

Tecogen Inc. (TGEN)

Company Report – April 22, 2017

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, as it has already shipped over 2,300 units, some of which have been operating for almost 25 years.

In the fourth quarter of 2016, product sales and service sales increased 144% and 32% respectively, which led to the highest quarterly revenue in Tecogen's history. The strong increase in sales lead the Company toward profitability in the last 6 months of the year. The Company expects this growth cycle to continue into the current year.

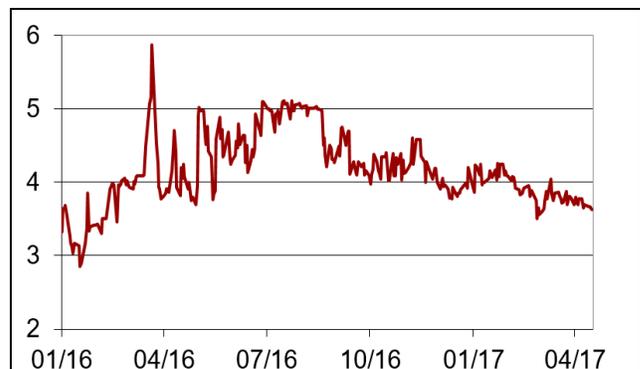
The Company's sales backlog of equipment and installations stands at \$15.6 million, well above the Company's stated goal of maintaining sales backlog above \$10 million.

The targets of the Company for 2017 and beyond are strong. Management continues to focus on delivering gross margins in the 35% to 40% range, maintaining the backlog and installation sales above \$10 million, and delivering stable operating expenses of approximately \$10 million on a yearly basis.

Based on the intrinsic value of Tecogen's shares derived from our model, we reiterate our buy recommendation for Tecogen Inc. with a price target of \$9.62, which is 157% above today's stock price.



- ▣ At ULTRATEK, everything is going as planned. The paper presented at the SAE World Congress described how the use of Tecogen's Ultra emissions technology resulted in significant reductions of carbon monoxide (CO), nitrogen oxides (NOx), and non-methane organic gas (NMOG) emissions, with no measurable effect on fuel economy.
- ▣ The development of Ultra for the propane-powered fork truck market is exciting, as it extends the technology into new platforms and verticals. Note that approximately 70,000 propane powered fork lift are sold annually in the United States alone.
- ▣ The acquisition of American DG is nearing its final stage. Its existing customers will add a steady, predictable income to Tecogen's bottom line. This should help grow the Company in many different ways.



Market Data

Price	\$3.73
Sector	Technology
52-Week Price Range	\$2.46 - \$6.50
Shares Issued (m)	20.04
Market Cap (m)	\$74.76
Listings	TGEN (NASDAQ)
Website	www.tecogen.com

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

Existing customers for these 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, laundries, ice rinks, swimming pools, factories, municipal buildings, and military installations.

The main drivers for end users to opt for a CHP system are a significant reduction in energy costs, fuel efficiency, emissions reduction, and backup power generation and Microgrid capabilities that allow for participation in demand response and load shaving incentive programs.

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.

The Company 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.

Tecogen is a well-established and respected Company in the industry, as it has shipped over 2,300 units so far,

some of which have been operating almost 25 years.

For the fourth quarter, ended December 31, 2016, Tecogen reported a positive net income. This was the second quarter in a row that the Company reached this important milestone.

Sales during the fourth quarter of 2016 reached a record \$7,111,108 up 66.2% compared to sales of \$4,279,350 in the fourth quarter last year. Similar to the third quarter of 2016, the Company achieved profitability in the fourth quarter, delivering \$4,556 in net income for the period, compared to a net loss of \$826,228 in the fourth quarter 2015.



Five Tecogen CHPs leaving the factory, ready to be installed.

ost of the product revenue in the quarter was generated from cogeneration sales with key repeat customers. The Company also saw impressive growth in service revenue due to increases in installation support accessories.

For the full year 2016, Tecogen reported revenues of \$24,490,386 compared to \$21,442,657 for the same period in 2015, an increase of 14.2%. Full year 2016 net loss improved significantly to \$1,096,283 from \$2,727,413 in the prior year. **The Company expects this growth cycle to continue into the current year.**

The Company's sales backlog of equipment and installations as of March 21, 2017 was \$15.6 million, well above the Company's stated goal of maintaining sales backlog above \$10 million. The current backlog is a

good mix of our core product segments, such as multi-unit residential, hospitality, education, healthcare, and industrial applications. Note that the backlog does not include service contract revenues, or sales of TEDOM products by the TTCogen joint venture.

Judging from the backlog, which continues to be far above the Company's ongoing goal of \$10 million, it's clear that the order pipeline is chock-full.

As of year-end 2016, Tecogen had 83 full-time employees and 3 part-time employees, including 7 sales and marketing personnel and 35 service personnel.

