

## Tecogen Inc. (TGEN)

Company Report – December 01, 2018

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.

Tecogen announced third quarter revenues of \$7,938,684 compared with revenues of \$8,501,198 for the same period in 2017. Although this represents a decline of 6.6% it's noteworthy to mention that last year's third quarter revenue was an all-time high for the Company.

Despite the small revenue decline, as of the end of Q3 2018, on a trailing four quarters basis, revenue growth was 23% reaching a total revenue level of \$37 million compared to \$30 million for the same trailing four quarters period a year ago.

Backlog of products and installations was \$15.7 million as of the end of the third quarter of 2018 and stood at \$20.2 million as of November 9, 2018. The solid and rising backlog is driven by strong traction in both the InVerde and TecoChill product lines, as well as installation services.

We reiterate our buy recommendation for Tecogen Inc. with a target price of \$9.41, which is 153% 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	\$3.71
Sector	Technology
52-Week Price Range	\$2.05 - \$4.20
Shares Issued (m)	24.82
Market Cap (m)	\$92.08
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 for 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.**

In 2017, Tecogen 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

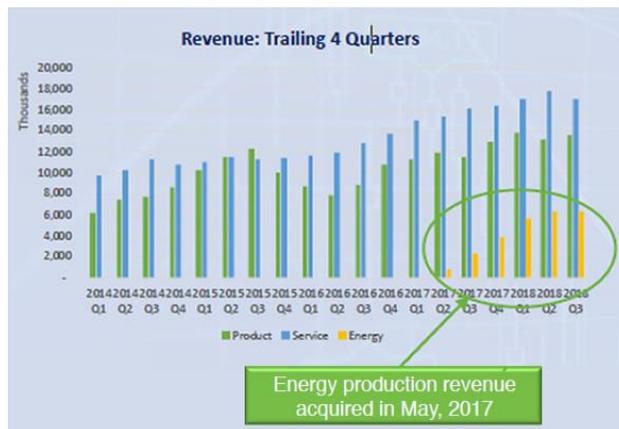
customer to be below conventional utility rates.

Consequently, bringing American DG under the Tecogen umbrella allows 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.

As of December 31, 2017, ADGE had 92 installed energy systems, representing an aggregate of approximately 5.5MW of heat and hot water and 4,500 tons of cooling.

**The transaction has created a vertically integrated clean technology company able to offer equipment design, manufacturing, installation, financing, and long-term maintenance service.**

During the third quarter, ended September 30, 2018, Product revenues increased 14.0% compared with Q3 last year. Especially the high number of chiller sales contributed to this solid performance. Total service and installation revenue declined by 17.8% over the prior year period, primarily due to decreased installation activity. Energy production revenue from the Company's American DG Energy sites declined 6.2%. This revenue stream adds an important second source - next to service and installation - of stable cash flows thanks to its long-term service contracts.



**On a trailing four quarters basis, revenue growth was 23% reaching a total revenue level of \$37 million at the end of the third quarter in 2018, compared to \$30 million for the same trailing four quarters period a year ago.**

Consolidated gross profit for the third quarter of 2018 was \$2,883,098 compared to \$3,258,031 in the third quarter of 2017, a decrease of 11.5% in overall gross profit year over year.

Overall gross margin was 36.3% for the third quarter of 2018 compared to 38.3% for the third quarter of 2017, resulting from the combination of an increase in product gross margin, and decreases in gross margins for services and energy production.

Tecogen's net loss for the third quarter of 2018 was \$603,000 compared to an income of \$27,000 for Q3 2017, a decrease of \$630,000. The decline is attributable to several items. R&D expenses, for example, increased 16.3% as the Company continues to invest in its emissions technology. Additionally, selling expenses increased by 78%, and Tecogen also opened a service centre in Florida contributing to an increase in G&A expenses of \$155,000.

Chillers account for about \$6.3 million of the current \$20.2 million backlog as the HVAC industry increasingly recognizes the tremendous value of so-called mechanical CHP with the TecoChill product, which uses natural gas instead of traditional electric equipment.

