

# Trickle Research

Every raging river, every great lake, every  
deep blue sea starts ... with a trickle



## Initiating Research Coverage



**Cavitation Technologies, Inc.**

(OTC: CVAT)

([www.ctinanotech.com](http://www.ctinanotech.com))

**Report Date: 08/22/19**

**12- 24 month Price Target: \$.10**

**Allocation: 4**

**Closing Stock Price at Initiation (Closing Px: 08/21/19): \$.0325**

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**Disclosure:** Portions of this report are excerpted from Cavitation Technology Inc.'s filings, website(s), presentations or other public collateral. We have attempted to identify those excerpts by *italicizing* them in the text. **This version of this report includes a revision from the original publication.**

## Company Overview

*Cavitation Technologies, Inc. (“CTI” or “CTi”) is a Nevada corporation originally incorporated under the name Bio Energy, Inc. We are a process and product development firm that has developed, patented, and commercialized environmentally friendly technology-based systems that are designed to serve large, growing, global markets such as vegetable oil refining, renewable fuels, water treatment, wines and spirits enhancement, algae oil extraction, water-oil emulsions and crude oil yield improvement. Our innovative flow-through devices and systems are designed to process industrial liquids at a reduced processing time, lower operating cost, improved yield while operating in environmentally friendly manner. We have developed, patented, and commercialized our proprietary technology that can be used in multiple liquid processing applications. Our patented Nano Reactor® is the critical component of our CTi Nano Neutralization® System which has been shown to reduce operating costs and increase yields in refining vegetable oils.*

CTi is defined as *“the process of formation of the vapor phase of a liquid when it is subjected to reduced pressures at constant ambient temperature. Thus, it is the process of boiling in a liquid as a result of pressure reduction rather than heat addition”*. (<http://web.mit.edu/hml/ncfmf/16CAV.pdf>). We will attempt to edify that further in the Product/Technology Overview of this report, but needless to say, it is not a concept most of us are familiar with or frankly (at least in our case) even capable of fully grasping. That notion may underscore the Company’s opportunities in terms of their ability to understand and apply the phenomenon to industries where it may represent an elegant solution.

The Company launched its first pilot test of their CTi NANO Neutralization System in 2010 at Carolina Soya, a 200-metric ton/day crude soy oil refining plant in Estill, South Carolina. Their second system, which was a 450 metric ton per day reactor, commenced operation in 2011 and has operated continually since. Today, the Company has over 30 systems operating both domestically and abroad. Cavitation was founded in 2007 and is headquartered in Chatsworth, California. By our last count, they currently have 16 issued U.S. patents, 6 issued international patents, and 7 additional patents pending.

We were first introduced to CTI in 2010, which was around the time the company signed their exclusive distribution agreement with Desmet Ballestra Group (“Desmet”), the *“world leader in developing, engineering and supplying technologies, processing plants and proprietary equipment for food, feed, oils and fats”*. As we recall at the time Ballestra believed it could install up to 50 reactors per year, so the numbers were quite significant. As it turned out, the numbers were obviously nowhere near that forecast, however, we believe that agreement is the basis for most of the revenues the Company has generated since then, so it has not been unfruitful, and they continue to place reactors around the globe. They recently signed a new agreement with Ballestra and the Company believes that portion of the business could accelerate going forward.

In addition to Desmet, in January 2017 the Company entered into *“a new global technology license, R&D and marketing agreement with GEA Westfalia (“GEA”) with respect to their patented Nano Reactor™ technology, processes and applications. Under the agreement, GEA has been granted a worldwide exclusive license to integrate CTI’s patented technology into water treatment application, milk and juice pasteurization, and certain food related processes. The license agreement between CTI and GEA has a three-year term and provides for the payment of \$300,000 per year in advanced license fees to Cavitation”*. GEA Westfalia *“manufactures filtration and equipment such as separators, clarifiers, decanters and membrane filtration systems. This equipment is used for the purification of suspensions, the separation of fluid mixtures with simultaneous removal of solids, extraction and concentration or removal of liquids from solids. The technological dominance of the company is based on over one hundred fifteen years of innovation, first-class engineering solutions and comprehensive processing capabilities. The company was founded in 1893 in Oelde, Germany”*.

Beyond the two agreements above, the Company has established a handful of additional opportunities around their technology platform that we believe could begin contributing to revenues in the coming fiscal year(s). We will discuss some of these opportunities further in this report.

Conceptually, we think this has always been a platform/licensing story (The Company has 5 employees). As we recall, from inception, the plan has always been to develop the basic cavitation platform/technology, and then license it (or iterations of it) to others that could then use the technology to develop specific applications for various industries. In that regard, (again, as we have always understood it) the plan has always been to be a provider of their IP platform (as opposed to a product developer and/or manufacturer). That approach would include a relatively small organization with low associated overhead and recurring licensing type revenue streams. Succinctly, we have seen that movie; small companies trying to license technology for ongoing royalties, typically to larger companies. For a variety of reasons, that always seems to be a much tougher proposition than anticipated, even in cases where the technology possesses marked advantages. We don't have a *rational* explanation for that other than that the best technologies don't always "win", usually because there are those who don't want them to, but anyone who has spent any time in the microcap space can likely attest to the reality.

To suggest that CTI has struggled to develop traction for their platform is probably an obvious understatement. We think it is fair to say that back when we first heard this story in 2010, they most certainly believed that they would have many more reactors in service around the world than the 30 or so they currently have. On the other hand, we also think the agreements they have in place with noted players in respective industries and the fact that they *have been able* to put units in place perhaps underscores the viability of the platform/technology to save users time and money. Further, this small group has also managed to stay in the game by controlling overhead/costs and thus minimizing added capital requirements along the way. Perhaps more importantly, we think they may be at the front end of some momentum and some breadth for the platform as they now have oars in the water in a handful of additional industries beyond vegetable oil processing. Moreover, this is another of our nanocap names with a sub-\$10 million market cap, which we realize is "too small" for some, but from our perspective, these small names can provide extraordinary results if they can ultimately execute to the "next level". The balance of this report provides our thesis regarding why we think that could be the case with Cavitation.

### **Technology/Product Overview**

As alluded to above, the Company has created a technology platform of sorts that it ultimately plans to modify and apply to various industries where that technology might be applicable. In this overview we will delineate a few of the industries they are currently targeting with those applications. Recognize, part of our premise here is that the phenomenon referred to as "cavitation" is generally understood but using the process to develop systems/applications that solve problems is not commonplace. In fact, as we will illustrate, in some instances cavitation actually cause problems that some industries are forced to mitigate. Further, there are various "forms" of cavitation we will also address and some of those forms involve characteristics that make them more applicable to particular uses and functions than others. As a result, CTI is largely focused a form of the phenomenon called "*hydrodynamic cavitation*". Here is a bit of their narrative in that regard:

*"CTi's core technology encompasses the utilization of hydrodynamic cavitation. Cavitation can be of different origins, for instance: acoustic (usually, ultrasound-induced), hydrodynamic or generated with laser light, accelerated particles, an electrical discharge or steam injection. Hydrodynamic cavitation comprises the nucleation, fluid's vaporization and growth, pulsation, if any, and collapse of bubbles which occurs in a flowing fluid as a result of a decrease and subsequent increase in its static pressure. Hydrodynamic cavitation can be achieved by passing the liquid through a constricted zone at sufficient velocity and onsets after the static pressure of the liquid has decreased to the saturated vapor pressure. The important characteristics of applied cavitation are the number of cavitation events in a flow unit, and the surface tension and the size of bubbles, which range from ten nanometers to a few microns or even larger in diameter. The collapse of the bubbles results in a localized significant increase in pressure and temperature. The combination of elevated pressure and temperature, along*

*with vigorous mixing supplied by the hydrodynamic cavitation, triggers and accelerates numerous reactions and processes. Each bubble can be described as an independent miniature reactor, in which chemical and physical alterations take place. The further transformations result from the reactions and processes occurring in the adjacent layers of vapor/liquid. While extreme pressure or heat can be unfavorable, the outcome of controlled cavitation-assisted processing has been shown to be exceptionally beneficial”.*

*“At the present time, with energy costs rapidly rising, it is highly desirable to reduce both treatment time and energy consumption to secure a profit margin as large as possible. CTi designs and builds advanced, highly specialized, multi-stage, robust, flow-through cavitation devices, reactors and systems to serve the diverse needs of both large-scale plants and small-scale producers. The versatility of the Company’s devices and the flexibility of their designs will meet the most stringent process requirements. CTi’s patent-pending oil refining technologies and patented flow-through multi-stage Nano Reactor® devices exhibit both superior performance and remarkable reproducibility. The systems currently commercialized by CTi may find many valuable, unique and environmentally friendly applications”.*

We will try to unpack that a bit.

As noted, contrary to the Company’s technology, cavitation has been a problem for some industries. For instance, cavitation is an unintended consequence for moving parts in water or other submersed processes. Boat propellers are often compromised by cavitation that occurs as a result of the agitation of the water in and around the propeller, which creates the type of cavitated bubbles described above. Parts damaged by cavitation are often pitted/eroded by the considerable pressure that is released when cavitation bubbles burst and the released energy/pressure is absorbed by the propeller. Actually, the process is a bit analogous (although not precisely) to thunder but on a nano-scale. Further, its resulting reaction looks like that which one might get from an endothermic reaction, but with the heat input.

