

## Tecogen Inc. (TGEN)

Company Report – August 25, 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 25 years.

Tecogen's revenues in the second quarter, ended June 30, 2018 reached \$8.45 million, up more than 11% compared with sales of \$7.59 million in the second quarter of 2017.

This solid result brings the Company's trailing four quarter revenues to a record level of \$37.4 million, an increase of almost 33% compared to \$28.2 million for the trailing four quarters period a year ago. While Tecogen's quarterly results may fluctuate due to the timing of shipments, the trailing data clearly shows the Company's true progress.

The Company's sales backlog of equipment and installations stood at \$14.2 million at the end of the second quarter and a whopping \$21.3 million last week. A new all-time record for Tecogen. The solid backlog is mainly driven by strong traction in the InVerde and TECOCHILL product lines and installation services.

We reiterate our buy recommendation for Tecogen Inc. with a target price of \$9.16, which is 181% above today's stock price.



- ❑ Tecogen's management team is step by step building a robust clean energy company. Although bottom line results still fluctuate somewhat, the trend is clearly upwards.
- ❑ The core business continues to grow with ever more installations and service agreements. The Company's technology advancements are impressive, and so is the resulting patent portfolio.
- ❑ The first of several blue sky opportunities is getting closer to fruition, as the Ultera equipped fork truck offers the best of both worlds: near-zero emissions and sustained peak performance levels. Also the Ultera for the automotive market continues to progress.



## 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.

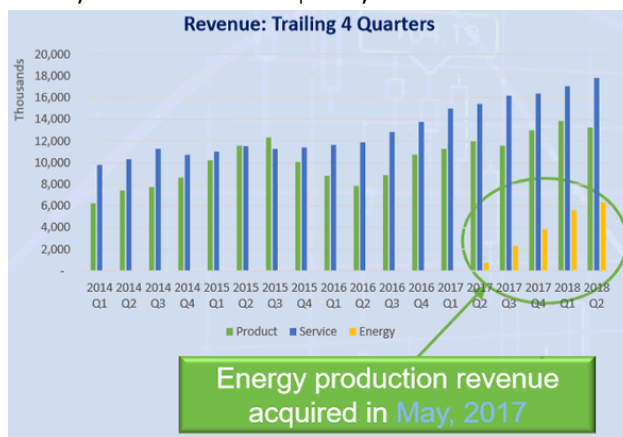
Consequently, bringing American DG under the Tecogen umbrella allows the latter to offer a cost-free-installation option to customers without access to financing, sufficient capital on hand, or for those who may not be interested in owning and maintaining the equipment.

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 second quarter, ended June 30, 2018, Tecogen again considerably advanced both its core business and its promising fork truck emissions application. Although revenues were up, Tecogen’s net loss for the three months ended June 30, 2018 was \$754,350 compared to a loss of \$517,899 for the same period in 2017, a difference of \$236,451.

The higher loss was due to a number of reasons. First, the Company invested heavily in research and development activities. These costs for Q2 2018 amounted to \$410,000 compared to \$219,000 for the same period in 2017, an increase of \$191,000.



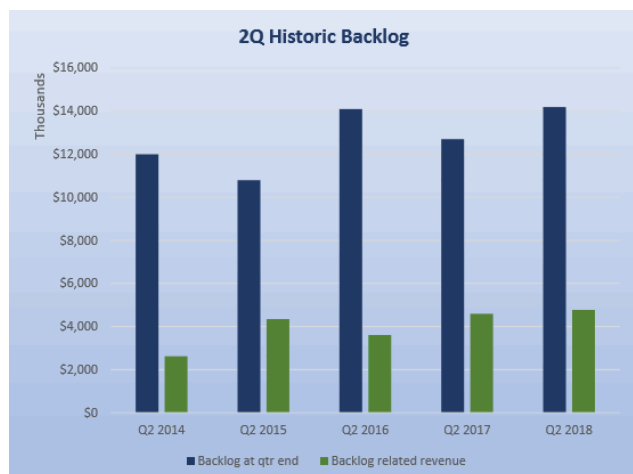
**Tecogen’s trailing four quarter revenues is at a record level of \$37.4 million, which shows the Company’s true progress.**

