TECOGEN INC.
Form 10-K
March 29, 2019

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, DC 20549
FORM 10-K
þ ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the fiscal year ended December 31, 2018
or
o TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
Commission file number 001-36103
TECOGEN INC.
(Exact name of Registrant as specified in its charter)

Delaware	04-3536131
(State or Other Jurisdiction of Incorporation or Organization)	(IRS Employer Identification No.)

45 First Avenue

Waltham, Massachusetts	02451
(Address of Principal Executive Offices)	(Zip Code)

Registrant’s Telephone Number, Including Area Code: (781) 466-6400
Securities registered pursuant to Section 12(b) of the Exchange Act:

Title of each class	Name of each exchange on which registered
Common Stock, $.001 par value	NASDAQ Capital Market

Securities registered pursuant to Section 12(g) of the Exchange Act:
None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act.Yes ¨ No ý
Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ¨ No ý
Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ý No ¨
Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes ý No ¨
Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of the registrant’s knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or an amendment to this Form 10-K. ¨
Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company or an emerging growth company. See the definitions of “large accelerated filer”, “accelerated filer”, “smaller reporting company” and "emerging growth company" in Rule 12b-2 of the Exchange Act. Large accelerated filer o Accelerated filer o Non –accelerated filer x Smaller reporting company x
Emerging growth company o
If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. x
Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act).Yes ¨ No ý

As of June 30, 2018, the last day of the registrant's most recently completed second fiscal quarter, the aggregate market value of the voting and non-voting common equity held by non-affiliates was: $65,946,973. Solely for purposes of this disclosure, shares of common stock held by executive officers and directors of the registrant as of such date have been excluded because such persons may be deemed to be affiliates. This determination of executive officers and directors as affiliates is not necessarily a conclusive determination for any other purposes.
As of March 28, 2019, 24,829,746 shares of common stock, $.001 par value per share, of the registrant were issued and outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Certain information required for Part III of this Annual Report on Form 10-K is incorporated by reference from the Tecogen Inc. definitive proxy statement for its 2019 Annual Meeting of Stockholders, which shall be filed with the Securities and Exchange Commission pursuant to Regulation 14A of the Securities Exchange Act of 1934, as amended, within 120 days following the registrant's fiscal year ended December 31, 2018.

CAUTIONARY NOTE CONCERNING FORWARD-LOOKING STATEMENTS

THIS ANNUAL REPORT ON FORM 10-K CONTAINS FORWARD-LOOKING STATEMENTS WITHIN THE MEANING OF THE PRIVATE SECURITIES LITIGATION REFORM ACT OF 1995 AND OTHER FEDERAL SECURITIES LAWS. THESE FORWARD-LOOKING STATEMENTS ARE BASED ON OUR PRESENT INTENT, BELIEFS OR EXPECTATIONS, AND ARE NOT GUARANTEED TO OCCUR AND MAY NOT OCCUR. ACTUAL RESULTS MAY DIFFER MATERIALLY FROM THOSE CONTAINED IN OR IMPLIED BY OUR FORWARD-LOOKING STATEMENTS AS A RESULT OF VARIOUS FACTORS.
WE GENERALLY IDENTIFY FORWARD-LOOKING STATEMENTS BY TERMINOLOGY SUCH AS “MAY,” “WILL,” “SHOULD,” “EXPECTS,” “PLANS,” “ANTICIPATES,” “COULD,” “INTENDS,” “TARGET,” “PROJECTS,” “CONTEMPLATES,” “BELIEVES,” “ESTIMATES,” “PREDICTS,” “POTENTIAL” OR “CONTINUE” OR THE NEGATIV OF THESE TERMS OR OTHER SIMILAR WORDS. THESE STATEMENTS ARE ONLY PREDICTIONS. THE OUTCOME OF THE EVENTS DESCRIBED IN THESE FORWARD-LOOKING STATEMENTS IS SUBJECT TO KNOWN AND UNKNOWN RISKS, UNCERTAINTIES AND OTHER FACTORS THAT MAY CAUSE US, OUR CUSTOMERS’ OR OUR INDUSTRY’S ACTUAL RESULTS, LEVELS OF ACTIVITY, PERFORMANCE OR ACHIEVEMENTS EXPRESSED OR IMPLIED BY THESE FORWARD-LOOKING STATEMENTS TO DIFFER.
THIS REPORT ALSO CONTAINS MARKET DATA RELATED TO OUR BUSINESS AND INDUSTRY. THIS MARKET DATA INCLUDES PROJECTIONS THAT ARE BASED ON A NUMBER OF ASSUMPTIONS. IF THESE ASSUMPTIONS TURN OUT TO BE INCORRECT, ACTUAL RESULTS MAY DIFFER FROM THE PROJECTIONS BASED ON THESE ASSUMPTIONS. AS A RESULT, OUR MARKETS MAY NOT GROW AT THE RATES PROJECTED BY THIS DATA, OR AT ALL. THE FAILURE OF THESE MARKETS TO GROW AT THESE PROJECTED RATES MAY HAVE A MATERIAL ADVERSE EFFECT ON OUR BUSINESS, RESULTS OF OPERATIONS, FINANCIAL CONDITION AND THE MARKET PRICE OF OUR COMMON STOCK.
SEE “ITEM 1A. RISK FACTORS,” “ITEM 7. MANAGEMENT’S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS” AND “ITEM 1. BUSINESS,” AS WELL AS OTHER SECTIONS IN THIS REPORT, THAT DISCUSS SOME OF THE FACTORS THAT COULD CONTRIBUTE TO THESE DIFFERENCES. THE FORWARD-LOOKING STATEMENTS MADE IN THIS ANNUAL REPORT ON FORM 10-K RELATE ONLY TO EVENTS AS OF THE DATE OF WHICH THE STATEMENTS ARE MADE. EXCEPT AS REQUIRED BY LAW, WE UNDERTAKE NO OBLIGATION TO UPDATE OR RELEASE ANY FORWARD-LOOKING STATEMENTS AS A RESULT OF NEW INFORMATION, FUTURE EVENTS OR OTHERWISE.

TECOGEN INC.
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FOR THE FISCAL YEAR ENDED DECEMBER 31, 2018
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Item 1. Business

The Company

Tecogen Inc. (“Tecogen,”) was incorporated in the State of Delaware on September 15, 2000. Tecogen designs, manufactures, markets, and maintains high efficiency, ultra-clean cogeneration products including natural gas engine-driven combined heat and power, air conditioning systems, and water heaters for residential, commercial, recreational and industrial use. Tecogen is known for cost efficient, environmentally friendly and reliable products for distributed power generation that, through patented technology, nearly eliminate criteria pollutants and significantly reduce a customer’s carbon footprint.

Tecogen has two wholly-owned subsidiaries, namely, American DG Energy, Inc. ("ADGE"), a Delaware corporation formed in July 2001 and acquired by Tecogen in May 2017 pursuant to the Merger described below, and TTcogen LLC, a Delaware limited liability company that became a wholly-owned subsidiary of Tecogen in March 2018 when Tecogen acquired the remaining membership interests in TTcogen that Tecogen did not previously own. ADGE also owns 51% of American DG New York, LLC ("ADGNY"), a joint venture. Both ADGE and ADGNY distribute, own, and operate clean, on-site energy 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 on a long-term contractual basis. Tecogen is also developing ultra-low emissions technologies using its patented Ultera® technology for the automotive market. See "Our Products - Ultera Low-Emissions Technology" below for a more in depth discussion of the Ultera emissions opportunity. Tecogen, together with its wholly-owned consolidated subsidiaries, is hereinafter referred to as the "Company," "Tecogen," "we," "our," or "us."

The Company's operations are comprised of two business segments. Our Products and Services segment designs, manufactures and sells industrial and commercial cogeneration systems as described above. Our Energy Production segment sells energy in the form of electricity, heat, hot water and cooling to our customers under long-term sales agreements.

On May 18, 2017, holders of approximately 71% of the ADGE's outstanding common stock approved the proposed acquisition of ADGE (the "Merger") and holders of approximately 55% of the outstanding stock of Tecogen approved the issuance of Tecogen shares in the Merger. Consequently, on that day Tecogen completed its acquisition, by means of a stock-for-stock merger, of 100% of the outstanding common shares of ADGE. As a result, ADGE became a wholly-owned subsidiary of Tecogen. See Note 4 - Acquisition of American DG Energy, Inc. of the Notes to the Consolidated Financial Statements for further information and Item 3. Legal Proceedings for information regarding litigation related to the Merger.

In May 2016, Tecogen entered into a joint venture agreement, (the "JV Agreement") with Tedom a.s., a European combined heat and power product manufacturer incorporated in the Czech Republic ("Tedom") and Tedom’s subsidiary, Tedom USA, Inc., a Delaware corporation. Pursuant to the JV Agreement, the parties formed TTcogen LLC, a Delaware limited liability company (“TTcogen”). TTcogen offered Tedom's line of Combined Heat and Power ("CHP") products to the United States via Tecogen's nationwide sales and service network. On March 27, 2018, the Company acquired Tedom's 50% interest in TTcogen LLC, and will continue to market, sell, and service the Tedom 35kW CHP equipment on an exclusive basis in certain territories.

On October 28, 2017, all the shareholders of the joint venture company organized by the Company and a group of European strategic investors, Ultra Emissions Technologies, Ltd. ("Ultratek"), including the Company, unanimously voted to terminate the joint venture. Ultratek was organized to develop and commercialize Tecogen's patented technology, Ultera®, for the automotive market. Upon termination of the joint venture, Ultratek was dissolved and the exclusive license for the use of Ultera that was granted to Ultratek automatically reverted back to the Company. The Company received its full $2,000,000 investment in Ultratek upon the completion of the dissolution process. Upon dissolution, the Company purchased all of the remaining assets of Ultratek, including new intellectual property that Ultratek developed and other assets, for a total purchase price of $400,000. The Company continues to develop the Ultera technology.

On May 4, 2018, the Company, and its wholly-owned subsidiaries, ADGE and TTcogen LLC (collectively, the "Borrowers"), entered into a Credit Agreement with Webster Business Credit Corporation (the "Lender") that matures in May 2021 and provides Borrowers a line of credit of up to $10 million on a revolving and secured basis, with availability based on certain accounts receivables, raw materials, and finished goods.
On December 14, 2018, the Company and ADGE entered into agreements relating to the sale of two energy purchase agreements and related energy production systems for $2 million and on March 5, 2019 entered into agreements relating to the sale of six energy purchase agreements and related energy production systems for $5 million. In connection with the sale, the Company entered into agreements to provide billing and asset management services and operations and maintenance services for agreed fees for the duration of the energy purchase agreements, pursuant to which the Company guarantees certain minimum collections and is entitled to receive fifty percent of the excess of collections over agreed minimum thresholds.

Business Overview

Tecogen designs, manufactures, markets, and maintains high efficiency, ultra-clean cogeneration products including natural gas engine-driven combined heat and power, air conditioning systems, and water heaters for residential, commercial, recreational and industrial use. The company is known for cost efficient, environmentally friendly and reliable products for distributed power generation that, through patented technology, nearly eliminate criteria pollutants and significantly reduce a customer's carbon footprint.

Tecogen's natural gas-powered cogeneration systems (also known as combined heat and power or "CHP") are efficient because they drive electric generators or compressors, which reduce the amount of electricity purchased from the utility while recovering the engine's waste heat for water heating, space heating, and/or air conditioning at the customer's building.

Tecogen manufactures three types of CHP products:

•Cogeneration units that supply electricity and hot water;
•Chillers that provide air-conditioning and hot water marketed under the TECOCHILL® brand name; and
•High-efficiency water heaters marketed under the Ilios® brand name.

All of these are standardized, modular, CHP products that reduce energy costs, carbon emissions, and dependence on the electric grid. Tecogen's products allow customers to produce power on-site in parallel with the electric grid or stand alone when no utility grid is available via inverter-based black-start capability. Because our CHP systems also produce clean, usable heat energy, they provide economic advantages to customers who can benefit from the use of hot water, chilled water, air conditioning and heating.

Following the acquisition of ADGE in May 2017, the Company also sells energy in the form of electricity, heat, hot water and cooling to customers under long-term energy sales agreements (with a standard term of 10 to 15 years). The typical sales model is to install and own energy systems in customers' buildings and sell the energy produced by those systems back to the customers at a cost set by a negotiated formula in customer contracts. We call this our "On-Site Utility" business, or our Energy Production segment.

Traditional customers for our cogeneration and chiller systems include hospitals and nursing homes, schools 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, indoor agriculture, and military installations; however, the economic feasibility of using our systems is not limited to these customer types. Market drivers include the price of natural gas, local electricity rates, environmental regulations, and governmental energy policies, as well as customers' desire to become more environmentally responsible.

Through our factory service centers in California, Connecticut, Florida, Massachusetts, Michigan, New Jersey, and New York our specialized technical staff maintains our products via long-term service contracts. To date the Company has shipped over 3,000 units, some of which have been operating for almost 35 years.

Our CHP technology uses low-cost, mass-produced engines, which we modify to run on natural gas. In the case of our mainstay cogeneration and chiller products, the engines have proven to be cost-effective and reliable. In 2009, in response to the changing regulatory requirements for stationary engines, our research team developed an economically feasible process for removing air pollutants from the engine exhaust. This technology's U.S. and foreign patents were granted beginning in October 2013 with other domestic and foreign patents granted or applications pending. Branded Ultera®, the ultra-clean emissions technology repositions our engine driven products in the marketplace, making them comparable environmentally with other technologies such as fuel cells, but at a much lower cost and greater efficiency. Because of this breakthrough design for emission control, multiple Tecogen natural gas-fueled CHP modules fitted with the patented Ultera control technology have been permitted to the current regulatory limits in the Los Angeles area. In 2018, a group of natural gas engine-generators upfitted with the Ultera system were successfully permitted in the same Los Angeles region to unrestricted operation, the first natural gas engines to do so without operating time limits or other exemption. These engines were permitted to levels matching the California Air Resources Board ("CARB") stringent 2007 emissions requirements, the same emissions standard used to certify fuel cells, and the same emissions levels as a state-of-the-art central power plant. We now offer our Ultera emissions control technology as an option on all our products or as a stand-alone application for the retrofitting of other rich-burn spark-ignited reciprocating internal combustion engines such as the aforementioned engine-generators. Tecogen products are designed as compact modular units that are intended to be installed in multiples when utilized in larger CHP plants. The majority of our CHP modules are installed in multi-unit sites with applications ranging up to 12 units. This approach has significant advantages over utilizing single larger units, allowing building placement in constrained urban settings and redundancy to mitigate service outages. Redundancy is particularly relevant in regions where the electric utility has formulated tariff structures that include high “peak demand” charges. Such tariffs are common in many areas of the country, and are applied by such utilities as Southern California Edison, Pacific Gas and Electric, Consolidated Edison of New York, and National Grid of Massachusetts. Because these tariffs are assessed based on customers’ peak monthly demand charge over a very short interval, typically only 15 minutes, a brief service outage for a system comprised of a single unit can create a high demand charge, and therefore be highly detrimental to the monthly savings of the system. For multiple unit sites, the likelihood of a full system outage that would result in a high demand charge is dramatically reduced, so consequently, these customers have a greater probability of capturing peak demand savings.

Our CHP products are sold directly to customers by our in-house marketing team, and by established sales agents and representatives.

ADGE installs, owns, operates and maintains complete distributed generation, or DG systems (or energy systems), and other complementary systems at customer sites, and sells electricity, hot water, heat and cooling energy under long-term contracts at prices guaranteed to the customer to be below conventional utility rates. As of December 31, 2018 we had 81 operational energy systems, representing an aggregate of approximately 5,035 kilowatts, or kW, 39.0 million British thermal units, or MMBtu's, of heat and hot water and 4,660 tons of cooling (kW is a measure of electricity generated, MMBtu is a measure of heat generated and a ton is a measure of cooling generated).

The Company's operations are comprised of two business segments. Our Products and Services segment designs, manufactures and sells industrial and commercial cogeneration systems as described above. Our Energy Production segment sells energy in the form of electricity, heat, hot water and cooling to our customers under long-term sales agreements.

Products and Services

Our Products and Services segment represented 82.2% and 88.5% of our consolidated revenues for the years ended December 31, 2018 and 2017, respectively. See Note 16. "Segments" of the Notes to the Consolidated Financial Statements. Our products and services are described below.

Our Products

We manufacture natural gas engine-driven cogeneration systems, heat pumps, and chillers, all of which are CHP products that deliver more than one form of energy. Our cogeneration products are all standard, modular units that come pre-packaged from the Company’s factory for ease of installation at a customer’s site. The package incorporates the engine, generator, heat-recovery equipment, system controls, electrical switchgear, emission controls, and a data controller for remote monitoring and data transmission; minimizing the cost and complexity of installing the equipment at a site. This packaged, modular system simplifies CHP technology for small to mid-sized customers who typically are less experienced with the implementation and benefits of a CHP system.

Traditionally all of our cogeneration systems and most of our chillers have utilized the same engine, the TecoDrive 7400 model. This is an engine modified by us to use natural gas fuel. In 2017, we introduced a new, slightly larger engine into certain products with advanced features, including improved efficiency and an advanced ignition system. The CHP products utilizing the new engine are the InVerde e+® and the TecoPower models CM-60 and CM-75. The new engine and the older TecoDrive model share custom features that enhance durability and efficiency, many of which date from our extensive research done previously with engine manufacturers and the gas industry, including the Gas Research Institute. For the Ilios water heater, we introduced a technologically advanced Ford engine that is enhanced for industrial applications.

Our commercial product lines include:

- the InVerde e+® and TecoPower cogeneration units;
- TECOCHILL® air-conditioning and refrigeration chillers;
- Ilios® high-efficiency water heaters; and
- Ultera® emissions control technology.

InVerde Cogeneration Units

Our premier cogeneration product has been the InVerde, a 100-kW CHP system that not only provides electricity and hot water, but also satisfies the growing customer demand for operation during a utility outage, commonly referred to as “black-start” capability. Our exclusively licensed microgrid technology (see “Intellectual Property” below) enables our InVerde CHP products to provide backup power in the event of power outages that may be experienced by local, regional, or national grids. In 2017 we introduced an extensively redesigned version of the unit, the InVerde e+, which includes a state of the art power conversion system, more effective acoustic treatment, and the larger, more efficient engine. The InVerde e+ includes variations with power ratings from 75kW to 125kW.

The InVerde e+ 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 in 50 or 60 Hertz.

This inverter technology was developed originally for solar and wind power generation. The Company believes that the InVerde is the first commercial engine-based CHP system to use an inverter. Electric utilities accept inverter technology as "safe" by virtue of its certification to the Underwriters Laboratory interconnection standard 1741. Our InVerde has earned this certification which qualifies our product for a much simpler permitting process nationwide and is mandatory in some areas such as New York City and California, a feature we consider to be a competitive advantage. The inverter also improves the CHP system's efficiency at partial load, when less heat and power are needed by the customer.

In 2018 the InVerde e+ was certified to the more technically advanced UL 1741SA. The "SA" or "smart inverter" certification is for those incorporating more advanced safety features and operating modes which can help support the grid on demand when strained. Upcoming SA requirements will require additional certification primarily involving standard communication protocols which will be available to the utility when enlisting grid support. We believe future utility programs which involve command and control of smart inverter assets on their grid will be an important change in how distributed generation is valued by utilities and may offer additional revenue to our customers.

The InVerde`s black-start feature addresses a crucial demand from commercial and institutional customers who are increasingly concerned about utility grid blackouts and brownouts, natural disasters, security threats, and antiquated utility infrastructure. Multiple InVerde units can operate collectively as a stand-alone microgrid, which is a group of interconnected loads served by one or more power sources. The InVerde is equipped with software that allows a cluster of units to seamlessly share the microgrid load without complex controls; a proprietary cost advantage for multiple modules at a single location.

The InVerde CHP system was developed in 2007 and began shipping in 2008. Our largest InVerde installation utilizes 12 units, which supply 1.2 MW of on-site power and about 8.5 million Btu/hr of heat (700,000 Btu/hr per unit).

TECOGEN Cogeneration Units

The TECOGEN cogeneration system is the original model introduced in the 1980s; available in sizes of 60 kW and 75 kW and capable of producing up to 500,000 Btu/hr of hot water. This technology is based on a conventional single-speed generator. It is meant only for grid-connected operation and is not universally accepted by utilities for interconnection, in contrast to the InVerde. Although this cogeneration product has the longest legacy and largest installed population, much of its production volume has been supplanted by the InVerde and its broader array of product features. In 2017 the Company introduced an upgraded version of the 60kW and 75kW models under the new name TecoPower. The key features of the TecoPower models are the larger engine with improved efficiency, advanced ignition system, more effective acoustic aftertreatment, and the ability to operate even at the very low gas supply pressures in New York City with a pressure booster.

TECOCHILL Chillers

Our TECOCHILL natural gas engine-driven chillers are available in capacities ranging from 25 to 400 tons, with the smaller units air-cooled and the larger ones water-cooled. Using technology first 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 heat or hot water. 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 gas-fueled chiller provides enough air conditioning to avoid most of the utility's seasonal peak charges for electric usage and capacity. In summer when electric rates are at their highest, natural gas is "off-peak" and quite affordable, allowing TECOCHILL® customers to avoid typically higher summer-time "peak-usage" electric rates. Gas-fueled chillers also free up the building's existing electrical capacity to use for other loads and can operate on minimal electric load in case of electric grid blackout; a key feature for customers concerned about load demand on backup power generators.

Ilios High-Efficiency Water Heaters

Tecogen has developed several heat pumps under the Ilios brand name including a High Efficiency ("HE") Air-Source Water Heater, HE Water-Sourced Water Heater, and HE Air-Sourced "Split System" Water Heater. Our water heater products operate like an electric heat pump but use 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 while heat pumps extract heat from outside and move

it indoors.
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. This means that the heat being captured from outdoors is supplemented by the engine's waste heat, which increases the efficiency of the process. The net effect is that an Ilios® heat pump's efficiency far surpasses that of conventional boilers for water heating. Gas engine heat pumps can deliver efficiencies in excess of 200%.
Similarly, if used for space heating, the engine-powered heat pump is more efficient than an electric heat pump, again because heat is recovered and used for other building processes. The product's higher efficiency translates directly to lower fuel consumption and, for heavy use customers, significantly lowers operating costs when compared with conventional equipment.

In 2013, a water-sourced model of the heat pump was added to our product line. This heat pump captures heat from a water source such as a geothermal well or from a pre-existing chilled water loop in the facility; the latter configuration provides simultaneous heating and cooling benefits, doubling the effect.

Following on the success of the water-sourced model, in early 2015 a 'split system' Ilios® model was introduced. The new split system offers increased flexibility because its air-source evaporator package can be installed remotely. The engine driven heat pump, which is contained in a small acoustic enclosure, can be located within a building's mechanical space while the quiet air-source evaporator package can be installed on a roof, or in any outdoor space. The outdoor evaporator component is connected to the indoor heat pump via refrigerant lines, therefore eliminating all freeze protection issues in colder climates. All of the water being heated remains inside the conditioned space, eliminating the need for a costly isolation heat exchanger and additional pumps, which simplifies installation and increases efficiency because it can operate at a lower delivery temperature.

The heat pump water heater serves as a boiler, producing hot water for drinking and washing, space heating, swimming pools, or other building loads. Energy cost savings to the customer depend on the climate. Heat pumps in general, whether gas or electric, perform best in moderate weather conditions although the performance of the Ilios® water-source heat pump is not impacted by weather or climate conditions. In a typical building, the Ilios® heat pump would be added on to an existing heating or water heating system, and would operate as many hours as possible. The conventional boiler would be left in place, but would serve mainly as a backup when the heat pump's engine is down for maintenance or when the heat pump cannot meet the building's peak heating load. In areas where low electric rates make CHP less economical, the Ilios® heat pump could be a financially attractive alternative because its economics depend only on natural gas rates. In some areas with high electric rates, the Ilios® option could have advantages over CHP; for example where it is hard to connect to the utility grid or where the building's need for electricity is too low for CHP to be economically sound.

Ultera Low-Emissions Technology

All of our CHP products are available with the patented Ultera® low-emissions technology as an equipment option. This breakthrough technology was developed in 2009 and 2010 as part of a research effort partially funded by the California Energy Commission and Southern California Gas Company. The objective was to bring our natural-gas engines into compliance with California's stringent air quality standards.

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The chart below compares emission levels of the Company's Ultera® technology to other technologies. As of December 31, 2018 our Ultera® CHP and fuel cell technologies are the only technologies that we know of which comply with California's air quality standards for CO and NOx, represented in the chart by the colored horizontal lines, shown as the world's strictest air quality standards on the lower right of the chart.

(5) (2) (4) (4) (3) (1)

(1) California has the strictest air quality standards for engines in the world
(2) Conventional Energy Source is U.S. powerplant and gas boiler. Average U.S. powerplant NOx emission rate of 0.9461 lb/MWh from (USEPA eGrid 2012),
CO data not available. Gas boiler efficiency of 78% (www.eia.gov) with emissions of 20 ppm NOx @ 3% O_2 (California Regulation SCAQMD Rule 1146.2
and <50 ppmv CO @ 3% O_2 (California Regulation SCAQMD BACT).
(3) Tecogen emissions based upon actual third party source test data.
(4) Microturbine and Fuel Cell emissions from EPA CHP Partnership - Catalog of CHP Technologies- March 2015.
(5) Stationary Engine BACT as defined by SCAQMD.

Through development of a two-stage catalyst emission treatment system, the Company was able to meet or exceed the strict air quality regulations with a solution that is cost-effective, robust, and reliable. Inclusion of the patent-protected Ultera® low-emissions technology as an option keeps our CHP systems compliant with air quality regulations. The first commercial CHP units equipped with Ultera low-emissions technology shipped to a California utility in 2011. We conducted three validation programs for this technology:

1. Third-party laboratory verification. The AVL California Technology Center, a long-standing research and technology partner with the international automotive industry, confirmed our results in their state-of-the-art dynamometer test cell, which was outfitted with sophisticated emissions measurement equipment.
2. Verifying longevity and reliability in the field. By equipping one of our 75 kW units, already operating at a customer location in Southern California with the Ultera® low-emissions technology and a device to continuously monitor emissions we verified longevity and reliability. 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.
3. Additional independent tests. During the field test, two companies licensed in California to test emissions each verified our results at different times. The results from one of these tests, obtained in August 2011, enabled us to qualify for New Jersey's fast-track permitting. Virtually every state nationwide requires some kind of permit related to local air quality, but New Jersey allows an exemption for systems such as ours that demonstrate superior emissions performance. This certification was granted in November 2011, and since then we have sold Ultera® low-emissions systems to customers in this territory.

In 2012, a 75 kW CHP unit equipped with the Ultera® system became our first unit to obtain a conditional air permit (i.e., pending a third party source test to verify compliance) in Southern California since the strict regulations went into effect in 2009. A state-certified source test, administered in January 2013, verified that our emissions levels were well below the new permitting requirements, and the final permit was approved in August 2013.

Standby Generators

After successfully developing the Ultera technology for our own equipment, the Company's research & development team began exploring other possible emissions control applications in an effort to expand the market for the ultra-clean emissions system. Retrofit kits were developed in 2014 for other stationary engines and in 2015 the Ultera Retrofit Kit was applied successfully to natural gas stand-by generators from other manufacturers, including Generac and Caterpillar.

Historically, standby generators have not been subjected to the strict air quality emissions standards of traditional power generation. However, generators which run for more than 200 hours per year or run for non-emergency purposes (other than routine scheduled maintenance) in some territories are subject to compliance with the same stringent regulations applied to a typical electric utility. As demand response programs become more economically attractive and air quality regulations continue to become more stringent, there could be strong demand for retrofitting standby generators with our Ultera® emissions control technology, thus providing a cost-effective solution to keeping the installed base of standby generators operational and in compliance.

