).

nuclear capabilities, and the continuation of design, construction and commissioning required for the completion of civil nuclear facilities."[16]

Nuclear fuel

Hungary clearly caved in to political pressure from Brussels and signed a fuel delivery agreement with Framatome in October 2024:

> "Framatome said it has 'a dual-track approach' to supplying fuel to VVER reactors in operation in the European Union. In the short term, it will fabricate fuel identical to the proven design currently used by the reactors. In parallel, Framatome is developing and qualifying European sovereign fuels of its own design for VVER 440 and 1000 reactors."[17]

The 'dual-track approach' is another way of saying that Framatome does not have a VVER fuel design ready and is fighting for a permit to produce VVER fuel in cooperation with Rosatom in Germany in Lingen. (See chapter two: "Lingen VVER Fuel Factory – Source of Independent VVER Fuel or Rather Kremlin's Outpost in Europe?")

Ukraine

During 2024, the last remaining reactors in Ukraine were switched to Westinghouse fuel; VVER-440 fuel is being tested at the Rivne NPP, as the Nuclear Regulator SNRIU confirmed on 25 June 25, 2024:

> "[…] starting from 2024, all WWER-1000 power units in Ukrainian NPPs, except for the temporarily occupied Zaporizhzhia NPP, will be supplied with nuclear fuel produced by Westinghouse. I would like to remind you that in 2023, trial operation of Westinghouse fuel started at Rivne NPP Unit 2, and this year trial operation of this fuel started at Rivne NPP Unit 1."[18]

Russia occupied the Zaporizhia NPP and plans to keep it and to restart it as soon as possible, as the plant director explained in April 2025. According to him, the restart should begin with units 2 and 6 which are loaded with Russian-made fuel.[19]

Conclusions

The country overview shows clearly that all VVER countries have eventually accepted that they must diversify their nuclear fuel supplies away from Russia.

Some have agreements and even deliveries from the US fuel supplier Westinghouse, certainly for the VVER 1000 series, although the actual situation with the VVER 440 remains unclear. For example,

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[16] "COUNCIL DECISION (CFSP) 2024/1744 of 24 June 2024", in: *Official Journal of the European Union*, https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L_202401744, June 24, 2024 (Accessed April 9, 2025).

[17] "Framatome to supply Hungarian plant with nuclear fuel", in: *World Nuclear News*, https://world-nuclear-news.org/articles/framatome-to-supply-hungarian-plant-with-nuclear-fuel, Octobre 28, 2024 (Accessed April 11, 2025).

[18] "Oleh Korikov: Ukraine has completely abandoned russian nuclear fuel and equipment for nuclear power plants", in: *State Nuclear Regulatory Inspectorate of Ukraine*, https://snriu.gov.ua/en/news/oleh-korikov-ukraine-has-completely-abandoned-russian-nuclear-fuel-and-equipment-for-nuclear-power-plants, June 25, 2024 (Accessed April 14, 2025).

[19] "Plans underway to restart Zaporizhia NPP", in: *Nuclear Engineering International*, https://www.neimagazine.com/news/plans-underway-to-restart-zaporizhia-npp/, April 2, 2025 (Accessed April 14, 2025).

Finland has tested the fuel and had its use confirmed but will not discontinue Rosatom fuel deliveries until 2030. Slovakia simply extended its existing delivery contract with TVEL in late 2025. In the long run, this could be the first VVER operating country to return to TVEL, but probably not the last, because Rosatom will also make irresistible offers to its other customers.

All the VVER countries also have fuel delivery agreements with Framatome and support the Framatome fuel development project in cooperation with EURATOM. However, Framatome fuel manufacturing is dependent on the German authorities granting a permit for VVER fuel production in the Lingen factory; this is highly contested because VVER fuel production is based on a joint venture involving a 25% Rosatom share. At the same time, there will be no problem for utilities with VVER reactors if the Framatome fuel arrives as promised in 2025, 2026 or 2027: they have sufficient stores of TVEL/Rosatom fuel which can be used in place of the 'Framatome fuel'. The Framatome fuel would be identical and thus does not need to be licensed by the national Nuclear Regulators. At his hearing before the European Parliament, the designated Energy Commissioner announced a phase-out of Russian energy deliveries; on 26 March this Action Plan was postponed, and "[t]he Commission declined to comment on a new date."[20]

[20] "EU Commission delays announcing plan to phase out Russian energy imports", in: *Reuters*, https://www.reuters.com/business/energy/eu-commission-delays-announcing-plan-phase-out-russian-energy-imports-2025-03-05/, March 5, 2025 (Accessed April 14, 2025).

