UK Atomic Energy Authority

Global Fusion Guide for SMEs

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There are multiple useful links in this publication which will not be available if printed.
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Executive Summary

The global fusion industry is entering a **decade of rapid scale-up**, creating clear and practical **routes to market for small and medium-sized enterprises (SMEs)** across multiple regions. As fusion companies shift from **laboratory prototypes to full demonstration power plants**, they are increasingly relying on **external suppliers** rather than building everything in-house, creating significant opportunities for SMEs with capabilities in **engineering, manufacturing, materials, robotics, software and digital systems,** even for those with **no prior fusion experience**. Around **68 private fusion companies across 13 countries** are currently developing next-generation fusion devices, supported by major public programmes such as the **International Thermonuclear Experimental Reactor (ITER)**, the UK's **Spherical Tokamak for Energy Production (STEP)** programme, and Japan's planned **Japan Demonstration Fusion Power Plant (JA-DEMO). Private investment now exceeds £10 billion,** and global spending on fusion demonstration plants between 2026 and 2035 is expected to rise sharply, with over £100 billion expected to flow into the fusion industry over this timeframe. As fusion firms mature, they are beginning to **outsource components and systems**, while keeping only a few complex technologies in-house. For SMEs, the landscape is becoming **more open, visible, and navigable than ever before.**

SMEs can engage with the fusion sector through a growing number of practical, low-barrier routes. Many of these entry points mirror processes used in aerospace, nuclear fission, and advanced manufacturing, making them familiar to companies even without prior fusion experience. Core engagement pathways include:

- **Registering on supplier portals** such as the UK Atomic Energy Authority (UKAEA) procurement system, Fusion for Energy (F4E), ITER's supplier portal, and U.S. Department of Energy (DOE) national laboratory systems.
- **Joining fusion clusters and industry associations** (e.g., the Fusion Cluster, Fusion Industry Association) to gain visibility, understand the market, and connect with developers.
- **Attending supplier days and technical briefings** hosted by UKAEA, ITER, and national laboratories to learn about future needs, procurement pipelines, and qualification requirements.
- **Engage directly with fusion developers**, many of which maintain supplier onboarding programmes and are actively seeking partners in manufacturing, robotics, diagnostics, materials, and digital systems.
- **Engage with fusion consultancies** and large engineering partners to conduct product-market fit analysis provided by fusion energy consulting firms to assist in understanding how best to approach their potential market.

These avenues provide SMEs with clear, actionable ways to access a fast-growing global sector that is building its supply chain now.

Fusion Technology Landscape

What is Fusion?

There are two forms of nuclear energy: fission and fusion. Nuclear fusion involves combining nuclei to produce energy, and nuclear fission involves separating nuclei to produce energy. Currently, all nuclear power plants use fission, because fusion power plants are still being developed. A fusion power plant can produce 4x more energy than a fission plant, without risk of runaway reactions or production of high level nuclear waste, so it is an attractive potential energy source. A nuclear fusion power plant would function much like a fission or coal plant, with the power plant core generating heat that drives a turbine to produce electricity.

UKAEA Fusion Energy 101.

Fusion Energy Insights has many general videos on fusion energy on their website.

The Fusion Industry Association has a fusion vs fission explainer on their website.

Several fuels can power fusion reactions, but the most common is deuterium-tritium (D-T). This fuel combination produces the most energy at the lowest temperature, making it the easiest to use with current technology. However, tritium is rare and expensive, and the reaction produces high-energy neutrons that can make reactor components radioactive over time.

International Atomic Energy Agency (IAEA) Basic Fusion Physics explains basic fusion physics and fusion's advantages.

Three main categories of fusion concepts are being developed to close the gap between fusion ignition and net energy generation:

Magnetic Fusion Energy (MFE)
Magnetic fusion energy uses strong magnetic fields to contain and control a hot, charged gas, or plasma, without the plasma touching any material surfaces. The plasma is kept at moderate density but confined for a relatively long time, allowing fusion reactions to occur steadily. This approach features in devices like tokamaks and stellarators, aiming for continuous energy production. Among private developers, about half pursue MFE concepts.

Inertial Fusion Energy (IFE)
Inertial fusion rapidly compresses a small fuel pellet using lasers or other beams to reach extremely high densities for a very short period. The fuel is confined only long enough for fusion reactions to happen before it disassembles, which requires precise timing and powerful drivers. This method produces fusion in intense, brief bursts rather than continuously. The National Ignition Facility (NIF) and First Light Fusion use an IFE concept.

Magnetic-Inertial Fusion Energy (MIF)
Magneto-Inertial Fusion (MIF) attempts to merge the principles of magnetic and inertial confinement to get a "best of both worlds" approach. Typically, this involves compressing small MFE targets using various pulsed compression schemes to produce a plasma with moderate density and confinement time, effectively balancing and relaxing the extremes of the other two approaches.

Myth 1: Regulation for fusion will be the same as fission
Many countries are developing fusion-specific, risk-appropriate frameworks distinct from fission's, reflecting different hazards.

Myth 2: Ignition has been achieved so fusion is solved
Ignition in a lab means that the plasma released more fusion energy than was put into the plasma, not that the whole facility produces net electricity. A power plant must deliver more electric power than the entire system consumes, and reliably.

Myth 3: Fusion can cause explosions like a nuclear bomb
Fuel mass is tiny and conditions are hard to sustain. If confinement fails, the reaction stops, so there is no runaway chain reaction.

Myth 4: Fusion has no radioactive waste or safety issues
Fusion avoids runaway reactions and long-lived spent fuel, but is not waste free. DT concepts produce high energy neutrons that activate surrounding materials, creating short to medium-lived radioactive components - power plants still need shielding and end-of-life disposal plans.

How to Engage with the Fusion Sector

SMEs looking to engage with the fusion sector should begin by mapping their capabilities to the technologies fusion developers rely on. Many technologies used in fusion have relevance in adjacent sectors such as aerospace, medicine and nuclear fission, making entry more accessible than expected. Simple first steps can help SMEs understand the landscape and get onto the radar of major buyers.

Practical entry routes include:

- Registering on supplier portals and fusion industry directories
- Joining fusion clusters and attending supplier days or technical briefings
- Leveraging innovation funding schemes
- Connecting directly with developers or large engineering partners
- Engaging with fusion consultancies to conduct product-market fit analysis

As fusion firms move from prototypes to demonstration plants, fusion developers are beginning to look to the supply chain to support their ambitious timelines rather than building equipment in-house. SMEs can strengthen their competitiveness by building early relationships with developers by attending major industry meetings and staying up to date with industry news.

The rest of this report provides more detailed, region-by-region entry routes — including specific supplier portals, funding schemes, innovation programmes and major projects across the UK, US, Europe, Japan and other fast-growing fusion markets. These resources give SMEs concrete next steps tailored to their geography, technology area and growth ambitions. Together, these steps give SMEs practical, low-barrier pathways to access fusion opportunities and position themselves early in a sector that is scaling rapidly through the 2030s.

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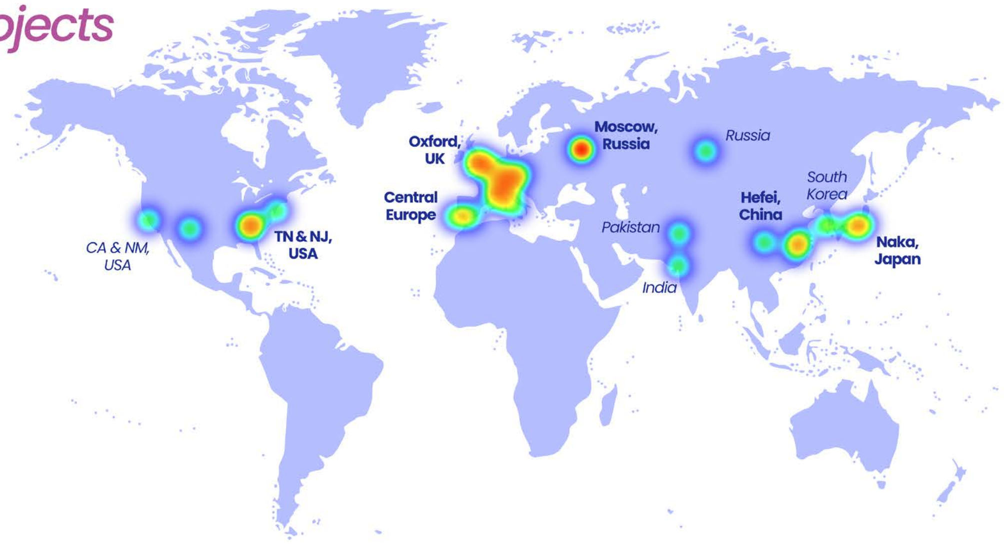
Where is Fusion Now?

Currently, there are about **68 private fusion companies** spread over **13 countries**, accompanied by several national laboratories. Private fusion investment now exceeds **£10 billion**, led by Commonwealth Fusion Systems (£2.2 billion), China Fusion Energy Corporation and Neo Fusion (each £1.5 billion), and TAE Technologies (£1 billion). Over 90% of this capital is concentrated in the US and China. In the public sector, governments are attributing hundreds of millions of pounds annually to support national fusion programmes. At the centre of global public collaboration is the **ITER project** in France, the world's largest fusion experiment. This international project is funded by China, the European Union, India, Japan, Korea, Russia and the United States, with total project expenditure approaching £20 billion.

Hotspots for National Institutions: *public fusion projects*

By plotting both institutions with upcoming fusion projects (machines, test facilities, upgrades) and active R&D, a clear distribution accross the globe can be seen.

Whilst this largely follows the same trends as fundraising in the private fusion sector, there is less focus on the USA, with Europe, Russia, and Asia playing a larger role.

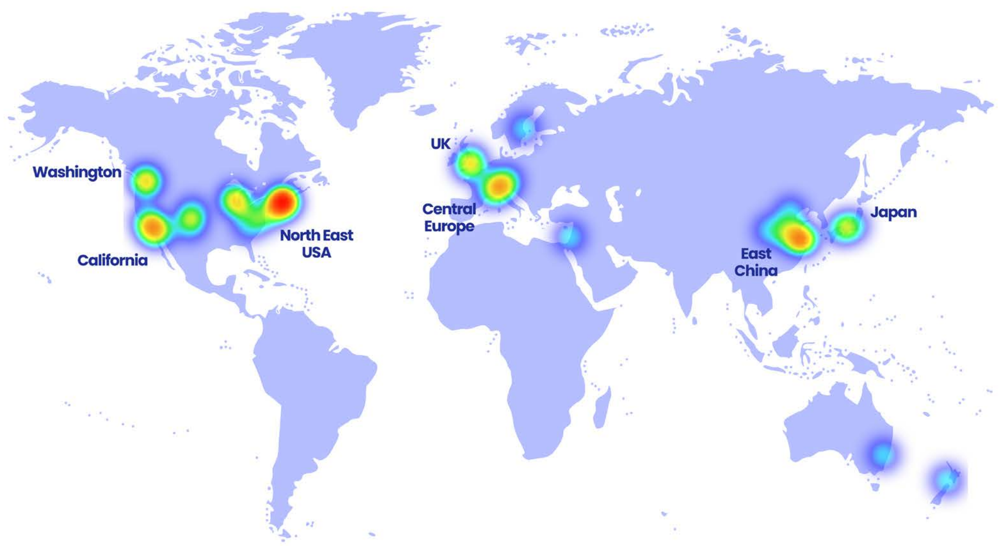


Hotspots for Funding: *private fusion companies*

By totalling cumulative investment into private fusion companies since 2000, the areas leading the charts are:

- **USA: ~£6.1 Billion**
- **China: ~£3.8 Billion**
- **UK & EU: ~£750 Million**
- **Japan: ~£75 Million**

As expected, the 10 top companies are all located in either the USA or China, forming key fusion developer clusters.



Heat maps of fusion spending by public and private fusion companies since 2000, illustrating global hotspots for fusion activity.

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Top Ten Funded Private Fusion Companies

COMPANY	**FUNDING** (as of Nov 2025)
Commonwealth Fusion Systems	£2,200,000,000
China Fusion Energy Corporation	£1,500,000,000
Neo Fusion	£1,500,000,000
TAE Technologies	£1,050,000,000
Helion Energy, Inc.	£770,000,000
Pacific Fusion	£675,000,000
SHINE Technologies	£416,000,000
ENN Fusion Program	£300,000,000
Energy Singularity	£270,000,000
General Fusion	£265,000,000

Over the last few years, a number of fusion clusters have emerged containing both private and flagship public programs. Fusion R&D and investment are now concentrated in a few major clusters:

- **Boston** (Massachusetts Institute of Technology, Commonwealth Fusion Systems, Acceleron)
- **Hefei** (Neo Fusion, Experimental Advanced Superconducting Tokamak (EAST), Comprehensive Research Facility for Fusion Technology (CRAFT), Burning Plasma Experimental Superconducting Tokamak (BEST), The Institute of Plasma Physics, Chinese Academy of Sciences, Hefei Institutes of Physical Science)
- **Munich** (Gauss Fusion, Marvel Fusion, Proxima Fusion)
- **Oxford** (UKAEA, Tokamak Energy, First Light Fusion, University of Oxford, Oxford Sigma)
- **Pacific Northwest** (Helion, Zap Energy, Avalanche Energy, University of Washington, Pacific Northwest National Laboratory)
- **San Francisco** (Focused Energy, Pacific Fusion, Inertia, Lawrence Livermore National Laboratory)
- **Shanghai** (China Fusion Energy Corporation, Energy Singularity, NovaFusionX)
- **Tokyo** (Helical Fusion, Kyoto Fusioneering, LINEA Innovations, Starlight Engines Ltd.)

Together, these eight clusters account for most private funding and government activity in fusion.

