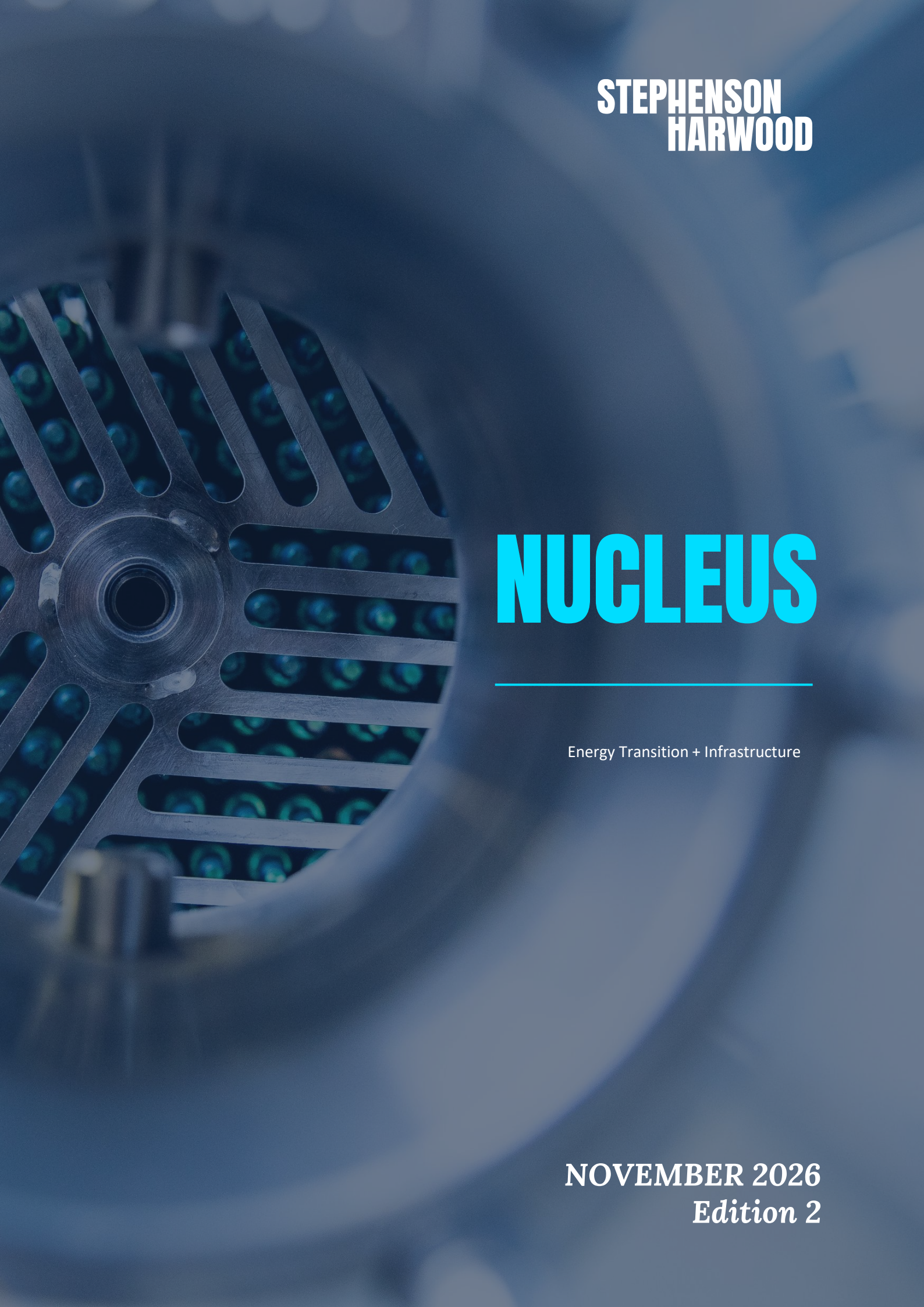
STEPHENSON HARWOOD



NUCLEUS

Energy Transition + Infrastructure

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Edition 2

WELCOME

Welcome to the latest edition of **Nucleus**

We are delighted to share the latest edition of Nucleus, the publication from Stephenson Harwood's nuclear team, designed to keep our clients and contacts informed of a range of key regulatory and commercial developments shaping the global nuclear industry. Our team is dedicated to helping clients navigate the challenges and opportunities of the global nuclear industry with confidence and clarity, and this briefing is part of that commitment.

Since our previous edition, the pace of change across the sector has continued to grow. The global focus on low-carbon energy, energy security and rising energy demand continues to drive new nuclear ambitions in established and emerging markets alike. In the Middle East, the landmark US-Saudi Arabia civil nuclear co-operation agreement was signed in July, as discussed in this edition. In Europe, SMR fleet plans are advancing, while in ASEAN, momentum continues to build around nuclear, which we also explore further.

In this edition of **Nucleus**, our four articles cover developments spanning the Middle East, ASEAN and the UK:

+ Civil nuclear developments and opportunities in the UAE and Saudi Arabia
+ Transboundary nuclear liability in ASEAN: Bridging the liability gap
+ AMRs and the UK automotive sector's energy transition
+ Too close to home: The planning law limits on population around a nuclear plant

Our market-leading 360 nuclear practice combines a core specialist team in London and Singapore with a network of nuclear hubs across key markets, including Paris, Dubai, Riyadh, Hong Kong and Seoul. This integrated approach enables us to deliver seamless, end-to-end legal insight at every stage of the nuclear project lifecycle.

We hope you enjoy this edition. If you would like to discuss any of the topics covered, or if there are any areas you would like us to address in future editions, please do not hesitate to contact any of the contributors to this briefing, any other member of our wider nuclear team, or your usual Stephenson Harwood contact.



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CIVIL NUCLEAR DEVELOPMENTS AND OPPORTUNITIES IN THE UAE AND SAUDI ARABIA

Civil nuclear energy is rapidly emerging as a cornerstone of the strategy of the Gulf Cooperation Council (GCC) to secure long-term energy security, economic diversification, and climate resilience. For leading states such as the United Arab Emirates (UAE) and now Saudi Arabia, investing in civil nuclear power is not only about meeting increasing domestic electricity demand and reducing reliance on hydrocarbons - it is also a critical enabler for achieving ambitious net-zero targets, driving industrial growth, and positioning themselves as global leaders in clean energy innovation.

