MY NO.1 EARLY STAGE TECH COMPANY

BROWNSTONE RESEARCH

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By Jeff Brown, Editor, *Exponential Tech Investor*

The world is faced with a seemingly impossible task.

Mankind's voracious consumption of energy is required to advance society… but it also leaves a clearly visible imprint on our delicate planetary ecosystem. Our climate is changing. Some of the change is the natural course of evolution over hundreds of millions of years, but we also cause change through our use of carbon-based fuels.

And one profound societal challenge is the need to shift global energy production to completely clean sources of energy. The world needs clean, carbon-free energy technology to provide critical, baseload energy production 24 hours a day… under any weather condition… every single day of the year.

This technology needs to meet the ever-increasing energy requirements of the world's growing population. The current world population is about 7.9 billion people, and the United Nations forecasts it will grow to 8.6 billion by 2030. That's only a decade away.

In this special research briefing, I'm going to show you the technology that will supply the world's growing population with all the clean energy it needs – and without impeding economic growth. In fact, I expect quite the opposite will happen. An abundance of clean energy – at lower production costs than we experience today – means we will witness an *increase* in economic growth.

Growth offers opportunity. After explaining the technology, I want to show you one of my favorite early stage tech companies. This company is making remarkable progress in this area. I guarantee you won't find this insight anywhere else.

The One Technology That Can Deliver Clean Energy to the World

If you just became a subscriber of *Exponential Tech Investor*, then welcome aboard. This research service isn't your usual "tech investing newsletter." For starters, I'm not some Wall Street analyst blindly picking stocks without understanding the underlying technology. I've spent nearly 30 years working as an executive for global high-tech firms. And my undergraduate work was done in aeronautical and astronautical engineering. Every month, I share my best insights with you, the reader.

With *Exponential Tech Investor*, you'll have access to investment research that Wall Street firms would typically pay millions for. And, of course, I'll show you the technology stocks that can deliver gains as high as 1,000%.

That's why I want to show you a technology that's truly on the bleeding edge of progress: nuclear fusion.

First conceived in 1920 by British astrophysicist Arthur Eddington, nuclear fusion is the one technology that can meet the world's clean energy requirements. It has been an aspiration for nearly a century, and now we are finally within reach of nuclear fusion reactors capable of producing a "net energy production." That means nuclear fusion can produce more energy than is required to start and maintain the fusion reaction.

And unlike what the mainstream media will have us believe, we won't have to wait until 2045 for this. **In fact, my prediction is that we'll see the first net energy production from nuclear fusion technology within five years.** That's right… a reactor capable of producing more energy than required to run the reactor – basically, limitless clean energy.

But now let's address the most basic question: What, precisely, is nuclear fusion?

In the simplest terms, it is the energy that powers the Sun. And without the nuclear fusion reactions in the Sun, life on Earth simply would not exist.

More specifically, nuclear fusion is the combination, at very high temperatures, of two separate nuclei to form a new nucleus. And in that process, huge amounts of energy are released. The Sun combines atoms of hydrogen to form helium atoms, plus energy. That energy travels all the way to Earth to provide the light and heat that we need to survive.

Here's the best part about nuclear fusion. There are no carbon emissions, and it provides an endless supply of energy that can support the world's growing energy requirements. It sounds too good to be true, but I'll even show you the one company that will achieve this phenomenon.

But before we get to that, it is important for us to step back. First, let's understand the landscape of activity in the world of nuclear fusion. Building a foundation of understanding in any area of technology is what informs good investment opportunities.

In the industry today, in both the private and the public sectors, there is a great sense of urgency to meet this challenge. Many say that the current progress is not happening fast enough.

