

## Tecogen Inc. (TGEN)

Company Report – May 25, 2019

Tecogen Inc. designs, manufactures and sells industrial and commercial CHP (Combined Heat & Power), or cogeneration, systems that produce combinations of electricity, hot water, and air conditioning. It's a well-established Company that has already shipped over 3,000 units, some of which have been operating for more than 35 years.

The market had little reaction to Tecogen's Q1 results. This is to be understood as revenue and gross profits declined, which will generally not attract the attention of new investors not familiar with the Company's story. What is more important though is that Tecogen has set itself up for a lucrative 2019 by shoring up its balance sheet, nearly doubling backlog since the end of 2018 and continuing with plans to market Tecofrost, which will only add to revenues and backlog for 2019 and beyond.

TGEN remains an under-the-radar stock. As the stock price remains fairly steady, existing shareholders can view the first quarter financial statements as one step closer to Tecogen achieving its goal of consistently profitable revenue growth. Its thinly traded nature makes it a prime candidate for a major run towards our target price on positive news or demonstrated profitability.

We reiterate our buy recommendation for Tecogen Inc. with a target price of \$9.41, which is 142% above today's stock price.



- In the United States, cannabis has been approved for sale on a state-by-state basis. Producers that want to participate in close proximity to their target market are often forced to establish growing centers in jurisdictions with high electricity rates.

Access to less-expensive, reliable and uninterrupted power is therefore essential for these growers.

Tecogen's gas-driven Tecochill line is an ideal solution for these greenhouses. The rapid growth of the cannabis sector is expected to continue and contribute to further sales of Tecochill units. In fact, just this week another sale of two Tecochill units to provide cooling for cannabis grow rooms was announced.



Market Data	
Price	\$3.88
Sector	Technology
52-Week Price Range	\$2.94 - \$4.20
Shares Issued (m)	24.83
Market Cap (m)	\$96.34
Listings	TGEN (US) & 2T1 (Fra)
Website	<a href="http://www.tecogen.com">www.tecogen.com</a>

## THE COMPANY

Tecogen designs, manufactures and sells industrial and commercial cogeneration systems that produce combinations of electricity, hot water, and air conditioning using engines that have been specially adapted to run on natural gas. This technology is called cogeneration, or Combined Heat and Power (CHP).

Cogeneration systems are efficient because they drive compressors or electric generators, which reduce the amount of electricity purchased from the utility. They then use the engine's waste heat for water heating, space heating, and/or air conditioning at the customer's building, vastly improving fuel efficiency.

The main drivers for end users to opt for a CHP system are a significant reduction in energy costs, fuel efficiency, emissions reduction, the availability of government incentives, zero capital outlay options (see revenue sources), backup power generation and Microgrid capabilities that allow for participation in demand response and load shaving incentive programs.

Existing customers of CHP systems include hospitals and nursing homes, colleges and universities, health clubs and spas, hotels and motels, office and retail buildings, food and beverage processors, multi-unit residential buildings, commercial laundry facilities, ice rinks, swimming pools, factories, municipal buildings, and greenhouses.

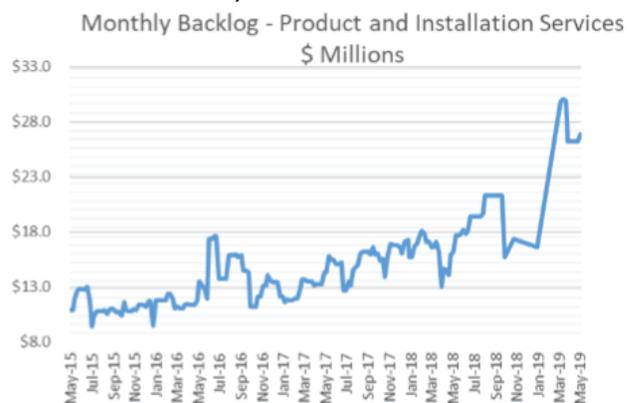
**Tecogen is a well-established and respected Company in the industry. It has shipped over 3,000 units so far, some of which have been operating for almost 25 years.**

Tecogen announced first quarter revenues of \$8,176,631, a decline of 19.7% from \$10,175,427 for the same period in 2018. Gross profit declined 22.9% from \$3,837,803 to \$2,958,759. The investment community never wants to see declining year-over-year revenues; however, in the context of recently announced contracts, growing backlog and the reintroduction of Tecofrost, shareholders

can look forward to growth in the remaining three quarters of 2019.

Despite the drop in revenue, adjusted EBITDA and working capital both significantly improved for Q1 2019 with the Company generating a record amount of cash flow. Moreover, backlog was \$26 million at the end of the first quarter of 2019 and stood at \$26.9 million as of May 13, 2019. This compares quite favorably to the backlog of \$16.6 million at the end of 2018.

Note that the backlog does not include recurring service contract revenues, nor does it include ADG's estimated undiscounted future energy production revenue, which exceeds \$50 million, stretching over the next 15 years. It also does not include any sales of the Company's Tecofrost product that will be re-launched this year.



**Tecogen's spike in backlog is largely due to two of the most significant contracts the Company has signed to-date occurring over the last two months.**

During the quarter, Tecogen sold eight energy producing assets, which were originally purchased as part of the American DG acquisition, for \$7 million. This resulted in a combined gain on sale of assets of \$1,081,049 and cash proceeds from the sale of \$5 million. Shoring up the balance sheet is imperative so that the Company can move forward in fulfilling its recently signed contracts, while simultaneously spending on R&D to introduce new product lines.

