CLEARSIGN COMBUSTION CORP
Form 10-K
March 27, 2018

UNITED STATES

SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM 10-K

(Mark One)

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

For the fiscal year ended December 31, 2017

OR

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

For the transition period from _____ to _____

Commission file number 001-35521

CLEARSIGN COMBUSTION CORPORATION

(Exact name of registrant as specified in its charter)

WASHINGTON	**26-2056298**
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)

12870 Interurban Avenue South

Seattle, Washington 98168

(Address of principal executive offices)

(Zip Code)

(206) 673-4848

(Registrant's telephone number, including area code)

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	**Name of each exchange on which registered**
Common Stock, par value $.0001	The NASDAQ Stock Market LLC

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ¨ No x

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 x

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 x 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 (§ 229.405 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 x 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 registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. x

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 ¨	Accelerated filer ¨
Non-accelerated filer ¨ (Do not check if a smaller reporting company)	Smaller reporting company x
	Emerging growth company ¨

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. ¨

Indicate by check mark whether the issuer is a shell company (as defined in Rule 12b-2 of the Exchange Act).

Yes ¨ No x

State the aggregate market value of the voting and non-voting common equity held by non-affiliates computed by reference to the price at which the common equity was last sold, or the average bid and asked price of such common equity, as of the last business day of the registrant's most recently completed second fiscal quarter.

As of June 30, 2017, the aggregate market value of the voting and non-voting common equity held by non-affiliates computed by reference to the last sale price of the common equity was $57,000,000.

Indicate the number of shares outstanding of each of the registrant's classes of common stock, as of the latest practicable date.

As of March 27, 2018, the registrant has 21,358,853 shares of common stock, par value $.0001, issued and outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's Proxy Statement for the 2018 Annual Meeting of Shareholders are incorporated herein by reference in Part III of this Annual Report on Form 10-K to the extent stated herein. Such proxy statement will be filed with the Securities and Exchange Commission within 120 days of the registrant's fiscal year ended December 31, 2017.

Combustion Corporation

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SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS AND OTHER INFORMATION CONTAINED IN THIS REPORT

This Annual Report on Form 10-K contains forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995 and the provisions of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. Forward-looking statements give our current expectations or forecasts of future events. You can identify these statements by the fact that they do not relate strictly to historical or current facts. You can find many (but not all) of these statements by looking for words such as "approximates," "believes," "hopes," "expects," "anticipates," "estimates," "projects," "intends," "plans," "would," "should," " or other similar expressions in this report. In particular, these include statements relating to future actions; prospective products, applications, customers and technologies; future performance or results of any products; anticipated expenses; and future financial results. These forward-looking statements are subject to certain risks and uncertainties that could cause actual results to differ materially from our historical experience and our present expectations or projections. Factors that could cause actual results to differ materially from those discussed in the forward-looking statements include, but are not limited to:

- our limited cash and our history of losses;
- our ability to successfully develop and implement our technology and achieve profitability;
- our limited operating history;
- emerging competition and rapidly advancing technology in our industry that may outpace our technology;
- customer demand for the products and services we develop;
- the impact of competitive or alternative products, technologies and pricing;
- our ability to manufacture any products we design;
- general economic conditions and events and the impact they may have on us and our potential customers;
- our ability to obtain adequate financing in the future;
- our ability to continue as a going concern;
- our success at managing the risks involved in the foregoing items; and
- other factors discussed in this report.

Forward-looking statements may appear throughout this report, including without limitation, the following sections: Item 1"Business," Item 1A "Risk Factors," and Item 7 "Management's Discussion and Analysis of Financial Condition and Results of Operations." The forward-looking statements are based upon management's beliefs and assumptions and are made as of the date of this report. We undertake no obligation to publicly update or revise any forward-looking statements included in this report. You should not place undue reliance on these forward-looking statements.

Unless otherwise stated or the context otherwise requires, the terms "ClearSign," "we," "us," "our" and the "Company" refer to ClearSign Combustion Corporation.

