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Star energy

The biggest moonshot of my career: how the secret to infinite energy could send this tiny stock storming higher

Eoin Treacy, Investment Director

Shelter and energy.

If we stick to first principles those are the only two things humans need to survive and thrive.

It doesn't matter who or where you are, everyone needs somewhere to lay their head at night. Little wonder then that homeownership is such a national and global obsession.

Just about everything else in life is about how much cheap energy we can easily access.

If we can solve the energy problem – if we can find a way of supplying virtually infinite energy – then we are truly close to ensuring constant improvements in the standard of living for *everyone* on Earth. All 7, and soon to be 9, billion of us.

they may lead. I am talking about a utopian outcome to the human condition.

Sounds too good to be true?

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I'm literally talking about the lifestyle of people in *Star Trek* where food, transportation and basic resources are of no concern to anyone. We could live only to further our creative interests in whichever productive avenue

Well suspend scepticism for a moment and let me explain.

Infinite energy might now be possible

The reason I bring this up this

month is that events have occurred which makes this an urgent bulletin. There is a theme I have been pursuing for a decade which has never been investible before, so there was no point talking about it.

I can't tell you how frustrating it is to have an idea gestate for years and not have a way to make money from it. That's what's it been like with this theme.

It has the potential to be the greatest game-changer in human history.

And now we can invest in it.

This is about a moonshot that is bigger than any one person or country. If this works, then we are talking about changing the way we live our lives forever. This story represents a paradigm shift like nothing humanity has ever seen, and I believe I have found the first – and perhaps only – way to invest in it.

We all want to get in on the ground floor of major new themes. Well this is about as ground floor as it gets, and the potential for growth is in the order of 166,000,000%.

We'll come back to that figure in a second. But first, it's worth considering just how world changing virtually infinite energy would be

Unlimited energy – a secret to world peace?

Do you wish for world peace? Do you begrudge people in the emerging markets the standard of living we enjoy? Do you want your life standard of living to improve too?

I don't know anyone who would answer in the negative to these questions.

The history of humanity is characterised by war and competition. Carl Von Clausewitz's idiom that war is the "continuation of **politics by other means**" is as true today as it was 200 years ago.

But ask yourself: why do we go to war? Resource competition is a major reason. Competition over scare energy resources even more so (think oil).

If we could solve the energy problem and break our reliance on scarce energy sources then there is the very real possibility that we could dramatically reduce outbreaks of war. Considering the escalating geopolitical tension we now see all over the world, that is an urgent ambition.

A point I've made previously, but is something I think about all the time, is the simple fact that the UK is now an energy importer. If we are ever to have a hope for returning to an equal trade footing with the rest of the world, let alone hoping for a surplus, we need to solve the energy problem. Not just over the short term, but forever.

That is the only way that the true ingenuity and creativity of our great nation can reach its potential. Sending tens of billions overseas every year in our thirst for oil, natural gas and coal is a drain on national resources that cannot continue to be justified. Quite frankly it is unsustainable.

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The bounty of energy exports has allowed rogue regimes all over the world to survive well beyond their shelf lives. In normal circumstances they would have expired long ago, but the excess capital they derive by selling us oil and gas means they get to persist longer than anyone might have imagined possible. That is bad news for the hundreds of millions of people living in places like Venezuela, Russia, the Middle East or Africa, but it is also bad news for us because of their mischief-making and desire for geopolitical glory.

If we can solve the energy problem, and I don't mean for now, but for the total of our possible energy demands for centuries into the future, regardless of what our dreams of development might be, we can put all this behind us.

That is only going to be close to possible if we can put resource

competition behind us. The answer to the world's energy needs, desires and plans for the future cannot rely on geological fortitude, proximity to the equator or to a wind tunnel. **We have to be able to produce energy wherever and whenever we want and we are going to need lots of it.**

In the entire span of human history, energy has been divisive. It has split us apart, it has separated the world into the haves and the have nots. The future is about bringing us together, taking two apparently separate world views and combining them to create a unified whole that benefits everyone. That is the essence of what I want to talk to you about this month.