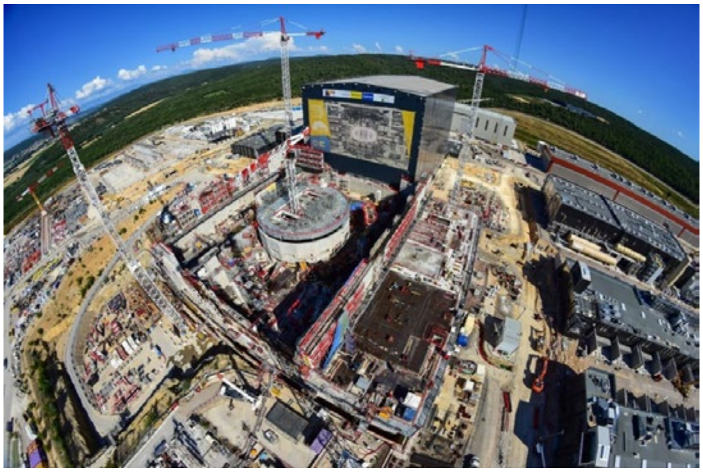
When it comes to government-backed projects around the world, I most certainly agree. These kinds of large-scale multidecade investment projects require heavy research and development. They are the perfect kinds of projects for country-level or regional-level funding.

Yet as I'll show below, these public-backed projects are the least interesting projects in nuclear fusion. Yes, they'll produce good research. But the real innovation, the actual technology that will provide the world with limitless clean energy, will come from the private sector.

The Largest Nuclear Fusion Project on the Planet

The project currently getting the most attention is being built in Provence, in southeastern France. The International Thermonuclear Experimental Reactor (ITER) is the largest nuclear fusion project on the planet.

ITER Under Construction



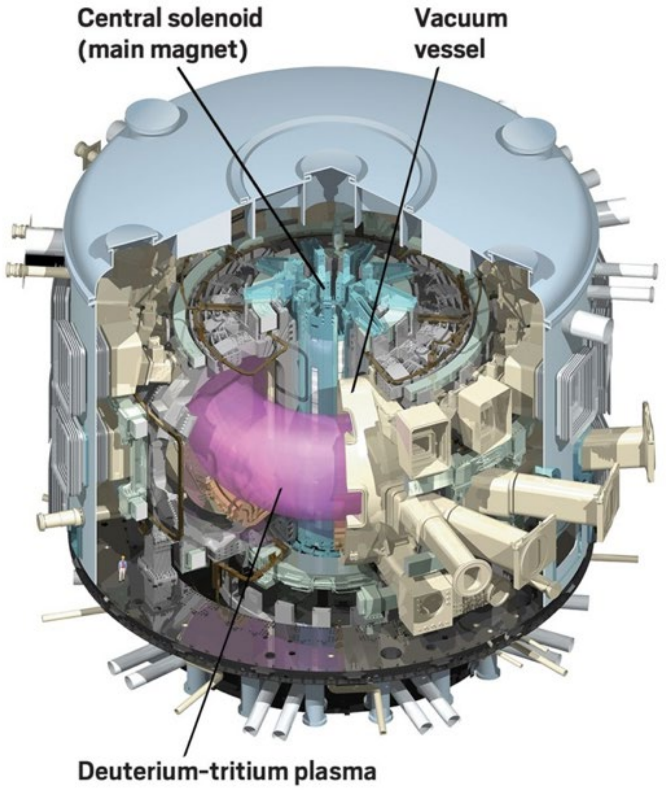
Source: ITER

Proposed in 1987, the project is funded by the European Union, India, Japan, China, Russia, South Korea, and the United States. The construction began in 2013. It should be completed by 2025.

The original cost estimate for the project was €5 billion back in 2001. This was increased to €10 billion in 2006 and then to €15 billion in 2013. The latest estimates are for the project to cost €20 billion. The actual costs will almost certainly be higher.

The ITER uses a fusion reactor design called a tokamak reactor. The reactor uses powerful magnets in the shape of a torus (think of a donut) to control the plasma generated by the fusion reactor. (Plasma is hot ionized gas with equal numbers of positive and negative electrons.)

ITER's Tokamak Fusion Reactor



Source: ITER

The reactor required to generate this reaction is immensely difficult and costly to build… but the process of producing energy from a fusion reaction is actually quite simple under the right conditions. By combining deuterium (a stable hydrogen isotope) and tritium (a radioactive hydrogen isotope) under the right conditions of heat and pressure, the reactor creates helium along with neutrons and a lot of energy.

In the case of ITER, its tokamak reactor is designed to operate in the "Goldilocks" range of 100–200 million degrees. It should produce 500 megawatts (MW) of power while using only 50 MW to run the tokamak reactor. That's 10 units of energy out for each unit of energy in.