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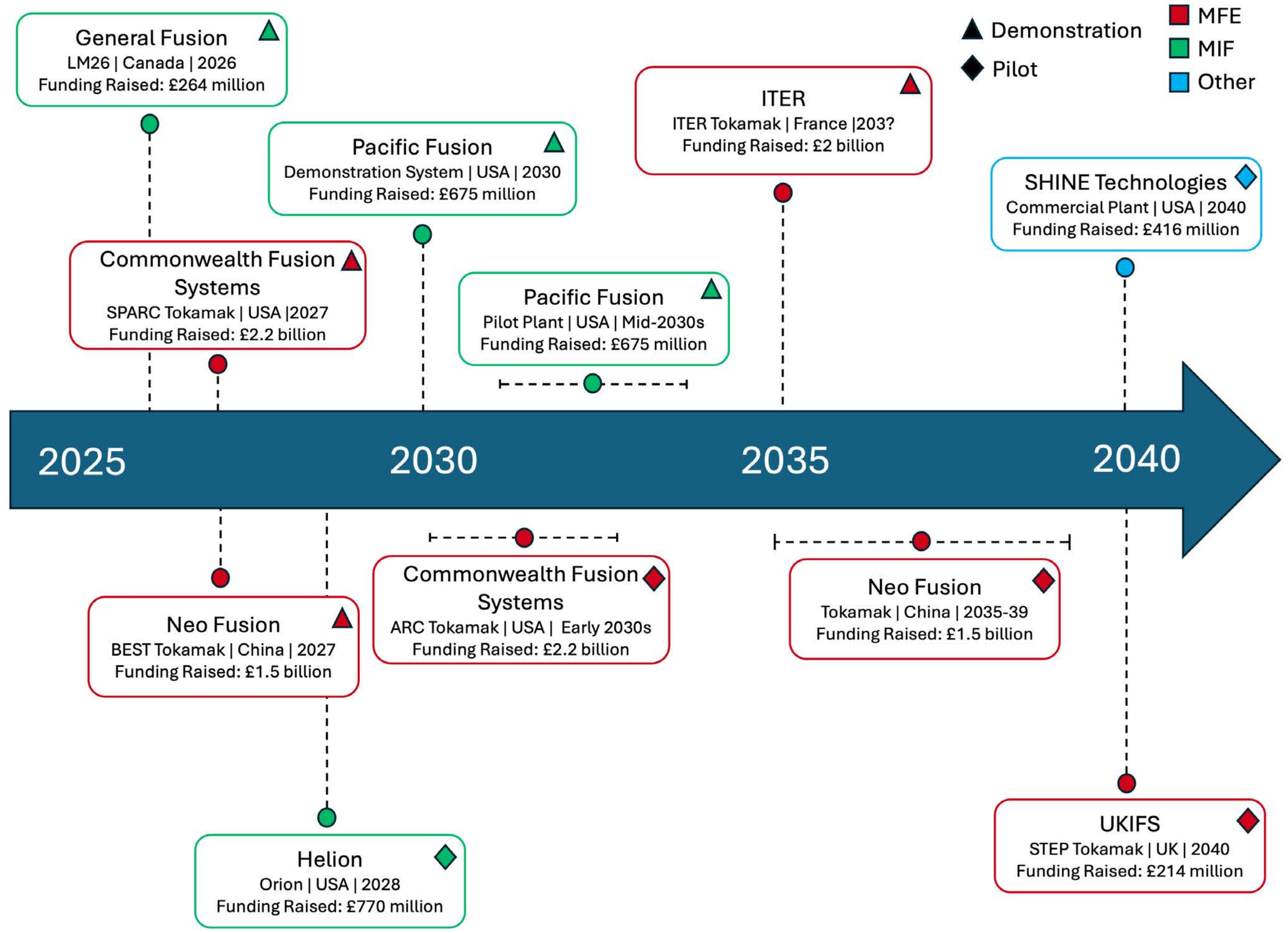
How Close Are We to Fusion Power?

After decades of scientific progress, fusion energy is now entering a decade of demonstration. Over the next 15 years, a series of demonstration plants will test whether fusion can reliably produce electricity for the grid. Most private developers expect to reach **net-energy demonstrations before 2040**, followed by first small-scale pilot plants operations. National programmes such as the UK's **STEP Fusion (Spherical Tokamak for Energy Production)** and the international **ITER (International Thermonuclear Experimental Reactor)** project are targeting the mid 2030s to mid 2040s for their larger scale demonstrations.

Private companies are generally taking a **modular approach**, building compact machines designed for rapid iteration and lower costs, while public projects focus on long-term research and large infrastructure. Together, these efforts are closing the gap between fusion as a laboratory science and fusion as a commercial power source.

For SMEs, this means the **supply chain is forming now**. Components, materials, and specialist services developed over the next five to ten years will underpin the first generation of operating fusion power plants.



Timeline of major fusion projects, including only companies that have raised £200 million and over. The concept type is included, as well as indication of whether the project is a technology demonstration or pilot plant.

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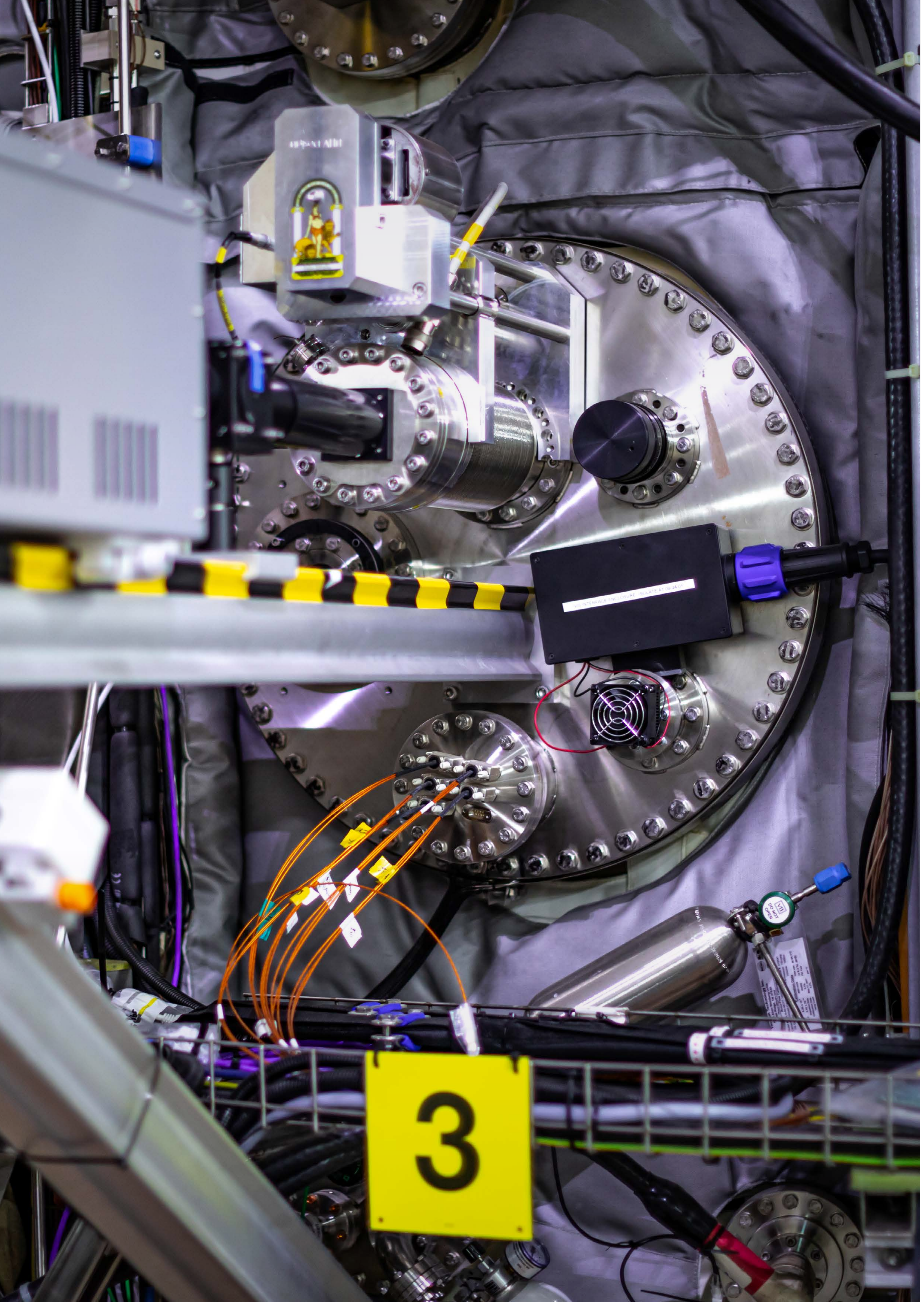
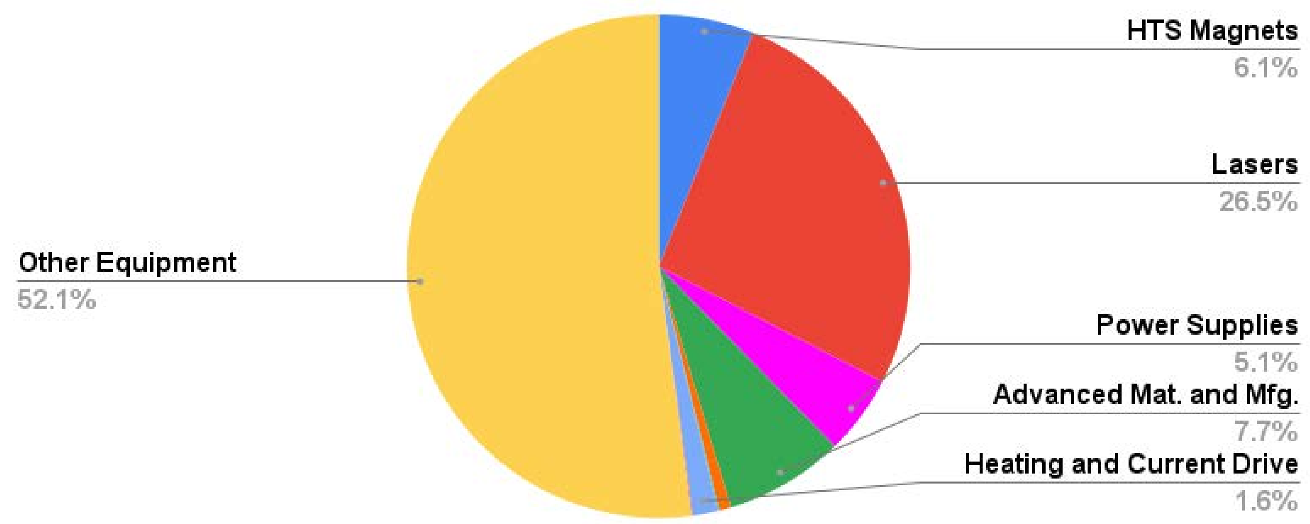


Key Technologies for Fusion Power

There are many technologies that are needed to create fusion power. The following sections outline eight key technologies central to fusion plant design. Projected investments for fusion demonstration projects between 2026 and 2035 are also summarized to highlight the major cost driver technologies: high-temperature superconducting (HTS) magnets, lasers, and advanced materials and manufacturing.

Projected Spending on Upcoming Fusion Machines from 2026-2035



Global, projected spending on upcoming fusion machines (technology demonstrations and pilot plants) from 2026 to 2035, broken down by technology spending.

[For more information about the fusion supply chain, read the FIA's Annual Supply Chain Report.]

Superconducting Magnets & Cryogenics

High-temperature superconductors (HTS) underpin most magnetic-fusion concepts because they enable stronger magnetic fields, higher power density, and more compact machines. Cryogenic systems are required for HTS magnets and can also be used to cool fusion fuel into pellets.

SMEs can supply:

- HTS tape sub-components (insulation, winding, joint fabrication)
- Cryogenic subsystems, sensors, valves, small cryocoolers
- QA, testing and characterisation services
- Radiation-resistant materials and coatings
- Precision manufacturing for current leads or busbars

ENGAGEMENT ROUTE
Several major fusion developers design and build HTS magnets internally; however, some fusion developers use subcontractors. SMEs should engage directly with fusion developers, or fusion technology consultancies, to understand technology needs and procurement pathways.

Market Landscape:

- Cryogenics → dominated by large enterprises in France, Germany, Japan
- HTS tape & magnet components → more fragmented, with many SMEs in Japan, China, US, Italy, Korea
- Demand currently exceeds supply for HTS tape, but there are high technical entry barriers

Key Companies (Non-Exhaustive):

- American Superconductor Corp (AMSC) • Bruker • Faraday Factory Japan • Fujikura • Furukawa Electric Group • Shanghai Superconducting Technology • SuNAM • Theva •Tokamak Energy Magnetics • Woodruff Engineering • and many others

Challenges & Barriers:

- Very high cost relative to copper or low temperature superconductors (LTS)
- Manufacturing HTS tape is complex and requires specialist equipment
- Radiation resistance is a key qualification requirement

TECHNOLOGY OVERLAP
HTS can also be used in wind turbines, electric motors, magnetic resonance imaging (MRI) machines, and electricity transmission systems.

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High Power Lasers

Two main laser types are used for IFE today: diode-pumped solid-state lasers (DPSSLs) and excimer lasers (ArF or KrF). The flashlamp system used by NIF is now considered obsolete due to its lower efficiency and is no longer pursued by developers.

What SMEs Can Supply:

- Optical coatings and components (gratings, crystals)
- Diagnostics, sensors, thermal management components
- Power electronics for laser drivers

ENGAGEMENT ROUTE
Fusion laser systems are typically built by external laser firms. SMEs should contact high-power laser firms working in this sector, alongside targeted relationships with the fusion companies themselves.

Market Landscape:

- Dominated by major US/German photonics firms
- SMEs operate mainly in niche optics and coatings
- Demand for high-rep-rate, high-efficiency lasers growing

Key Companies (Non-Exhaustive):

- Amplitude Laser • Coherent • Hamamatsu • Jenoptik • Laserline • Schott • Thales • Trumpf • and many others

Challenges & Barriers:

- Scaling to multi-MJ systems
- Efficiency + durability of optics at high repetition rates
- Long development cycles + high capital requirements

TECHNOLOGY OVERLAP
Laser diodes are also used for defence applications and for secondary sources of electrons, neutrons, protons, or X-rays for applications like imaging and waste treatment.

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Power Supplies (Pulsed & Continuous)

All fusion concepts rely on power delivery systems, though their functions vary by approach. This can range from pulsed power drivers delivering intense pulsed currents to directly initiate fusion, to steady-state power supplies to operate superconducting magnets, plasma heating systems, diagnostics, and controls.

What SMEs Can Supply:

- Bespoke pulsed-power systems
- High-voltage power electronics
- Capacitors, power modules, energy storage subsystems
- Controls, diagnostics, ruggedized electronics

ENGAGEMENT ROUTE
Pulsed-power systems are often subcontracted, meaning SMEs should reach out to specialist power-electronics integrators who supply to fusion projects.