Note that the backlog does not include 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.

Mr. Locke, the CEO of Tecogen commented, "While we are disappointed with the drop in overall revenues, the third quarter saw a lot of progress in terms of positioning the Company for future growth. We expect product sales and overall revenues in our core business to rebound as we execute on our plans to expand our chiller product line, and we anticipate initiating a fleet retrofit project with our forklift partner, Mitsubishi Caterpillar Forklift America Inc, in 2019."

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 2017, Tecogen had 91 full-time employees and 4 part-time employees, including 7 sales and marketing personnel and 46 service personnel.



**Tecogen 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.**

## Revenue Sources

Tecogen manufactures, sells, installs, and maintains four types of products:

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

Moreover, in May 2017, Tecogen added another important revenue source, as the Company completed its acquisition of American DG Energy. This company offers On-Site Utility energy solutions without any capital or start-up costs to the customer and at lower costs than charged by conventional energy suppliers.

Thanks to the acquisition, Tecogen can offer a cost-free-installation option to customers who

do not have access to financing, or who are not interested in owning and maintaining the CHP 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 will provide 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.

### 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 Ultera 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 Ultera 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.

## 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.



**The Ultera Emissions System mounted on top of a CHP unit. Hundreds of Ulteras have been installed on cogeneration systems so far to dramatically reduce emissions such as NO<sub>x</sub>, CO, and hydrocarbons.**

### 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.

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 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.



**TecoFrost is perfect for a wide range of applications, including cold food storage, ice production, food processors, breweries, etc. Note that the above image is from an old TecoFrost.**

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.

Early 2019, Tecogen will also re-launch its TecoFrost product to meet the growing demand for natural gas cooling using ammonia refrigerants for cold storage and other premium chiller applications (Also read Growth Drivers).

## 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.**

### 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.

## GROWTH DRIVERS

### New Sales Boost Expected from TecoFrost

In just a few weeks, Tecogen will re-launch 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.

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.

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.

Mr. Locke mentioned during the third quarter conference call, "The goal is to jointly market and sell the product using our combined sales channels. With Vilter Manufacturing's help, we plan on building and selling the first new TecoFrost unit in the first half of 2019 with sales of more units expected throughout 2019."

### Ultera Applications With Tremendous Potential

Tecogen's current success is in part based on its exceptional emissions control technology called Ultera. 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 Ultera 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 Ultera technology with tremendous blue-sky potential.

In December 2015, following the outbreak of the Volkswagen emissions scandal, Tecogen initiated a program to adapt the Ultera 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).

Tecogen has now initiated the next chapter of the program. Subsequent to quarter-end, on January 4, 2018, 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 had 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.

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>		

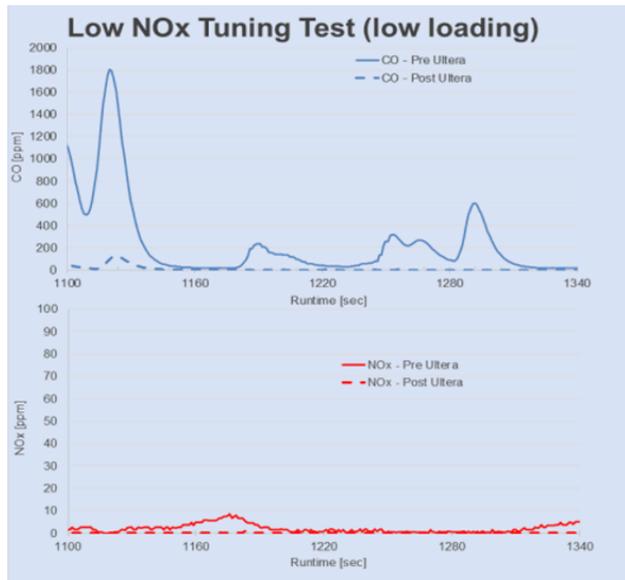
On the following page is a graph that shows the results of a test, which was completed at low load. For this test, the engine tuning was somewhat altered, which resulted in quite low NOx concentrations (solid red line). The detrimental side effect of this tuning however, is that the factory system was less effective in treating CO (solid blue line). With the Ultra added to the fork truck, both CO and NOx emissions were eliminated.