Benjamin Locke, CEO of Tecogen commented, "While we are disappointed with the drop in overall revenues, the first quarter saw good progress in terms of positioning the Company for future growth. The sale of some of our

ADG assets in the quarter significantly strengthened our balance sheet by eliminating our debt and providing working capital to meet our goals. With sales of our Tecofrost product expected to start in the second half of the year, we are excited to see further market attraction to our chiller products as well as our core CHP products. In combination with promising results from our Ultra emissions technology, we are excited for our prospects for the rest of the year."

The Company's products are sold directly to end-users by its own sales team and by established sales agents and representatives, who are compensated by commissions. Various agreements are in place with distributors and outside sales representatives for certain territories and product lines.

Tecogen is supported by an established network of engineering, sales, and service personnel across the United States.

As of year-end 2018, Tecogen had 92 full-time employees and 5 part-time employees, including 8 sales and marketing personnel and 43 service personnel.

## Revenue Sources

Tecogen manufactures, sells, installs, and maintains the following types of products:

- Combined Heat and Power (CHP) units that supply electricity and hot water;
- Chillers that provide air-conditioning and hot water;
- Tecofrost units that provide refrigeration with a natural gas driven engine;
- High-efficiency water heaters; and
- Ultra, a muffler-like kit that dramatically reduces a natural gas powered engine's harmful emissions such as NOx, CO, and hydrocarbons.

Moreover, in 2017, Tecogen added another important revenue source, as the Company acquired American DG Energy, which distributes, owns and operates natural gas powered cogeneration systems that produce electricity, hot water, heat and cooling. ADGE's business model is to own the equipment that it installs at customers' facilities and to sell the energy produced by these systems to the customer under long-

term contracts at prices guaranteed to the customer to be below conventional utility rates.

Consequently, bringing American DG under the Tecogen umbrella allowed the latter to offer a cost-free-installation option to customers without access to financing, sufficient capital on hand, or for those who may not be interested in owning and maintaining the equipment.

It is noteworthy that since the acquisition of ADG, approximately half of Tecogen's annual revenue is being derived from stable, long-term contracted sources. This revenue base provides a reliable funding source for both operating expense and growth initiatives, while also making Tecogen's revenue profile more predictable, as the revenue volatility caused by somewhat cyclical equipment sales and installations is reduced.

The transaction has created a vertically integrated clean technology company with 84 installed energy systems that are able to offer equipment design, manufacturing, installation, financing, and long-term maintenance service (Also read Balance Sheet).

## Case Study – Toren Tower

The Company's business model, and its benefits for all parties involved, will become perfectly clear on the basis of a case study.

Toren is an iconic skyscraper that forever changed downtown Brooklyn. The 37 story building offers 240 condominium homes with breathtaking floor-to-ceiling views of the Manhattan skyline and New York Harbor as well as the opportunity to live in the most environmentally advanced high-rise residential building in New York, perhaps even in the U.S.

Toren uses five Tecogen InVerde 100kW cogeneration modules, located on-site, to meet much of the building's energy needs.

The cogen modules provide electricity, while the waste heat they produce is recovered and used to heat interior spaces, provide domestic

hot water, heat the pool and even run the air conditioning.

That way, the remarkably efficient cogeneration system reduces Toren's carbon footprint by more than 2000 tons of CO<sub>2</sub> each year while providing annual cost savings of \$540,000.

Toren's CHP plant is designed to automatically follow the building's electric demand. As demand for electricity increases and decreases within the building, the electrical output from each of the five CHP modules will also increase and decrease.

Thanks to highly sophisticated load control software built into each unit, the amount of electricity being purchased from Consolidated Edison, the electric utility in Brooklyn, can be held to less than 20kW.

Another innovative and very desirable feature of Toren's cogen system is that it is a "Microgrid" with the ability to run independent from the grid in "Island Mode", providing power for the building if New York City should ever experience a blackout like the one in 2003.

## Government Regulations

Several kinds of government regulations affect the Company's current and future business, such as:

- ❑ Air pollution regulations, which govern the emissions allowed in engine exhaust;
- ❑ State and federal incentives for CHP technology; and
- ❑ Electric utility pricing and related regulations.

Strict regulations that control **air quality and greenhouse gases** increasingly favor Tecogen's low-emission products. In some states that have strict emissions regulations, such as California, the pollution from natural gas engines presents a challenge.

However, the development of the Ultra low-emissions technology has addressed this issue. In January 2013, a state-certified source test at a customer's site verified that emissions levels of a CHP unit equipped with

the Ultra technology, were well below the new permitting requirements.

In addition, there are currently 23 states that recognize CHP as part of their Renewable Portfolio Standards. New York and New Jersey, for example, have **incentive programs** that rebate a significant portion of the CHP project cost.

Similar incentive programs also exist in Massachusetts, Rhode Island, and Maryland albeit with different structures and terms. Massachusetts has an additional CHP incentive in the form of an annual rebate proportional to the carbon savings versus conventional technology.

Finally, the Company is targeting customers in states with **high electricity rates** in the commercial sector, such as California, Connecticut, Massachusetts, New Hampshire, New Jersey, and New York. These regions also have high peak demand rates, which favor utilization of modular units in groups so as to assure redundancy and peak demand savings.

## Nationwide Factory Service

Besides selling machines, which in many cases are one-off deals, Tecogen generates substantial revenue through service contracts. This is a reliable and growing part of the Company's total sales. In fact, more than half of Tecogen's installed units have a service contract.

Most of the service revenue is in the form of annual service contracts. Customers are invoiced based on equipment run-time hours without unforeseen add-ons for such items as unscheduled repairs or engine replacements.

Tecogen offers service support on all its CHP products nationwide through a network of ten service centers spread all over the United States. These centers are staffed by full-time Tecogen technicians and have been an essential part of Tecogen's growth and success through the years, as good factory support from Tecogen allows its customers to focus on their core missions and businesses.

In September 2018, the Company opened its 10<sup>th</sup> service center in Tampa, Florida, which

will provide service for Tecogen’s growing fleet of equipment and installations in the Southeast portion of the United States.