In 2017, a group of generators owned by a single customer in Southern California were supplied Ultera kits because of their particular requirement to exceed the 200-hour annual limit. These units are now operational and have been tested by the customer and shown to be compliant with the local pollution limits which we believe to be the strictest anywhere in the United States, and potentially the world. Our CHP products have been permitted to this same standard. However, CHP products are given a heat credit which effectively increases the allowable limit. In 2018 permitting was completed making these certification levels the lowest we have achieved. We believe no other engines have been certified to these levels since the latest regulations in the Los Angeles region became effective ten years ago.

Biogas

The Ultera®emissions control technology developed by our engineering team applies specifically to rich-burn, spark-ignited, internal combustion engines. While originally intended for natural gas-powered engines, we believe that our technology may be adapted for other fuel types as long as the engine meets the rich-burn criteria.

In 2015 the Ultera system was applied to a biogas powered engine operating at the Eastern Municipal Water District's (EMWD) Moreno Valley Region Water Reclamation Facility in Perris, California. The demonstration project was a result of an ongoing collaboration between Tecogen, the EMWD and various other partners, and successfully applied an Ultera Retrofit Kit to a 50-liter Caterpillar engine fueled by biogas extracted from an anaerobic digester.

Biogas is a significant byproduct of wastewater treatment plants. Considered to be a renewable source of fuel, it is becoming an increasingly important resource for power generation. According to the American Biogas Council, nationwide there are over 1,100 engines fueled by wastewater-derived biogas, over 600 fueled by landfill-generated biogas, and over 100 running on biogas from agricultural waste. This represents a significant potential market for the Ultera Retrofit Kit application as these biogas engines become subject to the same air quality standards as traditional power generation sources.

Automotive Emissions Control

In October 2015, following revelations of wide-scale problems with vehicle emissions compliance and testing, Tecogen formed an Emissions Advisory Committee to examine the potential application of Ultera to the automotive gasoline market. According to the U.S. EPA, 50 percent of nitrogen oxides (NOx) and 60 percent of all carbon monoxide (CO) emissions in the United States come from vehicle exhaust. The Ultera® emission control system is designed to target both NOx and CO. After a thorough investigative process on the part of the Emissions Advisory Committee and various industry expert consultants, the group recommended that the Company pursue a funded initiative to develop the technology for gasoline vehicles.

In December 2015, the Company and a group of strategic investors formed a joint venture company, Ultra Emissions Technologies, Ltd. ("Ultratek"), to advance the Ultera near-zero emissions technology for adaptation to transportation applications powered by spark-ignited rich-burn engines in the automobile and truck categories. Tecogen granted Ultratek an exclusive license for the development of its patented, emissions-related, intellectual property for the vehicle market.

Initially Ultratek's focus was on preliminary research, testing, and verification that the Ultera technology can in fact be applied to gasoline engines while maintaining similar near-zero emission results as have been demonstrated in other use cases. Having completed multiple phases of testing at AVL's California Technology Center, the Ultratek team verified the viability of the Ultera technology for gasoline automotive use.

On October 24, 2017, the Company and the group of strategic investors agreed to dissolve Ultratek due to varying opinions regarding next steps toward potential commercialization. Upon dissolution, the remaining cash was disbursed in accordance with the joint venture agreement, first to the Company which was entitled to receive its cash investment of $2,000,000, with the remainder, on a pro rata basis, to the strategic investors. Additionally, the license the Company originally granted to Ultratek reverted back to the Company, and the Company purchased all of the remaining Ultratek assets and intellectual property that Ultratek had created for a total purchase price of $400,000.

On November 28, 2017 Tecogen formed Ultera Technologies, Inc., a Delaware corporation, as a wholly owned subsidiary, to continue the effort toward commercialization that was begun by Ultratek. Ultera Technologies Inc. was dissolved in 2018 and Tecogen will continue the research and development relating to prototypes for commercialization. If successfully developed, the market for automotive emissions control could be a source of future growth for the Company; although it could take years to realize that goal, and there is no guarantee that such efforts will be successful.

Fork-Truck Research

In October 2016, the Company was awarded a Propane Education & Research Council (PERC) research grant funding the Company's proposal to develop the Ultera ultra-clean emissions control technology for the propane powered fork truck market.

Electric fork trucks have been making significant in-roads in the fork truck industry, in part, because of their green image and indoor air quality benefit. The primary benefit of the Ultera-equipped ultra-clean propane fork truck will be fuel cell like emissions and a propane-green brand that offers a robust indoor air quality advantage without compromising vehicle performance. The project will assess the adaption of the Ultera near-zero emissions technology for the fork truck category and demonstrate the technical performance on popular propane fork truck models. In 2018, the PERC funded portion of the project concluded successfully and our manufacturer that participated in the project, providing technical and marketing support and supplying a test truck, reviewed the results and decided to move forward with the program. The manufacturer was named in 2018 as Mitsubishi Caterpillar Forklift America (MCFA), a major supplier in North and South America. The program is currently focused on testing modified engine control firmware being prepared by MCFA in Japan for optimizing the Ultera process on the test fork truck.

Management believes that approximately 70,000 propane powered fork trucks are sold annually in the United States. Successful completion of this project could open a new emissions control market to the Company.

Other Ultera Applications

According to a 2013 Massachusetts Institute of Technology study, the U.S. experiences 200,000 early deaths each year due to emissions from heavy industry, transportation, and commercial and residential heating. As climate change and air quality continue to develop as areas of focus for government regulators, emissions restrictions are expected to become increasingly stringent around the world. These tightening regulations could open up new markets and applications for the Ultera near-zero emissions control technology. These opportunities may include:

- commercial and industrial natural gas fueled engines from other manufacturers; and
- natural gas and biogas powered vehicle fleets - such as municipal bus fleets

Product Service

We provide long-term maintenance contracts, parts sales, and turnkey installation through a network of ten well-established field service centers in California, the Midwest, the Northeast and now the Southeast. These centers are staffed by full-time Company technicians, working from local leased facilities. The facilities provide offices and warehouse space for inventory. We encourage our customers to provide internet connections to our units so that we may maintain remote communications with the installed equipment. For connected installations, the machines are contacted daily to download their status and provide regular operational reports (daily, monthly, and quarterly) to our service managers. This communication link is used to support the diagnostic efforts of our service staff, and to send messages to preprogrammed phones if a unit has experienced an unscheduled shutdown. In many cases, communications received by service technicians from connected devices allow for proactive maintenance, minimizing equipment downtime and improving operating efficiency for the customer.

The work of our service managers, supervisors, and technicians focuses on our products. Because we manufacture our own equipment, our service technicians bring hands-on experience and competence to their jobs. They are trained at our corporate headquarters and primary manufacturing facility in Waltham, Massachusetts.

Most of our service revenue is in the form of annual service contracts, which are typically of an all-inclusive “bumper-to-bumper” type, with billing amounts proportional to the equipment's achieved operating hours for the period. Customers are thus invoiced in level, predictable amounts without unforeseen add-ons for such items as unscheduled repairs or engine replacements. We strive to maintain these contracts for many years, and work to maintain the integrity and performance of our equipment.

Our products have a long history of reliable operation. Since 1995, we have had a remote monitoring system in place that connects to hundreds of units daily and reports their “availability,” which is the amount of time a unit is running or is ready to run. More than 80% of the units operate above 90% availability, with the average being 93.8%. Our factory service agreements have directly impacted these positive results and represent an important long-term annuity-like stream of revenue for the Company.

New equipment sold beginning in 2016 and select upgrades to the existing installed equipment fleet includes an industrial internet solution which enables Tecogen to collect, analyze, and manage valuable asset data continuously and in real-time. This provides the service team with improved insight into the functionality of our installed CHP fleet. Specifically, it enables the service department to perform remote monitoring and diagnostics and to view system results in real time via a computer, smart phone or tablet. Consequently, we can better utilize monitoring data ensuring customers are capturing maximum possible savings and efficiencies from their installation. Through constant monitoring and analysis of equipment data, Tecogen expects to enhance the performance of installed equipment by ensuring machinery consistently operates at peak performance and is available to deliver maximum potential value for customers. In 2018 we migrated our cloud based system from the General Electric's Company's Equipment Insight product to our system developed in-house which we have trade named CHP Insight®. CHP insight stores operating data on the cloud like the GE system but we have added improved user interface features specific to CHP operation as well as sophisticated data analysis tools. Management believes that similar monitoring solutions are available from other alternative sources.

Energy Production

Our Energy Production segment represented 17.8% and 11.5% of our consolidated revenues for the years ended December 31, 2018 and 2017, respectively. See Note 16. "Segments" of the Notes to the Consolidated Financial Statements. Our on-site utility business is described below.

On-Site Utility

Our wholly-owned subsidiary, ADGE, distributes, owns and operates clean, on-site energy systems that produce electricity, hot water, heat, and cooling. Our business model is to own the equipment that ADGE installs at customers' facilities and to sell the energy produced by these systems to customers on a long-term contractual basis. We call this business the “On-Site Utility” and offer natural gas powered cogeneration systems that are reliable and energy efficient.

ADGE utilizes energy equipment supplied by Tecogen and other cogeneration manufactures. Our cogeneration systems produce electricity from an internal combustion engine driving a generator, while the heat from the engine and exhaust is recovered and typically used to produce heat and hot water for use on-site. ADGE also distributes and operates water chiller systems for building cooling applications that operate in a similar manner, except that the engines in the water chiller systems drive a large air-conditioning compressor while recovering heat for hot water.

Cogeneration systems reduce the amount of electricity that a customer must purchase from the local utility and produce valuable heat and hot water on-site to use as required. By simultaneously providing electricity, hot water and heat, cogeneration systems also have a significant positive impact on the environment by reducing the carbon dioxide, or CO2, produced by replacing a portion of the traditional energy supplied by the electric grid and conventional hot water boilers. Distributed generation of electricity, or DG, often referred to as cogeneration systems or combined heat and power systems, or CHP, is an attractive option for reducing energy costs and increasing the reliability of available energy. DG has been successfully implemented by others in large industrial installations over 10 Megawatts ("MW"), where the market has been growing for a number of years and is increasingly being accepted in smaller sized units because of technology improvements, increased energy costs, and better DG economics. We believe that our target market for DG, users of up to 1 MW, has been barely penetrated and that the reduced reliability of the utility grid, increasing cost pressures experienced by energy users, advances in new, low cost technologies, and DG-favorable legislation and regulation at the state and federal level will drive our near-term growth and penetration of this market. We believe that the primary opportunity for DG energy and equipment sales is in regions of the U.S. where commercial electricity rates exceed $0.12 per kW hour, or kWh, which is predominantly in the Northeast and California. Attractive DG economics are currently attainable in applications that include hospitals, nursing homes, multi-tenant residential housing, hotels, schools and colleges, recreational facilities, food processing plants, dairies, and other light industrial facilities. We also believe that the largest number of potential DG users in the U.S. require less than 1 MW of electric power and less than 1,200 tons of cooling capacity. We are able to design our systems to suit a particular customer's needs because of our ability to place multiple units at a site. This approach is part of what allows our products and services to meet changing power and cooling demands throughout the day (also from season-to-season) and greatly improves efficiency. As these technologies mature to the point that they are both reliable and economical, the Company will consider employing these power sources to supply energy for our customers. Management regularly assesses the technical, economic, reliability, and emissions issues associated with systems that use solar, micro-turbine, or fuel cell technologies to generate power.

Sales & Distribution

Our products are sold directly to end-users by our sales team and by established sales agents and representatives. Various agreements are in place with distributors and outside sales representatives, who are compensated by commissions for certain territories and product lines. Sales through our in-house team or sales that are not covered by a representative’s territory carry no or nominal commissions. For the fiscal years ended 2018 and 2017, no distribution partner or customer relationship accounted for more than 10% of total combined company revenue.

Our product sales cycle exhibits typical seasonality for the HVAC industry with sales of chillers generally stronger in the warmer months while heat pump sales are stronger in the cooler months.

Total product and installation backlog as of December 31, 2018 was $16.6 million compared to year end backlog 2017 of $15.6 million. Please see "Management’s Discussion and Analysis of Financial Condition and Results of Operations" and related Risk Factors below for additional information about the Company’s backlog.

Markets and Customers

Worldwide, stationary power generation applications vary from huge central stationary generating facilities (traditional electric utility providers) to back-up generators as small as 2 kW. Historically, power generation in most developed countries such as the United States has been part of a regulated central utility system utilizing high-temperature steam turbines powered by fossil-fuels. This turbine technology, though steadily refined over the years, reached a maximum efficiency (where efficiency means electrical energy output per unit of fuel energy input) of approximately 40%.

A number of developments related primarily to the deregulation of the utility industry as well as significant technological advances have now broadened the range of power supply choices available to all types of customers. CHP, which harnesses waste energy from power generation processes and puts it to work for other uses on-site, can boost the energy conversion efficiency to nearly 90%, a better than two-fold improvement over the average efficiency of a fossil fuel plant. This distributed generation, or power generated on-site at the point of consumption rather than power generated centrally, eliminates the cost, complexity, and inefficiency associated with electric transmission and distribution. The implications of the CHP distributed generation approach are significant. Management believes that if CHP were applied on a large scale, global fuel usage might be dramatically curtailed and the utility grid made far more resilient.

Our CHP products address the inherent efficiency limitation of central power plants by siting generation close to the loads being served. This allows customers with energy-intensive buildings or processes to reduce energy costs and operate with a lower carbon footprint. Furthermore, with technology we have introduced, like the Ultera low-emissions technology, our products can now contribute to better air quality at the local level while complying with the strictest air quality regulations in the United States.

Cogeneration and chiller products can often reduce the customer's operating costs (for the portion of the facility loads to which they are applied) by approximately 30% to 60% based on Company estimates, which provides an excellent rate of return on the equipment's capital cost in many areas of the country with high electricity rates. Our chillers are especially suited to regions where utilities impose extra charges during times of peak usage, commonly called "demand" charges. In these cases, the gas-fueled chiller reduces the use of electricity during the summer, the costliest time of year.

On-site CHP not only eliminates the loss of electric power during transmission, but also offsets the capital expense of upgrading or expanding the utility infrastructure. The national electric grids of many developed countries are already challenged to keep up with existing power demand. In addition, the transmission and distribution network is operating at capacity in a majority of urban areas. Decentralizing power generation by installing equipment at customer sites not only relieves the capacity burden on existing power plants, but also lessons the burden on transmission and distribution lines. This ultimately improves the grid's reliability and reduces the need for costly upgrades.

Increasingly favorable economic conditions could improve our business prospects domestically and abroad. Specifically, we believe that natural gas prices might increase from their historically depressed values, but only modestly, while electric rates would continue to rise over the long-term as utilities pay for grid expansion, better emission controls, efficiency improvements, and the integration of renewable power sources.

The largest numbers of potential new customers in the U.S. require less than 1 MW of electric power and less than 1,200 tons of cooling capacity. We are targeting customers in states with high electricity rates in the commercial sector, such as California, Connecticut, Massachusetts, New Hampshire, New Jersey, and New York. Most of these states also have high peak demand rates, which favor utilization of our modular units in groups so as to assure redundancy and peak demand savings. Governmental agencies in some of these regions may also provide generous rebates that can improve the economic viability of our systems.

We aggressively market to both potential domestic and international customers where utility pricing aligns with our advantages. These areas include regions that have strict emissions regulations, such as California, or those that reward CHP systems that are especially non-polluting, such as New Jersey. There are currently 23 states that recognize CHP as part of their Renewable Portfolio Standards or Energy Efficiency Resource Standards and several of them, including New York, California, Massachusetts, New Jersey, and North Carolina, have initiated specific incentive programs for CHP.

The traditional markets for CHP systems are buildings with long hours of operation and with corresponding demand for electricity and heat. Traditional customers for our cogeneration 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.

Traditional customers for our chillers and heat pumps overlap with those for our cogeneration systems. Engine-driven chillers are often used as replacements for aging electric chillers because they both occupy similar amounts of floor space and require similar maintenance schedules.

On-site utility services are provided in standardized packages of energy, equipment, and services suited to the needs of property owners and operators in healthcare, hospitality, large residential, athletic facilities, and certain industrial sites. This includes national accounts and other customer groups having a common set of energy requirements at multiple locations.

Competition

Although we believe that the Company offers customers a suite of premier best-in-class clean energy and thermal solutions, the markets for our products are highly competitive. Our cogeneration products compete with the utility grid, existing technologies such as other reciprocating engine and microturbine CHP systems, and other emerging distributed generation technologies including solar power, wind-powered systems, and fuel cells. We believe that Capstone Turbine Corporation is the only microturbine manufacturer with a commercial presence in CHP.

Although operating solar and wind powered systems produce no emissions, the main drawbacks to these renewable powered systems are their dependence on weather conditions, their reliance on backup utility grid-provided power, and high capital costs that can often make these systems uneconomical without government subsidies. Similarly, while the market for fuel cells is still developing, a number of companies are focused on markets similar to ours. Fuel cells, like solar and wind powered systems, have received higher levels of incentives for the same type of applications as CHP systems in many territories. We believe that, notwithstanding these higher government incentives, our CHP solutions provide a better value and more robust solution to end users in most applications.

Additionally, our patents relating to the Ultera ultra-low emissions technology give Tecogen products a strong competitive advantage in markets where severe emissions limits are imposed or where very clean power is favored, such as New Jersey, California, and Massachusetts.

Our 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. Overall, we compete with end users' other options for electrical power, heating, and cooling on the basis of our clean technology's ability to:

- Provide power when a utility grid is not available or goes out of service;
- Reduce the customer's total cost of purchasing electricity and other fuel;
- Reduce emissions of criteria pollutants (NOx and CO) to near-zero levels and cut the emission of greenhouse gases such as carbon dioxide;
- Provide reliable on-site power generation, heating and cooling services; and
- Control maintenance costs and ensure optimal peak equipment performance.

InVerde e+ CHP

We believe that no other company has developed a product that competes with our inverter-based InVerde e+ , which offers UL-certified grid connection, black-start capability, and patented variable-speed operation. An inverter-based product with at least some of these features has been introduced by others, but we believe that they face serious challenges in duplicating all the unique features of the InVerde e+. Competitors product development time and costs could be significant. The Company has exclusive license rights to Microgrid algorithms developed by the University of Wisconsin researchers. We have exclusive rights for engine-driven systems utilizing natural gas or diesel fuel in the application of power generation where the per-unit output is less than 500kW. The software allows our products to be integrated as a Microgrid, where multiple InVerde e+® units can be seamlessly isolated from the main utility grid in the event of an outage and re-connected to it afterward. We expect that our patents and license for Microgrid software will deter others from offering certain important functions. See "Business-Intellectual Property".

Similarly, in the growing Microgrid segment, neither fuel cells nor microturbines can respond to changing energy loads when the system is disconnected from the utility grid. Engines such as those used in the Company's equipment inherently have a fast-dynamic response to step load changes, which is why they are the primary choice for emergency generators. Fuel cells and microturbines require additional energy storage systems to be utilized in off-grid operation, giving our engine-driven solutions an advantage for Microgrid and resiliency applications.

TECOCHILL Chillers

The Company's TECOCHILL line of chillers are the only gas-engine-driven chillers available on the market. Natural gas can also fuel absorption chillers, which use fluids to transfer heat without an engine drive. However, engine chillers continue to have an efficiency advantage over absorption machines. TECOCHILL chillers reach efficiencies well above levels achieved by similarly sized absorption systems. Today's relatively low natural gas prices in the United States improve the economics of gas-fueled chillers while their minimal electric demand on backup power systems make them ideal for facilities requiring critical precision climate control.

Ilios Heat Pump

There are a few companies manufacturing gas-engine heat pumps. Two companies that we deem to be competitors are Yanmar and Tedom. The Ilios® water heater and other heat pump products compete in both the high-efficiency water heating market and the CHP market.

On-Site Utility

Our on-site utility business competes with established utilities that provide electricity, wholesale electricity and gas utility distributors, companies that provide services similar to ours, and other forms of alternative energy. We believe DG is gaining acceptance in regions where energy customers are dissatisfied with the cost and reliability of traditional electricity services. These end-users, together with growing support from state legislatures and regulators, are creating a favorable climate for the growth of DG that is overcoming the objections of established utility providers. In our target markets, we compete with large utility companies such as Con Edison Inc. and Long Island Power authority in New York, Public Service Electric and Gas Company in New Jersey, and Eversource and National Grid USA Service Company, Inc. in Massachusetts. These companies are much larger than us in terms of revenues, assets, marketing, and other resources, but we target the same markets and customers. We compete with large utility companies by marketing our electricity services to the same potential commercial building customers. We compete on the basis of the cost, service, price, and favorable environmental benefits of generating energy with our installed systems. We also compete with other on-site utility companies, such as Aegis Energy Services Inc. and All Systems Cogeneration Inc.

TECOGEN INC.
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Research & Development

Tecogen's long and rich research and development tradition and sustained programs have allowed us to cultivate deep engineering expertise. We have strong core technical knowledge that is critical to product support and continuous product improvement efforts. Our TecoDrive engine, permanent magnet generator, cogeneration and chiller products, InVerde, Ilios heat pumps, and most recently the Ultera emissions control system were all created and optimized in-house with both public and private funding support.

We continue to seek to forge alliances with utilities, government agencies, universities, research facilities, and manufacturers. The Company has already succeeded in developing new technologies and products in collaboration with several entities, including:

- Sacramento Municipal Utility District has provided test sites for the Company since 2010.
- Southern California Gas Company and San Diego Gas & Electric Company, each a Sempra Energy subsidiary have granted us research and development contracts since 2004.
- Department of Energy’s Lawrence Berkeley National Laboratory, with which the Company has had research and development contracts since 2005, including ongoing Microgrid development work related to the InVerde.
- Eastern Municipal Water District has co-sponsored demonstration projects to retrofit both a natural-gas powered municipal water pump engine and a biofuel powered pumping station engine with the Ultera low emissions technology since 2012.
- Consortium for Electric Reliability Technology Solutions executed research and development contracts with the Company, and provided a test site to the Company since 2005.
- California Energy Commission executed research and development contracts with the Company from 2004 until March 2013.
- The AVL California Technology Center performed a support role in research and development contracts as well as internal research and development on our Ultera emission control system from August 2009 to November 2011. In Addition, the Center supported our research on emissions from gasoline vehicles from January of 2016 through October 2017 sponsored by our partially owned subsidiary, Ultra Emissions Technologies. AVL researchers collaborated with our engineers on several peer reviewed papers published by technology association SAE International in 2017 and 2018.
- Propane Education & Research Council (PERC) executed research and development contracts with the Company for work related to developing Ultera low emissions control systems for the propane powered fork truck market, now continuing with Mitsubishi Caterpillar Forklift America.
- The Southwest Research Institute (SWRI), a non-profit independent research center located in San Antonio, Texas, has been engaged by the Company to complete the next phase of research in the Ultera automotive application. This effort will focus on evaluation of advanced catalyst formulations tailored to the Ultera process and is ongoing.

Our efforts to forge partnerships continue to focus on utilities, particularly to promote the InVerde, our most utility-friendly product. The nature of these alliances varies by utility, but includes simplified interconnection, joint marketing, ownership options, peak demand mitigation agreements, and customer services. We have commissioned a Microgrid with the Sacramento Municipal Utility District at its headquarters in Sacramento, California, where the central plant incorporated three InVerde systems equipped with our Ultera low-emissions technology. Some expenses for this project were reimbursed to the utility through a grant from the California Energy Commission.

Certain components of our InVerde product were developed through a grant from the California Energy Commission. This grant includes a requirement that we pay royalties on all sales of all products related to the grant. As of December 31, 2017, such royalties accrued in accordance with this grant agreement were less than $6,000 on an annual basis.

Our relationship with the Propane Education & Research Council (PERC) plays an instrumental role in the development of our Ultera emissions control system for the propane powered fork truck market.

We also continue to leverage our resources with government and industry funding, which has yielded a number of successful developments, including the Ultera low-emissions technology, sponsored by the California Energy

Commission and Southern California Gas Company. Pursuant to the terms of the grants from the California Energy Commission, the California Energy Commission has a royalty-free, perpetual, non-exclusive license to these technologies for government purposes.

For the years ended December 31, 2018 and 2017, we spent $1,297,612 and $936,929, respectively, in research and development activities.

Intellectual Property

Patents

We currently hold ten United States patents for our technologies:

- 9,995,195: “Emissions control systems and methods for vehicles.” This patent, granted in June 2018, is a method for vehicle cold start to enhance the removal of CO and hydrocarbons emissions, which are extremely problematic for cold engines. Air is injected in the exhaust between the engine’s close-coupled catalyst and underbody catalyst. Once the engine is warmed (> 500 F exhaust) this air stream is shut off. This method synergizes well with the Ultera system by utilizing the injection air feed for an alternative purpose during engine start.
- 9,956,526: “Poison-Resistant Catalyst and Systems Containing Same.” This patent, granted in May 2018, relates to a special catalyst formulation that is resistant to contaminant induced corrosion in conditions like those of the Ultera second stage. These poisons or contaminants are most commonly sulfur compounds.
- 9,702,306: “Internal Combustion Engine Controller.” This patent granted in July of 2017 relates to the unique control methodology used in the InVerde e+ CHP unit that maximizes engine fuel economy under variable speed operation.
- 9,470,126: "Assembly and method for reducing ammonia in exhaust of internal combustion engines." This patent, granted in October 2016, is related to the Ultera emission control system applicable to all our products.
- 9,856,767: “Systems and methods for reducing emissions in exhaust of vehicles and producing electricity." This application, filed in November 2015 and published in March 2016, is related to the development of the Ultera emission control system for vehicle applications.
- 9,121,326: “Assembly and method for reducing nitrogen oxides, carbon monoxide and hydrocarbons in exhausts of internal combustion engines.” This patent, granted in September 2015, is related to the Ultera emission control system applicable to all our products.
- 8,829,698: “Power generation systems.” This patent, granted in September 2014, is for a power generation system that includes an internal combustion engine configured to provide rotational mechanical energy.
- 8,578,704: “Assembly and method for reducing nitrogen oxides, carbon monoxide, and hydrocarbons in exhausts of internal combustion engines.” This patent, granted in November 2013, is for the Ultera emission control system applicable to all our products.
- 7,243,017: “Method for controlling internal combustion engine emissions.” This patent, granted in July 2007, applies to the specific algorithms used in our engine controller for metering fuel usage to obtain the correct combustion mixture and is technology used by most of our engines.
- 7,239,034: “Engine driven power inverter system with cogeneration.” This patent, granted in July 2007, pertains to the utilization of an engine-driven CHP module combined with an inverter and applies to our InVerde product specifically.

We have filed for several additional patents, most notable among them are the following:

- “Emissions Control Systems and Methods for Vehicles.” This application filed in April 2016 relates to emissions control systems for vehicles.
- "Assemblies and Methods for Reducing Particulate Matter, Hydrocarbons, and Gaseous Oxides from Internal Combustion Engine Exhaust." This application filed in February 2017 relates to emissions controls system for vehicles.
- "Dual Stage Internal Combustion Engine Aftertreatment System Using Exhaust Gas Intercooling and Charger-Driven Air Ejector." This application filed in February 2017 relates to emissions controls systems for vehicles.