CTI has effectively developed technology that is able to create, control and consistently duplicate cavitation reactions that can be used to facilitate a number of processes that they believe can be (are) commercialized at scale. The first of those applications was/is in vegetable oil processing per the agreement with Desmet. This particular agreement has been responsible for most of the Company’s historic sales and we believe it will continue to contribute going forward. The agreement was renewed in Q4 2018 which we will speak to in the Operation Overview.

#### **- Edible Oil Processing**

CTI signed its initial licensing agreement with Ballestra in 2010. That agreement was subsequently renewed in both 2015 and 2018. As we addressed prior, when the Company originally signed this agreement, they believed that Ballestra would sell considerably more of these units than they have achieved to this point. As we recall, their expectation at the time was that Ballestra would eventually ramp to a rate of selling approximately 1 unit per week or about 50 per year. To put that into perspective, they have to this point placed about 30 units around the world, and we believe (based on recent sales) the Company’s gross profit per machine something in the neighborhood of \$150,000 per machine. Doing the math, if Desmet were in fact ramp to 50 units per year, we think that would generate gross profits of something around \$7.5 million, and likely operating profits of \$5+ million. Put another way, we think Desmet sales of 10 machines annually would likely move the Company to breakeven. While submit, we are not sure why Desmet has not sold/placed more machines, but we continue to believe that their willingness to renew the license (and make upfront payments along the way) continues to provide validation for the technology in the processing of edible oils. Here is some narrative from the Company regarding the advantages of the technology in edible oils, as well as color regarding their relationship with Ballestra.

*Vegetable oil refining facilities process crude oils such as soybean oil, palm oil, rapeseed oil, canola oil, sunflower oil and other specialty oils including: peanut oil, olive oil and cottonseed oil. The processing converts them into*

oil for various consumer and industrial uses, for example, cooking oil, flavor enhancements and food additives. The demand for the edible oil industry has historically grown at over 5% per year, even during periods of global economic instability. CTi currently focuses on expanding its market share across a variety of edible oil refining sectors.

The Company refers to its process as “CTi Nano Neutralization”®.



Based on the technology developed by CTi and exclusively brought to the oils and fats industry by the oil giant Desmet Ballestra, the Nano Neutralization® process offers enhanced performance: improved oil yield, lowered operating expenses, reduced environmental impact and exceptional oil quality. The neutralization of free fatty acids transforms them into soaps followed by the separation step. The procedure also removes non-hydratable phosphatides and decreases the level of impurities. The repeated controlled formation and the implosion of cavitation nano bubbles, high-velocity jet occurrence, shockwave formation and other phenomena act on the oil-

containing process mixture significantly accelerating the rates of desirable processes. One Nano Reactor® is capable of processing hundreds of metric tons per day (MTPD) of oil. The pressure in the Nano Reactor® typically ranges from 600 to 1,200 psig and the discharge pressure allows the direct feeding of the treated oil into the centrifugal separator. CTi's systems are compact, made of durable and chemically inert stainless steel, easy to clean and scalable.

The revolutionary process is commercially proven and offers a quick return on its investment. New or existing refining plants deserve the best: CTi Nano Neutralization® can be effortlessly incorporated, in line, at an existing oil refining facility to improve the oil yield and save silica or wash water, reduce the consumption of phosphoric acid and caustic, and can even allow savings on steam, maintenance, repair parts and labor costs. Repair parts and maintenance costs can be lessened in refineries that presently use outdated high-shear mixers and acid reactors to mix the acid into the oil and provide retention. In such cases, the high-shear mixer and tank agitator are taken out of service. The annual maintenance and repair parts costs for this equipment far exceed that of the CTi Nano Reactor®. CTi Nano Neutralization® is also available for implementation in new edible refineries. The technology reduces equipment and installation costs while also providing the above mentioned chemical savings.

Building on the success of the CTi Nano Neutralization® process, CTi is exploring opportunities for additional applications in edible oil refining, including water degumming, bleaching and deodorization. Pumping the mixture of oil and water through CTi's hydrodynamic cavitation devices maximizes the oil-water interfacial area, promoting vigorous gum hydration and their expeditious removal from oil. Plant pigments and target color compounds are removed from oil during a bleaching step using adsorbents. Superior mixing and the capacity of CTi's devices are expected to substantially cut the costs and facilitate oil bleaching. Volatile components that negatively affect oil's taste and its odor are removed by deodorization, which typically employs steam injection under a high vacuum and increased temperature. The process can be modified, accordingly, to incorporate the use of CTi's flow-through systems. The Company is actively marketing its technologies to small-scale oil refineries.

We and Desmet have worked together to determine the appropriate sales approach and installation process. Our CTi Nano Neutralization System is designed to be used as an add-on process to an existing neutralization system within soybean and other vegetable oil refineries. Desmet's recent focus has been on marketing our CTi's Nano Neutralization® System to vegetable oil refiners to help them increase profits through cost savings and improved oil yields. Desmet purchases our CTi Nano Neutralization Reactor Systems from us and installs them at the

*refinery as part of an integrated neutralization system. Based on successful commercial implementations, Desmet guarantees minimum economic benefits to a facility that installs our CTi Nano Neutralization® Systems. We are therefore substantially dependent on Desmet to identify prospects, complete sales contracts, install the system and manage relationships with end-users.*

Again, perhaps we can provide a few bullet points to the above.

First, on the face, we think the Company's technology provides a number of advantages that address both efficiencies and cost reductions but can also deliver the solution on an online (throughput) scalable basis. Further, they are generally able to integrate their reactor into existing manufacturing lines, so their solution does not require substantial modification or other disruption of those lines in order to be implemented. In our experience, that is a problem for companies attempting to sell technology enhancements into manufacturing/processes facilities, as companies are often quite reluctant to disrupt processes that are working as they are supposed to even if it is to add something that will supposedly make it better. Clearly, that possesses some risk for those adding enhancements of this nature. To reiterate, we view Desmet's considerable position servicing the industry and their agreement with CTi as validation of the technology's ability to deliver on these points. While we don't think that is a huge leap of faith, we admit it may be anecdotal.

Second, in spite of Desmet Ballestra's willingness to continue to renew the license and apparently continue to market the product, we submit, the limited sales penetration/adoption over the past 6 years or so begs the question, "if the technology is so beneficial, why has that adoption been so slow"? We don't know the answer to that, and we think the Company asks the same question periodically, so clearly, they don't know the answer to that either. We do however suspect that their may be some reasons, and we don't necessarily think they have to do with ROI or other similar metrics that drive adoption of such technologies. We tend to think that the technology represents a single arrow in a very large quiver of lines Desmet sells. Succinctly, as we understand it they represent 5,000+ sku's to their customers. That being the case, it may be understandable that CTi's technology might get lost in the shuffle. That said, as some of the narrative above suggests, the Company indicates that it has been working more diligently with Desmet to enhance the sales process and other elements that might facilitate adoption. Again, even nominal acceleration of this end of the business could *profoundly impact* the Company's results. Further, we don't think Desmet would have to make a huge additional commitment to sell another dozen or so reactors each year.

#### **- Food Processing and Water Treatment – GEA**

Subsequent to their arrangement with Desmet Ballestra, in early 2017, CTI signed a *"global technology license, R&D and marketing agreement with GEA Westfalia Separator ("GEA") with respect to CTI's patented Nano Reactor™ technology, processes and applications. Under the agreement, GEA has been granted a worldwide exclusive license to integrate our patented technology into water treatment application, milk and juice pasteurization, and certain food related processes"*.

*"GEA is one of the largest suppliers for the food processing industry and a wide range of process industries. As an international technology group, the Company focuses on process technology and components for sophisticated production processes in various end-user markets. The Group generates more than 70 percent of its revenue in the food sector that enjoys long-term sustainable growth. GEA manufactures filtration and equipment such as separators, clarifiers, decanters and membrane filtration systems. This equipment is used for the purification of suspensions, the separation of fluid mixtures with simultaneous removal of solids, extraction and concentration or removal of liquids from solids. The technological dominance of the company is based on over one hundred fifteen years of innovation, first-class engineering solutions and comprehensive processing capabilities"*.

To the best of our knowledge, outside of the licensing advances (\$300,000 per year) this agreement has not generated any revenues for CTI. We suspect this arrangement, like the Desmet arrangement, may tell us something about the Company's opportunities and the corresponding trajectories of the same. That is, we think agreements

like this provide some validation for the technology, but it also underscores that their technology involves a fair amount of technical complexity, which may speak to the long adoption cycles, and perhaps even the niche nature of processes that are ultimately created around CTI's platform(s). With that said, keep in mind, we view the Company as largely a licensor of technology, which has positive attributes (limited overhead and burn for instance) but also some limitations in terms of their control over developments that might ultimately generate ongoing sales. As we will demonstrate, some of the Company's more recent endeavors involve a bit more participation on their part in terms of the development and marketing of new applications. That said, we view the GEA agreement much as we see the Ballestra agreement. Clearly, progress will depend on the degree (if any) and that rate at which GEA integrates CTI technologies into their own offerings. Again, that could mean nothing, but on the other hand, if GEA decides to integrate CTI technology even on a relatively small scale, the impact to CTI could be marked. To translate, we think the agreement is validating and potentially significant, but we have no idea how to assess those possibilities.

