

### Tecogen Inc. (TGEN)

Company Report – April 07, 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 2,500 units, some of which have been operating for more than 25 years.

Tecogen had a transformative 2017 as it generated a positive net income for the full year, successfully completed the acquisition of American DG Energy (ADGE), and repaid most of its debt.

Both for the fourth quarter, as well as for the full year, Tecogen reached record breaking revenue of \$10.2 million and \$33.2 million respectively. Also net income improved significantly in 2017 to \$47,436 from a loss of \$1,096,283 in the prior year, an increase in profitability of \$1,143,719.

Perhaps even more importantly, Tecogen achieved adjusted EBITDA of \$533,000 in the fourth quarter, which was not only a record, it also marked the sixth consecutive quarter and the first full calendar year of positive operational results.

Based on our model, we reiterate our buy recommendation for Tecogen Inc. and are increasing our target price from \$8.41 to \$9.06, which is 203% above today's stock price.



- ❑ Sales backlog of equipment and installations has grown to \$15.7 million at year end 2017 compared to \$11.1 million at year end 2016, a sizable increase. As of March 19, 2018, backlog stood at \$17.4 million, well ahead of the Company's stated goal of maintaining sales backlog above \$10 million.
- ❑ The outlook for Tecogen has never been more promising. The core business of selling, installing and servicing cogeneration and chiller systems is profitable, scalable and provides a fundamental revenue and profit stream. Moreover, its Ultera emissions technology, whether it's upgrading existing stationary engine systems, retrofitting fork trucks to be Near Zero emission, or improving gasoline vehicle emissions, promises tremendous upside for the Company.



## 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 2,500 units so far, some of which have been operating for almost 25 years.**

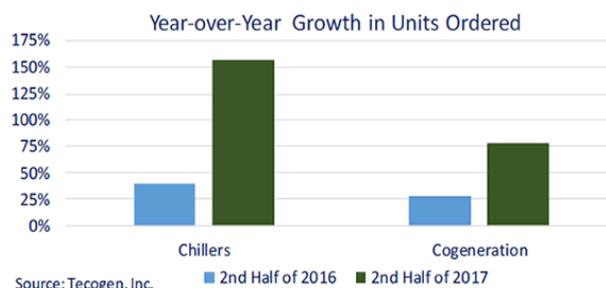
In 2017, Tecogen acquired American DG Energy, which distributes, owns and operates natural gas powered cogeneration systems that produce electricity, hot water, heat and cooling. ADGE's business model is to own the equipment that it installs at customers' facilities and to sell the energy produced by 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.**



Tecogen had a transformative 2017 as it generated a positive net income for the full year, successfully completed the acquisition of American DG Energy (ADGE), and repaid most of its debt. Tecogen is now moving forward into 2018 as a viable, profitable, and scalable business.

In the fourth quarter, ended December 31, 2017, Tecogen reached record breaking revenue of \$10.2 million delivering 44.3% revenue growth when compared to the prior year's fourth quarter revenue of \$7.1 million, which was in itself an increase of 66.2% compared to sales of \$4.2 million in the fourth quarter of 2015.

Thanks to the strong rise in revenue, profitability also grew in the quarter, delivering a record \$268,981 in net income, compared to \$4,556 in net income reported in the fourth quarter of 2016.

Product revenue increased 45% in the fourth quarter compared to the fourth quarter of 2016 to a record \$4.6 million, bringing product revenues for the full year to \$13 million, a 21% increase over 2016. The growth was a result of ongoing strong order flows from both new customers and existing ones.

Service and installation revenue once again rose higher to \$4.1 million for the quarter, a 5% increase over the fourth quarter of 2016 and \$16.4 million for the year, up 19% versus 2016.

Finally, ADGE's energy production revenue of \$1.5 million was steady and consistent with prior results as the fleet provides a nice baseline of revenues and cash flow for the company.

For the full year, ended December 31, 2017, Tecogen reported record revenue of \$33.2 million compared to \$24.5 million for the same period in 2016, an increase of 35.6%. The completion of the merger with American DG Energy on May 18, 2017 added over \$3.8 million to revenue for the year.

