



Resisting Russia's Energy War:

UK Nuclear Investment
for Allied Energy Security

All-Party Parliamentary
Group on Nuclear Energy

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Executive summary

Russia's aggressive and successful exports of its civil nuclear technologies threaten the energy security and strategic position of the Western Alliance, including allies in NATO, the EU and the Pacific. Nuclear is the leading source of clean power in the United States, Europe, South Korea and Japan, but all these countries rely heavily on Russian nuclear fuel imports. In addition, developing countries are being pulled into Russia's energy orbit as they accept Kremlin offers to finance, construct, and support the operation of Russian-designed reactors.

In all, more than 30 countries now depend on Russia to maintain their nuclear facilities or provide fuel to run them. These contracts feed revenue into the Russian war economy and strengthen Russian geopolitical energy leverage.

Many utilities in allied nations are urgently seeking to move their uranium and nuclear fuel services away from Russian supply. However, they need viable Western alternatives to be built out at once, especially for uranium conversion and enrichment.

The UK Government should take the following actions immediately to strengthen those Western alternatives in the next two to three years:

- Awarding funding this autumn under the Nuclear Fuel Fund for the reinstatement of primary uranium conversion capability and the establishment of reprocessed uranium conversion capability at Springfields in Lancashire and preserve uranium enrichment capacity at Capenhurst in Cheshire
- Setting a policy to promote the commercial development of UK fuel cycle facilities, including conversion, enrichment and fuel fabrication and encouraging our allies to maximise their use of UK and Western fuel

The UK Government must also initiate the following actions for the medium and long-term to help drive Russia out of the global nuclear market:

- Facilitate the domestic deployment and export of the Rolls-Royce SMR to create another viable Western reactor and complementary UK fuel solution for global deployment
- Agree a common strategy with our allies to maximise Western nuclear fuel fabrication and reactor exports in place of Russian exports

The Kremlin is waging an energy war against the free and democratic world, and we must use all available means to fight back.