In addition, the Company licensed specific rights to Microgrid software algorithms developed by University of Wisconsin researchers for which we pay royalties to the assignee, The Wisconsin Alumni Research Foundation (WARF). The specific patent named in our agreement is “Control of small distributed energy resources” (7,116,010), granted in 2006. Our exclusive rights are valid for engine-driven systems utilizing natural gas or diesel fuel in the application of power generation where the per-unit output is less than 500 kW. The software allows our products to be integrated as a Microgrid, where multiple InVerde units can be seamlessly isolated from the main utility grid in the event of an outage and re-connected to it afterward. The licensed software allows us to implement such a Microgrid with minimal control devices and associated complexity and cost. Tecogen pays WARF a royalty for each cogeneration module sold using the licensed technology. Such royalty payments have been in the range of $5,000 to $30,000 on an annual basis through the year ended December 31, 2018. In addition, WARF reserved the right to grant non-profit research institutions and governmental agencies non-exclusive licenses to practice and use, for non-commercial research purposes, the technology developed by the Company that is based on the licensed software.

We consider our patents and licensed intellectual property to be important in the operation of our business. The expiration, termination, or invalidity of one or more of these patents may have a material adverse effect on our business. Our earliest patent, licensed from WARF, was issued in 2006 and expires in 2022. Most of our current patents expire between 2022 and 2027.

We believe that one other company, Aegis Energy Service Inc., has developed a product that competes with our inverter-based InVerde. We anticipate that an inverter-based product with at least some of these features will be introduced by others, but we believe that competitors will face serious challenges in duplicating the InVerde. Product development time and costs would likely be significant, and we expect that our patent for the inverter-based CHP system (7,239,034) would offer significant protection, for key features. We consider the Microgrid software algorithm licensed from WARF to be a key feature of our InVerde product, and one that would be difficult to duplicate outside the patent.

In 2013, we purchased rights to designs and technologies, including patents granted or pending for our permanent magnet generators. A key component of our InVerde module uses this acquired technology.

The issuance by the U.S. PTO of the patent for the Ultera® low-emissions control technology keeps that technology exclusive to us. It applies to all our gas engine-driven products and may have applications to other rich-burn spark-ignited internal combustion engines. We have been granted patents for this technology in Europe, Australia, Brazil, Canada, Mexico, and have applications in process in India, Japan, and others. There is no assurance, however, that the Ultera low-emissions control patent applications will be approved in any other country.

Copyrights

Our control software is protected by copyright laws or through an exclusive license agreement.

Trademarks

The Company has registered the brand names of our equipment and logos used on our equipment. These registered trademarks include Tecogen, Tecochill, Tecopower, Ultera, InVerde, Ilios, InVerde e+ and the associated logos. We will continue to trademark our product names and symbols.

We rely on treatment of our technology as trade secrets through confidentiality agreements, which our employees and vendors are required to sign. Also, we rely on non-disclosure agreements with others that have or may have access to confidential information to protect our trade secrets and proprietary knowledge.

Sourcing & Manufacturing

We are focused on continuously strengthening our manufacturing processes and increasing operational efficiencies within the Company. Many of the components used in the manufacture of our highly-efficient clean energy equipment are readily fabricated from commonly available raw materials or are standard available parts sourced from multiple suppliers. We believe that in most cases, adequate supplies exist to meet our near to medium term manufacturing needs. Tecogen has an on-going focus on developing and implementing new systems to simplify our manufacturing processes, product sourcing methods, and our supply chain.

The Company has a combined total of approximately 27,000 square feet of manufacturing and warehouse space running on a single 5-day per week shift at the Waltham, Massachusetts facility. We believe we have sufficient spare capacity to meet near to medium term demand without incurring additional fixed costs.

Government & Regulation
Several kinds of federal, state and local government regulations affect our products and services, including but not exclusive to:
- Product safety certifications and interconnection requirements;
- Air pollution regulations which govern the emissions allowed in engine exhaust;
- State and federal incentives for CHP technology;
- Various local building and permitting codes and third-party certifications;
- Electric utility pricing and related regulations; and
- Federal versus state laws regarding the legalization of cannabis for medicinal and recreational use.

Our markets can be positively or negatively impacted by the effects of governmental and regulatory matters. We are impacted not only by energy policy, laws, regulations and incentives of governments in the markets in which we sell, but also by rules, regulations and costs imposed by utilities. Utility companies or governmental entities may place barriers on the installation or interconnection of our products with the electric grid. Further, utility companies may charge additional fees to customers who install on-site power generation; thereby reducing the electricity they take from the utility, or for having the capacity to use power from the grid for back-up or standby purposes. These types of restrictions, fees or charges could hamper the ability to install or effectively use our product or increase the cost to our potential customers for using our systems. This could make our systems less desirable, adversely impacting our revenue and profitability. In addition, utility rate reductions can make our products less competitive, causing a material adverse effect on our operations. These costs, incentives and rules are not always the same as those faced by technologies with which we compete.

Similarly, rules, regulations, laws and incentives could also provide an advantage to our distributed generation solutions as compared with competing technologies if we are able to achieve required compliance in a lower cost, more efficient manner. Additionally, reduced emissions and higher fuel efficiency could help our customers combat the effects of global warming. Accordingly, we may benefit from increased government regulations that impose tighter emission and fuel efficiency standards. We encourage investors and potential investors to carefully consider associated Risk Factors detailed below which highlight various aspects of the regulatory environment and other related risks.

Our products are well-suited to meet the needs of the rapidly emerging indoor agriculture market, including cannabis. To date our focus in the indoor agricultural market has primarily involved cannabis, a high revenue generating potential. However, we have sold to other indoor agricultural growers, and we believe that the indoor food production market will provide significant opportunities for the Company. This growth provides us with increased confidence that this segment of the indoor agriculture market in particular has the potential to be a major driver of growth as states move to legalize the use of cannabis for medicinal purposes and recreational use. However, under the Controlled Substances Act (CSA) cannabis continues to be categorized as a Schedule I drug, so that cannabis growers continue to face significant uncertainty regarding their ability to conduct business.

First passed by Congress in 2014, the Rohrabcher-Farr Amendment is an amendment to the annual appropriations bill that, among other things, funds the Department of Justice. It prohibits the Attorney General from using funds to prosecute the medical use of cannabis. It does not address recreational use. On January 4, 2018, US Attorney General Jeff Sessions rescinded the Cole memo. Written in 2013, the Cole memo had directed US Attorneys not to allocate resources to prosecute "individuals whose actions are in clear and unambiguous compliance with existing state laws" regarding the cannabis market. As of the date of this filing, we are not aware of any US Attorney who has taken action against participants in the recreational cannabis market operating in accordance with state law. The uncertainty we face regarding the potential for growth from the cannabis industry is due in part to uncertainty regarding prosecutorial priorities.

Our Energy Production segment is subject to extensive government regulation. We are required to file for local construction permits (electrical, mechanical and the like) and utility interconnects, and must make various local and state filings related to environmental emissions.

In the past, many electric utility companies have raised opposition to DG, a critical element of our On-Site Utility business. Such resistance has generally taken the form of stringent standards for interconnection and the use of target rate structures as disincentives to combined generation of on-site power and heating or cooling services. A DG company's ability to obtain reliable and affordable back-up power through interconnection with the grid is essential to the business model. Utility policies and regulations in most states are often not prepared to accommodate widespread on-site generation. These barriers erected by electric utility companies and unfavorable regulations, where applicable, make more difficult or uneconomic our ability to connect to the electric grid at customer sites and are an impediment to the growth of this segment. The development of this segment could be adversely affected by any slowdown or reversal in the utility deregulation process or by difficulties in negotiating back-up power supply agreements with electric providers in the areas where we intend to do business.

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Employees

As of December 31, 2018, we employed 92 full-time employees and 5 part-time employees, including 8 sales and marketing personnel and 43 service personnel. Eight of our New Jersey service employees are represented by a two year collective bargaining agreement with an effective date of January 1, 2017 which renews annually unless terminated by either party by written notice within sixty days prior to the expiration date.

Periodic Reporting and Financial Information

The Company registered its common stock under the Securities Exchange Act of 1934, as amended (the "Exchange Act"), and has reporting obligations, including the requirement that it file annual and quarterly reports with the SEC. You may obtain information about the operation of the Public Reference Room by calling the SEC at 1-800-SEC-0330. The SEC maintains an Internet site that contains reports, proxy and information statements, and other information regarding issuers that file electronically with the SEC at http://www.sec.gov. The Company also makes available through its website the annual reports on Form 10-K, quarterly reports on Form 10-Q and current reports on Form 8-K and amendments to those reports as soon as reasonably practical after filing with the SEC. Its website address is http://www.tecogen.com. Information on the Company's website is not part of this Annual Report on Form 10-K.

Item 1A. Risk Factors

Our business, operations, and the Company face many risks. In additional to the other information in this Form 10-K, the following factors and the information contained under the heading "Cautionary Note Concerning Forward-Looking Statements" should be considered in evaluating the Company and its business. The risks described below may not be the only risks we face. Additional risks that we do not yet know of, or that we currently think are immaterial, may also impair our business operations or financial results. If any of the events or circumstances described in the following risks occur, our business, financial condition or results of operations could suffer and the trading price of our common stock could decline.

Risks Relating to Our Business

To the extent cash generated from operations in the future is insufficient to fund our operating requirements, we will be required to seek outside financing. Our inability to obtain necessary capital or financing to fund these working capital needs will adversely affect our ability to expand our operations.

If the cash generated by operations is insufficient to fund our future operating requirements, we will need to raise additional funds through public or private equity or debt financings. Such financing may not be available to us when needed, or if available, may not be available on terms that are favorable to us and could result in significant dilution to the holdings of our stockholders. Furthermore, any such debt financing is likely to include financial and other covenants that may impede our ability to react to changes in the economy or industry. Although we are in discussions with various possible funding sources and have executed a term sheet, we have no commitments for any such financing at this time. If adequate financing is not available when needed, we may be required to implement cost-cutting strategies, delay production, curtail research and development efforts or implement other measures, which may adversely affect our overall results of operations and financial condition.

If we experience a period of significant growth or expansion, it could place a substantial strain on our resources.

If our cogeneration and chiller products penetrate the market rapidly, we may be unable deliver large volumes of technically complex products or components to our customers on a timely basis and at a reasonable cost to us. We have never ramped up our manufacturing capabilities to meet significant large-scale production requirements. If we were to commit to deliver large volumes of products, we may not be able to satisfy these commitments on a timely and cost-effective basis.

Our operating history is characterized by net losses and there can be no assurance we will be able to increase our sales and sustain profitability in the future.

Although we were able to generate net income from our Products and Services segment for the year ended December 31, 2017, we have historically incurred annual operating losses from such segment. Such business is capital intensive and, because our products generally are built to order with customized configurations, the lead time to build and deliver a unit can be significant. We may be required to purchase key components long before we can deliver a unit. Changes in customer orders or lack of demand may also impact our profitability. There can be no assurance we will be able to increase our sales and achieve and sustain profitability in the future.

We are dependent on a limited number of third-party suppliers for the supply of key components for our products.
We use third-party suppliers for components in all of our products. Our engine supplier, generator supplier for cogeneration products (other than the InVerde), and the compressor and vessel sets in our chillers, are all purchased from large multinational equipment manufacturers. The loss of one or more of our suppliers could materially and adversely affect our business if we are unable to replace them. While alternate suppliers for the manufacture of our engine, generator and compressor have been identified, should the need arise, there can be no assurance that alternate suppliers will be available and able to provide such items on acceptable terms or on a timely basis.
From time to time, shipments can be delayed because of industry-wide or other shortages of necessary materials and components from third-party suppliers, as well as shipping delays at points of importation. A supplier's failure to supply components in a timely manner, or to supply components that meet our quality, quantity, or cost requirements, or our inability to obtain substitute sources of these components on a timely basis or on terms acceptable to us, could impair our ability to deliver our products in accordance with contractual obligations.
The amount of the Company's backlog is subject to fluctuation due to its customers’ experiencing unexpected delays in financing, permitting or modifications in specifications of the equipment.
The Company's total product and installation backlog as of December 31, 2018 was $16.6 million compared to $15.7 million as of 2017. Although Tecogen expects its customers to issue definitive purchase orders with respect to such backlog, there can be no assurance that such amounts will not be subject to modification in the event customers experience unexpected delays in obtaining permits, interconnection agreements or financing. Any of such events may result in customers modifying the equipment or the terms or timing of the expected installation, which may result in changes to the amount of backlog attributed to those projects.
We expect significant competition for our products and services.
Many of our competitors and potential competitors are well established and have substantially greater financial, research and development, technical, manufacturing and marketing resources than we do. If these larger competitors decide to focus on the development of distributed power or cogeneration, they have the manufacturing, marketing and sales capabilities to complete research, development, and commercialization of these products more quickly and effectively than we can. There can also be no assurance that current and future competitors will not develop new or enhanced technologies or more cost-effective systems, and therefore, there can be no assurance that we will be successful in this competitive environment.
If we are unable to maintain our technological expertise in design and manufacturing processes, we will not be able to successfully compete.
We believe that our future success will depend upon our ability to continue to develop and provide innovative products and product enhancements that meet the increasingly sophisticated needs of our customers.
However, this requires that we successfully anticipate and respond to technological changes in design and manufacturing processes in a cost-effective and timely manner. The development of new, technologically advanced products and enhancements is a complex and uncertain process requiring high levels of innovation, as well as the accurate anticipation of technological and market trends. There can be no assurance that we will successfully identify new product opportunities, develop and bring new or enhanced products to market in a timely manner, successfully lower costs, and achieve market acceptance of our products, or that products and technologies developed by others will not render our products or technologies obsolete or noncompetitive.
The introduction of products embodying new technologies and the shifting of customer demands or changing industry standards could render our existing products obsolete and unmarketable. We may experience delays in releasing new products and product enhancements in the future. Material delays in introducing new products or product enhancements may cause customers to forego purchases of our products and purchase those of our competitors.
Our intellectual property may not be adequately protected.
We seek to protect our intellectual property rights through patents, trademarks, copyrights, trade secret laws, confidentiality agreements, and licensing arrangements, but we cannot ensure that we will be able to adequately protect our technology from misappropriation or infringement. We cannot ensure that our existing intellectual property rights will not be invalidated, circumvented, challenged, or rendered unenforceable.

Our competitors may successfully challenge the validity of our patents, design non-infringing products, or deliberately infringe our patents. There can be no assurance that other companies are not investigating or developing other similar technologies. In addition, our intellectual property rights may not provide a competitive advantage to us or ensure that our products and technology will be adequately covered by our patents and other intellectual property. Any of these factors or the expiration, termination, or invalidity of one or more of our patents may have a material adverse effect on our business.

Others may assert that our technology infringes their intellectual property rights.
We may be subject to infringement claims from time to time. The defense of any claims of infringement made against us by third parties could involve significant legal costs and require our management to divert time from our business operations. If we are unsuccessful in defending any claims of infringement, we may be forced to obtain licenses or to pay additional royalties to continue to use our technology. We may not be able to obtain any necessary licenses on commercially reasonable terms or at all. If we fail to obtain necessary licenses or other rights, or if these licenses are costly, our operating results would suffer either from reductions in revenues through our inability to serve customers or from increases in costs to license third-party technologies.
Our success is dependent upon attracting and retaining highly qualified personnel and the loss of key personnel could significantly hurt our business.
To achieve success, we must attract and retain highly qualified technical, operational and executive employees. The loss of the services of key employees or an inability to attract, train and retain qualified and skilled employees, specifically engineering, operations, and business development personnel, could result in the loss of business or could otherwise negatively impact our ability to operate and grow our business successfully.
Our business is subject to product liability and warranty claims.
Our business exposes us to potential product liability claims, which are inherent in the manufacturing, marketing and sale of our products, and we may face substantial liability for damages resulting from the faulty design of products, manufacture of products or improper use of products by end users. We currently maintain a moderate level of product liability insurance, but there can be no assurance that this insurance will provide sufficient coverage in the event of a claim. Also, we cannot predict whether we will be able to maintain such coverage on acceptable terms, if at all, or that a product liability claim would not harm our business or financial condition. In addition, negative publicity in connection with the faulty design or manufacture of our products would adversely affect our ability to market and sell our products.
We sell our products with limited warranties. There can be no assurance that the provision in our financial statements for estimated product warranty expense will be sufficient. We cannot ensure that our efforts to reduce our risk through warranty disclaimers will effectively limit our liability. Any significant occurrence of warranty expense in excess of estimates could have a material adverse effect on our operating results, financial condition and cash flow. Further, we have at times undertaken programs to enhance the performance of units previously sold. These enhancements have at times been provided at no cost or below our cost. If we choose to offer such programs again in the future, such actions could result in significant costs.
Agreements with the Company and its affiliates may include potential liquidated damages relating to construction delays or performance guaranties.
Turnkey construction contracts to which the Company is a party may contain liquidated damages provisions resulting from failure to achieve agreed milestones relating to construction activity. Agreements relating to the sale of equipment or energy may include performance and other obligations that may result in payment obligations to customers.
Utilities or governmental entities could hinder our entry into and growth in the marketplace, and we may not be able to effectively sell our products.
Utilities or governmental entities on occasion have placed barriers to the installation of our products or their interconnection with the electric grid, and they may continue to do so. Utilities may charge additional fees to customers who install on-site CHP and rely on the grid for back-up power. These types of restrictions, fees, or charges could make it harder for customers to install our products or use them effectively, as well as increasing the cost to our potential customers. This could make our systems less desirable, thereby adversely affecting our revenue and other operating results.
The reduction, elimination or expiration of government and economic incentives for applications of our equipment could reduce demand for our equipment and harm our business.
The market for cogeneration equipment depends in part on the availability and size of government and economic incentives that vary by geographic market. Because our sales to customers are typically into geographic areas with

such incentives, elimination, or expiration of government subsidies and economic incentives for cogeneration equipment may negatively affect the competitiveness of equipment relative to other sources of electricity, heating, and cooling equipment, and could harm or halt the growth of the cogeneration industry and our business. In particular, the Company depends on the New York State Energy Development Authority CHP Program (PON 2568) and the New Jersey Smart Start Combined Heat and Power Incentive.

The Company sometimes incorporates price reduction on equipment sold to customers based on the anticipated receipt of governmental economic incentive payments, and applies for and collects the incentives payments. If such incentives become unavailable to the Company the Company may be materially adversely affected.

Competing sources of electricity, heating, and cooling equipment may successfully lobby for changes in the relevant legislation in their markets that are harmful to the cogeneration industry. Reductions in, or eliminations or expirations of, governmental incentives in regions where we focus our sales efforts could result in decreased demand for and lower revenue from cogeneration equipment there, which would adversely affect the Company. In addition, our ability to successfully penetrate new geographic markets may depend on new geographic areas adopting and maintaining incentives to promote cogeneration, to the extent such incentives are not currently in place. Additionally, electric utility companies may establish pricing structures or interconnection requirements that could adversely affect our sales and be harmful to cogeneration.

We may not achieve production cost reductions necessary to competitively price our products, which would adversely affect our sales.

We believe that we will need to reduce the unit production cost of our products over time to maintain our ability to offer competitively priced products. Our ability to achieve cost reductions will depend on our ability to develop low-cost design enhancements, to obtain necessary tooling and favorable supplier contracts, and to increase sales volumes so we can achieve economies of scale. We can make no assurance that we will be able to achieve any such production cost reductions. Our failure to do so could have a material adverse effect on our business and results of operations.

Our products involve a lengthy sales cycle and we may not anticipate sales levels appropriately, which could impair our results of operations.

The sale of our products typically involves a significant commitment of capital by customers, with the attendant delays frequently associated with large capital expenditures. For these and other reasons, the sales cycle associated with our products is typically lengthy and subject to a number of significant risks over which we have little or no control. We expect to plan our production and inventory levels based on internal forecasts of customer demand, which is highly unpredictable and can fluctuate substantially. If sales in any period fall significantly below anticipated levels, our financial condition, results of operations and cash flow would suffer. If demand in any period increases well above anticipated levels, we may have difficulties in responding, incur greater costs to respond, or be unable to fulfill the demand in sufficient time to retain the order, which would negatively impact our operations. In addition, our operating expenses are based on anticipated sales levels, and a high percentage of our expenses are generally fixed in the short term. As a result of these factors, a small fluctuation in timing of sales can cause operating results to vary materially from period to period.

The economic viability of our projects depends on the price spread between fuel and electricity, and the variability of these prices creates a risk that our projects will not be economically viable and that potential customers will avoid such energy price risks.

The economic viability of our CHP products depends on the spread between natural gas fuel and electricity prices. Volatility in one component of the spread, such as the cost of natural gas and other fuels (e.g., propane or distillate oil), can be managed to some extent by means of futures contracts. However, the regional rates charged for both base load and peak electricity may decline periodically due to excess generating capacity or general economic recessions. Our products and on-site utility service could become less competitive if electric rates were to fall substantially in the future, although, historically, electric rates have not had any sustained decline in price. Potential customers may perceive the risk of unpredictable swings in natural gas and electricity prices as a risk of investing in on-site CHP, and may decide not to purchase CHP products.

We are exposed to credit risks with respect to some of our customers.

To the extent our customers do not advance us sufficient funds to finance our costs during the execution phase of our contracts, we are exposed to the risk that they will be unable to accept delivery or that they will be unable to make payment at the time of delivery.

We may make acquisitions or take other corporate strategic actions that could harm our financial performance.

To expedite development of our business, including with regard to equipment installation and service functions, we anticipate investigating and potentially pursuing future acquisitions of complementary businesses. Risks associated with such acquisitions include the diversion of management attention and cash from operating to costs associated with

acquisitions, disruption of our existing operations, loss of key personnel in the acquired companies, dilution through the issuance of additional securities, assumptions of existing liabilities, and commitment to further operating expenses. If any or all of these problems actually occur, acquisitions could negatively impact our financial performance and future stock value.
The Company has recently completed the acquisition of ADGE. As the Company continues to integrate ADGE's business model into its operations, the Company's financial condition, cash flows, and results of operations could be negatively impacted.

U.S. federal income tax reform could adversely affect us.
On December 22, 2017, U.S. federal tax legislation, commonly referred to as the Tax Cuts and Jobs Act ("TCJA"), was signed into law, significantly reforming the U.S. Internal Revenue Code. The TCJA contains significant changes to the U.S. federal corporate income taxation, including reduction of the corporate tax rate from 35% to 21% for US taxable income. Further, it imposes significant additional limitations on the deductibility of interest, allows for the expensing of capital expenditures, puts into effect the migration from a "worldwide" system of taxation to a territorial system, and modifies or repeals many business deductions and credits. We continue to examine the impact the TCJA may have on our business. The Company is in the process of quantifying the impact of the TCJA and will record any adjustments in accordance with the guidance provided in SAB118.
The impact of the TCJA on holders of common stock is uncertain and could be adverse. This Annual Report does not discuss any such tax legislation or the manner in which it might affect investors of our common stock. Investors should consult with their own tax advisors with respect to such legislation and the potential tax consequences of investing in our common stock.
We are implementing a new enterprise resource planning system, and if this new system proves ineffective or if we experience issues with the transition, we may be unable to timely or accurately prepare financial reports, make payments to our suppliers and employees, or invoice and collect from our users.
We are implementing a new enterprise resource planning, or ERP system. Our ERP system is critical to our ability to accurately maintain books and records and to prepare our financial statements. The transition to our new ERP system may be disruptive to our business if the ERP system does not work as planned or if we experience issues relating to the implementation. Such disruptions could impact our ability to timely or accurately make payments to our suppliers and employees, and could also inhibit our ability to invoice, and collect from our customers. Data integrity problems or other issues may be discovered which, if not corrected, could impact our business or financial results. In addition, we may experience periodic or prolonged disruption of our financial functions arising out of this conversion, general use of such system, other periodic upgrades or updates, or other external factors that are outside of our control. If we encounter unforeseen problems with our ERP system or other related systems and infrastructure, it could adversely affect our financial reporting systems and our ability to produce financial reports, the effectiveness of internal controls over financial reporting, and our business, operating results and financial condition could be adversely affected.
Our business and financial performance may be adversely affected by information systems interruptions, cybersecurity attacks or other disruptions which could have a material adverse effect on our business and results from operations.
We depend upon information technology, infrastructure, including network, hardware and software systems to conduct our business. Despite our implementation of network and other cybersecurity measures, our information technology system and networks could be disrupted or experience a security breach from computer viruses, break-ins and similar disruptions from unauthorized tampering with our computer systems. Our security measures may not be adequate to protect against highly targeted sophisticated cyber-attacks, or other improper disclosures of confidential and/or sensitive information. Additionally, we may have access to confidential or other sensitive information of our customers, which despite our efforts to protect, may be vulnerable to security breaches, theft, or improper disclosure any of which could have a material adverse effect on our competitive position, results of operations, cash flows or financial condition.
Risks Relating to the Business of ADGE
Through ADGE, we may be exposed to substantial liability claims if we fail to fulfill our obligations to our customers or our on-site equipment malfunctions.
Through ADGE we enter into contracts with large commercial and not-for-profit customers under which we assume responsibility for meeting a portion of the customers' building energy demand and equipment installation. We may be exposed to substantial liability claims if we fail to fulfill our obligations to customers. If the equipment malfunctions, it may be costly to repair or replace. There can be no assurance that we will not be vulnerable to claims by customers and by third parties that are beyond any contractual protections that we are able to negotiate. As a result, liability claims could cause us significant financial harm.
Expiring ADGE customer contracts may lead to decreases in revenue and increases in expenses.

Each year, a portion of our customer contracts expire and need to be renewed or replaced. We may not be able to renew or extend contracts with existing customers or obtain replacement contracts at attractive rates or for the same term as the expiring contracts. To the extent ADGE is unable to extend customer contracts prior to their expiration date, energy production revenue will decline due to less energy billing. Expiring customer contracts can also lead to an increase in expenses because we are obligated to remove the equipment from the customer location at our own expense at the end of the customer contract.

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ADGE revenue from energy billing may be adversely impacted by reductions in utility rates for electrical power or by the weather, either of which could reduce our revenue.

Over the past several years, there has been a sharp decrease in electric rates, subsequent to the vast majority of customer contract dates, causing the billable value of the electrical power generated by ADGE's systems to decrease which has an adverse effect on our results of operations. In warmer months the customers do not use as much thermal energy because they do not have as much demand for heat at their locations. Due to lower demand in warmer months we may not be able to bill for thermal energy and in turn may have a decrease in revenue.

Litigation relating to the Merger pursuant to which the Company acquired ADGE has required, and any future litigation may require, the Company to incur significant costs.

The Company, along with ADGE and certain of our current and ADGE's former directors and officers, were named as defendants in a class action lawsuit filed prior to the Merger. That litigation, with respect to which all claims were dismissed in November 2018 was costly, and any future litigation may be costly and a distraction from the daily operation of our business. All claims relating to the Merger have been dismissed without cost or liability to ADGE or the Company other than fees for legal counsel and other professional advisors to ADGE, the Company, and their Boards of Directors.

Although the Company maintains, and ADGE maintained prior to the Merger, directors' and officers' insurance coverage, there can be no assurances that this insurance coverage will be sufficient to cover the substantial fees and expenses of lawyers and other professional advisors relating to any future litigation, our obligations to indemnify our officers and directors who are or may become parties to such pending and future actions, or the amount of any judgments or settlements that we may be obligated to pay in connection with such actions. We may be required to make material payments in connection with the defense of or to settle such litigation or to satisfy any adverse judgment. In addition, such action, or those that arise in the future, could be excluded from coverage or, if covered, could exceed our deductibles and/or the coverage provided. In addition, an adverse outcome of litigation could cause our insurance premiums and retention amounts to increase in the future. Any of these consequences could have a material adverse effect on our business, financial condition and results of operations. For more information regarding litigation, see "Item 3. Legal Proceedings" and Note 10 "Commitments and Contingencies" in the Notes to Consolidated Financial Statements included elsewhere herein.

