

'Power For The Planet': Company Bets Big On Fusion

by Richard Harris

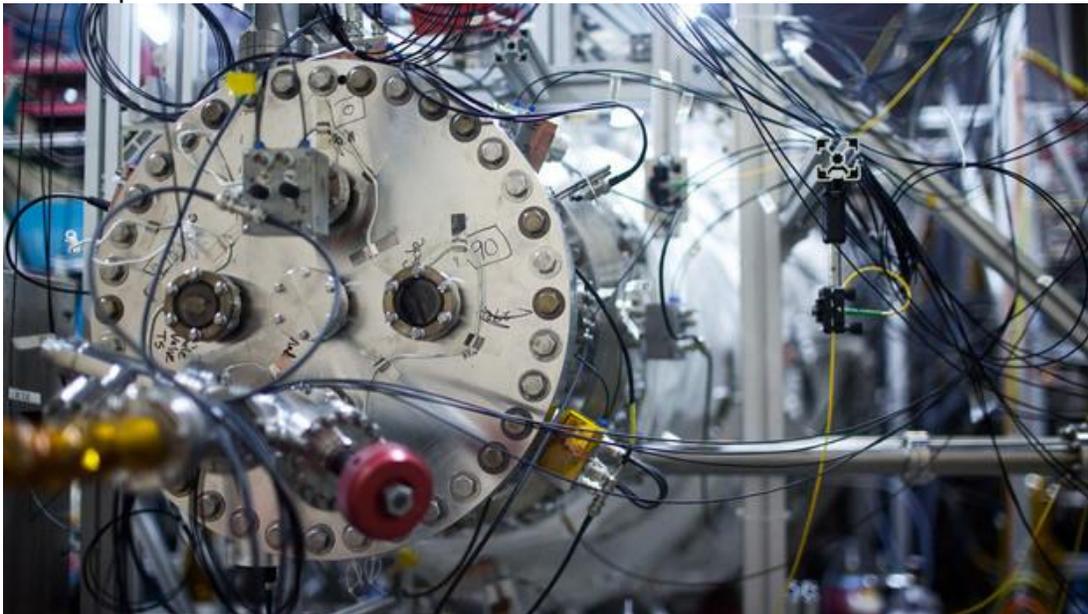
November 9, 2011

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Brett Beadle for NPR

A section of the fusion machine being tested at General Fusion's facility outside of Vancouver, British Columbia. General Fusion is hoping to implement a long-shot strategy that could produce fusion energy in the next few years.

November 9, 2011

The world would be a very different place if we could bottle up a bit of the sun here on Earth and tap that abundant and clean energy supply. Governments have spent many billions of dollars to develop that energy source, fusion energy, but it's still a distant dream. Now a few upstart companies are trying to do it on the cheap. And the ideas are credible enough to attract serious private investment.

One such company is hidden away in a small business park in the suburbs of Vancouver, British Columbia. Nothing seems unusual here — there's a food distributor, an engineering firm and small warehouses. But on one door there's a sign suggesting that all is not normal.

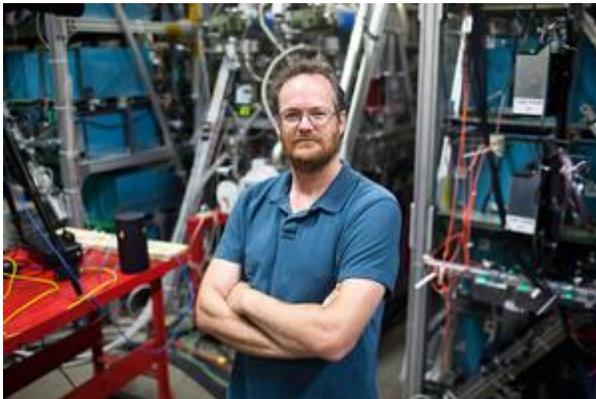
The sign says "General Fusion" and warns people with pacemakers to proceed with caution.

The reason for that caution can be found behind bulletproof walls that surround an experimental machine. This gleaming metal structure could be out of a science fiction movie set. It stands 15 feet tall, is crisscrossed with wires and is covered with aluminum foil. Two men are hunched over an instrument, troubleshooting.

The machine is flanked with banks of electrical capacitors, which hold — and release — the amount of energy you find in a stick of dynamite. A siren warns to stay clear: The system is charging up, and with all that electric charge, some piece of hardware could go flying.

This plasma ray gun is part of a bigger instrument, which is still under construction. The goal, simply put, is to create a small piece of the sun and harness that energy.