#### - **Alchemy Beverage**

In June 2018, the Company entered into an agreement with Alchemy Beverages ("ABI"). Much like the Ballestra and GEA deals, the essence of the Alchemy deal is a licensing agreement covering the use of CTI's technology for applications in the alcoholic beverage industry. This agreement differs from the other two in that CTI also owns 19.9% of Alchemy. As we alluded to above, while still a licensing agreement per se, we think the Company is a bit more involved in the advancement of the associated technology than with the prior two agreements. We also think that posture (trying to position themselves to help impact adoption of associated technologies) is perhaps a new strategic approach by CTI. (To that point, CTI's C-Suite also serves as ABI's "technology team", which we think supports our notion that CTI may become more involved with some of its newer licenses).

CTI's licensing agreements with ABI provides the latter the "*exclusive global distribution rights for our patented and patent pending technology for the processing of alcoholic beverages*". The Company provides the following narrative regarding the technology and its associated applicability to the alcohol/spirits industry:

*Our patented and patent-pending technologies are set to disrupt the spirits and liquor business. While the spirits industry has gone through changes and improvements in the fermentation and distillation process; in the last 400 years, there have been no major technology developments—until today. With the addition of our Clarification Process, we have fundamentally changed the consumer perception, taste, and experience in enjoying alcoholic beverages.*

*Applying this technology to alcohol, our Clarification Process produces physical and chemical restructuring at the molecular level. Molecular chains in the alcohol are broken to nano-particle size, thus creating an enormous force and energy that produces a change in the molecular structure and bonding in spirits. The process does not alter the proof or filter the spirits, it simply reduces the harsh tasting acids and toxins naturally found in alcohol. The result is a dramatic reduction in the 'alcohol burn', a significant enhancement in the taste profile and a reduction in the impurities. The end result is a dramatically accelerated chemical reaction that previously took hours, days, and years to achieve is produced instantly, with substantially improved final results.*

In conjunction with the licensing agreement, CTI and ABI have spent the past few years preparing a market launch of the technology. As we understand it, that launch has a three-pronged approach. The first of these involves providing the technology to the spirits industry on a scalable/white label type basis. For instance, ABI could provide the technology to established brands to enable them to provide their own branded "premium" spirits sourced from low cost "well" quality providers. For example, a restaurant or grocery chain could now have their own branded line of spirits (Outback Steak Whiskey, or Safeway Vodka) and the process would allow them to "clarify" the spirits at scale. Incidentally, we believe ABI carries all appropriate licenses to sell and ship spirits and we believe they actually have their own Vodka brand as well, which represents another potential direction for the Company. We believe their own premium spirits brands are part of the plan.

ABI and CTi have also developed a consumer product around their alcohol clarification process. The result of those efforts is a consumer appliance they refer to as “Barmuze”. Following is some narrative from ABI describing the appliance:



*ABI and its technology partner, CTi, spent over 4 years in the development of a home appliance that can accomplish the same result as its industrial-sized high-pressure Clarification Technology. In early 2018, the first functional prototype of the Barmuze home appliance was created and it delivered beyond expectations. Utilizing an independent sommelier, significant improvement was found to have taken place in every spirit that was tested and modest to significant improvement was recorded for each of the wines processed through the unit. In continued testing, it was estimated that approximately 9 out of 10 individuals noted significant improvement in the spirits they tested and well more than 50% of the wines demonstrated a more enjoyable taste profile. In what was one of our most important testing results, Rob Mondavi and his tasting team determined that all of the spirits were dramatically improved and  $\frac{2}{3}$  of the wines tested*

*showed improvement. Rob was sufficiently impressed, that he now has become a leading member of our Advisory Board.*

Here are a few of our observations regarding ABI, Barmuze and the “clarification” of alcohol.

First, the alcohol market in general, including the growth of craft beers, boutique wineries and emerging small batch spirits companies has been remarkable. We have no idea how that/those industries will continue to grow/evolve, but the alcohol industry is robust and clearly amenable to change of all sorts. From the 10,000 foot view, we think Barmuze may have a place in that dynamic.

The small appliance beverage market has seen a number of successes, some of which have been huge. Keurig is the obvious example, but others like SodaStream also illustrate the point. We are not suggesting Barmuze is the next Keurig, but we do think these prior successes may provide some validity to the potential for beverage based countertop appliances.



We have had a chance to review some of the Company’s projections, and we think they can provide the product at a reasonable price point ( around \$300) and still maintain a reasonable margin (likely 50%+ at scale). We think that is topical to any plans they may have in terms of measurable penetration from the product.

We think it’s cool, although that is of limited value since we are certainly not millennial influencers. But we still think its cool.

To the prior point, cool or not, the question of whether or not it actually works is where the rubber meets the road. To that end, the Company provides a number of independent lab results that reflect a number of conclusions that suggest that “something” is happening to alcohol that is run through the system. Those conclusions include opinions from sommeliers who opine that the treated versions are better than the untreated originals. Obviously, consumers’ attitudes about those differences will ultimately carry the day, but we are comfortable suggesting that the process clearly alters/changes the original, and predominantly that appears to be for the better. There is also

some suggestion that the treated alcohol may mitigate hangovers by altering harmful portions of the originals. That probably requires considerably more study, which they may or may not.

Lastly, inasmuch as we see the “buzz” potential for a consumer appliance of this nature, we still tend to think that the commercial white label and perhaps self-branded spirits opportunities are promising.

Again, we are not trying to draw any conclusions about the ultimate success of ABI, Barmuze et al. However, we do think it represents another (currently unmodeled) shot at the brass ring in terms of CTI’s opportunities to license the core technology into new markets. In our view, the more industries and resulting licensing arrangements the Company can touch with the platform, the better their chances of success. That brings us to frack water.

## - Frac Water Treatment

On April 08, 2019 announced that it received *“its first purchase order for Low Pressure Nano Reactor Technology (LPN) for frac water treatment. LPN is an environmentally friendly technology that will be used as an addition to existing processes in the produced and frac water treatment in the oil and gas industry. Installation of the LPN along with proprietary chemical formulations and engineering designs will address a growing demand for water supply and treatment, water used in drilling and completions operations, and ongoing regulatory requirements for the implementation of environmentally friendly technologies that will address industry needs”*. This represents another instance (much like ABI above) where we think the



Company has been more proactive and directly involved in creating a solution for a specific industry/problem based on their platform technology. Here is a bit of the technical narrative about the process:

*“In the electrocoagulation process, the coagulant is generated in situ by electrolytic oxidation of an appropriate anode material. The introduced highly charged polymeric metal hydroxide species neutralize the electrostatic charges on suspended solids and oil droplets to facilitate agglomeration and resultant separation from the aqueous phase. The simultaneous action of advanced hydrodynamic nano cavitation, electrocoagulation and active chemical species formed in situ provide a unique synergistic effect resulting in a high-efficiency purification process. The System is capable of removing heavy metals, fats, oil, grease, complex organics, bacteria, viruses and cysts, and suspended and colloidal solids; breaking oil emulsions in water and processing multiple contaminants”*.

In our discussion with management, we believe the Company has made great progress towards the development of a functional (portable) and scalable frac water/produced water solution. As we understand it, the reactor delivered per the April 2019 release is capable of treating 200 gallons per minute (“gpm”) and can process 24 hours per day. (we have made some modifications to that number based on about 25 days per month to account for downtime etc.). We believe they are also working on perfecting (and will soon deliver) models that can produce closer to 500 gpm. As we will also elaborate on in the Industry Overview, the treatment of frac water is a considerable and growing problem in the burgeoning domestic oil and gas production industry, which has largely been revived *because of fracing*.

The Company recently released an outlook for 2019 wherein they noted the following with respect to their fracing opportunities: *“Our Low Pressure Nano Reactors (“LPN”) have attracted several companies specializing in treatment of produced and frack water. We are currently in the final stages of negotiations to finalize our first water treatment contract in the Permian Basin. Our proprietary chemical formulas and patented process, along with LPN technology are providing highly efficient processes that substantially reduce operating costs and*

*chemical consumption for frack and produced water treatment, compared to the processes currently available in the industry. With the fast-growing oil and gas exploration and production in the US and Canada, we believe our company is well positioned to benefit from this booming industry”.*

We believe the Company is positioned to begin monetizing technology in the frac/produced water space. We believe the technology is capable of delivering a continuous, online throughput solution at scale, which we think is likely paramount for any successful water treatment system in the space. In our view, other opportunities aside, we think frac water treatment will provide a measurable new revenue line item to the Company’s financial, perhaps as early as 4Q 2019, but more likely beginning in 2020 and increasing sequentially. We believe fracwater operations could provide a marked inflection for the Company in 2020.

- **Other Areas of Potential Licensing**

- **Petroleum Upgrading** (Breaking down asphaltene agglomerates, improving both the viscosity and API gravity for a prolonged period of time, reducing pumping and atomization costs, facilitating hydrocarbon cracking and increasing the refining yields).
- **Emulsified Fuels** (Adding water to diesel to make it more efficient with lower emissions). We believe they are currently working on an iteration of this with/for GEA.
- **Biodiesel Transesterification** (Making high quality diesel from vegetable oils with fewer harsh chemicals)
- **Biomass and Biofuels** (Making natural gas from corn cobs, cotton stalk, wheat straw, rice straw, sugarcane bagasse, switchgrass, poplar wood and others).
- **Others**

Frankly, it is hard for us to wrap our head around how the Company has patented as much IP (and platform development around that IP) and still trades with a market cap of \$6 million. On the other hand, they have an accumulated deficit of \$24 million, so clearly, they have raised and spent some capital getting to this point. From another perspective, perhaps it is not too difficult to understand the limited traction they have been able to garner from the IP. As we alluded to prior, much of the IP is relatively technical in nature, and in fact involves some physics and or chemistry properties that are probably best described as at least “understudied” and perhaps even generally not well understood. We think that factor may explain some of the adoption problems. That is, even early adopters of new technologies and processes need to have a clear understanding of how and why new additions to their own processes might benefit them. We have seen a number of small companies fight adoption because they could not fully explain the mechanisms of action of their IP. That is clearly a more difficult task when it comes to lesser understood phenomenon and the technologies that address them. That said, we think the Company is beginning to see the platform funnel into potential commercial opportunities on multiple fronts. Any one of those opportunities/industries could be a marked catalyst for the Company. As we noted, even just a stepped up commitment from Ballestra would likely result in sustained profitability. While we submit, they have been at this for some time, we think the stars may be starting to align in terms of the commercialization of some of their licenses.