Risks Relating to Ownership of our Common Stock
Investment in our Common Stock is subject to price fluctuations and market volatility.
Historically, valuations of many small companies have been highly volatile. The securities of many small companies have experienced significant price and trading volume fluctuations, unrelated to the operating performance or the prospects of such companies. The market price of shares of our Common Stock could be subject to wide fluctuations in response to many risk factors listed in this section, and others beyond our control, including:

- results and timing of our product development;
- results of the development of our competitors' products;
- regulatory actions with respect to our products or our competitors' products;
- actual or anticipated fluctuations in our financial condition and operating results;
- actual or anticipated changes in our growth rate relative to our competitors;
- actual or anticipated fluctuations in our competitors' operating results or changes in their growth rate;
- competition from existing products or new products that may emerge;
-

announcements by us or our competitors of significant acquisitions, strategic partnerships, joint ventures, collaborations, or capital commitments;
- issuance of new or updated research or reports by securities analysts;
- fluctuations in the valuation of companies perceived by investors to be comparable to us;
- share price and volume fluctuations attributable to inconsistent trading volume levels of our shares;
- additions or departures of key management or personnel;
- disputes or other developments related to proprietary rights, including patents, litigation matters, and our ability to obtain, maintain, defend or enforce proprietary rights relating to our products and technologies;
- announcement or expectation of additional financing efforts;
- sales of our Common Stock by us, our insiders, or our other stockholders; and
- general economic and market conditions.

Furthermore, the stock markets have experienced extreme price and volume fluctuations that have affected and continue to affect the market prices of equity securities of many companies. These fluctuations often have been unrelated or disproportionate to the operating performance of those companies. These broad market and industry fluctuations, as well as general economic, political, and market conditions such as recessions, interest rate changes, or international currency fluctuations, may negatively impact the market price of shares of our Common Stock. In addition, such fluctuations could subject us to securities class action litigation, which could result in substantial costs and divert our management's attention from other business concerns, which could potentially harm our business.

We experience significant fluctuations in revenues from quarter to quarter on our product sales which may make period to period comparisons difficult.

We have low volume, high dollar sales for projects that are generally non-recurring, and therefore our sales have fluctuated significantly from period to period. Fluctuations cannot be predicted because they are affected by the purchasing decisions and timing requirements of our customers, which are unpredictable. Such fluctuations may make quarter to quarter and year to year comparisons difficult.

We may be subject to litigation, which is expensive and could divert management attention.

Our share price may be volatile and in the past companies that have experienced volatility in the market price of their stock have been subject to an increased incidence of securities class action litigation. We may be the target of this type of litigation in the future. Securities litigation against us could result in substantial costs and divert our management's attention from other business concerns, which could seriously harm our business.

If securities or industry analysts do not publish research or publish inaccurate or unfavorable research about our business, our share price and trading volume could decline.

The trading market for our Common Stock will depend on the research and reports that securities or industry analysts publish about us or our business. We do not have any control over these analysts. There can be no assurance that analysts will cover us, or provide favorable coverage. If one or more analysts downgrade our Common Stock or change their opinion of our Common Stock our share price would likely decline. In addition, if one or more analysts cease coverage of the Company or fail to regularly publish reports on us, we could lose visibility in the financial markets, which could cause our share price or trading volume to decline.

Because our directors and executive officers are among our largest stockholders, they can exert influence over our business and affairs and have actual or potential interests that may depart from other stockholders or investors.

As of the date of this report our directors and executive officers collectively beneficially own approximately 13% of our issued and outstanding Common Stock. John Hatsopoulos, a director of the Company, beneficially owns approximately 9% of our issued and outstanding Common Stock. Additionally, the holdings of our directors and executive officers may increase in the future upon vesting or other maturation of exercise rights under any of the options they may hold or in the future be granted or if they otherwise acquire additional shares of our Common Stock. The interests of such persons may differ from the interests of our other stockholders. As a result, in addition to their board seats and offices, such persons will have influence over corporate actions requiring shareholder approval.

Such persons' stock ownership may discourage a potential acquirer from making a tender offer or otherwise attempting to acquire us, which in turn could reduce our stock price or prevent our stockholders from realizing a premium over our stock price.

Current stockholdings may be diluted if we make future equity issuances or if outstanding options are exercised for shares of our common stock.

"Dilution" refers to the reduction in the voting effect and proportionate ownership interest of a given number of shares of common stock as the total number of shares increases. Our issuance of additional stock, convertible preferred stock, or convertible debt may result in dilution to the interests of shareholders and may also result in the reduction of your stock price. The sale of a substantial number of shares into the market, or even the perception that sales could occur, could depress the price of our Common Stock. Also, the exercise of options may result in additional dilution.

The holders of outstanding options and warrants (and other convertible securities or derivatives, if any are subsequently issued) have the opportunity to profit from a rise in the market price of our Common Stock, if any, without assuming the risk of ownership, with a resulting dilution in the interests of other stockholders. We may find it more difficult to raise additional equity capital if it should be needed for our business while the options, warrants and convertible securities are outstanding.

Future sales of our Common Stock by our existing stockholders may cause our stock price to fall.

The market price of our Common Stock could decline as a result of sales by our existing stockholders of shares of our Common Stock in the market or the perception that these sales could occur. These sales might also make it more difficult for us to sell equity securities at a time and price that we deem appropriate and thus inhibit our ability to raise additional capital when it is needed.

Because we have not and do not intend to pay cash dividends, our stockholders receive no current income from holding our stock.

We have paid no cash dividends on our capital stock to date and we currently intend to retain our future earnings, if any, to fund the development and growth of our business. We currently expect to retain earnings for use in the operation and expansion of our business, and therefore do not anticipate paying any cash dividends in the foreseeable future. In addition, the terms of our credit facility may restrict our ability to pay any cash dividends. As a result, capital appreciation, if any, of our Common Stock could be the sole source of gain for our stockholders for the foreseeable future.

Failure to comply with the Nasdaq Capital Market continued listing requirements could lead to the commencement of delisting proceedings in accordance with the Nasdaq rules. Delisting could limit investors' ability to effect transactions in the Company's securities and subject the stock to additional trading restrictions.

The Company’s Common Stock is listed on the Nasdaq Capital Market, a national securities exchange. To maintain such listing, the Company is required to meet its continued listing requirements. If the Company is unable to maintain the listing of its stock on Nasdaq or another exchange for failure to comply with the continued listing requirements, including timely filing of Exchange Act reports and compliance with Nasdaq’s corporate governance requirements, the Company and its security holders could face significant material adverse consequences including a limited availability of market quotations for its stock and a decreased ability to issue additional securities or obtain additional financing in the future.

Certain provisions of our charter and bylaws may discourage mergers and other transactions.

Certain provisions of our certificate of incorporation and bylaws may make it more difficult for someone to acquire control of the Company. These provisions may make it more difficult for stockholders to take certain corporate actions and could delay or prevent someone from acquiring our business. These provisions could limit the price that certain investors might be willing to pay for shares of our Common Stock. The ability to issue “blank check” preferred stock is a traditional anti-takeover measure. This provision may be beneficial to our management and the board of directors in a hostile tender offer, and may have an adverse impact on stockholders who may want to participate in such tender offer, or who may want to replace some or all of the members of the board of directors.

Our board of directors may issue additional shares of preferred stock without stockholder approval.

Our certificate of incorporation authorizes the issuance of up to 10,000,000 shares of preferred stock. Accordingly, our board of directors may, without shareholder approval, issue one or more new series of preferred stock with rights which could adversely affect the voting power or other rights of the holders of outstanding shares of our Common Stock. In addition, the issuance of shares of preferred stock may have the effect of rendering more difficult or discouraging, an acquisition or change of control of the Company. Although we do not have any current plans to issue any shares of preferred stock, we may do so in the future.

Investor confidence in the price of our stock may be adversely affected if we are unable to comply with Section 404 of the Sarbanes-Oxley Act of 2002. As of the end of the period covered by this report, our principal executive officers and principal accounting officer have concluded there is a material weakness in our disclosure controls and procedures and our internal control over financial reporting, which could harm our operating results or cause us to fail to meet our reporting obligations.

As a public company, we are subject to the rules adopted by the SEC pursuant to Section 404 of the Sarbanes-Oxley Act of 2002, which require us to include in our annual report on Form 10-K our management’s report on, and assessment of the effectiveness of, our internal control over financial reporting (“management’s report”). If we fail to achieve and maintain the adequacy of our disclosure control or internal control over financial reporting, there is a risk that we will not comply with all of the requirements imposed by Section 404. Moreover, effective internal control over financial reporting, particularly that relating to revenue recognition, is necessary for us to produce reliable financial reports and is important in helping to prevent financial fraud. Any of these possible outcomes could result in an adverse reaction in the financial marketplace due to a loss in investor confidence in the reliability of our financial statements, which ultimately could harm our business and could negatively impact the market price of our common stock. Investor confidence and the price of our common stock may be adversely affected if we are unable to comply

with Section 404 of the Sarbanes-Oxley Act of 2002.
As of the end of the period covered by this Annual Report, December 31, 2018, our principal executive officers and principal accounting officer performed an evaluation of disclosure controls and procedures and concluded that our controls were not effective to provide reasonable assurance that information required to be disclosed by our Company in reports that we file under the Exchange Act, is recorded, processed, summarized and reported when required.
Management conducted an evaluation of our internal control over financial reporting and based on this evaluation, management concluded that the company’s internal control over financial reporting was not effective as of December 31, 2018. The Company has a small number of employees dealing with general controls over information technology security and user access. This constitutes a material weakness in financial reporting. Any failure to implement effective internal controls could harm our operating results or cause us to fail to meet our

reporting obligations. Inadequate internal controls could also cause investors to lose confidence in our reported financial information, which could have a negative effect on the trading price of our common stock, and may require us to incur additional costs to improve our internal control system.

In order to comply with public reporting requirements, we must continue to strengthen our financial systems and controls, and failure to do so could adversely affect our ability to provide timely and accurate financial statements.

Refinement of our internal controls and procedures will be required as we manage future growth, integrate the operations of ADGE and operate effectively as a public company. Such refinement of our internal controls, as well as compliance with the Sarbanes-Oxley Act of 2002 and related requirements, will be costly and will place a significant burden on management. We cannot assure you that measures already taken, or any future measures, will enable us to provide accurate and timely financial reports, particularly if we are unable to hire additional personnel in our accounting and financial department, or if we lose personnel in this area. Any failure to improve our disclosure controls or other problems with our financial systems or internal controls could result in delays or inaccuracies in reporting financial information, or non-compliance with SEC reporting and other regulatory requirements, any of which could adversely affect our business and stock price.

Item 1B. Unresolved Staff Comments.

Disclosure in response to this item is not required of a smaller reporting company.

Item 2. Properties.

Our headquarters is located in Waltham, Massachusetts, and consists of approximately 43,000 square feet of manufacturing, storage and office space. Our lease will expire March 31, 2024. We believe that our facilities are appropriate and adequate for our current needs.

Our ten leased service centers can be broken into two different sizes. The larger leased spaces have office space to accommodate administrative, sales and engineering personnel, and warehouse space to stock parts in support of our service contracts.

As of December 31, 2018, the service centers that fit this larger category are based in Piscataway, New Jersey, Valley Stream and Buchanan, New York to service the Metro New York City and the Mid-Atlantic region. The San Francisco Bay area and Northern California is served by such a center in Hayward, California. A portion of the corporate headquarters in Waltham, Massachusetts is used in this manner to service Boston and New England.

The smaller type service centers are a parts depot or warehouse for the stocking of parts in support of our service contracts. These centers are located in Los Angeles, California; Sterling Heights, Michigan; Newark, New York; and East Windsor, Connecticut and Florida.

Item 3. Legal Proceedings.

The Company was previously a party to an action in the United States District Court for the District of Massachusetts, described below, related to the Merger. All claims in the litigation relating to the Merger have been dismissed.

On November 16, 2018, the US District Court for the District of Massachusetts dismissed all remaining claims against all defendants in the litigation against Tecogen Inc. and its affiliates, including American DG Energy Inc., and their directors and certain officers, relating to the merger of American DG Energy Inc. with and into a subsidiary of Tecogen Inc. in a case filed on May 15, 2017 titled Vardakas v. American DG. Energy, Inc., Case No. 17-CV-1024(LTS).

The case was originally filed in February 2017 in Massachusetts state court by William C. May ("May"), individually and on behalf of the other shareholders of American DG Energy Inc. as a class in the Business Litigation Session of the Superior Court of the Commonwealth of Massachusetts, Civil Action N. 17-0390. Plaintiff May voluntarily dismissed the state court case on May 31, 2017 and consolidated that case with the case filed by plaintiff Lee Vardakas on May 15, 2017 in US District Court for the District of Massachusetts, alleging violations of federal securities laws and breaches of fiduciary duties to minority shareholders of American DG Energy Inc. in connection with the merger of American DG Energy Inc. with a subsidiary of Tecogen Inc. The US District Court dismissed all federal securities law claims in the case on March 2, 2018. On November 16, 2018 the remaining state law claims alleging breach of fiduciary duties to minority stockholders, and aiding and abetting breaches of fiduciary duties, were dismissed on the basis of the defendants' Motion for Judgment on the Pleadings. Plaintiff's motion for class certification was also dismissed on November 16, 2018.

Item 4. Mine Safety Disclosures.
Not applicable.

PART II
Item 5. Market for Registrant’s Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities.
Market
The Company's common stock has been listed on the NASDAQ Capital Market since May 2014 and trades under the ticker symbol TGEN.
Holders
As of March 28, 2019, there were more than 300 beneficial owners of our Common Stock including 66 holders of record.
Issuer Purchases of Equity Securities
Not applicable.

Item 6. Selected Financial Data.
Disclosure in response to this item is not required of a smaller reporting company.

Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations
You should read the following discussion and analysis of our financial condition and results of operations together with our financial statements and related notes appearing elsewhere in this Annual Report on Form 10-K. Some of the information contained in this discussion and analysis or set forth elsewhere in this Annual Report on Form 10-K, including information with respect to our plans and strategy for our business, includes forward-looking statements that involve risks and uncertainties. You should review “Item 1A. Risk Factors” of this Annual Report on Form 10-K for a discussion of important factors that could cause actual results to differ materially from the results described in or implied by the forward-looking statements contained in the following discussion and analysis.
Overview
Tecogen designs, manufactures and sells industrial and commercial cogeneration systems that produce combinations of electricity, hot water, and air conditioning using automotive engines that have been specially adapted to run on natural gas. Cogeneration systems are efficient because in addition to supplying mechanical energy to power electric generators or compressors – displacing utility supplied electricity – they provide an opportunity for the facility to incorporate the engine’s waste heat into onsite processes such as space and potable water heating. We produce standardized, modular, small-scale products, with a limited number of product configurations that are adaptable to multiple applications. We refer to these combined heat and power products as CHP (electricity plus heat) and MCHP (mechanical power plus heat).
Our products are sold directly to end-users by our in-house marketing team and by established sales agents and representatives. We have agreements in place with distributors and sales representatives. Our existing customers 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, military installations and indoor growing facilities. To date the Company has shipped over 3,000 units, some of which have been operating for almost 35 years.
As a result of our acquisition of American DG Energy ("ADGE") in May 2017, we added an additional source of revenue. Through ADGE, we install, own, operate and maintain complete distributed generation of electricity systems, or DG systems or energy systems, and other complementary systems at customer sites and sell electricity, hot water, heat and cooling energy under long-term contracts at prices guaranteed to the customer to be below conventional utility rates. Each month we obtain readings from our energy meters to determine the amount of energy produced for each customer. We use a contractually defined formula to multiply these readings by the appropriate published price of energy (electricity, natural gas or oil) from each customer's local energy utility, to derive the value of our monthly energy sale, which includes a negotiated discount. Our revenues per customer on a monthly basis vary based on the amount of energy produced by our energy systems and the published price of energy (electricity, natural gas or oil) from our customers' local energy utility that month.
Although we may, from time to time, have one or a few customers who may represent more than 10% of our product revenue for a given year, we are not dependent on the recurrence of revenue from those customers. Our product revenue is such that customers may make a large purchase once and may not ever make a purchase again. Our equipment is built to last 30 or more years. Therefore, on the one hand, our product revenue model is not dependent on recurring sales transactions from the same customer. Our service revenue, on the other hand, does lend itself to recurring revenue from particular customers, although we currently do not have any service revenue customers who make up more than 10% of our total revenues on an annual basis.
For the last two fiscal years, more than half of our revenue was generated from long-term maintenance and energy production contracts, which provide us with a predictable revenue stream, especially during the summer months. We have a slight surge of activity from May through September as our “chiller season” is in full swing. Our service revenue has grown from year to year since 2005, with our New York City/New Jersey, New England and to some extent California territories experiencing the majority of the growth. This growth is consistent with the sale of new units into

those territories. Our service margins are generally predictable as we service hundreds of long-term contracts with relatively low dollar, high volume sales.

Our product revenue is derived from the sale of the various cogeneration modules, such as the InVerde, InVerde e+, the CM-75, the CM-60, Ilios heat pumps, and the three TECOCHILL chiller models, such as the smaller ST, the larger DT and the RT (roof-top) units. 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. Furthermore, since our products and their installation are costly, they are considered a major capital improvement and customers may be slow in making their buying decisions. Our product sales are high dollar value, low volume transactions. Therefore, our product revenue can be difficult to predict and the expected margin is variable.

Our cogeneration, heat pump, and chiller modules are built to order and revenue is recognized upon shipment. The lead time to build and deliver a unit depends on its customized configuration and is approximately 12 to 14 weeks for a chiller and 6 to 8 weeks for a cogeneration or heat pump from time of purchase order. As revenue is recognized upon shipment, our work-in-process is an important factor in understanding our financial condition in any given quarter.

The Company's operations are comprised of two business segments. Our Products and Services segment designs, manufactures and sells industrial and commercial cogeneration systems as described above. Our Energy Production segment sells energy in the form of electricity, heat, hot water and cooling to our customers under long-term sales agreements.

Recent Developments

On May 18, 2017, holders of approximately 71% of ADGE’s outstanding common stock approved the Merger and approximately 55% of the outstanding stock of Tecogen approved the issuance of Tecogen shares in the Merger. Consequently, on that day Tecogen completed its acquisition, by means of a stock-for-stock merger, of 100% of the outstanding common shares of ADGE. As a result, ADGE became a wholly-owned subsidiary of Tecogen. See Note 4."Acquisition of American DG Energy Inc." of the Notes to Consolidated Financial Statements for further information and Item 3. Legal Proceedings for information regarding the dismissal of all remaining claims in the litigation related to the Merger.

On October 28, 2017, all the shareholders of the joint venture company organized by the Company and a group of European strategic investors, Ultra Emissions Technologies, Ltd. (“Ultratek”), including the Company, unanimously voted to terminate the joint venture. Ultratek was organized to develop and commercialize Tecogen’s patented technology, Ultera®, for the automotive market. Upon termination of the joint venture, Ultratek was dissolved and the exclusive license for the use of Ultera that was granted to Ultratek automatically reverted back to the Company. The Company received its full $2,000,000 investment in Ultratek upon the completion of the liquidation process. Upon dissolution, the Company purchased all of the remaining assets of Ultratek, including new intellectual property that Ultratek developed and other assets, for a total purchase price of $400,000.

On December 14, 2017, Tecogen through principal payment of $3,150,000 to Michaelson Capital Special Finance Fund LP ("Michaelson") discharged the Senior Convertible Promissory Note (the "Note") with Michaelson. Through the Note, Michaelson was the Company's principal debt holder and a beneficial holder of approximately 5% of Tecogen's outstanding shares. There were no pre-payment penalties paid by the Company, as Michaelson provided a waiver of the pre-payment penalties that were contained in the Note. By completing the payment, we satisfied all our obligations under the Note and the Note was cancelled.

In May 2016, Tecogen entered into a joint venture agreement, (the "JV Agreement") with Tedom a.s., a European combined heat and power product manufacturer incorporated in the Czech Republic ("Tedom") and Tedom’s subsidiary, Tedom USA, Inc., a Delaware corporation. Pursuant to the JV Agreement, the parties formed TTcogen LLC, a Delaware limited liability company (“TTcogen”). On March 27, 2018, the Company acquired Tedom's 50% interest in TTcogen LLC, and the Company will continue to market, sell, and service the Tedom 35kW CHP equipment on an exclusive basis in certain territories.

On May 4, 2018, the Company and its wholly-owned subsidiaries, American DG Energy Inc., and TTcogen LLC (collectively, the "Borrowers") entered into a Credit Agreement with Webster Business Credit Corporation (the "Lender") that provides Borrowers a line of credit of up to $10 million on a revolving and secured basis, with availability based on Borrowers' accounts receivable, raw materials, and finished goods, during the period until May 4, 2021. The line of credit was used to repay the amounts due to Mr. John Hatsopoulos under a promissory note assumed by the Company in connection with the merger of American DG Energy Inc. into a subsidiary of the Company, and for working capital for the Company.

On December 14, 2018, the Company entered into Amendment No. 1 to, and Waiver No. 1 under, Credit Agreement dated May 4, 2018 (the "Credit Agreement") among the Company, American DG Energy Inc., and TTcogen LLC (collectively, the "Borrowers") and Webster Business Credit Corporation ("Lender") (the "Amendment and Waiver") pursuant to which Lender waived restrictions in the Credit Agreement to (1) permit American DG Energy Inc. to form a wholly owned company to which it contributed its interests in two energy purchase agreements and associated assets, and enter into an agreement pursuant to which all equity interests in such company were sold to an unrelated third party for $2 million, and (2) permit the Company to enter into a Billing and Asset Management Agreement and an Operation and Maintenance Service Agreement pursuant to which the Company will be responsible for the management and operation of the on-site utilities transferred with the energy purchase agreements, guarantee the collection of certain minimum collections from such on-site utilities, and receive one-half of all collection in excess of agreed minimum collections. Proceeds from the sale described above were deposited to American DG Energy Inc.'s account with Lender and applied against the outstanding balance under the Credit Agreement. The Amendment and Waiver also reduced the availability reserve requirement under the Credit Agreement and waived a default relating to a requirement that Borrowers maintain certain Minimum Availability (as defined in the Credit Agreement) at all times through the date of the Amendment and Waiver. The Company and American DG Energy completed the transactions described above on December 14, 2018, providing funds a substantial portion of which will be used to complete certain construction of on-site utilities managed and operated by the Company, and increasing the amount available to Borrowers under the Credit Agreement.

See Note 18. "Subsequent events" of the Notes to the Consolidated Financial Statements for information regarding the sale for $5 million of six energy purchase contracts and related energy generation systems to the same purchaser that acquired the energy purchase contracts in the transactions on December 14, 2018 described above.

Critical Accounting Policies

Our discussion and analysis of our financial condition and results of operations are based upon our consolidated financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States. The preparation of these financial statements requires us to make judgments, assumptions and estimates that affect the reported amounts of assets, liabilities, sales and expenses, and related disclosure of contingent assets and liabilities. These judgments, assumptions and estimates are made or applied within the context of accounting policies related to the nature of the transaction. Note 2. "Summary of Significant Accounting Policies" of the Notes to Consolidated Financial Statements describes the significant accounting policies used in the preparation of the consolidated financial statements.

Certain aspects of certain accounting policies require management to make difficult, subjective or complex judgments that could have a material effect on the Company’s financial condition and results of operations. These aspects of these accounting policies are considered critical accounting policies. These policies may require management to make assumptions about matters that are highly uncertain at the time of the estimate, or employ an estimate where alternative estimates could have also been employed, and may involve estimates that are reasonably likely to change with the passage of time. Estimates and assumptions about future events and their effects cannot be determined with certainty. The Company bases its estimates on historical experience and on various other assumptions believed to be applicable and reasonable under the circumstances. These estimates may change as new events occur, as additional information is obtained and as the Company’s operating environment changes. These changes have historically been minor and have been included in the consolidated financial statements as soon as they became known. In addition, management is periodically faced with uncertainties, the outcomes of which are not within its control and will not be known for prolonged periods of time. These uncertainties are discussed in Item 1A, “Risk Factors" above.

Management believes that the following are critical accounting policies:

Revenue Recognition

Revenue is recognized when performance obligations under the terms of a contract with our customer are satisfied; generally this occurs with the transfer of control of our products, services and energy production. Revenue is measured as the amount of consideration we expect to receive in exchange for transferring goods or providing services or energy to customers.

Determination of contract consideration allocable to multiple performance obligations within a single contract requires employing stand-alone selling prices which may be based on observable selling prices, estimated selling prices or as a residual. We use an observable selling price to determine standalone selling prices where available and either a combination of an adjusted market assessment approach, an expected cost plus a margin approach, and/or a residual approach to determine the standalone selling prices for separate performance obligations as a basis for allocating contract consideration when an observable selling price is not available.

Under complete turnkey installation service contracts our performance obligation under such contracts is satisfied progressively over time as enhancements are made to customer owned and controlled properties. We measure progress towards satisfaction of the performance obligation based on an input method based on cost and revenue is recognized over time using the percentage-of-completion method determined on a cost to cost basis. This method requires management to estimate future cost to complete based on conditions and information available at the time the estimate is made. Events or changes in circumstances can cause these estimates to be revised which may result in significant adjustments to revenue amounts previously recognized.

Accounts Receivable

Accounts receivable are stated at the amount management expects to collect from outstanding balances. An allowance for doubtful accounts is provided for those accounts receivable considered to be uncollectible based upon historical experience and management’s evaluation of outstanding accounts receivable at the end of the year.

Inventory

Raw materials, work in process, and finished goods inventories are stated at the lower of cost, as determined by the average cost method, or market. The Company periodically reviews inventory quantities on hand for excess and/or obsolete inventory based primarily on historical usage, as well as based on estimated forecast of product demand. Any reserves that result from this review are charged to cost of sales.

ADGE's Property and Equipment and Depreciation

Upon acquisition, property and equipment employed in energy production are recorded at fair value using a cost approach whereby replacement cost new ("RCN") is utilized as the starting point, with factors for inflation, physical obsolescence, functional obsolescence and economic obsolescence being considered and applied as required to arrive at an estimated fair value.

Depreciation is computed using the straight-line method at rates sufficient to write off the cost of the applicable assets over their estimated useful lives. Repairs and maintenance are expensed as incurred.

The Company reviews its energy systems for potential impairment whenever events or changes in business circumstances indicate that the carrying value of the assets may not be fully recoverable or that the useful lives of the assets are no longer appropriate. The Company evaluates the recoverability of its long-lived assets when impairment is indicated by comparing the net book value of the asset group to the estimated future undiscounted cash flows attributable to such assets. The useful life of the Company's energy systems is the lesser of the economic life of the asset or the term of the underlying contract with the customer, typically 12 to 15 years. If impairment is indicated, the asset is written down to its estimated fair value.

Contract Assets and Liabilities

The favorable contract asset and unfavorable contract liability included in the intangible assets and liabilities of the consolidated balance sheets represent the fair value of customer energy production contracts (both positive for favorable contracts and negative for unfavorable contracts) which were acquired by the Company.

The determination of fair value required development of an estimate of the price at which an orderly transaction to sell the asset or to transfer the liability would take place between market participants at the measurement date under current market conditions. Contracts are considered to be assets or liabilities by virtue of the rights and obligations inherent in the contract terms. Typically, contracts with terms considered to be at market are considered to have no fair value as, in order to be entitled to the rights under the contract, performance must occur for which a market rate of return is earned due to the at market terms. The fair value of a contract is primarily a measurement of its off market terms. The obligation to perform under a contract with terms that are unfavorable to market results in a liability to the extent its terms are off market. The resulting liability is an estimate of the price that would need to be paid to a willing market participant to assume the obligations under the contract in order for them to receive a market rate of return for their remaining performance obligation under the contract. The exact opposite holds true in instances where the terms of a contract are considered to be favorable to market. In that case an asset would exist as an estimate of the price that would be received from a willing market participant in order to be entitled to the rights under the contract.

