TECOGEN INC
Form 10-K
March 27, 2013

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, 2012
or

o TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

Commission file number 333-178697

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) 622-1120
Securities registered pursuant to Section 12(b) of the Act: None
Securities registered pursuant to Section 12(g) of the Act:

Title of each class	Name of each exchange on which registered
Common Stock, $0.001 par value	N/A

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 Securities 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 and posted on its corporate Web site, if any, every
Interactive Data File required to be submitted and posted 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 and post

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. ý

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or a smaller reporting company. See the definitions of “large accelerated filer”, “accelerated filer” and “smaller reporting company” in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer o	Accelerated filer o
Non –accelerated filer o	Smaller reporting company x

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes ¨ No ý

The aggregate market value of the voting shares of the registrant held by non-affiliates is not applicable because our common stock was not yet trading as of June 29, 2012.

As of March 27, 2013, the registrant’s shares of common stock outstanding were: 54,447,854.

WARNING 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 OUR, 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. THESE MARKET DATA INCLUDE 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 THESE 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,” “MANAGEMENT’S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS” AND “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, 2012
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Item 1. Business

Overview

Tecogen designs, manufactures, and sells systems that produce electricity, hot water, and air conditioning for commercial and industrial buildings. These systems, powered by natural gas engines, are efficient because they drive electric generators or compressors – which reduce the amount of electricity purchased from the utility – plus they use the engine's waste heat for water heating, space heating, and/or air conditioning at the customer's building. We call this cogeneration technology CHP for combined heat and power.

Tecogen manufactures three types of CHP products:

- Cogeneration units that supply electricity and hot water;
- Chillers that provide air-conditioning and hot water; and
- High-efficiency water heaters.

All of these are standardized, modular, small-scale CHP products, with a limited number of designs that can serve many different types of customers. The market for these products is driven by their ability to reduce energy costs, carbon emissions, and customers' dependence on the electric grid. Other factors behind the demand for natural gas-fueled CHP systems include America's growing natural gas reserves and its domestic energy policies, as well as customers' desire to become more socially responsible. Traditional customers for our cogeneration and chiller 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.

Our CHP technology uses low-cost, mass-produced engines manufactured by GM and Ford, which we modify to run on natural gas. In the case of our mainstay cogeneration and chiller products, the engines have proved to be cost-effective and reliable. In 2009, our research team developed a low-cost process for removing air pollutants from the engine exhaust. This low-emissions technology gives our natural gas engines exceptionally low levels of "criteria" air pollutants (those that are regulated by the EPA because they can harm human health and the environment).

After a successful field test of more than a year, in 2012 we introduced the technology commercially as an option for all of our products under the trade name Ultra (patent pending). The Ultra low-emissions technology repositions our engine-driven products in the marketplace, making them comparable environmentally with emerging technologies such as fuel cells, but at a much lower cost and greater efficiency.

Our CHP products are sold directly to customers by our in-house marketing team and by established sales agents and representatives, including American DG Energy and EuroSite Power which are affiliated companies. We have an installed base of more than 2,100 units. Many have been operating for almost 25 years. Our principal engine supplier is GM, and principal generator supplier is Marathon Electric. To produce air conditioning, our engines drive a compressor purchased from J&E Hall International.

In 2009, we created a subsidiary, Ilios, to develop and distribute a line of high-efficiency heating products, starting with a water heater. These products are much more efficient than conventional boilers in commercial buildings and industrial processes (see "Our Products" below). As of the date of this report, we own a 65.0% interest in Ilios.

Tecogen was formed in the early 1960s as the Research and Development New Business Center of Thermo Electron Corporation, which is now Thermo Fisher Scientific Inc. For the next 20 years, this group performed fundamental and

applied research in many energy-related fields to develop new technologies. During the late 1970s, new federal legislation enabled electricity customers to sell power back to their utility. Thermo Electron saw a fit between the technology and know-how it possessed and the market for cogeneration systems.

In 1982, the Research and Development group released its first major product, a 60-kilowatt (kW) cogenerator. In the late 1980s and early 1990s, they introduced air-conditioning and refrigeration products using the same gas engine-driven technology, beginning with a 150-ton chiller (tons are a measure of air-conditioning capacity). In 1987, Tecogen was spun out as a separate entity by Thermo Electron and in 1992 Tecogen became a division of the newly formed Thermo Power Corporation.

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In 2000, Thermo Power Corporation was dissolved, and Tecogen was sold to private investors including Thermo Electron's original founders, Dr. George N. Hatsopoulos and John N. Hatsopoulos. Tecogen Inc. was incorporated in the State of Delaware on November 15, 2000. Our business and registered office is located at 45 First Avenue, Waltham, Massachusetts, 02451. Our telephone number is 781-466-6400.

Industry Background

During the 20th century, fossil-fuel power plants worldwide evolved toward large, complex central stations using high-temperature steam turbines. This technology, though steadily refined, reached a maximum efficiency of about 40% that persists to this day. According to the EPA website, the average efficiency of fossil-fuel power plants in the United States is 33% and has remained virtually unchanged for four decades.

The efficiency limitation reached in steam power plant design is universal in devices that convert the chemical energy from a burned fuel to electric power. This upper boundary is due not only to practical design limitations, but also to the fundamental thermodynamic barriers inherent in energy conversion. The limit can be exceeded only incrementally and at significant cost.

The best efficiency obtainable today is about 50%, from either a combined-cycle steam turbine or a fuel cell, as stated by the Northwest Power Planning Council report of August 2002, titled "Natural Gas Combined-cycle Gas Turbine Power Plants." A combined-cycle system incorporates a second turbine powered by exhaust gases from the first turbine. Large-scale replacement of existing power plants with combined-cycle technology would take decades, be very expensive, and yield marginal benefits. Fuel cells remain very expensive, and they are mostly confined to highly subsidized projects aimed at proving that the technology works.

CHP – which harnesses waste energy from the power generation process and puts it to work on-site – can boost the efficiency of energy conversion to nearly 90%, a better than two-fold improvement over central steam plants. Power generation alone, without capturing and using waste heat, cannot exceed an ideal, theoretical efficiency of about 70%, according to the basic thermodynamic laws governing energy conversion from fossil fuel combustion.