### **Industry Overview**

This may be a bit different than our typical Industry Overview, because as we noted, the company seeks to provide a platform technology that others can integrate into their own processes and offerings to address any multitude of industries. That said, we have provided some color on some of the markets we currently envision their platform(s) addressing. We have presented these in much the same order as they are presented in the Product/Technology Overview above. First, here is some narrative from the Company regarding their view of the competitive landscape that we find topical:

- **Edible Oils**

*“Our competitors who sell equipment and engineering services for the vegetable oil refining business are a myriad of companies both large and small that provide equipment and technology to oil refiners. These include known companies that have longer operating histories, more experience, and stronger financial capabilities. Competitors include Alfa Laval, and Crown Iron Works as well as many firms that provide advice and services to small and regional firms. In addition, Arisdyne Systems, a designer of cavitation devices, is marketing a system using similar technology. The vegetable oil refining business is a highly competitive commodity market in which the lowest-cost producer has the advantage. We intend to compete by offering solutions that help our clients remain or become a low-cost producer. Because the industry in which we compete has had limited new technology introduced in the last 50 years, we believe our CTi Nano Neutralization® Systems provide a unique opportunity for refiners to increase margins. We seek to differentiate ourselves by offering solutions based on our proprietary and patented designs, processes, and applications to help our clients described in our issued and patent pending applications. We compete by offering solutions that we believe can reduce operating expenses and increase oil yield vs currently applied technologies”.*

According to IHSMARKIT.COM:

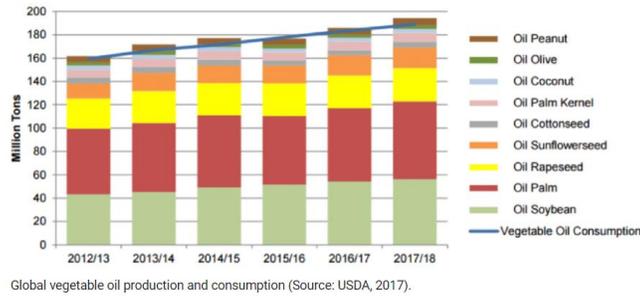
*Fats and oils are used throughout the world for both food applications and industrial uses. They are consumed in butter, shortening, margarine, salad oils, and cooking oils, as well as in animal feeds, fatty acids, soaps, personal care products, biodiesel, paints (made from alkyd resins), lubricants, and greases. The sources of fats and oils include edible vegetable oils, palm oils, industrial oils, animal fats, and marine oils. Food applications account for the major share (about three-fourths) of the worldwide consumption of fats and oils. However, there has been a continued shift from food to industrial consumption, particularly in biodiesel. In Europe and the United States, this has been due mainly to the increased use of rapeseed (canola) oil and soybean oil for biodiesel production. In Central and South America, soybean oil consumption has also increased in use for biodiesel as a result of country mandates. Industrial applications of other oil crops are also being studied and developed.*

*Global production of fats and oils is led by Asia. Indonesia is the world's largest producer, and accounts for more than half of the global production of palm oil. China ranks second in total world production of fats and oils in 2018 and is a larger producer of soybean and rapeseed (canola) oils. Malaysia ranks third in world production because of its place as the world's second-largest palm oil producer. India also produces large volumes of canola and butter. Overall, Asia accounts for more than half of global fats and oils production in 2018.*

*World consumption is also driven mainly by Asia, which accounts for almost 50% of the world total. China and India together make up almost 30% of the world total. Chinese demand is mainly for soybean oil, followed by palm and canola oils. India is a major consumer of canola oil, as well as palm oil and butter. Both countries expect continued strong growth. Indonesia and Malaysia also contribute to overall consumption, especially in palm oil demand.*

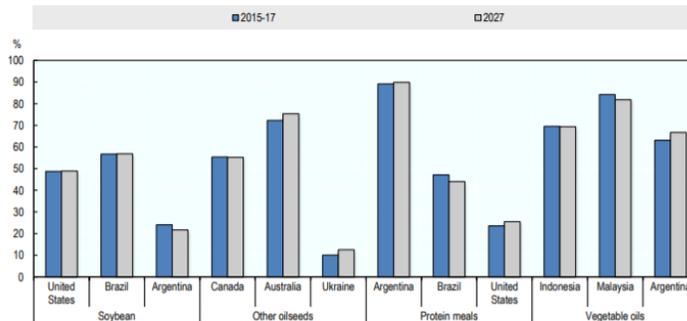
*Overall, world fats and oils consumption is expected to grow at a rate of 2.5–3.0% per year, driven mainly by growth in Asia and steady increases in the United States and Europe. In Asia, China and India will continue to experience growing populations and economies, which will result in an increase in per capita consumption of fats and oils. In the United States, Europe, and Central and South America, fats and oils consumption for nonfood use, particularly biodiesel production, is expected to continue to increase.*

The global edible oils market is large and growing, reaching nearly 200 million tons in 2017:



Edible oil production is dispersed across the globe, and in some instances is a function of proximity and/or access to feedstocks:

Figure 4.8. Share of exports in total production of oilseeds and oilseed products for the top three exporting countries



<http://www.agri-outlook.org/commodities/Agricultural-Outlook-2018-Oilseeds.pdf>

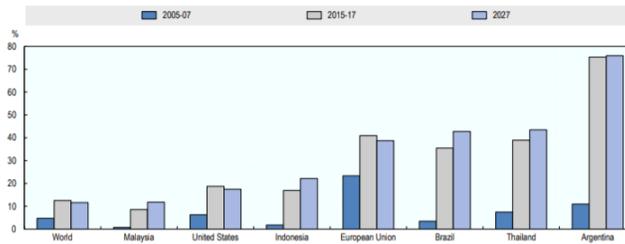
As the map below reflecting CTI’s footprint of edible oil customers illustrates, through Desmet Ballestra, CTI currently has systems operating in some of the more prominent edible oil production areas in the world for particular oils (the U.S., Canada, Brazil and Argentina). They have about a third of these system installations in East and South East Asia, with 7-8 systems in India. America’s and Asia are their largest markets but to date they have virtually no presence in other regions of prominence for other oils (Indonesia, Malaysia and Australia):



As we understand it, in part because of the commodity nature of the end product oils, most edible oil refiners operate on relatively thin margins, which may make technologies like CTI’s attractive because they can reduce costs and increase efficiencies.

As an adjunct to the above, recognize some of the narrative references industrial oil consumption, which also happens to be something CTI technology addresses. The chart below sheds some light on the expanding role of biofuels in the plant based oil equation(s):

Figure 4.6. Share of vegetable oil used for biodiesel production



Source: OECD/FAO (2018), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-outl-data-en>.

StatLink <http://dx.doi.org/10.1787/888933743100>

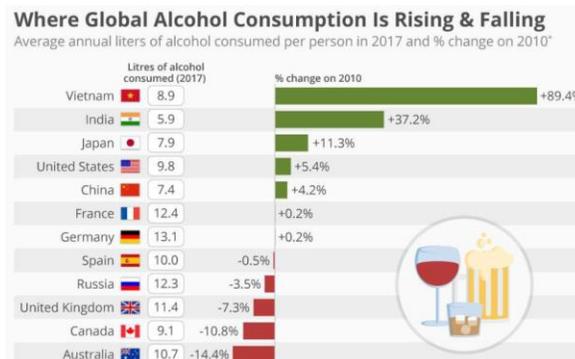
Clearly, the edible oil and the oil-to-biofuels markets are large and growing. As we have noted, we don't think that Desmet has met expectations in terms of addressing the potential market with CTI's technology, and we would argue that the same is probably true of GEA. That is, we feel comfortable that CTI anticipated more from each agreement to this point. However, what is clear to us is that the Company's technology is capable of addressing challenges across areas of the plant oil spectrum, and that includes some iterations of their technology we have not focused on here. Succinctly, we believe they will continue to generate benefits from these industries and that may include growth from already embedded technologies as well as from others the Company has developed and is in the process of testing and refining. For instance, we believe their LPN mixers are currently being tested on emulsified fuels, which if successful could create some identified opportunities in renewables. We think there are other opportunities of that nature on the plant oil side of the business.