A new era in energy

As a GCC first mover, the UAE has successfully transitioned from a regional nuclear pioneer to a global reference model for civil nuclear deployment. With the 5.6 GW Barakah Nuclear Energy Plant now operational, the Emirates Nuclear Energy Corporation (ENEC) is pursuing its next strategic evolution. This "Next Nuclear Paradigm" could extend beyond large-scale baseload generation to small modular reactors (SMRs), advanced modular reactors (AMRs), maritime decarbonisation and strategic positioning within the global nuclear fuel cycle.

However, the UAE is no longer the only Gulf state with serious civil nuclear ambitions. The 30-year US-Saudi Section 123 Agreement, signed in July 2026, marks a step-change in the Kingdom's relationship with the global nuclear community and could make nuclear a cornerstone of Vision 2030, as Saudi Arabia accelerates its drive to diversify its energy mix and transition away from traditional fossil fuels.

The development of robust civil nuclear programmes in the UAE and Saudi Arabia signals a new era of technological advancement, international collaboration, and strategic influence within the global energy landscape.

Developments in the UAE

The Barakah baseline

As the pioneer of civil nuclear in the Gulf, the UAE's Barakah Nuclear Energy Plant, with four South Korean-built APR-1400 units, has now been fully operational since September 2024, marking a significant shift in the GCC energy architecture. Producing 40 TWh of zero-carbon electricity annually (25% of UAE domestic power demand), has cut the UAE's LNG import reliance by more than $9 billion, freeing gas for industry and export, and prevents 22.4 million tonnes of carbon emissions every year, driving the nation's Net-Zero by 2050 Strategy. The same APR-1400 technology is now under consideration in Saudi Arabia.

UAE nuclear liability frameworks

To make this possible, the UAE established a comprehensive nuclear liability regime to ensure safety, accountability, and transparency in its civil nuclear sector. Oversight is provided by the Federal Authority for Nuclear Regulation (FANR), which enforces strict regulatory standards aligned with international best practices. The UAE's framework channels liability exclusively to the operator, requiring absolute liability regardless of fault, and mandates robust financial security and insurance coverage. The UAE is also a signatory to key international treaties, including the Vienna Convention on Civil Liability for Nuclear Damage and the Treaty on the Non-Proliferation of Nuclear Weapons, reinforcing its commitment to global nuclear safety, environmental protection, and peaceful technology use.

Expansion of the UAE nuclear sector

With FANR formally implementing its 2025-2029 regulatory plan, Abu Dhabi is preparing for capacity expansion, and ENEC is evaluating a tender that could double its commercial reactor fleet. This is driven by an unprecedented surge in domestic power demand, projected to rise from 54.15 GW to 68.08 GW, propelled by Abu Dhabi's multi-billion-dollar investments in AI data centres, which need uninterrupted, clean baseload power.

Opportunities for SMRs, AMRs and maritime nuclear

For high-temperature, energy-dense demand that large-scale reactors cannot easily serve, the ENEC ADVANCE programme positions the UAE as a global SMR and AMR incubator. Driven by its Net-Zero by 2050 Strategy and its role as a global shipping hub, the UAE is also considering applying nuclear technology to maritime and port decarbonisation, focusing on port electrification, alternative fuel synthesis and advanced hull propulsion.

SMRs

In May 2025, ENEC began a multi-phase evaluation with GE Vernova Hitachi Nuclear Energy to deploy the BWRX-300 SMR, targeting power for AI data centres, off-grid co-generation for large-scale electrolytic hydrogen and other clean molecules, and a commercial framework in which ENEC acts as primary co-developer and financing partner for SMR deployments across the Middle East and Africa.

AMRs and micro-reactors

Stepping down in scale but up in temperature flexibility, the UAE is also interested in pursuing micro-modular reactors (MMRs), including targeting the deployment of MMRs and AMRs to bypass municipal grids entirely and decarbonise heavily industrial port infrastructure. On 24 February 2026, Abu Dhabi-based EHC Investment, linked to the International Holding Company, signed a memorandum of understanding with US-based NANO Nuclear Energy for the domestic deployment and potential dual listing of the KRONOS MMR. This is a 45 MW thermal, 15 MW electrical high-temperature gas-cooled reactor with a sealed, waterless, transportable core, suited to remote oil and gas extraction facilities, off-grid mining and heavy industry zones lacking water-cooling infrastructure.

Maritime: AMR port decarbonisation

The KRONOS reactor is designed to be embedded directly into megaports such as Jebel Ali and Khalifa Port and could provide consistent, zero-emission shore-side electricity ("cold ironing") to docked container ships. It also offers resilient infrastructure by isolating critical logistical assets from grid failures and regional energy supply volatility.

The UAE's open fuel cycle

The foundational pillar of the UAE's civil nuclear legitimacy has been its commitment to a 100% open, non-domestic fuel cycle. Under its 2009 Section 123 Agreement with the United States, Abu Dhabi voluntarily forwent domestic uranium enrichment and spent-fuel reprocessing.

Instead, the UAE has built a highly resilient, internationally diversified procurement model. ENEC maintains long-term fuel fabrication and supply arrangements with global suppliers, ensuring stable commercial inventories without domestic fuel manufacturing. The Emirates Nuclear Technology Centre (ENTC), under FANR oversight, leads research on spent-fuel radiation management and long-term repository planning, focusing on internationally verified fuel leasing, secure transportation and disposal, rather than domestic reprocessing.