## Competition

Tecogen’s products fall into the broad market category of distributed generation systems that produce electric power on-site to mitigate the drawbacks of traditional central power and the low efficiency of conventional heating processes.

The Company’s CHP products use reciprocating engines originally designed for gasoline fuel that are modified to run on natural gas. Although gas-fueled CHP units are relatively common, Tecogen is confident that no other company has developed a product that competes with its inverter-based InVerde e+ CHP, which is highly efficient, facilitates battery or solar array integration, and is compliant with the NFPA 110 standard for emergency and standby power systems.

If competitors wanted to develop a similar product, development time and costs would be significant. In addition, certain Tecogen patents and licenses for microgrid software would prevent others from offering certain important functions.

## Strengthening Patent Portfolio

Tecogen holds several patents that protect both its technology and specific methods of use. More importantly, the Company’s patent portfolio continues to expand rapidly.

In June of 2018, for example, the Company obtained patent protection for its Ultera system in Japan. And in May of this year, Tecogen was notified that the European Patent Office intends to grant a patent for the Company’s Ultera emissions technology. This patent will give Tecogen exclusive control over the Ultera technology in Europe when it files for national protection in countries such as the United Kingdom, Ireland, France, and Germany.

Next to Europe, Tecogen has also filed for, or been granted, patents for this technology in Australia, Brazil, Canada, China, Costa Rica,

Dominican Republic, India, Japan, Mexico, New Zealand, Republic of Korea, Singapore, and South Africa.

## TECHNOLOGY

Combined Heat & Power (CHP) is truly a way to get “two for the price of one”. It produces the electricity or cooling power that a customer needs, and it captures much of the thermal energy that is normally lost during the energy conversion into power.

With CHP, the “waste” thermal energy gets captured and put to good use on site, for heating water or building spaces.

Following is an overview of the three types of CHP systems that Tecogen offers. Also, the highly efficient Ultera system that makes CHPs meet the most stringent emissions standards is described in more detail below.

### Combined Heat and Power

Tecogen’s premier cogeneration product is the InVerde e+ CHP system. The revolutionary unit combines the best technologies in the field and features a unique set of proprietary innovations.



**Four InVerde CHPs on their way to a new customer.**

The InVerde incorporates an inverter, which converts direct current, or DC, electricity to alternating current, or AC. With an inverter, the engine and generator can run at variable speeds, which maximizes efficiency at varying loads. The inverter then converts the generator’s variable output to the constant-frequency power required by customers (50 or 60 Hertz).

Thanks to the cutting-edge inverter technology, an innovative power control, and

a new and improved engine, the InVerde e+ reaches an electrical efficiency of 33%, while its nearest competitor achieves efficiencies between 27 and 29 percent.

Note that this efficiency only refers to the produced electricity and does not take into account the harvested heat to produce thermal energy. With heat recovery a Tecogen CHP system can achieve an overall efficiency of 80 to 90 percent.

The DC input capability, facilitating battery or solar array integration, is another huge innovation. It allows for a seamless transfer of energy between the CHP unit, other energy generators, such solar panels, windmills, and backup batteries, eliminating the need for costly converters.

### **NFPA 110**

The NFPA 110 standard covers performance requirements for emergency and standby power systems providing an alternate source of electrical power in buildings and facilities in the event that the normal electrical power source fails. Amongst these requirements is that the backup equipment needs to supply electrical power within 10 seconds of the blackout in order for it to qualify.

Moreover, the InVerde e+ automatically starts up within 10 seconds in the event of a full blackout of the grid, making the CHP compliant with the new strict Type 110 standard for emergency and standby power systems by the National Fire Protection Association (NFPA). This is yet another innovation that very few competitors offer.

This is also the first engine-driven product to carry full UL 1741 Certification for "utility-safe" interconnection. As a result, it does not require any additional permitting for interconnecting to the electric grid, speeding the installation process.

### **Ilios High-Efficiency Water Heaters**

The Ilios high-efficiency water heater operates like an electric heat pump but uses a natural

gas engine instead of an electric motor to power the system.



**The market for Ilios high-efficiency water heaters continues to expand both geographically and into different end-market segments.**

The water heater, uses a heat pump, which captures warmth from outdoor air even if it is moderately cool outside. Heat pumps work somewhat like a refrigerator, but in reverse. Refrigerators extract heat from inside the refrigerator and move it outside the refrigerator. Heat pumps extract heat from outside and move it indoors.

In both cases, fluids move the heat around by flowing through heat exchangers. At various points the fluids are compressed or expanded, which absorbs or releases heat. The gas engine's waste heat is recovered and used in the process, unlike its electric counterpart, which runs on power that has already lost its waste heat.

The net effect is that the efficiency of an Ilios' heat pump far surpasses that of conventional boilers for water heating. This translates directly to lower fuel consumption and, for heavy use customers, significantly lower operating costs. Gas engine heat pumps can deliver efficiencies in excess of 200%.

The Ilios market continues to expand both geographically and into different end-market segments. The high-efficiency water heater is

ideal for locations with a gas demand of at least 4000 Therms/month, such as water parks, swimming pools, hotels, hospitals, apartment buildings and recreation centers.

The Ilios system also attracts customers that consistently have the simultaneous need for heating and cooling, such as manufacturing and R&D type facilities.

## Chillers

TECOCHILL natural gas engine-driven chillers provide building owners with a reliable, proven, efficient, and cost-effective alternative to conventional electric motor-powered chillers. It's the only natural gas engine-driven chiller on the North American market in its size range.

The engine drives a compressor that makes chilled water; while the engine's free waste heat can be recovered to satisfy the building's needs for hot water or heating. This process is sometimes referred to as "mechanical" cogeneration, as it generates no electrical power, and the equipment does not have to be connected to the utility grid.