## - Alcohol/Spirits

According to Forbes:

(<https://www.forbes.com/sites/niallmccarthy/2019/05/09/where-global-alcohol-consumption-is-rising-falling-infographic/#515aac9816e4>)

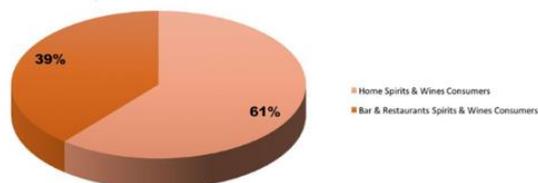
*"A recent study published in The Lancet has found that global alcohol consumption is steadily increasing. Total alcohol consumed globally per year has gone from 21 billion liters in 1990 to 35.7 billion liters in 2017 - an increase of 70%. Low and middle-income countries are the driving force behind the trend with Vietnam, India and China all recording significant increases. That has resulted in alcohol consumption increasing by 34% in Southeast Asia in the seven-year period from 2010 to 2017. With an average of 15 liters of pure alcohol consumed per adult annually as of 2017, Moldova is the country with the highest levels of consumption while Kuwait has the lowest at 0.005 liters per year on average".* We are not sure anyone will be surprised by those statistics. On the home front, which is probably what matters more to CTI/ABI at this point, the growth numbers are not as robust as some parts of the world, but Americans are apparently consuming more...not less... alcohol.



Again, we are not sure how topical that is to CTI/ABI but given the choice we think they would rather have that number growing rather than shrinking. On the other hand, ABI provides the following graphics that we do think are particularly germane to their Barmuze opportunity:

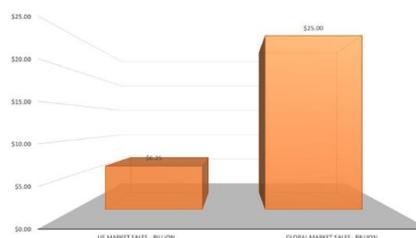
#### Alcohol Consumption at home vs. bars & restaurants:

61% of Spirit & wine consumers drink at home  
39% of Spirit & wine consumers drink outside the home



#### Small Kitchen Appliance Annual Sales:

United States: \$6.5 Billion  
Global: \$24 Billion



From their first consumer product launch in 2010 through 2014 Kuerig sold approximately 10 million single serve coffee appliances. Since their introduction in 1994, there have been over 100 million George Forman grills sold worldwide. We have all seen our share of consumer appliances that we looked back on and said, “I wish I had thought of that”. To that we would reiterate, we like the Barmuze concept, which means absolutely nothing in terms of its potential success, but, we wish we had thought of it, which in this case we really never could have because it contains technology we could never have come up with. We think that is an important point by the way.

According to Research and Markets ([https://www.researchandmarkets.com/research/3kw621/united\\_states?w=5](https://www.researchandmarkets.com/research/3kw621/united_states?w=5)) “*The US craft spirits market is expected to reach revenues of more than \$20 billion by 2023, growing at an impressive **CAGR of over 32% during 2018-2023***”. That number may actually be more germane to ABI’s opportunity than the others. In short, spirits appear to be popular among millennials, which we think bodes well for ABI and Barmuze. Although we will cover this in a bit more detail in the Operating Overview below, as we understand it, ABI intends to launch a Kickstarter campaign over the next 30-60 days. We believe they also have other promotional and awareness arrangements planned for the balance of the year and into 2020. The Company has also designed Barmuze with “smart” capabilities, which we think may make it more than an “appliance” and could provide a number of additional opportunities. If their plans are successful, we think they could create awareness for CTI as well and perhaps provide a catalyst for the shares. That said, we think the Company’s most imminent and perhaps most promising new endeavor may be its progress in the frac/produced water space of the oil and gas industry.

#### - Produced Water

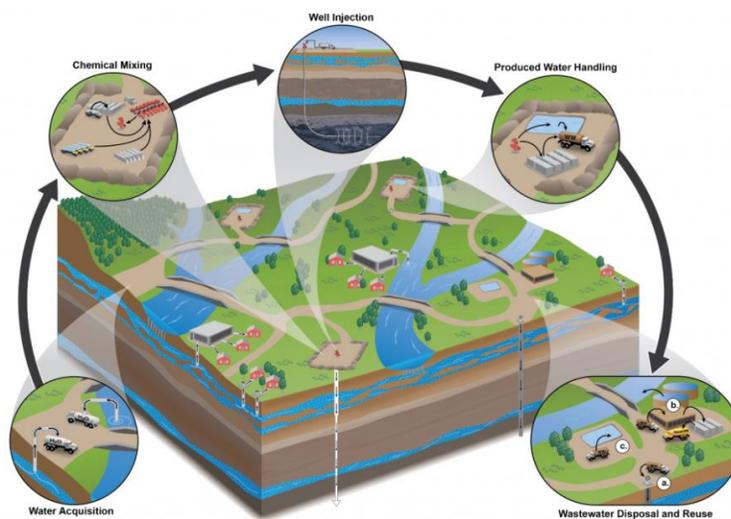
According to the Produced Water Society (<http://www.producedwatersociety.com/produced-water-101/>) “*Nearly every oil and gas well generates water as part of the production process. The United States has almost 1 million producing oil and gas wells. During 2012 (the most recent year for which national volume data have been collected), 21.2 billion barrels (bbl = 42 gallons) of produced water were generated in the United States. By comparison, this is more than twice the amount of water that typically flows over the Niagara Falls each day. This volume can be expressed in other units:*

- 58 million bbl/day
- 890 billion gallons/year or 2.44 billion gallons/day
- 3.57 billion m3/year or 9.2 million m3/day

Regardless of how the volume is expressed, it is a huge quantity of water. The rest of the world generates large volumes of produced water too, but insufficient data are available to make a precise estimate. 97% of the produced water comes from onshore wells located in 31 states. The remainder comes from offshore platforms in U.S. waters. More than one third of the U.S. produced water is generated in the state of Texas.

*Based on 2012 data from 21 states, an average of 9.2 bbl of produced water is generated for each bbl of oil. However, data supporting that calculation were not available from Texas and Oklahoma, which have tens of thousands of old wells producing high percentages of water. If those states had been averaged in, it is likely that the actual ratio of water to oil would be higher than 10-to-1”.*

To edify, oil and gas production tends to be a water intensive business. Fracing for instance involves pumping (in some instance millions) of gallons of water down the drill hole along with chemicals and sand to stimulate” the oil/gas bearing structure to enhance the recovery. In addition, most oil/gas bearing rock natural contains water as well. When these wells flow, that flow includes not only oil and gas but considerable amounts of water, generally referred to as “produced” water. In addition, to the produced water, much of the water put down the hole to stimulate the well also flows back to the surface as part of the process. Depending on the geology/formation, produced water and associated “flowback” water often contain a mix of elements (salts, metals, radioactive materials, bacteria etc.) that can often complicate their mitigation. As a result, disposing them in a way that does not compromise nearby water sources is paramount to the process. The illustration below from the Environmental Protection Agency depicts the water cycle in oil and gas production:



<https://www.epa.gov/hfstudy/hydraulic-fracturing-water-cycle>

The disposal of flowback and produced water from oil and gas production is becoming a more acute issue for the industry and scrutiny surrounding the industry’s handling and disposal of these effluents is coming from multiple sources. Regulators, state and local officials, environmental groups and individual citizens are all raising growing concerns about the impact of produced water and its disposal on local drinking and recreational water sources including aquifers and other associated watersheds. The industry has responded with a myriad of (ongoing) solutions aimed at storing, filtering, treating and otherwise trying to mitigate the negative impact of produced water inclusions. That is an ongoing process that is far from perfected, and part of its complexity lies in the differences in the elements contained in produced water from one place to the next. Other complications involve trying to find flow-through and/or other scalable solutions that can be applied (for instance) on-site and perhaps are portable enough to move with production. Further, the industry is gathering added opposition around its use of water in general, since access to clean water is becoming a bigger issue in many oil and gas producing areas. That factor supports solutions that involve recycling or otherwise reusing water backflow and/or produced water. Again, it is a large and growing problem with no standard solution, and in our view, the scrutiny surrounding the problem will almost certainly get more acute moving forward.

A recent article from the Society of Petroleum Engineers (<https://www.spe.org/en/jpt/jpt-article-detail/?art=4273>) notes;

*“As oil production rises in the Permian, the even larger volumes of water from those wells is becoming a pressing problem for many operators, particularly those drilling in the wetter western half of the basin. Over time the cost of producing a barrel of oil could include a \$3–6/bbl water disposal cost, according to a new report by Wood Mackenzie. If those numbers are realized—and there is considerable uncertainty how this will play out—it would reduce the consultancy’s 2025 production growth projection for the region by 400,000 B/D...Intense development there is straining the limits of water-injection wells and could prove to be another limiter for drilling in a play already producing more oil than the pipeline system can handle...Water risks to date have largely been described as a cost issue, but as projects continue to build scale, the risks become more serious.” “They could impact the ability to actually carry out operations. Investors and project partners should challenge operators on how water is being managed.”*

In our view, companies that can provide viable, cost effective solutions to growing produced water issues, could experience marked success. We believe CVAT may have one of those solutions.

#### - **Other Associated Industries**

As we noted above, CTI’s technology platform holds application in a number of identified industries, but also likely a number of industries yet to be identified. For instance, we know some of their current testing with potential partners in emulsified fuels, could have broader application in a number of biofuel and other renewable areas. We will update the research as information regarding new applications and industries become available.