PART I

ITEM 1: BUSINESS

Introduction

We design and develop technologies for the purpose of improving key performance characteristics of combustion systems, including emission and operational performance, energy efficiency and overall cost-effectiveness. We believe that our patented Duplex™ technology is capable of enhancing the performance of combustion systems in a broad range of markets, including the energy (upstream oil production and down-stream refining), commercial/industrial boiler, chemical, petrochemical, and power industries. Our Duplex technology, which is our primary technology, uses a porous ceramic tile above a standard burner to significantly reduce flame length and achieve very low emissions without the need for external flue gas recirculation, selective catalytic reduction, or excess air systems. To date, our operations have been funded primarily through sales of our equity securities. We have earned nominal revenue since inception in 2008.

While we have recently begun commercializing our Duplex technology, Duplex has had limited testing and verification by independent third parties and, based on the results of our laboratory and field testing as well as our initial commercialized installations in different applications, we believe that this proprietary technology is capable of improving emissions control performance and operational performance for many types of industrial and commercial combustion systems. As a result, we also believe that Duplex may reduce costs associated with the construction (including refurbishment and upgrade), operation and maintenance of these combustion systems as compared to combustion systems that use no or alternative technology to enhance combustion and control emissions.

Based on the results of our testing, we believe that Duplex compares favorably with current industry-standard air pollution control technologies, such as selective catalytic reduction devices, low- and ultra-low NOx burners (which address nitrogen oxides or NOx), excess air systems and other similar technologies. Such systems are used in our current target market segments of petroleum refining and petrochemical process heaters, large-scale once through steam generators (OTSGs), enclosed ground flares, and packaged boilers.

Corporate History

We were incorporated in Washington on January 23, 2008. The address of our corporate headquarters is 12870 Interurban Avenue South, Seattle, Washington 98168 and our telephone number is (206) 673-4848. Our website can be accessed at www.clearsign.com. The information contained on or that may be obtained from our website is not a part of this report.

Recent Developments

On July 28, 2017 we formed ClearSign Asia Limited, a Hong Kong corporation. On November 20, 2017, we announced that we received a Letter of Intent from TG CITIC Environment Investment Group (TG CITIC), which is a joint venture between Tangshan Iron and Steel Group Company Limited and CITIC Group Corporation Ltd. The Letter of Intent from TG CITIC indicates their interest in investing in ClearSign Asia Limited as well as assisting in accelerating the marketing and promotion of our products for the Chinese market. We expect to reach a definitive agreement TG CITIC in 2018, however no assurance can be given that any definitive agreement will be entered into. Based in Hong Kong, ClearSign Asia Limited will have exclusive rights in greater China and key markets in the Asia Pacific region to certain of our intellectual property.

Our Industry

The combustion and emissions control markets are significant, both in the wide array of industries in which the systems are used and in the amount of money spent in installing and upgrading systems. These are used to provide heat for all manner of industrial processes, including boilers, furnaces, kilns and turbines. In order to maximize energy efficiency while keeping pace with regulatory guidelines for air pollution emissions, operators of these systems are continually installing, maintaining and upgrading a variety of costly process control, air pollution control and monitoring systems. Although we believe that there are many potential markets for our Duplex technology, to date we have limited the introduction of Duplex to certain segments including petroleum refining process heaters, steam generation, and enclosed ground flares.

Our initial target markets center on the energy sector, including upstream crude oil production through the use of OTSGs and wellhead enclosed flares and downstream oil refineries through the use of process heaters and boilers. In recent years, the energy sector has been significantly affected by the volatile market price of crude oil and marginal economic growth. Crude oil prices have stabilized during 2016 and 2017 and enjoyed appreciation with the general post-election upswing in certain commodities and improved economic outlook. According to the U.S. Energy Information Administration, the spot price of West Texas intermediate crude oil in the last five years has ranged from approximately $110 per barrel to approximately $25 per barrel, with 2017 prices ranging from $42 to $64 per barrel and February 2018 prices approximating $62 per barrel. Regardless of the effect of crude oil price volatility, based upon our experience and feedback from current and prospective customers, we believe that the value of our Duplex technology to the energy sector continues to be validated because of the technology’s ability to cost-effectively lower emissions and drive certain operational efficiencies.