A TECOCHILL's benefits are significant. It cuts a building's cooling costs in half, by eliminating most of the electrical demand (kW) associated with providing cooling. In addition, it offers optional "waste" heat that is always available at the same time. This high-quality heat source (up to 230°F hot water) literally comes for free, whenever the chiller is running.

The TECOCHILL chillers are available in capacities ranging from 25 to 400 tons, with the smaller units air-cooled and the larger ones water-cooled. They are ideal in facilities where new chilling capacity is desired, as replacements for aging electric chilling equipment, where the local electric utility's kW demand charges are high, or where the site's electrical capacity is limited.

Basically, they make sense wherever large chillers are needed, including hospitals, colleges, schools, office buildings, aquariums, government buildings, large residential facilities, industrial facilities, hotels, and ice rinks.

## Tecofrost

Tecogen has recently relaunched its Tecofrost chiller. Unlike Tecochill, the Tecofrost product is meant for industrial ammonia refrigeration systems typically found in manufacturing facilities, such as dairy operations, meatpacking, bottling facilities, food processing and cold storage facilities.

The Tecochill product, which circulates chilled water or directly chilled air, is not an ideal fit for these applications, as ammonia is much more efficient. On the other hand, a Tecofrost unit can't be used in hotels, schools, or commercial buildings, as ammonia posed a safety hazard.



**Tecofrost is perfect for a wide range of applications, including cold food storage, ice production, food processors, breweries, etc.**

Refrigeration plants have extremely large electrical demand and usage loads. In many application's this load peaks in the daytime and summer, the same periods when electricity is the most expensive and natural gas supply is the most abundant. By reducing the refrigeration plant's electric demand and usage during these periods, owners can save significantly in their total energy costs through the entire year.

The original Tecofrost product line was discontinued in the early 2000s due to high gas prices, but the resurgence in gas availability, combined with continued electric grid escalation, particularly on the demand component of electric grids, makes Tecofrost an excellent product to reintroduce given the

strong market pull. In fact, in many regions, the total cost of meeting refrigeration load by natural gas is substantially less than the cost of using electricity.

An important aspect to this product reboot is Tecogen's ability to work with its previous compressor manufacturing partner Vilter Manufacturing to jointly bring the products to market. The major advantage of again working together with Vilter Manufacturing is that all the product engineering, manufacturing data, testing, operation and maintenance are already in place. This minimizes cost and the timeframe to re-launch the product.

Maximum savings can be realized by utilizing the heat generated by the engine jacket and exhaust gas. Recovered heat can be used for space heating, domestic hot water, boiler feed water preheating, or process applications. Nearly one-half of the engine's fuel consumption can be recovered through this waste heat and is available up to 225°F.

## Ultra

In 2008 there was a dramatic change in the air quality regulations for distributed electricity generation in Southern California. At that time no technology could enable engine-driven generators to meet the new, stricter, emission standards. In reaction to the new regulations, Tecogen developed the Ultra technology.

Tecogen decided to look at the chemistry of emissions instead of the mechanical controls of the engine to simultaneously get rid of NOx compounds, CO and hydrocarbons. They broke the catalyst process into two steps and ran each step at a different temperature.

By controlling the temperature in the first stage, the system could achieve very low NOx emissions. In a second stage process the remaining pollutants were oxidized by injecting some air between the first and second stages and altering the process conditions.

In 2012, a 75 kW CHP unit equipped with the Ultra system became the first unit to obtain

a conditional air permit in Southern California since the strict regulations went into place in 2009. A state-certified source test, administered in January 2013, verified that the emissions levels of the system were well below the new permitting requirements, and the final permit version was approved in August 2013.

**The Ultra retrofit kits deliver simple, cost-effective and robust solutions for meeting even the most stringent emissions standards. The patented system provides peace of mind to its customers by lowering NOx and CO to near-zero levels without the need for complex additional controls or frequent maintenance.**

## GROWTH DRIVERS

### Ultra Applications With Tremendous Potential

Tecogen's current success is in part based on its exceptional emissions control technology called Ultra. This is a muffler-like kit that dramatically reduces a **natural gas powered engine's** harmful emissions such as NOx, CO, and hydrocarbons. Since 2012, the Ultra technology has been installed on hundreds of cogeneration systems and functions impeccably.

Following that achievement, Tecogen has been developing a number of applications for its Ultra technology with tremendous blue-sky potential.

In December 2015, following the outbreak of the Volkswagen emissions scandal, Tecogen initiated a program to adapt the Ultra technology to **gasoline fueled automotive engines**. The prospect of vehicle engines realizing fuel cell like emissions is tremendously compelling from a policy and market standpoint.

Two phases of testing conducted since at the world-renowned AVL California Technical, showed that Ultra was highly successful in reducing emissions of carbon monoxide (CO) and non-methane hydrocarbons (NMOG).

Subsequently, Tecogen entered into an agreement with a leading not-for-profit research and development organization with globally recognized expertise in vehicle powertrain development, including emissions after-treatment processes. The goal of this first phase is to optimize the chemistry and design of the second stage of the Ultra two-stage catalyst system.

The organization is performing the first phase of a three-phase program that will ultimately lead to Tecogen's goal of creating a working prototype of the Ultra system that is fully integrated into a vehicle.

This will enable potential partners in the automobile industry to have confidence in their evaluation, especially regarding cost, space and reliability. Tecogen is funding this initial phase. For the following phases, which will focus on component development, followed by completion and testing of the refined prototype, Tecogen may seek external financiers.

Additionally, in the first quarter of 2017, Tecogen began a research program, funded by the Propane Education and Research Council (PERC), to demonstrate the effectiveness of the Ultra emissions systems on **propane fueled fork trucks**.