The implications of the CHP approach are significant. If CHP were applied on a large scale, global fuel usage might be curtailed dramatically. Small on-site power systems, in sizes like boilers and furnaces, would serve customers ranging from homeowners to large industrial plants. This is described as "distributed" energy, in contrast to central power.

CHP became recognized in the late 1970s as a technology essential to reduce fossil fuel consumption, pollution, and grid congestion. Since then, CHP has been applied increasingly around the world, mainly to reduce consumers' energy costs but also for its societal benefits. According to a report by the International Energy Agency, or IEA, titled "Sustainable energy technologies for today...and tomorrow (2009)," the value of CHP technology to customers and policy makers stems from the fact that CHP systems are "inherently energy efficient and produce energy where it is needed."

According to the IEA report, the benefits of CHP include:

- Dramatically increased fuel efficiency;
- Reduced emissions of carbon dioxide (CO2) and other pollutants;
- Cost savings for the energy consumer;
- Reduced need for transmission and distribution networks; and

- Beneficial use of local energy resources, providing a transition to a low-carbon future.

CHP generates about 10% of the world's electricity. With CHP-friendly policies in place, most countries could double or triple their existing CHP power output by 2030 (Figure 1). According to the IEA report, CHP could supply up to 24% of global generation, while meeting 40% of Europe's target reductions in carbon emissions.

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Figure 1 - Major Economies' CHP Potential
Source: IEA report, Cogeneration and District Energy:
Sustainable energy technologies for today...and tomorrow (2009)
(Data from 2008)

For the United States, this IEA report indicates the potential for CHP could increase from approximately 8% share of electricity generation in 2005 to approximately 18% by 2030. Given U.S. electric demand of about 500,000 megawatts in 2012, CHP could account for up to 35,000 megawatts of new capacity through 2030 in a broad spectrum of sizes and market sectors. Moreover, an Executive Order to accelerate investments in industrial energy efficiency, including CHP released by the White House on August 30, 2012, has set a new national goal of 40 gigawatts, or GW, of new CHP in the United States, thus accelerating this IEA timetable by 10 years.

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 grid is already challenged to keep up with existing power demand. The grid consists of power generation plants as well as the transmission and distribution network consisting of substations and wires.

Power plants are aging, and plans for new power plants are on the decline (Figure 2). According to the U.S. Energy Information Administration's "Form EIA-860 Annual Electric Generator Report (2010)," the average age of a U.S. coal-fired power plant is 44 years. Coal plants account for about 30% of the nation's generation capacity.

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Figure 2 – Proposed U.S. New Capacity: Coal, Natural Gas, Wind, and Nuclear
Source: National Energy Technology Laboratory, Tracking New Coal Fired Power Plants (2012).

In addition, the transmission and distribution network is operating at capacity in urban areas. Decentralizing power generation by installing equipment at customer sites not only relieves the capacity burden on existing power plants, but also unburdens transmission and distribution lines. This ultimately improves the grid's reliability and reduces the need for costly upgrades. Consolidated Edison, Inc., the electric utility of New York City and surrounding areas, intends to integrate energy efficiency, distributed generation, and demand response as a way to defer new infrastructure investments, according to the utility's 2010 long-range plan.

We believe that increasingly favorable economic conditions could improve our business prospects domestically and abroad. Specifically, we believe that natural gas prices might increase from their current depressed values, but only modestly, while electric rates could go up over the long-term as utilities pay for better emission controls, efficiency improvements, and the integration of renewable power sources. The net result of relative gas and electric prices could be greater cost savings and annual rates of return to CHP customers.

Moreover, we believe that natural gas could win favor politically as a domestic fuel with low carbon emissions. Government policy, both here and abroad, might promote CHP as a way to conserve natural resources and reduce carbon and toxic emissions. Renewable wind and solar sources could encounter practical limitations, while nuclear power is likely to be affected by its safety setbacks.

Tecogen's Strategy for Growth

Target markets and new customers

The traditional markets for CHP systems are buildings with long hours of operation and with coincident 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.

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Traditional customers for our chillers overlap with those for our cogeneration systems. Chiller applications include schools, hospitals and nursing homes, office and apartment buildings, hotels, retailers, ice rinks and industrial facilities. Engine-driven chillers are ideal replacements for aging electric chillers, since they both take up about the same amount of floor space.

The Company believes that the largest number of potential new customers in the U.S. require less than 1,000 kW 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.

As stated earlier, the total US Market Potential in 2030 is projected to be 35,000 MW. In order to estimate the share of that market in our size range, we reference a study done by ICF International on the California market that breaks down projected market penetration by kW output range. According to Combined Heat and Power Market Assessment of the California Energy Commission (April 2010), in 2029, new CHP in the size range that fits our products (50 kW to 500 kW), is projected to be 476 MW in the base case, or 684 MW if incentives such as carbon credits and power export credits are considered. This size range constitutes 17.4% of the total California market potential in the base case, or 11% in the case with incentives. If we assume California's apportionment of small size CHP is applicable to the country, we can estimate the US market addressable by our products as 17.4% of 35,000 MW in the base case (11% with incentives) which amounts to 6,100 MW (3,864 MW with incentives). If we assume we can capture 30% of this market, the potential over the next twenty years is 11,600 – 18,300 InVerde (100 kW) units, or approximately $1.3 – 2.1 billion in revenue (@ $112,500 per unit).

An Executive Order to accelerate investments in industrial energy efficiency, was promulgated in August 2012. In response, the Department of Energy, or DOE, and the EPA released a new report titled "Combined Heat and Power: A Clean Energy Solution" that projects $40-$80 billion of new capital investment in CHP in the next decade based upon the goal of a 40 GW expansion of CHP of all sizes. Our potential market share of that market is difficult to predict.

The largest market sectors identified by ICF that are suitable for our products closely match our sales data from January 2007 through June 2012 (Figure 3).

Figure 3 - Tecogen Customer Distribution (CHP and Engine-Driven Chiller Systems)
From January 2007 through June 2012
Source: Tecogen Inc.