Fusion energy could be a reality at last

This is a story that has been building for a century and it is no exaggeration to state that it is something physicists have been dreaming of but it has always been tantalisingly out of reach.

In fact, this is the way stars generate power. Lots of it. Constantly. Fuse hydrogen atoms together to form helium and BANG! You have a lot of energy. And you're not likely to run out any time soon – hydrogen is the most abundant element in the universe.

For proof of just how important fusion is, let's give the stage to the late, great Stephen Hawking. In 2016 Hawking was asked to give the opening lecture at Cambridge University's Big Data Institute. His brief was to showcase the one idea he felt would change the world more than any other.

What did he choose?

You guessed it. Fusion.

Hawking had long been a supporter of the idea, having stated previously: "I would like nuclear fusion to become a practical power source. **It would provide an inexhaustible supply of energy, without pollution or global warming.**"

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Fusion energy – if we can make it work – means energy scarcity is a thing of the past. Fusion is essentially the opposite of nuclear fission. Rather than splitting atoms, we merge them – releasing enormous amounts of energy.

I could go on in listing the number of highly respected people who believe fusion is the future. But I won't. You get the picture. And I think it fitting that we give Hawking the final word on just how important the technology could be.

But there's been a problem. We've never been able to make fusion work properly.

For the longest time the running joke in scientific circles has been that fusion energy is always 30 years away. But that started to change a few years ago. The estimates for when fusion would be working, and on the market, started to shrink.

First, I heard 25 years, then 20 and now it's 10 years. In fact, the ignition for proof of concept is scheduled for 2025, so that is 7 years from now. There is one good reason for that contraction in the estimates. It all comes down to one particular breakthrough – and we're going to invest directly in it today.

But recently this story caught fire. On 9 March MIT scientists announced that they'd made a breakthrough in the pursuit of fusion. The secret? A new type of superconducting material that allows high powered magnets to hold the superheated plasma at the heart of a fusion reaction.

These new superconductors hold the key to fusion. They've enabled MIT tests to generate "positive" fusion – a reaction that gives off more energy than it requires to get started. Scientists believe soon these reactions will give off enough energy to power a small city – in one ten-second pulse.

As I said, it's advances in superconductors and the corresponding increase in magnet strength that's the real breakthrough here. From a Guardian report on the

announcement, with added emphasis from me:

> ***The team intend to use a new class of high-temperature superconductors they predict will allow them to create the world's first fusion reactor that produces more energy than needs to be put in to get the fusion reaction going.***
>
> *Prof Howard Wilson, a plasma physicist at York University who works on different fusion projects, said:* ***"The exciting part of this is the high-field magnets."***
>
> *A newly available superconducting material –* ***a steel tape coated with a compound called yttrium-barium-copper oxide, or YBCO – has allowed scientists to produce smaller, more powerful magnets.*** *And this potentially reduces the amount of energy that needs to be put in to get the fusion reaction off the ground.*
>
> *Prof Maria Zuber, MIT's vice-president for research, said that the development could represent a major advance in tackling climate change. "At the heart of today's news is a big idea - a credible, viable plan to achieve net positive energy for fusion," she said.*
>
> ***"If we succeed, the world's energy systems will be transformed. We're extremely excited about this."***

In short: superconductors are the key to this. Remember that. Burn it into your memory: **superconductors are the secret to fusion creating infinite energy.** I'll come back to this in a second – because this month's recommendation sits at the heart of the superconductor/fusion story.

The team involved here are making bold claims that it will take five years to perfect the design and another five years to build it and more importantly it is going to be small. It is seeking $300 million in funding for a working prototype to be up and running within a decade. It's going to cost $300 million and it's going to be small.

I am reminded of the Human Genome Project. It was this enormously expensive international cooperative effort that was characterised by massive costs and was a bureaucratic nightmare. Craig Venter came along, cut the Gordian knot, and sequenced the first human genome in a fraction of the time.