In determining the estimate of fair value of customer energy production contracts, the measure of market, and thus the baseline to measure the amount related to any of the off market terms or conditions with respect to the contracts, was considered best determined, given the nature of the services provided under the contracts, by utilizing a benchmark level of margin, in this case 35% of revenue which is consistent with the average return on revenue of US investor owned public utilities.

Goodwill

Goodwill is not amortized, however it is reviewed for impairment annually in the fourth quarter and/or when circumstances or other events indicate that impairment may have occurred. ASC 350 “Intangibles—Goodwill and Other” (ASC 350) permits entities to make a qualitative assessment of whether it is more likely than not that a reporting unit’s fair value is less than its carrying amount before applying the two-step goodwill impairment test. Circumstances that are considered as part of the qualitative assessment and could trigger the two-step impairment test include, but are not limited to: a significant adverse change in the business climate; a significant adverse legal judgment; adverse cash flow trends; an adverse action or assessment by a government agency; unanticipated competition; decline in our stock price; and a significant restructuring charge within a reporting unit. We define reporting units at the business segment level. For purposes of testing goodwill for impairment, goodwill has been allocated to our reporting units to the extent it relates to each reporting unit. Based upon our qualitative assessment in 2017, it was more likely than not that the fair value of our reporting units were greater than their carrying amounts as of December 31, 2017. No impairment charges were recorded for 2017.

During 2018, the Company early-adopted the provisions of ASU 2017-04 which simplified goodwill impairment testing by eliminating the requirement to determine the implied value of goodwill where a quantitative analysis indicates that the carrying value of the reporting unit exceeds its fair value.

It is our practice, at a minimum, to perform a quantitative goodwill impairment test in the fourth quarter of the year following an acquisition involving a significant amount of goodwill. In the fourth quarter of 2018, we performed a quantitative goodwill impairment test for our energy production reporting unit acquired in 2017. We used a discounted cash flow approach to develop the estimated fair value of that reporting unit. Management judgment is required in developing the assumptions for the discounted cash flow model. An impairment would be recorded if the carrying amount of a reporting unit including goodwill exceeded the estimated fair value. Based on the aforementioned analysis, the carrying amount of that reporting unit, including goodwill, exceeded the estimated fair value.

The Company recorded an impairment loss of $4,390,590 for 2018 based on the analysis. The impairment recognizes the shortening of remaining contract terms with customers without replacement and without further growth, as well as less than expected cost savings and increased profitability from the Company's initiative to optimize the long-term profitability of its various site operations, and a price peak of the Company's stock on the date of the business combination to which the goodwill relates (see also Note 18. "Subsequent events").

The discount rate, profitability assumptions and terminal growth rate of this reporting unit were the material assumptions utilized in the discounted cash flow model used to estimate its fair value. The discount rate reflects an estimate of weighted-average cost of capital of American DG Energy.

The discounted cash flow analysis requires estimates, assumptions and judgments about future events. Our analysis uses our internally generated long-range plan. The long-range plan reflects management judgment and assumptions about future events.

We believe the assumptions used in our goodwill impairment analysis are appropriate and result in a reasonable estimate of the fair value of the reporting unit. However, given the economic environment and the uncertainties regarding the impact on our business, there can be no assurance that our estimates and assumptions, made for purposes of our goodwill impairment testing, will prove to be an accurate prediction of the future. If our assumptions regarding future performance are not achieved, we may be required to record additional goodwill impairment charges in future periods.

Recent Accounting Pronouncements

In February 2016, the FASB issued an accounting standard update related to leases requiring lessees to recognize operating and financing lease liabilities on the balance sheet, as well as corresponding right-of-use assets. The new lease standard also makes some changes to lessor accounting and aligns key aspects of the lessor accounting model with the revenue recognition standard. In addition, disclosures will be required to enable users of financial statements to assess the amount, timing, and uncertainty of cash flows arising from leases. The accounting standard update will be effective for the Company beginning in the first quarter of fiscal 2019 on a modified retrospective basis. The Company believes the adoption of this accounting standard update will result in recognition of lease liabilities and right of use assets related to operating leases of approximately $2.6 million without any cumulative impact on equity upon adoption.

TECOGEN INC.
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Results of Operations

The following table sets forth for the periods indicated, the percentages of the net sales represented by certain items reflected in the Company's statements of operations.

	Years ended December 31,	
	2018	2017
Revenues	100.0 %	100.0 %
Cost of Sales	62.1	61.0
Gross Profit	37.9	39.0
General and administrative	30.1	28.7
Selling	7.4	6.8
Research and development	3.6	2.8
Income (loss) from operations	(15.4)	0.7
Total other expense, net	(0.6)	(0.4)
Consolidated net income (loss)	(16.2)	0.3
(Income) loss attributable to the noncontrolling interest	0.3	(0.2)
Net income (loss) attributable to Tecogen Inc.	(15.9)%	0.1 %
Comprehensive loss		(0.4)%

Year Ended December 31, 2018 Compared to Year Ended December 31, 2017

Revenues

Revenues in 2018 were $35,883,684 compared to $33,202,666 in 2017, an increase of $2,681,018 or 8.1%. This increase is the result of the increased sales in both services and energy production. Product revenues in 2018 were $12,624,867 compared to $12,991,283 in 2017, a decrease of $366,416 or 2.8%. This decrease from the year ended December 31, 2017 to 2018 resulted from a decrease in cogeneration sales of $2,718,455 offset by an increase in chiller sales of $2,352,039. The focus on chiller sales efforts in 2018 yielded this increase in sales. Our product mix, as well as product revenue, can vary significantly from period to period as our products are high dollar, low volume sales in which revenue is recognized upon shipment.

Revenues derived from our service centers, including installation activities, in 2018 were $16,859,291 compared to $16,377,443 for the same period in 2017, an increase of $481,848 or 2.9%. Our service operation grows with the sales of installed systems, since the majority of our product sales are accompanied by a service contract or time and materials agreements. As a result our “fleet” of units being serviced by our service department grows with product sales. Our service department revenue has increased due to turnkey projects of $8,097,473 in 2018 compared to $7,680,125 in 2017.

Energy production revenues for the year ending December 31, 2018 were $6,399,526 compared to $3,833,940 for 2017, which represents energy revenues earned through ADGE from May 19, 2017, the day after the acquisition.

Cost of Sales

Cost of sales in 2018 was $22,291,822 compared to $20,248,262 in 2017, an increase of $2,043,560 or 10.1%. Our overall gross margin was 37.9% in 2018 compared to 39.0% in 2017, a decrease of 1.1%. The decrease in gross margin is attributable to a leveling off of our improved margins on product sales realized over the past two years due to production efficiencies in material, labor and factory utilization as well as the addition of the energy production segment. The factory continues to improve product service cycles, ease of maintenance, and component sourcing in order to continuously improve efficiencies in our processes.

Cost of sales for energy production for the year ending December 31, 2018 was $3,801,154 compared to $2,034,518 in 2017, which represents the cost associated with energy revenues earned from May 19, 2017, the day after the acquisition of ADGE. Included in Energy production cost of sales is depreciation expense associated with the energy producing sites, net of amortization of unfavorable contract liability of $398,079.

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Operating Expenses

Operating expenses increased in 2018 to $19,130,171 compared to $12,729,252 in 2017, an increase of $6,400,919 or 50.3%. This increase was mainly due to the goodwill impairment charge of $4,390,590, relating to the ADGE sites as discussed in Note 8. "Goodwill" in the accompanying consolidated financial statements. In addition to this impairment, a combination of an increase in general and administrative expense of $1,270,344, an increase of $379,302 in selling expense and an increase in research and development expense of $360,683 also contributed to the increase. General and administrative increase was mainly due to the acquisition of ADGE and the additional costs associated with this business and its acquisition. Selling expenses increased in 2018 to $2,651,128 compared to $2,271,826 in 2017, an increase of $379,302 or 16.7%. This increase in selling expenses was due to an increase in commissions and marketing expenses. Research and development expenses increased in 2018 to $1,297,612 compared to $936,929 in 2017, an increase of $360,683 or 38.5%. The increase in research and development expenses was due to development of our fork truck emissions program, bringing the vehicle emissions program in-house and other product developments. There has not been a change in focus with regards to research and development activities.

Income (Loss) from Operations

Loss from operations for the year ended December 31, 2018 was $5,538,309 compared to income of $225,152 in 2017, an increase of $5,763,461. The change in the net loss from operations was mostly due to the goodwill impairment of $4,390,590 recognized in 2018 as discussed in Note 8."Goodwill" in the accompanying consolidated financial statements together with the additional costs associated with our continuing investment in our fork truck emission program.

Other Income (Expense), net

Other expense, net, for the year ended December 31, 2018 was $230,069 compared to $127,456 for the same period in 2017. Other income (expense) includes interest and other income of $8,030, net of interest expense on debt of $120,015 in 2018. For the same period in 2017, interest and other income was $27,626 and interest expense was $155,082. For the year ended December 31, 2018, other expense, net also includes the unrealized loss on securities of $118,084, which was classified as "Other comprehensive loss" for the year ended December 31, 2017, as discussed below.

Noncontrolling Interest

With the addition of ADGE, the Company has income and losses attributable to the noncontrolling interest it has in ADGE's 51% owned subsidiary, ADGNY. The noncontrolling interest share of ADGNY profits and losses was a $92,594 loss for the year ended December 31, 2018 and income of $50,260 for the period ended December 31, 2017.

Net Income (Loss) Attributable to Tecogen, Inc

Net loss for the year ended December 31, 2018 was $5,708,532 compared to income of $47,436 for the same period in 2017. The decrease in income of $5,755,968 was mostly the result of our goodwill impairment as discussed above.

Other Comprehensive Loss

The unrealized loss on securities of $165,317 for the period ended December 31, 2017 represents the market fluctuation impacting the fair value of ADGE's remaining common stock ownership in its former partially owed subsidiary, EuroSite Power Inc.

Net Loss Per Share

Net loss per share for the year ended December 31, 2018 was $0.23 compared to a $0.00 for the same period in 2017. The loss per share of $0.23 was due to the increase in operating expenses, mainly goodwill impairment, as discussed above. The basic and diluted weighted average shares outstanding for the year ended December 31, 2018 was 24,815,926 compared to 23,171,033 for the same period in 2017.

Liquidity and Capital Resources

Consolidated working capital at December 31, 2018 was $13,170,252, compared to $12,952,537 at December 31, 2017, an increase of $217,715 or 1.7%. Included in working capital were cash and cash equivalents of $272,552 at December 31, 2018, compared to $1,673,072 at December 31, 2017. This increase in consolidated working capital and decrease in cash and cash equivalents is primarily due to the pay off of the loan due to a related party of $850,000 offset by the establishment of a revolving line of credit with Webster Business Credit as discussed in Note 9.

"Revolving line of credit, Convertible debentures and loan due to related party" in the accompanying consolidated financial statements.
Net cash used in operating activities for the years ended December 31, 2018 and 2017 were $3,857,332 and $591,256, respectively, an increase of $3,266,076. Our accounts receivable increased by $4,467,939 at December 31, 2018 compared to December 31, 2017, due to timing of billing, shipments, and collections. Unbilled revenues also increased by $697,586 in connection with turnkey projects as some revenues are recognized prior to contractual milestones for invoicing. Our inventory increased by $1,165,057 as of December 31, 2018 compared to December 31, 2017. Due from related party decreased by $576,087,

prepaid expenses and other current assets decreased by $49,484 and other non-current assets decreased by $113,284 as of December 31, 2018 as compared to December 31, 2017.

Accounts payable increased by $1,173,979 from December 31, 2017 to December 31, 2018. The increase in accounts payable is related to increased manufacturing activities. Accrued expenses from operations increased by $111,038 as of December 31, 2018 compared to December 31, 2017. Deferred revenues from operations increased by $1,006,893 as of December 31, 2018 as compared to December 31, 2017.

During 2018 our cash flows used in investing activities were $1,281,061, and included purchases of property and equipment of $828,086, expenditures related to intangible assets such as patents and product certifications of $226,847, distributions to non-controlling interest holders of ADGNY of $107,901 and offset by cash acquired in the acquisition of ADGE of $442,746.

During 2018 our cash flows provided by financing activities were $1,175,751 which included proceeds from the revolving line of credit of $21,533,143 together with payments on the credit line of $19,435,306. This increase in funds was offset by the payoff of our related party loan of $850,000, payment of debt issuance costs of $145,011 associated with our revolving line of credit and proceeds from the exercise of stock options of $72,925.

Tecogen's total product and installation backlog as of December 31, 2018 was $16.6 million compared to $15.7 million as of December 31, 2017. Backlog does not include maintenance contract service revenues or energy contract revenues.

At December 31, 2018, our commitments included various leases for office and warehouse facilities of $3,177,367 to be paid over several years through 2024. The source of funds to fulfill these commitments are expected to be provided by operations.

Subsequent to year end, the Company transferred ownership of certain of its energy systems related assets and related energy production contracts in a sale transaction. See Note 18. "Subsequent events" in the Notes to Consolidated Financial Statements for discussion regarding this transaction.

Based on our current operating plan, we believe existing resources, including cash and cash flows from operations, together with our revolving line of credit, will be sufficient to meet our working capital requirements for the next twelve months. As we continue to grow our business, we expect that our cash requirements will increase. As a result, we may need to raise additional capital through a debt financing or an equity offering to meet our operating and capital needs for future growth.

Seasonality

We expect that the majority of our heating systems sales will be operational for the winter and the majority of our chilling systems sales will be operational for the summer. Our cogeneration sales are not generally affected by the seasons. Our service team does experience higher demand in the warmer months when cooling is required. These chiller units are generally shut down in the winter and started up again in the spring. This chiller "busy season" for the service team generally runs from May through the end of September.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk.

Not applicable.

Item 8. Financial Statements and Supplementary Data.

The information required by this item is incorporated from Item 15 and pages F-1 through F-30 of this Annual Report on Form 10-K.

Item 9. Changes in and Disagreements with Accountants on Accounting and Financial Disclosure.

None.

Item 9A. Controls and Procedures.

Management's Evaluation of Disclosure Controls and Procedures:

Our disclosure controls and procedures are designed to provide reasonable assurance that the control system's objectives will be met. Our management, including our Chief Executive Officer and Chief Accounting Officer, after evaluating the effectiveness of our disclosure controls and procedures as of December 31, 2018, (the "Evaluation Date"), have concluded that as of the Evaluation Date, our disclosure controls and procedures were not effective due to the material weakness in financial reporting relating to a small number of employees dealing with general controls over information technology. At the present time, our management has decided that the expense associated with a new system is justified and is in the process of implementing a system which will put the proper control procedures in place to remediate this weakness.

For these purposes, the term disclosure controls and procedures of an issuer means controls and other procedures of an issuer that are designed to ensure that information required to be disclosed by the issuer in the reports that it files or submits under Section 13(a) or 15(d) of the Exchange Act is recorded, processed, summarized and reported, within the time periods specified in the SEC's rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by an issuer in the reports that it files or submits under Section 13(a) or 15(d) of the Exchange Act is accumulated and communicated to the issuer's management, including its principal executive and principal accounting officers, or persons performing similar functions, as appropriate to allow timely decisions regarding required disclosure.

Management's Annual Report on Internal Control over Financial Reporting:

The management of the Company is responsible for establishing and maintaining adequate internal control over financial reporting as defined in Rules 13a-15(f) under the Securities Exchange Act of 1934, as amended.

The Company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles in the United States of America. The Company's internal controls over financial reporting include those policies and procedures that:

- pertain to the maintenance of records that in reasonable detail accurately and fairly reflect the transactions and dispositions of the assets of the Company;
- provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with U.S. generally accepted accounting principles;
- provide reasonable assurance that receipts and expenditures of the Company are being made only in accordance with authorizations of management and directors of the Company; and
- provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the Company's assets that could have a material effect on the consolidated financial statements.

Because of its inherent limitations, internal control over financial reporting, no matter how well designed, may not prevent or detect misstatements. Accordingly, even effective internal control over financial reporting can provide only reasonable assurance with respect to financial statement preparation. Also, the assessment of the effectiveness of internal control over financial reporting was made as of a specific date. Projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Management, including our Chief Executive Officer and Chief Accounting Officer, conducted an evaluation of our internal control over financial reporting based on the framework and criteria established in Internal Control—Integrated Framework (2013), issued by the Committee of Sponsoring Organizations of the Treadway Commission. This evaluation included review of the documentation of controls, evaluation of the design effectiveness of controls, testing of the operating effectiveness of controls and a conclusion regarding this evaluation. Based on this evaluation, management concluded that the Company's internal control over financial reporting was not effective as of December 31, 2018.

At December 31, 2018, the Company employed 92 active full-time employees and 5 part-time employees. Considerable progress has been made during 2018 with the addition of competent staff, competent consultants and changes in processes, however, due to the small number of employees dealing with general controls over information technology security and user access, management believes this constitutes a material weakness in financial reporting. At this time, management has decided that the expense associated with a new system is justified and is in the process of implementing a system which will put the proper control procedures in place to remediate these weaknesses.

Our management, including our Chief Executive Officer and Chief Accounting Officer, does not expect that our disclosure controls or our internal control over financial reporting will prevent or detect all errors and all fraud. A control system, no matter how well designed and operated, can provide only reasonable, not absolute, assurance that the control system’s objectives will be met. The design of a control system must reflect the fact that there are resource constraints, and the benefits of controls must be considered relative to their costs. Further, because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that misstatements due to error or fraud will not occur or that all control issues and instances of fraud, if any, within the Company have been detected. These inherent limitations include the realities that judgments in decision-making can be faulty and that breakdowns can occur because of a simple error or mistake. Controls can also be circumvented by the individual acts of some persons, by collusion of two or more people, or by management override of the controls. The design of any system of controls is based in part on certain assumptions about the likelihood of future events, and there can be no assurance that any design will succeed in achieving its stated goals under all potential future conditions. Projections of any evaluation of controls effectiveness to future periods are subject to risks. Over time, controls may become inadequate because of changes in conditions or deterioration in the degree of compliance with policies or procedures.

This annual report does not include an attestation report of the Company’s registered independent public accounting firm regarding internal control over financial reporting. Management’s report was not subject to attestation by the Company’s registered independent public accounting firm pursuant to rules of the Securities and Exchange Commission that permit the Company to provide only management’s report in this Annual Report on Form 10-K.

Changes in Internal Control Over Financial Reporting

The Company is in the process of implementing a company-wide ERP system which will put the proper control procedures in place to remediate internal control weaknesses. As of December 31, 2018, this implementation was in process. There has been no change to the Company’s internal control over financial reporting (as such term is defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act) during the fourth quarter of the fiscal year ended December 31, 2018, that has materially affected, or is reasonably likely to materially affect, the Company’s internal control over financial reporting.

Item 9B. Other Information.

None.

PART III

Item 10. Directors, Executive Officers and Corporate Governance.

The information required by this item is incorporated herein by reference from the Company's definitive proxy statement, which will be filed with the SEC no later than 120 days after December 31, 2018.

Item 11. Executive Compensation.

The information required by this item is incorporated herein by reference from the Company's definitive proxy statement, which will be filed with the SEC no later than 120 days after December 31, 2018.

Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.

The information required by this item is incorporated herein by reference from the Company's definitive proxy statement, which will be filed with the SEC no later than 120 days after December 31, 2018.

Item 13. Certain Relationships and Related Transactions, and Director Independence.

The information required by this item is incorporated herein by reference from the Company's definitive proxy statement, which will be filed with the SEC no later than 120 days after December 31, 2018.

Item 14. Principal Accounting Fees and Services.

The information required by this item is incorporated herein by reference from the Company's definitive proxy statement, which will be filed with the SEC no later than 120 days after December 31, 2018.

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PART IV

Item 15. Exhibits and Financial Statement Schedules.

The following consolidated financial statements and the related notes thereto of Tecogen Inc. and the report of the Accounting Firm thereon are filed as part of this Annual Report on Form 10-K.

(a) Index to Financial Statements and Financial Statement Schedules

Report of Independent Registered Public Accounting Firm
Consolidated Balance Sheets as of December 31, 2018 and 2017
Consolidated Statements of Operations and Comprehensive Loss for the years ended December 31, 2018 and 2017
Consolidated Statements of Stockholders' Equity for the years ended December 31, 2018 and 2017
Consolidated Statements of Cash Flows for the years ended December 31, 2018 and 2017
Notes to Consolidated Financial Statements

All other schedules for which provision is made in the applicable accounting regulations of the SEC are not required under the related instructions, or are inapplicable, and therefore have been omitted.

(b) Exhibits

The exhibits to the Registration Statement are listed in the Exhibit Index attached hereto and incorporated by reference herein.

Item 16. Form 10-K Summary.

The Company has determined not to include a summary of the information permitted by this Item 16 of the Form 10-K.

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EXHIBIT INDEX

Exhibit Number	Description
2.1	Agreement and Plan of Merger, dated as of November 1, 2016, by and among Tecogen Inc, American DG Energy Inc. and ADGE.Tecogen Merger Sub Inc. (Incorporated by reference to exhibit 2.1 to the registrant's Current Report on Form 8-K, as filed with the SEC on November 2, 2016).
2.2	Amendment 1 to the Agreement and Plan of Merger, dated as of March 23, 2017, by and among Tecogen Inc., American DG Energy Inc., and ADGE.Tecogen Merger Sub Inc. (Incorporated by reference to exhibit 2.2 to the registrant's Current Report on Form 8-K, as filed with the SEC on March 24, 2017).
3.1	Amended and Restated Certificate of Incorporation (Incorporated by reference to exhibit 3.1 to the

	registrant's Registration Statement on Form S-1, as amended (Registration No. 333-193791), filed with the SEC on June 27, 2014).
3.2	Amended and Restated Bylaws (Incorporated by reference to exhibit 3.2 to the registrant's Registration Statement on Form S-1, as amended (Registration No. 333-193791), filed with the SEC on June 27, 2014).
4.1	Specimen Common Stock Certificate of Tecogen Inc. (Incorporated by reference to exhibit 4. to the registrant's Registration Statement on Form S-1, as amended (Registration No. 333-193791), filed with the SEC on June 27, 2014).
4.3+	Form of Stock Option Agreement (Incorporated by reference to exhibit 4.3 to the registrant's Registration Statement on Form S-1, as amended (Registration No. 333-193791), filed

	with the SEC on June 27, 2014).
10.1+	Tecogen Inc. 2006 Stock Incentive Plan, as amended and restated on November 1, 2016 with stockholder approval on June 29, 2017 (Incorporated by reference to exhibit 10.1 to the registrant's Annual Report on Form 10-K, as filed with the SEC on March 21, 2018).
10.7	Lease Agreement between Atlantic-Waltham Investment II, LLC, and Tecogen Inc., dated May 14, 2008 (Incorporated by reference to exhibit 10.7 to the registrant's Registration Statement on Form S-1, as amended (Registration No. 333-193791), filed with the SEC on June 27, 2014).
10.8	Second Amendment to Lease Agreement between Atlantic-Waltham Investment II, LLC, and Tecogen Inc., dated January 16, 2013 (Incorporated by reference to exhibit 10.2 to the registrant's Quarterly Report

	on Form 10-Q, as filed with the SEC on May 15, 2014).
10.13#	Exclusive License Agreement between Tecogen Inc. and the Wisconsin Alumni Research Foundation, dated February 5, 2007 (Incorporated by reference to exhibit 10.13 to the registrant's Registration Statement on form S-1, as amended (Registration No. 333-193791), filed with the SEC on June 27, 2014).
10.24	Facilities and Support Services Agreement between American DG Energy Inc. and Tecogen Inc., dated August 8, 2014. (Incorporated by reference to exhibit 10.1 to American DG Energy Inc.'s Quarterly Report on Form 10-Q (No. 001-34493) filed with the SEC on August 14, 2014).
10.29	Shelf Registration Rights Agreement dated August 3, 2015 (Incorporated by reference to Exhibit 10.29 to the registrant's Current Report on Form 8-K, as filed

	with the SEC on August 8, 2015).
10.30	First Amendment to the Facilities and Support Services Agreement between American DG Energy Inc. and Tecogen Inc., dated August 7, 2015 (Incorporated by reference to exhibit 10.1 to American DG Energy Inc.'s Current Report on Form 8-K (No. 001-34493), as filed with the SEC on August 13, 2015).
10.38	TTcogen LLC Operating Agreement dated as of May 19, 2016 (Incorporated by reference to exhibit 10.38 to the registrant's Current Report on Form 8-K, as filed with the SEC on May 24, 2016).
10.41	Promissory Note-Line of Credit issued on December 22, 2016 by American DG Energy Inc. to John Hatsopoulos (Incorporated by reference to American DG Energy Inc.'s Current Report on Form 8-K (No. 001-34493), as filed with the SEC

	on December 28, 2016).
10.42+	Advisory Agreement, dated January 3, 2018, between Tecogen Inc. and John N. Hatsopoulos (Incorporated by reference to exhibit 10.1 to the registrant's Current Report on Form 8-K, as filed with the SEC on January 8, 2018).
10.43	Research and Development Contract between Southwest Research Institute and Tecogen Inc. (Incorporated by reference to exhibit 10.1 to the registrant's Current Report on Form 8-K, as filed with the SEC on January 9, 2018).
10.44	Membership Interest and Wind-Down Agreement between Tedom USA Inc., Tedom a.s., TTcogen LLC and Tecogen Inc. dated as of March 27, 2018 (Incorporated by reference to exhibit 10.1 to the registrant's Current Report on Form 8-K, as filed with the SEC on March 30, 2018).
10.45	Credit Agreement with Webster Business Credit

	Corporation, as of May 4, 2018 (Incorporated by reference to exhibit 10.45 to the registrant's Quarterly Report on Form 10-Q as filed with the SEC on August 14, 2018).
10.46	Amendment No. 1 to, and Waiver No. 1 to, Credit Agreement dated May 4, 2018 (Incorporated by reference to exhibit 99.01 to the registrant's Current Report on Form 8-K, as filed with the SEC on December 17, 2018).
10.47*	Waiver No. 2 under Credit Agreement dated May 4, 2018.