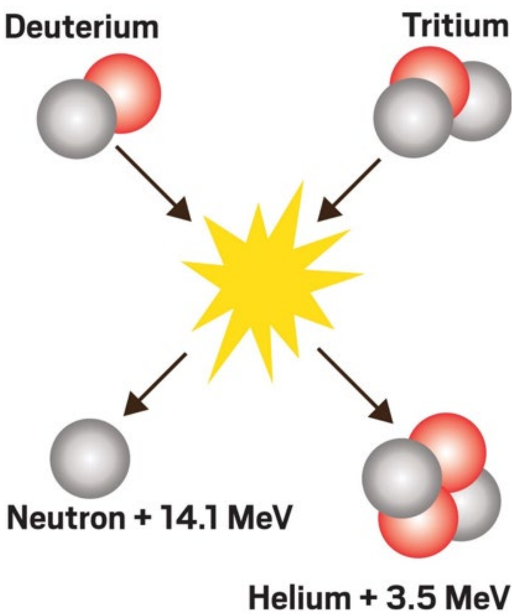
One megawatt of energy can support roughly 750 homes. Therefore, the ITER, if proven successful, will be able to power the equivalent of 375,000 homes upon completion.

This might be hard to believe, but this is exactly why nuclear fusion is such an incredible source of clean energy. One unit of energy input will produce 10 times the amount of energy output.

If nuclear fusion reactors can feed the world's baseload power requirements (the minimum level of demand on the electrical grid), energy would be available in abundance.

It would also be the cheapest energy the world has ever seen… and have zero carbon emissions.

Nuclear Fusion From Combining Deuterium and Tritium



What's important to understand is that deuterium – one of the key ingredients – occurs naturally. You can find it in a glass of water. Tritium requires a bit more work, but it can be derived from lithium. Lithium, therefore, is the most limiting resource in these reactions.

But according to the U.S. Geological Survey, there are about 30 million tons of potentially extractable lithium deposits on Earth. That is enough to sustain the world's current rate of energy consumption for the next 10,000 years.

At an individual consumer's level, a few tablespoons of water and the amount of lithium in an average smartphone contain enough deuterium and lithium to provide enough energy for 10 years. That's how powerful nuclear fusion is as an energy source.

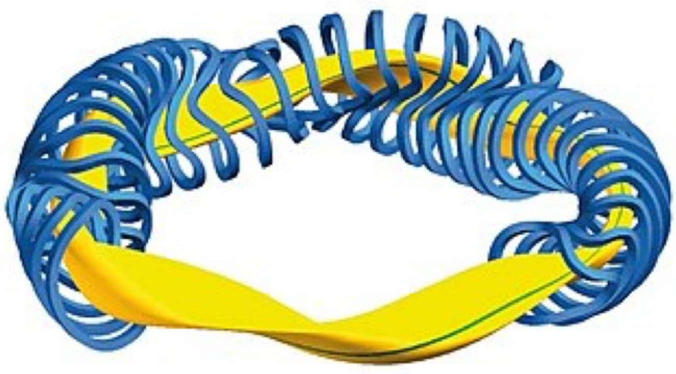
The Wendelstein 7-X

Another major public nuclear fusion project is taking place in Greifswald, Germany. The reactor is called the Wendelstein 7-X. It was completed in October 2015 by the Max Planck Institute of Plasma Physics (IPP).

This project was almost entirely funded by the IPP at a total cost of just over €1 billion. Some small contributions were made by Princeton University, Oak Ridge National Laboratory (which is sponsored by the U.S. Department of Energy), and Los Alamos National Laboratory (a part of the U.S. Department of Energy).

What's unique about the Wendelstein 7-X reactor is its stellarator design. Both the tokamak and the stellarator are toroidal ("donut-shaped") designs, yet they look very different. While a tokamak looks like a perfectly symmetrical donut, the stellarator looks like a donut that has been twisted and distorted.

Stellarator Design (Blue = Magnetic Coils, Yellow = Plasma)



Source: IPP

Stellarators have one key advantage over a traditional tokamak. They don't need a plasma current, which allows them to operate plasma in a steady state (without the instabilities seen in tokamaks). While this simplifies some aspects of the reactor, the rest becomes significantly more complex.

Due to the stellarator's complex shape, the magnetic coils are all different and very hard to manufacture with the necessary precision. It also becomes much more complex to manage the magnetic field that controls the plasma reaction in a stellarator.