Additionally, selling expenses increased \$28,000 year-over-year as Tecogen continues to grow sales activities. Finally, general and administrative expenses included an additional loss of \$236,000 year-over-year, as Q2 of 2018 included a full quarter of American DG Energy's (ADG) operations, while only about six weeks were included in Q2 of 2017. This was due to the fact that ADG was acquired by Tecogen in the middle of the second quarter of last year.

Gross margin for the quarter was 37.4% compared to 39.3% in the second quarter of 2017, well within management's targeted 35-40% gross margin range.

The Company's sales backlog of equipment and installations stood at \$14.2 million at the end of the second quarter and a whopping \$21.3 million last week. A new all-time record for Tecogen. The solid backlog is mainly driven by strong traction in the InVerde and TECOCHILL product lines and installation services.

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.



**Tecogen's quarter-end backlog of \$14.2 million on 6/30/18 versus \$12.7 million on 6/30/17. Backlog as of August 10, 2018 at \$21.3 million.**

Tecogen's Chief Executive Officer Benjamin Locke commented, "The second quarter of 2018 continued our trend of positive revenue growth quarter-over-quarter. We are seeing a strong uptick in demand for our TECOCHILL

natural gas chiller systems as well as our flagship InVerde product. While we did not achieve full profitability for the quarter, we expect our strong backlog of over \$20 million to drive profitability in future quarters."

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.

## 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, when combined, approximately half of Tecogen's annual revenue will be derived from stable, long-term

contracted sources (Tecogen Service revenue and American DG Energy revenue). 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 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 nine field service centers in California, the Midwest, and the Northeast. 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.

Factory service also keeps Tecogen in close touch with its customers and their specific site issues.

### 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.

### 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 as solar panels, windmills, and backup batteries, eliminating the need for costly converters.

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.

#### 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.

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.



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

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.



**TECOCHILL units reduce operating costs for indoor growing facilities by up to 50%.**

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.

## 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.

Only a couple of weeks ago, Tecogen was granted a US patent for a customized catalyst formulation developed for its Ultra emissions reduction process. The patent covers the material composition and manufacturing method used in its production. This material provides excellent performance while being impervious to corrosion in applications where the engine fuel contains significant contaminants such as sulfur and phosphorus.

This is a very important piece of the Ultra technology as many important fuels, including natural gas, gasoline, propane and biofuels have significant impurities which generate corrosive emissions that degrade unprotected emissions control catalysts. Testing over multiple years has demonstrated its effectiveness in extending the longevity of our catalysts.

In June of 2018, the Company obtained patent protection for its Ultra 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 Ultra emissions technology. This patent will give Tecogen exclusive control over the Ultra 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

### 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).

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 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.

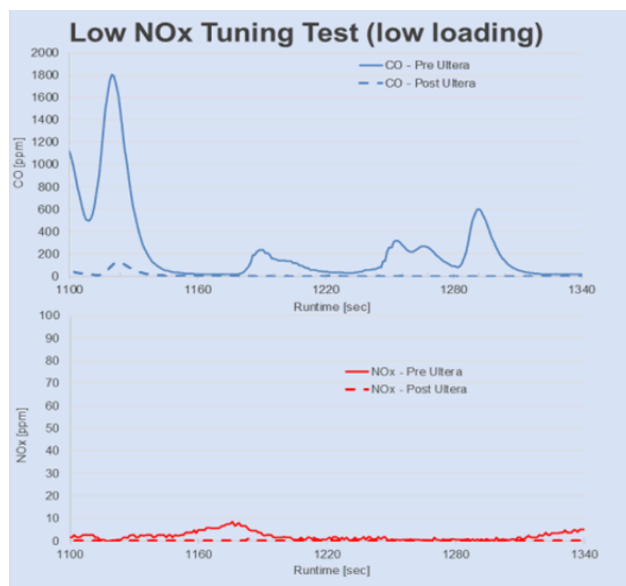
As shown in the table, the Ultra reduced Carbon monoxide (CO) emissions with 99% and 91% respectively. Total hydrocarbons (THC) emissions were reduced by over 52% according to the third-party, while Tecogen instrumentation wasn't able to measure this pollutant. The Ultra also improved nitrogen oxides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

the third party, respectively. This is another true validation of the Ultra capabilities!