Developments in the Kingdom of Saudi Arabia

The US-Saudi Section 123 Agreement and its implications

On 22 July 2026, US Energy Secretary Chris Wright and Saudi Energy Minister Prince Abdulaziz bin Salman signed a landmark 30-year civil nuclear co-operation agreement, establishing the legal foundation for US companies to participate in building Saudi Arabia's civilian nuclear infrastructure. Unlike the UAE's strict non-proliferation commitment, it does not explicitly compel the permanent forfeiture of domestic enrichment and reprocessing. Instead, it uses an alternative mechanism:

+ *Two-year economic study*: enrichment is deferred to a two-year joint study of whether domestic enrichment is commercially justified.
+ *"Black box" compromise*: if validated, US entities would build an enrichment facility run by Saudi personnel legally and technically walled off from the sensitive technology.
+ *Safeguards gap*: the agreement relies on bespoke bilateral safeguards; Saudi Arabia has so far resisted the International Atomic Energy Agency's full Additional Protocol, limiting inspectors' authority to detect undeclared activities compared with the UAE model, a potential source of concern for some.

Diplomatic uncertainty
Despite the historic signing, the agreement faces immediate diplomatic challenges. President Donald Trump has publicly tied the deal to Saudi normalisation of relations with Israel under the Abraham Accords, a linkage Saudi officials reject. There is also bipartisan concern over the absence of a permanent Saudi commitment to forgo domestic enrichment, and a Congressional review is underway in the US. The outcome will shape the operational environment for all stakeholders, and to date the agreement has not yet entered into force.

Vision 2030 and full fuel cycle ambitions
Under Vision 2030, the National Project for Atomic Energy (NPAE) aims to meet soaring grid and significant desalination demands, replacing domestic hydrocarbon burning with nuclear power, to preserve crude oil for high-value exports. The state-managed Nuclear Holding Company (NHC) coordinates international purchasing tenders, asset capitalisation and joint ventures. Unlike the UAE, Saudi Arabia aims to manage the full fuel cycle domestically, ideally including uranium exploration, yellowcake production, and low-enriched uranium fuel manufacturing, potentially for both domestic use and export.

Potential technologies under consideration
Saudi Arabia's plans include large-scale Generation III+ baseload stations, integrated fuel cycle operations and potentially advanced SMRs. Candidate designs include Westinghouse's AP1000 (US) - well placed after the Section 123 Agreement; KEPCO's APR-1400 (South Korea) - proven at Barakah; and EDF's EPR (France) - heavy evolutionary PWR for baseload generation. Rosatom's VVER-1200 (Russia) and CNNC's Hualong One (China) are effectively excluded post-US alignment. SMRs are under consideration for localised desalination and decentralised grids, and Saudi Arabia's first research reactor, built by Argentina's INVAP, is complete and awaits fuelling.

Saudi nuclear liability frameworks
Saudi Arabia has established a modern nuclear liability regime overseen by the Nuclear and Radiological Regulatory Commission (NRRC). The Law of Civil Liability for Nuclear Damage channels liability exclusively to the operator, shielding vendors and contractors from third-party claims, and imposes absolute liability without requiring victims to prove fault. Operators must also maintain mandatory insurance or other financial security in line with international standards.

Saudi Arabia has also joined key international instruments, including the Vienna Convention on Civil Liability for Nuclear Damage and its 1997 Protocol, which extend cross-border coverage, broaden the definition of environmental damage and raise liability limits. It is also party to the Treaty on the Non-Proliferation of Nuclear Weapons and the Convention on Nuclear Safety and maintains an IAEA Comprehensive Safeguards Agreement following rescission of its Small Quantities Protocol, reinforcing its commitment to peaceful nuclear use, international monitoring and nuclear safety.

Opportunities for civil contractors

Taken together, the UAE's next-phase expansion and Saudi Arabia's new-build programme create a substantial regional pipeline, spanning reactor construction and supporting infrastructure, including transport, water, waste management and grid integration. With international contractors potentially poised for high-level contracts in both countries, key opportunities include:

+ *Infrastructure development and construction*: EPC contracts; civil works for site preparation, access roads and utilities; and specialised construction for nuclear-grade containment, security and waste storage.
+ *Supply chain participation*: contractors with expertise in nuclear standards, quality assurance and regulatory compliance will find opportunities in the fabrication and supply of nuclear-grade materials and components, safety and security systems provision, and logistics and project management services.
+ *Localisation and joint ventures*: in line with Vision 2030, joint ventures with Saudi firms, investing in local manufacturing and workforce training will boost competitiveness.
+ *Regulatory and compliance advisory*: contractors will require sophisticated legal, regulatory and risk management advice.

A defining decade for the region

The UAE appears to be leveraging its early-mover advantage and is expanding its international nuclear partnerships, with ENEC positioning itself as a transnational investor by co-financing conventional builds, brownfield mergers and SMR projects in the United States, South Korea and Romania. Through ENEC ADVANCE, strategic port electrification and international infrastructure investment, Abu Dhabi is embedding advanced nuclear technology into the global clean energy economy.

Saudi Arabia's civil nuclear programme, meanwhile, is entering a defining phase. The US-Saudi Section 123 Agreement brings significant opportunities, and challenges, for global civil contractors, and the evolving legal, regulatory and geopolitical landscape demands proactive engagement, strategic partnerships and expert legal guidance.

For contractors willing to invest in compliance, localisation and partnership, the combined ambitions of the UAE and Saudi Arabia offer a once-in-a-generation opportunity to shape the future of energy in the Middle East and beyond. Stephenson Harwood's deep sectoral expertise and presence in London, Riyadh and Dubai make us ideally positioned to support clients as they navigate this new frontier.



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TRANSBOUNDARY NUCLEAR LIABILITY IN ASEAN: BRIDGING THE LIABILITY GAP

ASEAN stands at a critical juncture in its energy policy. Faced with surging electricity demand, a growing population of around 700 million, and ambitious decarbonisation commitments, several member states have announced nuclear energy programmes. Modern nuclear reactor designs incorporate safety features intended to reduce the likelihood and consequences of severe accidents. Some designs, including certain Gen III+ reactors and certain small modular reactors, use passive systems to reduce reliance on external power or operator intervention. These features require design and site-specific assessment and do not eliminate accident risk; estimated accident frequencies are not observed accident rates. A clear and comprehensive compensation framework to address nuclear accidents is essential for sound risk management and to support public confidence in nuclear development as a pathway to a cleaner energy future.