Market Landscape:

- Mix of multinational suppliers + specialised SMEs
- Strong presence in the US, Germany, Japan
- Fusion applications often require custom power profiles

Key Companies (Non-Exhaustive):

- Ampegon • General Atomics • Hitachi • Jema Energy • Woodruff Engineering • and many others

Challenges & Barriers:

- High-radiation, high-magnetic field environments
- Unique pulse shapes and reliability requirements
- Scaling from prototype to plant-scale

TECHNOLOGY OVERLAP
Fusion relevant capacitors are also used in power transmission, defence applications and industrial manufacturing.

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Advanced Materials and Manufacturing

The interior surfaces of fusion power plants experience high temperatures, irradiation from neutrons, and strong particle fluxes. Refractory metals like tungsten are typically considered for these surfaces, but liquid metals walls made of lithium or tin are also under investigation. Advanced manufacturing techniques like additive manufacturing and electron beam welding are necessary to produce complex parts for fusion power plants.

What SMEs Can Supply:

- Refractory metals (tungsten), alloys, advanced composites
- Additive manufacturing (AM) services for refractory metals
- Electron beam welding, high-precision fabrication
- Radiation-resistant coatings, testing and qualification

ENGAGEMENT ROUTE
Fusion firms rely heavily on external suppliers for fabricated components, so SMEs should engage directly with fusion developers.

Market Landscape:

- Highly international sector, with strong representation from US, UK, Italy, Japan
- Mix of established EPCs + innovative manufacturing SMEs
- Strong demand for materials validated in neutron environments

Key Companies (Non-Exhaustive):

- Alsymex • Curtiss-Wright • ExoFusion • Frazer-Nash • IDOM • Kyoto Fusioneering • Larsen & Toubro • Metamorphic • Oxford Sigma • and many others

Challenges & Barriers:

- Lack of neutron testing facilities (until IFMIF-DONES is built in 2030s)
- Qualification requirements are stringent
- Managing thermal loads + complex geometries

TECHNOLOGY OVERLAP
Additive manufacturing has applications in aerospace, fission, defence and medical fields.

[A fusion materials roadmap has been published in the UK by The Henry Royce Institute.]

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Tritium and Blanket Technologies

Tritium is the most common fuel explored for fusion reactions, but it does not occur naturally in significant quantities. Many fusion plants will produce, or breed, tritium by bombarding Lithium-6 (an isotope of natural Lithium), with neutrons from the fusion reaction to produce more tritium. Fusion plants will require a full tritium breeding loop to breed, isolate, and feed tritium back into the plasma.

What SMEs Can Supply:

- Lithium breeder materials
- Enriched lithium for tritium breeding (or enrichment equipment)
- Tritium extraction sub-systems
- Heat exchangers, loop components

Market Landscape:

- Concentrated in Europe, UK, Canada, Japan, US
- Mix of EPCs + niche SMEs
- Most work still public-funded and early TRL

ENGAGEMENT ROUTE
Tritium and blanket R&D is led by national laboratories and major international demonstrations currently, so SMEs should engage primarily with collaborative programmes such as ITER's Test Blanket Module Programme, UKAEA's Lithium Breeding Tritium Innovation Programme (LIBRTI) and H3AT Tritium Loop Facility, and Kyoto Fusioneering's UNITY-2 platform, and the US' Innovation Network for Fusion Energy (INFUSE) programme.

Key Companies (Non-Exhaustive):

- Frazer-Nash • Fusion Fuel Cycles • Torion Plasma • Kinetrics • Kyoto Fusioneering • Tyne Engineering • AtkinsRealis • Amentum • and many others

Challenges & Barriers:

- No integrated tritium breeding test environment yet
- Strict safety + radioactive materials handling regulations
- Low TRLs for most subsystems

TECHNOLOGY OVERLAP
Lithium-6 does not have many major applications outside of fusion and defence, though it is explored for some medical treatments and can be used for neutron detection.

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Robotics and Remote Handling

Robotics and remote handling are fundamental to plant design, licensing and economics. Humans won't be able to enter the fusion machine during normal operations, so systems must be inspectable, maintainable, and upgradable entirely by robotics.

What SMEs Can Supply:

- Remote handling systems
- Radiation-tolerant robotics components
- Visualisation + simulation software
- Grippers, manipulators, tooling
- Remote maintenance and repair capabilities

ENGAGEMENT ROUTE
Most robotics work is outsourced, so SMEs should partner with fusion engineering contractors and robotics research facilities that deliver full maintenance systems.

Market Landscape:

- UK and China lead R&D; there are only a few companies in this sector
- SMEs mostly provide consulting + niche robotics tools
- Large EPCs dominate full-system delivery

Key Companies (Non-Exhaustive):

- Amentum • Ansaldo Nucleare • Assystem • Boston Dynamics • Nuvia • Veolia Nuclear Solutions • and many others

Challenges & Barriers:

- Radiation tolerance
- Complex maintenance tasks in confined spaces
- Qualification for safety-critical operations

TECHNOLOGY OVERLAP
Radiation resistant robotics are also used in the aerospace, fission and defense sectors.

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Heating and Current Drive

Heating and current drive in fusion plasmas are essential for reaching and maintaining the high temperatures and plasma conditions needed for sustained fusion reactions. External systems such as neutral beam injection, radiofrequency waves, and microwaves provide energy to heat the plasma and drive electric currents that help control its stability and confinement.

What SMEs Can Supply:

- RF components, antennas, waveguides
- Neutral beam components
- Microwave generators and gyrotron subsystems

ENGAGEMENT ROUTE
Key components are usually purchased from specialist suppliers, so SMEs should engage through established supply chains rather than developers directly.

Market Landscape:

- Few companies globally; mix of large integrators + specialist SMEs
- Russia, US, and Japan dominate capability

Key Companies (Non-Exhaustive):

- Beam for Fusion • Budker Institute of Nuclear Physics• Kyoto Fusioneering • Thales • and many others

Challenges & Barriers:

- Scaling systems to high power
- Improving efficiency
- Integration complexity with fusion machines

TECHNOLOGY OVERLAP
Heating and current drive technology is also useful in drilling deep wells and for some medical treatments.

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Advanced Computing and AI

Fusion power plants will generate vast amounts of data that must be processed, managed and used in real-time feedback loops to optimize performance. Advanced computing, including AI, machine learning and high-performance computing, enables this capability.

What SMEs Can Supply:

- Simulation tools, digital twins
- Control algorithms, real-time data pipelines
- Data processing, machine learning workflows
- Verification & validation tools

ENGAGEMENT ROUTE
Fusion companies actively seek digital tools, so SMEs should reach out directly to fusion developers and national labs with software prototypes and modelling capabilities or seek to collaborate with major companies and institutions developing relevant capabilities.

Market Landscape:

- Vibrant SME sector in US, UK, France
- Low capital cost; high technology overlap
- Strong technology overlap with fission and aerospace, derisking market participation

Key Companies (Non-Exhaustive):

- Amentum • Dassault Systèmes • digiLab • Next Step Fusion • Nvidia • Quanscient • and many others

Challenges & Barriers:

- Lack of fusion-relevant datasets
- Need for real-time control reliability
- Integration with hardware systems

TECHNOLOGY OVERLAP
Advanced computing relevant for fusion has overlap in fission and aerospace.

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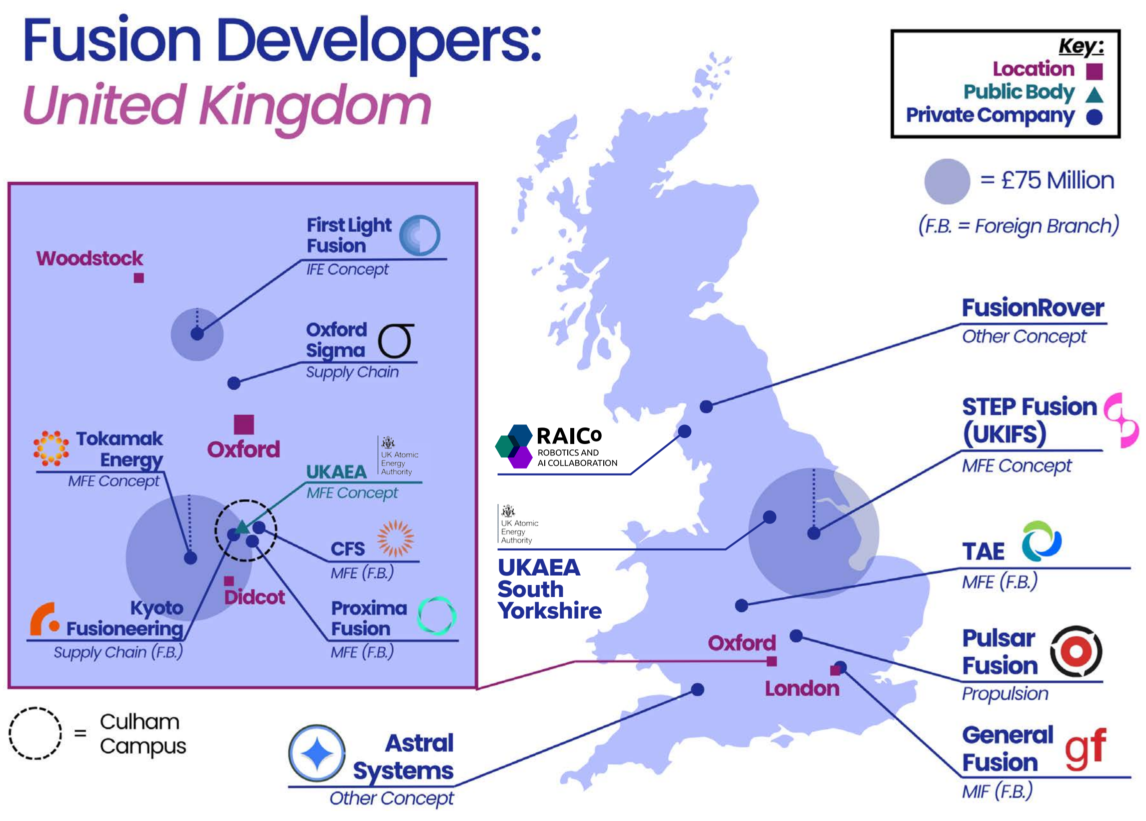
Global Routes to Market

Each country and region is unique in how they support fusion energy initiatives. This section provides insight into key national fusion programmes, highlighting major players, potential routes to entry, and the projected market size. This provides SMEs with a general overview of how to operate across the global fusion landscape.

United Kingdom

Major Developers

The United Kingdom remains one of the world's foremost centres for fusion research and commercialisation. UKAEA is the national fusion laboratory hosting the UKs public sector research programme and facilities. Key commercial players include **Tokamak Energy**, developing magnetic fusion energy with HTS, **First Light Fusion**, pursuing inertial fusion using pulsed power, and UK Industrial Fusion Solutions (**UKIFS**), a subsidiary of the UKAEA. Five international fusion companies have branches in the UK: American fusion companies **Commonwealth Fusion Systems** and **TAE**, German fusion company **Proxima Fusion**, Canadian fusion company **General Fusion**, and Japanese fusion supply chain company **Kyoto Fusioneering**. The major fusion hub is in Oxfordshire, encompassing UKAEA, Tokamak Energy, and First Light Fusion. Across the UK, there is a fairly even split between MFE, IFE, MIF, and other concepts across fusion companies.



Map of major fusion activity in the UK.

How to Engage with the UK Fusion Ecosystem

Join the Fusion Cluster – main industry forum linking 100+ organisations; access networking, capability mapping, and supply-chain insights.

Register for UKAEA's Procurement Portal – gateway for procurement for UKAEA.

Join the Fusion Energy Insights – Weekly newsletter, online events, and an online community where you can meet others in the fusion sector.

Join the Nuclear Industry Association – they have a dedicated Fusion Working group.

Register on the Fusion Energy Industry Directory – gateway for procurement and partnership opportunities.

Attend UKAEA Supplier Events – regular SME showcases and annual supplier days.

Join UKAEA's LinkedIn Suppliers' Network Group – stay updated on tenders, collaborations, and technical calls.

Attend the Fusion Industry School – a structured, week-long introduction to fusion technologies and markets.

Apply for UKRI Innovation Calls – funding routes for SMEs entering fusion R&D or developing cross-sector technologies.

Register for UKIFS (STEP Fusion) Procurement Portal – gate for procurement for UKIFS.

Engage with UKAEA's Materials Research Facility – access specialist materials testing for fusion applications.

Join AMRC membership – access R&D support and supply-chain development for fusion-related manufacturing projects.

Apply to become a Tokamak Energy supplier – capability review, NDA, assessment and onboarding to their preferred supplier list. fusion energy and high temperature superconducting magnets - Tokamak Energy

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Major Projects

Some companies have not yet released timelines, so those with timelines are included here.

PROJECT NAME	DEVELOPER	LOCATION	COMMISSIONING DATE	GOAL
Machine 3	First Light Fusion	Oxfordshire	Already commissioned	Pulsed-power facility for fusion and non-fusion applications
MAST Upgrade	UKAEA	Oxfordshire	Already commissioned	Spherical-tokamak experiment validating technologies and physics models, including plasma exhaust solutions
Materials Research Facility	UKAEA	Oxfordshire	Already commissioned	Tests activated material samples
Remote Applications in Challenging Environments (RACE)	UKAEA	Oxfordshire	Already commissioned	Robotics and remote handling R&D facility for fusion and other applications
ST40	Tokamak Energy	Oxfordshire	Already commissioned	Compact high-field spherical tokamak demonstrating high-temperature plasma operation
Demo4	Tokamak Energy	Oxford, UK	2025	Testing a complete set of tokamak geometry HTS magnets
Sunbird	Pulsar Fusion	Bletchley	2027	In orbit demonstration of direct fusion drive, space propulsion technology
Eni-UKAEA H3AT Loop	UKAEA	Culham	2028	Demonstrate closed loop fuel cycle
Lithium Breeding Tritium Innovation Programme (LIBRTI)	UKAEA	Culham	2028	Create a testbed facility for engineering-scale tritium breeder blankets
STEP Fusion	UKIFS (currently 100% government funded)	Nottinghamshire	2040	Net energy gain in a prototype fusion power plant

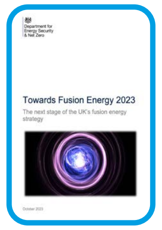
Market Size

The UK fusion market combines a diverse private sector with sustained public investment. On the public front, the UK Government has committed £2.5 billion over the next five years. Because public funding often supports private fusion companies through grants, partnerships, or joint projects, the value of the public and private fusion markets is closely connected.

