Prepare for the Fusion Investment Opportunity?

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$$E = mc^2$$

Albert Einstein, 1905

1. Executive Summary

After decades of being "always 20 years away," fusion energy has reached an inflection point. In December 2022, the US National Ignition Facility (NIF) achieved net energy gain for the first time in history. Since then, the NIF has continued to push its record, achieving ignition ten times. In April 2025, NIF delivered 8.6 megajoules (MJ) of energy — more than four times the 2.08 MJ of laser input — setting a new record and demonstrating that ignition is now a repeatable process, not a one-off event.

In January 2025, China achieved an impressive nuclear fusion breakthrough with its Experimental Advanced Superconducting Tokamak (EAST), setting a world record at the time sustaining stable plasma at over 100 million °C for 1,056 seconds (approximately 18 minutes)[2]. Then in early 2026, EAST broke through a long-standing plasma density barrier, confirming that plasma can remain stable even at extreme densities previously considered impossible — a critical step toward practical fusion power.

These milestones have sparked a robust private sector ecosystem racing to commercialise this technology. Global private investment has now exceeded US$10 billion, according to the International Atomic Energy Agency (IAEA)[3].

This paper has the following sections:

- The science
- Why fusion is important
- Current market structure
- Likely future developments
- Investment opportunities
- Conclusion

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[2] https://neutronbytes.com/2025/07/20/china-takes-the-lead-in-fusion-energy/

[3] https://www.iaea.org/newscenter/news/fusion-energy-in-2025-six-global-trends-to-watch

2. The science

Fusion is the process that powers the sun and stars. It occurs when two light atomic nuclei — typically deuterium and tritium (hydrogen isotopes) — combine to form a heavier nucleus which is slightly lighter than the sum of the two input nuclei. The minuscule difference in mass is converted to enormous amounts of energy according to Einstein's famous formula:

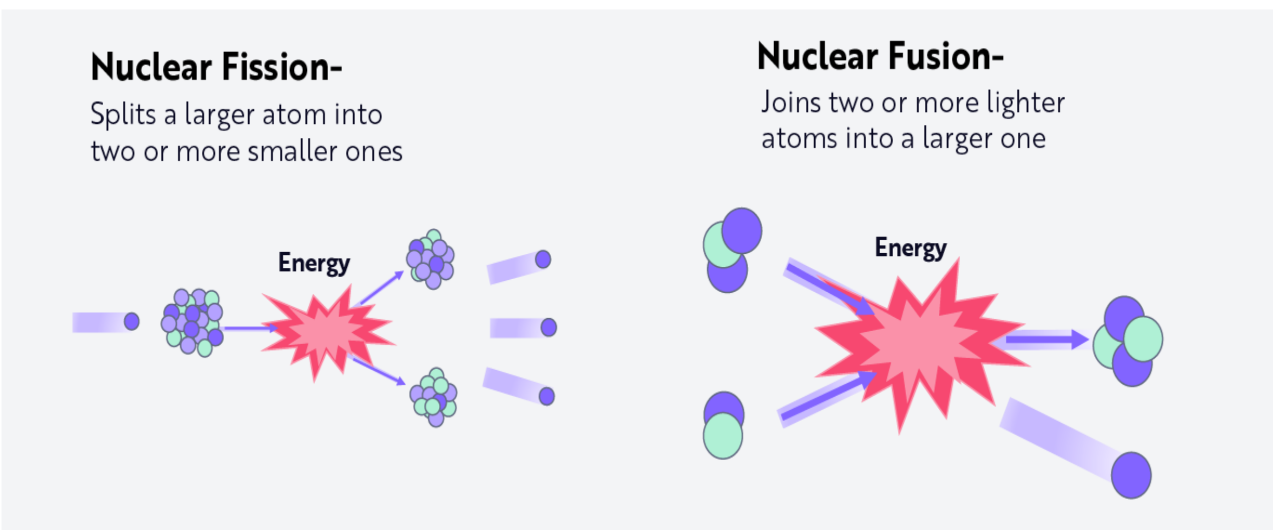
$$\boldsymbol{E = mc^2} \quad \text{where}$$

- E is energy,
- m is mass, and
- c is the speed of light — a very large number[4].

The challenge has been to recreate on Earth the conditions required for fusion, which demands precise magnetic or inertial confinement of superheated plasma at temperatures exceeding 100 million degrees Celsius — far hotter than the core of the sun.