"This is an insanely ambitious project," says Michel Laberge, the brains behind the project. He's a physicist and inventor with a rusty beard and a college-casual wardrobe.



Enlarge Brett Beadle for NPR

Michel Laberge, president and chief technology officer of General Fusion, says the fusion machine he is developing "is an insanely ambitious project."

Beating The Big Guys

This story really starts a dozen years ago, when the company where he was working asked him to join in a hot technology race that had nothing to do with energy. He was asked to build a switch for fiber optics communication cables.

"So I was in competition with Nortel, Bell Lab, Lucent," Laberge says. "All those guys were putting literally billions of dollars in this project. And they gave me half a million dollars, and one guy ... said, 'Do something that will work better than the other guy.' [And I said,] 'Oh, OK!' "

As Laberge tells the story, he actually succeeded.

"For half a million dollars, we beat the billion-dollars worth of work. So that inflated my head a little bit. I said, 'Hey, look at that. You can beat the big guy if you do something different.' "

Of course I think it's going to work! Do you think I'm going to spend ten years of my life doing something I think won't work?

- Michel Laberge, president and chief technical officer, General Fusion

So, on his 40th birthday, he quit his job in what he calls a midlife crisis, took the pile of money he'd earned at his old company, and decided to try something really revolutionary. With his Ph.D. in fusion energy, he thought he'd try to beat the big boys in the fusion field.

"Reason No. 1 is to save the planet. We are in deep poo-poo," Laberge says.

Fossil fuels will run out, and in the meantime they are causing global warming. Among the allures is that fusion reactors can't melt down, and they don't produce significant nuclear waste. And Laberge says if he succeeds, he could be worth billions.

"As for glory, I word that as a negative. I don't want glory. That's just a pain. I don't want anybody to know me, really. Not interested in the glory. I'll take the money, though," he says with a hearty laugh.

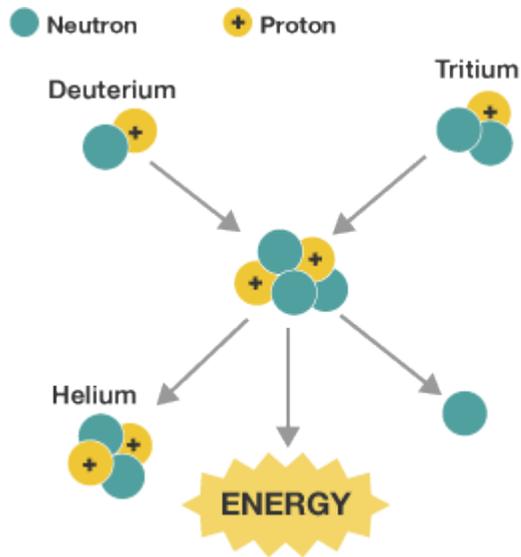
He knew he couldn't beat the existing multibillion-dollar fusion labs at their own game. So instead, he decided to combine ideas from the two current approaches to make a vastly cheaper machine.

A One-Two Punch

The general principle behind fusion is simple. If you can fuse together light atoms, you can create a heavier atom plus lots of energy. The trick is that in order to fuse atoms together, you need to provide enough energy to heat the atoms up to 150 million degrees Celsius.

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Inside General Fusion's Machine



How Fusion Works

When two atoms fuse together to form a larger, heavier atom, they release large amounts of energy. That's called a fusion reaction, and it's what powers the sun.

Canadian startup General Fusion has designed a machine to generate fusion power by smashing together two variants of hydrogen atoms: deuterium, which has one neutron and one proton, and tritium, which has two neutrons and one proton.

The result: helium gas (which will get released into the atmosphere) and vast amounts of energy, which will get captured and turned into electricity. The company is still constructing its prototype. Here's how it's supposed to work.

Credits: Andrew Prince, Stephanie d'Otreppe / NPR

"Other fusion uses a very complex way of producing energy — superconducting magnets, laser beams, all sorts of expensive and complicated and pricey stuff," he says. "It costs them billions and billions of dollars, so it's not so practical in my opinion. Here, what the energy source is, is compressed air. Compressed air is dirt cheap."

Think of his idea as a one-two punch. His big electrical gizmo starts to heat up the atoms. Those get injected into a 10-foot-wide sphere full of swirling molten lead.

"The liquid will be circulated with a pump, so it spins around and makes a vortex in the center. You know, like your toilet with a hole in the center," Laberge says.

And just as the heated atoms get into the center, Laberge fires 200 pistons, powered with compressed air, which surround the sphere. "Those are compressed air guns ... that send a big compression wave, squash the thing, and away you go!"