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Operators in all of our target markets are under intense pressure to meet current and proposed federal, state and local pollution emissions standards. The standards applicable to our target markets have been developed over the past 50 years with broad political input. Due to the localized effects of poor air quality, we expect these standards to continue to become more stringent regardless of political leadership. We believe this to be the case in the U.S. and worldwide in most major developed and developing countries. As an illustration, air pollution emission standards are most stringent in the states of California and Texas, historically politically leaning in opposite directions. As a result, these standards are a significant driver in our development and sales efforts. We believe that our Duplex technology can provide a unique, cost-effective pollution control solution for operators in comparison to all known competing products.

Emissions standards largely emanate from the Clean Air Act, which is administered by the Environmental Protection Agency (EPA) and regulates six common criteria air pollutants, including ground-level ozone. These regulations are enforced by state and local air quality districts as part of their compliance plans. As a precursor to ground-level ozone, NOx is a regulated emission by local air quality districts in order to achieve the EPA limits. The 8-hour ground-level ozone regulations have been reduced from 84 parts per billion (ppb) in 1997, to 75 ppb in 2008, and 70 ppb in 2015, with the requirement of realizing these levels approximately 25 years following the year of legislation. The areas of non-attainment related to this 1997 limit of 84 ppb are depicted below in the map on the left and the projected areas of non-attainment related to the 2015 limit of 70 ppb are depicted below in the map on the right.

Non-attainment areas under the 1997 limit of 84 ppb *Projected non-attainment areas under the 2015 limit of 70 ppb*

Source: EPA, August 2016 *Source: URS, August 2015*

Additionally, we believe that current emissions standards in Europe, China and Canada will continue to trend towards stricter air emission standards as these jurisdictions seek to achieve cleaner air. Existing and new emissions standards in such jurisdictions may create additional market opportunities for us.

We have noted that local air quality districts in EPA designated “severe non-attainment zones” in California are uncertain as to how they will achieve the 2015 standard. As such, we believe that local regulators are in search of additional means beyond those included in the current regulations to comply with the impending standards. For example, although NOx emissions from refineries and other oil production and processing operations are highly regulated since they are historically a significant source of stationary NOx emissions, enclosed ground flares have not historically been viewed as a source requiring the same level of regulation. We believe that our Duplex technology is uniquely able to address the emissions challenges being faced by oil producers and other industries as those challenges relate to both current and reasonably predictable future local air emission standards.

Our Technologies

In the process of attempting to develop our ECC technology beyond laboratory scale for a potential process heater design in 2013, we developed Duplex, which is a simplified application for gaseous fuel. While we continue to pursue development of our ECC technology through laboratory testing, in 2014 we began to pursue field development and conditional sales of our Duplex technology. We engaged in a number of field development projects in which we successfully demonstrated the technology operating with thermal output of up to 62 million BTU/hr in an OTSG and pursued business development and marketing activities with established entities that use steam generators, process heaters, enclosed flares, boilers, and other combustion systems as well as original equipment manufacturers (OEMs).

We have completed several field test projects in three of our five target markets using our Duplex technology: one related to wellhead enclosed flares, four related to process heaters in the oil refining industry, and three related to OTSGs in the enhanced oil recovery industry. We believe that the successful completion of these field development projects, which resulted from years of research and development work, is fundamental to the commercialization of our Duplex product. We reported our first meaningful product sales of $621,000 during the second half of 2016 from the installation of our Duplex technology through retrofits of a wellhead enclosed flare for a major California oil producer, an enhanced oil recovery OTSG, and two refinery process heater projects. Furthermore, we entered into an agreement to supply the oil producer customer with 5 additional wellhead enclosed flare retrofits for $900,000 and in 2017 we delivered three units generating sales revenue of $540,000. The remaining two units were completed and installed in the first quarter of 2018. Our laboratory research currently focuses on enhancing our Duplex products and includes the development of a packaged boiler application that enhances operational performance by eliminating flue gas recirculation.