Also, net income improved significantly in 2017 to \$47,436 from a loss of \$1,096,283 in the prior year, an increase in profitability of \$1,143,719. This full year profitability is a major accomplishment for the Company and was the result of strong performances across-the-board from product sales, installation and services to the ADGE fleet of on-site utility sites.

Perhaps even more importantly, Tecogen achieved adjusted EBITDA of \$533,000 in the fourth quarter, which was not only a record, it also marked the sixth consecutive quarter and the first full calendar year of positive operational results.

Sales backlog of equipment and installations has grown to \$15.7 million at year end 2017 compared to \$11.1 million at year end 2016, a sizable increase. As of March 19, 2018, backlog stood at \$17.4 million, well ahead of the Company's stated goal of maintaining sales backlog above \$10 million. Both the backlog and backlog-related revenue have consistently moved higher since management

began providing backlog data in 2014. The growth is broadly attributable to all the components that comprise the backlog, namely all product sales and installation services.

Note that the backlog does not include service contract revenues, nor does it include ADGE's estimated undiscounted future energy production revenues, which exceed \$50 million, stretching over the next 15 years.



**Partly thanks to the tremendous success of the InVerde e+, Tecogen's product revenue grew 45% in the fourth quarter of 2017.**

Speaking about the results, co-CEO Benjamin Locke noted, "We expect the strong order flow to continue as enthusiasm for our InVerde e+ continues to grow due to its superiority over other CHP systems in our size range, and we expect our chiller sales will continue to improve as the HVAC market increasingly recognizes the tremendous value of so-called mechanical CHP for applications such as indoor growing, ice rinks and traditional applications, such as hospitals and other industrial applications."

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. Service

contracts make up a reliable and growing part of the Company's total sales.

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; and
- High-efficiency water heaters

Next to the three products above, Tecogen also markets an 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.

In 2012, a 75 kW CHP unit equipped with the Ultera system became the first unit to obtain a conditional air permit in Southern California, an area with one of the strictest emissions regulations worldwide.



**The Ultera Emissions System mounted to a CHP unit. Hundreds of Ulteras have been installed on cogeneration systems so far.**

Since then, the Ultera technology has been installed on hundreds of cogeneration systems and functions impeccably. **There is no comparable technology on the market today. It truly sets Tecogen apart from its competition** (also read Ultera on page 8).

Moreover, in May 2017, Tecogen added another important revenue source, as the Company completed its acquisition of

American DG Energy (NYSE Mkt: ADGE). American DG 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 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 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.

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.

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.

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.**

## RECENT EVENTS

### Bulova Corporate Center Added Four Tecogen Chillers

In February 2018, the Bulova Corporate Center, the former home of the Bulova Watch

Company located in Queens, NY, installed four 200-ton Tecochill water-cooled chillers. The units replaced five 170-ton Tecochills that were installed in 1994, and which consequently were approaching the end of their service lives. The sale also included a long-term service contract, which will generate additional revenue for Tecogen over the years to come.



**The Bulova Corporate Center in Queens, NY is now equipped with six Tecochill units servicing the building.**

Tecogen now has six Tecochill units servicing the building, including two 350-ton DT Series chillers that were installed in 2002.

Benjamin Locke, Tecogen's Co-CEO stated, "The chiller replacement cycle continues. The fact that customers are happy to do repeat business with us decades after an initial sale speaks volumes not only of the quality of our products and service, but also that the value proposition of our natural gas-powered chillers is real and unrivaled."

The purchase of these chillers qualified for incentives from Con Edison's Demand Management Program (DMP). The DMP offers electric customers financial incentives for installing qualified equipment that will permanently reduce demand on the grid's peak load. Incentives can sometimes be as high as 50% of the project's costs. This program is open to Con Edison customers in New York City and Westchester County.

State-based incentives for natural gas-engine driven chillers are a boon for facilities across the Northeastern states. In Massachusetts, for example, an incentive of between \$0.25 and

\$0.30 per kilowatt hour that is removed from the grid, is provided. Other states, such as Connecticut, New Jersey and Pennsylvania also offer incentives for similar installations.

In addition to reducing the cost of purchase thanks to these incentives, customers' energy bills are also substantially lower over the service lives of the chillers. At Bulova, for example, millions of dollars in energy costs will be saved because of the super-efficient Tecochill chillers.

