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IENE Comment

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By Anjana Ahuja *

In the 1950s, the British engineer John Lawson came up with criteria for whether a nuclear fusion reaction — the process that powers stars — on Earth could produce more energy than that needed to start it. A “Q” factor greater than 1 would signify a net energy output, suggesting fusion energy could one day move from sci-fi concept to feasible power source.



Since then, scientists have achieved much higher Q factors. Prototype fusion power plants are under construction. And now scientists have come up with a measure called “economic Q” to assess their commercial viability.

The idea — published last month in the *Journal of Fusion Energy* and taking in such factors as construction costs and energy price — aligns with growing investor confidence. Privately held fusion companies raised \$4.5bn over the past year alone, according to the *Fusion Industry 2026* report. There are now more than 50 such companies. Last month, General Fusion, a Canadian outfit backed by Jeff Bezos, became the first publicly listed fusion company.

These signals hint at an important shift: fusion energy is gradually being perceived less as a scientific challenge and more as an economic one. External factors — energy shocks, geopolitical instability, climate change, energy-intensive AI — have also cast this perpetually fledgling technology in a flattering light.

Nuclear fusion powers the stars, including our Sun. Enormous gravitational forces squeeze hydrogen nuclei so close together that they fuse into helium, releasing a massive amount of energy. Fusion is distinct from fission, used in existing nuclear power plants, in which heavy atoms like uranium are split apart to release energy.

Over decades, scientists in both state and private labs have mimicked stellar fusion by combining two isotopes of hydrogen, deuterium and tritium — heated to more than 100mn Celsius into a plasma — to create helium. As Lawson realised, temperature, particle density and timing were crucial: confine the resulting plasma tightly enough, and for long enough in hot enough conditions, and fusion could not only happen but become self-sustaining, unleashing near-limitless clean energy with little waste.

Today, confinement can be magnetic or inertial. The former uses magnetic fields to contain the hot deuterium-tritium (D-T) plasma; tokamaks, doughnut-shaped chambers fitted with superconducting magnets, are a popular choice. Inertial confinement usually features laser beams focused on a tiny D-T pellet.

As fusion happens, energetic neutrons are ejected and absorbed by a blanket surrounding the reactor. That kinetic energy turns into heat, which is then used to generate electricity. The National Ignition Facility at Lawrence Livermore National Laboratory in California, which uses laser confinement, achieved a Q of more than four in 2025. ITER, the international tokamak reactor due for completion in southern France in the 2030s, is aiming for a Q of 10.

That is why the economics of fusion energy are in the spotlight. The lead author of the paper, Dennis Whyte, is a leading fusion advocate and professor of engineering at the Massachusetts Institute of Technology, who was recently appointed head of the UK Atomic Energy Authority. Economic Q, the metric devised by Whyte and others and which must exceed one to represent net economic gain, compares the capital gained over a fusion energy plant's lifetime to that expended. Factors reflect the extreme engineering involved and include construction costs, component durability and the efficiency of converting fusion power into a commodity.

Before his appointment, Whyte gave an interview to Physics World in which he insisted that a Lawson-style formula was now needed to evaluate different fusion power plant designs. He and his co-authors also usefully point out that the costs of fusion research have never been historically well defined or understood, even kept under wraps.

Interestingly, Whyte co-founded Commonwealth Fusion Systems, a private company that is teaming up with MIT to build Sparc, a prototype fusion power plant, in Massachusetts. The company, in which Google is an investor, is also building a 400MW plant in Virginia.

It is possible that the field emulates the arc of AI, with fusion energy arriving suddenly, everywhere, all at once. Or that it remains forever a decade or two away, an enticing mirage perpetually sustained by a fusion of hype and investment.

**** The writer is a science commentator. This article has been abstracted from the Financial Times, August 25, 2026.***

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