10.48	Amendment No. 2 to, and Waiver No. 3 under, Credit Agreement dated as of March 5, 2019 (Incorporated by reference to exhibit 10.47 to the registrant's Current Report on Form 8-K, as filed with the SEC on March 7, 2019).
10.49	Membership Interest Purchase Agreement by and among SDCL TG Cogen LLC, as Purchaser, and American DG Energy Inc., as Seller, and Tecogen Inc. dated as of December 14, 2018 (Incorporated by reference to exhibit 10.48 to the registrant's Current Report on Form 8-K, as filed with the SEC on March 7, 2019).
10.50	Guaranty Agreement by Tecogen Inc. in favor of

	CogenOne LLC and SDCL TG Cogen LLC dated December 14, 2018 (Incorporated by reference to exhibit 10.49 to the registrant's Current Report on Form 8-K, as filed with the SEC on March 7, 2019).
10.51	Membership Interest Purchase Agreement by and among SDCL TG Cogen LLC, as Purchaser, and American DG Energy Inc., as Seller, and Tecogen Inc. dated as of March 5, 2019 (Incorporated by reference to exhibit 10.50 to the registrant's Current Report on Form 8-K, as filed with the SEC on March 7, 2019).
10.52	Guaranty Agreement by Tecogen Inc. in favor of CogenTwo LLC and SDCL TG

	Cogen LLC dated March 5, 2019 (Incorporated by reference to exhibit 10.51 to the registrant's Current Report on Form 8-K, as filed with the SEC on March 7, 2019).
10.53	Billing and Asset Management Agreement by and among CogenOne LLC and Tecogen Inc. as amended and restated as of March 5, 2019 (Incorporated by reference to exhibit 10.52 to the registrant's Current Report on Form 8-K, as filed with the SEC on March 7, 2019).
10.54	Billing and Asset Management Agreement by and among CogenTwo LLC and Tecogen Inc. dated March 5, 2019 (Incorporated by reference to exhibit 10.53 to the

	registrant's Current Report on Form 8-K, as filed with the SEC on March 7, 2019).
21.1*	List of subsidiaries
23.1*	Consent of Wolf & Company, P.C.
31.1*	Rule 13a-14(a) Certification of Chief Executive Officer
31.2*	Rule 13a-14(a) Certification of Chief Accounting Officer
32.1*	Section 1350 Certifications of Chief Executive Officer and Chief Accounting Officer
101.INS*	XBRL Instance Document
101.SCH*	XBRL Taxonomy Extension Schema
101.CAL*	XBRL Taxonomy Extension Calculation Linkbase
101.DEF*	XBRL Taxonomy Extension Definition Linkbase
101.LAB*	

	XBRL Taxonomy Extension Label Linkbase
101.PRE*	XBRL Taxonomy Extension Presentation Linkbase

*	Filed herewith.
#	Confidential Treatment has been granted for portions of this document. The confidential portions were omitted and filed separately, on a confidential basis, with the Securities and Exchange Commission.
+	Management contract or compensatory plan or agreement.

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SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

TECOGEN INC.
(Registrant)

Dated: 3/28/2019 By: /s/ Benjamin M. Locke
Chief Executive Officer
(Principal Executive Officer)

Dated: 3/28/2019 By: /s/ Bonnie J. Brown
Chief Accounting Officer, Treasurer and Secretary
(Principal Accounting Officer)

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below constitutes and appoints Benjamin Locke and Bonnie J. Brown, or either of them, each with the power of substitution and re-substitution, as his or her attorney-in-fact and agents, for him or her and in his or her name, place and stead, in any and all capacities, to sign any and all amendments to this Annual Report on Form 10-K for the year ended December 31, 2018, and to file the same, with all exhibits thereto and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorneys-in-fact and agents, and each of them, full power and authority to do and perform each and every act and thing requisite and necessary to be done in connection therewith, as fully to all intents and purposes as he or she might or could do in person, hereby ratifying and confirming that all said attorneys-in-fact and agents, or any of them or their or his or her substitute or substitutes, may lawfully do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacity and on the dates indicated.

Signature	Title	Date
/s/ Angelina M. Galiteva Angelina M. Galiteva	Director, Chairman of the Board	March 28, 2019
/s/ John N. Hatsopoulos John N. Hatsopoulos	Lead Director	March 28, 2019
/s/ Benjamin M. Locke Benjamin M. Locke	Director and Chief Executive Officer (Principal Executive Officer)	March 28, 2019
/s/ Bonnie J. Brown Bonnie J. Brown	Chief Accounting Officer, Treasurer and Secretary (Principal Accounting Officer)	March 28, 2019
/s/ Charles T. Maxwell Charles T. Maxwell	Director	March 28, 2019
/s/ Ahmed F. Ghoniem Ahmed F. Ghoniem	Director	March 28, 2019

/s/ Keith Davidson Keith Davidson	Director	March 28, 2019
/s/ Deanna Petersen Deanna Petersen	Director	March 28, 2019

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Report of Independent Registered Public Accounting Firm

To the Board of Directors and Stockholders of
Tecogen Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Tecogen Inc. (the “Company”) as of December 31, 2018 and 2017, the related consolidated statements of operations and comprehensive loss, stockholders' equity, and cash flows, for the years then ended and the related notes (collectively referred to as the "financial statements"). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2018 and 2017, and the results of its operations and its cash flows for the years then ended, in conformity with accounting principles generally accepted in the United States of America.

Basis for Opinion

These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company's financial statements based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) ("PCAOB") and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. As part of our audits we are required to obtain an understanding of internal control over financial reporting, but not for the purpose of expressing an opinion on the effectiveness of the Company’s internal control over financial reporting. Accordingly, we express no such opinion. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ WOLF & COMPANY, P.C.
We have served as the Company's auditor since 2014.
Boston, Massachusetts
March 28, 2019

TECOGEN INC.
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CONSOLIDATED BALANCE SHEETS
As of December 31, 2018 and 2017

	2018	2017
ASSETS		
Current assets:		
Cash and cash equivalents	$272,552	$1,673,072
Accounts receivable, net	14,176,452	9,536,673
Unbilled revenue	4,893,259	3,963,133
Inventory, net	6,294,862	5,130,805
Due from related party	9,405	585,492
Prepaid and other current assets	722,042	771,526
Total current assets	26,368,572	21,660,701
Property, plant and equipment, net	11,273,115	12,265,711
Intangible assets, net	2,893,990	2,896,458
Goodwill	8,975,065	13,365,655
Other assets	393,651	482,551
TOTAL ASSETS	$49,904,393	$50,671,076
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Revolving line of credit, bank	$2,009,435	$—
Accounts payable	7,153,330	5,095,285
Accrued expenses	1,528,014	1,416,976
Deferred revenue	2,507,541	1,293,638
Loan due to related party	—	850,000
Interest payable, related party	—	52,265
Total current liabilities	13,198,320	8,708,164
Long-term liabilities:		
Deferred revenue, net of current portion	2,375,700	538,100
Unfavorable contract liability, net	6,292,599	7,729,667
Total liabilities	21,866,619	16,975,931
Commitments and contingencies (Note 10)		
Stockholders' equity:		
Tecogen Inc. stockholders' equity:		
Common stock, $0.001 par value; 100,000,000 shares authorized; 24,824,746 and 24,766,892 issued and outstanding at December 31, 2018 and 2017, respectively	24,825	24,767
Additional paid-in capital	56,427,928	56,176,330
Accumulated other comprehensive loss-investment securities	—	(165,317)
Accumulated deficit	(28,670,095)	(22,796,246)
Total Tecogen Inc. stockholders' equity	27,782,658	33,239,534
Noncontrolling interest	255,116	455,611
Total stockholders' equity	28,037,774	33,695,145
TOTAL LIABILITIES AND STOCKHOLDERS' EQUITY	$49,904,393	$50,671,076

The accompanying notes are an integral part of these consolidated financial statements.

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CONSOLIDATED STATEMENTS OF OPERATIONS AND COMPREHENSIVE LOSS
For the Years Ended December 31, 2018 and 2017

	2018	2017
Revenues		
Products	$12,624,867	$12,991,283
Services	16,859,291	16,377,443
Energy production	6,399,526	3,833,940
Total revenues	35,883,684	33,202,666
Cost of sales		
Products	7,797,591	8,012,012
Services	10,693,077	10,201,732
Energy production	3,801,154	2,034,518
Total cost of sales	22,291,822	20,248,262
Gross profit	13,591,862	12,954,404
Operating expenses		
General and administrative	10,790,841	9,520,497
Selling	2,651,128	2,271,826
Research and development	1,297,612	936,929
Goodwill impairment	4,390,590	—
Total operating expenses	19,130,171	12,729,252
Income (loss) from operations	(5,538,309)	225,152
Other income (expense)		
Interest and other income	8,030	27,626
Interest expense	(120,015)	(155,082)
Unrealized loss on investment securities	(118,084)	—
Total other expense, net	(230,069)	(127,456)
Income (loss) before income taxes	(5,768,378)	97,696
State income tax provision	32,748	—
Consolidated net income (loss)	(5,801,126)	97,696
(Income) loss attributable to the noncontrolling interest	92,594	(50,260)
Net income (loss) attributable to Tecogen Inc.	$(5,708,532)	47,436
Other comprehensive loss-unrealized loss on securities		(165,317)
Comprehensive loss		$(117,881)
Net income (loss) per share - basic	$(0.23)	$0.00
Net income (loss) per share - diluted	$(0.23)	$0.00
Weighted average shares outstanding - basic	24,815,926	23,171,033
Weighted average shares outstanding - diluted	24,815,926	23,342,627

The accompanying notes are an integral part of these consolidated financial statements.

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CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
For the Years Ended December 31, 2018 and 2017

	Tecogen Inc. Stockholders						
	Common Stock Shares	Common Stock $.001 Par Value	Additional Paid-In Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Noncontrolling Interest	Total
Balance at December 31, 2016	19,981,912	$ 19,982	$ 37,334,773	$ —	$ (22,843,682)	$ —	$ 14,511,073
Exercise of stock options	122,043	122	179,796	—	—	—	179,918
Issuance of common stock in connection with ADGE acquisition, net of costs of $377,246	4,662,937	4,663	18,477,993	—	—	—	18,482,656
Consolidation of non-controlling interest in ADGNY	—	—	—	—	—	453,272	453,272
Distributions to non-controlling interest	—	—	—	—	—	(47,921)	(47,921)
Stock-based compensation	—	—	183,768	—	—	—	183,768
Comprehensive income (loss)	—	—	—	(165,317)	47,436	50,260	(67,621)
Balance at December 31, 2017	24,766,892	$ 24,767	$ 56,176,330	$ (165,317)	$ (22,796,246)	$ 455,611	$ 33,695,145
Exercise of stock options	57,854	58	72,867	—	—	—	72,925
Reclassification of Accumulated Other Comprehensive Loss	—	—	—	165,317	(165,317)	—	—
Stock issuance costs	—	—	(2,457)	—	—	—	(2,457)
Distributions to non-controlling interest	—	—	—	—	—	(107,901)	(107,901)
Stock-based compensation	—	—	181,188	—	—	—	181,188
Net loss	—	—	—	—	(5,708,532)	(92,594)	(5,801,126)
Balance at December 31, 2018	24,824,746	$ 24,825	$ 56,427,928	$ —	$ (28,670,095)	$ 255,116	$ 28,037,774

The accompanying notes are an integral part of these consolidated financial statements.

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CONSOLIDATED STATEMENTS OF CASH FLOWS
For the Years Ended December 31, 2018 and 2017

CASH FLOWS FROM OPERATING ACTIVITIES:	2018	2017
Consolidated net income (loss)	$(5,801,126)	$97,696
Adjustments to reconcile net income (loss) to net cash used in operating activities:		
Depreciation, accretion and amortization, net	789,123	587,822
Gain on contract termination	(124,733)	—
Loss on sale of assets	22,088	2,909
Provision (recovery) for losses on accounts receivable	4,395	(16,600)
Provision of inventory reserve	1,000	17,000
Stock-based compensation	181,188	183,768
Goodwill impairment	4,390,590	—
Non-cash interest expense	32,225	1,491
Changes in operating assets and liabilities, net of effects of acquisition:		
(Increase) decrease in:		
Accounts receivable	(4,467,939)	(336,051)
Unbilled revenue	(697,586)	(1,676,409)
Inventory, net	(1,165,057)	(298,167)
Due from related party	576,087	(325,651)
Prepaid expenses and other current assets	49,484	(47,498)
Other non-current assets	113,284	(32,252)
Increase (decrease) in:		
Accounts payable	1,173,979	1,335,042
Accrued expenses and other current liabilities	111,038	(494,095)
Deferred revenue	1,006,893	375,499
Interest payable, related party	(52,265)	34,240
Net cash used in operating activities	(3,857,332)	(591,256)
CASH FLOWS FROM INVESTING ACTIVITIES:		
Purchases of property and equipment	(828,086)	(580,044)
Proceeds on sale of property and equipment	2,003,606	—
Purchases of intangible assets	(226,847)	(453,598)
Cash acquired in acquisition	442,746	971,454
Expenses associated with asset acquisition	(2,457)	—
Return of investment in Ultra Emissions Technologies Ltd	—	2,000,000
Payment of stock issuance costs	—	(377,246)
Distributions to noncontrolling interest	(107,901)	(47,921)
Net cash provided by investing activities	1,281,061	1,512,645
CASH FLOWS FROM FINANCING ACTIVITIES:		
Proceeds from revolving line of credit	21,533,143	—
Payments on revolving line of credit	(19,435,306)	—
Payments for debt issuance costs	(145,011)	—
Payments made on loan due to related party	(850,000)	(3,150,000)
Proceeds from exercise of stock options	72,925	179,918
Net cash provided by (used in) financing activities	1,175,751	(2,970,082)
Change in cash and cash equivalents	(1,400,520)	(2,048,693)
Cash and cash equivalents, beginning of the year	1,673,072	3,721,765
Cash and cash equivalents, end of the year	$272,552	$1,673,072

Supplemental disclosure of cash flow information:		
Cash paid for interest	$140,055	$110,979
Cash paid for taxes	$32,748	$—
Issuance of stock to acquire American DG Energy, net	$—	$18,482,656
Issuance of Tecogen stock options in exchange for American DG Energy options	$—	$114,896

The accompanying notes are an integral part of these consolidated financial statements.

TECOGEN INC.
Notes to Audited Consolidated Financial Statements for December 31, 2018 and 2017

Note 1 – Nature of business and operations

Tecogen Inc. ("Tecogen" or the "Company"), a Delaware Corporation, was incorporated on November 15, 2000, and acquired the assets and liabilities of the Tecogen Products division of Thermo Power Corporation. The Company produces commercial and industrial, natural-gas-fueled engine-driven, combined heat and power (CHP) products that reduce energy costs, decrease greenhouse gas emissions and alleviate congestion on the national power grid. Tecogen's products supply electric power or mechanical power for cooling, while heat from the engine is recovered and purposefully used at a facility. The majority of the Company's customers are located in regions with the highest utility rates, typically California, the Midwest and the Northeast.

On November 28, 2017 after the dissolution of a former joint venture, Ultratek, the Company created Ultera Technologies Inc., a Delaware corporation that is wholly owned by the Company ("Ultera Technologies"). Ultera Technologies was organized to continue to develop and commercialize Tecogen's patented technology, Ultera®, for the automotive market.

The Company's operations are comprised of two business segments. Our Products and Services segment designs, manufactures and sells industrial and commercial cogeneration systems as described above. Our Energy Production segment sells energy in the form of electricity, heat, hot water and cooling to our customers under long-term sales agreements.

Acquisition of American DG Energy, Inc.

On May 18, 2017, the Company completed its acquisition, by means of a stock-for-stock merger, of 100% of the outstanding common shares of American DG Energy Inc. ("ADGE"), a company which installs, owns, operates and maintains completed distributed generation of electricity, or DG systems or energy systems, and other complementary systems at customer sites and sells electricity, hot water, heat and cooling energy under long-term contracts at prices guaranteed to the customer to be below conventional utility rates.

Prior to the acquisition, ADGE was considered a related company because certain major stockholders had significant ownership positions in both companies. ADGE also had a sales representation agreement for Tecogen's products and service in New England and purchased the majority of its energy system from Tecogen.

Pursuant to the Merger Agreement, Tecogen acquired ADGE by means of a merger of one of our wholly owned subsidiaries (the "Merger Sub") with and into ADGE, so that ADGE became a wholly owned subsidiary of Tecogen. Pursuant to the Merger Agreement, at the effective time of the Merger, each outstanding share of ADGE common stock, $.001 par value per share, was automatically converted into the right to receive 0.092 shares of common stock, $.001 par value per share, of Tecogen (the "Exchange Ratio"), with cash paid in lieu of any fractional shares. As a result of the Merger, Tecogen issued approximately 4,662,937 shares of Tecogen common stock at $4.02 per share. This price was based on the closing price of Tecogen's common stock on May 18, 2017, the closing date of the Merger. The aggregate value of the consideration paid in connection with the Merger to former holders of ADGE common stock, net of costs, was approximately $18.5 million. Upon consummation of the Merger, ADGE stock options and other equity awards converted into stock options and equity awards with respect to Tecogen common shares, after giving effect to the Exchange Ratio.

ADGE distributes, owns, and operates clean, on-site energy systems that produce electricity, hot water, heat and cooling. ADGE's business model is to own the equipment that it installs at customer's facilities and to sell the energy produced by these systems to the customer on a long-term contractual basis. We have assumed these customer contracts and ADGE's business model and have fully incorporated ADGE's business into ours.

Note 2 – Summary of significant accounting policies

Principles of Consolidation and Basis of Presentation

The financial statements have been prepared in accordance with accounting standards set by the Financial Accounting Standards Board, or FASB. The FASB sets generally accepted accounting principles, or GAAP, to ensure financial condition, results of operations, and cash flows are consistently reported. References to GAAP issued by the FASB in these footnotes are to the FASB Accounting Standards Codification, or ASC. The Company adopted the presentation requirements for noncontrolling interests required by ASC 810 Consolidation. Under ASC 810, earnings or losses attributed to the noncontrolling interests are reported as part of the consolidated earnings and not a separate component of income or expense.

The accompanying consolidated financial statements include the accounts of the Company and entities in which it has a controlling financial interest. Those entities include the Company's wholly-owned subsidiary, ADGE and a joint venture, American DG New York, LLC, or ADGNY, in which ADGE holds a 51.0% interest. As the controlling partner, all major decisions in respect of ADGNY are made by ADGE in accordance with the joint venture agreement. The interests in the individual underlying energy system projects in ADGNY vary between ADGE and its joint venture partner. The noncontrolling interest and distributions are determined based on economic ownership. The economic ownership is calculated by the amount invested by the Company and the noncontrolling partner in each site. Each quarter, the Company calculates a year-to-date profit/loss for each site that is part of

TECOGEN INC.
Notes to Audited Consolidated Financial Statements for December 31, 2018 and 2017

ADGNY and the noncontrolling interest percent of economic ownership in each site is applied to determine the noncontrolling interest share in the profit/loss. The same methodology is used to determine quarterly distributions of available cash to the noncontrolling interest partner. On the Company's balance sheet, noncontrolling interest represents the joint venture partner's investment in ADGNY, plus its share of after tax profits less any cash distributions. ADGE owned a controlling 51.0% legal and economic interest in ADGNY as of December 31, 2018.
Investments in partnerships and companies in which the Company does not have a controlling financial interest but where we have significant influence are accounted for under the equity method.
Noncontrolling interests in the net assets and operations of ADGNY are reflected in the caption "Noncontrolling interest" in the accompanying consolidated financial statements. All intercompany transactions have been eliminated.

Reclassification

Certain prior period amounts have been reclassified to conform with current year presentation.

Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from those estimates.

Concentration of Credit Risk

The Company's financial instruments that are exposed to concentrations of credit risk consist primarily of cash and cash equivalents and accounts receivable. The Company maintains its cash balances in bank accounts, which at times may exceed the Federal Deposit Insurance Corporation's general deposit insurance limits. The amount on deposit at December 31, 2018 and 2017 which exceeded the $250,000 federally insured limit were approximately $0 and $1,172,911, respectively. The Company has not experienced any losses in such accounts and thus believes that it is not exposed to any significant credit risk on cash.
There were no customers who represented more than 10% of revenues for the year ended December 31, 2018 and one customers who represented more than 10% of revenues for the year ended December 31, 2017. The Company has approximately five hundred customers who represented 100% of the revenues for the year ended December 31, 2018. There was 1 customer who represented more than 10% of the accounts receivable balance as of December 31, 2018, and none as of December 31, 2017.

Cash and Cash Equivalents

The Company considers all highly liquid instruments with an original maturity date of three months or less when purchased to be cash and cash equivalents. The Company has cash balances in certain financial institutions in amounts which occasionally exceed current federal deposit insurance limits. The financial stability of these institutions is continually reviewed by senior management. The Company believes it is not exposed to any significant credit risk on cash and cash equivalents.

Accounts Receivable

Accounts receivable are stated at the amount management expects to collect from outstanding balances. An allowance for doubtful accounts is provided for those accounts receivable considered to be uncollectible based upon historical experience and management's evaluation of outstanding accounts receivable at the end of the year. Bad debts are written off against the allowance when identified. At December 31, 2018 and 2017, the allowance for doubtful accounts was $26,800 and $22,400, respectively.

Inventory

Raw materials, work in process, and finished goods inventories are stated at the lower of cost, as determined by the average cost method, or net realizable value. The Company periodically reviews inventory quantities on hand for excess and/or obsolete inventory based primarily on historical usage, as well as based on estimated forecast of product demand. Any reserves that result from this review are charged to cost of sales.

Property, Plant and Equipment

Property, plant and equipment are recorded at cost. Depreciation is provided using the straight-line method over the estimated useful life of the asset, which range from three to fifteen years. Leasehold improvements are amortized using the straight-line method over the lesser of the estimated useful lives of the assets or the term of the related leases. Expenditures for maintenance and repairs are expensed currently, while renewals and betterments that materially extend the life of an asset are capitalized.

TECOGEN INC.
Notes to Audited Consolidated Financial Statements for December 31, 2018 and 2017

The Company receives rebates and incentives from various utility companies and governmental agencies which are accounted for as a reduction in the book value of the assets. The rebates are payable from the utility to the Company and are applied against the cost of construction, therefore reducing the book value of the installation. As a reduction of the facility construction costs, these rebates are treated as an investing activity in the statements of cash flows. The rebates received by the Company from the utilities that apply to the cost of construction are one time rebates based on the installed cost, capacity and thermal efficiency of the installed unit and are earned upon the installation and inspection by the utility and are not related to or subject to adjustment based on the future operating performance of the installed units. The rebate agreements with utilities are based on standard terms and conditions, the most significant being customer eligibility and post-installation work verification by a specific date. During 2018 the amount of rebates applied to the cost of construction was $180,000.

Intangible Assets

Intangible assets subject to amortization include costs incurred by the Company to acquire product certifications, certain patent costs and developed technologies. These costs are amortized on a straight-line basis over the estimated economic life of the intangible asset. Indefinite life intangible assets such as trademarks are recorded at cost and not amortized. The Company reviews intangible assets for impairment when the circumstances warrant.

The favorable contract asset which relates to existing ADGE customer contracts is more fully described in Note 6., "Intangible assets and liabilities other than goodwill".

Impairment of Long-lived Assets

Long-lived assets, including intangible assets and property, plant and equipment, are evaluated for impairment whenever events or changes in circumstances have indicated that an asset may not be recoverable and are grouped with other assets to the lowest level for which identifiable cash flows are largely independent of the cash flows of other groups of assets and liabilities. If the sum of the projected undiscounted cash flows (excluding interest charges) is less than the carrying value of the assets, the assets will be written down to the estimated fair value and such loss is recognized in income from continuing operations in the period in which the determination is made. Management determined that no impairment of long-lived assets existed as of December 31, 2018.

Goodwill

Goodwill is the excess of the acquisition cost of businesses over the fair value of the identifiable net assets acquired. Impairment testing for goodwill is performed annually in the fourth fiscal quarter or more frequently if impairment indicators are present. To determine if goodwill is potentially impaired, we have the option to perform a qualitative assessment. However, we may elect to bypass the qualitative assessment and perform an impairment test even if no indications of a potential impairment exist. The impairment test for goodwill is performed at the reporting unit level and compares the fair value of the reporting unit (calculated using a discounted cash flow method) to its carrying value, including goodwill. The discount rate represents our estimate of the weighted-average cost of capital, or expected return, that a marketplace participant would have required as of the valuation date. If the carrying value exceeds the fair value, an impairment charge is recorded for the excess carrying value over fair value, limited to the total amount of goodwill of that reporting unit. Our assessment in 2018 indicated that the carrying value of our energy production reporting unit exceeded its fair value and therefore resulted in an impairment of goodwill (see Note 8."Goodwill").

The Company early-adopted the provisions of ASU 2017-04, during 2018, which simplified the impairment testing process by eliminating the requirement to determine the implied fair value of goodwill. The Company tests it goodwill for impairment on either a qualitative basis under certain conditions, or a quantitative basis. On a quantitative basis, fair value of the reporting units is primarily determined using probability weighted discounted cash flow analysis.

Income (loss) per Common Share

The Company computes basic loss per share by dividing net income (loss) for the period by the weighted-average number of shares of common stock outstanding during the period. The Company computes its diluted earnings per common share using the treasury stock method. For purposes of calculating diluted earnings per share, the Company considers its shares issuable in connection with the convertible debentures, stock options and warrants to be dilutive common stock equivalents when the exercise/conversion price is less than the average market price of our common stock for the period. For the year ended December 31, 2017 the Company included 171,594 dilutive shares resulting from assumed exercise of stock options.

Segment Information

The Company's operations are comprised of two business segments. Our Products and Services segment designs, manufactures and sells industrial and commercial cogeneration systems as described above. Our Energy Production segment sells energy in the form of electricity, heat, hot water and cooling to our customers under long-term sales agreements. Prior to the acquisition of ADGE (see Note 4."Acquisition of American DG Energy Inc."), the Company's operations were comprised of a single segment (see Note 16. "Segments").

Income Taxes

The Company uses the asset and liability method of accounting for income taxes. The current or deferred tax consequences of transactions are measured by applying the provisions of enacted tax laws to determine the amount of taxes payable currently or in future years. Deferred tax assets and liabilities are determined based on the difference between the financial statement and tax bases of assets and liabilities and expected future tax consequences of events that have been included in the financial statements or tax returns using enacted tax rates in effect for the years in which the differences are expected to reverse. Under this method, a valuation allowance is used to offset deferred taxes if, based upon the available evidence, it is more likely than not that some or all of the deferred tax assets may not be realized. Management evaluates the recoverability of deferred taxes and the adequacy of the valuation allowance annually.

The Company has adopted the provisions of the accounting standards relative to accounting for uncertainties in tax positions. These provisions provide guidance on the recognition, de-recognition and measurement of potential tax benefits associated with tax positions. The Company elected to recognize interest and penalties related to income tax matters as a component of income tax expense in the statements of operations. The Company has analyzed its current tax return compliance positions and has determined that no uncertain tax positions have been taken that would require recognition.

With few exceptions, the Company is no longer subject to possible income tax examinations by federal, state or local taxing authorities for tax years before 2015, with the exception of loss carryforwards in the event they are utilized in future years. The Company's tax returns are open to adjustment from 2001 forward, as a result of the fact that the Company has loss carryforwards from those years, which may be adjusted in the year those losses are utilized.

Fair Value of Financial Instruments

The Company’s financial instruments are cash and cash equivalents, accounts receivable, available-for-sale securities, accounts payable and revolving line of credit. The recorded values of cash and cash equivalents, accounts receivable, accounts payable and line of credit approximate their fair values based on their short-term nature. At December 31, 2018, the recorded value on the consolidated balance sheet of the loan due to related party approximates fair value as the terms approximate those available for similar instruments. See Note 13. "Fair value measurements".

Revenue Recognition

Revenue is recognized when performance obligations under the terms of a contract with our customer are satisfied; generally this occurs with the transfer of control of our products, services and energy production. Revenue is measured as the amount of consideration we expect to receive in exchange for transferring goods or providing services or energy to customers.

Shipping and handling fees billed to customers in a sales transaction are recorded in revenue and shipping and handling costs incurred are recorded in cost of sales. The Company has elected to exclude from revenue any value add sales and other taxes which it collects concurrent with revenue-producing activities. These accounting policy elections are consistent with the manner in which the Company historically recorded shipping and handling fees and taxes.

Incremental costs incurred by us in obtaining a contract with a customer are negligible, if any, and are expensed ratably in proportion to the related revenue recognized.

The application of ASU 2014-09 did not have an impact upon adoption or on the amounts reported for 2018 as compared with the guidance that was in effect before the adoption and application of ASU 2014-09.

Disaggregated Revenue

In general, the Company's business segmentation is aligned according to the nature and economic characteristics of its products and customer relationships and provides meaningful disaggregation of each business segment's results of operations.

