



HALLGARTEN & COMPANY

Coverage Initiation

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Bloom Energy

(NASDAQ: BE)

Strategy: Neutral/Long

Price (USD)		\$11.78			
12-Month Target Price (USD)		\$13.00			
Upside to Target		10%			
High-low (12 mth)		\$2.44 - \$16.63			
Market Cap (USD mn)		1,389.9			
Shares O/S (millions)					
	Class A	75.6			
	Class B	42.4			
		2018	2019e	2020e	2021e
Consensus EPS			(\$0.31)	(\$0.24)	n/a
Hallgarten EPS			(\$1.83)	(\$0.38)	\$0.40
Actual EPS		(\$2.21)			
P/E		(5.3)	n/a	n/a	\$ 29.53

Bloom Energy

Scandium's Biggest Consumer

- + The company's Bloom Box is hitherto the gold standard in the Solid Oxide Fuel Cell (SOFC) space
- + Rising uptake of the product for server farms and by Big Tech companies, particularly in Silicon Valley
- + A Bloom Box converts fuel into electricity through an electrochemical process without combustion, underpinning it as a "green" technology, though not without carbon emissions
- + The company is the largest consumer of Scandium, consuming between 25% to 35% (or more) of a rather nebulous global production number
- + Bloom closed 2019 with a backlog of 1,983 systems (up 43% YoY). Backlog value includes \$1.1 billion for product and installation revenue and \$1.1 billion for service revenue
- + Ended FY19 with a consolidated cash balance of \$377.4mn (up \$19mn from 3Q19)
- + The company has seen off aggressive Short-seller raids in the second half of 2019
- ✗ Soaring sales mean the company is using an ever-higher percentage of the total global production of Scandium
- ✗ The company is vulnerable to a Scandium supply shock from China
- ✗ It is almost inevitable that the Chinese will move into the SOFC niche at some time in the near future
- ✗ Losses have been on-going, and sizeable with a sizeable debt pile

The Secret Sauce at Bloom

The words "secret" and "secretly" oft appear in conjunction with mentions of Bloom Energy and its evolution. For the company it is the technology and its end users that are the clandestine elements. For us though the company's dependence upon Scandium as its "secret sauce" is the most interesting aspect. This is well known to the Scandium cognoscenti (all of whom would fit in a phone booth) but not well-known outside and is seemingly something that Bloom would prefer us not to know.

In this review we shall look at Bloom's progress since listing and what it means, or does not, for the Scandium space.

Background

Bloom Energy was founded in 2001 under the name Ion America before being renamed Bloom Energy in 2006. The company's origins lie in work performed by K.R. Sridhar in connection with creating a technology to convert Martian atmospheric gases to oxygen for propulsion and life support. Sridhar and his team built an electrochemical cell for NASA capable of producing air and fuel from electricity

generated by a solar panel.

The company worked in secret for eight years before coming out of stealth mode in 2010. According to the San Francisco Chronicle, that year Bloom had "a coming-out party packed with politicians and Silicon Valley elite." The company was featured on 60 Minutes and supported by political figures. At that time, Bloom had raised \$400 million in funding (valuing the entity at \$2.9bn) and had 300 employees and was producing around one fuel cell appliance per day, before opening a factory in Newark, Delaware in April 2012.

In 2011, Bloom started selling the electricity produced by its units, rather than the units themselves, fronting the costs of manufacturing the fuel cells. The Federal Investment Tax Credit (ITC) for fuel cells expired in 2016 and the California Self-Generation Incentive Program was discontinued the following year as the state focused its subsidies on batteries.

By 2013, it raised \$1.1 billion in funding, which was followed by additional funding rounds in 2014 and 2015. Federal subsidies were re-instated in 2018. Later that year, Bloom moved its headquarters to San Jose in 2018. In a major step-up in profile the company appointed, late last year, the former CEO of GE, Jeff Immelt to its board.

The IPO

The IPO of Bloom Energy Corp. was priced at \$15 a share, at the high end of its \$13 to \$15 price range. The company sold 18 million shares to raise \$270 million. Underwriters, including J.P. Morgan, Morgan Stanley and Credit Suisse, had access to an additional 2.7 million shares in case of overallocments.

Products

Bloom Energy produces solid oxide fuel cell power generators called Bloom Energy Servers (more catchily called Bloom Boxes). The servers are based on a proprietary solid oxide fuel cell technology, which converts fuel into electricity through an electrochemical process without combustion. The primary input to the system is standard low-pressure natural gas or biogas from local gas lines. The electrical output of the Energy Server is connected to the customer's main electrical feed, which avoids the transmission and distribution losses associated with the centralized grid system.

The fuel cells use wafers/ceramic disks made from sand that are stained with proprietary green and black "inks". The disks are separated by cheap metal alloy plates. Methane (or other hydrocarbons) passes over the wafers, mixes with oxygen thus creating a chemical reaction that produces electricity. The chemical reaction takes place at about 1,500 degrees Fahrenheit. The company estimates that a box filled with 64 ceramic disks can produce enough energy to power a Starbucks branch.

The fuel cells are housed in metal cabinets as shown in the photo on the following page. Each one produces about 200 to 300 kilowatts of electricity.