Enlarge Brett Beadle for NPR

Banks of capacitors are a key part of General Fusion's machine. The capacitors, which charge up and release bursts of electricity, will be used to heat gases to 1 million degrees Celsius in preparation for a fusion reaction.

If all goes as planned, squashing the mixture heats it up enough to fuse the atoms and ignite nuclear reactions.

The concept is called magnetized target fusion. Laberge didn't invent the idea, but he re-imagined it, and, more to the point, he raised \$30 million from Amazon.com founder Jeff Bezos and several venture capital firms to see if he can get it off the ground.

Ask Laberge if he thinks it will work, and you'll get an indignant reply: "Of course I think it's going to work! Do you think I'm going to spend 10 years of my life doing something I think won't work? I think it [has] a good shot of working."

He adds, "I wouldn't say I'm 100 percent sure it's going to work. That would be a lie. But I would put it at 60 percent chance that this is going to work. Now of course other people will give me a much smaller chance than that, but even at 10 percent chance of working, investors will still put money in, because this is big, man, this is making power for the whole planet. This is huge!"

Changing The Venture Capital Game

And the physics concept isn't the only big idea here: Laberge is also pioneering the idea that venture capital firms, which are used to taking big gambles but expect a quick payback, can sometimes have the patience to invest in a project they can't just flip in three years. Private funding could change the game for fusion energy.

Richard Siemon used to run the fusion program at Los Alamos National Laboratory, which is part of the multibillion-dollar federal research effort. He says radical ideas like this get dreamed up at the big labs, but they get starved for money, which flows mostly to the industrial-sized projects. Sure, he says, those big projects are exploring important physics, "but when they are working on a concept and somebody says, 'Yeah, but it's going to cost too much for the customer in the end,' that's sort of like a non-issue for a government researcher."



Enlarge Brett Beadle for NPR

General Fusion is relying heavily on funding from venture capital firms, which are generally accustomed to quick turnarounds. This project is pioneering the idea that such firms can have the patience to invest in longer-term projects.

But private investors are only interested in projects that could become commercially viable power sources. That's why Siemon is happy to see private investors taking an interest in fusion energy.

"I really think that venture capital might just come in at this point and pick the best fruits off the tree and run with them," says the retired physicist.

In fact, Laberge's company is not the only one out there using private funds to build reactors based on magnetized target fusion and other novel concepts. Siemon says he's confident someone will eventually figure this out. And that may be an economic competitor.

"Just in the last year I heard it reported from some technical meetings that China has gotten interested in magnetized target fusion," Siemon notes.

China could easily throw hundreds of millions of dollars at the idea. So venture capitalists could have some serious competition. Laberge, of course, is betting he will emerge victorious.

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Heard on All Things Considered

November 9, 2011 - GUY RAZ, host: It's ALL THINGS CONSIDERED from NPR News. I'm Guy Raz.

ROBERT SIEGEL: And I'm Robert Siegel. The world would be a very different place if we could produce clean energy the same way the sun does by harnessing the kind of nuclear reactions that make the sun shine.

While governments have spent billions of dollars to develop what's called fusion energy, it is still a distant dream. But that hasn't stopped a few upstart companies from trying to do it on the cheap and their ideas are credible enough to have attracted some serious private investment.

NPR's Richard Harris visited one of these companies in the suburbs of Vancouver, British Columbia.

RICHARD HARRIS: There's almost no hint that anything at all unusual is going on in this small business park. There's a food distributor, an engineering firm, small warehouses, usual stuff. But on one door, there's a sign suggesting that all is not normal here. The sign says, General Fusion, and a small warning: Do you have a pacemaker or aid? Speak with a General Fusion employee.

The reason for that caution can be found behind bulletproof walls that surround an experimental machine. This gleaming metal structure could be out of a science fiction movie set. It stands about 15 feet tall, it's crisscrossed with wires and it's covered with aluminum foil. Two men are hunched over an instrument, troubleshooting.

MICHEL LABERGE: That's when you fire for real, right?

UNIDENTIFIED MAN: That's when we...

LABERGE: Yeah.

UNIDENTIFIED MAN: When this charges up and...

HARRIS: The machine is flanked with banks of electrical capacitors which hold and release the amount of energy you find in a stick of dynamite.

(SOUNDBITE OF SIREN)

HARRIS: The siren warns to stay clear. The system is charging up and, with all that electric charge, some piece of hardware could go flying.

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Richard Harris, NPR News.

(SOUNDBITE OF MUSIC)

SIEGEL: You can learn more about how this fusion reactor would work and see photos of the massive machine at NPR.org/science.