	Tecogen	Third Party
CO	98.8%	91.0%
THC	N/A	52.1%
NOx	24.3%	29.2%

**Emission reductions achieved during heavy lift tests were confirmed by an independent third party.**

Below is also a graph that shows the results of a different 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.



In the conference call, following the release of the second quarter results, Tecogen's management mentioned that it successfully demonstrated its near-zero emissions propane fork truck to engineers from the manufacturer and several managers from PERC.

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

In addition, Tecogen will present a scientific paper describing the program and the emissions reduction results at the WORLD LPG Forum early October, in Houston, Texas. This is an excellent opportunity for the Company to showcase its the exceptional technology at the premier global event for the LPG industry.

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 2008, SCAQMD expanded the rule to cover such newly installed generators, which was the original basis for the invention of Tecogen's now patented Ultera emission system. To-date, Ultera is the only known technology that enables rich-burn engines, specifically, to comply with the rule.

Several machines that utilize Ultera are now recorded in California's BACT Clearinghouse as examples of projects able to meet SCAQMD's high standard. Regulators outside of California also refer to the Clearinghouse for their own BACT-related inquiries.

This is a tremendous achievement by Tecogen's applied science capabilities. While it does not mark a regulatory change within SCAQMD, it does raise Tecogen's profile substantially.

More importantly, it alerts other regulators both within California and beyond that there is a viable way to achieve fuel-cell-like emissions with an internal combustion engine.

Being listed as BACT by one regulatory body greatly eases the adoption of the standard by other regulators, thus enabling BACT, and by extension the utilization of Ultera, to spread

rapidly across the country. It's hard to overstate just how significant a sales driver this could turn out to be.

## Tecogen Inc Awarded Prestigious Certification for InVerde e+ Line of CHPs

With the ongoing development of efficient and reliable on-site electrical generating systems, the capability to secure immediate backup power, independent from the electric grid, is gaining traction in the market. The option to install distributed power has always appealed to critical industries where even a short interruption of electric power could create extreme disruption to operations.

Consider for example the importance for a data center to remain online and functioning at all times. The potential disruption and costs associated with an unplanned shutdown have made access to backup generators essential for certain businesses, despite the added expense associated with the install. But now the efficiency of the latest technology is improving, and a variety of financial incentives have been introduced that further improve the economics of these systems enough to become attractive to a wider range of end users.



**ANSI/UL 1741 SA certification, achieved by the InVerde e+ line, continues to position Tecogen at the forefront of technology for distributed power generation.**

Tecogen has taken the distributed energy generation platform to the next level, when the Company recently introduced its flagship InVerde e+ product line which incorporates inverter technology to expand the operational functioning of the units.

By combining an inverter with the InVerde e+ system, the technology is now compatible with protocols for the emerging Smart Grid. This enables end users to participate in Demand Response (DR) programs that have been developed to allow local electric utilities to better manage power supply during periods of peak electric demand on the grid.

The Smart Grid employs sensors to monitor electrical power usage and allows distributed power generation to supplement the electric supply to the grid during peak demand intervals. In effect, rather than disconnecting from the grid and activating backup power needs as would occur during a grid-down event, the latest inverter technology included with InVerde e+ units will enable generator operations to proactively supply power to the grid, while still maintaining the power to critical systems for end users.

The ANSI/UL 1741 SA level of certification involved in this system is the new safety standard for distributed generation using inverters, adopted by California and other states. By 'interconnecting' with the local electrical utility, it creates the option during a power imbalance for certified generator systems to go online and contribute power to help stabilize the grid. To meet the requirements for this Smart Grid, the onsite generating units must be equipped with certified 'smart inverter' capability.