Deuterium is abundant and can be extracted from seawater, while tritium is less common but can be "bred" inside a fusion reactor by using lithium. This deuterium-tritium fuel is favoured because it requires lower temperatures to initiate fusion compared to other potential fuels. The fuel is effectively inexhaustible and widely distributed globally, eliminating geopolitical supply concerns.

Fission, which powers some 440 nuclear reactors in 31 countries today, involves splitting a relatively heavy atomic nucleus, such as Uranium 236, into two lighter nuclei. Again, the combined mass of the two nuclei after the process is less than the mass of the original, and the difference is converted into enormous amounts of energy. The diagram below contrasts the splitting of a heavy nucleus under fission with the combination of two light nuclei under fusion.



[4] A loss of mass of one gram according to the famous formula would produce 90 terajoules of energy which is approximately the same yield as the "Fat Man" atomic bomb dropped on Nagasaki.

3. Why fusion is important

The investment thesis is compelling: fusion promises virtually unlimited clean energy with none of the downsides of current alternatives. Its advantages are striking:

- No carbon emissions
- No long-lived radioactive waste
- No intermittency issues
- No shortage of fuel (derived from seawater and lithium)
- No risk of meltdowns (unlike fission)
- No large environmentally unfriendly land footprints (unlike wind and solar)

The growing demand from artificial intelligence data centres is creating an urgent new driver for fusion. Major technology corporations urgently need clean, reliable baseload power that solar and wind cannot alone provide. This AI energy premium is now a central element in the fusion investment thesis, reflected in power purchase agreements being signed by Google, Microsoft, and Eni.

The IAEA's 2025 World Fusion Outlook[5], incorporating global modelling by MIT, projects that in a favourable cost scenario, fusion's share of global electricity generation could reach up to 50% by 2100. Even in the highest cost scenario, fusion energy is projected to reach 10% of global electricity generation by 2100.

4. Current market structure

The December 2022 achievement at the NIF proved the fundamental physics works. This and other scientific validations have catalysed private sector investment and accelerated development timelines across the industry.

The fusion industry has evolved rapidly from a handful of academic projects to a robust ecosystem. A 2025 survey by the International Fusion Association[6] identified 53 private companies across 13 countries. The United States leads with 29 companies, followed by the United Kingdom, Germany, Japan, and China with three each. The industry has grown from employing approximately 1,000 people in 2021 to over 4,000 in 2025—a 300% increase.

Major corporations including Google, Microsoft, Chevron, and Eni have demonstrated their confidence in fusion success by already committing over $1 billion in power purchase agreements. The total private investment raised between 2021, and end-2025 reached US$10.6 billion. The 12 months to July 2025 alone saw $2.64 billion in new funding.

The industry is pursuing multiple technological pathways, reducing single-point-of-failure risk:

- Magnetic Confinement (25 of 53 companies): Tokamaks and stellarators use powerful magnetic fields to contain plasma
- Inertial Confinement (11 companies): Lasers or electromagnetic pulses compress fusion fuel
- Magneto-Inertial Fusion (6 companies): Hybrid approaches combining magnetic and inertial methods

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[5] IAEA World Fusion Outlook 2025 — https://www.iaea.org/topics/fusion

[6] https://www.fusionindustryassociation.org/wp-content/uploads/2025/07/2025-Global-Fusion-Industry-Report.pdf

- Alternative Concepts (10 companies): Including field-reversed configurations and advanced fuels

Key companies and recent developments (as at April 2026):

Commonwealth Fusion Systems (CFS) — ~$3 billion raised

- Building SPARC tokamak at a 60-acre campus in Devens, Massachusetts
- In January 2026, CFS installed the first of 18 superconducting toroidal field magnets (24 tons each, generating 20 tesla — 13x stronger than a typical MRI). All 18 magnets are expected to be installed by end of summer 2026
- SPARC is scheduled to begin operations in 2026 and produce first plasma net energy in 2027
- In September 2025, the Department of Energy, (DOE), independently validated CFS's toroidal field magnet milestone, awarding $8 million — the largest payment to any company in the DOE's Milestone-Based Fusion Development Program
- At CES 2026, CFS announced partnerships with Nvidia and Siemens to build a digital twin of SPARC using AI and advanced simulation, compressing years of experimentation into weeks
- New investors include Nvidia and Google; CFS has raised an $863 million Series B2 round in August 2025
- First commercial plant (ARC), 400 MW capacity, targeting grid connection in the early 2030s in Chesterfield County, Virginia
- Power purchase agreements with Google (200 MW) and Eni ($1+ billion deal)
- Estimated valuation: $5–6 billion