Just recently SpaceX, Virgin Galactic and Blue Origin have left NASA and Russia in the dust by pioneering reusable rockets and cutting launch costs to previously unimaginably low levels. Again, this is an example of just what private capital can do when unleashed against a previously intractable problem.

ITER – not finished, already obsolete

Right now, in Provence in the south of France, the ITER project is underway. It is designed to make fusion a reality. It hasn't exactly been a success.

It is a cooperative effort by the EU, US, Russia, China, India, Japan and South Korea. Every piece of information has to be shared with everyone else and in every language, there are parallel manufacturing operations in a handful of countries so no one nation dominates production. Each of those components then has to be shipped from every corner of the global to France and the site for the reactor is not on the coast.

The project is due to cost $25 billion and is already way over budget. How could it be otherwise when it has been a field day for the bureaucrats that will spend a career collecting pay cheques and making sure everything goes as slow as possible?

More important than that is that the ITER project is being built along the same lines of the magnetic confinement projects that were conceived in the early 1990s. It's just bigger. A lot bigger. They are overcoming the limitations of the original technology by going for scale because they did not have powerful enough magnets to build it on a smaller scale. The ITER project is due to fire up in 2025 but by that time it will already be obsolete by decades.

That was what really piqued my interest about the MIT team's announcement last month. It is proposing a reactor that can be built on campus in Boston. That'll will give you an idea of how small we are talking about. And it is only

possible because of "commercially available" superconductors that boost the magnetic field to such an extent that the diameter of the containment field can be shrunk down. Miniaturisation in scale means miniaturisation in cost. With lower costs, comes scaling.

MIT is not the only team that has reached this conclusion. That is why it is now in such a rush to get back into this market. It's as if suddenly the whole world has realised that fusion is within our grasp at last.

Here's a rundown of the major projects – though there are more than we can realistically cover in our humble newsletter.

An energy arms race – and the ultimate prize

Tri Alpha Energy, which is backed by Microsoft's Paul Allen, has already raised $500 million for its prototype and has teamed up with Google's artificial intelligence arm to run iterations on the best way to contain the plasma. That is taking the time to run the calculations for experiments from a month to a few hours.

Jeff Bezos is backing General Fusion based in Canada, which is iterating on an old US army design that aims to compress liquid metal so that a vortex forms within which the plasma can be confined.

The UK's Tokamak Energy has built a spherical tokamak reactor which hit temperatures of 15 million degrees last year and aims to hit the key fusion target of 100 million degrees this year. Pay particular attention to this time-lapse video of the construction of the reactor. It took less than 100 days. That's an incredible feat. It really highlights what British will and engineering can achieve when we set our minds to it. It also proves that the UK is in the race to be the first country in the world where fusion is a commercial reality.

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Peter Thiel, one of PayPal's founders, has invested in Helion Energy which claims to have a design that produces 8 times as much energy as what's put in, and at a 50-megawatt scale can power 40,000 homes for less than $0.04/kWh.

Superconductors are the key

Today the field of superconductors has progressed so much that the magnetic fields scientists are capable of achieving are multiples as powerful as what was conceived 25 years ago.

Why is that? Well, one of the chief arguments that fusion would ever be economic was the cost of keeping liquid helium at the optimum temperature for the superconductors to create the magnetic fields. However, advances in the superconductor sector remove the need for liquid helium and the newest versions can achieve the desired magnetic field with liquid nitrogen, which is a lot warmer.

The rare-earth barium copper oxide (REBCO) superconductors that MIT has been experimenting with function at temperatures of around 90-100 kelvin. That's versus 4 kelvin for the magnets inside the ITER project, which was conceived before the REBCO superconductors were invented.

With much stronger magnetic fields, you can have small devices. Smaller devices are cheaper to build. Since they are cheaper to build you have less to lose when something goes wrong. While building fusion reactors is not yet an off-the-shelf routine, the reality is today that we are in a position where the cost is not so high that failure means the endeavour has to be abandoned. That is why there are so many fusion startups.