### **Operating Overview**

Again, the Company currently has two licensing agreements that yield annual income in the form of minimum payments. The Desmet Ballestra agreement allows for a minimum annual payment of \$600,000, which is accounted for as an advance against the licensure of reactors that Ballestra puts into service. The revenues the Company generates from a reactor sale/license to Desmet varies by reactor size and configuration, but, for instance, they announced a recent sale in South America, for an aggregate installation value of \$160,000. (By the way, that sale kicked off fiscal 2020 with a sale in the first 20 days of the year which is encouraging). We are using an estimate of \$150,000 per installation in our modeling, but the actual numbers going forward could be a bit higher or lower than that. Keep in mind, cost of goods associated with Desmet sales are generally nominal (around 5%+-), so gross margins on these sales are high (90%+). As we alluded to above, we think the Company is focused on establishing ways to assist the Desmet sales efforts, which admittedly they have had little success in affecting. However, for instance, we think if the Company can begin generating profits from other relationships (frac water treatment for instance) providing some additional working capital, we could envision them adding some sales infrastructure to assist with existing relationships like Desmet and GEA. For now, we are modeling 8 Desmet sales for the current fiscal year (2020) and we are assuming a few additional sales in years thereafter. However, we continue to believe that this remains an open-ended opportunity that could potentially elevate the Company to profitability on its own. To that end, recognize, in the most recently reported quarter (3Q fiscal 2019, ended March 31, 2019) the Company reported revenues of \$252,000 and a net loss of just \$23,000. Granted, SG&A was lower than “normal” for the quarter, but our point is that we think Desmet sales of something around 10 machine per year would likely get them close to sustainable breakeven.

The GEA agreement also calls for a minimum annual payment which in this case is \$300,000. Here again, considering this in conjunction with the Ballestra agreement, the Company currently operated within a few more

sales of breakeven. As we noted above, our understanding is that the Company is currently testing some technology iterations that GEA *might* ultimately license/sell, but to this point, the GEA relationship has been limited to the annual license upkeep. Put another way, any success they might have in developing something that GEA in turns licenses and sells would likely move CTI into profitability.

Unfortunately, unlike Desmet and GEA, the Alchemy Beverages agreement does not contain any minimum payments. On the other hand, it does include a considerable equity ownership position, and combination of royalties, consulting and other line items that look like they should add up to around 15%-18% of Alchemy sales. For our initial model, we are not assuming any contribution from Alchemy. That is not to suggest that we think Alchemy will not sell anything, we just don't think we have the visibility to asses that at this point. We do think we will have more clarity on this issue through the balance of calendar 2019, and we will make appropriate adjustments to the model as additional data points dictate. To edify, we think revenues from the Alchemy arranges are entirely possible before the end of calendar 2019 and/or the Q1 calendar 2020, we just are not comfortable adding those to the model just yet. We view this as an asset that the market has largely ignored in terms of valuing the Company.

In April (2019) CTI received its first order for a reactor to treat fracwater. We think that announcement was highly significant. To be clear, the Company has not provided a great deal of public information around this opportunity, so we have to glean a few things in order to try to frame the opportunity, be here are some parameters from our first attempt to model the impact of this addition. Much like Desmet, we think the licensee(s) will bear the costs associated with the assembly, delivery and commissioning of the reactors. That is, we are not modeling capex and/or working capital requirements for CTI to build out reactors for the space. While we would caution that we are not even sure the numbers have been worked out and/or finalized just yet, our assumptions are based on conversations we have had with management regarding *potential* reactor capacity and per barrel revenue payments associated with initial applications with partners. To edify, our understanding is that there will be an initial phase of the technology's application which will address an identified and small but growing amount of produced water, with potential follow-on agreements that could provide better recurring revenue opportunities for CTI, based on initial performance and by extension future demand for their technology.

Specifically, as we noted prior, we believe the initial reactor the Company delivered against the April announcement is a 200 gpm unit and they are currently attempting to perfect a 500 gpm reactor. Regardless, if our math ties, a 200 gpm reactor should be capable of treating about 7,000 barrels per day (To edify 200 gpm is equivalent to about 4.75 barrel per minute or nearly 286 barrels per hour). Extending the math, a single 500 gpm reactor can process approximately 17,200 barrels of produced water per day. The Company believes it has the capacity to assemble, deliver and deploy between 16 and 20 **500 gpm** reactors (or equivalent 200 gpm units) over the next 12-24 months.

Again, extending the math from above, on an annual basis, a single 500 gpm reactor would process approximately 6.3 million barrels of produced water each year on a 24/7/365 basis. Of course, the reactor would likely have some downtime etc., but we estimate the net capacity in that regard could certainly be at or above 5 million barrels per year. We submit, we don't know what the Company might be able to retain from each barrel of treated water, nor do we know how many barrels they may be able to procure the treatment of. However, to reiterate, we do know our industry narrative above references estimates that historically there have been **58 million barrels of produced water generated each day** (a good portion of which comes from Texas where the Company's initial phase is being deployed). As a result, 17,200 barrels per CTI reactor looks like an insignificant portion of the whole. Further, industry estimates suggest that oil production in Texas' Permian Basin could double over the next 4 years, so we don't expect a shortage of produced water that needs to be dealt with. In fact, we tend to believe that produced water treatment/disposal could be one of the major challenges to that number becoming a reality. Moreover, as we also noted in the Industry Overview above, treatment and/or disposal costs in excess of \$1.00 per barrel of water are not unheard of. So then, to put that into perspective, if a single reactor can process/treat 5 million barrels per year, we believe CTI could earn something close to \$50,000 per reactor for each 1¢ of per barrel processing fees they might be able to negotiate. Carrying the decimals, that means a \$1.00 per barrel processing fee might

yield **\$5 million per year per reactor**. Obviously, there is a big difference between \$.01 per barrel and \$1.00 per barrel, but even cents per barrel would have a large impact on the current revenue run rate of the Company. Further, given the magnitude of the problem, we also think the ultimate volumes could be many times higher than our estimates provided the technology continues to perform.

In terms of operating expenses, we noted that the Company currently operates under a licensing strategy, which essentially means it avoids some of the typical overhead items that most other companies would include. For instance, they have no manufacturing or sales organization to speak of, and as a result nominal administrative function. While they do engage ongoing R&D efforts around the technology, the Company is literally made up of a small handful of people. While as we alluded to above, we think the Company would likely add some SG&A infrastructure if it had additional resources, especially in terms of perhaps some in-house sales muscle, we don't expect the Company's modest operating posture to change significantly, even in the event of some successes in the various new initiatives we have described. Specifically, the Company's quarterly SG&A over the past three years has typically averaged around \$450,000 (the most recently reported quarter was just \$250,000), and we are modeling something along those lines of the average into the foreseeable future. Again, the business plan is designed as a low overhead model, which has proven fortuitous over the years in terms of keeping burn rates down in the face of underperforming expectations with respect to their licensing agreements. To put that into perspective, in spite of the challenges, over the past three years, shares outstanding have remained largely unchanged and current share counts are only about 20% higher than they were five years ago, which we believe is the last time they attempted to access the capital markets. That is commendable (and atypical) in our view, and perhaps a testament to management's sensitivity to dilution.

## Management

- **Igor Gorodnitsky** Board Member & Principal Executive Officer, Founder of CVAT

*Igor Gorodnitsky is the founder of the Cavitation Technologies and currently, serves as the President and Principal Executive Officer of Cti. As a Senior Hazmat Specialist with over twenty years of experience, he has coordinated and successfully completed over 500 emergency hazardous material cleanups. He has effectively advised the City of Los Angeles Bureau of Street Services on many specialized situations, both emergency and non-emergency, such as, confined space entries into asphalt storage silos; emergency confined space entry into the aggregate dryer; hazmat cleanup of the hot oil tanks; cleanup and removal of spilled liquids and hardened asphalt; and coordinated the remediation of La Brea tar spills. His vast experience with hazardous materials became an impetus for his vision of Cti: a company devoted to green technologies and solutions.*

- **ND Voloshin** Chief Operations Officer & Chief Financial Officer

*Mr. N. D. Voloshin is the current Chief Financial Officer of Cavitation Technologies. Mr. Voloshin has over 20 years of experience in investment banking, marketing, asset management, business operations, and IPO's prior to joining Cavitation Technologies, Inc. Mr. Voloshin was a President and Chairman of the Board of Regional Broker Dealer, Member of FINRA and NYSE from 1998 to 2012. Mr. Voloshin was Chief Operating Officer of a Real Estate Investment Fund from 2006 to 2012. Mr. Voloshin has served on a board of Frontier Mining Limited, USA-AIM Listed in UK and Turan Petroleum, Inc USA. Mr. Voloshin has joined Cavitation Technologies, Inc in 2012 and became Chief Financial Officer in 2013. In 2014, Mr. Voloshin has successfully raised approximately \$1.5M in equity financing for the Company.*

- **Roman Gordon** *Global Technology Manager & Founder*

*Roman Gordon is the founder of the Company. He brings more than fifteen years of experience in business management and energy risk management to Cti. He served as a member of the Board of Directors, CEO and Secretary of the Company since its inception. In June of 2011, he was appointed as Cti's Chief Technology officer. His work in the area of Hydrodynamic Cavitation in the past years has been in the area of R&D and modeling of cavitation dynamics for industrial applications. Roman Gordon is the author of many issued patents by both USPTO and international patent applications in the area of Hydrodynamic Cavitation, oil refining, and electrocoagulation.*

- **Maxim Promptov** *Director of R&D, Head of Research*

*Maxim Promptov is head of research and development at Cti. Mr. Promptov was department chair and later Dean for the Technological Processes, Devices and Technospheric Safety department to one of the largest education institutions in Russia, Tambov State Technical University.*

*He was with the Tambov State Technical University for more than 25 years where he first started as engineer R&D in 1986.*

*He received a degree in chemical engineering in 1986. He holds a Doctorate in Technical Sciences (DrS) and a PhD for the process of emulsification, dispersion, dissolving and extraction in the pulse flows of heterogeneous liquids in rotor devices. Maxim is the author of more than 100 research papers, 23 patents and 9 study guides on cavitation technologies for the preparation of emulsions and suspensions, extractions, valuable biologically-active substances from vegetative and other raw material.*

### **Risks and Caveats**

CTI is a small company that has been in business for over a decade and has yet to post a profitable year (although they have managed to operate relatively close to cash flow breakeven given non-cash charges and compensation). That fact has labeled them a "going concern" designation for much of the past several years. As we noted, much of their operating disappointment has stemmed from the underperformance of their initial licensing partner Desmet Ballestra. A decade ago, many (us included) believed that arrangement would be a Company maker, but that has not been the case. As we suggested, while we believe that agreement could/should bear more fruit going forward, the great likelihood at this point is that if the Company is to emerge into marked profitability, it will likely have to come from places other than their licensing arrangements with Desmet and/or GEA.