Against that backdrop, the absence of a transboundary nuclear liability framework within ASEAN is a significant regulatory gap. Only the Philippines is party to an international nuclear liability convention (the Vienna Convention), and the relevant domestic law remains outdated. There is therefore no uniform treaty-based route to compensation across ASEAN; cross-border claims may nevertheless be covered, depending on the applicable convention and domestic law.

This liability gap weakens effective victim protection, undermines the bankability of nuclear projects, and makes public acceptance, already sensitive after accidents such as Fukushima, significantly harder to secure.

International nuclear liability conventions

Because nuclear accidents can be low-probability but catastrophic, with long-lasting environmental and health impacts and complex causation issues, ordinary tort law is often inadequate. Low estimated probabilities do not justify disregarding extreme external hazards, common-cause failures or events affecting several units. To deal with this, two parallel international conventions emerged: (i) the Paris Convention (1960), adopted under the Organisation for European Economic Co-operation (OEEC), the OECD's predecessor, and (ii) the Vienna Convention (1963), adopted under the IAEA. The Paris Convention mainly serves European states, while the Vienna Convention was designed to create a truly international instrument open to all states.

Despite different institutional origins, both the Paris and Vienna regimes are built on similar core principles. They impose strict liability on nuclear operators, so victims need not prove fault. Subject to limited exceptions and rights of recourse, they channel third-party liability for nuclear damage covered by the relevant convention to the operator, generally shielding suppliers and contractors from direct claims and simplifying insurance arrangements. Operators are required to maintain financial security, such as insurance or other guarantees, to fund covered claims within the applicable limits. Jurisdiction over claims is exclusive to the courts of the installation state, limiting forum shopping. Compensation must be available without discrimination based on nationality or residence, but liability amounts are capped at defined ceilings and claims must be brought within prescribed periods. These principles aim to collectively balance victim protection, legal certainty for operators, and the facilitation of nuclear energy development.

Subsequent updates (the 1997 Protocol to the Vienna Convention and the 2004 Protocol to the Paris Convention) raised minimum liability amounts, broadened the definition of nuclear damage to include economic and environmental loss and preventive measures, and in the Paris regime's case extended limitation periods and allowed for unlimited operator liability. The Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (Joint Protocol) was also adopted to allow victims in a Vienna Convention state to claim under the Paris Convention for an incident in a Paris Convention state and vice versa.

However, uptake of these protocols has been limited and geographically concentrated, and major nuclear states such as the US, China, Japan and India remain outside the Paris/Vienna framework.

Recognising that the Joint Protocol could not achieve universal coverage, the IAEA developed the Convention on Supplementary Compensation for Nuclear Damage (CSC), adopted in 1997 and in force since 2015, to provide a more globally inclusive mechanism. The CSC is open to parties to the Paris and Vienna Conventions and to states that are party to neither, provided their national legislation meets specified minimum standards. The CSC also created an international supplementary fund financed by contributions from contracting states, weighted by installed nuclear capacity. At least half of the international fund must be reserved for transboundary damage. The CSC also explicitly permits regional arrangements consistent with its framework, offering a legal foundation for ASEAN to build regional mechanisms atop a global system. A 2026 amendment further improves the CSC's attractiveness by removing capacity-based contribution requirements for states with no nuclear reactors, making accession more appealing for states such as Singapore or Thailand.

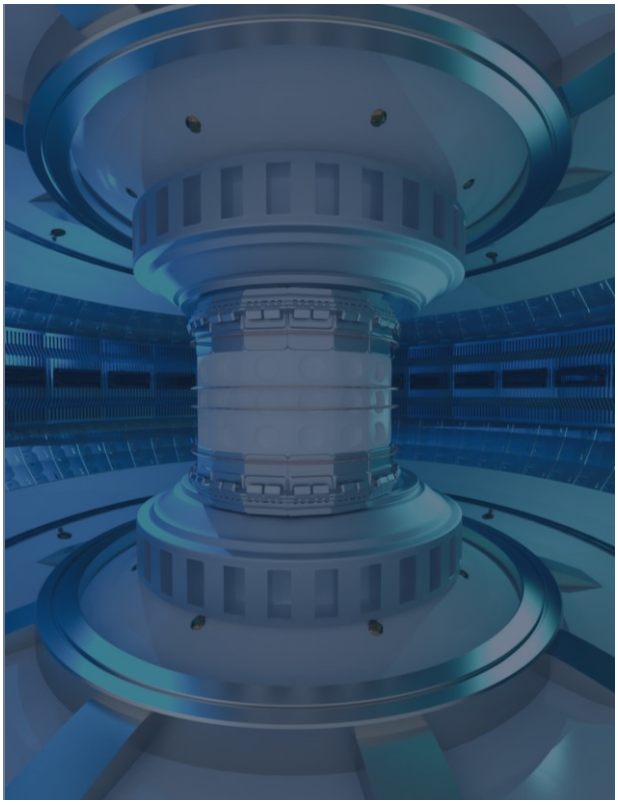
Globally, the nuclear liability landscape is multi-layered rather than unified, but CSC now covers the largest number of operational reactors under any single instrument, including reactors in states such as Japan and India that are not party to the Paris or Vienna Conventions.

National nuclear liability laws

Many nuclear-operating countries that remain outside these conventions have domestic nuclear liability laws that reflect similar core principles, including strict operator liability, caps and mandatory financial security. Japan's handling of compensation under national law after the 2011 Fukushima accident, before it joined the CSC in 2015, illustrates the role of national compensation regimes and state financial support. Nonetheless, international treaties remain important because they provide predictable jurisdictional rules, agreed mechanisms for legal channelling, and better prospects for cross-border enforcement of judgments. Without treaty relations, victims may pursue claims in multiple jurisdictions, and suppliers and investors face fragmented litigation risk, as illustrated by Fukushima-related lawsuits in US courts, where the absence of a nuclear liability treaty between the US and Japan left US courts unconstrained by Japanese jurisdiction and channelling rules.