Each Bloom Energy Server is modular and composed of independent 50 kilowatt power modules. A typical configuration includes multiple power modules in a single Energy Server, which produces 250 kilowatts of power in a footprint roughly equivalent to that of half a standard 30 foot shipping container. The company claims to be approximately 125 times more space-efficient than solar power generation. These Energy Server systems can be clustered together in various configurations to form solutions from hundreds of kilowatts to many tens of megawatts.

The Economics of SOFC

Solid Oxide Fuel Cells are not new, but they have, until recent years been too expensive to be viable. Despite gaining efficiencies of scale, and greater uptake, a Bloom Box is still somewhat of a luxury item with a price tag of around \$700,000 to \$800,000 per unit.

Some popular media have referred to the Bloom Box as “a little power plant-in-a-box.” The generators are normally used for large buildings, manufacturing facilities, or data centers to produce power on-site. Major companies like eBay, Google, Staples, and FedEx are believed to be users. eBay reputedly saved around \$100,000 in electricity costs in the first nine-months after the installation of five boxes at one of its facilities. eBay even claimed that the boxes generated more power than the 3,000 solar panels at its headquarters.

In an interesting recent announcement that steps outside the “tech space”, the supermarket chain, Stop & Shop, announced that it would power 40 of its stores in Massachusetts and New York with Bloom Energy Servers to power each store in the event of a grid power outage. This move is expected to reduce

Stop & Shop's carbon emissions by over 15,000 metric tons per year (claimed to be the equivalent of removing about 3,200 cars from the road). However Stop & Shop are not neophytes with Bloom Boxes as they already power a Mt. Vernon, NY, store and have helped keep it open during several severe storms since 2014. The technology is also deployed at a Stop & Shop store in Peekskill, NY.

In 2019, Samsung Heavy Industries, a part of Samsung Group, signed a deal with Bloom to design and develop ships powered by fuel cells running on natural gas. Each new ship requires 19 MW to 100 MW of power. With 2,000 to 2,500 new ships annually entering the global fleet over the next five years, Bloom claims its servers could provide the power to operate these ships, which could materially reduce their carbon footprint by up to 45%.

The Carbon Footprint

Data from the State of Delaware found that Bloom's fuel cells produce about 823 pounds of carbon dioxide per megawatt hour. This is less than the ~1,000 pounds produced when power is taken from the electrical grid. However one should note that a Bloom Box may suffer declining efficiency of the appliances with age. In some studies SOFCs have been found to have a power efficiency of about 65-70%, depending on design and waste heat recovery values. A combined cycle natural gas turbine (peaking unit) is similar, but probably a little bit less efficient.

The SOFC is distributed power, not dependent on an electrical distribution system, so much less vulnerable to interruption. SOFC's are inherently producers of DC power, not AC, so both good and bad. It is good for lots of computer devices and systems that actually run internal DC. Converting back and forth creates a 6-10% energy loss each time. Of course solar energy is DC too. DC sources, in the right place, enjoy a significant conversion advantage, such as in data centers for example, which are big power hogs.

The carbon footprint for SOFC vs highest efficiency gas turbine is probably similar. Solar and nuclear is zero, wind is zero, coal is massive, while petrol cars and planes are major contributors to emissions. Therefore, natural gas is the very best of the fossil fuel options, and arguably SOFC's are the most efficient user of that energy source.

Bloom still has to prove that its box can produce energy at a cheaper rate than other power sources. The box also produces carbon dioxide as a byproduct – a potential downside depending on how much it generates.

MSAs

Bloom's customers use Managed Service Agreements (MSAs) to finance their acquisition of Bloom Energy Servers. The Managed Services program is one of several financing vehicles that Bloom uses to sell its Energy Servers. Under this program, Bloom sells its equipment to a bank financing party, which pays Bloom for the Energy Server and takes title to the Energy Server. Bloom then enters into a service contract with an end-customer, which pays the bank a fixed, regular fee for its use of the Energy Server

and pays Bloom for its maintenance and operation of the Energy Server.

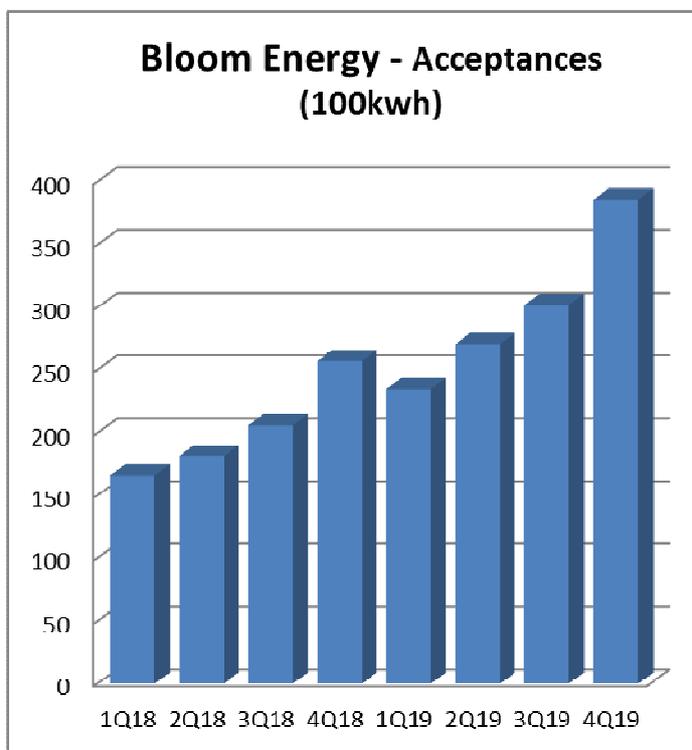
Sales & Uptake

As of 2018, Bloom had installed about 300 Megawatts of units. This has escalated rapidly since. While there are different sizes of Bloom Boxes, the company reports its sales in 100kwh units called Acceptances.