Mitsubishi Caterpillar has meanwhile informed that it wants to proceed with the program. The fork truck manufacturer will provide engineering support to enhance the prototype, which will be followed by its relocation to their facility for evaluation on their test track.

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.

During a recent interview with Smallcaps Investment Research, Mr. Locke mentioned that this opportunity is not only tied to retrofitting fork trucks, as Ultera can be implemented on the OEM level as well.



Finally, earlier this year, 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.

In 2017, Tecogen supplied a customer with Ultera kits for a group of natural gas generators in Southern California that required permitting for general use well beyond the 200-hour annual exemption given to emergency generators today.

So far, all but one of the units, have been successfully tested by a third-party to confirm compliance. This official test is the final step

in the approval process. The final unit is expected to receive approval in the coming weeks.

This again presents a vast opportunity for Tecogen. Customers could equip their – almost idle - backup generators with an Ultera and run them during certain times of the year and certain times of the day when electricity rates peak. This would be tremendous cost saver for thousands of potential customers.

## RECENT EVENTS

### More Sales into Indoor Cannabis Industry

Just this week, Tecogen sold two more Tecochill DTx 400-ton natural gas engine driven chillers to a Massachusetts indoor cannabis growing facility. The units are expected to be commissioned and running in early 2019 and will provide cooling for the grow rooms and hot water for dehumidification control.

“This grow facility in Massachusetts needed a substantial amount of cooling capacity in order to meet its production goals,” stated Stephen Lafaille, Product Manager for Tecogen. “The Tecochill solution uses a natural gas engine to turn the refrigeration compressor to meet the strict cooling requirements of the facility, substantially reducing its electrical needs from the utility. This facility is also utilizing the waste heat recovery of the Tecochill system to provide heating and dehumidification, further increasing the efficiency and savings for the project. It’s this simultaneous production of cooling and engine heat recovery that categorizes it as a combined heat and power (CHP) system, thereby unlocking local utility incentives, as well as federal tax credits to supplement the operational cost savings inherent with CHP systems.”

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. The

Tecochill units at this grow facility are expected to reduce GHG emissions by upwards of 1,000 tons of CO<sub>2</sub>/year.

The order is Tecogen's 16th into North America's rapidly emerging indoor cannabis industry. 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.

### Technology Upgrades Lead to Significant New Sales Contract

In recent years a growing awareness of environmental issues has encouraged people to reconsider their energy use and explore products that provide cleaner options for their needs. For Tecogen, as a technology company providing efficient on-site power, heating and cooling products, this trend is good for business.

It also comes as no surprise that Tecogen is generating repeat business from long term clients that are ready to upgrade to new equipment as their original systems approach the end of the scheduled service life. Back in June, for example, the Company sold a new 150 ton TECOCHILL chiller system to a prominent Connecticut elementary school to replace an existing Tecogen chiller system.

A few weeks ago, the Company reported a similar new contract with another existing long term client. The University of Connecticut has purchased four of the larger 400-ton TECOCHILL chiller units for installation into the main campus facility located in Storrs, CT. This purchase agreement is designed to replace a Tecogen chiller system that has been in operation at the campus for 20 years. A clear validation of the product line.

The large size of the facility is one of the contributing factors that led to the choice to select Tecogen for this important equipment contract. The TECOCHILL product line is the only natural gas powered system available on

the market that can deliver air conditioning for a facility of this scale. This emphasizes the advantage Tecogen has achieved in this market segment with its diversified product line.



**The University of Connecticut has purchased four of the larger 400-ton Tecochill units for installation into the main campus facility located in Storrs, CT.**

The University of Connecticut has already secured long term cost savings and reliable operations from its relationship with Tecogen and therefore the choice to upgrade to an even more efficient TECOCHILL system was easy to make. The improvements in technology for these units will also ensure greater environmental benefits from the Ultra emissions controls system that is now incorporated in the TECOCHILL product line. Another plus, the refrigerant used in TECOCHILL units is ozone-friendly.