Revenue Sources

Tecogen manufactures 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. The Ultera is designed to deliver simple, cost-effective solutions for natural gas engines to meet stringent emissions standards.

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 9).

In 2015, following Volkswagen's emissions scandal, Tecogen formed Ultra Emissions Technologies Ltd (ULTRATEK), a joint venture with a group of strategic investors, to test, verify and develop the Ultera system for gasoline powered automotive engines.

Results from initial Phase I testing of Ultera on a light duty vehicle indicated that the system is highly effective at delivering emissions reduction in criteria pollutants (those contributing to smog and negatively impacting human health) in excess of currently available commercial technology. Also very important to know is that consistent with the experience of the Ultera in stationary industrial applications, the system did not increase the fuel usage of the test vehicle. Phase II testing, which was successfully completed late October 2016, again showed outstanding results (Also read ULTRATEK JV on page 10).

In October 2016, Tecogen was awarded research grant funding from the Propane Education & Research Council (PERC) to develop the Ultera technology for propane powered fork trucks. This could be another lucrative opportunity, knowing that 70,000 propane powered fork lift trucks are sold each year in the US alone.

Moreover, Tecogen should soon add another important revenue source. Early November 2016, the Company announced that it would acquire American DG Energy (NYSE Mkt: ADGE), which 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.

When the acquisition is completed, which is expected in the first half of 2017, Tecogen will be able to offer a cost-free-installation option to customers that don't have access to financing, or that are not interested in owning and maintaining the equipment.

Noteworthy is 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.

Another major advantage of the acquisition is that there will be plenty of cost saving opportunities. For instance, the combined companies are expected to benefit from approximately \$1 million of general and administrative cash savings as duplicative functions are eliminated. Also, the merged companies will allow for more efficient deployment of service technicians thanks to Tecogen's wide service network. In addition, a consolidated inventory will improve purchasing economics and shipping costs (Also read Growth Drivers).

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 CO₂ 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.



Tecogen's cogeneration system reduces Toren's carbon footprint by more than 2000 tons of CO₂ each year while providing an annual energy cost savings of \$540,000.

Through 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 maintained at less than 20kW.

Another innovative, unique 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 should ever experience a blackout like the one in 2002.

Nationwide Factory Service

Besides selling machines, which in many cases are one-off deals, Tecogen generates plenty of revenues 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. In addition, the Company plans to eventually add a 10th service center in the southeast of the US.

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 and 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.

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
- Electric grid interconnection 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.

Likewise, in New Jersey, where emissions regulations are trending towards California levels, the Company has already established its Ultera-fitted CHP as a certified technology; a unique status that separates it from the competition.

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.

TTCOGEN JV

In May 2016, Tecogen formed a 50/50 joint venture corporation with the Czech company TEDOM, one of Europe's largest Combined Heat and Power manufacturers.

The new company, called TTcogen LLC offers a complete package of 27 different CHP modules, ranging in size from 35 kW up to 4 MW, making it the premier packaged CHP provider with the widest range available in the United States.

Soon after the formation of the JV, the initial sale was booked for a TEDOM Micro 35 kW Combined Heat and Power unit. The CHP was recently installed in a 138 unit multi-family residential building in Brooklyn, NY. Close on the heels of the initial one, the second order was received from an elementary school in New Jersey.



The first TEDOM Micro 35 kW CHP unit arriving in the United States at Tecogen's headquarters.

With a less than 3 year payback period after incentive rebates and annual savings estimated to be in excess of \$60,000, the Micro 35 kW unit is a natural fit for many residential buildings.

The true beauty of this joint venture is that Tecogen in the past often got inquiries from potential clients who ended up not buying a CHP unit from Tecogen because its equipment was not an appropriate size for the customer's facility. The building's required load was either too big or too small for Tecogen's equipment. Now, thanks to the much expanded offering, TTcogen is able to service those potential customers, quadrupling Tecogen's addressable market for CHP.

Biofuel

Most notably, TEDOM's specialized line of cogeneration equipment has the power to operate on biofuel, a renewable energy source with a rapidly growing market. This is an important feature as the United States is expected to implement new regulations in the coming years which require that all food and agricultural waste be recycled.

New York City's zero waste initiative, for example, aims to reduce garbage by 90% in 2030. A substantial aspect of this initiative is the required collection of organic food waste for use in anaerobic digester facilities to fire large-scale CHP systems by using the resulting biogas as a fuel feedstock. Many of these facilities are planned for construction in 2017 and 2018. Those facilities would be ideal for TTcogen's equipment.

The biofuel CHP units could potentially also open up the market for agricultural installations that are starting to use their agricultural waste as a fuel source. Eventually, it may even open up the wastewater and landfill markets, similar to recent development seen in Europe.