The chart at the right shows the steady rise in the number of Acceptances. In full year 2017 they were 622 while in 2018 they were 810.

The company recently announced its metrics for 4Q19 with a record number of Q4'19 and FY'19 acceptances of 386 and 1,194, respectively.

Looking forward the company closed 2019 with a record backlog of 1,983 systems, an increase of over 43% year-over-year.



Going Retail?

The founder of Bloom Energy, K.R. Sridhar, has estimated that a Bloom Box for the residential market could be out in five to ten years for under \$3,000. This is a quantum leap from the current price. What voltage it would be is still not clear. This could be an attractive option in areas where natgas is relatively cheap. The issue of solar panels only being good for daylight hours mean that a niche remains for night-time electricity generation. However that is an issue only as long as mass storage devices (VRBs or Powerwalls, for example) are still sub-optimal or overly expensive.

One should also not discount that in the coming years, big name competitors (ahem, the Chinese) will come out with cost-efficient boxes of their own. Will the Bloom Box and fuel cell devices like it eventually replace the power grid? Probably not, but they hold out the possibility that, one day, a mix of SOFCs, solar panels, wind turbines, and other alternative energy sources could at least partially free homeowners from the grid.

Bloom's Role in the Scandium Market

Scandium appears to be the "secret sauce" in the SOFCs produced by Bloom. The publication *Wired* reported that the secret ingredient may be yttria-stabilized zirconia (based upon a US patent that was

granted to Bloom in 2009). This material is also one of the most common electrolyte materials in the field. The US patent application 20080261099, assigned to Bloom Energy, says that the "electrolyte includes yttria-stabilized zirconia and a scandia-stabilized zirconia, such as a scandia ceria stabilized zirconia". ScSZ has a higher conductivity than YSZ at lower temperatures, which provides greater efficiency and higher reliability when used as an electrolyte. Scandia is scandium oxide (Sc_2O_3) which is classified as a transition metal oxide.

It is worth mentioning that 1 ppm of Sc metal equals 1.5338 ppm scandium oxide (Sc_2O_3).

Estimates of the size of the global consumption of Scandium range from 10-25 tpa. This is quite a wide range and an indication of the opacity of that market. According to the USGS, due to its low concentration, scandium is produced exclusively as a byproduct during processing of various ores or recovered from previously processed tailings or residues. In recent years, scandium was produced as byproduct material in China (iron ore, rare earths, titanium, and zirconium), Kazakhstan (uranium), Russia (apatite and uranium), and Ukraine (uranium). Red mud (a waste product from alumina processing) is known to be a source of Scandium as well.

With the market being so small and the non-Bloom consumers being atomized amongst very niche players (the halogen lighting usages etc), Bloom is the 800lb (or maybe 80lb) gorilla in this story.

The Curious Omission

When Bloom Energy was in the throes of its IPO back in July 2018, we decided to do a little exercise. We had few doubts that the investment bank doing the deal even knew what Scandium was and that the investing public knew nothing either and as for the SEC....

So we decided to search the (appropriately named) Red Herring available on EDGAR for the word Scandium. Surely the fact that Bloom was the largest global Scandium user, and thus uniquely vulnerable to Scandium supply shocks would be mentioned in the investment risks. Well, no. Not only was it not mentioned in the risks, but the word Scandium was not mentioned at all in the whole document (despite being cited in the company's patents).

For those who did not know the omission was understandable if they were not told about its criticality to Bloom's business model. However for management to dissemble by not flagging it to the bankers and regulators was unconscionable in our book. "Don't ask, don't tell" does not operate in the context of prospectus writing.

But Then Again...

Despite the lack of mention of Scandium in Bloom's Red Herring the company is, according to the scuttlebutt in the trade, much more involved in the Sc supply-chain than outward appearances would indicate. It is said that the output of Scandium recovery circuits at a couple of Titanium Dioxide processing plants in China are siphoned off to a Bloom-managed upgrading plant in the Philippines.

Bloom-spec Scandium oxide is then directed to Denki Kagaku Kogyo (DKK) in Japan, where the material is manufactured into Sc-infused tape, a unique component in the Bloom Box made in facilities in the US.

What is the size of this business? Initially, it was believed that each Bloom Box consumed around 20kgs per unit, but now is said to be around 10kgs. If one posits that Bloom is producing and selling over 1,000 Bloom Boxes (our estimate for FY19) and each one is using an average of 15kgs per box then the company is consuming as much as 16 tpa in a total market, according to the USGS, of 10-15 tpa in global production. Clearly this is an underestimation by the USGS of the global oxide market, because Bloom's consumption escapes the statistics capture. Informed sources indicate that the global Scandium trade could be more like 20-30 tpa, based on available supply, rather than reading the runes of import/export statistics.

Some parties feel that current Chinese Sc-producing capacity may be around 30 tpa of scandium oxide, but that is a guesstimate at best. Russian sources are adding to available supply, but are variable and even more difficult to quantify.