TAE Technologies — ~$1.5 billion raised; $6 billion merger announced

- In December 2025, TAE announced a landmark merger with Trump Media & Technology Group (Nasdaq: DJT) in an all-stock transaction valued at over $6 billion, creating one of the world's first publicly traded fusion companies
- Trump Media has agreed to provide up to $200 million in cash to TAE at signing, with an additional $100 million available upon regulatory filing. The deal is expected to close mid-2026
- The combined company plans to site and begin construction of a 50 MWe utility-scale fusion power plant ("Copernicus") in 2026, targeting commercial operation by 2031
- In April 2025, TAE announced a physics breakthrough with its 'Norm' reactor, maintaining stable plasma at 70 million °C, validated in Nature Communications
- TAE's longer-term plants are expected to scale to 350–500 MW
- Backed by Google, Goldman Sachs, Chevron, and Sumitomo Corporation

Helion Energy — $1+ billion raised

- Backed by Sam Altman, SoftBank, KKR, and BlackRock
- Its Polaris prototype recently demonstrated measurable deuterium-tritium (D-T) fusion and reached plasma temperatures of 150 million °C, reportedly the highest temperature achieved in any non-tokamak fusion device
- Has begun construction of its commercial plant to supply 50 MW to Microsoft's data centres by 2028
- Uses unique "field reversed configuration" approach; note: some technical papers have challenged aspects of Helion's reactor physics, which the company disputes

Pacific Fusion — $900 million Series A (2025)

- Largest Series A in fusion history; backed by Eric Schmidt, Patrick Collison, and Reid Hoffman
- In February 2026, Pacific Fusion and Sandia National Laboratories reported a major engineering breakthrough: by adjusting fuel pellet casing design, they eliminated the need for more than $100 million in preheating laser equipment from their reactor design, making their pulser-driven inertial confinement approach significantly more cost-competitive
- Pursuing a pulsed inertial confinement approach using 156 coordinated electromagnetic generators delivering 2 terawatts; partnered with General Atomics and Sandia National Laboratories for target fabrication

General Fusion — $492 million raised; SPAC IPO announced

- Canadian company pursuing magnetised target fusion
- In January 2026, General Fusion announced a ~$1 billion SPAC merger with Spring Valley Acquisition Corp. III, expected to close mid-2026, to be listed on Nasdaq under ticker GFUZ — one of the first fusion companies to reach public markets
- Currently operating its Lawson Machine 26 (LM26) demonstration device, targeting 100 million °C by mid-2028
- Commercial fusion deployment targeted around 2035
- Backed by Jeff Bezos and Temasek; note: the company experienced layoffs and emergency fundraising in 2025, a reminder of the execution risk in this sector

New Entrants (2025–2026)

- Inertia (NIF spinout): Raised $450 million Series A in early 2026 to commercialise laser-based inertial fusion, directly building on NIF's ignition success
- China's Startorus Fusion: Raised ~$143 million Series A in January 2026, signalling China's rapidly expanding private fusion sector
- Germany's Marvel Fusion: Raised a €113 million Series B, bringing total funding to €385 million, targeting a fusion power plant by the mid-2030s

5. Likely future developments

The industry is currently in the "prove the machine" phase, validating that new reactor designs function as intended. Commonwealth Fusion Systems' SPARC tokamak is under active construction and is scheduled to begin operations in 2026 and to become the world's first commercially relevant fusion machine to produce net energy in 2027. This will replicate the NIF breakthrough in a repeatable, scalable format directly applicable to power generation.

A significant policy milestone was reached in October 2025 when the U.S. Department of Energy released its Fusion Science and Technology Roadmap, developed with input from over 600 scientists, engineers, and industry stakeholders[7]. The roadmap establishes a "Build–Innovate–Grow" strategy targeting commercial fusion power to the grid by the mid-2030s. Its timeline envisions private sector early-stage demonstration plants within 3–5 years, and first-of-a-kind nuclear power plants within 5–10 years.