Certified participants of the Smart Grid are able to capture attractive financial incentives that serve to enhance the economic efficiency of these new systems, making them even more attractive for end users.

Intertek, a leading Quality Assurance provider to the energy industry, has granted certification under this new system to Tecogen's InVerde e+ line. Tecogen has established a working relationship with Intertek spanning more than 30 years.

While California is currently the only state that mandates ANSI/UL 1741 SA certification, other states often follow the lead. As more distributed power generation systems come online, it is likely that this standard of safety will be adopted in other areas.

ANSI/UL 1741 SA certification, awarded by an independent Quality Assurance provider, is more than a matter of prestige. This level of standard achieved by the InVerde e+ line continues to position Tecogen at the forefront of technology for distributed power generation, and represents a proprietary advantage in the sector as the economic performance of these units continues to improve.

**The improved economics also make these generating systems viable to a larger number of end users, thereby expanding the potential market size for the technology, and building further growth potential. And as more of these units are installed and operating, the combined energy generation supplied to the grid during peak power demand intervals may contribute to make the entire electric grid more resilient for all users.**

## RECENT EVENTS

### Performance Improvements and Long Term Reliability Build Even Greater Appeal for Tecogen Cogeneration Power Units

In June, Tecogen issued two updates that highlighted the durability and efficiency of its products. The most recent one came with the launch of its updated Tecopower line cogeneration units. The new Tecopower series delivers material upgrades in performance to increase output and lower operating costs for end users.

Available in 60 kW and 75 kW sizes, the units have improved electrical efficiency by 5% while also providing the advantage of virtually eliminating the need to boost gas pressure, as has been required in the past. The result is a unit that is quieter, able to run more efficiently and with easier installation.

Incorporating the advanced and patented Ultera emission system developed by the Company, the new Tecopower line is able to achieve clean operating performance on par with fuel cell technology, but at a fraction of the cost. Some of the upgrades available in

this new line have been shipped in transition models delivered earlier this year and were met with enthusiasm in the market place. The Tecopower units will be available for shipment by the end of this quarter.



**With over 1000 units shipped and tens of millions of run hours logged, Tecopower CHP units have stood the test of time.**

In the second update, the Company reported that its combined fleet of InVerde units had surpassed 3.5 million hours of operations. A significant milestone, the performance record is unmatched by any other company in terms of the durability of this system.

This track record of advanced performance and reliability for the InVerde platform, along with the unique features and patented technology that make the system ideal for sustained operation even in the event of unplanned shutdowns of the electrical grid, have established the cogeneration units as the standard for clean energy solutions.

**With the addition of desirable features and proven long term reliability, Tecogen is setting the standard for cogeneration power capability. The recently reported milestone of 3.5 million hours of operation for its InVerde system is an indication of industry acceptance and the appeal of the many features available in these units that no other competitor is able to provide.**

## FINANCIALS

Product revenue decreased 20.3% from the same period in 2017 primarily due to timing of equipment deliveries. In the first half of

2018, chiller sales increased 95% over the first half 2017. Moreover, the current chiller backlog has increased to a record \$6.1 million. The chiller backlog is expected to continue to increase as TECOCHILL has become the basis of design for many indoor grow facilities.

Service revenue grew 20.6% year on year, benefiting from increasing penetration in service contracts and favorable operating metrics for the installed fleet. Continued penetration of the Company's 'turnkey lite' offering, which includes custom value-added engineering design work, as well as custom factory engineered accessories and load modules, has been a good source of services revenue growth and is expected to continue to develop as an important revenue stream.

Note that **Product Revenue** is derived from the sale of the various cogeneration and chiller units. Because the equipment is built to last 20 or more years, most of the product sales are to first time customers. The Company's **Service Revenue**, however, lends itself to recurring revenue from long-term maintenance contracts, which provide the Company with a somewhat predictable revenue stream.