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The ICF report reveals CHP's relatively low existing market penetration in the smaller system sizes. Given that multi-megawatt CHP is already well-established (Table 1), the market opportunity increases as size decreases. Small systems (less than 1 megawatt) may grow almost six-fold. The missed opportunity is evident and likely even more disproportionate nationally. Most areas of the country, except the Northeast, are essentially without measurable CHP systems.

Table 1 – CHP Market Penetration by Size in California and Potential Through 2029
Source: ICF International, Combined Heat and Power Market Assessment (2010)

System Size (MW)	<1	1-4.9	5-19.9	>20
2009 Inventory (MW)	200	350	750	7,900
New Potential Through 2029 (MW)	1,138	1,279	764	3,015
Relative Growth Potential (%)	569 %	365 %	102 %	38 %

The DOE/EPA report confirms that CHP is a "largely untapped resource" and states that there is significant technical market potential for CHP at commercial and institutional facilities at just over 65 GW. This report also indicates that there was a significant decline in CHP in the early 2000s due to deregulation of the power markets that resulted in market uncertainty and delayed energy investments. However, a significant rebound and expansion of the CHP market may occur because of the following emerging drivers:

1. Changing outlook for natural gas supply and pricing as a result of shale exploration
2. Growing State policymaking and support
3. Changing market conditions for the power and industrial sectors such as ageing power plants and boilers, as well as more strict air regulations.

We intend to seek customers, both domestic and international, in areas where utility pricing and government policy align with our advantages. These areas would 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 (DOE/EPA report).

Our new microgrid capability, 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, will likewise be exploited wherever utilities have resisted conventional generator interconnection but have conceded to UL-certified inverters (such as Consolidated Edison in New York and Pacific Gas and Electric Company in California). Because our InVerde systems operate independently from the grid, we also plan to exploit the need for outage security in certain market segments. These segments include military bases, hospitals, nursing homes, and hotels.

As noted above in "Industry Background", the IEA report estimates that world power from CHP, currently at 10%, could increase to 24% under a best-case scenario. We hope to participate in a robust international market, which we believe will be as large as or larger than the domestic market.

Alliances

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

•

General Motors Company – supplier of raw materials pursuant to a supplier agreement since the development of our cogeneration product in the early 1960s.

- California Energy Commission – research and development contracts since 2004.
- 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.
- Lawrence Berkeley National Laboratory – research and development contracts since 2005.

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- Consortium for Electric Reliability Technology Solutions – research and development contracts and provided a test site to the Company since 2005.
- The AVL California Technology Center – support role in performance of research and development contracts as well as internal research and development on our emission control system from August 2009 to November 2011.

We also have an exclusive licensing agreement from the Wisconsin Alumni Research Foundation (WARF) for its proprietary control software that enables our microgrid system. 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 $20,000 on an annual basis through the year ended December 31, 2012. In addition, WARF reserved the right to grant non-profit research institutions and governmental agencies non-exclusive licenses to practice and use the inventions of the Licensed Patents for Non-Commercial Research Purposes.

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 vary by utility, but could include simplified interconnection, joint marketing, ownership options, peak demand mitigation agreements, and customer services. We are currently installing a microgrid with the Sacramento Municipal Utility District at its headquarters in Sacramento, California, where the central plant will incorporate three InVerde systems equipped with our Ultra low-emissions technology. Some expenses for this project are being 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 Tecogen pay royalties on all sales of all products related to the grant. As of December 31, 2012, such royalties accrued in accordance with this grant agreement were less than $10,000 on an annual basis.

We also continue to leverage our resources with government and industry funding, which has yielded a number of successful developments. These include the Ultra low-emissions technology, sponsored by the California Energy Commission and Southern California Gas Company, and new 35-kW engine technology we developed with the California Energy Commission’s support.

For the years ended December 31, 2012 and 2011, we spent $103,102 and $223,745, respectively, in research and development activities, all of which was reimbursed through grants from the California Energy Commission and the Consortium for Electric Reliability Technology Solutions.

Tecogen’s Solution

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 within the last two years, our products can now contribute to better air quality at the local level.

According to our estimates and public sources, our cogeneration systems convert up to 90% of the natural gas fuel to useful energy in the form of electricity and hot water or space heat. This compares to less than 40% for central power. Other on-site upgrades such as insulation or lighting can help cut energy use as well, but they do not displace nearly as much low-efficiency electricity. Our engine-driven chillers, when the waste heat is effectively used, offer similar

efficiency benefits compared with running an electric chiller plus a furnace or boiler.

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 50% 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 electric 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 most costly time of year.

Our water heater product, recently introduced by Ilios, operates like an electric heat pump but uses a natural gas engine instead of an electric motor to power the system, see "Our Products" for an explanation of the heat pump. 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. As of the date of this report, we have sold one Ilios water heater and have five in production to fulfill current orders.

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The net effect is that our heat pump's efficiency far surpasses that of conventional boilers for water heating. Similarly, if used for space heating, the engine-powered heat pump would be more efficient than an electric heat pump, again because heat is recovered and used. The product's higher efficiency translates directly to lower fuel consumption and, for heavy use customers, significantly lower operating costs.

Our products also address the global objective of reducing greenhouse gas emissions. When burned to generate power, natural gas produces lower carbon emissions per unit of energy than any fossil fuel (Table 2), according to the EPA combined heat and power emissions calculator.

Table 2. Fossil Fuel Carbon Emissions
Source: EPA Emissions Calculator

Fuel	CO2 emissions, lb/million Btu
Natural Gas	116.7
Distillate Oil	160.9
Coal	206.7

Our products, in addition to using the lowest amount of carbon fuel, further reduce CO2 emissions (greenhouse gases) because of CHP's higher efficiency. Figure 4 compares the CO2 output of our products to that of the national electric grid and other generation technologies. Our products are far superior to the grid and even outperform the CHP technologies of fuel cells and microturbines.
Figure 4 – Comparison of Carbon Emissions (GHG) for Various Sources
Including Tecogen's CHP and Chiller Products
Source: Tecogen Inc.

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Furthermore, according to the EPA website's calculator, one Tecogen 100-kW CHP unit will reduce carbon emissions by 390 tons per year (based on 8,000 run-hours), the equivalent of 64 cars on the road. A microturbine of the same size would reduce carbon emissions by only 245 tons per year, the equivalent of 41 cars – less than two-thirds the emissions reduction of our CHP product. Our Ilios water heater also reduces CO2 emissions in proportion to its fuel savings.