### Boston-area Ice Rink Adds Chiller

Last week, an ice rink in the suburban Boston area ordered its second Tecochill STx Series water-cooled chiller to accompany the same chiller installed in late 2016. As with the first unit, the purchase of the second unit qualifies for local utility incentives due to its energy efficiency rating. Tecogen will provide ongoing maintenance following installation by a third-party contractor. The unit is likely to ship by early April.

"Tecochill is a true power-play for ice rinks. It gives them the ability to produce their ice at half the cost and provides ample free hot water to all of the necessary thermal loads at a rink such as ice resurfacing, dehumidification, ice pit melting, sub soil heating, domestic hot water production for showers, and even space heating," according to Tecogen Product Manager Stephen Lafaille.

Mr. Lafaille continued, "At the time of the initial sale in 2016, it was apparent that there may be a need for a second chiller. Six-figure savings in the first full year of operation and 99.9% uptime from the first chiller and a substantial incentive from the local utility certainly aided the owner's decision to work with us again. The local electric utility also projected rate hikes over the coming years while the owner's research into natural gas futures indicates that his spark spread is likely to only get wider."

### Florida Company Orders Three Chillers

During the past week, a major corporation in Florida's Tampa Bay decided to purchase three Tecochill RT-50 series chillers that will

be installed at its new headquarters, currently under construction. The units are expected to ship by the end of the second quarter of 2018.

Tecogen CEO Benjamin Locke commented, "Growing concerns about rising electric rates and grid resiliency are making Florida an increasingly attractive market for our products. Importantly, the state's Governor Rick Scott just last month signed into law two bills (SB 7028 and HB 7099) that require all nursing homes and assisted living facilities in the state to have an emergency back-up power source that can keep the air conditioning running in case of a power outage. Both our Tecochill line of natural gas-powered chillers and our flagship InVerde e+cogeneration product can be an integral part of the solution to meet the new requirement as the law allows for machines powered by pipeline gas. I would note that our chillers require less than 1% of the electricity to operate as a competing electrical chiller, which a small retail back-up generator can easily provide."

## 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, which is expected to take approximately four months, 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**.

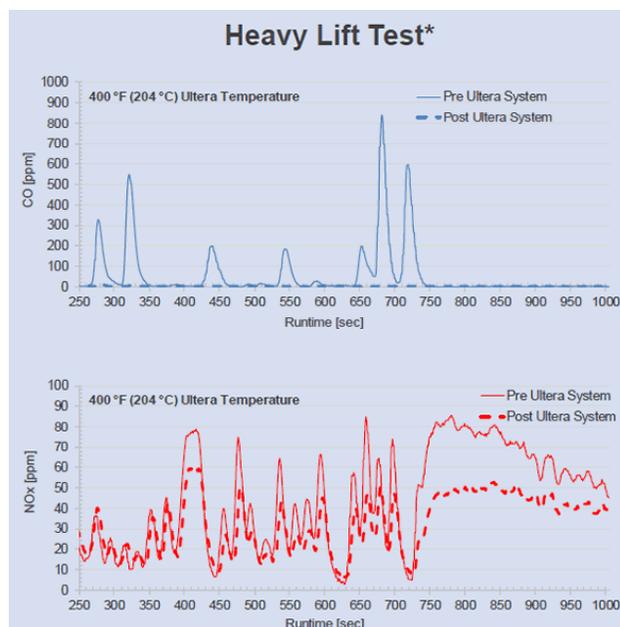
In late 2016, the PERC provided the Company with a research grant to demonstrate Ultra's emissions reduction capability in a propane-fueled fork truck.

The project has significant potential for the industry, as these vehicles generally operate indoors, where health concerns are magnified. In recent years, the market share for propane fork trucks has been eroded by battery-

operated versions, 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 are superb.

The image below depicts a representative test run for the fork truck under heavy use. In this heavy lift test, the truck is subjected to 20 repeated lifts in a 12-minute period. This is a strenuous duty cycle as the weight, 4,300 pounds, is close to the 5,000 pound rating of the truck.