The UK's private fusion sector has raised over £550 million to date. Between 2026 and 2035, spending is projected to total about £11 million, averaging £1.1 million per year. This relatively low figure reflects the fact that, although the UK is home to several fusion companies, only two have announced concrete demonstration projects expected before 2035, and just one of them, Pulsar Fusion, a magnetic fusion energy (MFE) company, plans to build its facility within the UK. This concentrates upcoming plant funding on MFE technologies, including magnets, cryogenic systems, and durable materials for plasma-facing components. One of the UK's largest fusion companies, Tokamak Energy have been designing a fusion pilot plant with support from the DOE milestone programme.

National Policy

The UK's 2025 fusion strategy focuses on **building a competitive supply chain** and **reducing entry barriers for SMEs** through new fusion-specific planning regulations and digital procurement frameworks. Workforce development is a major government focus: the **FOSTER** programme aims to train **over 2,000 specialists** for the fusion sector by 2030. The **"Starmaker One" fusion fund**, currently a £20 million public–private investment vehicle, is expected to unlock **£100 million+** in venture co-funding to accelerate industrial growth, supply chains, and high-skill jobs. Overall, the UK places strong emphasis on workforce development and supporting SMEs.



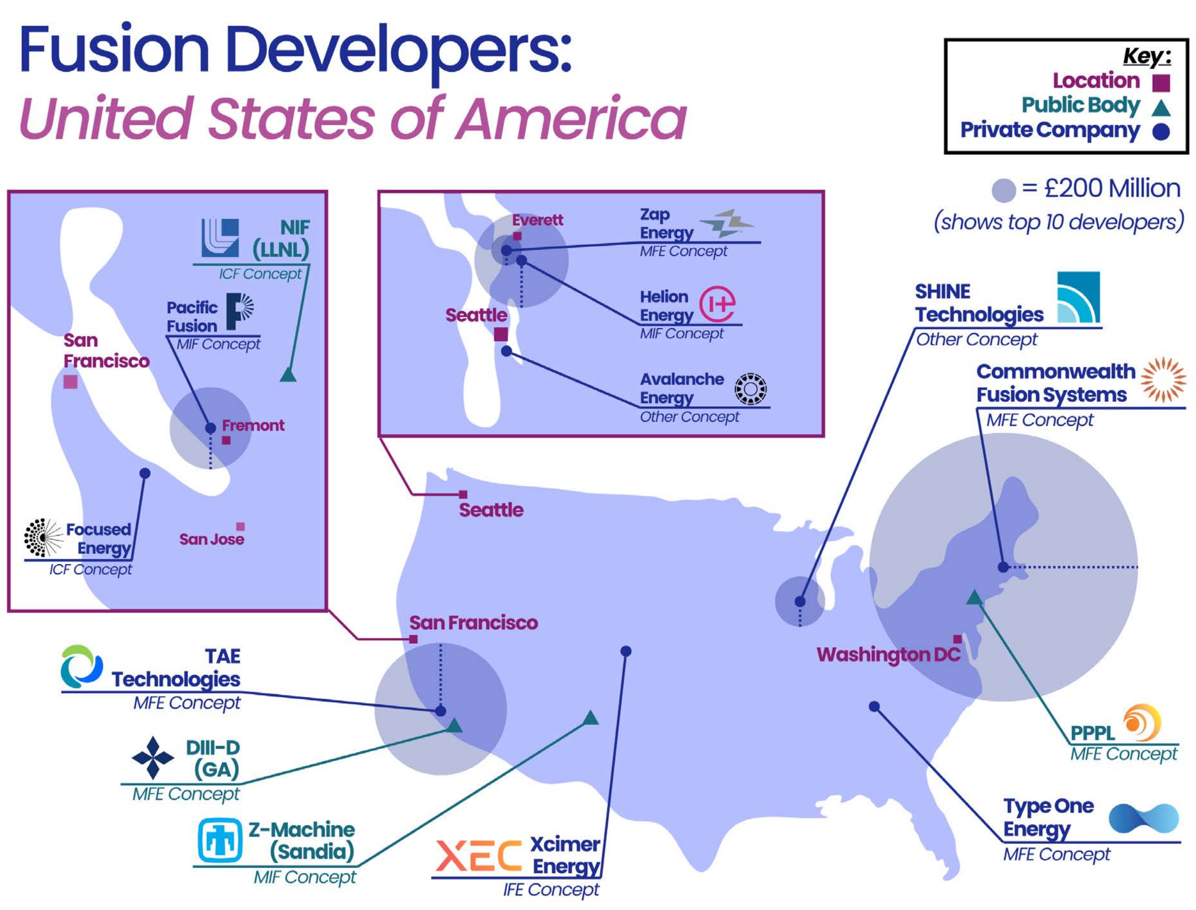
The UK published a national roadmap in 2023 called Towards Fusion Energy 2023.

In 2025, the UK published a materials-specific roadmap called UK Fusion Materials Roadmap.

United States

Major Developers

The United States hosts the world's largest private fusion ecosystem, driven by both federal backing and substantial private investment. Core federal activity is centred at the Department of Energy (DOE), which coordinates programs through its Fusion Energy Sciences (FES) office and the national labs. The US is home to the **National Ignition Facility** (NIF), which became the first fusion machine to achieve ignition in 2022. Leading commercial developers include **Commonwealth Fusion Systems** (CFS), a spin out from the Massachusetts Institute of Technology (MIT) working on compact magnetic fusion energy using HTS magnets; **Helion Energy**, pursuing a pulsed, direct energy conversion approach; **TAE Technologies**, focused on field-reversed configuration using advanced beam-driven plasma; **Zap Energy**, developing a sheared-flow Z-pinch; and **Pacific Fusion**, pursuing pulsed magnetic fusion energy. There are a diverse range of fusion concepts pursued in the US, though MFE is the most common concept for American fusion developers.



Map of major fusion activity in the US, showing the 10 companies with the most funding.

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How to Engage with the US Fusion Ecosystem

Join the Fusion Industry Association (FIA) - primary global networking and advocacy body for developers and suppliers.

Attend ARPA-E Annual Fusion Meeting - engage with project teams, leading figures from public and private sectors, and important stakeholders.

Engage via regional innovation clusters - The BUILT cluster represents fusion activity in Washington state and hosts Seattle Fusion Week. Be on the lookout for similar events from other fusion clusters in Boston and San Francisco.

Join the Focus on Fusion Cluster - CleanTech Alliance-led U.S. fusion cluster coordinating commercialization, supply chain, workforce and community engagement.

Join the VERTical Innovation Cluster - Pacific Northwest advanced clean energy cluster including next-generation nuclear and fusion deployment activities.

Register as a supplier with General Atomics – Ariba-based supplier registration for DIII-D's host organisation and related procurements, and supplier days.

Register as a prospective LLNL supplier – complete the Prospective Supplier Data Form to enter LLNL's supplier database.

Register for LLNL Small Business Program outreach events – small-business focused sessions on how to win LLNL work, including NIF-related procurements.

Register as a supplier with Sandia National Laboratories – Supplier registration and opportunities covering the Z pulsed-power facility.

Attend Sandia Supplier Open House events – in-person sessions explaining how to do business with Sandia and meet buyer/technical contacts.

Register in the PPPL / Princeton Supplier Portal – submit a prospective supplier profile considered for PPPL (and Princeton) sourcing events.

Apply to become a Commonwealth Fusion Systems supplier – online form to join CFS's qualified vendor database for fusion projects.

Register as a supplier with Oak Ridge National Laboratory – SAM.gov and ORNL supplier portal gateway to US ITER contracts.

Register for ORNL / US ITER Business Opportunities alerts – Email notifications of fabrication and equipment tenders, including US ITER fusion hardware contracts.

Apply to Innovation Network for Fusion Energy (INFUSE) Program - matches private R&D needs with U.S. national-lab expertise and facilities, open to US companies and US subsidiaries.

Participate in Fusion Innovation Research Engine (FIRE) Collaboratives - multi-institution centers linking labs, universities, and industry to close key fusion S&T gaps. FIRE Collaboratives must be led by a U.S. organization but non-U.S. entities can join as subawardees.

Attend World Fusion Energy Congress (WFEC America) – global fusion congress in Chicago with 150+ companies, policy and supply-chain sessions.

Attend the California Fusion Convening – statewide meeting highlighting California's fusion ecosystem, talent pipeline and developing industrial supply chain.

Attend the DIII-D Industry Event Day – industry day at US tokamak facility, highlighting fusion R&D needs and supplier capabilities.

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Major Projects

PROJECT NAME	DEVELOPER	LOCATION	COMMISSIONING DATE	GOAL
DIII-D	General Atomics	California	Already commissioned	Flagship DOE tokamak for magnetic confinement research
FuZE-Q	Zap Energy	Washington	Already commissioned	Prototype validating sustained Z-pinch fusion plasmas with incremental power scaling
National Ignition Facility (NIF)	Lawrence Livermore National Laboratory (LLNL)	California	Already commissioned	Laser-based IFE research facility that achieved ignition
National Spherical Torus Experiment-Upgrade (NSTX-U)	Princeton Plasma Physics Laboratory	New Jersey	Already commissioned	Spherical tokamak research facility refining next-generation plasma control
Norman	TAE Technologies	California	Already commissioned	Operating field reverse configuration prototype
Polaris	Helion	Washington	Already commissioned	Helion's seventh prototype, validating their field-reversed configuration
Z Pulsed Power Facility	Sandia National Laboratory	New Mexico	Already commissioned	Pulsed power facility, used to study the MIF magnetized liner inertial fusion (MagLIF) concept
SPARC	Commonwealth Fusion Systems	Virginia	2026	Demonstrate net power in 2027.
Orion	Helion	Washington	2028	Begin delivering at least 50 MW of carbon-free electricity to Microsoft.
Demonstration System	Pacific Fusion	California	2030	Net facility gain by the end of 2030
ARC	Commonwealth Fusion Systems	Virginia	Early 2030s	Grid-connected commercial fusion power plant.
Fusion Power Plant	Tokamak Energy (UK company with US subsidiary)	To be constructed in the US	2030s	Grid-connected commercial fusion power plant.
Copernicus	TAE Technologies	California	Unknown	Demonstrate net energy gain.
Pilot Plant	Zap Energy	Washington	Unknown	Grid-connected commercial fusion power plant.

Market Size

The US government invested around £600 million in 2024, combining DOE Fusion Energy Sciences, Innovation Network for Fusion Energy (INFUSE), ARPA-E, and milestone-based private-sector programs. The American private fusion sector has cumulatively raised over £5.8 billion, the most of any country. This is complemented by strong cost-sharing from US Department of Energy (DOE) programs. Sector spending is projected to exceed £58 billion between 2025 and 2035, averaging as £5.8 billion per year. Based on the distribution of upcoming fusion machines, the US has a high concentration of IFE concepts, meaning a significant portion of supply chain activity centres around laser technologies.

National Policy

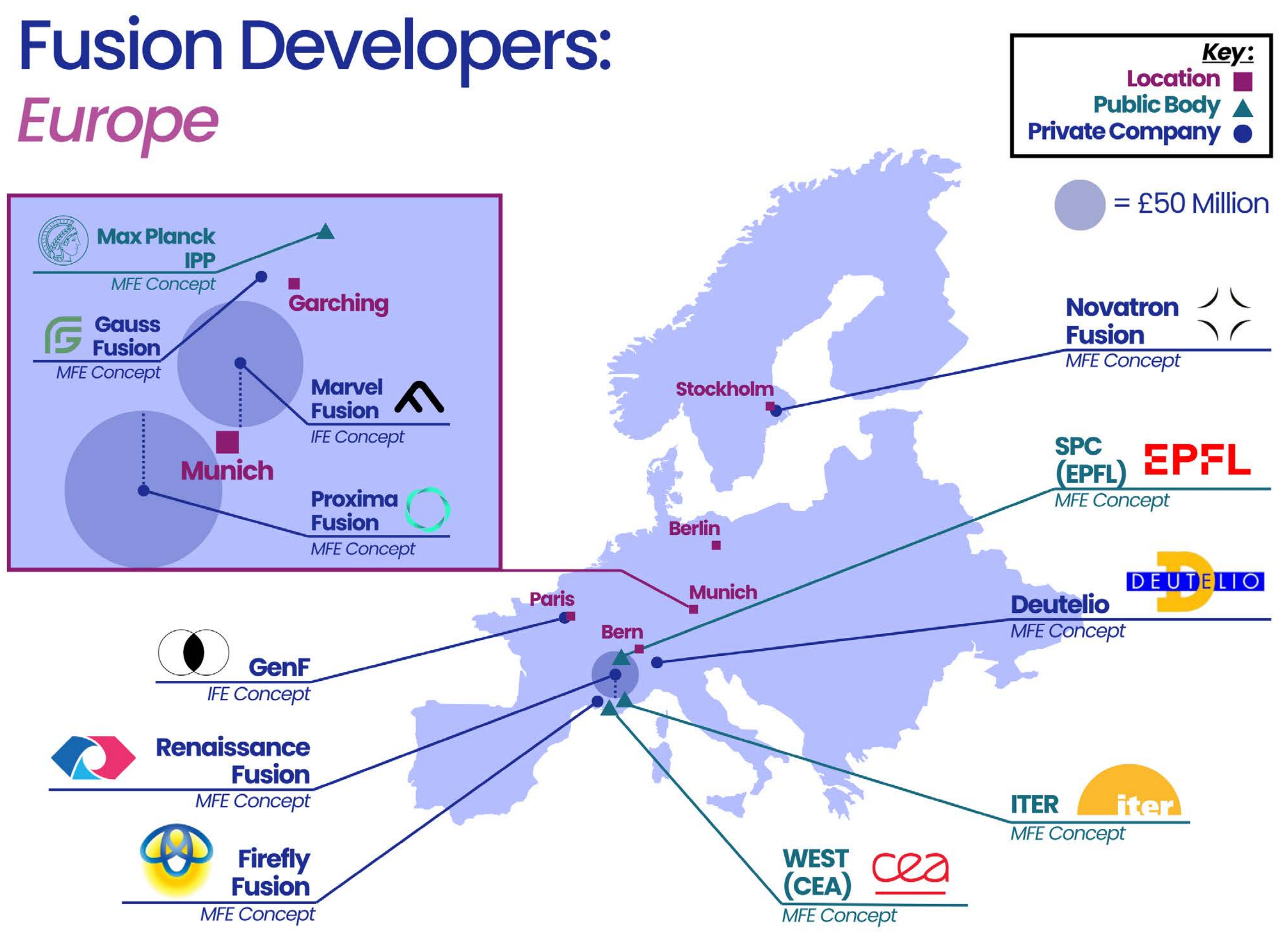
The U.S. national fusion energy policy is focused on accelerating commercial fusion power by the mid-2030s through a coordinated "Build-Innovate-Grow" strategy that aligns public investments with private innovation, closes critical science and technology gaps, leverages AI, and expands public-private partnerships. In 2022, the DOE launched the Milestone-Based Fusion Development Program to support private fusion developers, utilizing a cost-shared, performance-based model that releases funding upon the verification of pre-negotiated technical and commercial milestones.