Energy production revenue from the sites of American DG Energy, contributed \$1,508,225 to the quarterly result. This is up almost 95% compared with last year's second quarter, which is logical as ADG was acquired in Q2 of 2017.

Product gross margin was 39.9% for the second quarter of 2018 compared to 36.9% for the second quarter of 2017. Product gross margin was primarily helped by the materials and supplier arrangements put in place in previous quarters.

Service gross margin declined to 33.6% in the second quarter of 2018 compared to 37.6% for the second quarter of 2017. Installation projects, which carry a lower margin than service maintenance contracts, were a higher percentage of the product mix as compared to the same period last year, bringing the overall service margin down on a comparative basis.

Energy production gross margin for the second quarter of 2018 was 44.3% compared



with 57.3% in the previous year's second quarter, which was an exceptionally strong quarter. The energy production gross margin is expected to fluctuate due to seasonality.

Amounts in \$000's	06/30/18	06/30/17
Product Revenue	2,484	3,116
Service Revenue	4,461	3,700
Energy Revenue	1,508	774
<b>Total Revenue</b>	<b>8,453</b>	<b>7,591</b>
Cost of Product Sales	1,492	1,966
Cost of Services Sales	2,962	2,307
Cost of Energy Sales	840	331
Total Cost of Sales	5,294	4,604
<b>Gross Profit</b>	<b>3,160</b>	<b>2,987</b>
Operating Expenses	3,796	3,232
<b>Income (Loss) from Operations</b>	<b>(636)</b>	<b>(246)</b>
Total Other Expenses	(64)	(31)
<b>Net Income (Loss)</b>	<b>(754)</b>	<b>(294)</b>
Diluted EPS	(0.03)	(0.01)
Diluted Shares Outs.	24,818	23,120

**Selected income statement data for the quarters ending June 30, 2018 and June 30, 2017. Source: Company Filing**

It should be noted in the table above that the Q2 2017 calculation of loss per share excludes the effect of the unrealized loss on investment securities, giving rise to the comprehensive loss in that year.

On a combined basis, operating expenses increased to \$3,795,880 for the second quarter of 2018 from \$3,232,479 in the same quarter of 2017. As mentioned above, an increase in research and development expenses of 87.3% to \$409,779, and selling expenses which rose 4.6% to \$635,396, along with the consolidation of American DG Energy's core overhead accounted for the majority of this increase.

### Balance Sheet as of June 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.

Current assets at quarter end of \$23,385,930 were more than double current liabilities of \$11,270,213 which resulted in a solid current

ratio of 2.07. Current liabilities as of June 30, 2018 included \$2,557,817 of short-term debt on the revolving line of credit with Webster.

Amounts in \$000's	06/30/18	06/30/17
Cash and Cash Eq.	1,015	3,318
Accounts Receivable	11,441	8,868
Inventory	5,534	6,100
Total Current Assets	23,386	22,727
Property & equipment	11,361	15,725
Intangible Assets	2,951	2,098
Excess of Cost Over Fair Value of Net Assets Acquired	13,366	12,571
<b>Total Assets</b>	<b>51,472</b>	<b>55,586</b>
Accounts Payable	4,962	4,502
Accrued Expenses	1,946	1,900
Total Current Liabilities	11,270	8,461
Promissory Note	-	3,149
Unfavorable Contract Liability	6,783	10,304
<b>Total Liabilities</b>	<b>18,372</b>	<b>22,364</b>
Total Stockholder Equity	32,647	32,735

**Selected balance sheet data for June 30, 2018 and June 30, 2017. Source: Company Filing**

Cash used in operating activities for the six months ended June 30, 2018 was \$2,541,234 compared to \$891,955 for the same period in 2017. The Company's accounts receivable balance increased to \$11,440,542 at June 30, 2018 compared to \$8,868,157 at June 30, 2017, a rise of \$2,572,385 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

Tecogen's InVerde cogeneration fleet hit a milestone in the past quarter, as it surpassed 3.5 million hours of operation since its introduction in 2008. Tecogen has now more inverter-based natural gas engine cogeneration systems in operation than any other manufacturer in the US.