2. Lingen VVER Fuel Factory – Source of Independent VVER Fuel or Rather Kremlin's Outpost in Europe?

> "Framatome welcomes this EU funding,
> recognising our efforts and supporting the acceleration of our
> development to contribute to the diversification and security of fuel supply
> for VVER reactors. Framatome is the only fuel supplier able
> to guarantee a 100% sovereign European technology,
> with a fully European design & product, and manufacturing facilities
> and a fuel component supply chain located and operated in the EU,"

Framatome vice president Lionel Gaiffe was quoted at the occasion of receiving EU funding of €10 million under the Euratom Programme in June 2024.[21]

The key element of this plan is the fuel element factory in Lingen, Germany, which Framatome intends to adapt to enable the production of the fuel needed for the VVER reactors. This chapter provides an analysis of the question of whether Framatome's plan for Lingen will ensure the independent fuel supply to VVER countries or rather give Russia another lever of influence on Europe for a very long time.

This report summarizing the hotly debated issues is based on publicly available expert opinions and media reports. All included information was checked with experts and officials working in this field; a large part stems from notes taken during the discussions, presentations and the official Word protocol of a non-public hearing which took place as part of the permitting procedure undertaken by the Ministry of the Environment of Lower Saxony from 20-22 November 2024.

This report does not focus on the very complex options the German legal system offers in this highly sensitive and very politicized case. Instead, it provides the most important political and technical facts which have implications far beyond Germany – as this is where the decision will be taken on whether the much-sought independence from Russian fuel supply will be established by a joint venture of the French state company Framatome with a 25 percent share belonging to the Russian State company Rosatom.

For the fuel supply situation in the VVER countries three options are open:

- **Continuation or even return to the Rosatom/TVEL deliveries from Russia**, which is economically favourable and has proven reliable, even after Russia's invasion of Ukraine and the EU economic sanctions against Russia.

- **VVER fuel from the US company Westinghouse. WEC** can already supply VVER-1000 fuel and seems to be getting close to producing VVER-440 fuel. However, it remains unclear whether its manufacturing capacity is sufficient to supply all NPP including Ukrainian NPP.

[21] "EU funding Framatome VVER-440 fuel development", in: *World Nuclear News*, https://www.world-nuclear-news.org/Articles/EU-funding-Framatome%C2%A0VVER-440-fuel-development, June 21, 2024 (Accessed April 11, 2025).

- **French state company Framatome**, which has concluded agreements and contracts with all the VVER countries as well but has **no VVER fuel design** nor the permit for the Lingen factory to produce the VVER nuclear fuel in Europe under a product license agreement with **Rosatom.**

This report investigates the claim that this Framatome-Rosatom cooperation to produce VVER fuel in Germany would ensure electricity generation in the respective CEE countries is independent of Russia, or whether the contrary is true – that this cooperation at Lingen would instead open Europe's doors to Rosatom's influence, even prolonging and finally locking in fuel dependence. The question behind the legal and technical facts is whether the joint venture would be open to blackmail directly from the Kremlin. In view of the European Union's policy of responding with increased defence spending to what is perceived as a Russian war threat, this option appears increasingly less convincing.

The application and the permitting procedure

The owner of the Lingen fuel factory, Advanced Nuclear Fuels GmbH (ANF), submitted the application for a license to modify the plant and its operation in accordance with Section 7 (1) of the Atomic Energy Act in a letter dated 10 March 2022; additional information was provided on 18 October 2023. An EIA was not deemed necessary, since the main parameters will not change.
In an unusual move, the German authorities opened the permitting procedure to public participation. A total of around 11,000 people and institutions raised 47 objections, and several expert opinions and reports were published.