[US Department of Energy Fusion Science & Technology]

Europe

Major Developers

Europe remains a global pillar of fusion energy development, combining large state-funded projects with a growing private sector. France is home to the **International Thermonuclear Experimental Reactor** (ITER), the world's largest fusion project. The European Union coordinates fusion activities through the EUROfusion Consortium, which unites national laboratories and universities across its 28 member institutes, 3 associated partners, and 162 affiliated entities from across Europe. Leading commercial players include **Proxima Fusion** (Germany), a spin-out of the Max Planck **Institute for Plasma Physics** (IPP), **Marvel Fusion** (Germany), **Renaissance Fusion** (France), and **Gauss Fusion** (Germany). The majority of fusion companies in Europe are MFE, though there are a handful of IFE companies as well.



Map of major fusion activity in Europe, showing all 8 companies and all major national fusion laboratories.

How to Engage with the European Fusion Ecosystem

Register on Fusion for Energy's Industry and Fusion Laboratories Portal – main EU hub for F4E/ITER business opportunities, SME Channel, partnership tool and e-procurement access.

Join the European Fusion Technology Marketplace – use F4E/EUROfusion's tech-transfer marketplace to source fusion-developed technologies and propose commercial applications.

Participate in ITER Business Forum (IBF) - biennial event connecting European industry to ITER and DEMO supply chains.

Attend the Symposium on Fusion Technology (SOFT) - a key event to meet public and private fusion leaders.

Apply to EUROfusion / FUTTA Demonstrator Calls – funding calls supporting technology-transfer demonstrators that bring fusion lab technologies into non-fusion markets.

Engage with the EIC Accelerator – a funding programme under Horizon Europe that supports early-stage companies developing fusion-adjacent technologies.

Register as an ITER Organisation supplier (SAP Ariba) – submit the Self-Supplier Request to join ITER's vendor database and become eligible for calls for tender.

Become a member of the European Fusion Association (EFA) – an industry-led organisation that connects companies across the European fusion ecosystem and provides a coordinated voice on industrial needs for future EU fusion programmes.

Join Fusion Europe – European industrial association for private fusion companies and partners developing grid-scale fusion power.

Register on EPFL's electronic procurement platforms – EPFL requires suppliers to be set up in its e-procurement systems before any orders can be placed.

Register on the Max Planck Society digital procurement marketplace – Max Planck is rolling out a Unite-based e-procurement marketplace; suppliers register there to access institute purchases.

Register via CEA's "Espace Fournisseurs / Portails des marchés" – access French national e-tender platforms, download CEA tender docs and submit electronic bids.

Register on ENEA's e-Procurement Portal (CINECA) – create a supplier account to view ENEA calls and submit bids for equipment and R&D contracts (including fusion-relevant work).

Register on Spain's Public Sector Procurement Platform for CIEMAT – monitor CIEMAT's Perfil del contratante and bid on its public tenders via the national portal.

Attend F4E Supply Chain Days – three-day event for industry and SMEs on fusion procurement, contracts and collaboration.

Join the FUSION NOW Association – emerging stakeholder platform connecting European industry, research and policymakers around fusion.

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Major Projects

PROJECT NAME	DEVELOPER	LOCATION	COMMISSIONING DATE	GOAL
Tokamak à Configuration Variable (TCV)	École Polytechnique Fédérale de Lausanne (EPFL)	Switzerland	Already commissioned	To explore advanced plasma shapes and configurations, supporting ITER and DEMO research
Wendelstein 7-X	Max Planck Institute	Germany	Already commissioned	World's largest stellarator, exploring steady-state operation and high-performance plasmas
WEST Tokamak	French Atomic Energy and Alternative Energies Commission (CEA)	France	Already commissioned	Tokamak with tungsten divertor, testing steady state plasma operation. Holds record for longest plasma duration.
Diverter Tokamak Test	ENEA	Frascati, Italy	2026	Study advanced divertor and exhaust solutions for DEMO.
Proof of Concept	Marvel Fusion	Munich, Germany	2027	Laser technology demonstration.
IFMIF-DONES	CIEMAT	Granada, Spain	2030s	Test materials under high neutron flux conditions to qualify components for DEMO plants
Stellaris	Proxima Fusion	Munich, Germany	2030s	Grid-connected commercial power plant..
Alpha	Proxima Fusion	Munich, Germany	2031	Achieve net-energy gain.
Pilot Plant	Marvel Fusion	Munich, Germany	2032	Grid-connected commercial power plant.
Pilot Plant	Renaissance Fusion	Fontaine, France	2032	Grid-connected commercial power plant.
ITER	ITER Organisation	France	2035	To demonstrate net energy gain through magnetic confinement
DEMO	EUROfusion	EU	-	Produce net electricity, and continuous operation.

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Market Size

Euratom sets aside around £4.7 billion for fusion activities from 2028-2032 (about £940 million annually), with 74% of that allocated for ITER and the rest for other European fusion projects. In 2025, Germany announced that £1.75 billion would be set aside for fusion funding through to 2029, (about £438 million annually). In addition to European private fusion companies and national labs, ITER is a major customer for the European supply chain. Since 2007, 45% of procurement for ITER has gone to EU based companies, amounting to around £5.1 billion.

Europe's private fusion sector has cumulatively raised approximately £368 million across EU member states and Switzerland, with the majority concentrated in Germany, which accounts for about 78% of this private investment. Sector spending is projected to be around £31 billion between 2026 and 2035, averaging as £3.1 billion per year. Upcoming projects are split between MFE and IFE concepts, meaning there is a wide spread of technology opportunities for companies catering to the European fusion supply chain.

More detailed breakdown of EU spending can be found in Fusion for Energy's Global Investment in the Private Fusion Sector.

Regional Policy

The European fusion policy framework is coordinated primarily through EURATOM and the EUROfusion consortium, which define Europe's pathway to commercial fusion energy. The EUROfusion Roadmap outlines **a staged approach to ITER operation** and to the construction of **a DEMO demonstration power plant in the 2040s**. EU policy emphasises public-private collaboration, with mechanisms under Horizon Europe and Fusion for Energy (F4E) enabling joint R&D, supply chain participation, and industrial readiness. The European Commission announced that "[it] will put forward a strategy for setting up the first fusion power plants in Europe, which will contribute to our energy independence." Collectively, EU fusion policy aims to transition fusion from research to deployment within the next two decades, positioning Europe as a global leader in safe, sustainable fusion power.

The EUROfusion Roadmap has more information on Europe's regional policy.

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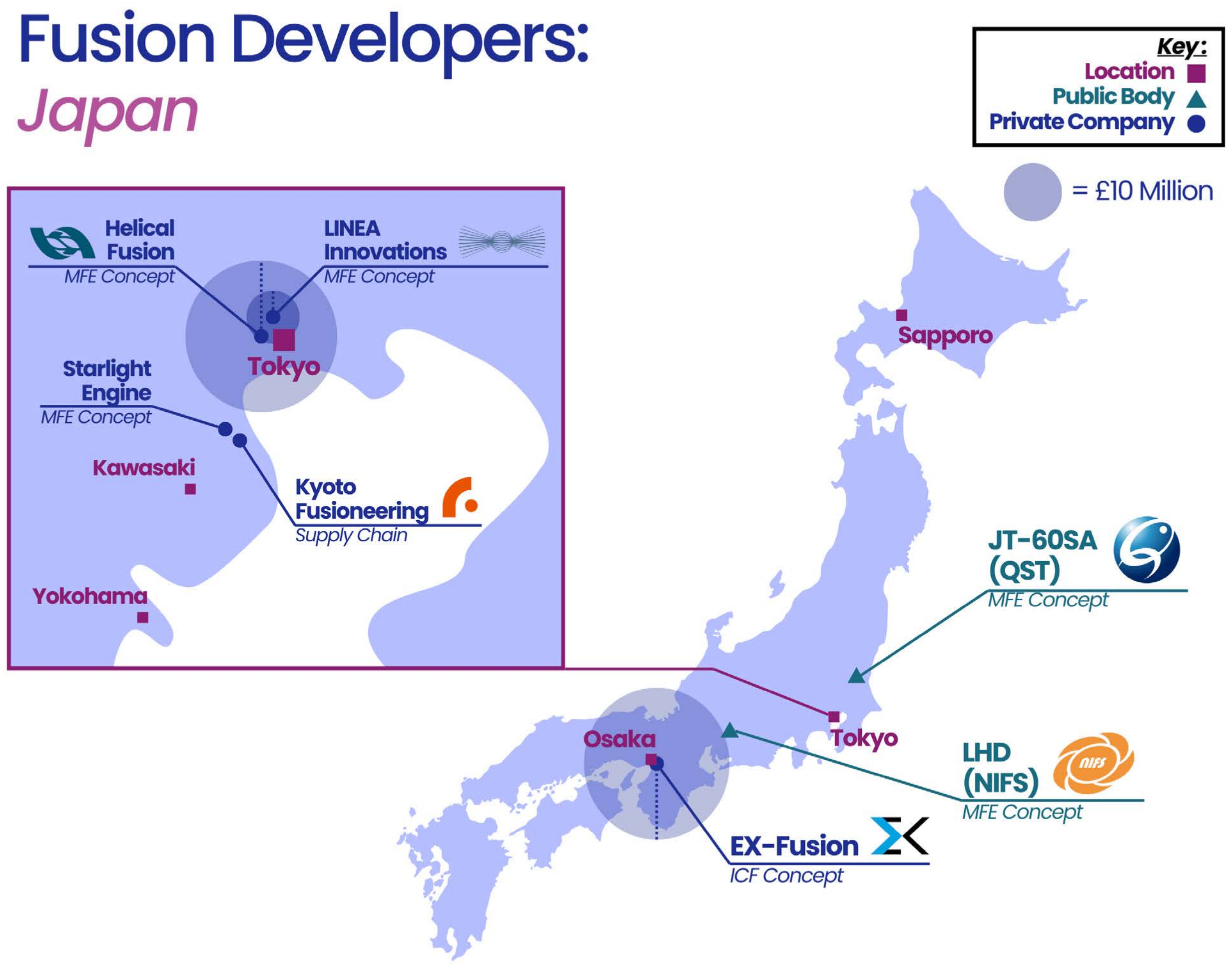
Japan

Major Developers

Japan has a growing fusion ecosystem, with world-class public programs like the National Institutes for Quantum Science and Technology (QST) and the National Institute for Fusion Science (NIFS), alongside a fast growing private sector. Policy and funding are led by their Ministry of Education, Culture, Sports, Science and Technology (MEXT) and their Ministry of Economy, Trade and Industry (METI), with the New Energy and Industrial Technology Development Organization (**NEDO**) and the Japanese Science and Technology Agency (**JST**) supporting R&D and commercialization. Major private companies include **Helical Fusion, EX-Fusion** and **Kyoto Fusioneering (supply chain company)**, with significant activity in Tokyo. Tokamak Energy also opened an office in Tokyo in 2025. Most fusion companies are pursuing an MFE concept.



Map of major fusion activity in Japan, showing all 4 companies and all major national fusion laboratories.

How to Engage with the Japanese Fusion Ecosystem

Register on Japan's Government Procurement Portal (GEPS) – online account to search tenders and submit electronic bids to the National Institutes for Quantum Science and Technology (QST) and other agencies.

Join the Japan Fusion Energy Council (J-Fusion) - access member networking, policy working groups, and events.

Apply for QST tenders via its procurement portal – bid for ITER, JT-60SA and IFMIF/EVEDA-related contracts listed under "Procurement information".

Register for Japan's unified government supplier qualification – required baseline status to participate in national-level tenders from QST and other ministries/agencies.

Apply to the QST Venture Support Scheme – for start-ups commercialising QST technologies, gaining access to facilities and IP licensing.

Register as a supplier with NIFS – submit creditor-registration data sheet and compliance pledge before supplying goods or services.

Apply for NIFS procurement competitions – respond to open calls for equipment, manufacturing, services and construction via the institute's procurement page.

Attend NIFS Open Campus – annual open day with LHD tours and outreach; useful for understanding facilities and technical needs first-hand.

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Major Projects

PROJECT NAME	DEVELOPER	LOCATION	COMMISSIONING DATE	GOAL
JT-60SA	QST	Naka	Already commissioned	A superconducting tokamak built to support the operation of ITER.
LHD - Large Helical Device	NIFS	Toki	Already commissioned	A superconducting stellarator, with the goal of conducting fusion plasma confinement research in a steady state.
Linear IFMIF Prototype Accelerator	IFMIF/EVEDA	Rokkasho	Already commissioned	A fusion relevant neutron source for materials testing, a step towards IFMIF-DONES.
Unity-1	Kyoto Fusioneering	Kyoto, Japan	2026	A liquid metal thermal cycle test facility
Helix KANATA	Helical Fusion	Tokyo, Japan	2030s	Demonstration device, aiming to be a commercially viable fusion power plant.
Demonstration	EX-Fusion	TBD	2030	Core technology demonstration.
Prototype Fusion Machine	EX-Fusion	TBD	2035	Demonstration fusion power plant.
JA-DEMO	QST	TBD	2040/50s	Power generation of 100s of MW and tritium self-sufficiency.

Market Size

The Japanese government spends about £251 million annually on fusion activities. Currently, the private fusion sector has raised over £59 million. Sector spending is projected to be around £4 billion between 2026 and 2035, averaging as £400 million per year. About ⅔ of this is for upcoming IFE machines, with the rest focused on MFE technologies.