The project has significant potential for the industry, as these vehicles generally operate indoors, where health concerns are magnified. In recent years, the market share for propane fork trucks has been eroded, while battery-operated versions have taken over, mainly because of this issue.

Given these regulatory market drivers, the Company secured a commitment from Mitsubishi Caterpillar, a major fork truck company, to support the Tecogen engineering team and to supply a fork truck for testing. The initial results from these tests were superb.

During a heavy lift test, the truck was subjected to 20 repeated lifts in a 12-minute period. This was a strenuous duty cycle as the weight, 4,300 pounds, was close to the 5,000 pound rating of the truck. Both Tecogen and a

third party lab conducted this test with comparable results.



**The test results of the Mitsubishi Caterpillar forklift truck are consistent with the program goal of near-zero certification.**

As shown in the table, the Ultra reduced Carbon monoxide (CO) emissions with 99% and 91% respectively. Total hydrocarbons (THC) emissions were reduced by over 52% according to the third-party, while Tecogen instrumentation wasn't able to measure this pollutant. The Ultra also improved nitrogen oxides (NOx) emissions by 24% and 29% as measured by Tecogen instruments and that of the third party, respectively. This proves again that the Ultra technology is flexible and adaptable.

	<b>Tecogen</b>	<b>Third Party</b>
CO	98.8%	91.0%
THC	N/A	52.1%
NOx	24.3%	29.2%
<b>Emission reductions achieved during heavy lift tests were confirmed by an independent third party.</b>		

Further tests have shown that the reduced NOx and CO emissions qualify the system for near-zero certification. The next step would in fact be to conduct official tests on a dynamometer in a properly equipped laboratory to successfully achieve the near zero certification.

This may then result in a small fleet of fork trucks being upgraded with an Ultra to further demonstrate its benefits over a longer period of time as the fork trucks go through their daily activities. From that point on, the program really has a clear path to commercialization.

Finally, in 2018, the South Coast Air Quality Management District (SCAQMD) reset its Best

Available Control Technology (BACT) Guideline for **stationary non-emergency electrical generators** powered by a spark-ignition internal combustion engine to be consistent with its Rule 1110.2 emissions standard.

SCAQMD covers the Los Angeles Basin, extends eastward to within a few miles of the Arizona border, and represents almost half of the state's population. To date, Ultera is the only known technology that enables rich-burn engines to comply with the rule.

Tecogen's application has the potential to serve an emerging need in the region where there are dispersed loads in terrain that is vulnerable to woodland and brush fires. The hazard is most acute when high winds sever overhead power lines. The generators are then used to mitigate this problem by allowing overhead power lines in vulnerable areas to be de-energized during periods of high winds, with the dispersed loads powered by the generators located close to the load centers. Expected annual operating hours for generators used in this way exceed the 200-hour limit for which strict emissions standards are waived.

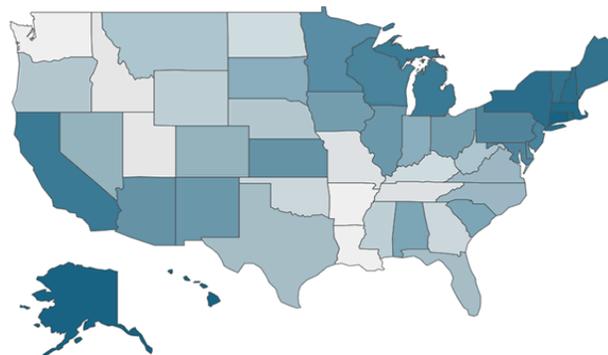
This application is significant given that Ultera equipped generators could cost effectively serve this need for utilities operating in areas of significant fire risk. The Ultera process works particularly well in this application as it is relatively inexpensive and requires no onsite chemical storage as is the case for some emission control systems used in distributed generation applications.

### Cannabis Becomes Key Industry for Tecogen

In recent quarters, Tecogen has emerged as a premier supplier to the cannabis market due to the comprehensive natural gas powered chiller systems the Company has developed which provide cooling while also achieving superb energy efficiency, reduced pollution output, high reliability, and certified performance.

The Tecochill product not only delivers substantial energy savings over electric cooling systems, but also accomplishes

significant greenhouse gas (GHG) savings compared to traditional forms of heating and cooling similar facilities which typically use grid-powered electric chillers and boilers. At one facility, where two Tecochill DTx 400-ton units were installed, the chillers are expected to reduce GHG emissions by upwards of 1,000 tons of CO<sub>2</sub>/year.



**States where cannabis is legalized with a large population and high electricity rates are ideal for Tecogen's Tecochill chillers. States with some of the highest electricity rates are: Hawaii, Alaska, Connecticut, Rhode Island, Massachusetts, New Hampshire, and New York (dark blue on the map).**

This excellent performance is contributing to rapid growth for the Company, and a new sales record was achieved in 2018 for Tecochill products with more than half of that growth driven by demand from the indoor cannabis cultivation subsector. The successful trend continues into 2019, as the Company has announced several more sales in the indoor growing area.

The energy savings and infrastructure simplification of using the Tecochill product is becoming standard practice when engineering cannabis or other high value indoor growing crops. Tecogen's nationwide service presence and cloud-based remote monitoring capabilities ensure rapid response to critical process cooling customers such as indoor agriculture facilities.

## RECENT EVENTS

### Tecogen Wins 1 MW Cogeneration Project in NYC

In May 2019, Tecogen won an order for eight interconnected InVerde e+ cogeneration modules with a capacity upwards of 1 MW for

a large residential building under construction in New York City. The system will be installed on the roof of the building and will substantially reduce the required electric infrastructure needed for the building operation. In the case of a grid outage, the system will continue to provide emergency power to the building, eliminating the need for additional standby generators.