An in-depth overview of the issue at hand was provided by the following expert opinions and reports. The Nuclear Safety and Consumer Protection (BMUV) of the Federal Ministry for Nature Conservation commissioned Prof. Dr. Gerhard to prepare a legal opinion in the context of a nuclear regulatory review procedure. It was published in June 2023 and is available on the BMU website.[22]

The subject of the expert opinion is, in particular, whether and to what extent § 7 (2) of the *Atomic Energy Act* contains a discretionary power of refusal and under which framework conditions this may have to be exercised. Simply put: Even if all legal conditions are fulfilled, the German authorities can refuse to grant the permit for the operation of the fuel factory as a joint venture between Framatome and Rosatom.

ANF commissioned another expert opinion to counter the BMUV argumentation, the Thienel/Ewer report, which can be found on their website.[23]

The German environmental group BUND commissioned and published the report *Statement and objections to the application for a license according to § 7 AtG for the fabrication of VVER fuel*

[22] *Bundesministerium für Umwelt, Naturschutz, nukleare Sicherheit und Verbraucherschutz,* https://www.bmuv.de/fileadmin/Daten_BMU/Download_PDF/Nukleare_Sicherheit/gutachten_brennelemente_lingen_bf.pdf (Accessed April 15, 2025).
[23] *Framatome,* https://www.framatome.com/de/implantations/lingen/ (Accessed April 15, 2025).

elements in the ANF fuel element fabrication plant Lingen on its website.[24] In this report, the independent nuclear expert Oda Becker also assessed the radiological and technical issues at stake, based on the safety report submitted by ANF for the licensing procedure.

A non-public hearing took place at Lingen from 20-22 November 2024. The responsible authority, the Ministry of the Environment of Lower Saxony, is currently drafting the positive or negative response to the application by ANF which will decide whether VVER fuel will be produced in Germany. The decision on whether the German authorities will grant a permit to the joint venture to produce the VVER fuel in their Lingen fuel factory is expected to be taken in the near future. While the German authorities have a certain discretion by law, the other side – the project proponent ANF – puts pressure on the authorities and threatens to take legal steps in case the process of granting the permit keeps dragging on or is not granted at all.

It is not known whether ANF would make use of other facilities in France for the production of VVER fuel and, if so, why they tried the foreseeably very tricky permitting procedure in Germany, a country which had completed its nuclear phase-out in 2023.

The Lower Saxony Ministry of the Environment, Energy and Climate Protection is responsible for preparing the draft decision. However, the Federal Ministry of the Environment will also have a say in granting or refusing the permit. Neither ministry is hiding the fact that they will make use of all existing legal options to avoid granting this permit for the production of hexagonal fuel elements for Russian design NPP in the fuel factory in Lingen, Lower Saxony, Germany.

Interestingly, ANF is very keen on pointing out that five EU member states (Bulgaria, the Czech Republic, Finland, Hungary and Slovakia), which operate a total of 19 VVER reactors, need a quick and reliable alternative supply. ANF consistently claims that, against the backdrop of the war in Ukraine, all utilities with VVER reactors have asked Framatome to develop an independent fuel element supply. The aim is to avoid interruptions in the electricity supply and to reduce dependence on imports from outside Europe, i.e. from Russia.

However, in a first step, ANF intends to produce identical fuel elements under a license granted from Rosatom/TVEL. During the hearing in November 2024, they even had to admit that fabrication will be dependent on the delivery of key precursor products from Russia, such as the fuel rod cladding. The company announced the parallel development of its own design for both VVER-1000 and VVER-440 fuel to achieve full independence from Rosatom by 2030.

2.1 Company ownership structure

The owner of the Lingen fuel factory is ANF, which is 100 percent owned by Framatome. To produce identical and licensed VVER fuel elements, Framatome has set up a joint venture, the European Hexagonal Fuels S.A.S (EHF) based in France. Framatome holds a majority stake of 75 percent in EHF, and the licensor Rosatom/TVEL 25 percent. The machines which will be used at

[24] *Bund für Umwelt und Naturschutz Deutschland,* https://www.bund.net/fileadmin/user_upload_bund/publikationen/atomkraft/stellungnahme-einwendungen-anf-lingen-bund.pdf, Februar 2024 (Accessed April 15, 2025).

the Lingen factory will be delivered from Russia but will be fully owned by European Hexagonal Fuels S.A.S.
Framatome is fully owned by EDF, which is fully owned by the French state, just as Rosatom is fully controlled by the Russian state. ANF likes to point out they are independent of the joint venture.