National Policy

Japan's **Fusion Energy Innovation Strategy** puts industrialisation of fusion power at the core and envisions electricity demonstration in the 2030s, alongside **support for workforce, supply chain, and public-private partnerships**. Additionally, fusion is part of Japan's **Moonshot program**, which sets big national science goals for 2050, aiming at game-changing breakthroughs. Fusion energy is goal number 10, targeting diverse practical uses of fusion energy.

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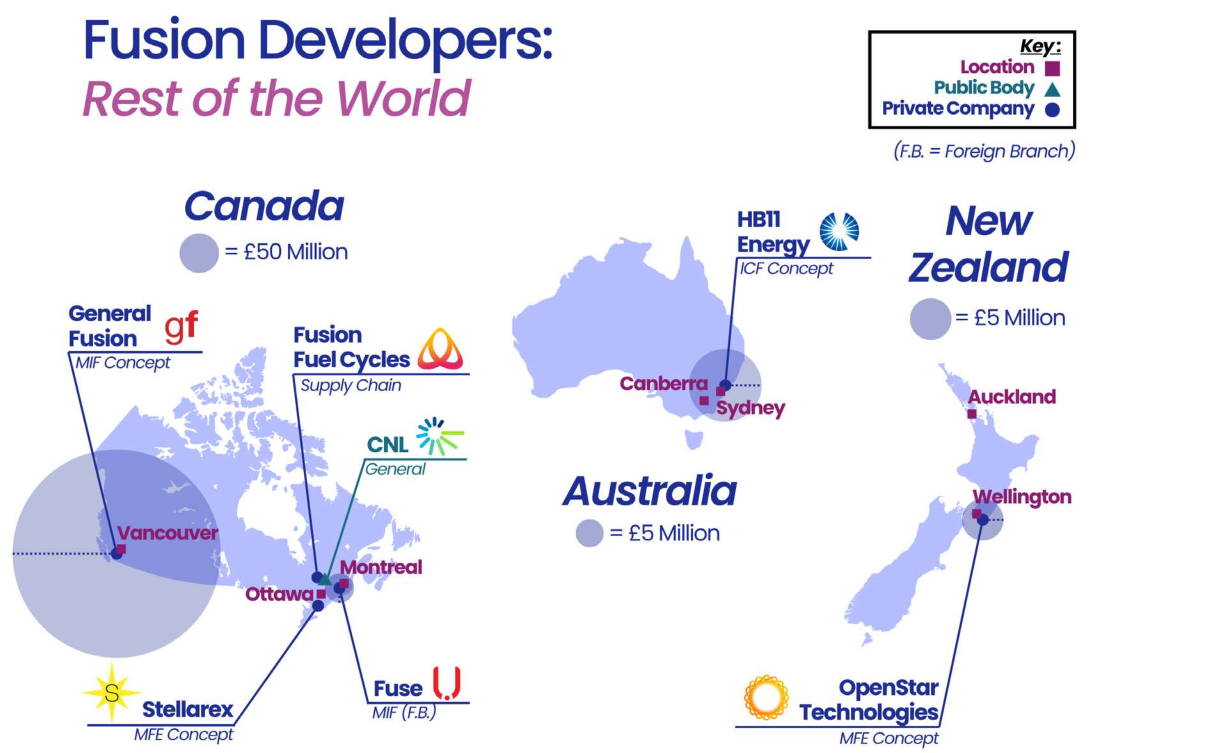
Other Regions

Major Developers

There are a large set of public and private fusion developers outside the US/UK/EU/Japan. Fusion activity in this region includes large public flagship devices in China (**EAST**), India (**SST-1**) and Korea (**KSTAR**), as well as a wide range of private fusion developers. Major private fusion companies are dominated by several well-funded Chinese companies, including China's **Neo Fusion, China Fusion Energy Corporation, ENN Science and Technology Development Co., Energy Singularity, NovaFusionX**, and **Startorus Fusion**. Outside of China, other major companies include Canada's **General Fusion**, Israel's **nT-Tao**, and Australia's **HB11 Energy**. Most fusion companies are pursuing MFE concepts.



Map of major fusion activity in Canada, Australia and New Zealand, showing all companies and major national fusion laboratories.

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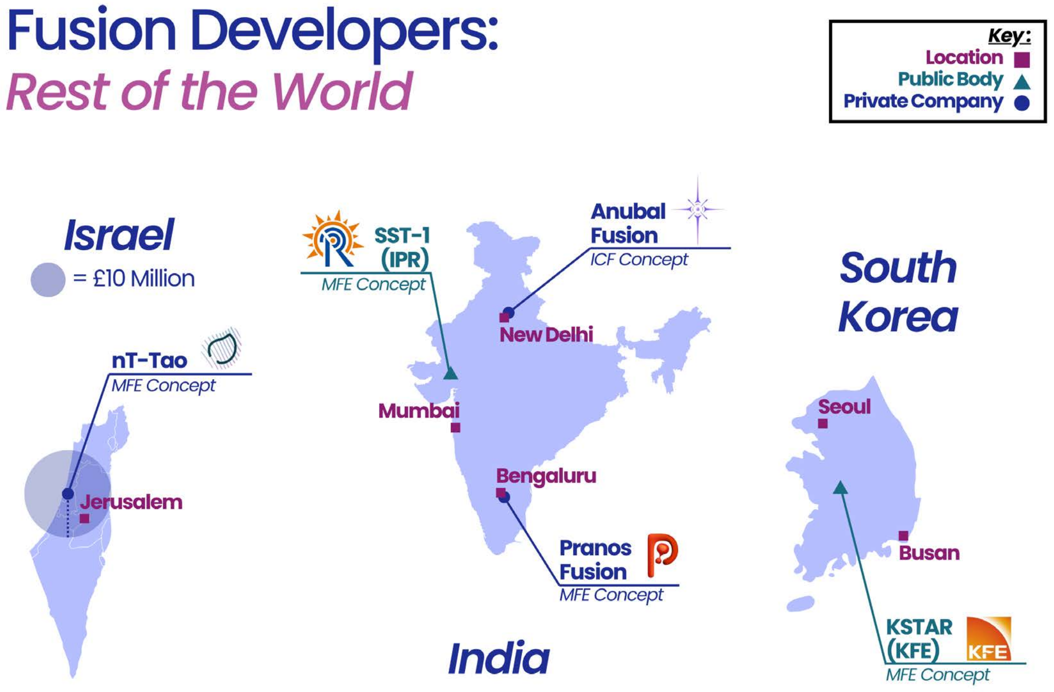
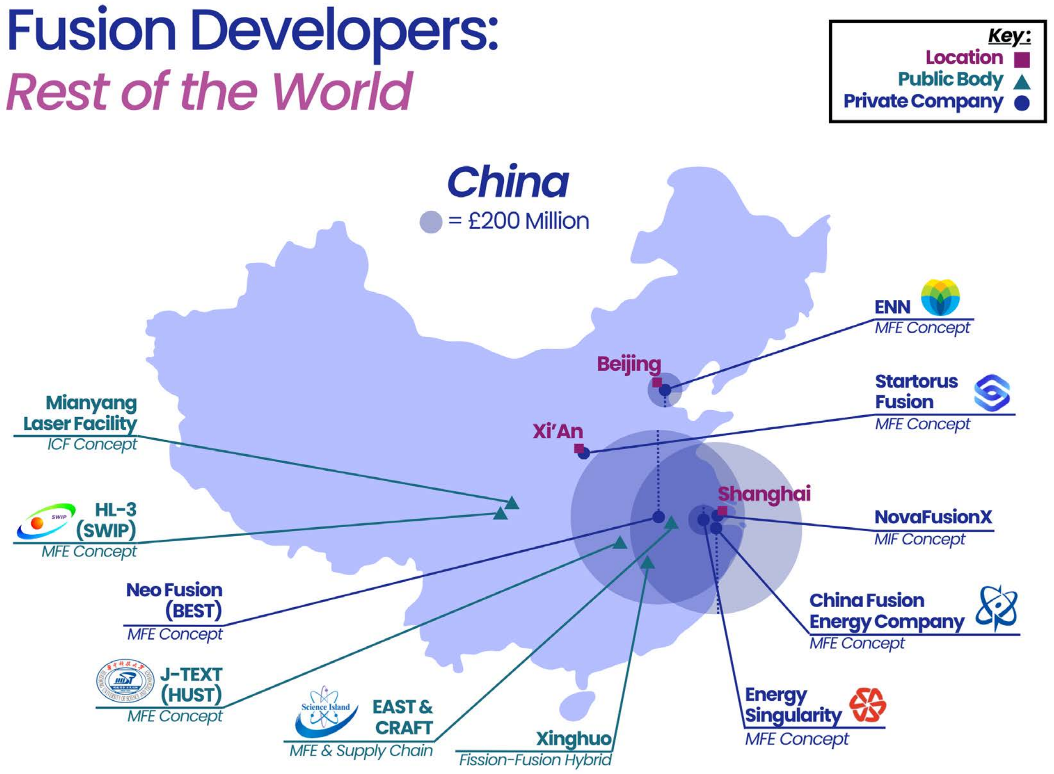
Fusion Developers:
Rest of the World



Map of major fusion activity in Israel, India and South Korea, showing all companies and major national fusion laboratories.

Fusion Developers:
Rest of the World



Map of major fusion activity in China, showing the top six companies by funding and major national fusion laboratories.

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How to Engage with the Fusion Ecosystem in Other Countries

South Korea:

Engage with the Korean Institute of Fusion Energy (KFE) - lead agency for KSTAR and K-DEMO. Register on the Korea ON-line E-Procurement System (KONEPS) to bid for tenders, and track Ministry of Science, ICT (MSIT) and Korea Institute of Fusion Energy (KFE) calls. Non-Korean companies can register on KONEPS and bid where eligible.

Register on Korea's PPS (Public Procurement Service) system – KFE / KSTAR tenders are issued through PPS; registration is needed to access documents and bid.

Israel:

Work with the Israel Innovation Authority - secure grants or partner with funded firms open to Israeli companies, with funding for Israeli companies that are partnered with foreign companies as well.

Canada:

Monitor the Canadian Nuclear Society - follow roadmap updates and supplier opportunities.

Attend CNL's Fusion Day – Canadian Nuclear Laboratories' forum on fusion deployment, roadmap and new programmes for industry and supply chain.

Register for CNL Clean Energy Siting Invitation – siting programme widened to include fusion projects.

Join the Fusion Energy Council of Canada (FECC) – national membership body linking industry, utilities, investors and supply-chain companies in Canada.

Apply to the CNRI fusion call at CNL – Canadian Nuclear Research Initiative now accepts fusion projects, supporting vendors with R&D and demonstration partnerships.

Australia & New Zealand:

Partner via research agencies and startups - e.g., Australia's Nuclear Science and Technology Organisation collaborations and private ventures like HB11 Energy and OpenStar

China:

Register on HUST Procurement & Bidding Centre – bid for Huazhong University of Science & Technology equipment, IT and services contracts.

Register on HUST Scientific e-Procurement (eBuy) platform – supply lab reagents and consumables to HUST research groups.

Register on ASIPP tender platform – access EAST tokamak / Institute of Plasma Physics (CAS) tenders via the dedicated ASIPP e-procurement site.

Register on China Bidding / similar portals – required to download documents and bid for Hefei Institutes of Physical Science procurements (e.g. gyrotrons, liquid helium systems).

Use Chinese national tender platforms for SWIP – HL-3 / Southwestern Institute of Physics upgrades (e.g. NBI main vacuum chamber) are published via national bidding portals.

India:

Register on India's Government eProcurement System (eprocure.gov.in) – gateway to submit electronic bids for Institute for Plasma Research tenders.

Track IPR 'Public Tenders' page – IPR publishes its calls there; each notice points back to the relevant e-tendering workflow.

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Major Projects

PROJECT NAME	DEVELOPER	LOCATION	COMMISSIONING DATE	GOAL
J-TEXT	Huazhong University of Science & Technology	Huazhong, China	Already commissioned	Study plasma confinement, stability, and fundamental tokamak physics to support CFETR design.
SST-1	Institute for Plasma Research (IPR)		Already commissioned	Experimental superconducting tokamak for plasma behaviour studies and pathway toward SST-Bharat and Indian DEMO.
K-STAR	Korea Institute of Fusion Energy (KFE)	Daejeon, South Korea	Already commissioned	Superconducting tokamak supporting ITER physics and informing Korea's K-DEMO programme.
EAST	Hefei Institutes of Physical Science	Hefei, China	Already commissioned	First experimental tokamak to use HTS coils for both toroidal and poloidal fields.
T-15MD	Kurchatov Institute	Moscow, Russia	Already commissioned	High-field, high-power tokamak testing components and regimes for future plants.
HH70	Energy Singularity	Shanghai, China	Already commissioned	HTS private-sector tokamak, demonstrating high-field HTS operation; precursor to HH170.
SUNIST-2	Startorus Fusion	Xi'an, China	Already commissioned	Spherical tokamak exploring novel configurations including negative triangularity.
Lawson Machine 26	General Fusion	Richmond, Canada	Already commissioned	Magnetized Target Fusion (MTF) machine targeting scientific breakeven by 2026.
HL-3	SWIP / Center of Fusion Science	Chengdu, China	Already commissioned	Research tokamak for plasma heat-exhaust studies to inform CFETR and next-gen Chinese devices.

PROJECT NAME	DEVELOPER	LOCATION	COMMISSIONING DATE	GOAL
CFETR	ASIPP & Partners	Hefei, China	By 2040	Bridge the gap between ITER and DEMO. Demonstrate power output over 1 GW and tritium self-sufficiency.
K-DEMO	Korean Institute of Fusion Energy	TBD, Korea	TBD	Test power plant components and then produce net power generation.
HH170	Energy Singularity	TBD, China	2027	Scale beyond success of HH70, ambitions for Q>1.
DEMO-FNS	Rosatom	TBD, Russia	TBD	Planned to be a fission-fusion hybrid to use fusion-produced neutrons to transmute nuclear waste.
SST-Bharat	Institute for Plasma Research	TBD, India	TBD	Planned as a fusion-fission hybrid, the next step toward a full-fledged fusion demonstration plant by 2060.
BEST	Neo Fusion	Hefei, China	2027	Net energy demonstration.
Pilot Plant	ENN Science and Technology Development Co.	Langfang, China	2035	Grid-connected fusion pilot plant.
Pilot Plant	HB11 Energy	Sydney, Australia	2030s	Grid-connected fusion pilot plant.
Fusion Demonstration Plant	General Fusion	Richmond, Canada	Early/mid 2030s	Grid-connected fusion power plant.
Pilot Plant	nT-Tao	Hod Hasharon, Israel	2032	Grid-connected fusion power plant.
Unity-2	Kyoto Fusioneering	Ontario, Canada	2026	Fusion Fuel Cycle Demonstration Facility

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Market Size

In this market segment, most government funding comes from China and South Korea. The Chinese government spends around £1 billion annually on fusion, dwarfing contributions from any other country in this market segment. South Korea has set aside around £660 million over the next ten years. So public fusion spending exceeds £1.6 billion annually for this regional segment.