Scandium Pricing

To say the market in Scandium is opaque is an understatement. It is more like a witch's brew composed of *eye of newt and toe of frog* to quote the three crones in Macbeth. The recently released USGS estimate speaks of 99.99% oxide trading at US\$3,900/kg. However our sources indicate that, today, the price is definitely under US\$2,000/kg in China for this grade. The issue however is how to get usable stocks of metals at this guide price.

The USGS estimate on (Aluminium) Master alloy at 2% is US\$300/kg, (for quantities in tonnes). That would equate to almost a US\$20/kg premium to a US\$5/kg aluminum alloy, for a Scandium 0.1% load. At these prices, Scandium will only have uptake from the most high-value added users (i.e. Bloom and lighting manufacturers). The chimaera of usage in the aeronautical industry (on which most mine projects are posited) will have to wait a steep lowering in the price (which then becomes a chicken-and-egg issue). Which comes first, the mass-market application or the mine?

What is clear is that Bloom is competing everyone else out of the market for this scarce metal.

Sourcing Future Supply

For Bloom (at least for now) the bitty nature of Scandium supply is barely tolerable as long as other new applications do not appear to compete for the metal. What would happen to supplies out of China if the Chinese decided to make their own version of the Bloom Box? Exports would be choked off and Bloom would have to scramble. What would happen if China aluminum producers (~56% of world aluminum supply) decided to incorporate an AlSc alloy in their global alloy offerings? Obviously, another specialty metal-enabled alloy product would be immediately dominated by China, and potentially only be available in upgraded manufactured product form from China. This scenario should sound very familiar to the Tungsten industry.

The USGS provides what is probably the most reliable (though not flawless) assessment of what is happening in the supply space. In the absence of primary mines, the plants going up are all small tonnage. In India, a project to construct a 2.4 tpa Scandium oxide plant awaited environmental approval. In the Philippines, a plant to recover 7.5 tpa of Scandium oxide equivalent was being commissioned by Sumitomo Metal Mining at its Taganito HPAL (high-pressure acid-leach) nickel-cobalt operation. Production of an intermediate concentrate was expected to increase in 2019. Suggestions exist that Bloom would want to increase its sourcing from this source, at the expense of Chinese exports, to insulate itself from China becoming a hostile force in the SOFC industry and repeating what it did to the Rare Earth magnet makers.

In Russia, an aluminum producer was commercializing a hybrid technology for producing scandium-aluminum master alloy and developing new aluminum alloy formulations for additive manufacturing. Feasibility studies for making scandium oxide as a byproduct of alumina refining in the Ural Mountains were ongoing. The pilot plant was reported to have produced scandium oxide with purity greater than 99%. Based on pilot test results, plans were in place for a 3 tpa Scandium oxide plant. In Dalur, Kurgan region, development of scandium recovery as a byproduct of uranium production continued, and a 1.5 tpa plant produced finished Scandium oxide in 2018.

The mining players in the Scandium space are concentrated in Australian properties, with two claimants that we know of, presenting properties in North America. The six are:

- Clean TeQ (the Syerston project in NSW)
- Scandium International (the Nyngan project in NSW)
- Imperial Mining (the Crater Lake project in Quebec)
- Platina Resources (the Owendale project in NSW)
- AusMin (Flemington project in NSW)
- Niocorp (the Elk Creek project in Nebraska, USA)

The players are summarised in this table:

	Ticker	Location	Project	Mineralisation	Capex	Sc Grade ppm	Sc Contained Tonnes
Australian Mines	AUZ.ax	Australia	Flemington	Co/Sc/Ni		404	1,091
CleanTeq	CLQ.ax	Australia	Syerston	Ni/Co/Sc	US\$1.33bn	421	19,240
Imperial Mining	IPG.v	Canada	Crater Lake	Sc/Ti/Zr			
Niocorp	NB.to	USA	Elk Creek	Nb/REE/Sc	US\$879mn	72	2,266
Platina Resources	PGM.ax	Australia	Owendale	PGMs/Sc	AU\$68mn	395	14,418
Scandium Intl	SCY.to	Australia	Nyngan	Sc	US\$87.1mn	235	3,976

Firstly, we should remove the US player from contention. **Niocorp** is a Niobium project with Scandium credits. Niobium is essentially a monopoly with the Brazilian miner CBMM, controlling over 80% of the market and tolerating Niobec (the producer in Quebec that has an 8-10% market share) so that it does not run into anti-trust problems. CBMM can happily tolerate other miners with tiny Niobium credits

being added to the global mix because it can then moderate its own production to maintain price discipline. What it will not tolerate is a new primary Niobium mine of size. This kills dead any prospect of a Scandium by-product flow.

Next we might look at Clean TeQ, the stock with the highest “chatter” rating (and part of the Friedland stable). It is the owner of the Sunrise (formerly Syerston) project, with its much diminished \$190mn market cap (80% off its highs). In reality this is a laterite nickel project with a significant Cobalt kicker. Sunrise has, like many other projects, a “Scandium halo”.

The company published its long awaited DFS in June 2018 with a projected 20-year LoM. The study posited around 20,000 tpa of Nickel and 3,200 to 4,600 tpa of Cobalt with the higher Cobalt production skewed towards the early years.

The average scandium oxide production capacity would be around 80 tpa, which Clean TeQ claims can readily be expanded to 160 tonnes per year, with the DFS conservatively capping sales at 10 tpa for the life of mine. A dedicated scandium refinery with 80 tpa high-purity scandium oxide refining capacity is included in the DFS capital cost estimate.