The Tecogen solution was selected over larger cogeneration units which rely on synchronous generator technology. Synchronous generators often face complexities and high costs associated with grid interconnection. Tecogen's integral UL 1741SA certified inverter was developed specifically to allow a streamlined interconnect process, significantly reducing scheduling and costs associated with utility permitting.

"We are continuing to see strong demand for our InVerde microgrid-enabled systems for large buildings that benefit from a modular approach to cogeneration," stated Benjamin Locke, Tecogen's CEO. "The unmatched performance, environmental benefits, and streamlined utility interconnection of our InVerde system, along with Tecogen's large service presence in the greater New York City area, were primary considerations in the selection process. Our ability to run during a grid outage was also an important consideration as resiliency concerns in the city are becoming more important for residents."

Tecogen will deliver the eight cogeneration units in late 2019, with building completion and system startup expected in 2020. The project includes a five year service contract on all of the cogeneration units.

### Tecogen Signs Its Largest Contract To-Date

In February 2019, Tecogen signed an \$8.4 million contract for Turnkey Engineering, Procurement, and Construction Services to install a one MW trigeneration plant at a data center in New York City.

This agreement is the largest contract the Company has procured to-date and it calls for Tecogen to install, commission and provide

operations and maintenance services for multiple InVerde Combined Heat and Power (CHP) systems and an absorption chilling plant to be installed at the data center. The system will also provide backup power to the complex in the event of a grid outage.

We have previously spoken about Tecogen's business developments in the cannabis industry, where efficient power and climate control are imperative for maximizing crop yields. The data center business is yet another burgeoning industry experiencing heavy growth for which temperature control is vital to operations. This contract is important not only as the largest one to-date but it also gives Tecogen a chance to showcase its technology to this high-growth industry. CEO Benjamin Locke even referred to this contract as a "showcase project". If Tecogen's technology is proven successful in saving on utility costs for this one data center, this could lead to more contracts globally.

Another note to take away from this sale is the tremendous interest the Company is seeing for its products in dense, space-limited areas like Manhattan. Due to population booms in cities, a premium on space and demand for clean and reliable power will be intimately linked. Tecogen has built on its reputation of good quality, efficient clean energy systems for years, and now it is finally paying off as the demand for these products has never been stronger, but will only grow with time.

### Tecogen Secures Another Large Contract in New York City

A couple of weeks after Tecogen procured the largest single contract in its history, it quickly followed up that deal with the announcement of Multiple Turnkey Contracts with a Luxury Apartment Building Owner in New York. Tecogen will install, commission and provide complete maintenance services for seven InVerde CHP systems to be installed in three of the owner's properties. The systems will also provide backup power to the complex in the event of a grid outage. While no revenue numbers were disclosed, it's important to note that the contract includes five years of maintenance on the seven CHP units.

Tecogen operates three service centers in proximity to NYC. This ensures availability of technicians to maintain and service equipment, plus rapid access to parts. The service support on hand for this large urban center is a contributing factor to the large client base in the area.



**Building owners and developers are continuing to invest heavily in improvements to their buildings. Tecogen's CHP systems reduce operating expenses, improve resiliency and increase the value of these properties.**

Dense, space-limited urban areas like New York have high demand for clean and reliable power, especially as energy costs are on the rise. The flexibility of Tecogen's modular approach to its CHP solutions was imperative when procuring this new contract and will continue to be for any future business in the city.

While Tecogen units can only be sold to buildings that can handle the vast amount of energy produced, the most important aspect of Tecogen's sales pitch to landlords is the significant energy cost savings that can be generated, with a secondary benefit of being able to provide reliable power through outages, which improves service to the tenants.

The seven units are projected to exceed \$500,000 in annual savings with a 5-6-year payback for the property owner, based on the analysis of an independent engineering company. These savings, along with State incentive programs that rebate a portion of the CHP project cost, continue to be the driving forces behind Tecogen's success in New York City.

## FINANCIALS

Product revenues in the first quarter of 2019 were \$3,024,526 compared to \$3,673,506 for

the same period in 2018, a decrease of 17.7%. While cogeneration sales increased by 3.1%, chiller sales declined 37% year-over-year. Service revenues in the first quarter of 2019 were \$3,911,296 compared to \$4,719,386 for the same period in 2017, a decrease of 17.1%.

This decline was due to decreased installation activity for the quarter as service maintenance contract revenue grew 2% year-over-year. Energy production revenues in the fourth quarter of 2019 were \$1,240,809, compared to \$1,782,535 for the same period in 2018, a decrease of 30.4%. Energy production revenue represents energy revenues earned during the quarter by the American DG Energy.

Consolidated gross profit for the first quarter of 2019 was \$3,837,803 compared to \$2,958,759 in the first quarter of 2018, a decrease of 22.9% in overall gross profit year-over-year. Overall gross margin for the first quarter of 2019 was 36% compared to 38% for the same period in 2018. Product gross margin improved to 36% for the first quarter of 2019 compared to 34% for the same period in 2018. Overall service gross margin was 37% in the first quarter of 2019, four points lower than 41% for the same period in 2018 due to a decline in margins recognized on installation projects during the quarter. Energy production gross margin remained level at 36% for the first quarter of both 2019 and 2018.

Tecogen's net income for the first quarter of 2019, exclusive of the goodwill impairment of 3,693,198, was \$413,121 compared to \$20,759 for Q1 2018, an firm increase of \$392,362. The Company's operating expenses excluding the goodwill impairment and the gain on sale of asset decreased 2% from \$3,766,897 to \$3,693,747.

This cost containment is impressive considering that R&D expenses rose 14% from \$302,230 to \$345,083 in support of the market roll-out of Tecofrost and continued development of its Ultra emissions technology. Adjusted EBITDA, which excludes non-recurring merger related costs, goodwill impairment, mark to market adjustments and stock compensation expense, more than

doubled from \$303,732 to \$678,086 for Q1. Growth for both net income and EBITDA was driven by the gain on sale of assets of \$1,081,049.