In addition to reducing greenhouse gases, our products with Ultra low-emission controls can improve local air quality from other pollutants, such as NOx and CO (Figure 5). As shown below, the Ultra CHP system's emissions (D) are significantly less than the combination of the power plant and boiler (A + B) for the same energy output.

Figure 5 also compares the Ultra low-emissions CHP to the "best available control technology" (BACT) as defined by the EPA for natural gas engines. This reveals how dramatically Ultra reduces an engine's emissions and helps explain the negative perception that engines have historically had with respect to air quality. A central power plant is usually far away, so it doesn't affect local pollutant levels, and the boiler alone (B) produces far less air pollution than even the best engine (C).

Microturbines and fuel cells have been the low-emission alternatives to engines, but they produce more NOx than an Ultra low-emissions CHP unit (Figure 6). The Ultra low-emissions technology could transform the engine's reputation in the energy marketplace – it can now be considered a source of clean power.

Figure 5 – Emissions Levels of Criteria Pollutants from Various Sources
Compared to Tecogen's Ultra Low-Emissions Technology
Source: Tecogen Inc.

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Figure 6 — Comparison of Tecogen Ultra Low-Emissions Technology to Other Technologies
Source: Tecogen Inc.

Our Products

We manufacture natural gas engine-driven cogeneration systems and chillers, all of which are CHP products that deliver more than one form of energy. We have simplified CHP technology for inexperienced customers. Our cogeneration products are all standard, modular units that come pre-packaged from the factory. They include everything the customer needs to minimize the cost and complexity of installing the equipment at their site. The package incorporates the engine, generator, heat-recovery equipment, system controls, electrical switchgear, emission controls, and modem for remote monitoring and data logging.

All of our cogeneration systems and most of our chillers use the same engine, the TecoDrive 7400 model supplied by GM and modified by us to use natural gas fuel. The small 25-ton chiller uses a similar GM engine, the 3000 model. We worked closely with GM and the gas industry (including the Gas Research Institute) in the 1980s and 1990s to modify the engine and validate its durability. For the Ilios water heater, we introduced a more modern Ford engine that is enhanced for industrial applications. As of the date of this report, we have sold one Ilios water heater and have five in production to fulfill current orders

Our commercial product line includes:

- The InVerde® and TECOGEN® cogeneration units,
- TECOCHILL® chillers,
- Ilios high-efficiency water heaters, and

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- Ultra low-emissions technology.

InVerde Cogeneration Units

Our premier cogeneration product is 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. The InVerde incorporates an inverter, which converts direct current, or DC, electricity to alternating current, or AC. With an inverter, the engine and generator can run at variable speeds, which maximize efficiency at varying loads. The inverter then converts the generator's variable output to the constant-frequency power required by customers (50 or 60 Hertz), as shown in Figure 7.

This inverter technology was developed originally for solar and wind power generation. 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) – a status which the InVerde has acquired. This qualifies our product for a much simpler permitting process nationwide and is mandatory in some areas such as New York City and California. The inverter also improves the CHP system's efficiency at partial load, when less heat and power are needed by the customer.

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 standalone microgrid – 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.

The InVerde CHP system was developed in 2007, and we began shipping it in 2008. Our largest InVerde fleet is twelve units, which supply 1.2 megawatts of on-site power and about 8.5 million Btu/hr of heat (700,000 Btu/hr per unit).

Figure 7 - Diagram of InVerde CHP System
Source: Tecogen Inc.

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TECOGEN Cogeneration Units

The TECOGEN cogeneration system is the original model introduced in the 1980s, which is available in sizes of 60 kW and 75 kW, 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 population, much of its production volume has been supplanted by the InVerde.

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. This technology was developed in 1987. The engine drives a compressor that makes chilled water; while the engine's free waste heat can be recovered to satisfy the building's needs for hot water or heat. This process is sometimes referred to as "mechanical" cogeneration, as it generates no electrical power, and the equipment doesn't 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. Gas-fueled chillers also free up the building's existing electrical capacity to use for other loads.

Ilios High-Efficiency Water Heaters

Our newest product, 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 to your kitchen. Heat pumps extract heat from outside and move it indoors. In both cases, fluids move the heat around by flowing through heat exchangers. At various points the fluids are compressed or expanded, which absorbs or releases heat.

In the Ilios water heater, the heat pump moves heat from outdoors to the water being heated in the customer's building. The heat pump water heater serves as a boiler, producing hot water for drinking and washing or for 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.

In a conventional electric heat pump, the compressor is driven by an electric motor. In the Ilios design, a natural gas-fueled engine drives the compressor. This means that the heat being captured from outdoors is supplemented by the engine's waste heat, which increases the efficiency of the process. According to scientific studies, gas engine heat pumps can deliver efficiencies of up to 146%. As of the date of this report, we have sold one Ilios water heater and have five in production to fulfill current orders.

Ultra Low-Emissions Technology

All of our CHP products are available with the Ultra low-emissions technology. This breakthrough technology was developed in 2009 and 2010 as part of a research effort funded by the California Energy Commission and Southern California Gas Company. The objective was to bring our emission control systems into compliance with California's standards, which are the most stringent in the United States.

We were able to meet or exceed the standards with an emission control system that is cost-effective, robust, and reliable. The Ultra low-emissions technology keeps our CHP systems compliant with air quality regulations over the

long term. Given the proprietary nature of this work, we filed patents that are pending in the U.S. and Europe. We shipped the first commercial CHP units equipped with Ultra low-emissions technology 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.

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2. Verifying longevity and reliability in the field. We did so by equipping one of our TECOGEN 75-kW units, already operating at a customer location in Southern California, with the Ultra low-emissions technology and a device to monitor emissions continuously. To date, the Ultra low-emissions system has operated successfully for more than 13,000 hours (1½ years) and has consistently complied with California's emission standards. This field test is ongoing.

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 Ultra low-emissions systems to several customers.