TECOGEN INC.
Notes to Audited Consolidated Financial Statements for December 31, 2018 and 2017

The following table further disaggregates our revenue by major source by segment for the year ended December 31, 2018.

Year Ended	December 31, 2018		
	Products and Services	Energy Production	Total
Products	$12,624,867	$—	$12,624,867
Installation services	8,097,473	—	8,097,473
Maintenance services	8,761,818	—	8,761,818
Energy production	—	6,399,526	6,399,526
Total revenue	$29,484,158	$6,399,526	$35,883,684

Product and Services Segment

Products. We transfer control and generally recognize a sale when we ship a product from our manufacturing facility at which point a customer takes ownership of the product. Payment terms on product sales are generally 30 days.

We recognize revenue in certain circumstances before delivery to the customer has occurred (commonly referred to as bill and hold transactions). We recognize revenue related to such transactions once, among other things, the customer has made a written fixed commitment to purchase the product(s) under normal billing and credit terms, the customer has requested the product(s) be held for future delivery as scheduled and designated by them, risk of ownership has been assumed by the customer, and the product(s) are tagged as sold and segregated for storage awaiting further direction from the customer. Due to the infrequent nature and duration of bill and hold arrangements, the value associated with custodial storage services is deemed immaterial in the context of the contract and in total, and accordingly, none of the transaction price is allocated to such service.

Depending on the product and terms of the arrangement, we may defer the recognition of a portion of the transaction price received because we have to satisfy a future obligation (e.g., product start-up service). Amounts allocated to product start-up services are recognized as revenue when the start-up service has been completed. We use an observable selling price to determine standalone selling prices where available and either a combination of an adjusted market assessment approach, an expected cost plus a margin approach, and/or a residual approach to determine the standalone selling prices for separate performance obligations as a basis for allocating contract consideration when an observable selling price is not available. Amounts received but not recognized pending completion of performance are recognized as contract liabilities and are recorded as deferred revenue along with deposits by customers.

Installation Services. We provide both complete turnkey installation services and what we refer to as light installation services. Complete turnkey installation services typically include all necessary engineering and design, labor, subcontract labor and service, and ancillary products and parts necessary to install a cogeneration unit including integration into the customers' existing electrical and mechanical systems. Light installation services typically include some engineering and design as well as certain ancillary products and parts necessary for the customers' installation of a cogeneration unit.

Under light installation contracts, revenue related to ancillary products and parts is recognized when we transfer control of such items to the customer, generally when we ship them from our manufacturing facility, with revenue related to engineering and design services being recognized at the point where the customer can benefit from the service, generally as completed. Generally billings under light installation contracts are made when shipped and/or completed, with payment terms generally being 30 days.

Under complete turnkey installation service contracts revenue is recognized over time using the percentage-of-completion method determined on a cost to cost basis. Our performance obligation under such contracts is satisfied progressively over time as enhancements are made to customer owned and controlled properties. We measure progress towards satisfaction of the performance obligation based on an input method based on cost which we believe is the most faithful depiction of the transfer of products and services to the customer under these contracts. When the financial metrics of a contract indicate a loss, our policy is to record the entire expected loss as soon as it is known. Contract costs and profit recognized to date under the percentage-of-completion method in excess of billings are recognized as contract assets and are recorded as unbilled revenue. Billings in excess of contract costs and profit are recognized as contract liabilities and are recorded as deferred revenue. Generally billings under complete turnkey installation contracts are made when contractually determined milestones of progress have been achieved, with payment terms generally being 30 days.

Maintenance Services. Maintenance services are provided under either long-term maintenance contracts or one-time maintenance contracts. Revenue under one-time maintenance contracts is recognized when the maintenance service is completed. Revenue under long-term maintenance contracts is recognized either ratably over the term of the contract where the contract price is fixed or when the periodic maintenance activities are completed where the invoiced cost to the customer is based on run hours or kilowatts produced in a given period. We use an output method to measure progress towards completion of our performance obligation which results in the recognition of revenue on the basis of a direct measurement of the value to the customer of the services transferred to date relative to the remaining services promised under the contract. We use the practical expedient at ASC 606-10-55-18 of recognizing revenue in an amount equal to that amount to which we have the right to invoice the customer under the contract.

Energy Production Segment

Energy Production. Revenue from energy contracts is recognized when electricity, heat, hot and/or chilled water is produced by the Company owned on-site cogeneration systems. Each month we bill the customer and recognize revenue for the various forms of energy delivered, based on meter readings which capture the quantity of the various forms of energy delivered in a given month, under a contractually defined formula which takes into account the current month's cost of energy from the local power utility.

As the various forms of energy delivered by us under energy production contracts are simultaneously delivered and consumed by the customer, our performance obligation under these contracts is considered to be satisfied over time. We use an output method to measure progress towards completion of our performance obligation which results in the recognition of revenue on the basis of a direct measurement of the value to the customer of the services transferred to date relative to the remaining services promised under the contract. We use the practical expedient at ASC 606-10-55-18 of recognizing revenue in an amount equal to that amount to which we have the right to invoice the customer under the contract. Payment terms on invoices under these contracts are generally 30 days.

Contract Balances

The timing of revenue recognition, billings and cash collections result in billed accounts receivable, unbilled revenue (contract assets) and deferred revenue, consisting of customer deposits and billings in excess of revenue recognized (contract liabilities) on the Consolidated Balance Sheets.

Revenue recognized during the year ended December 31, 2018 that is included in unbilled revenue is approximately $2.2 million. Approximately $1.6 million of revenue was billed in this period that had been recognized in previous periods.

Revenue recognized during the year ended December 31, 2018 that was included in deferred revenue at the beginning of the period was approximately $3.0 million.

The increase in the deferred revenue balance during the year ended December 31, 2018 is primarily a result of approximately $4.5 million of prepayments added during the period, $2.0 million of which relates to an agreement for disposal of certain energy production related assets of the Company in December 2018, that was not included in the deferred revenue balance at the beginning of the year, offset by cash payments of $1.6 million received in advance of satisfying performance obligations.

Remaining Performance Obligations

Remaining performance obligations related to ASC 606 represent the aggregate transaction price allocated to performance obligations with an original contract term greater than one year, excluding certain maintenance contracts and all energy production contracts where a direct measurement of the value to the customer is used as a method of measuring progress towards completion of our performance obligation. Exclusion of these remaining performance obligations is due in part to the inability to quantify values based on unknown future levels of delivery and in some cases rates used to bill customers. Remaining performance obligations therefore consist of unsatisfied or partially satisfied performance obligations related to fixed price maintenance contracts and installation contracts.

As of December 31, 2018, the aggregate amount of the transaction price allocated to remaining performance obligations was approximately $16.6 million. The Company expects to recognize revenue of approximately 96% of the remaining performance obligations over the next 24 months, 45% recognized in the first 12 months and 51% recognized over the subsequent 12 months, and the remainder recognized thereafter.

Advertising Costs

The Company expenses the costs of advertising as incurred. For the years ended December 31, 2018 and 2017, advertising expense was approximately $273,000 and $278,000, respectively.

Research and Development Costs

Research and development expenditures are expensed as incurred. The Company's total research and development expenditures of approximately $1,298,000 and $937,000 were recognized for each of the years ended December 31, 2018 and 2017, respectively.

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Stock-Based Compensation
Stock-based compensation cost is measured at the grant date, based on the estimated fair value of the award, and is recognized as an expense in the statements of operations over the requisite service period.
The determination of the fair value of share-based payment awards is affected by the Company's stock price. For the awards prior to the Company being publicly traded, the Company considered the sales price of the Common Stock in private placements to unrelated third parties as a measure of the fair value of its Common Stock.
The Company utilizes actual forfeitures when calculating the expense for the period. Stock-based compensation expense recognized is based on awards that are ultimately expected to vest. The Company evaluates the assumptions used to value awards regularly and if factors change and different assumptions are employed, stock-based compensation expense may differ significantly from what has been recorded in the past. If there are any modifications or cancellations of the underlying unvested securities, the Company may be required to accelerate, increase or cancel any remaining unearned stock-based compensation expense.
Pursuant to ASC 505-50, Equity Based Payments to Non-Employees, the fair value of restricted Common Stock and stock options issued to nonemployees is revalued at each reporting period until the ultimate measurement date, as defined by ASC 505-50. The Company records the value of the instruments at the time services are provided and the instruments vest. Accordingly, the ultimate expense is not fixed until such instruments are fully vested.
See Note 12."Stockholders' equity" for a summary of the restricted stock and stock option activity under the Company's stock-based employee compensation plan for the years ended December 31, 2018 and 2017.
Significant New Accounting Standards Adopted this Period
Revenue Recognition In May 2014, the Financial Accounting Standards Board ("FASB") issued an accounting standard update (ASU 2014-09) related to revenue from contracts with customers, which, along with amendments issued in 2015 and 2016, supersedes nearly all current U.S. GAAP guidance on this topic and eliminates industry-specific guidance. The underlying principle is to recognize revenue when promised goods or services are transferred to customers in an amount that reflects the consideration that is expected to be received for those goods or services. The Company adopted this accounting standard update on a modified retrospective basis in the first quarter of 2018. See Revenue Recognition above for further discussion.
Investments in Equity Securities In January 2016, the FASB issued an accounting standard update related to investments in equity securities requiring unrealized holding gains and losses to be included in net income. Prior to this update, unrealized holding gains and losses related to available-for-sale securities were included in accumulated other comprehensive income and not included in determining net income. This accounting standard update became effective for the Company beginning in the first quarter of 2018 and is applied by means of a cumulative-effect adjustment to the balance sheet as of January 1, 2018. The Company adopted this accounting standard update in the first quarter of 2018 which resulted in reclassification of $165,317 of cumulative unrealized holding losses from accumulated other comprehensive loss to accumulated deficit. The future impact of recognizing unrealized holding gains or losses in net income is dependent on the movement in the stock prices related to such investments.
Business In January 2017, the FASB issued a new accounting standard that changes the definition of a business to assist entities with the evaluation of when a set of assets acquired or disposed of should be considered a business. The new standard requires that an entity evaluate whether substantially all of the fair value of the gross assets acquired is concentrated in a single identifiable asset or group of similar identifiable assets; if so, the set of assets would not be considered a business. The new standard also requires that a business include at least one substantive process, and it narrows the definition of outputs. The Company adopted this standard as of January 1, 2018. Adoption of this new standard may result in more transactions being accounted for as asset acquisitions versus business combinations; however, the impact on our consolidated financial statements in future periods will depend on the facts and circumstances of future transactions.
Goodwill During 2018, the Company early-adopted the provisions of ASU 2017-04 which simplified goodwill impairment testing by eliminating the requirement to determine the implied value of goodwill.
Disclosure update The Securities and Exchange Commission has recently issued several final rules, including but not limited to SEC Final Rule Release No. 33-10532 Disclosure Update and Simplification ("Final Rule"), which amends

certain redundant, duplicative, outdated, superseded or overlapping disclosure requirements. This Final Rule is intended to facilitate disclosure information provided to investors and simplify compliance without significantly impacting the mix of information provided to investors. The amendments also expand the disclosure requirements regarding the analysis of stockholders' equity for interim financial statements, in which entities will be required to present a reconciliation for each period for which a statement of comprehensive income is required to be filed. We adopted the Final Rule effective on November 5, 2018, which did not have any material impact on our consolidated financial statements and related disclosures.

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Significant New Accounting Standards or Updates Not Yet Effective

Leases In February 2016, the FASB issued an accounting standard update related to leases requiring lessees to recognize operating and financing lease liabilities on the balance sheet, as well as corresponding right-of-use assets. The new lease standard also makes some changes to lessor accounting and aligns key aspects of the lessor accounting model with the revenue recognition standard. In addition, disclosures will be required to enable users of financial statements to assess the amount, timing, and uncertainty of cash flows arising from leases. The accounting standard update will be effective for the Company beginning in the first quarter of fiscal 2019 on a modified retrospective basis, and early adoption is permitted. The Company believes the adoption of this accounting standard update will result in recognition of lease liabilities and right of use assets related to operating leases of approximately $2.6 million without any cumulative impact on equity upon adoption.

Note 3 – Income (loss) per common share:

Basic and diluted income (loss) per share for the years ended December 31, 2018 and 2017, respectively, was as follows:

	2018	2017
Net income (loss) attributable to stockholders	$(5,708,532)	$ 47,436
Weighted average shares outstanding - Basic	24,815,926	23,171,033
Basic income (loss) per share	$(0.23)	$ —
Weighted average shares outstanding - Diluted	24,815,926	23,342,627
Diluted income (loss) per share	$(0.23)	$ —
Anti-dilutive shares underlying stock options outstanding	144,077	441,356

Note 4 – Acquisition of American DG Energy Inc.

On May 18, 2017, we completed our acquisition, by means of a stock-for-stock merger, of 100% of the outstanding common shares of American DG Energy Inc. ("American DG Energy" or "ADGE"), a company which installs, owns, operates and maintains complete distributed generation of electricity systems, or DG systems or energy systems, and other complementary systems at customer sites and sells electricity, hot water, heat and cooling energy under long-term contracts at prices guaranteed to the customer to be below conventional utility rates, by means of a merger of one of our wholly owned subsidiaries with and into ADGE such that ADGE became a wholly owned subsidiary of Tecogen. We acquired ADGE to, among other reasons, expand our product offerings and benefit directly from the long-term contracted revenue streams generated by these installations. We gained control of ADGE on May 18, 2017 by issuing Tecogen Common Stock to the prior stockholders of ADGE.

We have included the financial results of ADGE in our condensed consolidated financial statements from the date of acquisition. For the year ended December 31, 2018, ADGE contributed $6,399,526 to our total revenues and $2,598,372 to our gross profit.

Acquisition related costs included in general and administrative expenses totaled $322,566 for the year ended December 31, 2018. Stock issuance related costs totaling $377,246 were netted against additional paid in capital during the year ended December 31, 2018.

The merger is intended to qualify for federal income tax purposes as a tax-free reorganization under the provisions of Section 368(a) of the Internal Revenue Code of 1986. Subject to the terms and conditions of the merger agreement, at the closing of the merger, each outstanding share of ADGE common stock was converted into the right to receive approximately 0.092 shares of common stock of Tecogen (the "Exchange Ratio").

Also in connection with the merger, Tecogen, at the effective time of the merger, assumed the outstanding stock options of ADGE as adjusted pursuant to the Exchange Ratio and subject to the terms of the merger agreement.

The fair value of the 4,662,937 shares of common stock issued as part of the consideration for the acquisition was determined based on the closing market price of Tecogen's stock on the date of acquisition. Additionally, as there is no required service condition in the assumed equity-based awards, 100% of the estimated fair value of the replacement equity-based awards at the date of the merger is considered attributable to pre-combination service and accordingly is included in the consideration.

The following table summarizes the consideration paid for ADGE and the amounts of the assets acquired and liabilities assumed recognized at the acquisition date, as well as the fair value at the acquisition date of the noncontrolling interest in American DG New York, LLC, a consolidated subsidiary of ADGE.

Consideration	
Tecogen common stock - 4,662,937 shares	$18,745,007
Assumed fully vested equity awards	114,896
	$18,859,903
Recognized amounts of identifiable assets acquired and liabilities assumed	
Financial assets	$1,542,137
Inventory	75,374
Prepaid and other current assets	358,628
Property, plant and equipment	12,186,664
Investment securities	519,568
Favorable contract asset	1,561,739
Financial liabilities	(1,912,859)
Unfavorable contract liability	(8,341,922)
Other liabilities	(939)
Total identifiable net assets	5,988,390
Noncontrolling interest in American DG New York, LLC	(453,272)
Goodwill	13,324,785
	$18,859,903

Goodwill acquired of $13.3 million arising from the acquisition is primarily attributable to the going concern element of ADGE’s business, including its assembled workforce and the long-term contractual nature of its business, as well as expected cost synergies from the merger related primarily to the elimination of administrative overhead and duplicative personnel. None of the goodwill recognized is expected to be deductible for income tax purposes.

The favorable contract asset and the unfavorable contract liability, both of which relate to existing customer contracts, and the estimated amortization are more fully described in Note 6. "Intangible assets and liabilities other than goodwill".

The fair value of the noncontrolling interest in American DG New York, LLC, a consolidated subsidiary of ADGE, was estimated using the income approach. This fair value measurement is based on significant inputs that are not observable in the market and thus represents a fair value measurement categorized within level 3 of the fair value hierarchy described in ASC Section 820-10-35. Key assumptions include a discount rate of 5.61% and the run out of existing contracts at current levels of profitability.

Unaudited Pro Forma Financial Information

The unaudited pro forma financial information in the table below summarizes the combined results of operations for Tecogen and ADGE as though the companies were combined as of the beginning of fiscal 2016. The pro forma financial information for all periods presented also includes the business combination accounting effects resulting from the acquisition including amortization charges and credits from acquired intangible assets and liabilities, and depreciation adjustments related to fair value as though the aforementioned companies were combined as of the beginning of fiscal 2016. The pro forma financial information as presented below is for informational purposes only and is not indicative of the results of operations that would have been achieved if the acquisition had taken place at the beginning of fiscal 2016.

	Year ended December 31, 2017
Total revenues	$36,232,650
Net income (loss)	113,255
Basic earnings (loss) per share	$0.01
Diluted earnings (loss) per share	$0.01

One-time acquisition-related expenses related to the merger incurred during the year ended December 31, 2017 are not included in the unaudited pro forma financial information as they are not expected to have a continuing impact on the consolidated results.

The unaudited pro forma financial information does not include the revenues or results of operations of a subsidiary previously owned and consolidated by ADGE as that subsidiary was disposed of in 2016 prior to the acquisition by Tecogen and was considered to be a discontinued operation by ADGE. Additionally, the unaudited pro forma financial information does not include a gain recognized on deconsolidation of that same subsidiary by ADGE and an amount of interest cost related to ADGE's long-term debt which was extinguished contemporaneously with the disposition of the subsidiary.

Note 5 – Inventory

Inventories at December 31, 2018 and 2017 consisted of the following.

	2018	2017
Gross raw materials	$6,165,099	$5,270,732
Less - reserves	(284,000)	(283,000)
Net raw materials	5,881,099	4,987,732
Work-in-process	413,763	11,852
Finished goods	—	131,221
	$6,294,862	$5,130,805

Note 6 – Intangible Assets and Liabilities Other Than Goodwill

The Company capitalized $120,455 and $61,053 of product certification costs during the years ended December 31, 2018 and 2017, respectively. Also included in intangible assets are the costs incurred by the Company to acquire certain patents. These patents, once in service, will be amortized on a straight-line basis over the estimated economic life of the associated product, which range from approximately 7-10 years. The Company capitalized $102,245 and $181,637 of patent-related costs during the years ended December 31, 2018 and 2017, respectively. The Company capitalized $3,212 and $2,375 in trademarks during the years ended December 31, 2018 and 2017, respectively. The Company capitalized $935 and $263,001 of in process R&D related to the former Ultratek joint venture during the years ended December 31, 2018 and 2017, respectively.

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Intangible assets and liabilities at December 31, 2018 and 2017 consist of the following:

	December 31, 2018			December 31, 2017		
Intangible assets	Cost	Accumulated Amortization	Net	Cost	Accumulated Amortization	Net
Product certifications	$726,159	$(345,658)	$380,501	$605,704	$(285,341)	$320,363
Patents	910,569	(188,239)	722,330	808,323	(154,972)	653,351
Developed technology	240,000	(92,000)	148,000	240,000	(76,000)	164,000
Trademarks	22,752	—	22,752	19,540	—	19,540
In process R&D	263,936	—	263,936	263,001	—	263,001
TTcogen intangible assets	29,607	(2,776)	26,831	—	—	—
Favorable contract assets	1,561,739	(232,099)	1,329,640	1,561,739	(85,536)	1,476,203
	$3,754,762	$(860,772)	$2,893,990	$3,498,307	$(601,849)	$2,896,458
Intangible liability						
Unfavorable contract liability	$7,912,275	$(1,619,676)	$6,292,599	$8,341,922	$(612,255)	$7,729,667

The aggregate amortization expense related to intangible assets exclusive of contract related intangibles was $112,359 and $99,310 during the years ended December 31, 2018 and 2017, respectively. The net credit to cost of sales related to the amortization of the contract related intangible asset and liability for the years ended December 31, 2018 and 2017 was $860,858 and $526,719, respectively.

Contract Asset and Liability

The favorable contract asset and unfavorable contract liability in the foregoing table represent the fair value of ADGE's customer contracts (both positive for favorable contracts and negative for unfavorable contracts) which were acquired by the Company on May 18, 2017 (see Note 4. "Acquisition of American DG Energy Inc."). These contracts are long-term and provide customers with an alternative source of electrical power in addition to that provided by the local power utility, at rates that are lower than local utilities. This alternative electrical power is typically produced by ADGE owned, operated and maintained natural gas powered systems installed at the customers' sites, with ADGE bearing all costs of operation and maintenance. In addition to the alternative source of electrical power provided by ADGE’s systems, customers can opt to add and take advantage of the heat generated in the electrical production process in the form of hot water and/or space heating. 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. As of the date of acquisition, utility electric rates were significantly below the level anticipated at the time the fixed percentage discounts contained in the vast majority of ADGE’s customer contracts were contracted for, thus these contract terms, although they produce cash flow, were considered to be off market in the vast majority of ADGE’s customer contracts. Additionally, the demand and volume of kilowatts produced and billed for vary by contract and by period and in certain instances have been significantly below what was originally expected such that had it been known at the time the contract(s) were negotiated, it would have influenced ADGE’s determination of the level of the fixed percentage discount in those contracts.

The determination of fair value requires development of an estimate of the price at which an orderly transaction to sell the asset or to transfer the liability would take place between market participants at the measurement date under current market conditions. Contracts are considered to be assets or liabilities by virtue of the rights and obligations inherent in the contract terms. Typically, contracts with terms considered to be at market are considered to have no fair value because in order to be entitled to the rights under the contract performance must occur for which a market rate of return is earned due to the at market terms. The fair value of a contract is primarily a measurement of its off market terms. The obligation to perform under a contract with terms that are unfavorable to market results in a liability to the extent its terms are off market. The resulting liability is an estimate of the price that would need to be paid to a willing market participant to assume the obligations under the contract in order for them to receive a market rate of return for their remaining performance obligation under the contract. The exact opposite holds true in instances where the terms of a contract are considered to be favorable to market. In that case an asset would exist as an estimate of the price that would be received from a willing market participant in order to be entitled to the rights under the contract.

In determining the estimate of fair value of ADGE's customer contracts, the measure of market, and thus the baseline to measure the amount related to any of the off market terms or conditions with respect to the contracts, was considered best determined, given the nature of the services provided under the contracts, by utilizing a benchmark level of profit margin, in this case 35% of revenue which is consistent with the average return on revenue of US investor owned public utilities.

Amortization of intangibles including contract related amounts is calculated using the straight line method over the remaining useful life or contract term and charged against cost of sales in the accompanying consolidated statement of operations and comprehensive loss. Aggregate future amortization over the next five years is estimated to be as follows:

	Non-contract related intangibles	Contract related intangibles	Total
2019	$ 246,837	$ (705,430)	(458,593)
2020	237,903	(675,232)	(437,329)
2021	212,446	(680,719)	(468,273)
2022	205,369	(655,086)	(449,717)
2023	198,296	(578,426)	(380,130)
Thereafter	440,746	(1,668,066)	(1,227,320)
	$ 1,541,597	$ (4,962,959)	$ (3,421,362)

Note 7 – Property, plant and equipment

Property, plant and equipment at December 31, 2018 and 2017 consisted of the following:

	Estimated Useful Life (in Years)	2018	2017
Energy systems	1 - 15 years	$ 12,709,990	$ 12,466,642
Machinery and equipment	5 - 7 years	1,355,617	1,215,951
Furniture and fixtures	5 years	222,542	205,320
Computer software	3 - 5 years	200,626	115,253
Leasehold improvements	*	450,792	440,519
		14,939,567	14,443,685
Less - accumulated depreciation and amortization		(3,666,452)	(2,177,974)
Net property, plant and equipment		$ 11,273,115	$ 12,265,711

* Lesser of estimated useful life of asset or lease term

Depreciation and amortization expense on property and equipment for the years ended December 31, 2018 and 2017 was $1,537,622 and $1,114,540, respectively.

In December 2018, the Company sold certain energy systems related assets and related energy production contracts. As the sales agreement contained a repurchase provision, no sale was recognized. Accordingly, the assets were not derecognized and the $2.0 million consideration for the sale was deferred. Subsequent to December 31, 2018, the sales agreement was modified to exclude the repurchase provision (see Note 18. "Subsequent Events").

Subsequent to December 31, 2018, the Company contracted for the disposition of certain energy systems (see Note 18. "Subsequent events").

Note 8. Goodwill

Changes in the carrying amount of goodwill by reportable segment during the year was as follows:

	Product and Service	Energy Production	Total Company
Balance at December 31, 2016	$40,870	$—	$40,870
Acquisitions		13,324,785	13,324,785
Balance at December 31, 2017	40,870	13,324,785	13,365,655
Impairment loss	—	(4,390,590)	(4,390,590)
Balance at December 31, 2018	$40,870	$8,934,195	$8,975,065

The Company recorded an impairment loss of $4,390,590 following the performance of its 2018 annual goodwill impairment test. The impairment loss represents the excess of the carrying value of the Company's energy production reporting unit, including goodwill, over its estimated fair value based on discounted cash flow analysis. The impairment recognizes the shortening of remaining contract terms with customers without replacement and without further growth, as well as less than expected cost savings and increased profitability from the Company's initiative to optimize the long-term profitability of its various site operations, and a price peak of the Company's stock on the date of the business combination to which the goodwill relates (see also Note 18 "Subsequent events").

9 – Revolving line of credit, Convertible debentures and loan due to related party

On December 23, 2013, the Company entered into a Senior Convertible Promissory Note (the "Note") with Michaelson Capital Special Finance Fund LP, ("Michaelson"), for the principal amount of $3,000,000 with interest at 4% per annum for a term of three years. On April 1, 2016, the Company amended the Note increasing the total principal amount to $3,150,000 increasing the conversion price to $3.54 from $3.37, and extending the term until December 23, 2018. The amended Note was a senior secured obligation which paid interest only on a monthly basis in arrears at a rate of 4% per annum, unless earlier converted in accordance with the terms of the agreement prior to such date. The Note was secured by an all asset lien and was senior in right of payment to any unsecured indebtedness that is expressly subordinated in right of payment to the Note.

On December 14, 2017, the Company, through principal payment of $3,150,000 to Michaelson (the "Payment"), terminated the Senior Convertible Promissory Note with Michaelson. Through the Note, Michaelson was the Company's principle debt holder and a beneficial holder of approximately 5% of the Company's shares outstanding. There were no pre-payment penalties paid by the Company, as Michaelson provided a waiver of the pre-payment penalties that were contained in the Note. By completing the Payment, the Company has satisfied all of its obligations under the Note and the Note was cancelled. Below is a summary of the terms of the Note, as amended.

The Company could prepay all of the outstanding principal and interest due and payable under this Note in full, at any time prior to the maturity date for an amount equal to 120% of the then outstanding principal and interest due and payable as of the date of such prepayment.

In connection with the acquisition of American DG Energy, the Company assumed a loan from John N. Hatsopoulos, the Company's then Co-Chief Executive Officer and a Company Director. The loan was in the amount of $850,000 with interest at 6%, payable quarterly. On May 4, 2018, the Company, through a payment of $919,590, terminated the loan and all obligations under the loan.

On May 4, 2018 ("Closing Date") the Company, and its wholly owned subsidiaries, American DG Energy Inc. and TTcogen LLC (collectively, the "Borrowers"), entered into a Credit Agreement with Webster Business Credit Corporation (the "Lender") that matures in May 2021 and provides Borrowers a line of credit of up to $10 million on a revolving and secured basis, with availability based on certain accounts receivables, raw materials, and finished goods.