One other benefit comes from the tax incentives that are now available from the State of Connecticut to encourage more system installs like the TECOCHILL units, as they are powered by natural gas and therefore contribute to lower electrical energy consumption.

### Ongoing Sales Growth in Key Market Segment

In September, Tecogen reported the sale of six of its InVerde e+ cogeneration units, to be installed among four separate projects within the greater New York City metropolitan area. The combined power generation of these units amounts to 800 kW.

One of the attractive features of the InVerde e+ line is the integrated functioning with

demand response electricity operations. The program enables independently operated generator units to be activated during times of peak energy demand within the electric grid, allowing these units to supply additional power that contributes to stabilizing the grid. In the event of a grid shutdown, the cogeneration units are still programmed to disconnect from the grid and provide backup power to meet the needs of the end user.

New York City is a case study for the effectiveness of this cogeneration system. As one of the largest municipal service areas in the United States the demand response program offered by electricity utilities encourages large power consumers to invest in cogeneration units that can provide additional power during times of critical grid demand.

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.

As was reported within the news release, all of the new installs will receive partially offsetting state incentives which serve to lower the net cost base for these units, in addition to the financial incentives paid by the electric utility as part of the demand response program and the ongoing operations of the cogeneration systems.

Tecogen has developed the most efficient CHP systems around. These advanced units are considered best in class and result in much lower operating costs compared with a typical distributed power installation. This has been highlighted by the growth in the client base located in the important New York City region. The sale of six new InVerde e+ units announced this month, demonstrates that growth potential.

## FINANCIALS

Product revenues in the third quarter of 2018 were \$2,765,094 compared to \$2,425,616 for the same period in 2017, an increase of

\$339,478 or 14.0%. This increase was the net of a decrease in cogeneration sales of \$178,307 and an increase in chiller sales of \$517,785, or 89%, year over year. The clear increase in chiller interest is due, in part, to the indoor agriculture market.

Service revenues in the third quarter of 2018 were \$3,713,770 compared to \$4,519,467 for the same period in 2017, a decrease of \$805,697 or 17.8%. This decrease in the third quarter is due to a decrease in installation activity of \$761,694 and a decrease of \$44,003 in service contract revenues. While service contract revenue remains relatively constant, installation activity can vary widely depending on the status of various projects.

Energy production revenues in the third quarter of 2018 were \$1,459,820, compared to \$1,556,115 for the same period in 2017, a decrease of \$96,295 or 6.2%. Energy production revenue represents energy revenues earned during the quarter by the American DG Energy sites.

Amounts in \$000's	09/30/18	09/30/17
Product Revenue	2,765	2,426
Service Revenue	3,714	4,519
Energy Revenue	1,460	1,556
<b>Total Revenue</b>	<b>7,939</b>	<b>8,501</b>
Cost of Product Sales	1,695	1,539
Cost of Services Sales	2,517	2,981
Cost of Energy Sales	843	723
Total Cost of Sales	5,056	5,243
<b>Gross Profit</b>	<b>2,883</b>	<b>3,258</b>
Operating Expenses	3,445	3,172
<b>Income (Loss) from Operations</b>	<b>(562)</b>	<b>86</b>
Total Other Expenses	(10)	(19)
<b>Net Income (Loss)</b>	<b>(603)</b>	<b>67</b>
Diluted EPS	(0.02)	0.00
Diluted Shares Outs.	24,819	24,721
<b>Selected income statement data for the quarters ending September 30, 2018 and September 30, 2017. Source: Company Filing</b>		

Product gross margin was 38.7% for the third quarter of 2018 compared to 36.6% for the third quarter of 2017, a 6% improvement year-over-year. Product gross margin was primarily helped by the materials and supplier arrangements put in place in previous quarters.

Service gross margin declined to 32.2% in the third quarter of 2018 compared to 34.0% for the third quarter of 2017. The margin decline is due to an installation project, which carried a lower margin.