The work by the IPP on the Wendelstein 7-X is important research. The IPP aims to have the stellarator operate the reactor at over 100 million degrees for a period of up to 30 minutes.

Unlike the ITER project in France, the Wendelstein 7-X is purely for research purposes. More specifically, it is designed to produce plasma and maintain a plasma reaction for an extended period of time using the stellarator design. If proven successful, it will be logical to build an energy-producing reactor for commercial power production as the next step.

Sadly, neither of these public projects provides the possibility of reaching net energy production delivered to a power grid within the next 30 years.

After all, the Wendelstein 7-X is still only a research project. The IPP has managed the project well, spending its €1 billion on very worthwhile research.

The ITER project, however, has been plagued by delays and is not expecting full-scale experiments until 2035.

Worse yet, the optimistic goal of ITER – providing industrial power production by 2050 – is likely too aggressive. The best estimates that I have seen put power generation in the 2055–2060 period.

It is always disappointing when journalists and the media only focus on the big, publicly funded projects and ignore the innovation being driven by the private sector.

After all, when we read articles about something that may or may not happen by 2055, the public doesn't get excited about that. It is just too far away and too uncertain.

But fortunately for you, you don't have to rely on the mainstream press to understand what is really happening with this revolutionary technology. I've done all the hard work for you. And like I said, net power generation from a nuclear fusion reactor will be here in less than five years.

Here's why…

Innovation in the Private Sector

I'm happy to say that compared to what is commonly believed, the reality of nuclear fusion is completely different. Night and day, in fact. We have reason to be very optimistic. As I said, I predict we will see the first net energy production from a nuclear fusion reactor within just five years. That's right – by 2025, we will witness a technology that creates abundant, limitless, clean energy.

One of the key projects I have been tracking that shows great promise is a unique public-private partnership. Commonwealth Fusion Systems (CFS) is an early stage company that was formed in 2018. CFS raised about $75 million in 2018 and was founded by a team that spun out of MIT's Plasma Science and Fusion Center (PSFC).

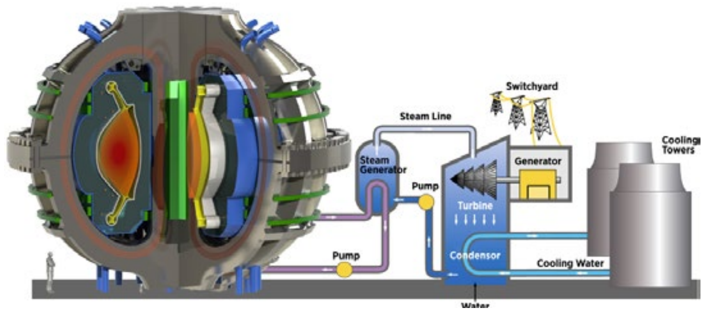
Somewhat ironically, the majority of the money that CFS raised ($50 million) came from Eni, the Italian multinational oil and gas company. The remaining amount came from two other energy-focused venture capital funds. From my perspective, it is very progressive and smart for Eni to invest in new forms of energy production… even if those forms will disrupt its core business.

What's unique about CFS is that it teamed up with MIT's PSFC to design a new form of tokamak reactor called SPARC. The reason why this partnership is so important is that MIT's PSFC is the largest and arguably most advanced university-based fusion laboratory in the world.

CFS is supporting more than $30 million of research at MIT's PSFC for what will ultimately become a commercial development. There are two things that make CFS's project interesting. The first is the design of the new tokamak reactor.

As shown in the image below, instead of taking the shape of a massive donut, the tokamak design is more like a perfectly symmetrical apple or pomegranate. That's important because the reactor is a fraction of the size of the ITER tokamak. Smaller, more compact designs are far less expensive to build. They will show far more promise to commercialize.

CFS and MIT SPARC Reactor



Source: PSFC

The second reason that CFS's project is interesting is the use of high-temperature superconductors for controlling the magnetic fields. Superconducting magnets are critical for a commercial fusion reactor. They do not have any resistance to the flow of electricity. Therefore, they do not lose any power to heat. (Resistance creates heat and negatively impacts the ability of the magnets to control the plasma.)

Here is the exciting part… This project is scheduled to produce 100 MW of heat, enough energy to power a small city. Its goal is to be operational no later than 2025.