2.2 License fuel fabrication

Advanced Nuclear Fuels GmbH (ANF) operates a production plant for Light Water Reactor fuel elements at the Lingen site. The Lingen site is home to both nuclear and non-nuclear production, where individual components are assembled. The plant has so far only produced fuel elements of western design and has a decreasing capacity utilization. [...] ANF has submitted an application to the Lower Saxony Ministry for the Environment, Energy and Climate Protection (NMU) in accordance with Section 7 (1) of the Atomic Energy Act, to modify the plant to also produce hexagonal pressurized water fuel elements.[25]

Framatome calls this a strategic approach. At first, they want to cooperate with the EHF to produce the licensed fuel elements which are identical to those already produced for the VVER reactors.
However, what was not clarified at any point in the discussion is the fact that every nuclear power plant in every country was supplied with customized fuel elements by TVEL, and that TVEL continues the development at its facilities in Russia. ANF did not answer whether the license agreement covers all upcoming fuel developments and how they will be able to produce all conceivable TVEL fuel elements in the future. It is hard to imagine that this would be possible without constant renegotiations. TVEL/Rosatom/Russia would always have access to the manufacturing process and opportunities for blackmail. In Russia, the development of fuel is not stopping. On the contrary, this newly developed fuel is being offered to clients.
The fuel development is geared towards extending the fuel campaign to increase output and profit for the utilities. At the end of 2024, Rosatom/TVEL announced new fuel with higher enrichment being under way:

> "Russia's Rosatom is testing VVER nuclear fuel containing the neutron absorber erbium and uranium enriched to about 5%. It says such fuel could significantly increase the economic efficiency of nuclear power plants. The irradiation is taking place in the MIR.M1 research reactor at the Dimitrovgrad Research Institute of Nuclear Reactors and is seen as being the first step in the joint gradual validation of nuclear fuel with enrichment above 5% - the existing figure is typically between 3% and 4.95%. Rosatom says it will enable the extension of the current 12–18-month fuel campaigns to 24 months - cutting the length of time units need to be shut down for refuelling. Reducing the number of fresh fuel bundles in a reload batch would also have a positive economic impact, the company says."[26]

For higher enriched fuel, ANF would also need to obtain a change in license from the German authorities, since it is currently limited to 5 percent.

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[25] Prof. Dr. Gerhard Roller: *Berücksichtigung der Belange der inneren und äußeren Sicherheit der Bundesrepublik Deutschland im Rahmen des Versagungsermessens nach § 7 Abs. 2 AtG Untersuchung* anlässlich des Änderungsgenehmigungsverfahrens der Brennelementefertigungsanlage Lingen, Frankfurt am Main, Juni 2023. Übersetzung dr. die Autorin.

[26] "Rosatom starts reactor tests aiming to increase nuclear fuel enrichment", in: *World Nuclear News,* https://www.world-nuclear-news.org/articles/rosatom-launches-reactor-tests-of-5-enriched-nuclear-fuel, December 11, 2024 (Accessed April 13, 2025).

With Rosatom as a business partner, which is under direct control of the Kremlin, the possibility can never be excluded that one day a stop will be put to the delivery of the precursor products; ANF would not be able to produce and deliver fuel elements.

What needs to be understood is that the uranium is bought by the respective utility and delivered to the fuel manufacturer, e.g. ČEZ has concluded contracts with Urenco[27]; Bulgaria[28] with both Urenco and Cameco and are not dependent on Russian uranium which seems to be currently delivered to Lingen from Russia.

2.3 Development of Framatome's own fuel design

Is it worth noting that the French Russian joint venture ANF is very keen on constantly repeating that they have been asked by the VVER operators to invest in the development and manufacturing of nuclear fuel after the war in Ukraine broke out; in truth, as ANF admitted at the hearing, they started preparation for fuel development in 2018. The cooperation agreement was already signed in 2021: "France's Framatome and Russian state nuclear corporation Rosatom have signed a new strategic cooperation agreement further expanding the companies' efforts to develop fuel fabrication and instrumentation and control technologies […]." [29]

ANF expects to achieve the new fuel design by 2030. This is far into the future and might not happen for a number of reasons. While there is some financial support from EURATOM, fuel development is a very lengthy and costly undertaking and makes little sense after 2030. Also unclear here is whether at this point in time ANF would end its cooperation with Rosatom in the sphere of nuclear fuel. During the hearing in Lingen in November 2024 it was not possible to answer the issue of design changes. Close monitoring of Rosatom's fuel development for its customers showed that the fuel is not one-size-fits all. Rather Rosatom offers different types of fuel, and it is hard to imagine that Framatome would invest in continuous R&D and these customer-related changes after 2030 on its own.