ASEAN's nuclear liability landscape

No ASEAN member state currently operates any power-generating nuclear power plant. Nevertheless, several states have adopted domestic nuclear liability regimes incorporating internationally accepted principles, creating a foundation for future regional harmonisation.



These states are the Philippines, Vietnam, Indonesia and Malaysia, though only the Philippines and Vietnam address transboundary nuclear incidents. Please see the table below for further details.

	Philippines	Vietnam	Malaysia	Indonesia
Key legislation on liability	Republic Act No. 5207 (RA 5207), as amended by Presidential Decree No. 1484	Law on Atomic Energy No. 94/2025/QH15	Atomic Energy Licensing Act 1984, as amended by the Atomic Energy Licensing (Amendment) Act 2025	Law No. 10 of 1997 on Nuclear Energy
International nuclear liability Conventions	1. Party to the Vienna Convention, but not the 1997 Vienna Protocol 2. Signed but not ratified the CSC	Not a party to any international nuclear liability convention	Not a party to any international nuclear liability convention	Signed but not ratified the Vienna Convention and the CSC
Liability regime	RA 5207, aligned with the Vienna Convention, remains the governing instrument for liability A proposed Philippine Nuclear Liability Act to modernise these provisions in line with the 1997 Vienna Protocol remains pending before Congress	Operators must obtain insurance or financial guarantees; any state support for excess liability is subject to the applicable statutory conditions Compensation limits depend on applicable domestic law and any international treaties binding on Vietnam	The Director-General may adjust liability limit, subject to a floor of RM 12 million (approximately USD 2.7 million). This floor is well below international benchmarks	Strict operator liability capped at approximately USD 93 million – a relatively low cap
Transboundary liability provisions	Yes	Yes	Not addressed in the legislation	Not addressed in the legislation

A harmonised ASEAN approach
Against this backdrop, a harmonised ASEAN approach is needed. In the near term, ASEAN member states with nuclear power programmes should align their domestic legislation to CSC standards and accede to the CSC.

Operationalising a nuclear liability regime, however, cannot be a purely national exercise. Because the effects of a nuclear accident can be cross-border, member states must co-operate on practical aspects such as transboundary claims handling and the mutual recognition of compensation awards. They also need to agree regional approaches on matters that the convention leaves to national laws, including the extent of compensation for non-core heads of damage and causation standards.

Experience from Fukushima, for which some estimates of total accident-related costs, including decommissioning and decontamination, not just victim compensation, have exceeded USD 200 billion, suggests ASEAN should consider whether it can generate compensation amounts substantially above current treaty minima. Options include establishing a regional nuclear insurance pool that aggregates the limited capacity of domestic insurers, using governments as reinsurers of last resort, and creating an additional fund financed by supply-chain participants, drawing by analogy on the reactor-operator-funded supplementary tier of the US Price-Anderson arrangements or the oil receiver-funded mechanisms used for marine oil pollution.

ASEAN's nuclear liability regime should also reflect the technologies the region is likely to deploy. Much of the anticipated build-out involves small modular reactors (SMRs), as well as innovations such as nuclear-powered ships and transportable nuclear plants, which raise liability questions not fully addressed in existing conventions. ASEAN should participate actively in international discussions on SMR liability and ensure its regional framework confronts these issues directly.

The region already has relevant institutional infrastructure: the ASEAN Network of Regulatory Bodies on Atomic Energy (ASEANTOM), which links national nuclear regulators, and the Nuclear Energy Cooperation Sub-Sector Network (NEC-SSN). This work is, moreover, already embedded in the region's energy blueprint, the ASEAN Plan of Action for Energy Cooperation 2026-2030, which commits to developing policies on nuclear liability and exploring financing and insurance mechanisms for nuclear programmes.

Regional cooperation has proved vital in other contexts, such as the European Atomic Energy Community (EURATOM) in Europe and Gulf Cooperation Council (GCC) initiatives in the Gulf, and ASEAN could usefully survey these experiences.

Encouragingly, momentum is building. The IAEA has been actively promoting accession to the CSC as a pathway towards a global nuclear liability regime, and ASEAN states appear increasingly receptive. In December 2025, the IAEA co-organised a workshop in Bangkok - mirroring one held in Europe that October - which brought together representatives from six member states (Brunei, Indonesia, Malaysia, the Philippines, Singapore, and Vietnam) to deepen their understanding of the CSC.

Challenges to a harmonised ASEAN approach
These foundations notwithstanding, the path to a regional liability framework faces real obstacles. ASEAN operates on a consensus-based model grounded in non-interference and respect for sovereignty, which makes binding, cost-bearing commitments harder to achieve than the prohibitory commitment embodied in the Treaty on the Southeast Asia Nuclear Weapon-Free Zone (known as the Bangkok Treaty), under which all ASEAN member states have agreed to ban nuclear weapons throughout the region. A nuclear liability regime asks states not merely to refrain from conduct but to accept affirmative financial obligations and cross-border exposure. Further, many states hold the view that national nuclear programmes are matters of national sovereignty.

Member states are also at markedly different stages of nuclear development - Vietnam and the Philippines have advanced programmes, while others remain in early exploration - so their appetite for assuming liability commitments varies widely. Disparities in regulatory capacity, legal infrastructure, and trained personnel further complicate harmonisation, particularly for less-developed member states still building the "bare minimum" of nuclear governance.

The need for a credible transboundary nuclear liability regime

Features intended to improve safety in modern reactor designs do not eliminate accident risk or the need for comprehensive compensation arrangements, even where assessed accident probabilities are low. Nevertheless, ASEAN currently has no coherent framework to address cross-border nuclear damage. Existing domestic laws are uneven, compensation limits are often far below international benchmarks, and only one member state presently participates in any international liability convention. At the same time, the international regime itself is fragmented, with multiple overlapping instruments and major nuclear states outside the core conventions.

ASEAN needs to bridge this liability gap. While political, institutional, and capacity constraints are real, a credible transboundary nuclear liability regime is not optional. It is a precondition for protecting victims, enabling investment, and securing public confidence in ASEAN's nuclear future.