Product Applications of Duplex

We have to date applied our Duplex technology through retrofits of existing burners. These often involve engineering around an existing burner architecture that can complicate the Duplex installation. Because of this, we believe that the retrofit market is best suited for larger projects and larger applications of Duplex.

Process Heaters in the Oil Refining Industry

We have completed laboratory testing and our first field test at a Texas oil refinery of a new burner product for refinery and industrial process heater applications. To date we have successfully retrofitted two process heaters with the standard Duplex and one with the Duplex Plug & Play™ design. We have two additional installations in process. The Duplex Plug & Play design provides a more simplified, pre-engineered and standardized direct burner replacement for traditional refinery process heaters. We believe that this product will reduce the customized engineering associated with typical retrofits and lend itself to mass production. The product derives its name from the fact that it is designed to allow quick and easy installation into a multi-burner heater or furnace and possibly allow the heater to continue operating during installation rather than be shut down. If field testing continues to confirm this design attribute, the ability to install the Duplex Plug & Play while the remaining burner system is operational will allow customers to limit down time and shorten the sales cycle often prolonged by annual or semi-annual scheduled maintenance. We plan to continue field testing of additional configurations and burner sizes to further enhance the performance and dependability of the product. If successful, we believe that this product, our first complete burner product, will be suitable for licensing and potential manufacturing arrangements with original equipment manufacturers (OEMs) with established manufacturing and distribution capabilities.

Wellhead Enclosed Ground Flares

A major California oil producer approached us in early 2016 to address a unique emission compliance need relating to wellhead enclosed ground flares. We developed a Duplex application, completed the wellhead enclosed ground flare retrofit and received payment in the third quarter of 2016, thereby recognizing $260,000 of revenue. This was an important milestone because it demonstrated the broad application of our Duplex technology. As a result, we entered into an agreement to supply this oil producer with five additional wellhead enclosed flare retrofits for $900,000, with three units completed during 2017. The remaining two units were completed in the first quarter of 2018. We previously received 40% of the contract amount as an initial payment on these units, which is standard for the industry for this stage of completion. These funds, netted against costs through the 2017 year end, are included in contract assets on our balance sheet as of December 31, 2017. These sales were recognized in the first quarter of 2018 as each of the remaining two units were installed and accepted by the customer and the performance obligations were completed.

Based upon discussions with local regulators and examination of regulatory reports, we believe that flare emissions are a potential target for increased regulation, in part because the success of our installations to date has shown regulators that establishing emissions standards for ground flares is possible. In anticipation of this, we are pursuing potential customers with target ground flare applications that would benefit from our proven installations.

OTSGs in Enhanced Oil Recovery Industry

We have successfully installed our Duplex technology in two OTSG projects in the enhanced oil recovery industry in Southern California. In March 2017, we entered into an agreement to complete a third installation for this customer fueled by oil field waste gas instead of natural gas. This installation was completed in the first quarter of 2018. We believe that our successful installations in the OTSG market to date are gaining regulator acceptance by the Southern California regulatory authorities and, as a result, market acceptance.

Duplex’s Emission Results and Licensing

We have now achieved emission results which exceeded current local Best Available Control Technology (BACT) levels in multiple installations in California related to three of our five target industries. We intend to continue to demonstrate Duplex capabilities through (i) working with local air quality officials to demonstrate the effectiveness of the technology, (ii) operating in-place units, (iii) engineering and testing with new customers and applications, (iv) pursuing additional lab research and development of new applications (e.g. packaged boilers) and next generation improvements to Duplex design and standardization, including the pursuit of more complete systems similar to the

Duplex Plug & Play for application in other vertical markets, and (iv) assisting our customers in making emission results available for designation as BACT by local regulatory bodies.