Currently, the private fusion sector outside of the UK, US, Europe and Japan has raised over £4 billion. About 91% of this fundraising is for Chinese fusion companies. Sector spending is projected to be around £13.7 billion between 2026 and 2035, averaging as £1.4 billion annually. However, this is likely an underestimation as little public information is available for some Chinese fusion companies, and companies without publicly available demonstration date or power output were not included in the market sizing.

National Policy (High Level)

- China: Multi-device public program currently (EAST, HL-3, J-TEXT) aiming for an **early, state-backed demonstration power plant** through a government led plan.
- South Korea: Policy follows a **staged roadmap towards building the K-DEMO**, leveraging their success of the long-pulse operation experience of the KSTAR facility.
- India: Policy balances their domestic experimental devices with their contributions to ITER, using both its **domestic campaigns and international contributions** to inform its longer-term state-backed DEMO strategy.

For more information, India's Institute for Plasma Research (IPR) Fusion Roadmap

- Canada: The Canadian Nuclear Society (CNS) has published its "Fusion 2030" roadmap laying out a strategy to position Canada to be a world player in fusion research in 5 years and a leader in 10. Canadian Nuclear Laboratories (CNL) have also released their "Fusion Energy for Canada" strategy to call for Canada to take action on developing a domestic fusion energy program.

For further info see the Fusion 2030 Roadmap For Canada

- Australia & New Zealand: Lacking a centralized national mission, relying on **industry-led private fusion initiatives** (e.g. HB11 and OpenStar).
- Israel: National strategy is to provide consistent government funding through the **Israeli Innovation Authority** to their currently sole fusion developer nT-Tao. They are favouring a focused, commercial path.

Fusion Standards & Regulations

Understanding who regulates what, and where extra scrutiny falls, helps you price, qualify and time your entry into the fusion supply chain.

How fusion is being regulated

Most fusion-specific regulations are still under development, but there is a growing effort to establish frameworks that distinguish fusion from fission.

Regulatory Frameworks for Fusion Technologies, A Discussion Paper by the International Group of Legal Experts on Fusion Energy (FELEX). This provides an international overview of fusion regulation.

Many countries are choosing frameworks **separate from fission reactor licensing**. The regulation of fusion plants is expected to continue to evolve significantly as countries work to determine how best to regulate fusion. The direction of travel is clear: **treat fusion as a high-hazard industrial activity with radiological aspects**, not as a conventional nuclear power reactor.

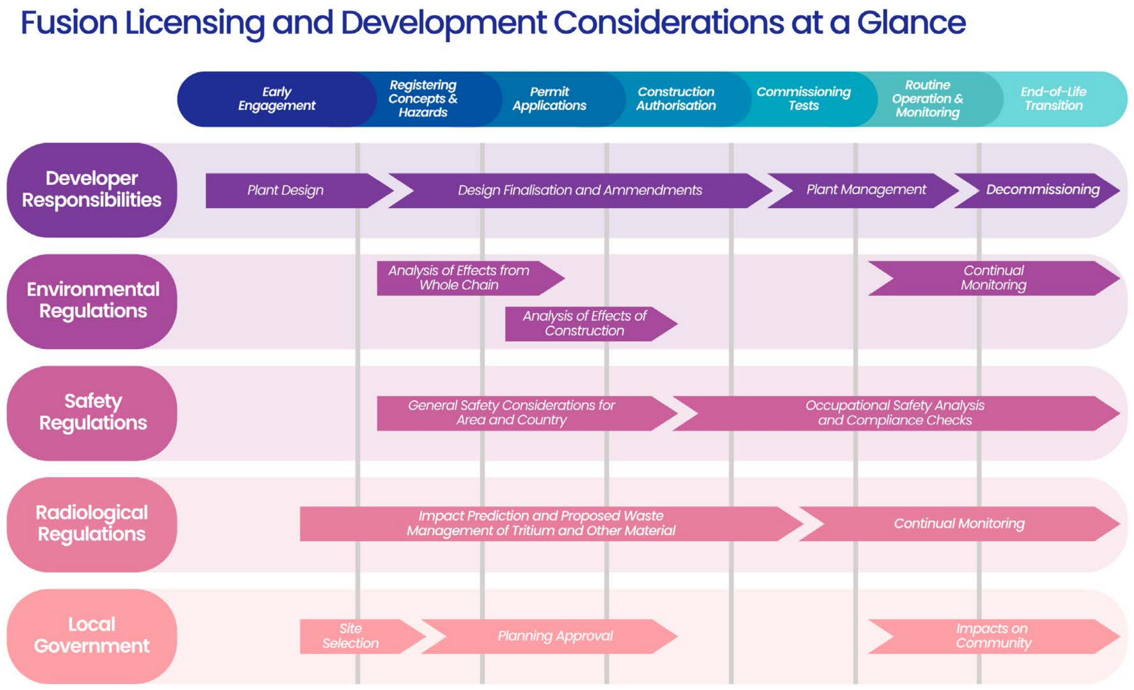
- **UK:** Fusion facilities are overseen primarily by the **Environment Agency (EA)** for radioactive/environmental permits and the **Health & Safety Executive (HSE)** for worker and conventional industrial safety, rather than by the Office for Nuclear Regulation.
- **US:** The **Nuclear Regulatory Commission (NRC)** decided in 2023 to regulate **fusion under its radioactive materials framework** (similar to accelerators/industrial radiation facilities), not the nuclear reactor part of its rulebook.
- **EU: No EU-wide fusion licensing yet.** Member states currently license facilities under national nuclear/radiation/environment laws, whilst the European Commission is developing a European fusion strategy.
- **Japan:** The **Nuclear Regulation Authority** classifies fusion as **"radiation-generating equipment"** under the Law Concerning Regulation of Radioactive Isotopes (RI Law), rather than the Nuclear Reactor Regulation Law, which governs nuclear fission materials and facilities.
- **International:** The **International Atomic Energy Agency (IAEA)** is shaping consistent, high-level fusion safety principles.

Who's who (typical points of contact)

OVERSIGHT AREA	EXAMPLE BODIES	SCOPE (KEYWORDS)
National nuclear / materials regulator	US NRC	Radioactive materials; site/security expectations
Environmental regulator	UK EA; national environment agencies	Discharges; waste; permits
Occupational safety regulator	HSE / OSHA	Pressure; electronics, cryogenics; lasers; lifting; construction
International guidance & standards	IAEA; ASME / IEC / IEEE / ISO (via national adoption)	Safety principles; codes; QA/ traceability

What this means in practice. Expect a licensing pathway focused on:

1. Containment of tritium and activated materials,
2. Environmental protection (air/water discharges),
3. Industrial safety (high voltages, cryogenics, lasers, vacuum/pressure, magnetic fields)
4. Quality Assurance (QA) proportional to component criticality.



Key considerations for fusion plant licensing and development procedures

Safety frameworks & typical approvals

Core safety principles (scaled to fusion): Layered defence-in-depth; As Low As Reasonably Practicable/Achievable (ALARP/ALARA) radiation principles; deterministic analyses (design-basis faults) plus risk-informed checks; strong operating procedures and training.

Regulators expect a **safety** case showing how hazards are controlled and how abnormal events are prevented/mitigated.

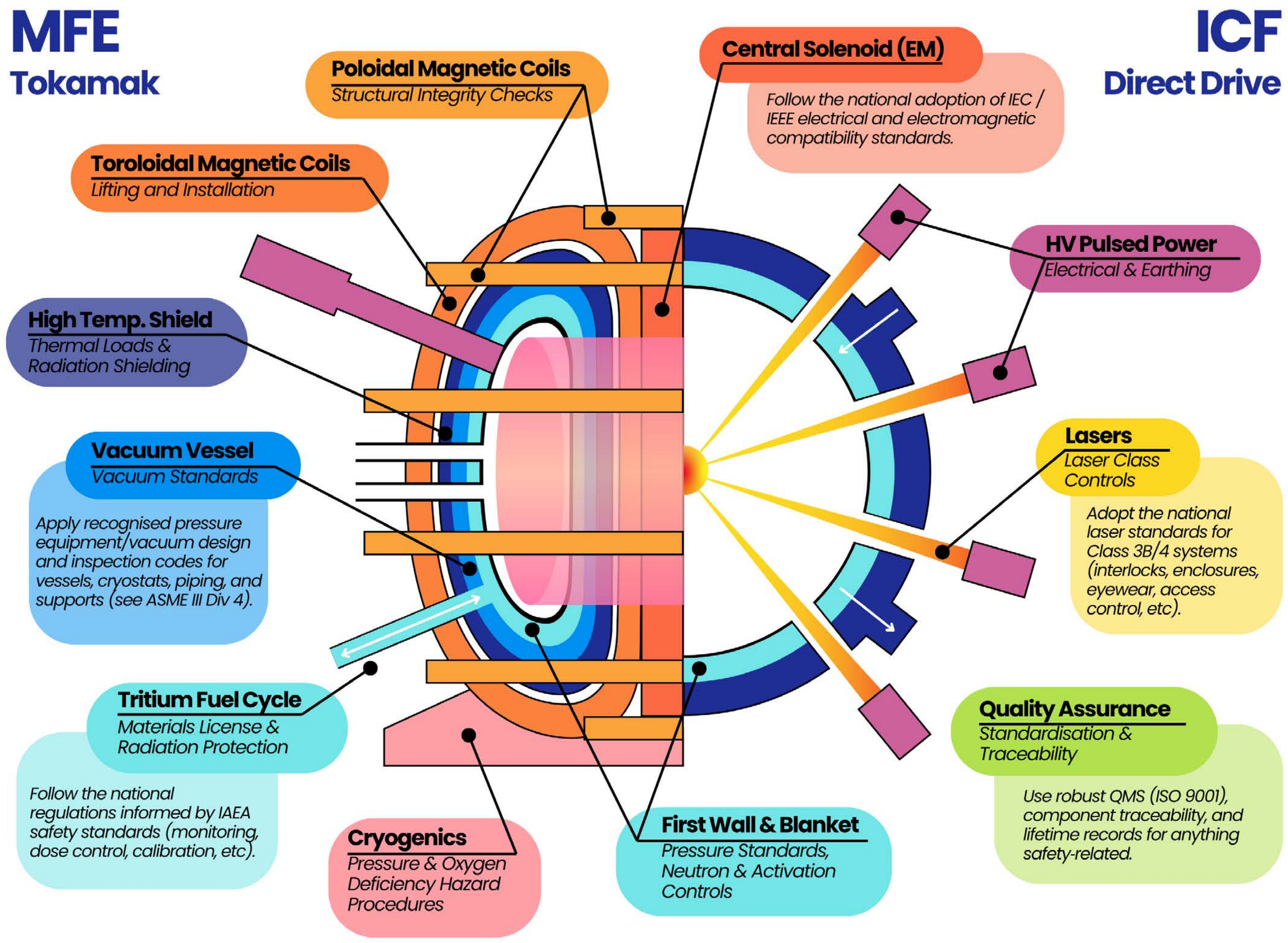
Typical approvals SMEs can encounter:

- **Environmental/radiological permits** (e.g., tritium handling, discharges, waste/storage).
- **Radioactive materials licensing/notification** (for tritium accounting).
- **Occupational safety approvals** for high-risk plants (pressure, vacuum, high voltage, cryogenics, lasers, magnets).
- **Planning/land-use consent** (siting, construction impacts).
- **Site/security controls** where sensitive materials/equipment are present. (Developers will map these for suppliers during pre-qualification.)

What counts as evidence?
Test plans & results, materials certification, functional/safety analyses, calibration/monitoring, QA traceability. Map each item to hazards in the developer's safety case.

Standards and codes you'll likely touch

Fusion-specific standards are emerging, and, where not yet available, **established industrial codes** are applied. Developers will specify which codes govern each package and what evidence is required for conformity and acceptance.



Split diagram showing two fusion reactor concepts (MFE tokamak and ICF laser direct drive) and where regulation standards apply. Note that these standards are not an exhaustive list, as fusion specific standards are still being developed.

Technologies that draw extra scrutiny

Tritium & lithium (fuel cycle/ breeding)	Tritium is radioactive; lithium is highly reactive and under neutron exposure breeds tritium. Expect materials licensing, tight inventory/accountancy, engineered containment, air/water treatment, and hazardous-chemical controls (storage, fire/water-reactivity). Many tritium components are dual-use; check export controls before sharing designs or shipping hardware/software cross-border. Interfaces: National materials & environmental regulators, as well as national occupational safety & health regulators. The descriptors above will vary by country and are provided to be indicative.
High-power lasers (IFE)	Class 3B/4 systems require laser safety programmes (interlocks, eyewear, enclosures, and training). Many laser components are dual-use; check export controls before sharing designs or shipping hardware/software cross-border.
Pulsed power & high voltage	Banked energy and fast discharges need electrical safety, robust enclosures, automatic discharge systems, electromagnetic/X-ray shielding where relevant, and certification by a competent body.
Additively manufactured (AM) parts	Safety-critical AM components face additional qualification (process controls, fracture/creep/fatigue evidence, witness testing). Expect conservative acceptance for additively manufactured parts.
Other dual-use items	Advanced power electronics, diagnostics, certain magnets/cryogenics controls may fall under national export controls; build compliance into contracting.