And the output would be twice as much power as is required to start and maintain the reaction. While SPARC may not produce 10 times the power input like ITER, its ability to generate twice as much power still means net energy production. This still gets us to limitless clean energy with no carbon emissions.

And the best part is that the more compact tokamak designs are far easier and cheaper to commercialize. They are also much faster to build. After all, spending more than €20 billion and decades to build a 500 MW fusion reactor like ITER just isn't practical to do at scale around the world.

Unfortunately, the first 100 MW reactor is a proof of concept. It is not meant to produce power for the grid. CFS envisions 200 MW fusion power plants generating electricity for the grid by 2033.

That just isn't soon enough. I also believe that it just won't take us that long. We'll get to commercial power production using a fusion reactor much sooner. After all, we have the technology we need to make this happen today…

And this technology can accomplish this at scale.

This is the part you've been waiting for. I want to reveal my favorite early stage tech company that will bring nuclear fusion to the world in five years.

The Private Company That Will Make It Happen

After analyzing every major nuclear fusion project on the planet, this is the one that came out on top… **TAE Technologies**.

TAE is an entirely private venture. It has been quietly working on nuclear fusion since its founding in 1998. And its mission is simple – to develop nuclear fusion technology that can produce perpetual, 100% clean energy with no radioactive waste in a compact size that can be used around the world.

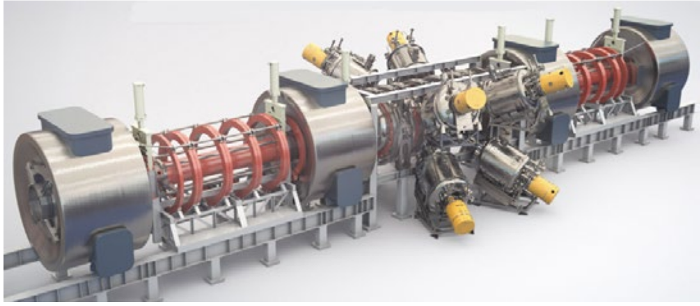
The late cofounder of Microsoft, Paul Allen, shared this vision and was the first major backer of TAE. He invested directly in TAE in 2002. Allen then continued funding the company through his venture capital firm, Vulcan Capital, for several more rounds of investment.

If it wasn't for Allen's foresight and passion for clean energy, this project might not exist today. By 2005, Venrock, the venture capital arm of the Rockefeller family, invested too. By 2007, Goldman Sachs joined the team.

And TAE has gained momentum over the past five years. During one of its venture capital rounds in 2016, which raised $375 million, Google's parent company, Alphabet, was the largest investor. I'll explain the significance of Google's investment in a minute.

The reason that TAE has been attracting attention is its compact, cylindrical fusion reactor design seen below. The whole reactor is a mere 25 meters and it uses a technique called field-reversed configurations (FRC).

TAE Technologies "Norman" Fusion Reactor



Source: TAE Technologies

Put more simply, there are plasma injectors on the left and right sides of the reactor. These injectors fire FRCs directly at each other to the middle of the reactor at one million kilometers an hour… ridiculously fast.

When they collide with each other, they form a plasma that is three meters long and half a meter wide. The yellow devices in the picture are used to fire neutral beams to keep the plasma stable and producing energy.

This design is advantageous because the external magnetic field can control more plasma than a tokamak reactor. In other words, it is far more efficient in its use of magnetic fields. This is also why TAE's reactors can be so compact.

Fueled by Two of the Most Abundant Elements in the Universe

Yet what is most radical about TAE's design is its choice of fuel. TAE's fusion reactions are fueled by hydrogen-boron (pB) fuel. These are two of the most abundant elements in the universe, and both are nonradioactive.

Better yet, unlike ITER, the output of the hydrogen-boron fusion contains zero radioactive waste. That's right – not only is the reaction carbon-free, there is no nuclear waste whatsoever.

ITER's deuterium-tritium fusion releases neutrons that make the fusion reactor radioactive. While that's nothing compared to a nuclear fission reactor, there is still some nuclear waste generated in taking that approach.

TAE's hydrogen-boron method produces no neutrons… just three helium nuclei and a whole bunch of clean energy. No waste.

This is the solution that the world needs. We can imagine what a company like this would be worth… A company with technology that can literally solve the world's clean energy needs.