View inside the Springfields Fuels facility in Lancashire

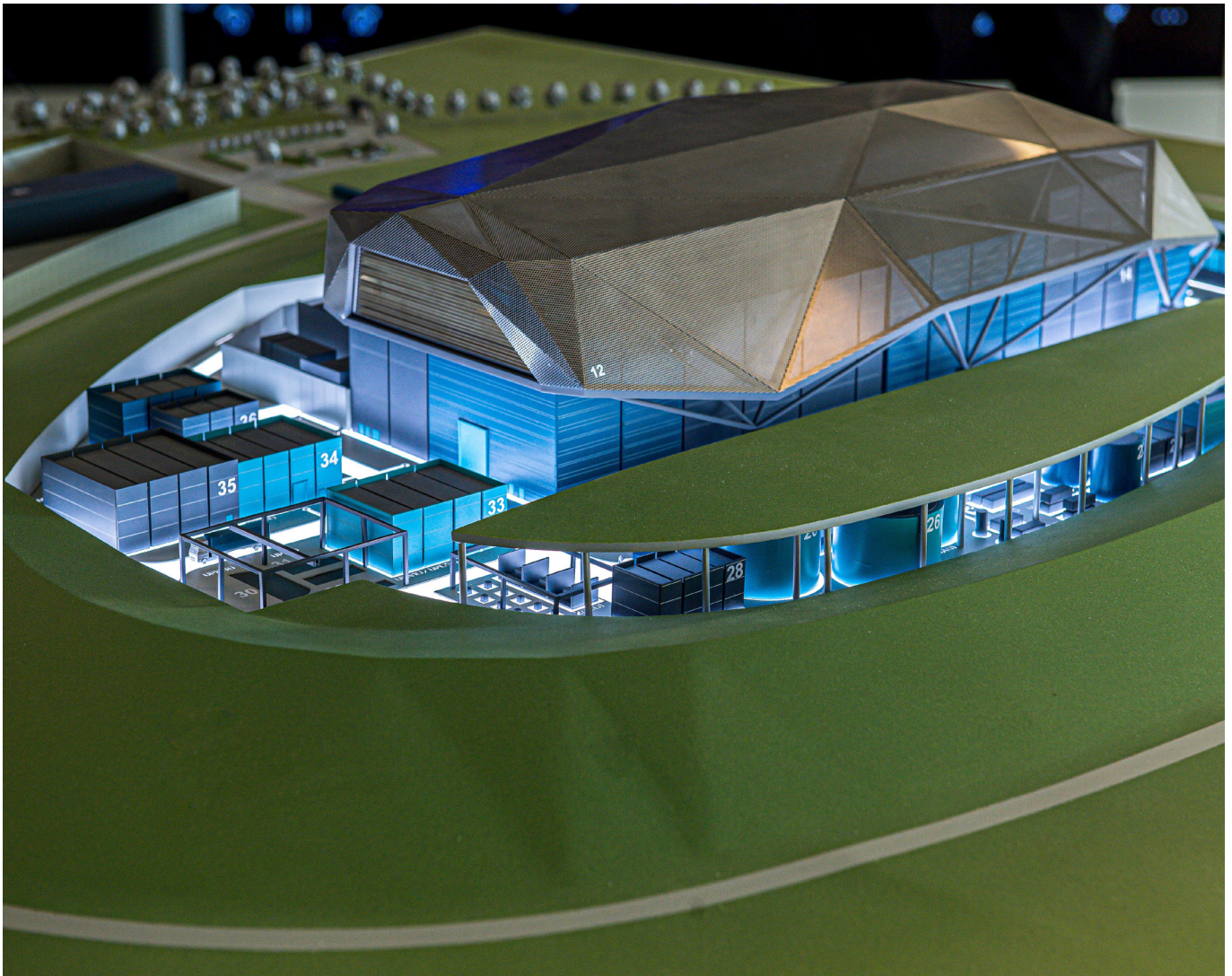
1. Introduction

While Western nations are technically superior, Russia deploys its civil nuclear capabilities more aggressively and successfully than any other. It manufactures more nuclear fuel than any other country and exports it to every major nuclear nation. In the last 30 years, it has exported more of its own reactors than any other country. More than 30 countries now depend on Russia to maintain their nuclear facilities and to provide fuel to run them. Looking to the future, Russia is the only country that can produce specialised High Assay Light Enriched Uranium (HALEU) and manufacture advanced fuel for Generation IV reactors at scale. It is the only country deploying floating, civil maritime, and large-scale plutonium-breeding nuclear reactors.

Russia's position is not a historic accident or the happenstance of market forces. It is the deliberate policy of the Russian state to secure energy leverage over its neighbours and fund its war economy through strategic investments and interventions. The Western alliance can only cut the Kremlin's leverage with our own coordinated strategic interventions.

The United Kingdom is uniquely placed to support this effort. We are one of the few countries with the existing capability and potential to expand our uranium conversion and enrichment production in the next 2-3 years and provide our allies with alternative Western supplies. We also have globally respected regulatory expertise that could be used to help new nations deploy their first nuclear reactors, as well as the Rolls-Royce SMR, a UK reactor design that can provide a further non-Russian export option.

Our ultimate goal must be to destroy Russia's energy leverage over allied nations. UK nuclear sector can and must play its vital part in that endeavour.



Rolls-Royce SMR, a UK reactor design that can provide a further Western export option

2. Nuclear fuel supplies

Traditional conversion and enrichment: the case for immediate action

After uranium is mined and milled into a powder, it must be converted into a form that can be enriched and then enriched at specialist facilities. Many utilities are looking to switch from Russian conversion and enrichment services, but they want to be certain that alternative Western supplies will be viable for the long-term. The UK Government should help provide that certainty by supporting strategic investments in UK fuel capabilities and engaging with allied governments to ensure the necessary customer base.

Conversion

Outside Russia and China, the world needs about 40,000 tonnes of uranium conversion per year. Western capacity is only 34,500 tonnes. Russia currently fills the gap since it owns 20% of global enrichment capacity and sells significant amounts to the United States, South Korea, Japan, and European countries. That gap represents the uranium needed to feed 1.4% of global electricity production, enough for almost 100 million people, overwhelmingly concentrated in allied nations.

The United Kingdom is the only country in the world with an operable conversion facility currently not producing but held under care and maintenance. Springfields Fuels in Lancashire has a facility that operated until 2014, producing around 4,000 tonnes per year.

Renewed investment of around £200 million could reinstate conversion services capability of 4,000 tonnes of Non-Irradiated Uranium (NIU) within 2-3 years and an additional 2,500 tonnes of Reprocess Uranium (REpU) in 5-7 years. This investment would also create up to 200 jobs and secure UK strategic capability in a critical part of the fuel cycle.