2.4 Framatome's fuel design development with EURATOM funding

In 2024, Framatome confirmed the fuel design development and that they will need 10 years until they have their own VVER fuel. Until then they will produce the VVER fuel under a license contract with TVEL. However, considering the number of VVER 440 reactors and their expected lifetimes, this does not seem to be a convincing business case; most of these plants have already reached the end of their 30-year operating lifetime, and some even 40 years.

The Framatome fuel development efforts are perceived by some as an endeavour which is not being undertaken with sufficient resources and might not deliver the European VVER fuel design. This has already been attempted without success with similar projects in the past:

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[27] "Obohacený uran pro české jaderné elektrárny bude dál dodávat britské Urenco", in*: oEnergetice*, https://oenergetice.cz/jaderne-elektrarny/obohaceny-uran-pro-ceske-jaderne-elektrarny-bude-dal-dodavat-britske-urenco, November 7, 2024 (Accessed April 13, 2025).

[28] Kamen Kraev, "Cameco And Urenco To Supply Uranium And Enrichment For Kozloduy-5 VVER", in: *Nucnet*, https://www.nucnet.org/news/cameco-and-urenco-to-supply-uranium-and-enrichment-for-kozloduy-5-vver-4-5-2023, April 21, 2023 (Accessed April 13, 2025).

[29] "Framatome and Rosatom expand cooperation", in: *World Nuclear News*, https://www.world-nuclear-news.org/Articles/Framatome-and-Rosatom-expand-cooperation, December 2, 2021 (Accessed April 11, 2025).

> "Although there were several attempts in the last two decades in both EU and Ukraine, for example the Euratom H2020 project ESSANUF (European Supply of Safe Nuclear Fuel) or the INSC project Strengthening SNRIU (State Nuclear Regulatory Inspectorate of Ukraine) capabilities to establish an alternative supplier of the nuclear fuel for the VVER reactors, outcomes were not sufficient […]. "[30]

The current EURATOM project SAVE (2024) "[…] will work with EUR 10 million in EU contribution. Led by the nuclear power company Framatome (France and Germany) and gathering 17 partners from seven EU Member States as well as Ukraine, it will contribute to a swift and secure development and deployment of a European fuel solution […]. "[31]

The aim of the SAVE project to strengthen VVER fuel security of supply in Europe and Ukraine […] will be performed within European test facilities to assess the performance of the new, safer and sovereign VVER-440 fuel assembly design. SAVE will prepare in-reactor qualification with mutualized LFA (Lead Fuel Assemblies) programs, which will significantly accelerate design readiness for fuel reloads. SAVE will also define the plans to enable a **fully European manufacturing route** and address the needs of **Core Monitoring Systems** [...].[32]

SAVE PROJECT, 2024 – 2028, funded under Euratom Research and Training Programme
Total cost € 18 680 500,00 with EU contribution €10 million.
Coordinated by FRAMATOME, France with participation – also some financial contribution – of the following companies in VVER countries:

CEZ AS, Czechia, MVM PAKSI, Hungary, SLOVENSKE ELEKTRARNE AS, Slovakia, ABILICO
AD, Bulgaria, UJV REZ AS, Czechia, HUN-REN ENERGIATUDOMANYI KUTATOKOZPONT, Hungary, VUJE AS, Slovakia, STUDSVIK SCANDPOWER GMBH, Germany, FORTUM POWER
AND HEAT OY, Finland, TEKNOLOGIAN TUTKIMUSKESKUS VTT OY, Finland, LIMITED LIABILITY COMPANY ENERGORISK, Ukraine, BUDAPESTI MUSZAKI ES GAZDASAGTUDOMANYI EGYETEM, Hungary, UJP PRAHA AS, Czechia, SKODA JS A.S, Czechia, COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, France, FRAMATOME GMBH, Germany