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AMRS AND THE UK AUTOMOTIVE SECTOR'S ENERGY TRANSITION

The UK's legally binding commitment to achieve net-zero carbon emissions by 2050 is reshaping every facet of the nation's industrial landscape. For energy-intensive industrial users (EIIUs) - including the automotive sector - this transition is not merely an environmental obligation, but a strategic imperative. Some key automotive manufacturers, already navigating the structural shift from internal combustion engines to electric vehicles, are now facing the dual challenge of decarbonising their own manufacturing processes while remaining globally competitive, amid volatile energy markets and rising regulatory scrutiny.

The sector's decarbonisation crossroads

The UK automotive industry is a bellwether for the broader industrial transition. With the government requiring all new cars and vans sold from 2035 to be zero emission, and the rapid electrification of transport, automotive manufacturers are under significant pressure to deliver zero-emission vehicles from zero-emission factories. Yet, the sector's production facilities tend to remain reliant on high-temperature fossil fuel processes - paint shop curing ovens, casting operations, and expansive HVAC systems - that are typically difficult and costly to electrify using conventional grid power or renewables alone.

Grid decarbonisation, while progressing, cannot deliver the high-grade heat required by automotive and allied industries at the scale and reliability needed. Moreover, the volatility of energy prices and the risk of grid constraints threaten both operational certainty and cost competitiveness for European-based manufacturers.

AMRs - a game changer for industrial energy

Advanced Modular Reactors (AMRs) represent the next generation of nuclear technology, designed to be smaller, safer, and more flexible than traditional large-scale nuclear plants. Unlike conventional nuclear or renewable sources, AMRs, especially high-temperature gas-cooled reactors (HTGRs), such as the U-Battery (discussed below) or the X-energy Xe-100, can potentially deliver both clean, low-carbon electricity and high-grade industrial heat (up to 710°C), directly addressing the most challenging decarbonisation needs of heavy industry.

Key features of AMRs include:

+ *Modular, factory-built design*: off-site manufacturing enables rapid deployment, quality assurance, and lower construction risk.
+ *Inherent safety*: use of accident-tolerant TRISO fuel, with robust containment and passive safety systems.
+ *Flexible siting*: compact footprint (as small as 350m² for a U-Battery unit) allows for installation at or near industrial sites, reducing transmission losses and enabling local energy autonomy.
+ *Co-generation capability*: simultaneous production of heat and power, ideal for integrated industrial applications.

The U-Battery example

Stephenson Harwood acted as project counsel to U-Battery, a technology which exemplifies many of these advantages. With an intended scalable output of 10MWt/4MWe per unit, the U-Battery concept was designed for off-grid and embedded industrial use. Its high-temperature output proposition is potentially suited to decarbonise processes such as:

+ District heating for automotive facilities.
+ Paint curing and drying.
+ Metal casting and forging.
+ Chemical manufacturing.
+ Hydrogen production (for fuel cell vehicles and green steel).

Strategic benefits for European automotive manufacturers

1. *Direct decarbonisation of hard-to-abate processes*

AMRs offer a practical solution to potentially augment and/or over time, replace natural gas and other fossil fuels in high-temperature applications.

2. *Cost and energy security*

Factory-built AMRs are projected to deliver competitive energy costs over their lifespan, with further reductions possible at scale. By generating power and heat on-site, manufacturers can hedge against grid price volatility and supply constraints, securing long-term operational certainty.

3. *Flexible deployment and scalability*

The modular nature of AMRs enables phased deployment, tailored to the evolving needs of individual plants or industrial clusters. Multiple units can potentially be installed to match demand, provide supply resilience, and the small footprint allows integration even at space-constrained sites.

4. *Regulatory and market alignment*

The UK government has made AMRs a cornerstone of its net-zero industrial strategy, with funding and regulatory support for demonstration projects. In February 2026, the Department for Energy Security and Net Zero launched the Advanced Nuclear Pipeline process (part of the Advanced Nuclear Framework), which is designed to provide a structured and transparent channel for privately led advanced nuclear projects to engage with the government, secure early support, and fast-track their development towards commercial deployment.

Industrial decarbonisation is at the heart of the Pipeline, with projects required to demonstrate how they would directly support the domestic economy in the UK, such as by providing high-temperature industrial heat for UK heavy manufacturing (such as steel or automotive) or dedicated power for UK-based AI data centres. Interestingly, whilst at least three projects are believed to have entered the Pipeline process, multiple AMR technologies are now going through the Generic Design Assessment process (pre-design certification) in the UK, with six AMR vendor companies represented.

Legal and commercial considerations

As with any transformative technology, the deployment of AMRs raises important legal, regulatory, and commercial questions for industrial end-users, including:

+ *Site licensing and planning*: AMRs benefit from a streamlined regulatory pathway compared to traditional nuclear plants, but site-specific assessments and community engagement remain critical.
+ *Contractual structures*: innovative power purchase agreements (PPAs), heat offtake contracts, and joint ventures may be required to align interests between reactor developers, operators, and industrial users.
+ *Financing and risk allocation*: the modular, off-site construction model reduces capital risk, but manufacturers will need to consider financing options, insurance, and long-term liability frameworks.

Case studies: The UK's AMR deployment momentum

Recently announced AMR projects demonstrate the UK's commitment to advanced nuclear:

+ *Cottam, Nottinghamshire*: Holtec UK and EDF's joint venture to deploy up to four advanced 300MWe reactors, leveraging existing grid infrastructure and directly powering new data centre clusters.
+ *Hartlepool, Teesside*: where X-energy plans to install up to 12 Xe-100 AMRs, providing both electricity and high-temperature heat to decarbonise the Teesside industrial base.

While these projects are outside the automotive sector, they provide a leading indicator of how early-stage AMR development is now being taken forward in the UK. This shows the potential for AMRs to be integrated into industrial supply chains, while also highlighting the UK's increasing regulatory and commercial readiness for AMR deployment, to facilitate future fleet roll-out.