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. Waste heat captured from the cogeneration system can even be fed into

a device called an absorption chiller, which is able to convert the waste heat into cooling. As such, a normally very energy intensive task, such as heating and cooling, is now accomplished at no additional cost to the customer or environment.

Tecogen's products also address the global objective of reducing greenhouse gas emissions. When burned to generate power, natural gas produces lower carbon emissions per unit of energy than any fossil fuel, according to the EPA combined heat and power emissions calculator.

The Company's products, in addition to using the lowest amount of carbon fuel, further reduce CO₂ emissions (greenhouse gases) because of a CHP's higher efficiency. The graph on the right compares the CO₂ output of a Tecogen product to that of the national electric grid and other generation technologies. It's clear that the Tecogen systems are far superior to the grid and even outperform the CHP technologies of fuel cells and microturbines at a fraction of the cost.

Following is an overview of the three types of CHP systems that Tecogen offers. Also, the highly efficient Ultra system that makes CHPs meet the most stringent emissions standards is detailed below.

Combined Heat and Power

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

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 maximize 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 that the harvested heat to produce thermal energy is not taken into account. A Tecogen CHP system that also uses the recovered heat, achieves efficiency between 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.

This way, the CHP unit basically becomes a complete **Building Energy Management System**. We're not aware of any CHP competitor having this feature.

BUILDING ENERGY MANAGEMENT SYSTEM (BEMS)

An energy management system (BEMS) is a sophisticated method to monitor and control a building's energy needs. Next to energy management, the system can control and monitor a large variety of other aspects of the building regardless of whether it is residential or commercial. Examples of these functions are heating, ventilation and air conditioning (HVAC), lighting or security measures.

The global market for building energy management systems continues to grow as technologies reach maturity and customers gain understanding of the business value generated by investment. According to Navigant Research, the global BEMS market reached \$2.4 billion in 2015 and is expected to grow to \$10.8 billion by 2024. Although Tecogen is a smaller player in this market, it does indicate the strong demand and growth potential.

Moreover, the new units automatically start up within 10 seconds in the event of a full blackout of the grid, making the CHP units 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.

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. So it doesn't need any additional permitting for interconnecting to the electric grid, speeding the installation process.

The best applications for Tecogen cogeneration systems are in facilities that have consistent electrical and thermal needs such as hospitals, nursing homes, colleges, schools, recreational facilities, government buildings, large residential facilities, industrial facilities, hotels, and ice rinks.

Ilios High-Efficiency Water Heaters

The Ilios water heater product operates like an electric heat pump but uses a natural gas engine instead of an electric motor to power the system.

The Ilios high-efficiency 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.

This technology was developed in 1987. The engine drives a compressor that makes chilled water; while the engine's free waste heat can be recovered to satisfy the building's needs for hot water or heating. This process is sometimes referred to as "mechanical" cogeneration, as it generates no electrical power, and the equipment does not have to be connected to the utility grid.

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

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



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

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.

More recently, sales in the agricultural space have taken off. For example, the Company sold several chillers to indoor growing facilities. Although these particular customers will use the chillers in the cannabis production industry, there are thousands of farmers with greenhouses or indoor facilities that grow fruits, vegetables, plants or flowers, that could also benefit from a similar installation.

Ultera

In 2008 there was a dramatic change in the air quality regulations in Southern California. At that time no technology could meet the new, stricter, emission standards.

In reaction to the new regulations, Tecogen developed the Ultera technology between 2009 and 2010 as part of a research effort funded by the California Energy Commission and Southern California Gas Company. The objective was to bring emissions from natural-gas engines and CHP systems into compliance with California's new standards, which were then and still are, among the most stringent standards in the world.

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 a little air between the first and second stages and altering the process conditions.

Tecogen conducted three validation programs for its revolutionary technology:

- **Third-party laboratory verification** - The AVL California Technology Center, a long-standing research and technology partner with the international automotive industry, confirmed Ultera's results in their state-of-the-art dynamometer test cell, which was outfitted with sophisticated emissions measurement equipment.
- **Verifying longevity and reliability in the field** - One of Tecogen's 75-kW units, already operating at a customer location in Southern California, was equipped with the Ultera low-emissions technology and a device to monitor emissions continuously. The Ultera low-emissions system operated successfully for more than 25,000 hours, approximately 3.5 years, and consistently complied with California's stringent emission standards over the entire field testing period.
- **Additional independent tests** - During the field test, two companies, licensed in California to test emissions, each verified the results at different

times. The results from one of these tests (obtained in August 2011) enabled the Company to qualify for New Jersey’s fast-track permitting for low emissions equipment. Virtually every state nationwide requires some kind of permit related to local air quality, but New Jersey allows an exemption for systems such as Tecogen’s that demonstrate superior emissions performance. This certification was granted in November 2011.