2.5 Market for Framatome fuel

According to ANF, the Framatome VVER fuel design should be available in 2030. However, there may not be much demand for VVER 440 for the smaller VVER series because these reactors went into operation in the 1980s and are now due for decommissioning. Although the exceptional reactor-startup of a VVER 440 in Slovakia in 2023 (Mochovce 3) and expected completion of Mochovce 4 in the next years with construction start in 1986 is well-known, this does not constitute a market. The

[30] "Safety of alternative nuclear fuel for VVER reactors", in: *European Commission,* https://cordis.europa.eu/programme/id/HORIZON_HORIZON-EURATOM-2022-NRT-01-01, last updated October 5, 2022 (Accessed February 7, 2025).
[31] "A new Euratom project will help diversify nuclear fuel supply", in: *European Commission,* https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/new-euratom-project-will-help-diversify-nuclear-fuel-supply-2024-06-20_en, June 20, 2024 (Accessed February 7, 2025).
[32] "Safe and Alternative VVER European Fuel", in: *European Commission,* https://cordis.europa.eu/project/id/101114771, last updated June 21, 2024 (Accessed February 7, 2025).

series of larger VVER reactors (1000 and 1200 MW) might remain in operation longer and Rosatom is constructing two VVER-1200 MW in Hungary. However, this will be the last export into the EU because the idea that a EU member state would order a nuclear power plant can be eliminated.
This very long timeline for developing a very specialized product for a shrinking number of customers suggests the license with Rosatom will not be a temporary solution but rather the business model Framatome and Rosatom will pursue as long there is demand.

2.6 Security issues

Security here is understood as the large complex of the influence of the Russian state on the Fuel Factory Lingen, the joint venture European Hexagonal Fuels S.A.S, the ANF employees, possible espionage and sabotage by Rosatom and the Russian government, and security and intelligence services. The factory may be a target for sabotage, but also the nuclear fuel which is delivered to the nuclear power plants for electricity production.
Another threat which was widely discussed is how Russian involvement in Lingen via the joint venture might impact the internal and external security of the Federal Republic of Germany, as well as European energy security and the nuclear security of Europe. During the hearing in November, ANF speakers excluded scenarios such as the release of Uranium hexafluoride (UF6) caused by sabotage resulting in catastrophic toxic and radiological consequences for Lingen and the region. An important security issue was the access granted to Russian employees to the facility, which was excluded by ANF. The German authorities inquired about these issues and asked ANF for answers, but many answers are classified for obvious reasons.

This was discussed at length at the hearing, with ANF repeating that no Russian experts or Rosatom employees had entered the fuel factory site and all training of the personnel in Germany had taken place in the furniture factory site next door where the license machine had been delivered from Russia.

Prof. Roller's expert opinion which was commissioned by the Federal German Environmental Ministry (BMU) summarizes certain risks:

> "Various scenarios are conceivable for plant or nuclear-specific hazards which can be differentiated into two categories: On the one hand (1), these include hazards caused by the direct misuse of nuclear materials, such as tampering with the facility or acts of sabotage that lead to damage or the theft of fissile material for military purposes (proliferation). However, threats to external security can also be (2) of an indirect nature, which result from the expanding legal or de facto access possibilities of a foreign state-owned company to a sensitive infrastructure, which could enable a foreign government to influence activities in a security-relevant manner that increase the nuclear-specific risk. This danger does not appear to be purely hypothetical, especially if it is a foreign state-owned company whose leader is not only waging a war of aggression in Europe in violation of international law but is also openly threatening to use nuclear weapons."[33]

Prof. Roller also noted in his expert opinion that exerting an influence on security-related decisions cannot be excluded:

[33] Prof. Dr. Gerhard Roller, Berücksichtigung der Belange der inneren und äußeren Sicherheit der Bundesrepublik Deutschland im Rahmen des Versagungsermessens nach § 7 Abs. 2 AtG Untersuchung anlässlich des Änderungsgenehmigungsverfahrens der Brennelementefertigungsanlage Lingen Frankfurt am Main, Juni 2023, S. 28. Übersetzung dr. die Autorin.