Is it easy? Most certainly not.

To make TAE's reactor successful, the hydrogen-boron fusion requires the highest temperatures of all types of fusion reactors… billions of degrees. The good news is that these temperatures have already been produced in laboratories.

The complexity is in maintaining the plasma in the optimal range. TAE does this by modulating the magnetic fields with neutral beams.

And this is precisely where Google's (Alphabet's) investment in TAE Technologies comes into play. To most, this investment doesn't seem to make a lot of sense. After all, Google is a search engine and advertising company… That's where it generates its $181 billion in annual revenue (2020).

What very few know is that Google is one of the most advanced artificial intelligence (AI) companies in the world. The company has also been building one of the most advanced quantum computers in the world.

Here's why that's important…

Quantum Computing and AI Are the Answer

In September 2019, Google achieved the first demonstration of quantum supremacy. Its quantum computer solved a task that would have taken Summit (the most powerful classical supercomputer at the time) 10,000 years to complete. And its 53-qubit quantum machine did it in three minutes and 20 seconds. And the implications of this are immense. Quantum computing is going to help us solve many problems we've not yet been able to address.

Google isn't new to working with quantum computers either. Cooperating with quantum computing company D-Wave back in 2015, Google demonstrated quantum computing performance that was 100,000,000 times faster than a classical computing system. That's not a typo – 100 million times faster using D-Wave's "quantum annealing" technology.

This is why Google's investment into TAE is so critical and so strategic. TAE is the most promising company in the world working on nuclear fusion. It could take investment money from many different places. But TAE's biggest challenge is using technology to maintain that optimal plasma condition.

There are thousands of variables that need to be analyzed, optimized, and controlled in real time to make that happen. And that is exactly where AI, powered by quantum computing, comes into the picture.

Solving a complex challenge like this simply isn't possible with current computing technologies. But remember, quantum computing is a game changer. A quantum computer could analyze all the variables in real time. It could then adjust the parameters to maintain the fusion reaction and keep the plasma stable.

This is why the combination of these two technologies is the key. Together, they will make scalable clean energy capable of literally replacing carbon-based power plants all over the world.

And this is what the critics are discounting.

TAE is already on track to demonstrate net energy production with its Norman reactor by 2024... And TAE is already in the process of raising additional funds that will eventually be used to build its next-generation reactor. That one will be able to power the grid of a city with hundreds of thousands of homes… for a small fraction of the cost of building ITER. This is the future.

And with the power of quantum computing coupled with AI, we're going to see net energy production within five years. Then, we'll see a nuclear fusion reactor powering a grid within the next 10 years.

Imagine how different our world will be once we have limitless clean energy. Consumers will pay the lowest energy prices the world has ever seen. Every human on Earth will have access to cheap energy.

Today, almost all electric vehicles (EV) are powered with electricity that comes from carbon-based power plants. That's right – consumers who drive EVs are not producing fewer carbon-based emissions… They are simply displacing where the emissions take place. Instead of emissions coming from the car, more carbon-based emissions happen at the power plants. And on average in the U.S., 5% of all energy is lost over electrical transmission lines.

Nuclear fusion will actually fuel our EVs and power our homes while creating zero emissions… from the power plant all the way to consumption.

Once employed, pollution from energy production and consumption will literally cease to exist. Smog-ridden places like Guangdong province, Shanghai, and Los Angeles will be a thing of the past.

And large-scale processes that require massive energy inputs, like the desalinization of water, will be commonplace. This will be vital to parts of the world that are starved of clean water for drinking and agriculture.

I believe that once TAE has demonstrated net energy production, it will try to raise $1 billion or more in capital to begin the process of commercialization. Investors can look for a potential initial public offering as an opportunity to invest in TAE Technologies.

A company that can solve the world's clean energy needs will be worth tens of billions, if not hundreds. I will be on the lookout for any opportunity for investors to invest in TAE Technologies, either directly or indirectly. And as a reader of *Exponential Tech Investor*, I promise you that you'll be the first to hear when the time is right to invest in TAE.

TAE is a moonshot investment opportunity solving one of the world's most critical problems. It's the type of company that could turn a small investment into a fortune. And I, for one, want the team at TAE to succeed as soon as possible.

Regards,
Jeff Brown
Editor, *Exponential Tech Investor*