Springfields is a critical asset that the UK can use to help our allies shake their dependence on the Russian state. Reinstating the facility is a clear next step the UK can take to produce Western alternatives to Russian nuclear fuel.



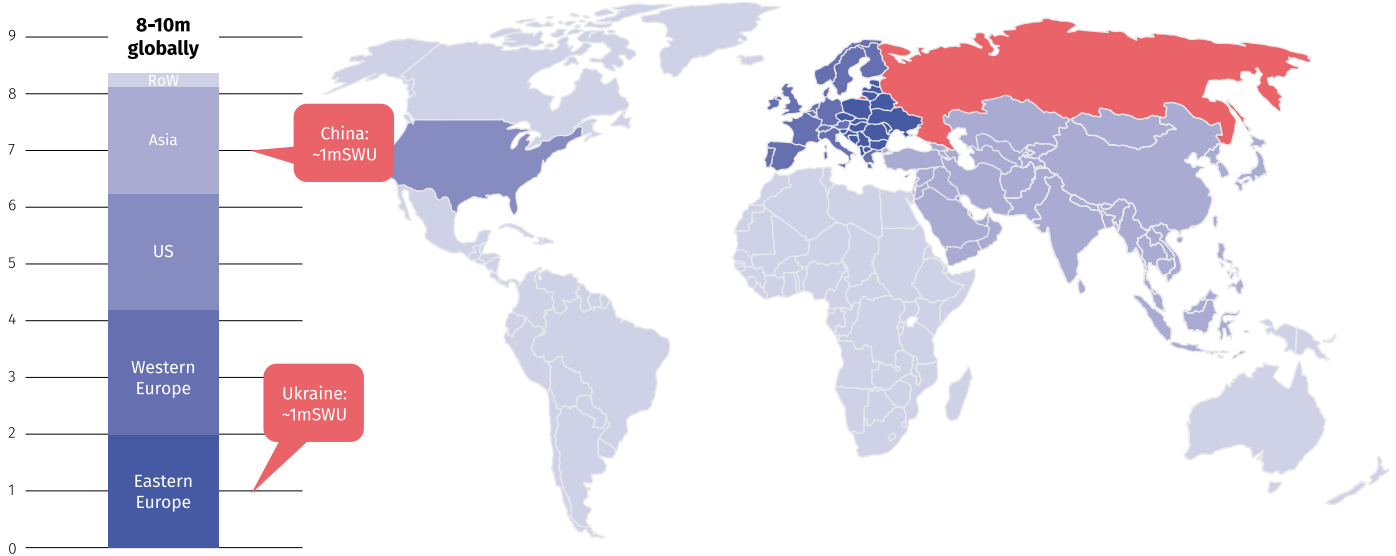
Aerial view of the Springfields Fuels facility in Lancashire

Enrichment

The situation is much the same for uranium enrichment. Russia is the leading global supplier, with 45% of global capacity. Again, countries across the Western Alliance are major customers of Russian fuel

Map of enrichment services by Russia sourcing percentage

Russian exports, mSWU p.a.



Without Russian exports, the world would face an annual shortfall in uranium enrichment of 8-10 million Separate Work Units (SWU), a specialised unit of enrichment activity, more than 20% of global output. In Capenhurst, owned and operated by Urenco, the UK has a world-leading enrichment facility with a capacity of 4.5 million SWU with room to expand, while Urenco has a global capacity of more than 18 million SWU.

Urenco could invest in preserving enrichment capacity at Capenhurst and consider expansion, again, if utility customers are willing to make the switch. This investment would create high-quality jobs and provide critical fuel supplies to help free our allies of Russian influence, but it depends on the UK Government and others facilitating the right market conditions to make the investment viable.



Urenco's UK enrichment facility at Capenhurst



Enrichment workers at Capenhurst

UK Government actions

The greatest risk to these commercial investments in UK strategic capabilities is the chance that countries currently looking to replace Russian fuel services will return to Russian supplies in a few years' time.