A major enabling technology trend is the broader adoption of high-temperature superconducting (HTS) magnets. The IAEA's 2025 World Fusion Outlook includes a special focus on HTS magnets,

[7] https://www.energy.gov/sites/default/files/2025-10/fusion-s%26t-roadmap-101625.pdf

noting they “could revolutionise the design of next generation fusion facilities” by enabling more compact and efficient machines. CFS’s 20-tesla HTS magnets are at the forefront of this trend.

Artificial intelligence is playing an increasing role. Google DeepMind’s TORAX plasma simulator is already a “linchpin” in CFS’s daily workflows, running millions of virtual experiments before SPARC is even turned on. Nvidia’s Omniverse digital twin platform and Siemens industrial software are being used to manage SPARC’s ~2 million components.

The public markets are beginning to open up. The TAE-Trump Media merger (announced December 2025) and General Fusion’s SPAC deal (announced January 2026) both seek to list in mid-2026, potentially creating the first publicly traded fusion companies. This is a significant milestone for investor access.

International competition is intensifying. China is investing an estimated US$1.5 billion per year in fusion research — roughly double the U.S. government’s annual allocation. Japan plans to open three major fusion R&D sites to private companies. The European ITER project, now involving 33 nations, has experienced construction delays, with research operations now expected to begin in 2034.

If technological milestones are achieved, the fusion energy sector could reach $40–$80 billion by 2035 and potentially exceed $350 billion by 2050.

6. Investment opportunities

Total fusion investment reached US$10.6 billion between 2021 and end-2025. Private capital comprises the overwhelming majority of this. The 12 months ending July 2025 saw $2.64 billion in new funding, the highest since 2022. Governments worldwide are also increasing support through public-private partnerships.

Strategy 1: Indirect Exposure Through Strategic Investors

Several large-cap public companies have made significant investments in fusion start-ups:

Alphabet Inc. (GOOGL): Invested in TAE Technologies and CFS (including an $863 million Series B2 in August 2025). Has signed a 200 MW power purchase agreement with CFS. New strategic partnership with CFS through Google DeepMind’s AI plasma simulator. Strategic rationale: powering AI data centres with clean fusion energy.

Chevron Corporation (CVX): Invested in TAE Technologies and Zap Energy. Maintains $500 million commitment to lower-carbon technologies through Chevron Technology Ventures.

Microsoft Corporation (MSFT): Binding 50 MW power purchase agreement with Helion Energy, to be delivered by 2028. Helion has now begun construction of this plant. Strategic rationale: meeting carbon-negative 2030 commitment and powering AI infrastructure.

Eni S.p.A.: Invested $50 million in CFS (2018); collaborative agreement for industrialisation; $1+ billion power purchase from ARC plant. Largest corporate fusion commitment globally.

Trump Media & Technology Group (DJT): The December 2025 merger with TAE Technologies — valued at over $6 billion — represents a significant new entry point. If the merger closes in mid-2026 as planned, DJT would become one of the first publicly traded fusion companies. Investors should note high risk and volatility; TAE has yet to demonstrate commercial-scale net energy gain.

Nvidia (NVDA): Joined CFS’s $863 million Series B2 round in August 2025 and announced at CES 2026 a collaboration to develop the digital twin of SPARC using Omniverse. Direct strategic interest in fusion as a power source for its AI chips.

Strategy 2: Picks-and-Shovels Approach

Investors can gain exposure through companies providing critical enabling components:

- **Furukawa Electric and Fujikura** (Japan): Leading manufacturers of High-Temperature Superconductor (HTS) tape, essential for CFS and other magnetic confinement designs. The IAEA's 2025 outlook highlights HTS as a potentially revolutionary enabling technology across multiple fusion concepts.
- **Albemarle Corporation**: Major lithium producer; fusion requires lithium for breeding tritium fuel.
- **Siemens** (via its digital industries division): Providing key industrial software for SPARC construction management (Xcelerator, NX, Teamcenter). Announced at CES 2026.
- **Nvidia**: Digital twin and AI infrastructure increasingly critical to fusion development timelines, in addition to its direct CFS investment.
- **Syntec Optics**: Announced entry into the fusion market in May 2025 with commercial orders for polymer optics for plasma diagnostics.