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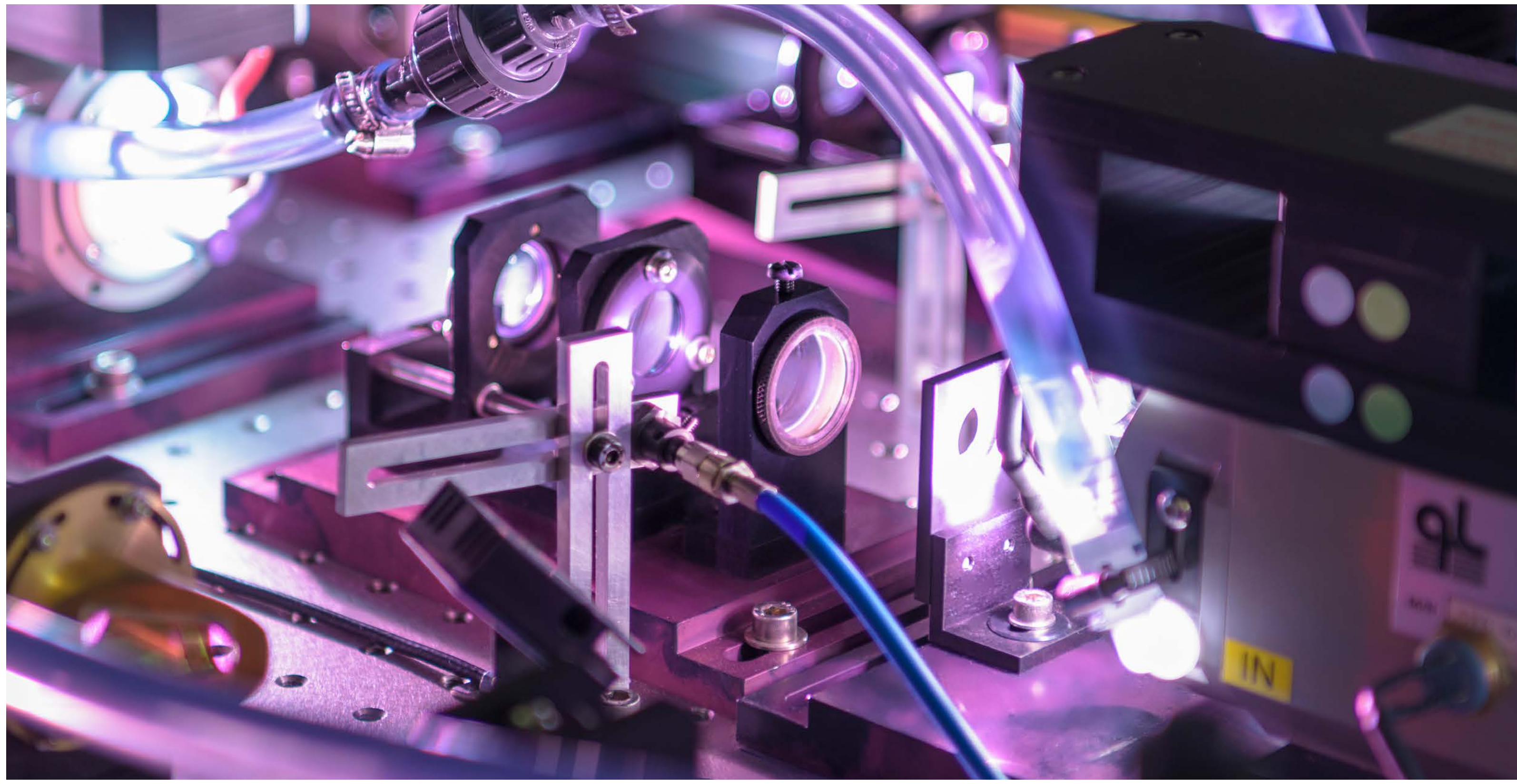
Timelines & implications for SMEs

Clear, proportionate rules reduce risk but **licensing still takes time**. Expect front-loaded work on the **safety case** and environmental permits for pilots; larger demonstrators will add more formal steps. Where frameworks are new, **regulatory learning** can add iterations. In the UK and US, policy choices are intended to **avoid fission-style timelines** and keep approvals tractable as projects scale through the 2030s.

What SMEs should do now:

1. **Pre-qualify early.** Ask customers for their **regulatory plan** and required **codes/QA** for your scope; align your quality management system and traceability.
2. **Design for evidence.** Plan test data packs (materials certs, non-destructive testing, functional tests, life models) **before** tender.
3. **Be aware of.** If you touch **tritium, lithium, high voltages, lasers or pressure boundaries,** verify permits/certifications and who holds them (you or the site operator?).
4. **Export-control screen** sensitive items/data and set checks by the **International Traffic in Arms Regulations (ITAR), Export Administration Regulations (EAR),** and **Wassenaar** where relevant.
5. **Budget time** for conformity assessment, audits and iterative reviews; these are normal gating steps for safety-related kit.
6. **Stay close to policy.** Track national guidance updates and industry working groups to anticipate changes; early insight shortens bid cycles.



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UK Government, Regulation decision to help 'accelerate' fusion energy progress.

US Nuclear Regulatory Commission, Press Release No. 23-029 (April 14 2023): "NRC to Regulate Fusion Energy Systems Based on Existing Nuclear Materials Licensing."

IAEA, World Fusion Outlook 2024.

Fusion Industry Association (FIA), FIA Responds to Japan's Cabinet Office on the "Basic Approach to Ensuring Safety for Realization of Fusion Energy" Draft Paper.

European Commission, Directorate-General for Research & Innovation, Exploring Regulatory Options for Fusion Power Plants.

European Commission, Directorate-General for Energy, Commission launches Call for Evidence to support first-ever EU-wide Fusion Strategy.

IAEA, Fundamental Safety Principles (SF-1)

IAEA, GSR Part 3: Radiation Protection and Safety of Radiation Sources (International Basic Safety Standards)

Japan Cabinet Office (Task Force), Basic Approach to Ensuring Safety for the Realization of Fusion Energy (draft)

European Commission, Directive 2014/68/EU (Pressure Equipment Directive)

IEC, IEC 60825-1: Safety of Laser Products.

ISO, ISO 9001:2015 – Quality Management System

IAEA, GSR Part 3 (International Basic Safety Standards)

NFPA, NFPA 484: Standard for Combustible Metals

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U.S. NRC, Report to Congress (Jul 2025): Risk-informed, performance-based, design-specific frameworks for mass-manufactured fusion machines

IAEA, Fusion Key Elements

Thomas Davis, Journal of Fusion Energy, The Need for Codes and Standards in Nuclear Fusion Energy.

ASME, BPVC.III.4 - BPVC Section III-Rules for Construction of Nuclear Facility Components-Division 4-Fusion Energy Devices.

AFCEN, RCC/RCC-MRx

Other Useful Information for SMEs

Public Industry Reports and Databases

- Fusion Industry Association's annual global fusion industry report
- International Atomic Energy Agency's World Fusion Outlook
- IAEA, Fusion Device Information System (FusDIS) provides a database of worldwide fusion devices

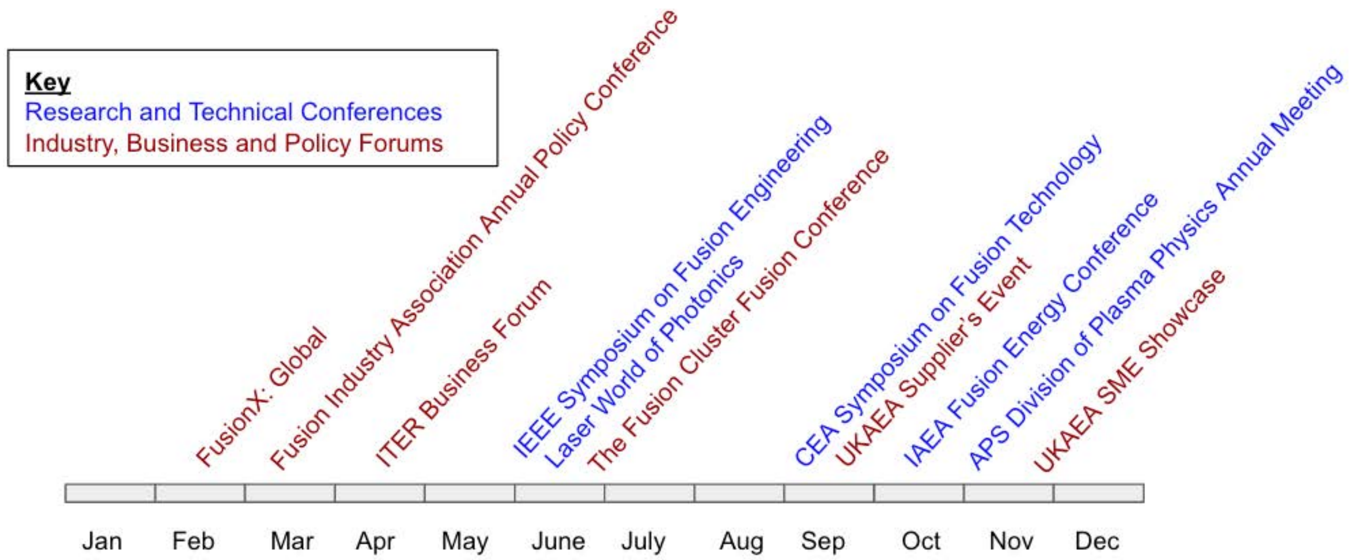
Fusion News

- UKAEA Supply Chain (quarterly newsletter directed to supply chain companies)
- Fusion Cluster (updates on cluster activities)
- Fusion Energy Insights (news insights, industry analysis)
- Fusion X Invest (financial updates on the industry)
- Fusion Energy Base (tracks fusion developers, the fusion supply chain, and jobs)
- ITER Newsline (official updates on ITER and related international fusion collaborations)
- UKAEA Newsroom (updates on UK government fusion projects)
- EUROfusion News (updates from across European labs)

Major Fusion Conferences

[ITER Conference List for all past/upcoming conferences.](#)

Some major fusion conferences in 2026:



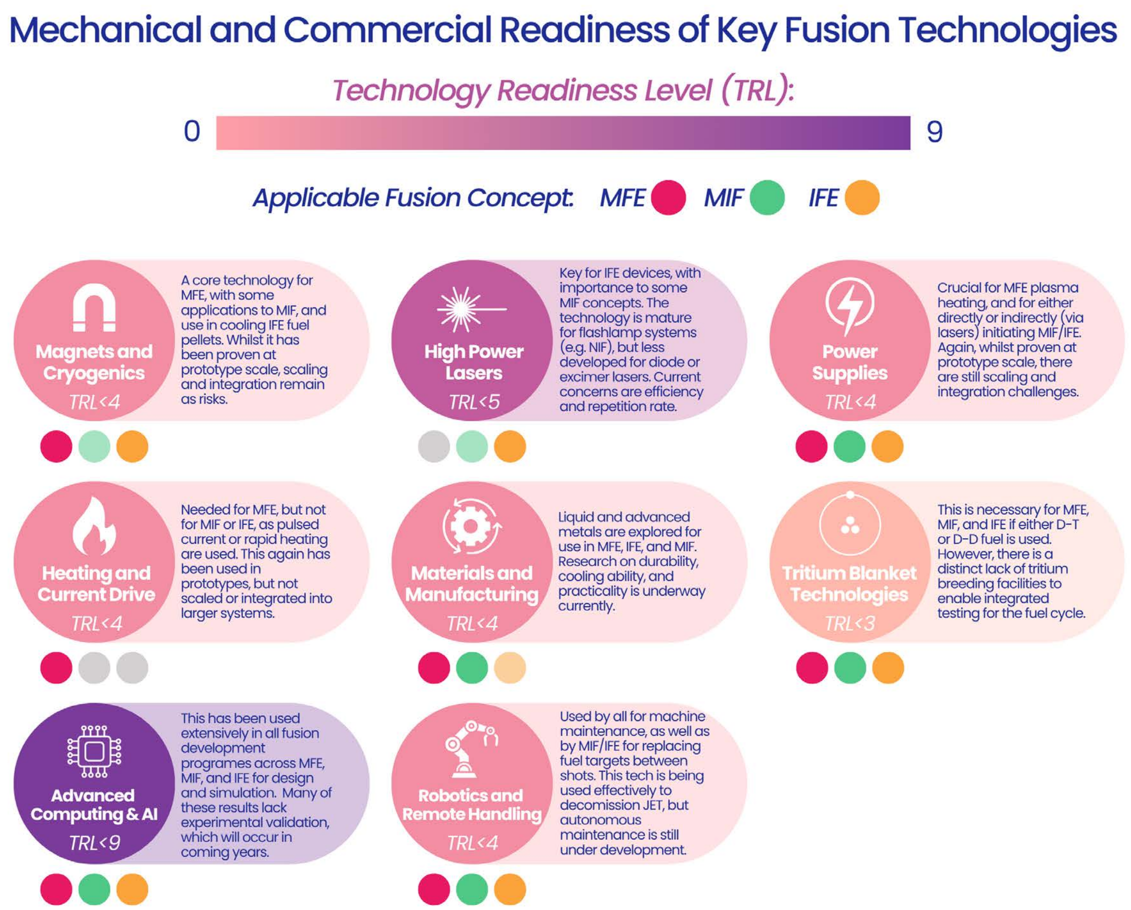
Key considerations for fusion plant licensing and development procedures

Understanding Technology Readiness Levels

The Technology Readiness Level (TRL) is a useful metric for assessing the development of various technologies and is often used in documents, articles and procurement information so understanding TRL's is extremely useful for SMEs. A key limiting factor for all current fusion technologies is that no subsystem has yet to be tested in a fusion-relevant neutron environment. The upcoming IFMIF-DONES (International Fusion Materials Irradiation Facility – Demo Orientated Neutron Source) facility aims to provide a fusion relevant neutron source by the mid 2030s. Without such validation, critical material and tritium behaviour, including swelling, embrittlement, helium transmutation, and retention, remain modelled rather than demonstrated.

TRL Scale:

- TRL 1: Pure research
- TRL 2: Applied research
- TRL 3: Laboratory testing of individual components
- TRL 4: Laboratory testing of integrated components
- TRL 5: Field testing of integrated components
- TRL 6: Field testing of scale prototype
- TRL 7: Full scale testing of prototype in cold conditions
- TRL 8: System completed and qualified through test and demonstration
- TRL 9: Actual system operations in full range of conditions



The UK Atomic Energy Authority's mission is to lead the delivery of sustainable fusion energy and maximise scientific and economic benefit

UK Atomic Energy Authority

Find out more
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