A strategic opportunity for automotive leaders
The UK automotive sector stands at a pivotal moment. Achieving net-zero manufacturing will require bold adoption of next-generation energy solutions. AMRs, especially high-temperature, co-generation designs, potentially offer a pragmatic, scalable, and future-proof pathway to deep decarbonisation, energy security, and competitive advantage.

As trusted advisers to the sector, we can work with automotive manufacturers to proactively explore potential PPAs, pilot projects, and/or regulatory engagement around AMRs.

Stephenson Harwood plays a key role in supporting the legal aspects of land, siting, regulatory, governance and real estate matters that facilitate the potential future development of AMRs in the UK. Drawing on our deep expertise in nuclear, we provide comprehensive legal counsel to address the unique challenges posed by AMR projects, such as co-location with legacy assets, environmental permitting, managing regulatory interfaces, and helping to unlock the full value of sites, positioning them as hubs for next-generation nuclear innovation and industrial decarbonisation in the UK.



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TOO CLOSE TO HOME: THE PLANNING LAW LIMITS ON POPULATION AROUND A NUCLEAR PLANT

It is no secret that it is difficult to get planning permission for a nuclear power station in the UK. One of the reasons is our mathematical test on the population around a reactor: the bemoaned semi-urban density population criterion.

The determination process

The Planning Act 2008 classifies a nuclear plant with capacity of more than 50 megawatts as a nationally significant infrastructure project. Applications for such projects in England and Wales fall to be determined by the Secretary of State for Energy Security and Net Zero. The Act obliges the Secretary of State to have regard to national policy statements on nuclear energy generation when deciding whether to grant or refuse an application. The latest policy statement (EN-7) came into force on 18 December 2025. In a move away from its 2011 predecessor (EN-6) its focus is no longer limited to eight specified sites.

The new policy statement encourages a broader range of sites to be brought forward in recognition of advancements in modern reactor designs. EN-7 sets out a framework of factors which should tilt the Secretary of State towards a 'yes' decision where satisfied. The factors include geophysical attributes, impact on biodiversity, and impact on water availability. The move to a flexible framework of factors is welcomed by the nuclear industry. Less welcomed by the industry is the retention in EN-7 of the Office for Nuclear Regulation's semi-urban density population criterion.

The maths test, not quite as easy as π

The semi-urban density population criterion applies a complex mathematical formula to the population around a potential site. It is a pass or fail test. In this respect it stands in contrast to the other factors listed in EN-7.

It works by totting up local population figures in a series of one-kilometre radial bands from a potential site out to 30 kilometres. The number of people in each band are separated into 30° segments like slices of a pie with the reactor at the centre. Next, weighting factors are applied to come up with a figure for each segment and each cumulative radial band. The weighting factors are derived from the atmospheric dispersion of radioiodine in a hypothetical nuclear incident. They reflect the average dose that a person would receive in each radial band with no protective measures. The effect is that a smaller, densely packed settlement near the centre of the pie has a worse impact on score than a larger, more evenly dispersed settlement towards the crust.

The final numbers are processed against fixed benchmarks and converted into 'site population factor' statistics, all of which must be less than one. The first benchmark, in unweighted terms, is 5,000 people per square kilometre when you look at each 30° segment. The second benchmark, in unweighted terms, is 1,000 people per square kilometre when you look at each cumulative radial band. In other words, the 5,000 people/km^2 test must be satisfied for twelve out of twelve slices of pie. The 1,000 people/km^2 test must be satisfied for 29 hypothetically smaller pies, not just the pie as a whole. These benchmarks are what the ONR considers an acceptable risk to the public. Determining what constitutes an acceptable risk to the public is an inherently political and philosophical art. It is nevertheless a judgement that governments make on matters of medicine, transport, housing and welfare every day.

Bad science

The benefit of a mathematical formula with fixed benchmarks is that developers know where they stand. And a comparison of the harm to be suffered from a nuclear incident in different locations is not a bad thing. However, the UK Nuclear Regulatory Taskforce submitted to Parliament this year that the criterion is based on outdated technology and bad science. This is not hard to believe for a policy that was introduced less than a decade after the UK's first commercial reactor was deployed and a full two decades before typewriters were replaced by office computers.

The methodology used in the criterion has not been substantially updated using decades of operational and safety data that has been collected since the 1960s. It does not care about reactor size. More importantly, the criterion fails to take account of safety improvements in modern reactor designs.

Shrinkage of reactor output in many modern designs depicts the criterion as a blunt instrument. Whilst it is an oversimplification to say size equals risk, a smaller reactor contains a smaller amount of fuel. In these very simple terms, there is a greater risk posed by a 1.6 gigawatt PWR than an SMR which is smaller in output by a factor of twenty. The criterion makes zero allowance for this reduction of risk.

Modern reactor designs employ a range of independent safety systems. Many of these are passive systems, meaning a reactor in distress will shut down in a safe and controlled manner without human intervention. These systems can rely on physical processes such as natural circulation or gravity to perform safety functions without power or operator action. For example, gravity-drop control rods are held up by electromagnets and will drop into a reactor in the event of an unexpected loss of power. The use of molten salt as coolant in some designs is another example. When molten salt overheats, it expands and naturally absorbs more heat from a reactor core, slowing the chain reaction.

The retention of an over-zealous local population criterion is therefore a missed opportunity. It curtails the benefit of reactor shrinkage and reactor safety improvements. The solutions are to revisit the numerical basis of the criterion (and end up with something probably even more complex) or to move to a qualitative test. A third solution is to do away with safe local population density as a planning consideration in EN-7 altogether.

The REPPIR alternative

To the extent that population density should remain a planning consideration, it could harness an exercise an operator must already carry out to comply with the Radiation (Emergency Preparedness and Public Information) Regulations 2019 (REPPIR). These regulations require an operator to carry out a hazard evaluation and consequence assessment of potential radiation emergencies. The consequence assessment looks at the incidents likely to occur with *that particular design* in *that particular location* with *that particular set of design and operational mitigations* that are in place.