The vast majority of the potential solutions being explored are relying on these REBCO superconductors so I set off to find the company that owns the patent and I'm glad to say I found it.

Patent 9,564,258

Superconductor Technologies is the closest investment there is to a pureplay on fusion energy.

It is a tiny company. It's a moonshot. Its market cap is just over $12 million and it has $400,000 in revenue in 2017, primarily from the US Department of Energy's project and that will remain a source of income for the next two years.

Keep in mind: fusion is not yet commercially available. But it is also the single most exciting technology sector there is, because the power capacity it represents dwarves anything else we know of.

I have no doubt we'll crack it. That may happen sooner than people realise. But it's still in the future. It may take another decade.

But by then the sector will already be worth hundreds of billions.

If we want to invest in the frontier of breakthrough technology, we need to be prepared to move early. We need to move now, while there's a race to get in on the ground floor. Superconductor Technologies is therefore going to be the riskiest bet in the moonshot category of the portfolio. It could eventually go bust and if it does you could lose all of your investment. However, it could also be taken over for multiples of what the price is today or it could survive and become a large company offering unique products to the global energy and health equipment sectors as fusion comes to dominate the global energy sector over the next 50 years.

It's that simple: breakthrough... or bust. The risks aren't small. But neither are the potential rewards.

Infinite energy is the prize here. Let's keep that in sight.

And Superconductor Technologies has some valuable intellectual property that gives it a great market position. U.S. Patent No. 9,564,258 entitled "Coated Conductor High Temperature Superconductor Carrying High Critical Current Under Magnetic Field By Intrinsic Pinning Centers, And Methods Of Manufacture Of Same" was awarded to Superconductor Technologies Inc on 2 February 2017. That is just one of more than 100 patents the company holds in the field of superconductor manufacturing.

The primary source of revenue for the company right now is a project it is working on for the US Department of Energy in conjunction with MIT, TECO-Westinghouse Motor Company and the University of North Texas. The aim of the project is to perfect the manufacture of "superconductive wires manufacturing process at high enough temperatures where nitrogen can be used as the cryogenic fluid to improve performance and yield while reducing cost."

In short, this business has a patent on *the* vital part of the fusion puzzle.

At the time of writing the share is trading at $1, which is a fraction of the $178,000 it traded at in February 2000. So, what happened?

Well the company made a big mistake by biting off more than it could chew.

It had hoped that its superconductors would end up in mobile phone towers and would help to drive the evolution of 4G. That was a highly competitive market and the company did not succeed in having its technology adopted so the share collapsed. More recently it bet on being able to supply the electricity transmission sector with fault limiters but that did not pan out either so the share took another leg down.

But fusion could be the technology needed to turn things around for Superconductor Technologies.

In response to my question at the company's recent conference call on 22 March, the CEO confirmed that Superconductor Technologies is supplying MIT with the superconducting wire it is using for its fusion projects. As I said, Superconductor Technologies is at the *very heart* of the most exciting fusion project we've seen for decades.

> While $1.2 million is a pittance in the pharmaceutical sector, it marked an important juncture for the company.

Energy generation is one strand of the business revenue stream. It's the technology that got me excited in the first place. But there's more going on here than just energy. Superconductors can be used for all kinds of technology. The three primary sectors are healthcare, power generation and electric machines. They estimate the total market for superconductors will be upwards of $40 billion by 2030. The market is worth around $1 billion today.

The CEO was also quite blunt that it will be a year before the company gets revenue from its investment in manufacturing capacity. Where he highlighted the most optimism was that it had six potential clients in the pipeline which have all agreed to accept a common standard for the wire they are willing to buy. Previously they all wanted different standards and meeting competing needs was not within Superconductor Technologies' ability to fulfil.

Next generation electric machines (NGEMs) are the focus on the Department of Energy's research. For example, next generation MRI machines, which rely on powerful magnets, will be possible with these kinds of next generation superconductors. Next generation motors could also be installed to help with moderating the flow of energy at renewable energy plants.