Our business plan contemplates licensing our technology after we prove commercial viability and generate interest from OEMs. We believe licensing would significantly change the makeup of our sales mix, sales cycles, and margins. Licensing our technology within one or an array of selected vertical markets (e.g. burners for refinery process heaters or packaged boilers) could dramatically accelerate the global sales and market adoption rate of our technology. In order to create channel flexibility and meet end user demand however, we intend to continue to pursue end user customers through direct sales, sub-contractors, or channel partners. While we are currently pursuing various licensing arrangements, we have no agreements at this time and do not anticipate entering into any such agreements prior to completing the field development projects discussed above and completing a meaningful number of installations and sales. We believe that the continuing development of Duplex, the completion of sales and an increase in end-users will enhance our ability to license our technology.

Development of ECC

We are continuing to pursue development of our patented ECC technology through laboratory research where we have demonstrated certain favorable attributes of this proprietary technology operating at lab scales. We are also developing certain derivative product expressions, some unrelated to industrial combustion products, that are being tested and validated both by the Company and by independent third parties.

Technical Components of our Duplex and ECC Technologies

Our Duplex burner technology consists of a traditional industrial burner and a porous ceramic tile. When the uncombusted mix of gaseous fuel and air is directed at the tile, hot gas combusts within the tile itself. Because the fuel and air have more time to mix, the NOx- forming hot spots that are typically produced in an open flame are greatly eliminated and a dramatically shorter flame is produced. NOx, a regulated pollutant comprised largely of nitrogen oxide and nitrogen dioxide, is greatly reduced to levels of 5ppm or below depending on the specific application without any external fans or associated power, thereby minimizing harmful emissions while improving system efficiency. A shorter flame allows for operation of the furnace at a higher capacity. We believe Duplex's radiant heat transfer enhances thermal efficiency as it eliminates the possibility of flame impingement and reduces the likelihood of coking in a combustion chamber.

Our ECC technology consists, in its simplest form, of four major components: (a) a computer, (b) standard software delivering proprietary algorithms to (c) a power amplifier (resident outside the combustion chamber) and (d) electrodes inside or proximate to the combustion chamber. ECC introduces a high voltage electric field into the combustion process to control the resulting flames electrically through the naturally forming ions. The electrodes are optimized in material and shape to best suit the specific geometry of a given installation. We have also demonstrated a technique to apply ECC to a combustion system without requiring an electrode to have physical contact with the flame.

The basic components of both systems are either available "off the shelf" or require manufacturing techniques that are well within the current capabilities of existing technologies. Thus, our products are readily available and scalable for high volume demand.

The Combustion Markets

Overview

We compete in the combustion and emissions control markets. According to the U.S. Department of Energy, in 2011, two-thirds of the energy used in U.S manufacturing is converted via boilers, furnaces, and process heaters, our core market focus. Based on the June 2016 Frost & Sullivan Market Assessment Report, we estimate that our addressable target market over the next ten years in the United States is up to $3.6 billion, comprised of up to $1.7 billion from the industrial/commercial/institutional boiler segment, up to $0.8 billion from the refinery segment, up to $0.8 billion from the large industrial segment, up to $0.2 billion from the flare segment, and up to $100 million from the enhanced oil recovery (EOR) segment.

These are highly competitive industries that are currently dominated by companies that have both substantially greater financial resources than we do and established products. Based on the testing and the field installations completed to date, however, we believe that our Duplex technology offers a unique and powerful ability to improve emissions and operational performance, energy efficiency and overall cost-effectiveness. We are targeting the following segments of the combustion market:

- ICI Boiler Segment
- Refinery and Petrochemical Segment
- Large Industrial Segment
- Flare Segment
- Enhanced Oil Recovery (EOR) Segment

In each segment, we are marketing solutions with our Duplex technology that we believe could simultaneously improve both pollution control and operational efficiency characteristics through (a) cost-effective retrofitting of our Duplex technology onto existing standard system designs, and (b) new system designs.

Market Entry

We believe that our Duplex technology can be applied to a wide range of systems in which there is a flame. While this implies many potential market opportunities, it also requires that we exercise a disciplined approach in comparatively evaluating those opportunities in order to select and prioritize those applications that are cost effective and afford the best mix of time and cost required for development relative to revenue potential. We also aim to select applications in which our technologies either offer immediate, clear, meaningful, and measurable advantages relative to competing technologies or address unmet market needs.