The pre-production capital cost estimate is US\$1.33bn, which excludes a US\$165mn estimated contingency. The project however is predicated upon Nickel and moreover Cobalt. Cobalt tanked after its 2017 surge and the project went into a holding pattern. Now the task is how to raise the funding. Certainly the steep retreat in the market cap makes that less easy than it might previously have been even with the heft of the Friedland presence on board.

Scandium International, which we have covered on several previous occasions in standalone research notes, is the owner of the Nyngan primary Scandium deposit in New South Wales. The revised NI 43-101 Measured and Indicated Scandium resource now totals 16.9 million tonnes at an average grade of 235ppm scandium and Nyngan is the only primary Scandium deposit on offer at the moment. The Definitive Feasibility Study on the project estimates CapEx at a low US\$87mn and projects NPV (at 10%) of US\$177 million and IRR is 33.1%, (NPV at 8% is US\$225 million). Cash costs were estimated at US\$557 per kg of Scandium Oxide, with DFS utilizing US\$2,000 per kg pricing.

Imperial Mining, is the holder of the Crater Lake deposit in far-northern Quebec. The deposit is “what it says on the box” a crater with a lake within it and the mineralisation in a halo around the edge of the lake. In 2014, an exploration program intersected a 225m long Scandium- and REE-bearing zone within a thick ferro-syenite layer. Review of the drilling data also returned a 19m long interval grading 0.506% Sc along the western side of the Crater Lake intrusion. A parallel Niobium target showing grab assay results of between 0.20% and 1.42% Nb₂O₅ sits 250 m west of the Scandium target. Clearly more work to be done here, but this is the only North American Scandium play that seems like to get traction.

Australian Mines is essentially piggybacking on Sunrise and claiming “closeology” as its main merit. It is claiming to be the “other half” of the Sunrise deposit, which must be mighty annoying to Robert

Friedland. In light of the sexiness of Cobalt in 2017-18, it was primarily touting this as a Cobalt deposit despite the grade being only 0.11%. The project has both a Co/Sc zone and a Sc zone. The latter though has infinitesimal Cobalt grades (0.01%) so a Scandium-only mine would have a grade of 433ppm but only yield 788 tonnes making it only a fraction of the next smallest player. How that would be viable as either a Cobalt, or a Scandium, mine is beyond our imagination at this point.

Platina used to be a PGM explorer. However in recent years it morphed into a quasi-Scandium stock which has a now much-diminished AUD\$7.5mn market cap. The company came out with a DFS in December 2018 into the jaws of a disinterested market so it has now shifted focus to a base metals project in California. Still it is one to watch.

There are clearly people with good intentions out there (SCY and Platina), some with serious backers (Clean TeQ), some with the smoke-and-mirrors heavily in evidence (Australian Mines) and some with projects that need an alignment of planets that is scarcely imaginable (Niocorp). If we had to rank these in terms of likelihood to production we would say Clean TeQ first (which would require a hefty Cobalt rebound), followed by Scandium International and then Platina.

The Tax Benefit

Before looking at recent earnings we would note that the aforementioned Federal Investment Tax Credit (ITC) was reinstated on February 9, 2018. ITC was not available to the fuel cell industry in 2017. Bloom's revenue in 2018 includes the benefit of the reinstatement. The total revenue for 2018 included \$171.1mn of benefit from ITC, whereas the total revenue for 2017 included \$9.6mn of benefit, thus an increase in benefit to revenue from ITC of \$161.5 million compared to the same period in 2017. The \$171.1mn benefit of ITC in 2018 included \$45.5mn benefit of the retroactive ITC for 2017 acceptances (ergo, a one-time "catch-up").

Acceptances

The company uses the term "acceptances" as a key operating metric to measure the volume of operational activity from period to period. It typically defines an acceptance as when an Energy Server is installed and running at full power as provided in the customer contract or the financing agreements.

The last full FY for which we have numbers was the year ended December 31, 2018. The portion of acceptances attributable to each purchase option was:

- Direct purchase (including Third Party PPAs) 88%,
- Traditional Lease 12%
- Managed Services 0%
- Bloom Electrons 0%

The portion of acceptances in the year ended December 31, 2018 attributable to each payment option was as follows: direct purchase (including Third Party PPAs and the Republic of Korea orders) 68%, Traditional Lease 16%, Managed Services 4% and Bloom Electrons 12% .

And oops....

In mid-February, the company advised the SEC and the markets that it had a problem with the accounting for its aforementioned Managed Services Agreements (MSAs). The majority of these Impacted MSAs were originally recorded as sales, subject to an operating lease, in which revenues and associated costs were recognized at the time of installation and acceptance of the Bloom Energy Server at the customer site. It has now been determined that the MSAs should have been accounted for as financing transactions, in which revenue is recognized over the life of the impacted MSAs.

This change will require restating the prior period Financial Statements, ergo the FS we use below are going to end up being restated, but to what extent and for what period remains unspecified. The revised accounting treatment does not impact cash, cash equivalents or service contracts, nor does it impact the economic terms or substance of Bloom's transactions with the bank financing party or the end-customer.

