

TECH POWER PLAYERS 2023

Climate change is a major problem. These Boston leaders have solutions.

From fusion power to solid-state batteries to a more eco-friendly steelmaking process, local tech companies are driving sustainable innovation.

By [Hiawatha Bray](#) Globe Staff, Updated May 12, 2023



Siyu Huang, founder and CEO of Factorial Energy. CRAIG F. WALKER/GLOBE STAFF

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Some of Greater Boston’s most promising tech entrepreneurs are tackling the biggest imaginable task — [slowing the pace of global warming](#).

Boston has long been a center of clean energy, driven by innovations spinning out of the Massachusetts Institute of Technology and other universities. And today, [local startups are advancing technologies to power the economy](#) while eliminating greenhouse gases driving climate change.

The sector plays an important role in the state’s tech economy, accounting for nearly \$1 of every \$5 [invested by venture capitalists in Massachusetts last year](#). That’s \$3.5 billion claimed by cleantech firms in the state, according to research firm Cleantech Group, out of the \$19.5 billion that the data firm Crunchbase says was invested in Massachusetts companies in 2022. At least a half-dozen of the entrepreneurs on *The Boston Globe’s* Tech Power Players 50 list come from the clean energy sector.

Even as [overall venture investing has slowed sharply amid declining economic activity](#), local cleantech companies are stepping on the accelerator. Anthony DeOrsey, research manager at Cleantech Group, expects venture money to keep flowing to Massachusetts companies because they’re tackling the most critical challenges in energy, from superior batteries to the ultimate in clean power — nuclear fusion.

“There is a bit more of an appetite globally to take risks on these technologies because of the urgency of climate change,” DeOrsey says. “You’ve got some potential global leaders” in Greater Boston.

Here are three areas to watch.

Potential Energy



A 100Ah and 1.5Ah, right, solid-state battery displayed at Factorial Energy in Woburn on March 24, 2023. CRAIG F. WALKER/GLOBE STAFF

[Turmoil in capital markets caused by the collapse of Silicon Valley Bank](#) hasn't harmed the Woburn battery maker Factorial Energy, which has raised \$220 million, much of it from car companies that will test its products. Batteries are [essential to electrifying a transportation sector that produces more than a quarter of greenhouse gas emissions](#) in the United States, according to the Environmental Protection Agency.

[Factorial](#) is making batteries safer by replacing the flammable liquid inside lithium-ion batteries with a solid, plastic-like substance that won't catch fire. Solid-state batteries, such as Factorial's, also promise to deliver more energy per pound than current designs.

Factorial is building a pilot plant in Methuen to manufacture batteries for testing by automakers such as Mercedes-Benz, Hyundai, Kia, and Chrysler parent Stellantis. When it starts up later this year, the factory is expected to produce enough batteries annually to power about 1,000 EVs. "We see a huge potential for solid state to be a major player in the next five to 10 years," says Factorial chief executive Siyu Huang.



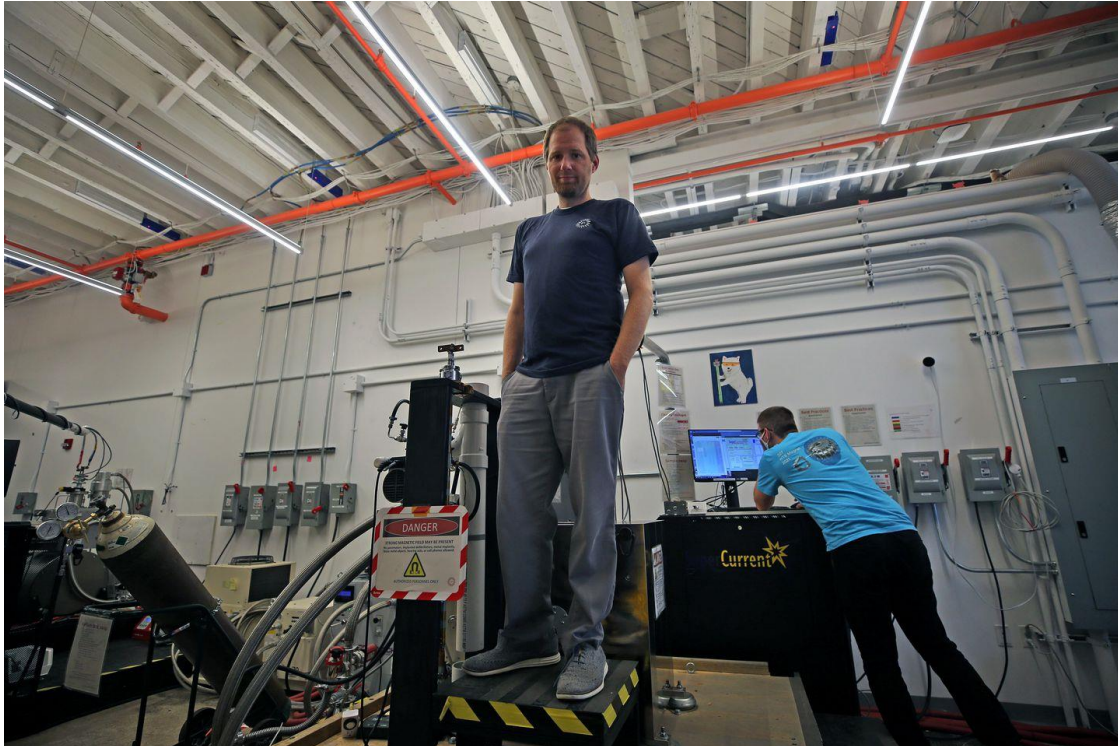
An iron-air cell at Form Energy in Somerville, a startup building massive batteries to store electricity produced by wind, solar, and other intermittent sources of renewable energy, on Feb. 15, 2022. DAVID L. RYAN/GLOBE STAFF