We have pursued retrofitting existing systems with our Duplex technology to improve their performance as we believe that provides us the quickest path to market. This is because (1) the installed base of existing combustion systems is far greater than the annual number of newly built systems, (2) integrating our technology into a retrofit is less complex than integrating our technology into a new combustion system designed by an OEM, (3) the design cycle of a retrofit application is far shorter, and (4) we believe that with the previously challenging economic and energy industry market conditions, less costly retrofits are more attractive to many segments of the energy market than new capital equipment and infrastructure builds to comply with environmental regulations and derive cost efficiencies.

Since we have completed initial retrofit projects in three vertical market installations, we believe that pursuit of new, stand-alone products, such as the Duplex Plug & Play, will enable us to substantially increase our sales to a meaningful level through licensing or other business arrangements with OEMs. Upon broader adoption of the Duplex Plug & Play, we will pursue OEMs or other means to license the product in order to take advantage of the manufacturing and distribution capabilities of more established market participants. We are planning to develop a stand-alone product for application in the packaged boiler market and intend to investigate the value of developing additional stand-alone products.

The success we have experienced in the wellhead enclosed flare, oil refining and enhanced oil recovery sectors has allowed us to capitalize on these recent product development results by refocusing our personnel and resources toward enhancing and productizing our Duplex technology in order to generate revenue. The success in these initial areas has also allowed us to work on developing the potential for installing our Duplex technology in both firetube and watertube boilers. A demonstration project on boilers is currently underway with a Chinese partner and research on this application continues in our laboratory.

Sales and Marketing Plan

Partnership Strategy and Field Development. We believe that our technologies have the potential to transform industries that rely on combustion and that our technologies are broadly applicable in large, scalable, global markets.

We intend to form strategic partnerships and/or license agreements with key incumbents who are currently participating in our targeted market segments. We expect to maintain our existing capabilities to serve our end-user customers via our current channel partners and subcontractors.

Our targeted market segment territories include North America, Europe, and China and encompass:

- end users of OEM products and services interested in incorporating our technology in order to address their operational and or environmental needs;

- large OEMs interested in our technology either as licensees or as distributors;

- government regulators such as California's South Coast Air Quality Management District, (SCAQMD), and other regulators charged with protecting the public health including the development of low emission and potentially disruptive environmental control technologies. Project funding was recently awarded to ClearSign and a refinery partner to demonstrate Duplex as a candidate for Best Available Control Technology for certain types of process heaters and boilers.

We currently are pursuing field development programs of our Duplex burner products. These programs are aimed at our target industrial combustion markets.

Pricing Strategy. Our target markets are characterized by well-established competitors in mature businesses. As a result, competitive pricing rather than pricing based on broad product value is the standard for these markets. Since we believe that our technology will provide greater economic value in comparison to our competitors, we plan to price our technology based upon the value that we believe it will provide in reduced air pollution control costs, including fines, and reduced maintenance and operating costs.

Channel Structure and Path to Market. Our path to market could involve any combination of (1) licensing our technologies for either one-time or periodic licensing fees for a period of time within specific fields of use and/or territories, (2) selling our intellectual property rights within specific fields of use and/or territories, or (3) manufacturing the components required to enable our technologies and/or supplying a complete burner package through strategic subcontracting agreements. Since our solutions consist largely of off-the-shelf components, we do not anticipate that we will require a large manufacturing capacity. To the extent we will require production of specific hardware (electrodes, for example), we plan to rely on outside contract manufacturers, which we believe are widely available and for which a competitive market exists.

Competition and Barriers to Entry

The industry in which we operate is global in scope and is populated by large, established suppliers of burners and post-combustion air pollution control systems, all of which possess substantially greater resources than we do. Worldwide, suppliers of burners and air pollution control equipment include but are not limited to companies such as UOP, Callidus and Maxon (all three are subsidiaries of Honeywell), John Zink Hamworthy Combustion (a subsidiary of Koch Industries and including Coen), Babcock and Wilcox, Westinghouse, Eclipse, General Electric, Haldor Topsøe, Hitachi, Linde, and Fives North American, among others.