This trend will only accelerate, as the Company's 60 kW and 75 kW CHP systems were recently upgraded resulting in a 5% increase in electrical efficiency, reduced gas pressure requirements, and 5 dBA decrease in noise level.

The Tecopower line now offers the highest savings and quietest operation of any competitive product. In addition, they emit near-zero emissions, thanks to the exclusive Ultra system. The Company anticipates a strong market response to the upgraded product line.

Moreover, in response to the overwhelming success of the TECOCHILL product family at grow operations, ice rinks and other HVAC cooling projects that are hampered by high electricity bills, the Company is exploring the potential for expanding its gas engine cooling technology. Many large HVAC systems depend on circulated refrigerants to accomplish comfort cooling and/or sub-zero cooling. In such cases Tecogen's TECOCHILL products aren't good fits.

However, Tecogen is evaluating resurrecting its natural gas engine refrigerant cooling product. This product was developed and deployed between 1998 and 2003. Manufacturing of the product line was halted when gas prices increased. Reviving this technology, at today's much lower gas prices, would have a tremendous and immediate industry benefit particularly for projects with high electric operating cost because incumbent electric refrigerating systems are simply too expensive.

The system would have a wide range of applications, including cold food storage, ice production, food processors, breweries, dairies, wineries, pharmaceutical, and industrial companies. Moreover, the Company is already working with many of the engineering firms that are involved in large scale industrial cooling projects, so the channels to market are already well established.

The strong overall demand for the Company's products is demonstrated by its sales backlog of \$21.3 million, driven by strong traction in both the InVerde and TECOCHILL product lines, and installation services.

Ben Locke said it best during the Company's Conference Call, "I am very happy with how Tecogen is positioning itself for the coming years. Our fundamental business is strong and growing. Our product advantages are well understood and embraced by the industry. And our emissions technology offers tremendous upside and value creation for our shareholders. It is a great time to be a Tecogen shareholder, and I hope to continue our tremendous achievements throughout the rest of the year."

### Valuation

Given the emerging nature of Tecogen's earnings, and the uncertainty of American DG's exact contribution to 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 \$9.16.

**We reiterate our buy recommendation for Tecogen Inc. with a target price of \$9.16, which is 181% above today's stock price.**

## SHARE DATA & OWNERSHIP

As of June 30, 2018, Tecogen had 24,819,646 common shares outstanding. In addition, the Company had 1,222,789 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 – 6M 2018

All numbers in thousands

PERIOD ENDING	FY 2015	FY 2016	FY 2017	6M 2018
<b>Total Revenue</b>	<b>21,443</b>	<b>24,490</b>	<b>33,203</b>	<b>18,629</b>
Cost of Revenue	13,809	15,190	20,248	11,631
<b>Gross Profit or (Loss)</b>	<b>7,633</b>	<b>9,301</b>	<b>12,954</b>	<b>6,997</b>
<b>Operating Expenses</b>				
General & Administrative	7,998	7,994	9,520	5,540
Selling	1,687	1,637	2,272	1,311
R&D	592	667	937	712
Total Operating Expenses	10,277	10,289	12,729	7,563
<b>Operating Income or (Loss)</b>	<b>(2,643)</b>	<b>(997)</b>	<b>225</b>	<b>(565)</b>
<b>Other Income or (Expense)</b>				
Interest Expense	(172)	(176)	(155)	(23)
Unrealized Gain (Loss) on Investment Securities	-	-	-	(79)
Provision for State Income Taxes	-	-	-	(39)
Income or (Loss) attributable to the non-controlling interest	74	65	50	(32)
<b>Net Income (Loss) attributable to Tecogen</b>	<b>(2,727)</b>	<b>(1,096)</b>	<b>47</b>	<b>(734)</b>

Annual Income Statement FY 2014 – 6M 2018. Source: Company Filings





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