Perhaps as an extension of the above, this is a small undercapitalized technology story trying to introduce and advance relatively complex technologies into established complex manufacturing and other environments. As microcap analysts, we have seen this movie before, and it is not a simple undertaking. There are a laundry list of challenges facing small companies in this position and they range from concerns about these companies' financial and other abilities to execute, to the simple idea that larger companies will often take advantage of smaller one whenever they can get away with it, which is more times than not. Again, it is very difficult for small companies (perhaps especially technology companies) to crack into these markets and it generally takes more time, effort and money than any of us initially envision. For example, there are a number of companies working on the produced water problems we described above and many of them certainly have more resources and industry clout than CTI.

Consequently, it will not be easy for CTI to establish a meaningful foothold in the market, *even if it has the best available technology*. The Company's meager stature (including its lack of capital) will likely continue to be an impediment to its success from multiple perspectives.

As we noted above, the Company's technology is based on harnessing a concept called cavitation. While we think it is fair to suggest that the concept is relatively well understood by the mainstream of science, there has not been an abundance of research aimed at trying to understand, harness and control the technology to solve relevant problems. As a result, as generalist analysts, it's harder to locate information that might poke holes in the approach on the face, or at least shed some light on how difficult it might be for C to develop technology that really does work. On some levels, we are satisfied that they have developed at least some sophisticated (yet practical) knowledge of the phenomenon because they signed (and subsequently renewed) agreements with relevant industry participants who have in fact sold and continue to sell their technology into the marketplace. In our view, that validates the technology and the Company's ability to deliver it. On the other hand, that does not guarantee that they will be able to continue to enhance the technology in ways that will make it applicable to other and perhaps bigger opportunities, which as we have noted, will probably be necessary if they are to achieve profitability and in turn enough success to speak to higher valuations for the Company.

We refer to CTI as a "microcap" but most would put into an even smaller category called a "nanocap". The Company's common shares are not listed on a national exchange and are very thinly traded and as such often include a considerable spread. Investors with limited time horizons and/or limited risk tolerances, should consider those attributes of the shares before contemplating an investment therein.

We have noted that the Company has done an admirable job of limiting additional dilution of the common shares in spite of reporting net losses. There is no assurance they will be able to continue on that path, and in fact, if they are unable to achieve profitability in the future, additional dilution is probably a likely outcome.

We have made the argument that the Company is literally a small handful of people. While that may be good for overhead, it provides particularly acute risks in terms of the Company's reliance on that small handful of people. Specifically, while as we recall, we did meet some of the other principals when we first heard the story almost 10 years ago, our recent interactions with the Company have been limited to Company CFO & COO, Naum ("Neal") D. Voloshin. Perhaps we are overstating this, but for instance, we think losing Mr. Voloshin would be a marked setback for the Company and we suspect that is true of the others on the team as well.

Our model currently lacks visibility. We have made some assumptions about the deployment of reactors and the revenues those might generate that could be substantially overstated. As we illustrated, the Company has had some experience with the notion of licensees/partners not being able to deploy CTI technology as perhaps anticipated and unfortunately, outside of delivering technology that actually works, CTI has little ability to directly impact the adoption of the technology, and they may be in a poor position to negotiate the pricing of the same. That could very well be the case here in which case our projections and associated price targets will almost certainly be overstated. Put another way, while promising (and a good portion of our projections), the frac water opportunity still faces challenges that may mitigate its success.

These are just a few of the more obvious risks associated with CTI. There are almost certainly others we have overlooked, and still others that may not be apparent at this time but are or could be equally precarious.

### **Valuation, Summary and Conclusion**

We recognize this is a small deal. With a market cap around \$6 million, it probably won't be attracting a great deal of institutional interest any time soon. By the way, that might be good or bad depending on how one looks at such things. Inasmuch as we certainly hope that institutions will subscribe to and/or otherwise pick up our

research and use it as a due diligence tool to ultimately own some of the names we write, we tend to view our research as particularly topical to people looking to own some small individual names as a part of a diversified portfolio that can stand/afford the risks and volatility that stocks at this end of the spectrum often entail. In that regard, we fully understand (and we hope our readers do as well) that much of our approach here is to try to identify companies that may be at the front end of a potential valuation catalyst(s) that could make the underlying shares worth multiples of where it is today *on a fundamental basis*. From that *single perspective* it really makes no difference to us what the market cap of the stock is at the time we initiate the coverage. We are just looking for ideas where if a few things go right, we can legitimately defend valuations at multiples of where the stock is today...regardless of where that is. Obviously, we don't make our decision "from a single perspective", but again, given our charter, we don't see any reason to eliminate ideas because they trade with market caps under \$10 million. So here we are.

As we noted, we first heard this story *nearly 10 years ago* at one of our conferences under a prior label. To be clear, that is not particularly atypical for us, because we have quite a number of names on our radar, or even in our current universe that we have followed for long periods of time. We originally initiated research of current coverage stock Pure Cycle Corporation (NasdaqCM: PCYO, \$10.11) under a prior label *in 2005*. Some of these names are hard to shake, especially when they underperform but you still feel like your underlying thesis is intact.

That is our general observation about CTI. We realize things haven't worked out as they planned when we first heard the story in 2010 but much of it remains intact, including that original reference customer. the technology is still relevant, they have new potential opportunities emerging for the platform and management has somehow persevered and kept the balls in the air long enough to get to this point of potential inflection. Further, the business model as it exists today, does not require large amounts of overhead, so they are within a few additional pieces of (visible) business from operating profitably. The question now is, "can they add some of those pieces to achieve meaningful and sustainable profitability that supports measurably higher valuations"? We don't know the answer to that with any certainty, but there are a few things we do know.

Let's start with the "10,000 foot view". We know cavitation is a recognized and generally understood phenomenon. That is, they are not building the technology around some theory that no one else seems to understand. We have seen our share of technology stories that appear to rely on a thesis that defies the laws of physics or chemistry or both, so that statement does not go without saying. Cavitation is accepted science, although it is perhaps more recognized for its destructive attributes, but it is not "voodoo". The trick (for CTI, and a small handful of others also working on it) has been to figure out how to harness, regulate and deliver the phenomenon in applications and/or platforms that solve real world problems. Further, those applications/platforms must be able to be delivered and maintained economically and must be able to be duplicated, scaled and operated on a consistent and reliable basis. By the way, when they are done figuring all of that out, they also need to be able to sell it into markets that may not be amenable to "change". That is a tall order for a small undercapitalized company with a handful of employees, but the fact is, CTI *has* developed cavitation based technology that is used today and continues to be sold by its large partner Desmet Ballestra. The technology works. It solves real world problems. They can deliver it economically. It can be scaled. It can be duplicated. The technology operates on a consistent and reliable basis in edible oil plants across the globe. This is not about whether or not they can make the technology "work". They have already crossed that bridge. This is about whether or not they can create additional adoption for the technology either by enhancing current relationships (which has been difficult) or by creating new applications for new industries and getting more oars in the water.

In 2016, the Company realized that outside of creating an in-house sales support staff, which it did not have the resources to create, it had very little ability to impact or support the sales (or development) efforts of its two licensees, Desmet Ballestra and GEA. After apparently realizing that waiting for a phone call from their licensees was not a particularly fruitful strategy, the Company began trying to identify other applications of the technology that they believed they could develop within the confines of their resource constraints. That is, they needed to find

some opportunities they could develop with their existing infrastructure as opposed to hiring a new layer of R&D staff. The opportunities we have discussed above are the results of (some of) those efforts. We believe there may be others as well. To reiterate, as we understand it, they have been in the process of establishing and developing these opportunities for some time now and our assessment here is that they may be at the forefront of the commercialization of one (fracwater treatment) or more (Alchemy Beverages) of these. *If that is the case*, we think our assumptions regarding higher valuations for the stock will prove valid.

Recognize, we are modeling what we view as moderate success on the fracwater side. We are comfortable doing that because we know they recently sold an LPN reactor designed specifically for fracwater. That does not mean they will necessarily sell more of them nor does it mean they will absolutely collect recurring revenues from treated water, but we think they will. The degree of accuracy of that statement will determine the success of our projections. Again, we don't think we are making unreasonable assumptions regarding the amount of produced water we think they could treat or the amount they might collect for doing so. To reiterate, both of those metrics were gleaned from our discussion with management, but really amounted to some broad assessments by them. In other words, management does not know the actual minutia of the initial treatment opportunity, so obviously neither do we, but again, we think the assumptions are reasonable. We would add, as we understand it, the 200 gpm fracwater reactor is performing as the Company anticipated.