The chart shows emissions from the fork truck associated with these heavy lifts. On top, are the measured carbon monoxide (CO) emissions, while below, in red, are the emissions for nitrogen oxides (NOx). The solid lines in each chart depict the concentrations before entering the Ultra stage, while the dash lines are post-Ultra emissions.

Beginning with CO, measurements pre-Ultra, show emission peaks of up to 900 parts per million, while the amount of CO leaving the Ultra is very close to 0. In addition, the bottom chart, shows an overall 24% reduction in NOx emissions when using Ultra.

Moreover, the Ultra removed 58% of total hydrocarbons (THC) emissions during these

tests. This is important, as regulations treat THC and NOx as a single pollutant. Their emissions are added together and are required to be below a single prescribed limit. As such, the hydrocarbon removal is very significant.

The project to apply Ultera to fork trucks has made substantial progress both in terms of testing and refinement of the prototype's design. Test results are strongly encouraging and now undergoing review by the fork truck manufacturer, which is planning to visit the Tecogen plant late April.

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 Dominates NYC Cogeneration Market

Sales of Tecogen's InVerde e+ cogeneration units continue to rise. Especially in the NYC area, sales are booming. The past few months, CHPs with a total capacity of over 1,000 kW, have been installed in different apartment buildings in Manhattan, NY.

These deals are worth several millions of dollars and all come with long-term service contracts, which will generate additional revenue for the Company in years to come.



**Office and apartment buildings in Manhattan, which sit over gas lines, are a natural fit for Tecogen's CHP equipment.**

Also notable is that several of the orders were won through third parties, such as engineering companies, building management companies, and energy efficiency consultants. This is important as those parties often advise building owners and managers on their construction or renovation plans. Being top of mind when it comes to a building's energy solutions is crucial.

Tecogen's Co-CEO Benjamin Locke was quoted saying, "As our robust flow of contract wins suggest, we are a dominant player in New York City's multi-unit residential cogeneration market. In fact, we believe that we are the leader in our segment of the market nationwide. As interest in cogeneration among owners and residents of

multi-unit housing gains traction, we are at the top of the list of preferred vendors."

New York City has experienced severe weather events in the past few years, such as Superstorm Sandy and Hurricane Irene. Such disasters, often causing electric outages lasting for days or weeks, have urged national and local officials to review ways to improve energy reliability and resiliency. After all, backup generators only have fuel supplies for a few days at most and refueling them is often impossible as roads can be flooded or blocked.

However, because some CHP systems operate independently of the grid, they do keep the lights on at apartment buildings, hospitals, nursing homes, and college campuses in case of an emergency.

Consequently, many state agencies and local utilities offer grants or other incentives for the installation of CHP equipment. For example, grants from the New York State Energy Research and Development Authority, known as NYSERDA, typically cover about 40 percent of the total cost to buy and install a CHP unit. The grants are worth \$1,800 per kilowatt in New York City and \$1,500 per kilowatt in other parts of New York State, up to a maximum grant of \$2.5 million.

Next to grid independence, New York also recognizes CHP as a key element in achieving its environmental goals. In order for New York State to reach its ambitious clean energy targets of 50 percent renewable energy by 2030 and an 80 percent reduction in greenhouse gas emissions by 2050, it is counting on CHP technology, amongst others.

A final item that mustn't be overlooked is getting the units up and running and maintaining them properly. This is a key aspect of the entire package. It is critical to do it right. Only an impeccable installation ensures the buyer of maximum energy and cost savings.

As for the installation of a CHP, Tecogen relies on experienced electrical and mechanical contractors. They are familiar with local codes and standards, have broad expertise on gas and electrical interconnections, and a

building's heating/cooling integration. Each CHP installation is unique; having an engineering team that can work with customers to solve their specific challenges is a differentiator.

But offering outstanding service extends beyond installation. Since many CHP systems are in place for 20 years or more, Tecogen also offers second to none service support. The Company does that through a nationwide 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.

## FINANCIALS

Total product revenue for the full year 2017 grew 21% year-on-year to almost \$13 million. Product revenue growth was driven by strong sales of chiller and cogeneration equipment.