Amounts in \$000's	03/31/19	03/31/18
Product Revenue	3,025	3,674
Service Revenue	3,911	4,719
Energy Revenue	1,241	1,783
<b>Total Revenue</b>	<b>8,177</b>	<b>10,175</b>
Cost of Product Sales	1,943	2,409
Cost of Services Sales	2,475	2,783
Cost of Energy Sales	800	1,146
Total Cost of Sales	5,218	6,338
<b>Gross Profit</b>	<b>2,959</b>	<b>3,838</b>
Operating Expenses	6,306	3,767
<b>Income (Loss) from Operations</b>	<b>(3,347)</b>	<b>71</b>
Total Other Expenses	67	34
<b>Net Income (Loss)</b>	<b>(3,406)</b>	<b>37</b>
Diluted EPS	(0.13)	0.00
Diluted Shares Outs.	24,819	24,881
<b>Selected income statement data for the quarters ending March 31, 2019 and March 31, 2018. Source: Company Filing</b>		

### Balance Sheet as of March 31, 2019

Tecogen significantly improved its working capital and eliminated all debt through the sale of some American DG sites and contracts (see below table).

When comparing the balance sheet ended December 31, 2018 to March 31, 2019, cash and equivalents increased from \$272,552 to \$2,610,235. Total current assets increased from \$26,368,572 to 26,763,765 while total current liabilities decreased from \$13,198,320 to \$10,567,241.

As a result, working capital (current assets less current liabilities) increased over \$3 million from \$13,170,252 to \$16,196,524. This is a record quarter-to-quarter improvement on working capital and cash flow despite the decreased revenues and gross margins.

Improving an already robust working capital figure is important because it further reduces the Company's need to finance in the near future as it fulfills its backlog and introduces new product lines to the market.

Amounts in \$000's	03/31/19	03/31/18
Cash and Cash Eq.	2,610	1,202
Accounts Receivable	11,677	11,791
Inventory	6,668	5,096
Total Current Assets	26,764	23,705
Property & equipment	3,925	12,048
Intangible Assets	1,573	2,948
Goodwill	5,282	13,366
<b>Total Assets</b>	<b>40,405</b>	<b>52,530</b>
Accounts Payable	5,914	6,835
Accrued Expenses	2,223	1,706
Total Current Liabilities	10,567	10,965
Unfavorable Contract Liability	2,870	7,465
<b>Total Liabilities</b>	<b>15,724</b>	<b>18,733</b>
Total Stockholder Equity	24,552	33,348
<b>Selected balance sheet data for March 31, 2019 and March 31, 2018. Source: Company Filing</b>		

In March 2019, Tecogen announced that it strengthened its balance sheet with approximately \$7 million thanks to the sale of eight projects that it obtained when it acquired American DG Energy Inc (ADGE) in May 2017.

The assets were sold to a company managed by the New York office of Sustainable Development Capital, an investment firm with a proven track record of investment in energy efficiency and decentralized generation projects.

At the time when ADGE was acquired, it had 92 installed energy systems, including various models of Tecogen cogeneration units, Tecochill water chillers, and conventional air-conditioning systems. The acquisition was a stock-for-stock transaction, which valued American DG Energy at approximately \$18.8 million.

Tecogen will continue to maintain the equipment and perform invoicing for the energy supplied by the equipment for the duration of the power purchase agreements. These agreements include performance incentives split evenly by both parties for energy savings collections exceeding the minimum collection guarantees in the agreements.

The Company will use the cash generated by the sale to eliminate debt, support growth in strategic product areas, and strengthen the balance sheet.

## OUTLOOK & VALUATION

As previously mentioned, backlog was \$26.9 million as of May 13, 2019, an increase of \$10.3 million from \$16.6 million at the end of 2018. Although this already implies significant revenue growth as at least two-thirds of the backlog is expected to be fulfilled in 2019, this figure does not include any sales from the Company's renewed Tecofrost product.

Tecogen is carefully developing several projects to demonstrate key vertical markets for the product and expects Tecofrost to add a meaningful contribution to the backlog by year-end and ultimately become a solid product revenue contributor next year. Tecogen is already approaching new customers about Tecofrost and expects to install several units before the end of 2019.

Full rollout across the United States is expected next year with plans to leverage the Company's compressor manufacturing partner Vilter Manufacturing's sales networks in the Americas and Europe.

Tecogen now has more than 250 separate microgrid enabled CHP systems online in the US, which amounts to a combined power output of 25MW. Just within the New York City area, several housing complexes already depend on large-scale CHP services provided by Tecogen equipment, and the potential for further expansion is at hand as many other projects are scheduled for refurbishment and renovations in the years ahead. The established benefits and reliability of the InVerde systems will factor into additional sales growth in this city and across the US.

The major contract announcements the past months also validate the advanced technology of the product line that created specific advantages for each client. The Tecogen systems provide operational flexibility, in addition to reliability and lower pollution emissions. All these factors contributed to the choice for each new client to upgrade to

Tecogen products, instead of other options that were considered.

The exponential demand growth for cannabis, and the unique regulatory framework that requires cultivation of the plants within each state where the sales are completed, has led to a rapid increase in the construction of new indoor cultivation centers for cannabis plants. The specific requirements necessary for optimal plant yields and the high energy costs associated with many of the states where these facilities are located, has encouraged cannabis growers to purchase integrated systems developed by Tecogen as the ideal solution for their needs.

As the sales volume increases for equipment, the Company is also securing long term service contracts that will contribute to increased recurring revenues. Combined with a network of service centers, strategically located in many of the largest market centers in the United States, the growth plan for Tecogen is to gain traction on multiple levels. This steady trend of sales growth will continue to support a rising share price for the stock.