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 annual output of emissions of the InVerde unit equipped with the Ultra technology is extremely low and compares favorably with alternative energy technologies producing the equivalent energy output on an annual basis (100 kW, 670,000 Btu/hr).

This technology was patented in the United States in October 2013 with many foreign patents granted or applications pending. The Ultra low-emissions technology repositions the Company’s engine-driven products in the marketplace, making them comparable environmentally with emerging technologies such as fuel cells, but at a much lower cost and greater efficiency.

Tecogen originally developed and patented the Ultra-low emission control technology for its own CHP products and has since decided to make the technology available for retrofit on non-Tecogen applications.

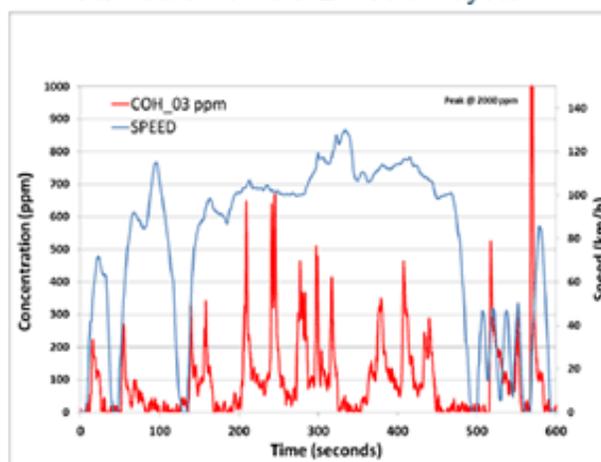
The Ultra retrofit kits deliver simple, cost-effective and robust solutions for meeting even the most stringent emissions standards. The patented system provides peace of mind to its customers by lowering NOx and CO to

near-zero levels without the need for complex additional controls or frequent maintenance.

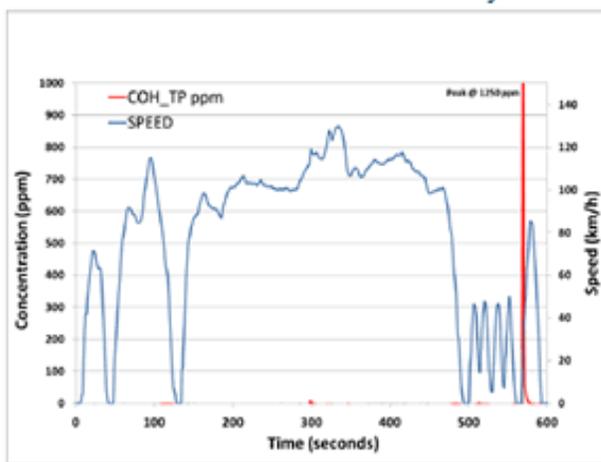
ULTRATEK JV

Adapting the Ultra technology to gasoline fueled automotive engines, represents an exciting and potential game-changing new market for Tecogen. The prospect of vehicle and stationary engines, with standard engine technology, but realizing fuel cell like emissions is tremendously compelling from a policy and market standpoint.

Standard Vehicle Emission System



With the addition of the Ultra System



The above graphs show the measured CO concentration in ppm (red) and the speed of the vehicle in kilometer per hour (blue). CO emission is nearly eliminated when the Ultra is added.

In December 2015, following the outbreak of the Volkswagen emissions scandal, Tecogen formed Ultra Emissions Technologies Ltd

(ULTRATEK), a joint venture to pursue this once-in-a-lifetime opportunity.

Tecogen received an initial 50% equity interest in the JV in exchange for a fully paid-up worldwide license to use Tecogen’s Ultra emissions control technology in the field of mobile vehicles burning gasoline. The other half of the joint venture equity interest was purchased for \$3,000,000 by a small group of offshore investors.

In August 2016, the ULTRATEK stakeholders invested an additional \$4 million, and the following month another \$6.25 million was raised in a third round financing. Very interesting to know is that investors in the third round of funding paid a substantial premium to prior funding rounds, giving ULTRATEK a valuation of \$58.2 million!

Although the emissions scandal for vehicles has primarily been about diesel engines, for which the Ultra technology is not suited, gasoline vehicles have been included in the larger problem of being certified in tests that underrepresent their true on-road emissions levels. In fact, European regulators are now implementing on-road, real-world driving tests for vehicle emissions compliance - the United States is considering similar testing standards.

Outstanding Phase I and Phase II Test Results

It was a proud moment for Tecogen representatives when they presented a paper at the prestigious SAE World Congress early April 2017. After all, when a provider of clean energy products is invited to present a paper on a platform as big as the SAE, it speaks volumes about the kind of research the Company is undertaking to eliminate criteria pollutants and significantly reduce the carbon footprint of engines.