Contribution to Revenue

The following table summarizes net revenue by product line and services for the years ended December 31, 2012 and 2011:

	December 31, 2012	December 31, 2011
Products:		
Cogeneration	$5,791,412	$2,737,161
Chiller	1,661,810	1,831,952
Total Product Revenue	7,453,222	4,569,113
Services	7,800,750	6,496,097
Total Revenue	$15,253,972	$11,065,210

Product Reliability

Our product lines 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 (% of hours). Figure 8 shows cumulative data for a fleet of 365 units. More than 80% of them operate above 90% availability, with the average being 93.5%. By comparison, the average availability for all U.S. fossil-fueled power plants was 87.5% during 2006-2010, according to a report by the North American Electric Reliability Corporation.

Figure 8 - Tecogen Product Reliability
Source: Tecogen Inc.

Product Service

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We provide long-term maintenance contracts, parts sales, and turnkey installation through a network of eight well-established field service centers in California, the Midwest, and the Northeast. These centers are staffed by full-time Tecogen technicians, working from local leased facilities. The facilities provide offices and warehouse space for inventory.

Our service managers, supervisors, and technicians work exclusively 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 manufacturing facility in Waltham, Massachusetts.

R&D Capabilities

Our research and development tradition and ongoing programs have allowed us to cultivate deep engineering expertise and maintain continuity over several decades. We have strong core technical knowledge that is critical to product support and enhancements. Our TecoDrive engine, cogeneration and chiller products, InVerde, and most recently the InVerde Ultra and Ilios heat pump water heater were all created and optimized with both public and private funding support.

At this time, we have two funded research contracts. The first is a $1 million program with the California Energy Commission, awarded in 2009, to develop a small CHP engine (about 35 kW) that uses advanced automotive technology. The engine achieves a nearly 20% fuel efficiency gain over our current TecoDrive technology. Since the endurance test was completed in 2012, we will transition to the latest model year advanced engine and introduce it in our products sometime in 2014.

Once an endurance test is completed in 2012, we expect to introduce this engine into the Ilios heat pump water heater and possibly into a small InVerde unit. The second contract, awarded in 2012, is with the U.S. Department of Energy’s Lawrence Berkeley National Laboratory for microgrid development work related to the InVerde.

Distribution Methods

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, including American DG Energy and EuroSite Power which are affiliated companies, for certain territories and product lines. For example, we have sales representatives for the chiller market in the New York City/New Jersey territory, but we do not have a sales representative for our cogeneration products in this territory. Sales through our in-house team or sales that are not covered by a representative’s territory carry no commission or only a fractional one.

In New England, our affiliate, American DG Energy, has exclusive sales representation rights to our cogeneration products only (not including chillers). In other words, when Tecogen sells its cogeneration products in New England, Tecogen pays a commission to American DG Energy. American DG Energy also has exclusive rights to our Ultra low-emissions technology if it is applied to engines from other CHP manufacturers in projects developed by American DG Energy. This means that American DG Energy could purchase CHP products from suppliers other than us and license that supplier to incorporate our Ultra low-emissions technology as long as the CHP system is owned and operated American DG Energy.

Summary of our Products’ Advantages

- Our CHP products provide an efficient on-site solution to power generation as the market seeks cost savings and clean alternatives to centralized grid power.

Our CHP products are all standard, modular units that come pre-packaged from the factory to simplify installation and grid connection. The systems are supported in the field by a nationwide network of experienced professional staff.

- Standardized CHP units, as opposed to custom-designed systems, achieve lower cost, better quality control, higher reliability, and easier service. Emission controls are integrated, and complete system warranty and maintenance are available.
- Our Ultra low-emissions technology eliminates the air quality concerns associated with engines. Our units comply with the most rigorous air quality regulations, including California's.
- Our cogeneration systems and chillers use standard, well-proven equipment made by reputable, well-established manufacturers. These components include rugged automotive engines, certified inverters, commercial generators, and conventional compressors. Certain key components are proprietary and have patent protection. Most notably, all control software is either proprietary (and copyright protected) or under an exclusive license agreement. Suppliers of the InVerde's inverter and generator hold certain related patent protection.

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- All of our CHP products can be designed for installation of multiple units at a single site, depending on the customer's particular needs. This enhances the ability of our products to meet the building's varying demand for electricity, heat, and/or air conditioning throughout the day and from season to season. Also, multiple units operate more efficiently throughout the range of a customer's high and low energy requirements.
- Our InVerde products are opening new market opportunities and expanding our reach to customers beyond our traditional market segments. The InVerde's black-start feature addresses a crucial demand from customers concerned about utility blackouts and brownouts, natural disasters, security threats, and antiquated grid infrastructure. The InVerde also provides premium-quality power, which is required by operators of computer server farms and precision instrumentation, for example.
- The InVerde overcomes barriers related to grid interconnection, since the product is UL-certified as utility-safe. In microgrids, InVerde units can help prevent brownouts by maximizing their power output when utilities approach peak capacity. Unlike standby diesel generators, the InVerde can operate without hourly limits because its emissions are so low, and it can serve as a stable anchor in hybrid microgrids that incorporate solar power.
- Our extensive use of standardized components lets us manufacture CHP products at competitive prices, even at relatively low production volumes. Proven, well-understood hardware increases the reliability and durability of the equipment and reduces the cost of servicing in the field. We are also able to minimize spare parts inventories and simplify training requirements.
- The Ilios heat pump water heater roughly doubles the efficiency of conventional heat pump systems. The Ilios heat pump targets a large international market that is characterized by heavy, year-round use. This will increase fuel savings and maximize return on investment for the customer. Also, such applications are mostly central heating and cooling systems, rather than units distributed throughout the building, so it is easier to integrate new equipment. The heat pump water heater product competes only against other gas-fueled water heaters, which could expand our market beyond areas with high electric rates, and regulatory issues should be minimal. As of the date of this report, we have sold one Ilios water heater and have five in production to fulfill current orders.