No buildout of conversion and enrichment capacity will occur without firm, long-term commitments from utility customers. No utility customers will switch, however, without firm, long-term guarantees of the viability of their new supply. The UK Government must help break the impasse and the Russians' grip with the following steps:

- Making awards from the £75 million Nuclear Fuel Fund in the autumn of 2022 that support the strategic priority of reinstating conversion capability and preserving enrichment capacity
- Revisiting and expanding the Nuclear Fuel Fund in the next Comprehensive Spending Review. For perspective, the United States has committed \$700 million (close to £600 million) for HALEU fuel development alone. We have set aside just £75 million for the entire nuclear fuel sector.
- Setting a policy to promote the commercial development of UK fuel cycle facilities, including conversion, enrichment and fuel fabrication
- Engaging with allied governments through the Department for International Trade and Foreign, Commonwealth and Development Office to encourage their utilities to switch to UK and Western fuel supplies
- Create an overall Uranium Strategy, as the US is developing, to maximise coordination between industry and Government

The Government should make these interventions because there is a strategic value to cutting Western dependency on Russian energy sources beyond what can be captured in purely commercial decisions. Ministers must assume responsibility for bringing the UK's world-class industrial capabilities fully to bear in defence of the democratic world.

Traditional fuel manufacturing

The Western Alliance is in a stronger position manufacturing nuclear fuel assemblies, the final products that are loaded into nuclear reactors. There is no overall shortage of fuel fabrication capacity. However, Hungary, Slovakia, Czechia, Bulgaria, and Ukraine still rely to varying degrees on Russian-manufactured fuel for their Soviet-designed VVER nuclear reactors. Westinghouse is qualified to produce fuel for the VVER-1000s for some utilities and is working to qualify for the remaining reactors. These investments can be made under the normal commercial parameters, so no Government intervention is needed at present. The UK Government should nonetheless monitor progress in the coming years and provide any support necessary to eliminate the use of Russian fuel.



Nuclear fuel manufacturing

Advanced fuel capabilities

Many leading nuclear nations are racing to develop Generation IV advanced modular reactors that will be optimised for co-generation of heat and power, hydrogen production and process heat for industrial decarbonisation. These reactors use new types of fuel compared to conventional reactors, often requiring more highly enriched uranium known as High Assay Low Enriched Uranium (HALEU).

Russia is the only country that can currently supply commercially viable HALEU. The UK should develop a domestic capability at Capenhurst to break this monopoly and to ensure our own security of supply.

Moreover, HALEU fuel will require deconversion and then manufacturing into advanced fuel to be ready for use. Therefore, investment is also needed in an advanced flexible fuel facility at Springfields with the capability to manufacture fuel for the different types of advanced reactor design.

Much like traditional conversion and enrichment, these capabilities will need a sustained customer base in the form of advanced reactor operators. The UK Government can help set the right market conditions with the following steps:

- Setting a policy that the High-Temperature Gas-Cooled Reactor (HTGR) demonstrator targeted for the early 2030s uses domestic advanced fuel
- Setting an ambitious capacity target for UK Generation IV reactor commercial deployment as part of the industrial decarbonisation strategy to make a capital investment in advanced fuel capabilities commercially viable

- Coordinating with allies on their advanced fuel requirements to ensure there is strong alignment across supply chains
- As noted the United States' Inflation Reduction Act 2022 allocates \$700 million for HALEU capability development alone. This should be the standard by which we measure our own commitment.



Springfield Fuels facility

The advanced fuel market is an opportunity for the UK Government and our Western allies to learn from our past mistakes and the Russians' success: we should not wait for the market to come to us but should shape the market and invest in competitive sovereign manufacturing. It is a lesson that we can and must apply here and elsewhere going forward.

3. New nuclear deployment across the globe

Russian dominance

From the beginning of 2017 through June 2022, 31 nuclear reactors began construction globally; 17 are Russian-designed, according to the International Energy Agency. In this short time, four new-to-nuclear countries have started building or have connected their first nuclear power plants: Belarus, Bangladesh, Egypt and Turkey. All have used Russian finance, expertise and reactor designs. India, long courted by the Western alliance, has started building four additional Russian reactors with Russian finance in the last five years, and Hungary, a NATO ally, will break ground on a new Russian reactor this year, again with Russian finance.

Russia has succeeded because it offered the full range of capabilities these countries do not have in order to deploy nuclear power: low-cost finance, proven reactor designs, nuclear construction expertise, regulatory expertise, and training in the operation of nuclear power plants. This approach deliberately creates a path dependency on Russian money, capability and ultimately goodwill which the Kremlin ruthlessly exploits.