Amounts in \$000's	12/31/17	12/31/16
Product Revenue	4,642	3,196
Service Revenue	4,118	3,915
Energy Revenue	1,504	-
<b>Total Revenue</b>	<b>10,264</b>	<b>7,111</b>
Cost of Product Sales	2,751	2,154
Cost of Services Sales	2,738	2,253
Cost of Energy Sales	981	-
Total Cost of Sales	6,469	4,407
<b>Gross Profit</b>	<b>3,795</b>	<b>2,704</b>
Operating Expenses	3,487	2,658
<b>Income (Loss) from Operations</b>	<b>308</b>	<b>46</b>
Total Other Expenses	20	42
<b>Net Income (Loss)</b>	<b>288</b>	<b>5</b>
Diluted EPS	0.01	0.00
Diluted Shares Outs.	24,737	19,964
<b>Selected income statement data for the quarters ending December 31, 2017 and December 31, 2016. Source: Company Filing</b>		

Total service revenue in 2017 was \$16.3 million, showing 19% growth over 2016. Total full year service revenue benefited from 2% growth in service revenues (revenue from contracted maintenance and replacement part sales) and 47% growth in installations revenue as the Company's turnkey installation

offerings continue to gain traction with customers.

Note that Product Revenue is derived from the sale of the various cogeneration and chiller units. The Company's Service Revenue, however, is derived from long-term maintenance contracts and turnkey installations.

The new energy production revenue from the ADGE sites added \$3.8 million to total revenue in 2017. The ADGE revenue stream adds an important second source of annuity-like revenue thanks to its long-term contracts.

Product gross margin was 38.3% for 2017 compared to 33% for 2016. This improvement is due to the implementation of production efficiencies and material labor and factory utilization efforts. Service margin declined to 37.7% for 2017 compared to 41.9% in 2016. Installation projects, which carry a lower margin than service maintenance contracts, were a higher percentage of the product mix as compared to last year, bringing the overall service margin down on a comparative basis.

Energy production activities from the ADGE fleet provided a 46.9% gross margin and \$1.8 million in gross profit, bringing the consolidated gross margin to 39% for the year.

### Balance Sheet as of December 31, 2017

Note that due to the American DG acquisition it is hard to compare the current balance sheet with the one a year ago.

For example, the Unfavorable Contract Liability in the table represent the estimated fair value of American DG Energy's customer contracts (both positive for favorable contracts and negative for unfavorable 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.

Amounts in \$000's	12/31/17	12/31/16
Cash and Cash Eq.	1,673	3,722
Accounts Receivable	9,537	8,630
Inventory	5,131	4,774
<b>Total Current Assets</b>	<b>21,661</b>	<b>20,059</b>
Property & equipment	12,266	517
Intangible Assets	2,896	1,066
Goodwill	13,366	41
<b>Total Assets</b>	<b>50,671</b>	<b>23,741</b>
Accounts Payable	5,095	3,367
Accrued Expenses	1,417	1,378
<b>Total Current Liabilities</b>	<b>8,708</b>	<b>5,623</b>
Promissory Note	-	3,149
Unfavorable Contract Liability	7,730	-
<b>Total Liabilities</b>	<b>16,976</b>	<b>9,230</b>
Total Stockholder Equity	33,695	19,982
<b>Selected balance sheet data for December 31, 2017 and December 31, 2016. Source: Company Filing</b>		

Also important to note on the balance sheet is that as a result of the Company's financial success of the past few quarters, it was able to retire a convertible note to Michaelson Capital Special Fund LP of \$3,150,000, plus interest, fully discharging its obligation under this agreement. Consequently, as of year-end 2017 total debt of Tecogen only consisted of a note due to a related party in the amount of \$850,000, plus the related accrued interest.

This enables the Company to better utilize its borrowing capacity on its balance sheet, should the need arise. Late February 2018, Tecogen signed a term sheet with a commercial lender regarding a credit facility that would permit the Company to borrow up to \$10 million. The goal is to finalize this

working capital line of credit in the second quarter.

## OUTLOOK & VALUATION

Tecogen has attained profitability for both the year and quarter ended December 31, 2017, breaking its previous quarterly and year end revenue records.