Competitive Position and Business Conditions

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. Renewable power sources, such as wind and solar do not improve heating inefficiencies as CHP systems do, so they do not compete with our products. That is, CHP utilization is based on the redirection of fuel from an onsite boiler to an engine (or other device) for the production of electricity; the waste heat from the engine meets the heating load of the site with only a small incremental fuel consumption increase, but with the benefit of a significant amount of electricity production. As the boiler output cannot be displaced by renewable electricity production – the output of which is far more valuable displacing utility electric power, than used for water heating – the CHP opportunity remains available even in sites fully exploited relative to their renewable potential.

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Cogeneration Systems

The ICF report breaks down the CHP market by technology as provided in Figure 9 below. We believe the California data applies to the domestic and international CHP market as a whole.

Figure 9 — Technology Size and Market Position
Source: ICF International, Combined Heat and Power Market Assessment (2010)
(Data from 2004)
Our CHP products use automotive reciprocating engines originally designed for gasoline fuel and modified to run on natural gas. Diesel-fueled reciprocating engines will remain prominent in the CHP market, but only in larger, custom-designed systems (a megawatt or more), so these products do not compete with ours.

In smaller CHP sizes, competitors have duplicated our older design, coupling an automotive engine to a single-speed generator and adding controls and heat recovery. To be competitive with our designs, however, they would have to acquire comparable experience in the equipment and technology, installation contracting, maintenance and operation, economic evaluation of candidate sites, project financing, and energy sales, as well as the ability to cover broad regions. They would also have to meet the price of our products, which is low because we use standardized components.

We believe that no other company has developed a product that competes with our inverter-based InVerde, which offers UL-certified grid connection, outage capability, and variable-speed operation. We anticipate that an inverter-based product with at least some of these features will be introduced by others, but we believe that they will face serious challenges in duplicating the InVerde. Product development time and costs would be significant, and we expect that our patents and license for microgrid software will keep others from offering certain important functions.

If our patent application relating to the Ultra low-emissions technology is approved, it will make the development of alternative technologies difficult. If this is the case, we could retain a strong competitive advantage for all our products in markets where severe emissions limits are imposed or where very clean power is favored, such as New Jersey, California, and Massachusetts.

Newer technologies such as fuel cells and microturbines pose limited competition to our CHP products. Reciprocating engines enjoy an economic advantage, and our Ultra low-emissions products are a lower cost, more efficient CHP alternative, with approximately equal emissions.

Besides their expense, fuel cells cannot recover enough heat to serve building loads effectively, and microturbines also recover less heat than our products. Microturbines also have to pressurize their own gas fuel, reducing their electrical output. Most manufacturers of microturbines have refocused on other markets. We believe that Capstone Turbine Corporation is the only microturbine manufacturer with a commercial presence in CHP.

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. Table 3 summarizes the technologies competing in the small CHP market, and Figure 10 reveals the modest impact of microturbines and fuel cells in California’s CHP space.

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Table 3- Comparison of CHP Technologies to Tecogen's InVerde 100
Source: ICF International, Combined Heat and Power Market Assessment (2010) and Tecogen Inc.

	Microturbine* 50-500 kW	Fuel Cell* 50-500 kW	Generic Engine* 100 kW	Tecogen INV-100** 100 kW
Installed Costs, $/kW	2,739	6,310	2,210	N/A
Heat Rate, Btu/kWh	13,542	9,475	12,000	12,630
Electric Efficiency, %	25.2 %	36.0 %	28.4 %	27.0 %
Thermal Output, Btu/kWh	6,277	2,923	6,100	6,700
Overall Efficiency, %	72 %	67 %	79 %	80.0 %
O&M Costs, $/kWh	0.022	0.038	0.020	N/A
NOx [ppm @ 15% O2)	3.41	1.15	3.39	0.62
NOx Emissions, lbs/MWh	0.17	0.04	0.15	0.03
NOx Emissions, lbs/MWh w/CHP Credit	0.06	N/A	0.05	0.01

*ICF International Combined Heat and Power Market Assessment (2010).
**Tecogen emissions obtained from actual source test data by a third-party air quality testing company in California.

Figure 10 – Share of Installed CHP by Prime Mover in California
Source: ICF International Combined Heat and Power Market Assessment (2010) - (Data from 2008)

Engine Driven Chillers (TECOCHILL)

According to the Energy Solutions Center (a non-profit consortium), three companies make gas-engine-driven chillers that compete with our products: Trane, a division of Ingersoll-Rand plc, York, a division of Johnson Controls, Inc. and Alturdyne. However, these competitors have been largely inactive in this market in recent years. Natural gas can also fuel absorption chillers, which use fluids to transfer heat without an engine drive. Absorption chillers are manufactured by eight companies, but these competitors also have been largely inactive in this market.

Today's low natural gas prices in the U.S. improve the economics of gas-fueled chillers, so more competition could emerge. However, engine chillers will continue to have an efficiency advantage over absorption machines. Chiller performance is measured in terms of cooling energy output per unit of fuel input. This industry standard is called the coefficient of performance, or COP. Absorption chillers achieve COPs of about 1.2 (see, for example, The Chartered Institution of Building Services Engineers' Datasheet 07, Absorption Cooling, February 2012). Our TECOCHILL products reach efficiencies well above that level (COPs ranging from 1.6 to 2.6).

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Ilios Engine-Driven Heat Pump

Although a few companies manufacture gas-engine heat pumps, their products are not directly comparable to the Ilios. The Ilios water heater and other heat pump products compete in both the high-efficiency water heating market and the CHP market. In a typical building, the Ilios heat pump would be added on to an existing heating/water heating system, but would be operated 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.

The best customers for the Ilios heat pump water heater would be very similar to those for traditional CHP – heavy consumers of hot water and process heat. In areas where low electric rates make CHP not 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 work economically. As of the date of this report, we have sold one Ilios water heater and have five in production to fulfill current orders.

Intellectual Property

We currently hold several patents for our technologies. In addition, our control software is protected by under an exclusive license agreement. We consider our patents and license to be important in the present 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 was issued in 2006 and expires on 2022. Most of our patents expire between 2022 and 2025.

We believe that no other company 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 they will face serious challenges in duplicating the InVerde. Product development time and costs would be significant, and we expect that our patents and license for microgrid software will keep others from offering certain important functions.