The Western response

The UK, and the entire Western Alliance, have a clear strategic and economic interest in offering Western technology and expertise to counter the Russian civil nuclear offer. This would slash Kremlin export revenues and energy leverage and bring developing nations toward the democratic, rules-based order rather than authoritarian spheres of influence.

To do this, Western countries, including the UK, must match Russia's offer line by line:

- The UK Government should facilitate the development of a UK-flagged reactor design by committing to deploying 16 Rolls-Royce SMRs in the UK. This will justify investment in several SMR factories that can service foreign and domestic orders and activate supply chain capabilities
 - The Rolls-Royce SMR reactor, at 470 megawatts, has more siting options than large-scale designs and can operate on smaller grids.
 - Building a fleet of 16 Rolls-Royce SMRs creates around £22 billion of value in fuel alone across the 60-year life span of the units.
- The UK Government should ensure that UK Export Finance has the organisational capability to support several multi-billion pound long-term projects at once. UK Export Finance's Direct Lending Facility £200 million limit should be raised and its Buyer Credit Facility, Standard Buyer Loan Guarantee, and Bills and Notes Guarantee all be made available to support overseas customers wishing to deploy UK-flagged reactors.
 - The UK should learn from South Korea's success in exporting four large-scale reactors to the new-to-nuclear United Arab Emirates, backed by \$2.5 billion in direct loans from the Export-Import Bank of Korea.
- The UK Government should expand the budget and remit of the Office for Nuclear Regulation (ONR) to allow it to support UK reactor vendors' and developers' engagement with potential overseas customers.
 - The US Nuclear Regulatory Commission, the ONR's counterpart, regularly accompanies American developers to promote reactor exports. Westinghouse is in line to export up to nine AP1000 reactors to Ukraine and potentially several more across eastern Europe.
- The UK Government should expand the budget and remit of the ONR to allow it to offer more comprehensive technical advice to nations looking to establish nuclear regulatory regimes for the first time.
 - The ONR is globally respected and frequently sought out for advice by even established nuclear nations, so this is a key strength of the UK nuclear "offer".
- Recognising that the UK will not export reactors to every country, the UK Government should coordinate with its allies on how UK supply chain capabilities can support the deployment of other Western reactor technologies.
- In general, the UK Government should propose that the six leading Western nuclear nations, the United States, France, Canada, Japan, South Korea, and the United Kingdom, develop common principles and a common strategy for exporting nuclear expertise to maximise the Western market share and minimise Russian leverage.

Together, the Western nuclear nations can make developing nations a much better technical offer than Russia, and one without the strings so cynically attached. With timely action and effective collaboration, the UK and our allies can drastically reduce Russia's standing in the global reactor export market and, with it, the Kremlin's revenues to wage war.

4. Conclusion

Russia uses its exports of nuclear fuel and nuclear reactors to fund its failing economy and to secure energy leverage over our allies. We cannot allow this to continue. The UK has unique capabilities, particularly in nuclear fuel, to replace Russian supplies, but the UK Government must make the following strategic and targeted interventions to unlock that potential:

- Using the Nuclear Fuel Fund to back investment in uranium conversion capacity at Springfields and uranium enrichment capacity at Capenhurst will help our allies replace thousands of tonnes of Russian imports
- Setting a policy to promote the commercial development of UK fuel cycle facilities including conversion, enrichment and fuel fabrication and encouraging our allies to maximise their use of UK and Western fuel will give long-term certainty for major commercial investment in our sovereign nuclear fuel capabilities
- Facilitating the domestic deployment and export of the Rolls-Royce SMR will create another viable Western reactor and complementary UK fuel solution for global deployment
- Driving international coordination with our allies in the United States, Canada, France, South Korea and Japan can ensure that every developing country that wants to deploy nuclear can come to us for help and spurn the Kremlin.

This challenge is now a question of will. No one doubts any longer that Putin uses energy as a weapon. We cannot hope that markets will take that weapon out of his hands. We must do it ourselves.

5. About the APPG

The APPG on Nuclear Energy provides a forum for MPs and Peers to engage with leading businesses and organisations that are working to enable the UK to meet its energy security and decarbonisation targets through the implementation of civil nuclear projects, and to discuss policy options to support these.

The Group was established in July 2015.

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