The consequence assessment also takes a real world look at the harm. For instance, in the majority of Great Britain, we have a prevailing south-westerly wind. This means an escaped cloud of radioactive particles is most likely to blow towards the north-east. A site located close to an infant school or a retirement home will have more particularly vulnerable people in harm's way than is revealed by simple population numbers. By contrast to the REPPIR exercise, the maths of the semi-urban density population criterion takes no account of these nuances.

The main duties of an operator under REPPIR are to carry out the hazard evaluation exercise, discuss it with the local authority, and implement an appropriate emergency preparedness plan. REPPIR behaves like a planning requirement in that these duties are a pre-condition to use of a site for ionising radiation. However, it is unlike a planning requirement in that it is focused on mitigating the impact of that use rather than questioning whether the use should happen in the first place. Nor does it give the public a say in the process.

If the REPPIR exercise were to replace the semi-urban density population criterion in the planning process, it would give the Secretary of State a better-tailored framework to consider the number of people in harm's way from a nuclear incident, the gravity of the risk, and the mitigations. Many will feel that the risk of a nuclear incident to the local population should remain a planning consideration so that the public has a voice on it. Evaluating nuclear risk should not be the exclusive preserve of the ONR.

The future

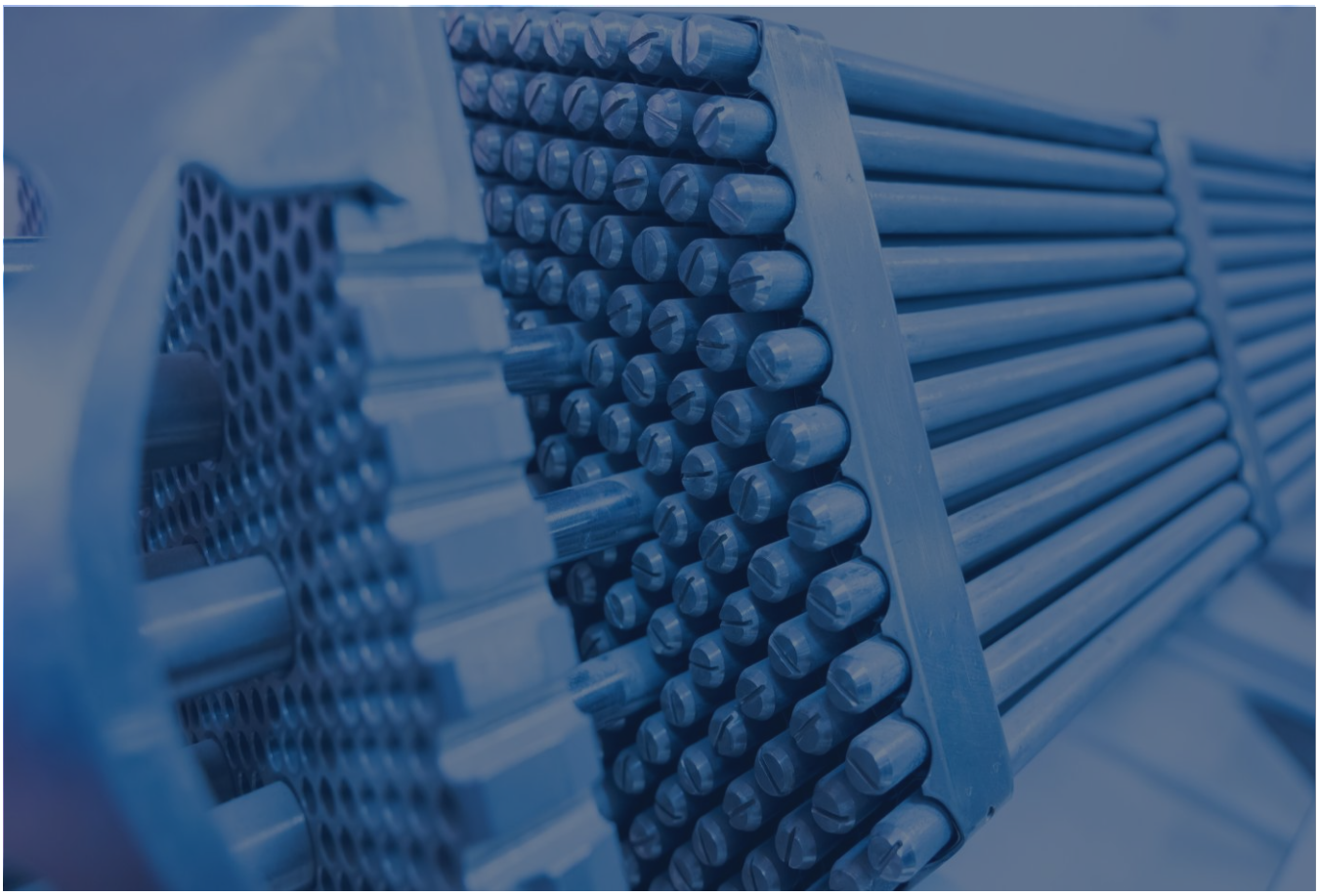
The critics of the semi-urban density population criterion say they do not want to compromise nuclear safety, they simply want the test to get with the times. Unless revisited in some way, the criterion will inhibit the UK government's pledge to quadruple nuclear generation to 24 gigawatts by 2050. We live on a densely populated island, and the new power stations will have to go somewhere.



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UPCOMING EVENTS

Energy Security in a Changing World
Tuesday 8th December 2026, London | 08:30 – 11:00am

Join us for an exclusive roundtable as part of our Energy Trilemma series, bringing together senior industry participants to explore the changing energy security landscape.

Energy security is no longer simply a question of securing sufficient supply. It is increasingly about building a resilient, diversified and investable energy system capable of responding to geopolitical uncertainty, growing electricity demand and the transition to a lower-carbon economy.

We will bring together perspectives from across the energy and infrastructure sector to consider what energy security means in practice, where the greatest opportunities for investment lie, and how governments and industry can work together to deliver the infrastructure required for the next generation of energy demand.

The roundtable will be held under the Chatham House Rule to encourage an open and candid discussion.

If you would like to attend this event, please contact: gemma.kay@stephensonharwood.com
Please note that places are limited.

STEPHENSON HARWOOD

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