Strategy 3: Clean Energy and Nuclear ETFs

While no fusion-specific ETFs exist, several funds provide broad exposure:

- **VanEck Uranium and Nuclear ETF**: Holdings include next-generation nuclear companies. 0.61% expense ratio. Top holdings include Constellation Energy, Cameco, and Oklo.
- **iShares Global Clean Energy ETF**: Nearly 100 holdings across clean energy spectrum, providing diversified exposure to the energy transition.

Strategy 4: Public Market Access via Fusion IPOs (Updated)

The IPO landscape has changed substantially since late 2025. As reported above two fusion companies are now seeking public listings:

- TAE Technologies / Trump Media (DJT): Merger announced December 2025, expected to close mid-2026. Will be listed on Nasdaq as DJT. Investors gain direct fusion exposure but also inherit the volatility of Trump Media's existing media and cryptocurrency business. TAE's plan is to site its first 50 MWe plant in 2026 with a target commercial operation date of 2031.
- General Fusion (GFUZ): SPAC merger with Spring Valley Acquisition Corp. III announced January 2026, ~$1 billion deal, expected to list on Nasdaq mid-2026. Note that General Fusion went through layoffs and emergency fundraising in 2025 before securing this deal — a reminder that not all fusion companies will succeed.
- Commonwealth Fusion Systems: Remains the most likely premium IPO candidate but has indicated no plans before late 2027 at the earliest, contingent on SPARC success.
- Helion Energy: Strong Microsoft contract could support a public markets debut post-2028 if commercial delivery succeeds.

Accredited investors may also access opportunities through secondary market platforms (Forge Global, EquityZen), venture capital funds with fusion exposure, or SPACs (though this mechanism has a mixed track record).

Strategy 5: Wait-and-See with Catalyst Monitoring

Conservative investors may prefer to wait for de-risking events. Near-term catalysts to monitor:

- SPARC first plasma and net energy demonstration (2026–2027)
- TAE-Trump Media and General Fusion SPAC listings (mid-2026)
- Helion's Microsoft delivery deadline (2028)
- First commercial plant grid connection (early 2030s)
- Additional corporate power purchase agreements
- Regulatory framework developments in the U.S., UK, and EU

7. Conclusion

Fusion energy has transitioned from science fiction to an investment-grade opportunity. Since the original December 2025 version of this paper, the pace of development has accelerated further. NIF has now achieved ignition ten times, with energy output growing to 8.6 MJ. China's EAST reactor broke through a plasma density barrier in early 2026. CFS installed its first SPARC magnet in January 2026, with SPARC on track to produce its first plasma in 2027. Two fusion companies are now approaching the public markets.

At the same time, the sector is not without risk. General Fusion's near-collapse and emergency fundraising in 2025 is a cautionary reminder. Helion has faced scientific scrutiny. TAE's merger with a politically charged media company adds complexity. The DOE's own roadmap, while optimistic, warns of "critical gaps" in materials science, tritium breeding, and plasma diagnostics that must still be closed.

The investment landscape is also evolving rapidly. Within months of this paper's original publication, the first publicly traded fusion vehicles emerged. Indirect exposure through Alphabet, Microsoft, Nvidia, Eni, and Chevron remains available, and now with direct-ish exposure possible through DJT and potentially GFUZ. The picks-and-shovels approach — via HTS magnet suppliers, lithium producers, and AI/simulation companies — continues to offer lower-risk participation.

For investment professionals, fusion continues to represent an asymmetric opportunity. The downside risk can be limited through small position sizes in diversified large-cap equities, but the upside potential from a transformational energy technology is substantial. The key is patience combined with active monitoring: commercial validation is 5–10 years away, but the window for early positioning is narrowing as the sector moves from private to public markets.

For Further Research

- Fusion Industry Association: Global Fusion Industry Reports (annual) — https://www.fusionindustryassociation.org
- Commonwealth Fusion Systems — https://cfs.energy
- TAE Technologies — https://tae.com
- Helion Energy — https://www.helionenergy.com
- Pacific Fusion — https://www.pacificfusion.com
- General Fusion — https://generalfusion.com
- NIF Ignition Achievements — https://lasers.llnl.gov/science/achieving-fusion-ignition
- World Nuclear Association: Nuclear Fusion Power — https://world-nuclear.org/information-library/current-and-future-generation/nuclear-fusion-power

Acknowledgements

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