The paper, entitled "Development and Testing of the Ultra® Dual Stage Catalyst System on Gasoline-Fueled Light Duty Vehicles", was a compilation of the results achieved in Phase I and Phase 2 of the Ultra tests on automobile engines conducted in 2016. It was presented by Prof. Ahmed Ghoniem, Ronald C. Crane

Chair Professor of Mechanical Engineering at MIT and Tecogen Board member.

SAE INTERNATIONAL

SAE is a U.S.-based, globally active professional association and standards developing organization for engineering professionals in various industries. The organization has more than 127,000 engineers globally. Principal emphasis is placed on transport industries such as automotive, aerospace, and commercial vehicles.

The main objective of the Phase I test was to verify that the favorable performance of the Ultra technology, which had been proven on stationary natural gas engines, could be repeated on a gasoline engine on a vehicle. The tests were conducted on two light duty trucks.

The so-called US06 standard drive cycle was performed. This cycle encompasses a high speed/quick acceleration loop that lasts 10 minutes, covers 8 miles (13 km), averages 48 mph (77 km/h) and reaches a top speed of 80 mph (130 km/h). It includes four stops and a brisk acceleration.

The test results show that carbon monoxide (CO) emissions are reduced by as much as 94%. In addition, levels of non-methane hydrocarbons (NMOG) are lowered by 81%.

	CO	NMOG	NOx	Nox + NMOG
Standard Vehicle	332	5.234	5.763	10.997
With Ultra	20	1.001	5.072	6.074
% Reduction	94%	81%	12%	45%

Drive cycle test results - Emissions (mg/mile). Source: Company Presentation

Needless to say these were outstanding test results. As far as we know no other technology in the world has ever accomplished similar results with gasoline powered engines.

As a result of these highly encouraging Phase I results, Phase II testing on a broader range of vehicles commenced in September of 2016. This phase was concluded late October and

was successful in accomplishing its goals with an Ultera device that was even more accurate than the unit used in Phase I. According to the Company, the tests have provided plenty of data showing the system's effectiveness.

Robert Panora, Tecogen's President and COO, and co-author of the paper noted, "This innovative aftertreatment technology will provide the automobile industry with an emission control system that can be both incorporated into vehicle design, or retrofitted to existing vehicles. We are very excited about the results".

RECENT EVENTS

Strong Relationships Help Secure Order Flow

It's great to see that Tecogen's growing network of energy service companies, engineering firms and construction companies, with whom it has a strong working relationship, helps to secure a constant flow of new orders.

Late last year, for example, Tecogen sold five 100 kW InVerde e+ Combined Heat and Power units at once through MMI Mechanical Inc. The five CHPs will provide electricity, space heating and domestic hot water to over 1000 residential units in a 5 building complex in Harlem, NY.

MMI Mechanical, based in Brooklyn, NY, specializes in the service and installation of heating and hot water equipment for large residential, commercial and industrial facilities. This is the first project with MMI for Tecogen, and hopefully the start of a fruitful relationship.

It is worth noting that the Tecogen state of the art CHPs will replace an old oil-fired steam plant. One of the major advantages of the new technology versus the old one, is that the InVerde e+ systems are expected to eliminate approximately 2,750 tons of carbon dioxide per year. To put that in perspective, reducing emissions with 2,750 tons of carbon dioxide equals removing 527 cars from the road or planting nearly 65,000 trees.

In addition, a few weeks ago, Tecogen won a substantial order to deliver six CM-75 Combined Heat and Power units for the under-construction MGM Springfield casino.

The six CHPs will provide heating and electricity for the entire building. Thanks to these units, MGM will save between \$300,000 - \$400,000 annually when compared with the estimated cost of a boiler and utility grid electric supply. The \$950 million resort in Springfield, Massachusetts, is scheduled to open in fall 2018.



Being built on a 14 acres lot, MGM Springfield is currently the largest construction project under development in Western Massachusetts.

MGM Springfield is currently the largest construction project under development in Western Massachusetts. When it opens, the resort will feature a luxury hotel and a variety of world-class entertainment offerings – including dining, shopping, gaming, and amusements – that will attract millions of visitors

CHPs are an excellent fit for casino resorts, as their consistent need for climate control and typically high electric demands mean cogeneration can offer substantial savings.

This is Tecogen's first casino project, and the first with MGM Resorts International (NYSE: MGM), one of the world's leading hospitality groups, that operates a portfolio of well-known resort/casinos, including Bellagio, MGM Grand, Mandalay Bay and The Mirage.

The units will be installed by Harry Grodsky Company Inc., a full service mechanical contractor with substantial experience in meeting the needs of casino resorts in the northeastern United States.

Collaboration With NEEA Could Open Up Pacific Northwest Market for Tecogen High-Efficiency Water Heater

In February of 2017, Tecogen initiated a collaboration with the Northwest Energy Efficiency Alliance (NEEA), a union of more than 140 Northwest utilities and energy efficiency organizations, to install more energy efficient natural gas equipment in the Pacific Northwest of the United States.