Superconductor Technologies is one the cusp of revenues growing with demand for its superconductor wire predicted to be 2,508 kilometres in 2018, 3,886 kilometres in 2019 and 9,280 kilometres in 2020. The magnet, science and fusion segment of its business is comparatively small right now but by 2020 is anticipated to be its second largest. It has facilities in place to scale production by five times and has a modular production process so that can be achieved in a piecemeal manner as demand increases.

The important point right now is that the company's market cap is $11.9 million but it cost $200+ million of investment to develop these superconductors and $37 million alone for the Conductos branded wire the company is now selling. The company has no debt.

Because the company has such large sunk costs and high manufacturing efficiencies that are not easily repeated, it raised the price it charged from $35 per metre in 2015 to $60 in 2017 per metre. If it can achieve sales of 2,508 kilometres by the end of 2018 or even the beginning of 2019, that is revenue of $150,480,000 in addition to what it is receiving from the Department of Energy. **That would be 12.6 times its current market cap in sales.** Even if it can sell a 10th of its manufacturing capability the company earn back its market cap.

So why is the share still trading at $1?

The simple matter of fact is that superconductors have been a technology that have been gestating for a long time and have been waiting for a killer utility to ignite interest.

There is a very real chance that fusion reactors are the use case that begins to drive interest in the superconductor sector in additional to growing needs in the renewable energy and medical imaging sectors.

The primary risks to a company like Superconductor Technologies are from competition. It is not the only company pursuing research in this area and Japan in particular, as a country with no energy assets of its own, is its biggest competitor. It has a moat of over 100 patents to protect its intellectual property, but this is a rapidly advancing sector and there is plenty of evidence of competitive forces from the company's history.

It is my fervent belief that with the private sector now in a position to pioneer fusion technology, advances are going to come thick and fast. That is why it is imperative we have an investment in the sector now because it is only by getting in on the ground floor of life-changing

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technology that we are to have a hope of making literally life-changing profits.

My 12-month target is $3, my three-year target is $10 and my five-year target is $30.

So, what is fusion?

It's the first thing we see in the morning. Fusion is the process that powers the sun and the stars. It has the potential to give us abundant, clean, limitless energy forever, with little to no proliferation threat and it would represent the biggest technological innovation in human history. Believe me I don't say that lightly.

Fusion happens when two hydrogen atoms are combined to form a single atom of helium. You might remember from GCSE science that the first two atoms on the periodic table are hydrogen and helium. To make it a little easier, the fuel they use is deuterium, which is essentially heavy hydrogen and tritium, which is heavy, heavy hydrogen. Deuterium is plentiful in sea water and tritium is manufactured from lithium but could eventually be manufactured using the reactor itself.

The two hydrogen atoms each have one electron and the resulting helium atom holds on to those, but the two nuclei fuse into one helium nucleus and the leftover energy is released. It is this released energy that forms the basis for the heat that creates a self-sustaining fusion reactor.

It all sounds so simple but there is a good reason why we don't have fusion energy already. It's really, really hard. First off, the two hydrogen atoms have the same charge and as anyone who has ever tried to hold two north-oriented magnets together will find, they don't like each other. The only way to get them close enough to even begin to think about fusing is to super-heat them so they become ionised. Basically, that means they have to be turned into a plasma by raising the temperature to 100 million degrees so that the electrons are stripped away from the nuclei. The plasma has to then be sustained for long enough so that fusion can occur.