Energy production gross margin from the ADG fleet for the third quarter of 2018 was 42.3% compared to 53.5% for the third quarter of 2017, which was exceptionally strong due to a one-time incentive payment received in that quarter. The margin for the third quarter of 2018 is consistent with management's expectations.

Total revenues for the first nine months of 2018 were \$26,567,276 compared to \$22,938,503 for the same period in 2017, an increase of \$3,628,773 or 15.8%.

Product revenues in the first nine months of 2018 were \$8,922,257 compared to \$8,349,159 for the same period in 2017, an increase of \$573,098 or 6.9%. Service revenues in the first nine months of 2018 were \$12,894,439, compared to \$12,259,037 for the same period in 2017, an increase of \$635,402 or 5.2%. Energy production revenues in the first nine months of 2018 were \$4,750,580, compared to \$2,330,307 for the same period in 2017. Note though that the 2017 energy production revenue only represents revenues earned after May 19, 2017, the day after the acquisition of American DG Energy through September 30, 2017.

Operating expenses increased to \$3,445,410 for the third quarter 2018 from \$3,172,492 in the third quarter of 2017. Loss from operations was \$562,312 compared to income of \$85,539 in the prior year comparable period.

### Balance Sheet as of September 30, 2018

On May 4, 2018, Tecogen entered into a Credit Agreement with Webster Business Credit Corporation, providing the Company with a line of credit up to \$10 million on a revolving secured basis, with availability based on certain accounts receivable and inventory balances. As of September 30,

2018, the outstanding balance on the line of credit was \$1,833,758.

Current assets at quarter end of \$22,925,281 were more than twice current liabilities of \$11,340,611.

Amounts in \$000's	09/30/18	09/30/17
Cash and Cash Eq.	137	2,077
Accounts Receivable	11,549	11,094
Inventory	5,983	6,119
<b>Total Current Assets</b>	<b>22,925</b>	<b>23,593</b>
Property & equipment	11,108	15,503
Intangible Assets	2,935	2,430
Excess of Cost Over Fair Value of Net Assets Acquired	13,366	12,602
<b>Total Assets</b>	<b>50,762</b>	<b>56,632</b>
Accounts Payable	5,716	5,356
Accrued Expenses	2,197	1,676
<b>Total Current Liabilities</b>	<b>11,341</b>	<b>9,399</b>
Promissory Note	-	3,149
Unfavorable Contract Liability	6,534	10,358
<b>Total Liabilities</b>	<b>18,218</b>	<b>23,293</b>
Total Stockholder Equity	32,098	32,856
<b>Selected balance sheet data for September 30, 2018 and September 30, 2017. Source: Company Filing</b>		

Cash used in operating activities for the nine months ended September 30, 2018 was \$2,356,680 compared to \$1,996,871 for the same period in 2017. The Company's accounts receivable balance increased to \$11,548,663 at September 30, 2018 compared to \$9,536,673 at December 31, 2017, due to the timing of billing, shipments, and collections.

Note that the Unfavorable Contract Liability in the table represent the estimated fair value of American DG Energy's customer contracts. Pricing to the customer for electrical power produced and supplied by ADGE under the contracts is under a fixed formula which requires the customer to pay for the kilowatts of electrical power provided at a fixed percentage discount to the local utility's electric rate for that period. As a result, as utility rates for electrical power change, the amount ADGE is able to charge the customer under the contract also changes.

There has been a sharp decrease in electric rates over the past several years, subsequent to the vast majority of customer contract dates, causing the billable value of the electrical power generated by ADGE's systems to decrease, resulting in a deterioration of expected profitability.

## OUTLOOK & VALUATION

Although Tecogen didn't have a profitable third quarter, it continues to position itself for significant growth in the coming years. Its fundamental business is strong and growing, the important product advantages are well understood by the industry, and the Company's emissions technology offers tremendous upside and value creation for shareholders.

The Company aims to return to profitability next quarter. It will do so by continuing to grow product sales, particularly in the chillers segment, managing its turnkey construction projects better to improve margins, and controlling expenses.