> "In addition to direct interventions, indirect risks could also arise by obtaining and passing on information about internal operations and security structures, and similar assistance for external measures which, in the event of a further escalation of the Russian war of aggression, could also serve to destabilize public security in Germany. The exploitation of information to disinform and unsettle the local population is also conceivable. The extent to which the cooperation between Rosatom and ANF has led to an influence on security-related decisions cannot be conclusively determined on the basis of the information available."[34]

The investor ANF has argued that the factory has been used for 50 years without major security or safety problems. However, it should be noted there have been no wars on the continent over these past 50 years, and the possibility that the factory will play a key role for many CEE states is a new fact to be considered.

From a geopolitical viewpoint, this factory could turn out to be a form of Trojan horse, because it is now clear what can happen if a country falls into energy dependence: Hungary is constructing a nuclear power plant with the Kremlin's help. During the past years, Hungary has continuously refused to support EU sanctions against the war aggressor, and only agreed to do so after causing major political difficulties, even two and half years into the war.[35] Politico reported: "There's renewed European Union momentum to kick Russia's nuclear sector out of the bloc and strip Moscow of one of its remaining holds over Europe's energy supplies — if Viktor Orbán will allow it.". In summer 2024, Hungary managed to get an exemption for the Paks II project with Rosatom when "for certain products and services, an exemption license had to be requested from the competent authority of a country supplying products or services. In the case of Paks II, this requirement has been dropped […]."[36] In March 2025, Hungary insisted on taking some oligarchs off the suggested blacklist.[37]

On 20 November 2025, at the hearing in Lingen, Russian environmentalist Vladimir Slivyak drew attention to Rosatom's important role in Russian politics:

> "Rosatom is managed by the supervisory board and that includes senior governmental officials sanctioned in numerous countries for their involvement in the war in Ukraine. This supervisory board includes, for example, Sergei Koroljow, Deputy Head of the Russian Secret Service, FSB."

Oda Becker, an independent expert speaking on behalf of the environmental group BUND at the hearing in Lingen in November 2024 was also clear in her opinion of ANF's claim that Rosatom will act reliably without posing any threat because they are bound by the contracts for the joint venture, by reminding the participants that Russia does not even shy away from threatening to use nuclear weapons.

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[34] Ibid., p. 34

[35] "EU eyes new clampdown on Russian nuclear sector", in: *Politico*, https://www.politico.eu/article/eu-eyes-new-clampdown-russia-nuclear-sector-hungary-viktor-orban/, November 5, 2024 (Accessed March 18, 2025).

[36] "EU exempts Hungary's Paks II nuclear project from Russia sanctions", in: *Nuclear Engineering International*, https://www.neimagazine.com/news/eu-exempts-hungarys-paks-ii-nuclear-project-from-russia-sanctions/, July 3, 2024 (Accessed March 18, 2025).

[37] "Hungary upholds veto against Russia sanctions roll-over as talks continue", in: *Euractiv*, https://www.euractiv.com/section/politics/news/hungary-upholds-veto-against-russia-sanctions-roll-over-as-talks-continue/, March 13 2025 (Accessed March 18, 2025).

Meanwhile, the situation has been further aggravated: Russia is not only waging a war against Ukraine, but it does also not shy away from threatening the safety and security of the NPP Zaporizhzia. Now the EU is stepping up its defence and military capabilities against Russia. In her speech to present the REARM Europe plan, the President of the European Union said on 7 March 2025: "Putin has proven time and again that he is a hostile neighbour. He cannot be trusted; he can only be deterred. And we know that Russia's military complex is outproducing ours."[38]

The role of Rosatom in the Kremlin's power plays was assessed by the US Department of State; an updated sanctions list was published on its website on 10 January 2025: "Today, the United States is sanctioning major targets in Russia's energy sector, the primary source of revenue fuelling Russia's war against Ukraine." Sanctions were imposed on a large number of Rosatom managers. The entire list was published on the U. S. State department's site.[39]

[38] "Speech by President von der Leyen at the European Parliament Plenary joint debate on European Council meetings and European Security", in: *European Commission*, https://ec.europa.eu/commission/presscorner/detail/en/speech_25_739, March 11, 2025 (Accessed March 18, 2025).

[39] "Sanctions to Degrade Russia's Energy Sector", in: *U.S. Department of State*, https://2021-2025.state.gov/office-of-the-spokesperson/releases/2025/01/sanctions-to-degrade-russias-energy-sector, January 10, 2025 (Accessed April 9, 2025).