The primary effects are estimated to be:

- ✘ Product and installation revenue will change from upfront recognition to recognition over the term of the Impacted MSAs
- ✘ Bloom expects to report a decrease in net revenue in its consolidated statements of operations for the Restated Prior Period Financial Statements in a range of \$165 million to \$180 million and will now recognize this revenue over the remaining term of the Impacted MSAs
- ✘ Bloom expects to report an increase in operating loss in a range of \$20 million to \$35 million for the Restated Prior Period Financial Statements
- ✘ Bloom expects to report an increase in net loss in a range of \$55 million to \$75 million for the Restated Prior Period Financial Statements

This, by implication, must mean a reduction in shareholder's funds as the losses have been understated until now.

Earnings Outlook

From its founding in 2001, Bloom's revenues grew rapidly but it was unprofitable, in some years losing more than \$200 million. Recent years have seen very high losses of over \$262mn in FY17, over \$240mn in 2018 and still likely to be over \$200mn in FY19. This is before the aforementioned restatements. We do however see light at the end of the tunnel as the company achieves critical mass and economies of scale.

As mentioned earlier Bloom closed 2019 with a backlog of 1,983 systems (up 43% YoY). This backlog value includes \$1.1 billion for product and installation revenue. It also includes \$1.1 billion for service revenue, assuming that all service agreements for these systems renew over their full contract terms. It's worth noting that the backlog does not include \$2.1 billion of service revenue to be recognized for systems already in the installed base.

In 3Q19, the company achieved a record 302 acceptances, an increase of 46.6% YoY and 11.4% higher than 2Q19.

At the time of announcing its 3Q19 results the company gave guidance for 4Q19 highlighting:

- Acceptances (100 kW): 355 to 385
- Average Sales Price (dollars-per-kilowatt): \$5,920 to \$6,220
- Total installed system cost (dollars-per-kilowatt): \$4,250 to \$4,550

In 3Q19 the company reported \$233.5mn of revenue, a GAAP gross margin of 22.9% and a net loss of \$34.9mn. Excluding stock-based compensation, Bloom reported non-GAAP gross margin of 25.8% and \$40.8 million of adjusted EBITDA.

The issues of tight Scandium supply markets imply that the cost of the metal in each Bloom Box is likely to go higher before it goes lower. Bloom can take control of its destiny by helping one of the mining projects towards production but that type of Chinese/Korean/Japanese thinking is not in any Harvard Business School Case Study. Thus Bloom is likely to remain a victim of a market of its own making.

Bloom could be producing 1,300 Boxes (of a standardised 100MW) in FY20 and over 1,500 in FY21. In the first instance, at current prices, presuming 13kgs per 100MW Box and using the USGS price, the Scandium purchase price would be over \$65mn, and that is before its upgrading into tape by DKK and whatever margin they might charge. As the market gets tighter and Bloom's usage grows one could see it spending over \$100mn per annum on Scandium oxide.

The Bloom model contains various unknowns. While we can guesstimate the Scandium input the cost of the ceramic disks and the mystery inks must remain beyond our ken. The maintenance contracts must not be set in stone as some early adopters (and Big Name users) probably cut advantageous deals. We must also wonder how long the subsidy will last as the company moves into profit.

Our earnings model is shown on the following page. We forecast a massive reduction in losses in FY20 as economies of scale are reached and thus a loss per share of around 38 cts. In FY21, the bottom line should swing to the positive with EPS of 40cts.

Bloom Energy

USD (mns)

	FY21e	FY20e	FY19e	3Q19	2Q19	1Q19	FY18	4Q18	3Q18	FY17
Total Revenue	1755.00	1350.00	909.96	233.47	233.78	200.71	742.04	213.61	190.19	376.00
Cost of Revenue, Total	1263.60	1012.50	740.07	180.01	192.11	184.95	624.97	196.36	166.81	394.04
Gross Profit	491.40	337.50	169.89	53.46	41.67	15.76	117.07	17.25	23.39	-18.04
General/Admin. Expenses	169.00	154.00	156.64	36.60	43.66	39.07	118.82	47.48	41.00	55.67
Selling	90.00	80.00	75.45	18.13	18.36	20.46	62.97	24.98	21.48	32.42
Research	112.00	110.00	106.02	23.39	29.77	28.86	89.14	32.98	27.02	51.15
Interest Expense(Income)	54.00	60.00	63.30	15.67	16.63	15.70	81.49	13.49	17.35	107.87
Other Expense (Income)	1.00	1.00	-0.32	-0.53	0.22	-0.27	1.00	1.69	0.71	0.49
Change in Assets							21.59	0.01	-1.66	15.00
Total Operating Expense	1689.60	1417.50	1141.16	273.27	300.76	288.79	999.97	316.99	272.70	656.63
Operating Income	65.40	-67.50	-231.20	-39.80	-66.98	-88.08	-257.93	-103.38	-82.51	-280.63
Tax	-7.50	5.50	0.88	0.14	0.26	0.21	1.54	1.08	0.00	0.64
Income Before Tax	57.90	-62.00	-230.31	-39.93	-67.23	-88.28	-259.47	-104.46	-82.51	-281.26
Minorities	7.24	-16.30	-18.67	-5.03	-5.02	-3.83	-17.74	-4.66	-3.93	-18.67
Net Income	50.66	-45.70	-211.64	-34.90	-62.22	-84.45	-241.73	-99.80	-78.58	-262.60
Basic Weighted Average Shares	127.00	120.00	115.45	116.33	113.62	111.84	109.42	109.42	81.32	10.25
Basic EPS	0.40	-0.38	-1.83	-0.30	-0.55	-0.76	-2.21	-0.91	-0.97	-25.62