The above said, in spite of having some visibility into Alchemy Beverages, (including their Advisory Board, which includes Rob Mondavi) *we have not modeled any contribution from this arrangement* even though we think it could make contributions beginning early 2020. We will assess this as visibility improves, but again, we see this as another potential leg up in the stock. Also, we are not sure we have provided sufficient ink to this opportunity, so if it's not apparent, we think it has the potential to be quite successful. To reiterate, aside from royalties, system sales and other revenue line items, CTI owns nearly 20% of ABI. In our view, it is not unthinkable to imagine that 12 months from now, CTI's "share" of ABI could be worth more than the current market cap of CTI.

As discussed, we also believe the Company is developing other technologies in renewable fuels and other related areas. These may also provide future catalysts for the stock.

Succinctly, the Company has spent a considerable amount of time as well as money getting here. That does not mean they spent all of that diligently, but in our view, they have developed a considerable amount of IP (22 issued and 7 pending patents) for a Company with a \$6 million market cap. IP aside, there appears to be a fair amount of disappointment in the investment community with the results to this point and that may sum up the opportunity we see here as well as anything.

Lastly, we think it is worth mentioning that in our view, the Company needs to seriously consider a reverse split. We recognize that is a dirty word to some and as such should probably be viewed as a risk in the name for those concerned about such things (provided the Company actually takes our advice in that regard). We think it is an accounting nuance that has been given a bad rap because of the confusion between correlation and causality, but that is just our view. The point is, the capitalization needs to be congruent with the operating levels of the enterprise. CTI is a good example of that. To translate, the small operating levels of the business don't "fit" the shares outstanding, so a robust increase in net income can be reflected as "flat" on an eps basis. We think that scenario mitigates the value of eps comparisons. We hope they will consider our view in that regard in spite of the likely protests from others.

To conclude, we recognize the Company has struggled to grow the business and ultimately break into profitability. We submit, they are not there yet, and our assessments about them getting there may be premature. However, as we alluded to, when we consider what we see as progress and underlying value in the context of the modest market cap, we think there may be a compelling risk/reward emerging in the story. As a result, we are initiating coverage of Cavitation Technologies, Inc. with an allocation of 4 and a 12-24 month price target of \$.10 per share. We will assess all of our assumptions as additional visibility becomes available.

## Projected Operating Model

| Cavitation Technology, Inc.                            |              |              |             |              |              |              |             |             |             |              |              |
|--|--------------|--------------|-------------|--------------|--------------|--------------|-------------|-------------|-------------|--------------|--------------|
| Projected Operating Model                              |              |              |             |              |              |              |             |             |             |              |              |
| Prepared by Trickle Research                           |              |              |             |              |              |              |             |             |             |              |              |
|  | (actual)     | (actual)     | (actual)    | (Estimate)   | (Estimate)   | (Estimate)   | (Estimate)  | (Estimate)  | (Estimate)  | (Estimate)   | (Estimate)   |
|  | 9/30/18      | 12/31/18     | 3/31/19     | 6/30/19      | Fiscal 2019  | 9/30/19      | 12/31/19    | 3/31/20     | 6/30/20     | Fiscal 2020  | Fiscal 2021  |
| <b>Income Statement</b>                                |              |              |             |              |              |              |             |             |             |              |              |
| Revenue  | \$ 55,000    | \$353,000    | \$ 252,000  | \$ 280,000   | \$ 940,000   | \$ 286,485   | \$ 357,255  | \$ 511,597  | \$ 665,938  | \$ 1,821,274 | \$ 4,464,314 |
| Cost of revenue  | 5,000        | 2,000        | 14,000      | \$ 25,200    | \$ 46,200    | \$ 25,459    | \$ 28,290   | \$ 34,464   | \$ 40,638   | \$ 128,851   | \$ 234,573   |
| Gross profit   | 50,000       | 351,000      | 238,000     | \$ 254,800   | \$ 893,800   | \$ 261,025   | \$ 328,965  | \$ 477,133  | \$ 625,301  | \$ 1,692,423 | \$ 4,229,741 |
| General and administrative expenses                    | 304,000      | 785,000      | 250,000     | \$ 389,000   | \$ 1,728,000 | \$ 389,324   | \$ 392,863  | \$ 400,580  | \$ 408,297  | \$ 1,591,064 | \$ 1,723,216 |
| Research and development expenses                      | 2,000        | 6,000        | 11,000      | \$ 16,786    | \$ 35,786    | \$ 17,558    | \$ 18,330   | \$ 19,230   | \$ 20,130   | \$ 75,248    | \$ 87,017    |
| Total operating expenses                               | 306,000      | 791,000      | 261,000     | \$ 405,786   | \$ 1,763,786 | \$ 406,882   | \$ 411,192  | \$ 419,810  | \$ 428,427  | \$ 1,666,312 | \$ 1,810,232 |
| Loss from Operations                                   | \$ (256,000) |              | (23,000)    | \$ (150,986) | \$ (429,986) | \$ (145,857) | \$ (82,228) | \$ 57,323   | \$ 196,874  | \$ 26,112    | \$ 2,419,509 |
| Gain on settlement of debt                             |              | \$ -         | \$ -        | \$ -         | \$ -         | \$ -         | \$ -        | \$ -        | \$ -        | \$ -         | \$ -         |
| Other expense, net                                     |              |              |             | \$ -         | \$ -         | \$ -         | \$ -        | \$ -        | \$ -        | \$ -         | \$ -         |
| Other income   |              | \$ -         | \$ -        | \$ -         | \$ -         | \$ -         | \$ -        | \$ -        | \$ -        | \$ -         | \$ -         |
| Taxable Income   | \$ -         |              |             | \$ (150,986) | \$ (150,986) | \$ (145,857) | \$ (82,228) | \$ 57,323   | \$ 196,874  | \$ 26,112    | \$ 2,419,509 |
| Income Tax Expense                                     | \$ -         |              |             | \$ -         | \$ -         | \$ -         | \$ -        | \$ -        | \$ -        | \$ -         | \$ -         |
| Net Loss   | \$ (256,000) | \$ (440,000) | \$ (23,000) | \$ (150,986) | \$ (869,986) | \$ (145,857) | \$ (82,228) | \$ 57,323   | \$ 196,874  | \$ 26,112    | \$ 2,419,509 |
| Net loss per share, Basic and Diluted                  | \$ (0.00)    | \$ (0.00)    | \$ (0.00)   | \$ (0.001)   | \$ (0.004)   | \$ (0.001)   | \$ (0.000)  | \$ 0.000    | \$ 0.001    | \$ 0.000     | \$ 0.012     |
| Weighted average shares outstanding, Basic and Diluted | 196,797,906  | 196,997,906  | 196,997,906 | 197,097,906  | 196,972,906  | 197,197,906  | 197,297,907 | 197,397,909 | 198,597,912 | 197,622,909  | 201,347,912  |

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## **Rating System Overview:**

There are no letters in the rating system (Buy, Sell Hold), only numbers. The numbers range from 1 to 10, with 1 representing 1 "investment unit" (for my performance purposes, 1 "investment unit" equals \$250) and 10 representing 10 investment units or \$2,500. Obviously, a rating of 10 would suggest that I favor the stock (at respective/current levels) more than a stock with a rating of 1. As a guideline, here is a suggestion on how to use the allocation system.

Our belief at Trickle is that the best way to participate in the micro-cap/small cap space is by employing a diversified strategy. In simple terms, that means you are generally best off owning a number of issues rather than just two or three. To that point, our goal is to have at least 20 companies under coverage at any point in time, so let's use that as a guideline. Hypothetically, if you think you would like to commit \$25,000 to buying micro-cap stocks, that would assume an investment of \$1000 per stock (using the diversification approach we just mentioned, and the 20-stock coverage list we suggested and leaving some room to add to positions around allocation upgrades. We generally start initial coverage stocks with an allocation of 4. Thus, at \$1000 invested per stock and a typical starting allocation of 4, your "investment unit" would be the same \$250 we used in the example above. Thus, if we initiate a stock at a 4, you might consider putting \$1000 into the position ( $\$250 * 4$ ). If we later raise the allocation to 6, you might consider adding two additional units or \$500 to the position. If we then reduce the allocation from 6 to 4 you might consider selling whatever number of shares you purchased with 2 of the original 4 investment units. Again, this is just a suggestion as to how you might be able to use the allocation system to manage your portfolio.

**For those attached to more traditional rating systems (Buy, Sell, Hold) we would submit the following guidelines.**

**A Trickle rating of 1 thru 3 would best correspond to a "Speculative Buy" although we would caution that a rating in that range should not assume that the stock is necessarily riskier than a stock with a higher rating. It may carry a lower rating because the stock is trading closer to a price target we are unwilling to raise at that point. This by the way applies to all of our ratings.**

**A Trickle rating of 4 thru 6 might best (although not perfectly) correspond to a standard "Buy" rating.**

**A Trickle rating of 7 thru 10 would best correspond to a "Strong Buy" however, ratings at the higher end of that range would indicate something that we deem as quite extraordinary..... an "Extreme Buy" if you will. You will not see a lot of these.**