As for 2019, market forces favour Tecogen's clean, reliable, natural gas generation systems. First, natural gas will remain an abundant and cost effective resource in the U.S. for many years to come, while electricity generation and distribution will remain expensive in many urban areas with the aging infrastructure. Therefore, natural gas generation systems, whether co-generation or chillers, are in an excellent position to displace electric systems for many industrial processes.

The legalization of cannabis in several US states has led to a boom in greenhouse growing centers for the cultivation of cannabis plants. However, a fully controlled environment is necessary to create the optimum growing conditions within the greenhouses. Since the Tecochill line delivers air conditioning and humidity control, operators gain the capability to manage the indoor climate of their facility. This has led to several breakthrough sales for Tecogen in the sector.

In addition, by reintroducing the TecoFrost product, Tecogen will be able to penetrate the

industrial cooling market. High electric costs make natural gas systems far more cost effective and ultimately cleaner from an air quality standpoint.

In general, chiller sales are an excellent contributor to the Company's business because the sales process tends to be more defined and transactional. Chiller replacements occur all the time throughout the HVAC sales and engineering community, which allows a continuous flow of opportunities through those established channels.

Finally, as ever more attention globally is focused on emissions, Tecogen's proprietary Ultra emissions technology continues to be validated as a cost effective and adaptable retrofit, or OEM component, for many gas engine systems, such as CHP chillers, other stationary engines, standby generators, forklifts, light vehicles, medium trucks, buses, or automobiles. It is proven that Ultra dramatically reduces CO and NOx emitted in the environment. While the timing of emissions regulations is imprecise, it's clear that state-by-state, country-by-country, the Ultra near-zero emissions technology will be valued highly in both transportation vehicles and industrial engine systems.

## 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 153% above today's stock price.**

## SHARE DATA & OWNERSHIP

As of October 31, 2018, Tecogen had 24,819,646 common shares outstanding. In addition, the Company had 1,234,289 stock options outstanding with a weighted average

exercise price of \$3.50. 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%), Monovoukas Yiannis (10.6%), 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 2015 – 9M 2018

All numbers in thousands

PERIOD ENDING	FY 2015	FY 2016	FY 2017	9M 2018
<b>Total Revenue</b>	<b>21,443</b>	<b>24,490</b>	<b>33,203</b>	<b>26,567</b>
Cost of Revenue	13,809	15,190	20,248	16,687
<b>Gross Profit or (Loss)</b>	<b>7,633</b>	<b>9,301</b>	<b>12,954</b>	<b>9,880</b>
<b>Operating Expenses</b>				
General & Administrative	7,998	7,994	9,520	8,123
Selling	1,687	1,637	2,272	1,892
R&D	592	667	937	993
Total Operating Expenses	10,277	10,289	12,729	11,008
<b>Operating Income or (Loss)</b>	<b>(2,643)</b>	<b>(997)</b>	<b>225</b>	<b>(1,128)</b>
<b>Other Income or (Expense)</b>				
Interest Expense	(172)	(176)	(155)	(56)
Unrealized Gain (Loss) on Investment Securities	-	-	-	(59)
Provision for State Income Taxes	-	-	-	(43)
Income or (Loss) attributable to the non-controlling interest	74	65	50	(59)
<b>Net Income (Loss) attributable to Tecogen</b>	<b>(2,727)</b>	<b>(1,096)</b>	<b>47</b>	<b>(1,337)</b>

Annual Income Statement FY 2014 – 9M 2018. Source: Company Filings



**NASDAQ: TGEN**

**Company Headquarters**

45 First Avenue  
Waltham, MA 02451  
United States

**Company Contact Information**

Benjamin Locke, Chief Executive Officer  
Phone : +1 781-466-6402  
Email : [Benjamin.Locke@tecogen.com](mailto:Benjamin.Locke@tecogen.com)

John N. Hatsopoulos, Chairman Emeritus  
Phone: + 1 781-622-1120  
Email : [John.Hatsopoulos@tecogen.com](mailto:John.Hatsopoulos@tecogen.com)

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Contact: [editor@smallcaps.us](mailto:editor@smallcaps.us)

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