Debt Profile

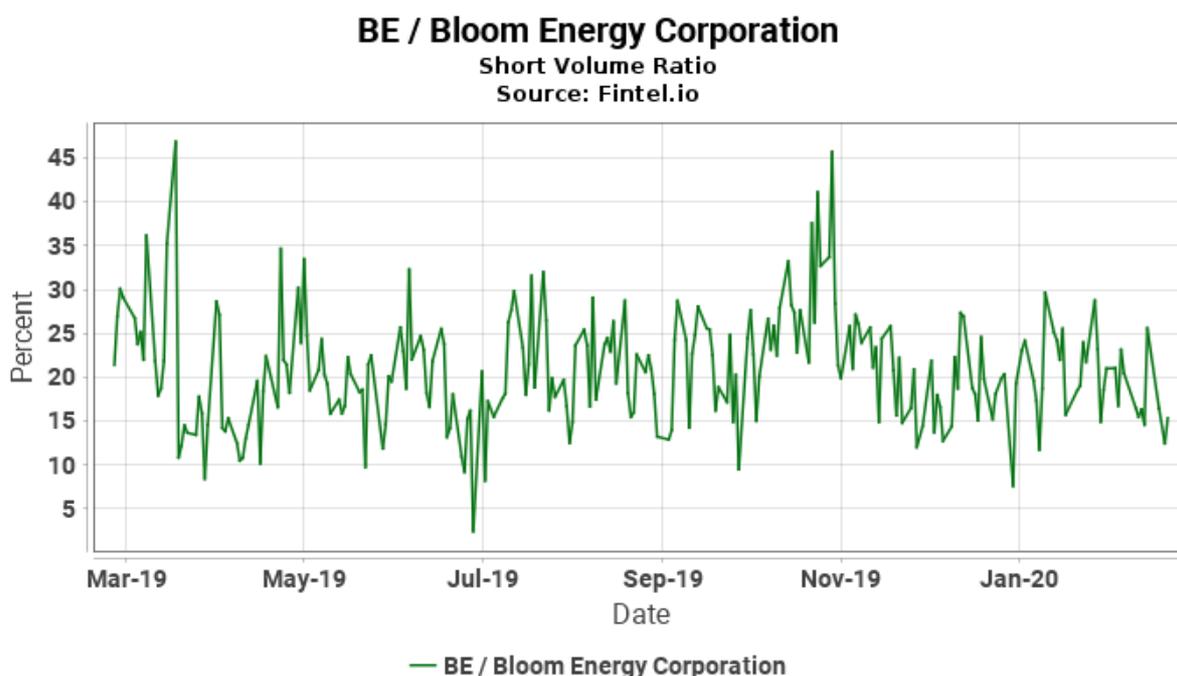
Total debt stood at \$1.81bn as at the end of September 2019. Bloom has retained the investment bank Jefferies to run the process to refinance its December 2020 debt maturities with a goal of resolving these maturities by the first-half of the 2020 calendar year.

Legal Matters

Since its IPO the company has been the target of numerous class action suits seeking to exploit the share price weakness in the wake of the listing.

Short Interest

The latest reading of Bloom's outstanding Short interest dates from 14th of February and shows a Short volume of 1,158,275 shares on a market volume of 4,525,700 shares giving a Short Volume Ratio of 26%. The Short position halved since that time. The stock has been a favorite of Shorters in the last 18 months, being sometimes as high as 45%.



In recent weeks, the Shorters have suffered a severe reverse with the stock heading sharply higher triggering strong buying by Shorters racing to cover. On one day alone the stock price rose 20%.

Risks

It is important to highlight some of the risks for Bloom Energy investors and one should consider:

- ✘ Scandium price fluctuations in what is an opaque market
- ✘ Lack of financing for Scandium mining projects means supply will remain constrained
- ✘ Lead time on new mines means price can soar and production will not rise to match the higher price, except in the medium term
- ✘ The Chinese could move into the SOFC space, finessing the technology (to put it tactfully) and then restricting Scandium exports to retain material for their own purposes
- ✘ Excessive number of competing mining projects crowd the scene and dilute capital for getting a couple of projects moving
- ✘ Soaring production at Bloom means it is taking an ever larger share of global supplies of the metal. If production doubles again, the company will be consuming something like 100% of current (estimated) global production, which will ramp prices
- ✘ Higher Sc prices will have to be built into the price of a Bloom Box

Scandium prices might be flatteringly described as “by appointment” though could also be described as “nod, nod, wink, wink”. This opacity does not help future mine builders fund their projects nor does it help with projections, either externally or internally, of what Bloom’s input costs might be in the near- and mid-term.

In looking at the potential mining projects we might note the advantage that Clean TeQ and Scandium International have in minimizing these risks is that they are so far advanced compared to other potential players, while in the case of Scandium International its bite-sized capex makes it eminently more buildable than some of the other contenders. Clean TeQ still needs Coabl to come to the party before its economics stack up. No matter what happens with the Scandium price or demand, the *Brobdignagian* project of Niocorp will not be realized.

The risk of China elbowing its way into SOFCs is real and present. This would bring the corollary of choking off Chinese exports to the likes of Bloom as the product would be needed for internal consumption.