In addition to achieving profitability, a significant accomplishment in 2017 was the completion of the American DG acquisition in May of 2017. ADGE is now an important source of stable, high-margin revenue that helps balance out the volatility in Tecogen's other revenue streams.

And there's lots more ahead...

A broad diversity of market participants is becoming increasingly comfortable with the Company, its products, and its ability to deliver the most value of any Combined Heat and Power system. For example, the Company continues to cultivate and deepen its relationships with energy service companies (ESCOs). They were important contributors to product revenue growth in 2017.

Also, indoor agriculture continues to emerge as an important driver of near-term revenue growth. In the fourth quarter, Tecogen announced 3 chillers to be installed at a Massachusetts grow facility and two CHP machines sold to a cucumber grow facility in Ontario. Many more orders in this area are expected in 2018.

The situation on the regulatory front is becoming more favorable to Tecogen as well. The Federal budget bill, passed into law in February 2018, extended the 10% investment tax credit (ITC) for new CHP projects to the end of 2021 and retroactively back to the start of 2017. In management's view, the ITC extension signals the growing appreciation among lawmakers and regulators for cogeneration. This appreciation extends to the state level via the continuation of state-run incentives such as the New York State Energy Research and Development Authority (NYSERDA) rebate program, New Jersey's

SmartStart program and emerging programs in other states.

Moreover, electric utilities are starting to embrace CHP as a means for supporting areas with constrained electrical capacity, as evidenced by new programs in the Con Ed territories as well as other large utilities.

**The outlook for Tecogen has never been more promising. The core business of selling, installing and servicing cogeneration and chiller systems is profitable, scalable and provides a fundamental revenue and profit stream. The Company's advanced microgrid controls technology are already in place to take advantage of grid stabilization needs and support strategies, and the Ultra emissions technology has been accepted as the best available approach for engine generation.**

**Finally, its Ultra emissions technology, whether it's upgrading existing stationary engine systems, retrofitting fork trucks to be Near Zero emission, or improving gasoline vehicle emissions, promises tremendous upside for the Company.**

### 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 25.9 million diluted shares outstanding, the intrinsic value of Tecogen's shares derived from our model is \$9.06.

**We reiterate our buy recommendation for Tecogen Inc. and are increasing our target price from \$8.41 to \$9.06, which is 203% above today's stock price.**

## SHARE DATA & OWNERSHIP

As of March 21, 2018, Tecogen had 24,803,096 common shares outstanding. In

addition, the Company had 1,061,552 stock options outstanding with a weighted average exercise price of \$3.60. Each stock option entitles its holder to purchase one common share of the Company.

The principal owners of the Company's common stock are Monovoukas Yiannis (10.5%), John Hatsopoulos (9.27%), Tryfon Natsis (6.5%), and George Hatsopoulos (5.7%),.

## MANAGEMENT

### ▣ **BEJAMIN 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 2014 – FY 2017

All numbers in thousands

PERIOD ENDING	FY 2014	FY 2015	FY 2016	FY 2017
<b>Total Revenue</b>	<b>19,343</b>	<b>21,443</b>	<b>24,490</b>	<b>33,203</b>
Cost of Revenue	12,944	13,809	15,190	20,248
<b>Gross Profit or (Loss)</b>	<b>6,399</b>	<b>7,633</b>	<b>9,301</b>	<b>12,954</b>
<b>Operating Expenses</b>				
General & Administrative	7,265	7,998	7,994	9,520
Selling	1,796	1,687	1,637	2,272
R&D	1,041	592	667	937
Total Operating Expenses	10,102	10,277	10,289	12,729
<b>Operating Income or (Loss)</b>	<b>(3,703)</b>	<b>(2,643)</b>	<b>(997)</b>	<b>225</b>
<b>Other Income or (Expense)</b>				
Interest & Other Income	10	14	12	28
Interest Expense	(177)	(172)	(176)	(155)
Income or (Loss) attributable to the non-controlling interest	125	74	65	50
<b>Net Income (Loss) attributable to Tecogen</b>	<b>(3,746)</b>	<b>(2,727)</b>	<b>(1,096)</b>	<b>47</b>

Annual Income Statement FY 2014 – FY 2017. Source: Company Filings



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