We have recently filed for patents in the U.S. and Europe for our Ultra low-emissions technology to keep its use exclusive to us. The outcome of the patent office application review is important because this technology will apply to all of our gas engine-driven products and may have licensing application to other natural gas engines. There is no assurance, however, that the Ultra low-emissions patent applications will be approved.

Government Regulation and Its Effect on Our Business

Several kinds of government regulations affect our current and future business, such as:
- Product safety certifications and interconnection requirements;
- Air pollution regulations, which govern the emissions allowed in engine exhaust;
- State and federal incentives for CHP technology; and
- Electric utility pricing and related regulations.

Regulations that control air quality and greenhouse gases might increasingly favor our low-emission products. Regulations related to utility rates and interconnection, which are burdensome today, could evolve to embrace CHP because of its efficiency benefits.

Product Safety Certifications and Interconnection Requirements

Our products must comply with various local building codes and must undergo inspection by local authorities. Our products are also certified by a third party to conform to specific standards. These certifications require continuous verification by a company that monitors our processes and design every three months. Our InVerde product is also certified to Europe's standard CE mark (European Conformity), which is mandatory for products imported into the European Union for commercial sale.

Our cogeneration CHP products are also certified to a particular group of standards specific to the distributed power industry, which are used in the utility interconnection permitting process. These unique certifications were developed by various manufacturers, utilities, and government regulators to standardize the process of getting the utility's permission to jointly power a facility.

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In essence, manufacturers of standard products are allowed to submit a sample unit to be “type-tested” by a Nationally Recognized Testing Laboratory. This test proves that the product adheres to safety requirements and that its design is fail-safe. The product then becomes eligible for a fast-track interconnection, after passing simple site-specific screens. Under state-mandated regulations, such as California Rule 21 and Massachusetts Interconnection Tariff 09-03, most utilities must accept the fast-track process, which includes the certification.

Simplified utility interconnection is important to CHP projects, so our interconnect certification, Underwriters Laboratory Standard 1741, or UL Certification, is a significant competitive advantage. Obtaining the UL Certification was a major reason for us to develop the inverter-based CHP product. As with our other product certifications, we plan to maintain the certification through routine processes when modest design changes occur. When complete recertification is required, such as when a new revision to the standard is applicable or when the design undergoes a major upgrade, the company will follow the normal procedures for first-time certification (third party design review and test verification). The company does not anticipate any changes to the standard that would be preclude recertification, as the underlying content is carefully administered by balanced committees (representing utilities, inverter suppliers, and academia). In addition, the standard and its utilization as the criteria for systems to qualify for simplified interconnection programs, is important for the solar PV industry. The company believes that this importance to the solar industry will help assure the long-term relevance in interconnection of distributed generation devices.

Air Pollution Regulations

Stationary natural gas engines are subject to strict emissions regulations that are part of a complex hierarchy of regional, state, and federal regulations. The EPA establishes technology-specific standards that are based on cost-benefit analysis for emission control strategies. These standards, termed BACT (best available control technology), are imposed in regions that fail to meet federal clean air standards. Local regulators can and do restrict engine emissions to lower levels.

In some instances, regional standards in our key markets have become sufficiently strict, presenting a challenge in controlling pollution from natural gas engines. However, our development of the Ultra low-emissions technology has addressed this issue, allowing us to permit our equipment in the strictest region of Southern California. In January 2013, a state-certified source test at a new customer's site verified that our emissions levels were well below the new permitting requirements. Since we have now successfully removed this barrier, we are not only competitive in the California market, but have an advantage as a cleaner CHP technology. Likewise, in the Northeast where emissions regulations are trending towards California levels, we have already established our Ultra CHP as a certified technology in New Jersey, exempt from the air permitting process and subsequent testing, a unique status that separates us from the competition.

On the East Coast, important CHP territories are also moving toward limits below federal BACT levels. Effective in 2012, Massachusetts, Rhode Island, and Connecticut require 3.6 ppm NOx and about 56 ppm CO, which is on par with California’s BACT standard. New Jersey also emulates California’s BACT, but allows the project to side-step the air permit process if the CHP device is “emissions certified” through third-party testing to 10 ppm NOx and 10 ppm CO. Our Ultra low-emissions technology has qualified for New Jersey’s “clean” certification, as noted earlier. In New York, clean power is encouraged through state grants that exclude products, or reduce the grant amount, unless low emissions are demonstrated.

Air emissions regulations also affect our air conditioning and Ilios heat pump products, though the effects are muted. TECOCHILL rebates are not common, and none has been tied to a specific emissions level. The heat pump’s small

size often exempts it from regulations, and the market for heat pump products could lie in lightly regulated regions (those with low electric rates). Nevertheless, the Ultra low-emissions technology can be applied to these products if required to meet regulatory standards.

State and Federal Incentives

On August 30, 2012, the White House released an Executive Order to accelerate investments in industrial energy efficiency, including CHP. The goal of the Executive Order is to supply 40 gigawatts of energy by 2020 from greater efficiency such as CHP systems. The DOE, Commerce, and Agriculture, and the Environmental Protection Agency, in coordination with the National Economic Council, the Domestic Policy Council, the Council on Environmental Quality, and the Office of Science and Technology Policy, shall coordinate policies to encourage investment in industrial efficiency in order to reduce costs for industrial users, improve U.S. competitiveness, create jobs, and reduce harmful air pollution. With this Executive Order, it is expected that barriers to CHP development will be removed with effective programs, policies, and financing opportunities resulting in $40 - $80 billion in new capital investment in CHP. This initiative by the U.S. government may boost CHP awareness and stimulate market activity.

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In addition, some states offer incentives to CHP systems. As mentioned above, California rebates a significant portion of the CHP project cost, while incentives of similar value exist in New Jersey, New York, Connecticut, Maine, and Massachusetts, albeit with different structures and terms. Massachusetts has an additional CHP incentive in the form of an annual rebate proportional to the carbon savings versus conventional technology.

Our products are also eligible for the bonus depreciation included in the 2009 American Recovery and Reinvestment Act. Also, the 2008 Troubled Asset Relief bill provides a 10% investment tax credit for CHP in our size range, which applies to the total project cost. Our TECOCHILL and heat pump products also qualify for the credit when heat recovery achieves a minimum 60% efficiency.