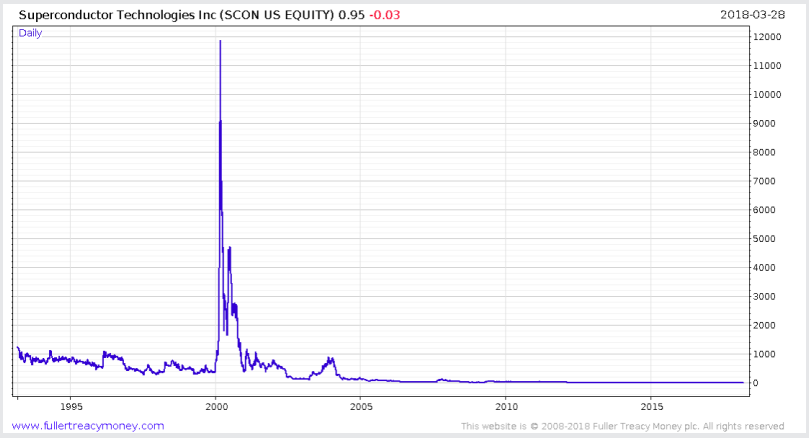
100 million degrees is ten times hotter than the centre of the sun. The sun can get fusion going because gravity is so much more powerful on such a massive body but we need to compensate by heating up the plasma to extraordinary temperatures. At 100 million degrees, if the plasma touches anything it would immediately vaporise so it has to be isolated inside an extremely strong magnetic field. With nuclear fusion there is one specific part of its process which has seen most of the innovation: creating stronger magnetic fields. The other big field of study is to fully understand the unique characteristics of plasma in a magnetic field and how to maximise efficiency.

It is innovation in the creation of massively powerful magnetic fields that has led me to suggest our first investment in fusion energy.

Action to take:	**buy Superconductor Technologies Inc**
Ticker:	**SCON US (Nasdaq)**
Price as of 28.03.2018:	**0.95 USD**
Buy up to:	**2 USD**
52-week high/low:	**2.47/0.88 USD**
Market cap:	**$11.34 million**

Figures accurate as of last market close: 28.03.2018

Past performance:



Please note that as this is a small company the price may rise significantly after this recommendation. If that occurs just wait for the price to subside and then proceed.

Data as of 28/03/2018

Energy

Company	Ticker	Rec Date	Price Then	Price Now	Gain/ loss %
Orocobre Ltd	ORE. AX	07/04/16	A$ 2.92	A$ 5.36	83.56
Ormat Technologies	ORA on NYSE	06/06/17	$58.79	$56.07	-3.96
Smart Meter-ing Systems	SMS LN	03/10/17	735.5p	734p	0.03
Sherritt Inter-national Corp	S CN	06/02/18	C$1.18	C$1.10	-6.78

Technology

Company	Ticker	Rec Date	Price Then	Price Now	Gain/ loss %
Cyberdyne	7779	30/05/16	JPY 2,353	JPY 1,518	-35.49
IBM	IBM LN	07/06/16	$153.33	$150	4.53
SAIC	SAIC US	05/07/16	$58.20	$80.10	41.36
Garmin	GRMN US	02/08/16	$55.75	58.06	10.55
2U INC	TWOU: US	06/02/17	$33.25	$83.78	151.97
Cisco Systems Inc.	CSCO: US	03/04/17	$33.80	$41.01	24.76
Advanced Micro Devices	AMD US	26/07/17	$14.76	$9.53	-35.43
Microsoft	MSFT	31/07/17	$73.04	$88.52	22.88
Northrup Grumman	NOC US	06/07/17	$301.66	$345.52	15.16

Medical

Company	Ticker	Rec Date	Price Then	Price Now	Gain/ loss %
Autodesk	ADSK	19/07/17	$108.83	$122.75	12.79
Abcam	ABC	07/03/17	907.5p	1239p	38.03
Illumina	ILMN	04/09/17	$207.15	$229.93	10.96
PureTech Health	PRTC-L	09/01/18	155.75p	152.00p	-2.41
Agios	AGIO	06/03/18	$84.23	$73.63	-11.34

Moonshot

Company	Ticker	Rec Date	Price Then	Price Now	Gain/ loss %
SolarWindow	WNDW	07/04/16	$3.96	$5.05	27.53
Alkane Resources Ltd	ALK: AU	05/09/16	AU$ 0.31	AU$ 0.30	-3.28
Editas	EDIT: US	07/03/17	$21.02	$31.77	49.30
Haydale Graphene Industries	HAYD	02/5/17	178.5p	93.00p	-47.90
Superconduc-tor Tech Inc	SCON	28/03/17	$0.95	$0.95	0

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