Borrowings under the Credit Agreement bear interest at a rate equal to, at the Borrower's option, either (1) One Month LIBOR, plus 3.00%, or (2) Lender’s Base Rate, plus 1.5%. Lender’s Base Rate is defined as the highest of (a) the Federal Funds rate plus 0.5%, (b) Lender’s Prime Rate as adjusted by Lender from time to time, and (c) One Month LIBOR, plus 2.75%, 7% as of December 31, 2018.

The Credit Agreement contains certain affirmative and negative covenants applicable to the Company and its subsidiaries, which include, among other things, restrictions on their ability to (i) incur additional indebtedness, (ii) make certain investments, (iii) acquire other entities, (iv) dispose of assets and (v) make certain payments including those related to dividends or repurchase of equity. The Credit Agreement also contains financial covenants including maintaining a fixed charge coverage ratio of not less

than 1.10:1.00 and the Company may not make any unfinanced capital expenditures in excess of $500,000 in the aggregate in any fiscal year. As of December 31, 2018, the Company believes it is in compliance with covenants.
The $145,011 of costs incurred in connection with the issuance of the revolving credit facility were capitalized and are being amortized to interest expense on a straight-line basis over three years based on the contractual term of the Agreement. As of December 31, 2018, the outstanding balance on the line of credit was $2,122,221 and the unamortized portion of debt issuance cost related to the Credit Agreement was $112,786 and is included as a reduction to the revolving line of credit in the accompanying Consolidated Balance Sheet.

Note 10 – Commitments and contingencies

Operating Lease Obligations

The Company leases office space and warehouse facilities under various lease agreements which expire through March 2024. Total rent expense for the years ended December 31, 2018 and 2017 amounted to $755,579 and $700,335, respectively. In 2017, a portion of rent expense was offset by $34,995 in rent paid by sub-lessees, to both related and unrelated parties, for a net amount of $665,340.
The Company leased one passenger vehicle under a lease agreement which expired in 2018. Vehicle rent expense amounted to $1,912 and $1,571 during the years ended December 31, 2018 and 2017, respectively.
Future minimum lease payments under all non-cancelable operating leases as of December 31, 2018 consist of the following:

Years Ending December 31,	Amount
2019	$643,930
2020	647,341
2021	589,538
2022	577,055
2023	584,803
Thereafter	134,700
Total	$3,177,367

Guarantees

The Company guarantees certain obligations of a former subsidiary of ADGE, EuroSite Power Inc. These guarantees include a payment performance guarantee in respect of collateralized equipment financing loans, with a remaining principal amount outstanding subject to the guarantee at December 31, 2018 of approximately $202,359 due ratably in equal installments through September 2021, and certain guarantees of performance in respect of certain customer contracts. Based on current conditions, the Company does not believe there to be any amounts probable of payment by the Company under any of the guarantees and has estimated the value associated with the non-contingent aspect of the guarantees is approximately $7,000 which is recorded as a liability in the accompanying financial statements.

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Dismissal of Litigation

The Company was previously a party to an action in the United States District Court for the District of Massachusetts, described below, related to the Merger. All claims in the litigation relating to the Merger have been dismissed.

On November 16, 2018, the US District Court for the District of Massachusetts dismissed all remaining claims against all defendants in the litigation against Tecogen Inc. and its affiliates, including American DG Energy Inc., and their directors and certain officers, relating to the merger of American DG Energy Inc. with and into a subsidiary of Tecogen Inc. in a case filed on May 15, 2017 titled Vardakas v. American DG. Energy, Inc., Case No. 17-CV-1024(LTS).

The case was originally filed in February 2017 in Massachusetts state court by William C. May ("May"), individually and on behalf of the other shareholders of American DG Energy Inc. as a class in the Business Litigation Session of the Superior Court of the Commonwealth of Massachusetts, Civil Action N. 17-0390. Plaintiff May voluntarily dismissed the state court case on May 31, 2017 and consolidated that case with the case filed by plaintiff Lee Vardakas on May 15, 2017 in US District Court for the District of Massachusetts, alleging violations of federal securities laws and breaches of fiduciary duties to minority shareholders of American DG Energy Inc. in connection with the merger of American DG Energy Inc. with a subsidiary of Tecogen Inc. The US District Court dismissed all federal securities law claims in the case on March 2, 2018. On November 16, 2018 the remaining state law claims alleging breach of fiduciary duties to minority stockholders, and aiding and abetting breaches of fiduciary duties, were dismissed on the basis of the defendants' Motion for Judgment on the Pleadings. Plaintiff's motion for class certification was also dismissed on November 16, 2018.

Note 11 – Product warranty

The Company reserves an estimate of its exposure to warranty claims based on both current and historical product sales data and warranty costs incurred. The majority of the Company’s products carry a one-year warranty. The Company assesses the adequacy of its recorded warranty liability annually and adjusts the amount as necessary. The warranty liability is included in accrued expenses on the accompanying consolidated balance sheets.

Changes in the Company’s warranty reserve were as follows:

Warranty reserve, December 31, 2016	$148,000
Warranty provision for units sold	128,100
Costs of warranty incurred	(142,600)
Warranty reserve, December 31, 2017	133,500
Warranty provision for units sold	348,100
Costs of warranty incurred	(341,000)
Warranty reserve, December 31, 2018	$140,600

Note 12 – Stockholders’ equity

Common Stock

As discussed in Note 4. "Acquisition of American DG Energy Inc.", on May 18, 2017, the Company completed the acquisition of ADGE, by means of a stock-for-stock merger, of 100% of the outstanding common shares of ADGE in exchange for 4,662,937 shares of the Company's newly issued common stock.

The holders of Common Stock have the right to vote their interest on a per share basis. At December 31, 2018 and 2017, there were 24,824,746 and 24,766,892 shares of Common Stock outstanding, respectively.

Preferred Stock

On February 13, 2013, the Company authorized 10 million shares of preferred stock. As of December 31, 2018, no preferred shares were issued or outstanding.

Warrants

In conjunction with the Ultratek Joint Venture, the Board of Directors granted 250,000 warrants to Dr. Elias Samaras at $4.00 a share with an expiration date of December 28, 2017. The warrants granted to Dr. Samaras expired unexercised.

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Stock-Based Compensation

The Company adopted the 2006 Stock Option and Incentive Plan (the “Plan”), under which the board of directors may grant incentive or non-qualified stock options and stock grants to key employees, directors, advisors and consultants of the Company. The Plan was amended at various dates by the Board of Directors to increase the reserved shares of common stock issuable under the Plan to 3,838,750 as of December 31, 2018, and in June 2017 stockholders approved an amendment to extend the termination date of the Plan to January 1, 2026 and to ratify all Company option grants made after January 1, 2016 (the “Amended Plan”).

Stock options vest based upon the terms within the individual option grants, with an acceleration of the unvested portion of such options upon a change in control event, as defined in the Amended Plan. The options are not transferable except by will or domestic relations order. The option price per share under the Amended Plan cannot be less than the fair market value of the underlying shares on the date of the grant. The number of shares remaining available for future issuance under the Amended Plan as of December 31, 2018 and 2017 was 1,990,980 and 2,123,747, respectively.

In 2018 the Company granted nonqualified options to purchase an aggregate of 367,500 shares of common stock in a range of $2.30 and $4.04 per share to certain officers and employees. These options have a vesting schedule of four years and expire in ten years. The fair value of the options issued in 2018 was $365,054. The weighted-average grant date fair value of stock options granted during 2018 was $0.99 per option.

In 2017, the Company granted nonqualified options to purchase an aggregate of 45,000 shares of common stock for between $3.22 and $3.72 per share to certain employees and a director. These options have a vesting schedule of four years and expire in ten years. The fair value of the options issued in 2017 was $41,113. The weighted-average grant date fair value of stock options granted during 2017 was $0.91 per option.

In 2018 and 2017, option holders exercised 57,854 and (156,124) options, respectively, with an intrinsic value of $137,085 and $149,598, respectively.

Stock option activity for the year ended December 31, 2018 was as follows:

Common Stock Options	Number of Options	Exercise Price Per Share	Weighted Average Exercise Price	Weighted Average Remaining Life	Aggregate Intrinsic Value
Outstanding, December 31, 2017	1,061,552	$0.79-$18.15	$ 3.60	4.95 years	$ 291,449
Granted	367,500	$2.30-$4.04	3.35		
Exercised	(57,854)	$1.20-$2.60	1.26		137,085
Canceled and forfeited	(78,609)	$2.30-$18.15	6.43		
Outstanding, December 31, 2018	1,292,589	$0.79-$10.33	$ 3.52	5.93 years	$ 671,331
Exercisable, December 31, 2018	855,089		$ 3.46		$ 620,266
Vested and expected to vest, December 31, 2018	1,226,964		$ 3.51		$ 663,672

Using the Company's historical forfeiture rate of 15%, the table above uses said rate in the expected to vest calculation. The Company uses the Black-Scholes option pricing model to determine the fair value of stock options granted. Use of a valuation model requires management to make certain assumptions with respect to selected model inputs. Expected volatility was calculated based on the average volatility of four comparable publicly traded companies. The average expected life was estimated using the simplified method to determine the expected life based on the vesting period and contractual terms, since it does not have the necessary historical exercise data to determine an expected life for stock options. The Company uses a single weighted-average expected life to value option awards and recognizes compensation on a straight-line basis over the requisite service period for each separately vesting portion of the awards. The risk-free interest rate is based on U.S. Treasury zero-coupon issues with a remaining term which approximates the expected life assumed at the date of grant.

The weighted average assumptions used in the Black-Scholes option pricing model for options granted in 2018 and 2017 are as follows:

Stock option awards:	2018	2017

Expected life	6.25 years	6.25 years
Risk-free interest rate	2.73%	1.86%
Expected volatility	20.90%	23.10%

The Company granted restricted stock awards to its employees and directors. The performance based awards have vesting schedules of 25% or 33% per year beginning one year after the Company's IPO in 2014.

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Restricted stock activity for the year ended December 31, 2018 was as follows:

	Number of Restricted Stock	Weighted Average Grant Date Fair Value
Unvested, December 31, 2017	42,921	$ 1.31
Granted	—	—
Vested	(42,921)	1.31
Forfeited	—	—
Unvested, December 31, 2018	—	$ —

During the years ended December 31, 2018 and 2017, the Company recognized stock-based compensation expense of $181,188 and $183,768, respectively, related to the issuance of stock options and restricted stock. No tax benefit was recognized related to the stock-based compensation expense recorded during the years. At December 31, 2018 and 2017, the total compensation cost related to unvested restricted stock awards and stock option awards not yet recognized is $415,941 and $281,554, respectively. This amount will be recognized over a weighted average period of 2.02 years.

Note 13 – Fair value measurements
The fair value topic of the FASB Accounting Standards Codification defines fair value as the exchange price that would be received for an asset or paid to transfer a liability (an exit price) in the principal or most advantageous market for the asset or liability in an orderly transaction between market participants on the measurement date. The accounting guidance also establishes a fair value hierarchy which requires an entity to maximize the use of observable inputs, where available, and minimize the use of unobservable inputs when measuring fair value. There are three levels of inputs that may be used to measure fair value:
Level 1 - Unadjusted quoted prices in active markets for identical assets or liabilities. The Company currently does not have any Level 1 financial assets or liabilities.
Level 2 - Observable inputs other than quoted prices included in Level 1. Level 2 inputs include quoted prices for identical assets or liabilities in non-active markets, quoted prices for similar assets or liabilities in active markets and inputs other than quoted prices that are observable for substantially the full term of the asset or liability.
Level 3 - Unobservable inputs reflecting management's own assumptions about the input used in pricing the asset or liability. The Company currently does not have any Level 3 financial assets or liabilities.
The following table presents the asset reported in the consolidated balance sheet measured at its fair value on a recurring basis as of December 31, 2018 and 2017 by level within the fair value hierarchy.

December 31, 2018		Quoted prices in active markets for identical assets	Significant other observable inputs	Significant unobservable inputs	
	Total	Level 1	Level 2	Level 3	Total gains (losses)
Recurring fair value measurements					
Available-for-sale equity securities					
EuroSite Power Inc.	$236,167	$ —	$ 236,167	$ —	$(283,401)
Total recurring fair value measurements	$236,167	$ —	$ 236,167	$ —	$(283,401)
December 31, 2017					

Recurring fair value measurements					
Available-for-sale equity securities					
EuroSite Power Inc.	$354,251	$—	$354,251	$—	$(165,317)
Total recurring fair value measurements	$354,251	$—	$354,251	$—	$(165,317)

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The Company utilizes a Level 2 category fair value measurement to value its investment in EuroSite Power Inc. as an available-for-sale security at period end. That measurement is equal to the quoted market closing price at period end. Since this security is not actively traded we are classifying as Level 2.

Note 14 – Retirement plans
The Company has a defined contribution retirement plan (the “Plan”), which qualifies under Section 401(k) of the Internal Revenue Code (IRC). Under the Plan, employees meeting certain requirements may elect to contribute a percentage of their salary up to the maximum allowed by the IRC. The Company matches a variable amount based on participant contributions up to a maximum of 4.5% of each participant’s salary. The Company contributed approximately $238,680 and $231,945 to the Plan in 2018 and 2017, respectively.

Note 15 – Related party transactions
In January of 2017, prior to its acquisition of American DG Energy, the Company purchased a large quantity of used equipment from ADGE for approximately $985,000. Tecogen sold the majority of this equipment to specific customers during the year and plans to sell the remainder in the coming year.
In connection with the acquisition of American DG Energy, the Company assumed a loan from John N. Hatsopoulos, the Company's Co-Chief Executive Officer and a Company Director. The loan is in the amount of $850,000 and bears interest at 6%, payable quarterly. On May 4, 2018, the Company, through a payment of $919,590, terminated the loan and all obligations under the loan.
Ultra Emissions Technologies S.ar.L
On December 28, 2015, the Company entered into a joint venture agreement relating to the formation of a joint venture company (the “JV”) organized to develop and commercialize Tecogen’s patented technology (“Ultera® Technology”) designed to reduce harmful emissions generated by engines using fossil fuels. The joint venture company, called Ultra Emissions Technologies S.ar.L, formerly known as "Ultra Emissions Technologies Limited" ("Ultratek"), was originally organized under the laws of the Island of Jersey, Channel Islands.
The Company received a 50% equity interest in the JV in exchange for a fully paid-up worldwide license to use Tecogen’s Ultera emissions control technology in the field of mobile vehicles burning fossil fuels. The other half of the joint venture equity interests were purchased for $3,000,000 by a small group of non US investors. Warrants to purchase additional equity securities in the JV were granted to all parties pro rata. If the venture is not successful, all licensed intellectual property rights will revert to Tecogen.
On August 2, 2016, Tecogen exercised 2,000,000 warrants (the "Ultratek Warrants"), to purchase shares of the JV, at $1.00 per share, for an aggregate amount of $2 million. The funds used to exercise the Ultratek Warrants were acquired by the Company from the holders of certain Company warrants (the "Tecogen Warrant Holders"), when they partially exercised their Tecogen warrants (the "Tecogen Warrants"), in July of 2016. The Tecogen Warrant Holders exercised a total of 675,000 Tecogen Warrants with a $4.00 exercise price, resulting in cash proceeds of $2,700,000 to the Company, which the Company then used in part to invest in the JV. An additional $8,500,000 was raised from other outside investors for a total equity investment in the JV to date of $13,500,000. Due to this investment, Tecogen's ownership decreased to 43%.
By unanimous written consent on October 24, 2017, the shareholders of Ultratek voted to dissolve Ultratek, thus terminating the joint venture agreement dated December 28, 2015 and the license agreement between the Company and Ultratek. This joint venture agreement and license agreement is described in its entirety on the Company's Form 8-K that was filed with the Securities and Exchange Commission on December 31, 2015.
Pursuant to the unanimous shareholder consent dissolving Ultratek, the Company received its full $2,000,000 investment in Ultratek upon the completion of the liquidation process. Further, upon termination of the license agreement all intellectual property immediately reverted to the Company. Upon dissolution, the Company purchased all of the remaining assets of Ultratek, including new intellectual property that Ultratek developed and other assets, for

a total purchase price of $400,000.

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TTcogen LLC

On May 19, 2016, the Company along with Tedom a.s., an unrelated corporation incorporated in the Czech Republic and a European combined heat and power product manufacturer ("Tedom"), entered into a joint venture, pursuant to which the Company held a 50% participating interest and the remaining 50% interest was held by Tedom. As part of the joint venture, the parties agreed to create a Delaware limited liability company, TTcogen LLC ("TTcogen"), to carry out the business of the venture. Tedom granted TTcogen the sole and exclusive right to market, sell, offer for sale, and distribute certain products as agreed to by the parties throughout the United States. The product offerings of the joint venture expand the current Tecogen product offerings to the MicroCHP of 35kW to large 4,000kW plants. Tecogen agreed to refer all appropriate sales leads to TTcogen regarding the products agreed to by the parties, and Tecogen had the first right to repair and maintain the products sold by TTcogen.

Until the Company acquired the assets of TTcogen, the Company accounted for its interest in TTcogen's operations using equity method accounting. Any initial operating losses of TTcogen were borne and funded by Tedom. To the extent any such losses were borne and funded solely by Tedom, the Company did not recognize any portion of such losses given the Company did not guarantee the obligations of the joint venture nor is it committed to provide funding to the joint venture.

On September 22, 2017, the Company provided written notice to Tedom and Tedom USA Inc., a Delaware subsidiary of Tedom (“Tedom USA”) that the Company is exercising its rights under the Joint Venture Agreement dated May 19, 2016 ("JVA") and the TTcogen LLC Operating Agreement ("LLC Operating Agreement"), to terminate the JVA and LLC Operating Agreement. This notice began the dissolution process under the LLC Operating Agreement.

On March 27, 2018, the Company entered into a Membership Interest Purchase and Wind-Down Agreement (the “Purchase Agreement”) among the Company, Tedom, Tedom USA, and TTcogen. The Purchase Agreement follows the mutual agreement of the parties to terminate the joint venture between the Company and Tedom that resulted in the creation of TTcogen, and implements the acquisition by the Company of Tedom USA’s 50% membership interest in TTcogen for a purchase price of one dollar, plus $72,597, which represents a portion of Tedom USA's initial investment in TTcogen, minus certain adjustments.

The Purchase Agreement also grants TTcogen and the Company the exclusive right to market, sell, and distribute Tedom’s Micro T35 combined heat and power equipment within an agreed territory in the northeastern United States under certain conditions, and limits the Company’s right to sell certain competing products. The Company will provide services for Tedom equipment sold by TTcogen or the Company.

The acquisition of Tedom's 50% membership interest for $72,598 was accounted for as an acquisition of assets, and not a business combination, due to the lack of an assembled workforce. The Company adopted the provisions of ASU 2017-01 "Business Combinations - Clarifying the Definition of a Business" at the beginning of 2018, which require, at a minimum, the presence of an input and substantive process that together significantly contribute to the ability to create an output. The lack of an assembled workforce results in the non presence of a substantive process. The following represents the consideration for and the fair value of assets acquired and liabilities assumed recognized at the acquisition date:

Cash	$442,786
Accounts receivable	176,235
Unbilled revenue	232,540
Fixed assets	47,508
Intangible assets	29,607
Accounts payable	(811,468)
Deferred revenue	(44,610)
Cash payable	$72,598

The intangible asset represents contract backlog related to acquired contracts. The value assigned to contract backlog was determined based on the result of a discounted cash flow analysis, which resultant value was capped so as to preclude recognition of any amount in excess of cost after considering the fair values assigned to other assets acquired and liabilities assumed.

Revenue from sales of cogeneration and chiller systems, parts, installations and service to TTcogen during the year ended December 31, 2017 amounted to $347,275. The amounts due to Tecogen from TTcogen and Tedom USA as of December 31, 2017 was $585,492. This amount was recorded in the accompanying consolidated balance sheets as due from related parties.

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Other financing transactions
During the years ended December 31, 2018 and 2017, the Company had a loan with John N. Hatsopoulos, the former Co-Chief Executive Officer of both Tecogen and American DG Energy. Details of these transactions can be found in Note 9. "Revolving line of credit, Convertible debentures and loan due to related party".
On December 23, 2013, the Company entered into a Senior Convertible Promissory Note with Michaelson Capital Special Finance Fund LP. On April 1, 2016, this note was amended to extend the maturity date and revise the security and conversion price. On December 14, 2017 the note was discharged. Details of this payoff and discharge can be found in Note 9. "Revolving line of credit, Convertible debentures and loan due to related party".

Note 16 – Segments
As of December 31, 2018, the Company was organized into two operating segments through which senior management evaluates the Company’s business. These segments, as described in more detail in Note 1, are organized around the products and services provided to customers and represent the Company’s reportable segments. Prior to the acquisition of ADGE (see Note 4. "Acquisition of American DG Energy Inc."), the Company’s operations were comprised of a single segment.The following table presents information by reportable segment for the years ended December 31, 2018 and 2017:

	Products and Services	Energy Production	Corporate, other and elimination (1)	Total
Year ended December 31, 2018				
Revenue - external customers	$29,484,158	$6,399,526	$ —	$35,883,684
Intersegment revenue	1,211,148	—	(1,211,148)	—
Total revenue	30,695,306	6,399,526	(1,211,148)	35,883,684
Gross profit	10,993,490	2,598,372	—	13,591,862
Identifiable assets	27,566,921	22,337,472	—	49,904,393
Year ended December 31, 2017				
Revenue - external customers	$29,368,726	$3,833,940	$ —	$33,202,666
Intersegment revenue	750,692	—	(750,692)	—
Total revenue	30,119,418	3,833,940	(750,692)	33,202,666
Gross profit	11,154,982	1,799,422	—	12,954,404
Identifiable assets	24,234,505	26,436,571	—	50,671,076

(1) Corporate, intersegment revenue, other and elimination includes various corporate assets.

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Note 17 – Income taxes

A reconciliation of the federal statutory income tax provision to the Company's actual provision for the years ended December 31, 2018 and 2017 is as follows:

	2018	2017
Pre-tax book income (loss)	(5,768,378)	97,697
Expected tax at 21% and 34%, respectively	(1,211,359)	33,217
Permanent differences:		
Machinery & equipment	4,658	10,888
Mark to market	24,798	—
Goodwill impairment	922,024	—
Intangible Amortization	(180,780)	—
Stock compensation	—	(179,084)
Non-deductible interest	—	10,788
Other	876	26
State taxes:		
Current	32,748	—
Deferred	(120,477)	(24,960)
Other items:		
Federal research and development credits	(35,550)	(33,406)
Change in valuation allowance	(153,000)	277,000
Deferred tax past year true-up's	(99,348)	191,355
ADGE deferred tax assets and liabilities at purchase	—	(3,702,013)
ADGE other post-closing adjustments	—	(1,330,665)
Change in statutory tax rate for deferred tax assets-Federal	—	4,914,329
Change in statutory tax rate for deferred tax assets-State	—	(167,475)
True up - ADG NOL IRC Sec 382 limitation	817,198	—
Other	30,960	—
Income tax provision	$ 32,748	$ —

The components of net deferred tax assets recognized in the accompanying consolidated balance sheets at December 31, 2018 and 2017 are as follows:

	2018	2017
Net operating loss carryforwards	$7,206,000	$7,429,000
R&D and ITC credit carryforwards	244,000	203,000
Accrued expenses and other	1,140,000	879,000
Accounts receivable	7,000	6,000
Inventory	73,000	73,000
Property, plant and equipment	568,000	801,000
Deferred tax assets	9,238,000	9,391,000
Valuation allowance	(9,238,000)	(9,391,000)
Deferred tax assets, net	$—	$—

At December 31, 2018, the Company had approximately $29,793,000 of Federal Loss Carryforwards that expire beginning in the year 2022 through 2037. In addition, the Company has varying amounts of state net operating losses, expiring at various dates starting in 2019 through 2038.

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The Tax Cuts and Jobs Act was enacted on December 22, 2017. A significant provision of the act was to reduce the statutory Federal tax rate from 34% to 21%. During 2018, the Company’s valuation allowance decreased by $153,000. This decrease is affected by the absorption of deferred tax attributes associated with its acquisition of American DG Energy, Inc. along with permanent book to tax differences and provision to return adjustments.

In accordance with the provisions of the Income Taxes topic of the Codification, the Company has evaluated the positive and negative evidence bearing upon the realizability of its deferred tax assets, which are comprised principally of net operating losses. Management has determined that it is more likely than not that the Company will not recognize the benefits of federal and state deferred tax assets and, as a result, a full valuation allowance has been established for 2017 and 2018 respectively.

Utilization of the NOL and research and development credit carryforwards are subject to a substantial annual limitation due to ownership changes, as provided by Section 382 of the Internal Revenue Code of 1986, as well as similar state provisions. Ownership changes may limit the amount of NOL and tax credit carryforwards that can be utilized to offset future taxable income and tax, respectively. In general, an ownership change, as defined by Section 382, results from transactions increasing the ownership of certain shareholders or public groups in the stock of a corporation by more than 50 percentage points over a three-year period.

The Company acquired a new subsidiary, American DG Energy, Inc. during 2017, by acquiring 100 percent of the company's stock. Accordingly, utilization of their consolidated and/or separately computed NOL and/or tax credit carryforwards will be subject to an annual limitation under Internal Revenue Code Section 382. Any such limitation may
result in expiration of a portion of the NOL or tax credit carryforwards before utilization. The extent of the limitation, and related allocation and impact upon the NOL and credit carryforwards has been determined to be $391,394 per year for a 20 year period at the ADGE level. The Company, however, has enough pre-merger NOLs to offset anticipated taxable income for the taxable year ended December 31, 2018 and is not expected to be limited in NOL utilization for the period.

A full valuation allowance has been provided against the Company's loss carryforwards and, if an adjustment is required under Section 382, it would be offset by a corresponding adjustment to the valuation allowance. Thus, there would be no impact to the balance sheet or statement of operations if an adjustment were required.

The Company has not recorded any amounts for unrecognized tax benefits as of December 31, 2018 or 2017.

The Company files tax returns as prescribed by the tax laws of the jurisdiction in which it operates. In the normal course of business the Company is subject to examination by federal and state jurisdictions, where applicable. There are currently no pending tax examinations. The Company is thus still open to examination from tax year 2015 for both federal and state jurisdictions.

Note 18 – Subsequent events
On February 1, 2019, the Board of Directors increased the size of the Company's Board of Directors to seven directors and elected Mr. John Hatsopoulos to serve as a director of the Company for the period from February 1, 2019 until the Company's 2019 annual meeting of stockholders, or until his successor is duly elected and qualified. Mr. Hatsopoulos will serve as Lead Director for purposes of assisting the Company in identifying and evaluating financing alternatives for the Company.
On March 5, 2019, the Company transferred ownership of certain of its energy systems related assets and related energy production contracts in a sale transaction in consideration for approximately $5 million. In connection with the sale, the Company entered into two separate agreements to provide operational and maintenance services for the

purchaser. Concurrently, the Company amended the terms of an agreement related to certain energy systems related assets and related energy production contracts, the ownership of which were transferred to the same purchaser in December 2018 in consideration of approximately $2 million, in order to conform and finalize the terms of the agreement to the latter agreement. The foregoing resulted in a disposition of more than an insignificant portion of the income producing assets of the energy production segment of the Company which will result in additional impairment of the goodwill associated with those assets.

The Company has evaluated subsequent events through the date of this report and determined that there are no additional subsequent events that have occurred that would require recognition in the consolidated financial statements or disclosure in the notes thereto.