NORTHWEST ENERGY EFFICIENCY ALLIANCE (NEEA)

Founded 20 years ago, the Northwest Energy Efficiency Alliance (NEEA) is an alliance of more than 140 Northwest utilities and energy efficiency organizations working together on behalf of more than 13 million energy consumers in Idaho, Montana, Oregon and Washington.

As part of its 2015-2019 business plan, the NEEA is striving to achieve 145 average megawatts (aMW) of total regional electric savings, and more than 280 million therms of gas savings. The organization clearly knows what it's talking about. Since 1997, it has saved more than 1,200 average megawatts (aMW) of electricity through our market transformation work — the equivalent to powering more than 900,000 homes each year.

As an initial test project, an Ilios air-source unit will soon be installed in a retirement community in Salem, Oregon. The NEEA chose this location as it felt that it successfully met key parameters like appropriate size, load demand and usage and that it could become a good demonstration project.

The alliance's goal is to make the Northwest states increasingly energy efficient by accelerating new technologies, products and best practices and promoting the adoption of existing energy-efficient technologies. In addition, it aims to promote the use of natural gas, which is abundantly available in the region.

The Ilios heat pump project will examine how much energy can be saved. The test project

at the retirement facility will run through to late winter 2017. The project partners expect to publish the initial results mid-2017.

Assuming the results of this test are satisfactory, natural gas utility companies in the region could implement an incentive program similar to those in New York, New Jersey or Maine, for energy efficient equipment. This way potential clients will be able to acquire Ilios units at a lower cost, encouraging more rapid technology adaption.

GROWTH DRIVERS

Tecogen Takes Major Hurdle in Acquiring American DG Energy



A few days ago, Tecogen received positive news from the Securities and Exchange Commission (SEC) declared effective the Company's registration statement in connection with its

planned merger with American DG Energy (NYSE Mkt: ADGE). A special meeting will be held on May 18, 2017, where shareholders can vote in favor or against the merger. When a majority of shareholders votes in favor, the merger will be formally concluded shortly after the special meeting.

Upon completion of this acquisition, Tecogen shareholders are expected to own approximately 81% and American DG shareholders are expected to beneficially own approximately 19% of the combined company.

If successful, the transaction will create a vertically integrated clean technology company able to offer equipment design, manufacturing, installation, financing, and long term maintenance service.

The seeds for this merger were sown in early November 2016 when the Boards of Directors of both companies unanimously approved a definitive agreement under which Tecogen

would acquire all of the outstanding shares of American DG in a stock-for-stock merger.

If the proposed merger is consummated, each share of American DG common stock will be exchanged for 0.092 shares of Tecogen common stock, valuing American DG at an approximately 27% premium to the company's closing share price at the time of the announcement.

The combined company will retain the Tecogen Inc. name and be led by Co-Chief Executive Officers John Hatsopoulos and Benjamin Locke.

The vision behind the merger is actually threefold:

- **Make Tecogen More Competitive** – American DG Energy 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. Consequently, bringing American DG under the Tecogen umbrella allows Tecogen 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. This will make Tecogen a vertically integrated clean technology company that is well poised to compete with other distributed generation peers offering in-house financing arrangements.
- **Give Tecogen a More Stable Revenue Base** - Approximately half of the revenue generated by the merged entity will come 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. In addition, it will make the combined company's revenue profile more predictable, reducing the revenue volatility caused by somewhat cyclical equipment sales and installations.
- **Derive More Profits and Savings for Shareholders** - Shareholders of the

combined company will benefit from Tecogen's ongoing growth initiatives and joint venture interests, such as the automotive emissions control joint venture ULTRATEK and the cogeneration joint venture TTcogen. Moreover, the combined companies can benefit from approximately \$1 million expected general and administrative savings as duplicative functions will be eliminated.

FINANCIALS

Sales for the fourth quarter, ended December 31, 2016, were \$7.11 million, an astonishing 66% increase, compared with sales of \$4.27 million in the fourth quarter of 2015.

Product revenue grew 144% to \$3.2 million over the prior year comparable quarter. For the full year 2016, product revenue grew 6.6% year-on-year to \$10.7 million. Growth was particularly driven by sales of chiller and heat pump equipment.

Services revenue grew 32% in the fourth quarter to \$3.9 million, compared with Q4 2015. Service revenue for the full year 2016 was \$13.7 million, showing a 20.9% growth over the \$11.4 million in reported service revenues in 2015. Service revenue benefited from both contracted maintenance and replacement parts sales, as well as installation sales.