But batteries aren't just for cars. At Somerville-based Form Energy, they're [building massive batteries to store electricity produced by wind, solar, and other intermittent sources of renewable energy](#), and connect that electricity to the grid to power homes and businesses.

The company, which recently raised \$450 million in venture funding, makes its batteries from iron, avoiding harder-to-get metals, such as cobalt, used in today's batteries. Iron is one of the most plentiful — and cheapest — materials on earth. It also has the advantage of being nonflammable and nontoxic.

In January, [Form Energy](#) signed a contract with Midwestern utility Xcel Energy to build power storage units in Minnesota and Colorado, each with a 10-megawatt capacity. Each project can store enough electricity to power about 8,000 homes — and give Form Energy batteries a real-world workout.

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CEO

Bob Mumgaard at Commonwealth Fusion Systems in Cambridge on Sept. 17, 2021. DAVID L. RYAN/GLOBE STAFF

A Cambridge company, meanwhile, is pursuing what might be called the ultimate solar power: fusion. Scientists for decades have dreamed of [a nuclear fusion plant to produce safe, clean, and limitless energy](#). But no one has managed to commercialize the technology, which produces energy by forcing atoms together — the same process that powers the sun. But Commonwealth Fusion Systems says it expects to flip the switch on a prototype fusion plant in 2025 or 2026, a development that could revolutionize the power industry.

[Bob Mumgaard](#), Commonwealth’s CEO, describes a fusion reactor as “a star in a bottle.” But building the bottle — a magnetic field capable of containing a reaction that generates millions of degrees of heat — has been the greatest challenge. Any magnet powerful enough to do the job consumes more energy than the reactor produces.

A new ceramic material could provide the answer. Commonwealth Fusion, [backed by about \\$2 billion](#) from Bill Gates’s Breakthrough Energy Ventures, Google, and European energy companies ENI and Equinor, is assembling an array of ceramic magnets that would generate an intense magnetic field while using relatively little power — and solve the bottle problem.

‘Green Steel’

New England isn't blast furnace country. But Boston Metal, based in Woburn, is [developing a method to refine iron ore into steel without spewing greenhouse gases](#). As much as 9 percent of global carbon dioxide emissions come from steelmaking.

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Steel is made by feeding huge blast furnaces with massive amounts of a carbon-rich form of coal known as coke. The coke reacts with oxygen to extract iron from its ore, but also produces millions of tons of CO₂. Boston Metal, however, uses electricity to purify the iron without producing the carbon emissions of traditional steelmaking — a feat that was inconceivable a decade ago, says Boston Metal CEO [Tadeu Carneiro](#).



CEO Tadeu Carneiro poses for a portrait inside Boston Metal in Woburn on Aug. 18, 2022. JESSICA RINALDI/GLOBE STAFF

But with a chromium-based electrode material invented at MIT, the company is cranking out small quantities of carbon-free metal known as “green steel.”

“I am producing steel in Woburn, Mass.,” Carneiro says. “Nobody knows!”

It's not a secret anymore. Boston Metal has [caught the attention of investors](#), including Gates and steelmaking giant Arcelor Mittal. They've put about \$220 million into the company.

Boston Metal is prospecting for a site to build its first commercial-scale plant. It may not be in Massachusetts, but wherever it ends up, Carneiro plans to ramp up fast. “We will be commercial by 2026,” he says.

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