Electric Utility Pricing and Related Regulations

Electricity prices, rate structures, and tariffs are another form of government incentive or disincentive. Utility pricing is administered through state agencies, typically public utility commissions, through formal proceedings involving the public, utilities, and various affected parties. Often, direct legislative mandates apply to specific issues. How these rules are structured and interpreted has a significant impact on the economic viability of CHP. These rules have hurt the CHP industry in the past, but we have designed our products to undermine their impact.

Demand Charges. Many electric utilities structure their commercial rates such that part of the customer's bill is fixed charges such as meter fees, and part is peak demand charges, which are a much larger line-item based on the building's maximum short-term usage (typically 15 minutes). Fixed charges, usually small, are not addressed by CHP technology. Avoidance of peak demand charges requires a CHP system to always operate at extremely high efficiency, which is difficult to achieve in practice.

Our CHP products, being small and modular, are often installed as multiple units. This protects the customer to some degree from incurring peak demand charges at the full system rating. A single large generator has a good chance of going down briefly at some point during the monthly billing period. The customer would then have to buy more electricity to make up for it, possibly incurring a large demand charge. With a modular, multi-unit CHP system, all the units would have to fail simultaneously to incur an equivalent charge.

Our TECOCHILLs are highly effective in eliminating not only summertime electricity usage, but also peak demand charges. The chiller's operation is confined to the cooling season, allowing maintenance to be scheduled for other times. Outages during the cooling season can be managed to minimize their impact.

Avoided-Cost Penalties. In some regions, utilities have argued that CHP customers, by reducing their electric usage, have avoided paying their fair share of the costs associated with grid infrastructure. To correct this perceived inequity, some utilities have successfully petitioned their state commissions to impose a "departing load charge." Utilities have also been allowed to add a "standby" surcharge to compensate for the cost of utility power being available when the CHP system is down.

These types of charges are not prevalent in East Coast states, but both standby and departing load charges are well-established in California. Although our CHP products are affected, our chillers and heat pumps are not.

Technology-Specific Net Metering. Interconnection issues are safety-related and should be product-neutral, but technology bias is common. In many states, CHP is excluded from net metering while other technologies are eligible. Under net metering, utilities must pay on-site generators for excess electricity that's fed into the grid. Net metering makes it easier to manage the operation of a CHP system or other generator.

Other Utility-Related Regulations. Another category of utility regulation that might affect our business is Renewable Portfolio Standards, or RPS. Under this type of regulation, utilities must gradually increase the share of their power generation that comes from renewable sources. Among states with RPS mandates, 14 include CHP as an eligible technology. Together, these states account for more than half of the electricity sales in the United States. RPS-type mechanisms have been adopted in several other countries, including Britain, Italy, Poland, Sweden, Belgium, and Chile.

Overall, RPS appears to be a positive policy for Tecogen and CHP. Program structures, if fair and balanced, encourage less fossil fuel use by offering financial incentives to improve efficiency. Electric power generated from renewable sources would tend to increase overall electric rates and improve CHP investment returns. Since these programs are in their early stages, their impact is yet to be determined.

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A national carbon “cap and trade” program is not anticipated in the foreseeable future. Cap and trade programs seek to reduce carbon emissions by putting a price on them. Of possible impact to Tecogen is the cap and trade bill moving forward in the California legislature. The program’s details are still being reviewed and negotiated by various government and advocacy groups.

Employees

As of December 31, 2012 , the Company employed 61 full-time and 4 part-time employees. We believe that our relationship with our employees is satisfactory. None of our employees are represented by a collective bargaining agreement; however, a few of our New Jersey and New York City service employees have been in contact with a labor union, and we are currently negotiating with this labor union.

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Item 1A. Risk Factors

The securities offered herein are highly speculative and should be purchased only by persons who can afford to lose their entire investment in us. You should carefully consider the following risk factors and other information in this Annual Report on Form 10K before deciding to become a holder of our Common Stock. If any of the following risks actually occur, our business and financial results could be negatively affected to a significant extent.

Risks Relating to Our Business

Our business faces many risks. If any of the events or circumstances described in the following risks occurs, our business, financial condition, or results of operations could suffer and the trading price of our Common Stock (if and when it becomes publicly traded) could decline. Investors and prospective investors should consider the following risks and the information contained under the heading “Warning Concerning Forward-Looking Statements” before deciding whether to invest in our Common Stock.

Our operating history is characterized by net losses. We anticipate further losses, and we may never become profitable.

For each of our last five fiscal years and prior thereto, we have incurred annual operating losses. We expect this trend to continue until such time that we can sell a sufficient number of systems and achieve a cost structure to become profitable. We may not have adequate cash resources to reach the point of profitability, and we may never become profitable. Even if we do achieve profitability, we may be unable to increase our sales and sustain or increase our profitability in the future.

We experience significant fluctuations in revenues from quarter to quarter due to a preponderance of one-time sales.

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. For example, when compared to the previous quarter, our revenues in 2010 decreased during the first, second and fourth quarters and increased during the third quarter. In 2011, our revenue decreased during the first and fourth quarters and increased during the second and third quarters. In 2012, our revenues increased during the first, second and fourth quarters and decreased during the third quarter Fluctuations cannot be predicted because they are affected by the purchasing decisions and timing requirements of our customers, which are unpredictable.

We may be unable to fund our future operating requirements, which could force us to curtail our operations.

To the extent that our funds are insufficient to fund our future operating requirements, we would need to raise additional funds through further public or private equity or debt financings depending upon prevailing market conditions. These financings may not be available to us, or if available, may be on terms that are not favorable to us and could result in significant dilution to our stockholders and reduction of the trading price of our stock (if then publicly traded). The state of worldwide capital markets could also impede our ability to raise additional capital on favorable terms or at all. If adequate capital were not available to us, we likely would be required to significantly curtail our operations or possibly even cease our operations.

We believe that our existing resources, including cash and cash equivalents and future cash flows from operations, are sufficient to meet the working capital requirements of our existing business through 2013. After that our cash requirements may increase.

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 would be required to deliver even larger volumes of technically complex products or components to our customers on a timely basis and at a reasonable costs to us. We have never ramped up our manufacturing capabilities to meet 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.

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