Amounts in \$000's	12/31/16	12/3/15
Product Revenues	3,196	1,311
Service Revenues	3,915	2,968
Total Revenues	7,111	4,279
Cost of Product Sales	2,154	1,097
Cost of Services Sales	2,253	1,584
Total Cost of Sales	4,407	2,681
Gross Profit	2,704	1,598
Operating Expenses	2,658	2,384
Income (Loss) from Operations	46	(785)
Total Other Expenses	42	13
Net Income (Loss)	4	(798)
Diluted EPS	0.00	(0.05)
Diluted Shares Outs.	19,964	17,705
Most important income statement data for the quarters ending December 31, 2016 and December 31, 2015. Source: Company Filing		

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 sales cycle for each module varies widely, and can range from as short as a month to as long as a year or more. The cogeneration and chiller modules are built to order and revenue is recognized upon shipment.

The Company's **service revenue**, however, lends itself to recurring revenues from particular customers. For the last two fiscal years, close to one third of Tecogen's revenues were generated from long-term maintenance contracts, which provide the Company with a somewhat predictable revenue stream.

Full year 2016 gross margin was 38.0% compared to 35.6% in 2015, delivering a 240 basis point year-on-year gross margin improvement that was almost entirely driven by improved product gross margins. Product gross margin for 2016 was 29.0%, delivering 400 basis points of improvement over 2015, while service gross margin was 41.9%, a 50 basis point improvement over the prior year.

Total operating expenses of \$10.3 million are perfectly in line with management's goal to deliver full year operating expenses near \$10 million. The negligible rise in operating expenses compared with last year is noteworthy, especially in light of the solid revenue growth that Tecogen achieved.

Management's goal of delivering approximately \$10 million in operating expense for the full-year remains in place going forward.

Speaking about the results, co-CEO Benjamin Locke noted, "2016 was a tremendously productive year for the Company in terms of technology development, sales and marketing improvements, business development activities, and most importantly financial performance. This trend establishes the groundwork for continued success in 2017."

Balance Sheet as of December 31, 2016

Tecogen's balance sheet remains solid. The Accounts Receivable did increase with about \$3.3 million. That was due to several large shipments of equipment that took place right at the end of the year. Mr. Garrison, Tecogen's CFO, mentioned during the fourth quarter conference call that a large portion of the increase has already cycled back through.

Amounts in \$000's	12/31/16	12/31/15
Cash and Cash Eq.	3,722	5,487
Accounts Receivable	8,630	5,287
Inventory	4,774	5,683
Total Current Assets	20,059	19,403
Property & equipment	517	544
Intangible Assets	1,066	1,045
Total Assets	23,741	21,091
Accounts Payable	3,367	3,312
Accrued Expenses	1,378	1,067
Total Current Liabilities	5,623	5,376
Promissory Note	3,149	3,000
Total Liabilities	9,230	8,649
Total Stockholder Equity	19,982	18,479
Most important balance sheet data for December 31, 2016 and December 31, 2015. Source: Company Filing		

OUTLOOK & VALUATION

2016 represented a year of tremendous progress for Tecogen. The research and engineering team managed a new product launch with the InVerde e+, a second generation inverter-based 100 kW cogeneration module with multiple new and unique features, reasserting Tecogen's competitive advantage and core CHP competency and driving sales and backlog in key markets.

In addition, the team made material progress in developing the Ultra emissions control technology for new market verticals.

Similarly, the sales team's efforts at cultivating new markets and selling relationships began bearing fruit. Key

relationships with ESCOs, property management companies and project developers have yielded good quality repeat business.

In the fourth quarter of 2016, product sales and service sales increased 144% and 32% respectively, which led to the highest quarterly revenues in Tecogen's history. This strong increase in sales lead the Company toward profitability in the last 6 months of the year.

Finally, the operations and executive team executed a number of strategic transactions - including the acquisition of the Ilios minority interest, the launch of the TTcogen joint venture with TEDOM, and the planned acquisition of American DG Energy - all of which set the stage for Tecogen's next chapter of profitable growth.

The merger between Tecogen Inc. and American DG Energy, Inc. is nearing its final stage with the acceptance of the registration statement by the SEC. Once the merger is ratified by the stakeholders of both companies, the combined entity will soon thereafter become a fact.

The existing customers of American DG will add a steady, predictable income to Tecogen's bottom line. This should help grow the Company in many different ways.

Also at the ULTRATEK JV, everything is going as planned. The paper presented at the SAE World Congress described how the use of Tecogen's Ultera emissions technology resulted in significant reductions of carbon monoxide (CO), nitrogen oxides (NOx), and non-methane organic gas (NMOG) emissions, with no measurable effect on fuel economy.

The paper is a significant validation of the tests. After all, the most important aspect of negotiating with an automotive component supplier or car manufacturer is to make sure that the test data is unassailable and verified.