Bloom risks becoming a victim of its own success if its voracious consumption of scant global Scandium supplies ends up pushing prices higher and limited supplies become a roadblock in the way of annual production beyond 2,000 of its standard units.

Conclusion

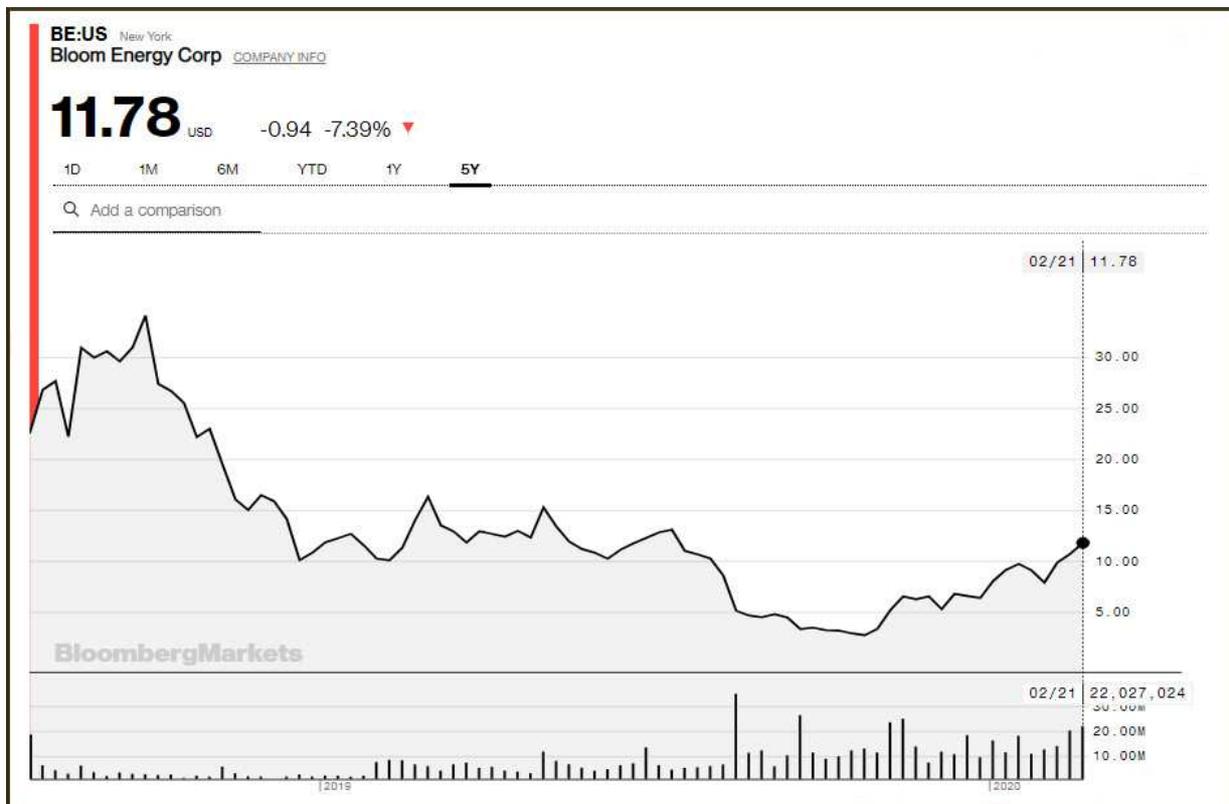
Despite Bloom Energy’s best efforts to not let on that its “secret” sauce is actually made with more than a tincture of Scandium, we and other observers are not so easily fooled. Bloom Energy and the Scandium market are joined at the hip, with the company comprising a goodly portion of the global Scandium market no matter which total number for the combined Scandium production one might use. Currently though the supply is there for Bloom’s needs but it would not be there in a circumstance where Bloom’s demand from customers expanded substantially via greater adoption, or another novel application started competing for Scandium supplies (e.g. 5G switches) or, worse of all, the Chinese decided to get into the SOFC sphere and stop exports of Scandium oxide and concentrated on using their own Scandium for their own value chain in SOFCs.

Bloom appears to be acting to insulate itself from this with greater sourcing from the Philippines but it is hard to reassure the market that one is not dependent, when one doesn't admit any usage in the first instance.

With sales of Bloom Boxes rising exponentially the company faces the real danger that further quantum growth will have it running into a brick wall of lack of supply of Scandium, AT ANY PRICE, from the current or prospective producers of the metal. At the current time, we estimate that Bloom could double its consumption but this would involve crowding out all other users of the metal (which would inevitably involve pricing other players out by pushing up the price of Scandium oxide.

In a perverse evolution (and ever was it thus) Bloom Energy now has a market capitalization greater than all the primary Scandium (or major Sc by-product) plays out in the market, and that is including the benighted Niocorp. And yet without some production of size appearing in the near future, Bloom will find itself running into a brick wall as it nears consuming ALL of current global production in the next two or three years.

Putting a price target on a stock that is oscillating by between 5-20% per day is somewhat like sticking a tail on the donkey. However we shall apportion Bloom a **Neutral/Long** rating at this time with a 12-month target price of \$13.



Source: Bloomberg

Important disclosures

I, Christopher Ecclestone, hereby certify that the views expressed in this research report accurately reflect my personal views about the subject securities and issuers. I also certify that no part of my compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

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