### Valuation

Given the still emerging nature of Tecogen's earnings, a multiple-based valuation is challenging. Instead, we apply a Discounted Cash Flow (DCF) model.

Based on our estimate of 26.1 million diluted shares outstanding, the intrinsic value of Tecogen's shares derived from our model is \$9.41.

**We reiterate our buy recommendation for Tecogen Inc. with a target price of \$9.41, which is 142% above today's stock price.**

## SHARE DATA & OWNERSHIP

As of March 31, 2019, Tecogen had 24,829,746 common shares outstanding. In addition, the Company had 1,292,589 stock options outstanding with a weighted average exercise price of \$3.52. Each stock option entitles its holder to purchase one common share of the Company.

The principal owners of the Company's common stock are George Hatsopoulos (11.1%), Monouvoukas Yiannis (10.5%), John Hatsopoulos (9.3%), Joseph Comeau (9.1%), and Tryfon Natsis (6.5%).

## MANAGEMENT

### ▣ **BENJAMIN LOCKE – CHIEF EXECUTIVE OFFICER**

Mr. Locke was named Co-Chief Executive Officer in October, 2014 and sole Chief Executive Officer in March, 2018. He joined Tecogen in June, 2013 as the Director of Corporate Strategy and was promoted to General Manager prior to his appointment as Co-CEO. Previously Mr. Locke was the Director of Business Development and Government Affairs at Metabolix, responsible for developing and executing plans for partnerships, joint ventures, acquisitions, and other strategic arrangements for commercializing profitable clean energy technologies. Mr. Locke has a B.S. in Physics from the University of Massachusetts, an M.S. in Electrical Engineering from Tufts University, and an MBA in Corporate Finance from Boston University.

### ▣ **ROBERT PANORA – CHIEF OPERATIONS OFFICER**

Mr. Panora has served as President of Tecogen since 2000. He had been General Manager of Tecogen's Product Group since 1990 and Manager of Product Development, Engineering Manager, and Operations Manager of the Company since 1984. Over his 27-year tenure with Tecogen, he has been responsible for sales and marketing, engineering, service, and manufacturing. Mr. Panora contributed to the development of Tecogen's first product, the CM-60 cogeneration module, and was Program Manager for the cogeneration and chiller projects that followed. Mr. Panora has B.S. and M.S. degrees in Chemical Engineering from Tufts University.

### ▣ **BONNIE BROWN – CHIEF ACCOUNTING OFFICER**

Ms. Brown served as ADGE's Chief Financial Officer, Treasurer and Secretary since September 2015. From September 2015 to January 2017, Ms. Brown served as Chief Financial Officer, Treasurer, and Secretary of EuroSite Power Inc. Ms. Brown was a Financial Advisor at Barker Financial Group, a strategic wealth management advisement company, from July 2014 to September 2015. From 2009 to December 2014, Ms. Brown served as the Chief Financial Officer of Ilios Inc. She joined Tecogen as its Controller in 2005 and became the Chief Financial Officer in 2007 and remained in that position until December 2014. Prior to 2005, Ms. Brown was a partner at Sullivan Bille PC, a regional accounting firm, for 15 years where she provided financial, accounting, audit, tax, and business consulting services for mid-sized companies.

### ▣ **DR. JOHN N. HATSOPOULOS – CHAIRMAN EMERITUS, DIRECTOR**

Dr. Hatsopoulos was the Chief Executive Officer of the Company since the organization of Tecogen in 2000. Later, he became the co-CEO of the Company next to Benjamin Locke. On March 29, 2018, Mr. John Hatsopoulos resigned as Co-Chief Executive Officer of the Company, making Mr. Locke the sole Chief Executive Officer. Mr. Hatsopoulos will continue to serve as a Director of the Company through the end of his current term. Mr. Hatsopoulos is a co-founder of Thermo Electron Corporation, which is now Thermo Fisher Scientific (NYSE: TMO), and the retired President and Vice Chairman of the Board of Directors of that company. Mr. Hatsopoulos graduated from Athens College in Greece, and holds a bachelor's degree in history and mathematics from Northeastern University, as well as honorary doctorates in business administration from Boston College and Northeastern University.

## ANNUAL INCOME STATEMENT FY 2016 – 3M 2019

All numbers in thousands

PERIOD ENDING	FY 2016	FY 2017	FY 2018	3M 2019
<b>Total Revenue</b>	<b>24,490</b>	<b>33,203</b>	<b>38,884</b>	<b>8,177</b>
Cost of Revenue	15,190	20,248	22,292	5,218
<b>Gross Profit or (Loss)</b>	<b>9,301</b>	<b>12,954</b>	<b>13,592</b>	<b>2,959</b>
<b>Operating Expenses</b>				
General & Administrative	7,994	9,520	10,791	2,655
Selling	1,637	2,272	2,651	693
R&D	667	937	1,298	345
Goodwill Impairment	-	-	4,391	3,693
Total Operating Expenses	10,289	12,729	19,130	6,306
<b>Operating Income or (Loss)</b>	<b>(997)</b>	<b>225</b>	<b>(5,538)</b>	<b>(3,347)</b>
<b>Other Income or (Expense)</b>				
Interest Expense	(176)	(155)	(120)	(28)
Unrealized Gain (Loss) on Investment Securities	-	-	(118)	(39)
Benefit (Provision) for State Income Taxes	-	-	(33)	8
Income or (Loss) attributable to the non-controlling interest	65	50	(93)	126
<b>Net Income (Loss) attributable to Tecogen</b>	<b>(1,096)</b>	<b>47</b>	<b>(5,709)</b>	<b>(3,280)</b>

Annual Income Statement FY 2016 – 3M 2019. Source: Company Filings



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**Frankfurt: 2T1**

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