At the same time, it proved that Tecogen's Ultera technology is a viable alternative to emerging new vehicle testing regulations that incorporate real world driving conditions, such as the EU6d Emission Regulation.

Knowing that Tecogen currently owns 43.09% of ULTRATEK's shares, its stake is worth about \$25 million. Given Tecogen's \$75 million market capitalization, the Company's core business is valued at only \$50 million, which is extremely low.

In addition, we expect a lot from the research contract that was awarded to Tecogen by the Propane Education & Research Council (PERC) to develop Ultera for the propane powered fork-truck market. The project will assess the adaption of Tecogen's technology for the category in collaboration with select leading fork truck manufacturers - ultimately with the goal of developing an ultra-clean propane fork truck offering a robust indoor air-quality advantage without compromising vehicle performance.

The targets of the Company for 2017 and beyond are strong. Management continues to focus on delivering gross margins in the 35% to 40% range, maintaining the backlog and installation sales above \$10 million, and delivering stable operating expenses of approximately \$10 million on a yearly basis.

Valuation

We see tremendous potential for Tecogen as its management believes it will be profitable going forward, while its growth opportunities come to fruition.

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

Based on our estimate of 22.3 million diluted shares outstanding, the intrinsic value of Tecogen's shares derived from our model is \$9.62, about equal compared to our previous report.

We reiterate our buy recommendation for Tecogen Inc. with a price target of \$9.62, which is 157% above today's stock price.

SHARE DATA & OWNERSHIP

As of March 21, 2017, Tecogen had 20,043,052 common shares outstanding. In

addition, as of December 31, 2016, an aggregate of 1,367,918 shares of common stock are issuable upon exercise of outstanding warrants and options. And finally, Tecogen has \$3,148,509 convertible debt, which is convertible into 889,831 shares of common stock.

The principal owners of the Company's common stock are John Hatsopoulos (16.2%), Tryfon Natsis (8.1%), George Hatsopoulos (6.9%), Wincrest Capital Ltd. (6.2%), and Michaelson Capital Partners (6.0%).

MANAGEMENT

▣ DR. JOHN N. HATSOPOULOS – CO-CHIEF EXECUTIVE OFFICER

Dr. Hatsopoulos has been the Chief Executive Officer of the Company since the organization of Tecogen in 2000. He has also been the Chief Executive Officer of American DG Energy Inc. since 2000, and the Chairman of EuroSite Power Inc. since 2009. 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.

▣ BEJAMIN LOCKE – CO-CHIEF EXECUTIVE OFFICER

Mr. Locke was named Co-Chief Executive Officer in October, 2014. 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.

▣ DAVID A. GARRISON – CHIEF FINANCIAL OFFICER

Mr. Garrison has been the Chief Financial Officer, Treasurer and Secretary of Tecogen since August of 2014. Prior to joining Tecogen, Mr. Garrison was Executive Vice President and Chief Financial Officer of Arrhythmia Research Technology, Inc. and its subsidiary Micron Products, Inc. since 2002. Leading the finance department of this NYSE listed company, Mr. Garrison oversaw all aspects of SEC compliance, internal controls and raising capital through debt in a capital intensive medical device manufacturing business. Mr. Garrison hold a B.S. in Finance from Miami University and an MBA from Boston University.

▣ JOSEPH GEHRET – CHIEF TECHNOLOGY OFFICER

Mr. Gehret is Tecogen's Chief Technical Officer. He is responsible for leading technology development at Tecogen and defining the Company's research and development efforts. With an expansive depth and breadth of classic as well as cutting edge technology, he has been integral in the development of all Tecogen products and technology for 30 years. He has a B.S. in Mechanical Engineering as well as an M.S. in Nuclear Engineering, both from the Massachusetts Institute of Technology.

ANNUAL INCOME STATEMENT FY 2013 – FY 2016

All numbers in thousands

PERIOD ENDING	FY 2013	FY 2014	FY 2015	FY 2016
Total Revenue	15,850	19,343	21,443	24,490
Cost of Revenue	10,820	12,944	13,809	15,190
Gross Profit or (Loss)	5,030	6,399	7,633	9,301
Operating Expenses				
General & Administrative	5,931	7,265	7,998	7,994
Selling	1,424	1,796	1,687	1,637
R&D	1,087	1,041	592	667
Total Operating Expenses	8,700	10,102	10,277	10,289
Operating Income or (Loss)	(3,670)	(3,703)	(2,643)	(997)
Other Income or (Expense)				
Interest & Other Income	4	10	14	12
Interest Expense	(141)	(177)	(172)	(176)
Income or (Loss) attributable to the non-controlling interest	357	125	74	65
Net (Loss) attributable to Tecogen Inc.	(3,449)	(3,746)	(2,727)	(1,096)

Annual Income Statement FY 2013 – FY 2016. Source: Company Filings



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