These systems include low NO_X burners, electrostatic precipitators, bag houses, selective catalytic reduction systems and various types of scrubbers. The companies that provide these systems are well established and their combustion and emissions control technologies are based on mature, well-understood technologies that are proven in the market. We believe the further development of their technologies, however, will be limited largely to marginal performance improvements. As a consequence of this relatively slow pace of adopting innovation, we believe current technology offerings from the large competitors have become largely commoditized, and differentiation between suppliers is very often based on price. This provides both an opportunity and a barrier to more nimble, disruptive companies.

From a customer's perspective, legacy air pollution control technology is viewed as a cost of doing business, and as a means to operate within regulatory requirements and avoid fines. Unlike most other kinds of capital equipment that provide an economic return through enhanced productivity or efficiency, we believe customers of traditional emissions control equipment do not otherwise expect any positive return on these investments.

As indicated above we are seeking to enter the combustion and emissions control market and to establish ourselves in a highly competitive industry against companies that have both substantially greater financial resources than we do and established products. Because they have been available in the market for many years, our competitors' product offerings may have several advantages. Among these are:

- *Availability of trained technicians:* The number of technicians who are able to specify, install and operate our competitors' products will be greater than those who have been trained on our technology.

- *Conservative choice:* Because our competitors' technologies are well understood and their performance has been proven over time, customers may perceive their offerings as a safe, low-risk choice.

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Business relationships: Because our competitors have established long-standing personal relationships with their customers, they may prefer to continue to do business with one another.

We believe, however, that our Duplex technology would be an attractive alternative to the products and solutions offered by companies with which we seek to compete. In particular, we believe that our Duplex technology could offer a unique cost-effective means to reduce many pollutants at the source while improving operational efficiency. We believe our Duplex technology could be capable of reducing the requirement for costly legacy equipment, offering customers the prospect of a positive return on their investment in the form of enhanced efficiency and productivity while reducing emissions to the levels of existing air pollution control technologies. In particular, we believe our Duplex technology could offer the following advantages when compared with the next best alternatives.

Emissions Reduction from Combustion Sources. Current technology reduces emissions by using mechanical mixing aids such as swirlers, staging combustion in two or more zones, or treating emissions such as NO_X after the fact using selective catalytic reduction. In contrast, we believe our Duplex technology can:

- enhance mixing with none of the additional pressure drop or power requirements that swirlers demand; and

- reduce NO_X without reducing turndown or narrowing the burner operating window as staged combustion does or requiring expensive post combustion treatments with chemical additives such as catalytic reduction requires.

Improving flame shape. The main goal of virtually all process combustion is to transfer heat to raise steam or enable a chemical reaction, and to do so as efficiently as possible. Conventional technology uses buoyancy (the natural tendency for a flame and heat to rise opposite to the force of gravity) and momentum (fuel mixed with air and forced through a nozzle, as in a torch) as the only tools to shape flames. Unfortunately, momentum effects die out over distance from their source and buoyancy always operates counter to the gravitational field. Moreover, momentum and buoyancy effects often drive wayward flames into process tubes where they cause overheating and potential failure. In contrast, we believe that our technology eliminates flame impingement by shortening the combustion flame.

Enhancing heat-transfer and process efficiency. The main objective of industrial combustion in furnaces and boilers is to transfer heat to a process fluid. Conventional combustion techniques do their best to optimize flame shape to achieve this end, but we believe conventional combustion techniques have no additional means for enhancing heat transfer. In contrast, we believe that our technology could enhance heat transfer to the process tube with radiation from the solid Duplex tile, which is a more effective radiator than a conventional flame.

Compared to the products and solutions of companies with which we seek to compete, we believe our technology could provide our potential customers with a lower total cost of ownership, offering the prospect of a positive economic return on investment to systems operators due to a reduction in their capital and operating expenses, and an increase in energy efficiency.

Because our technology is not yet widely used, we do not currently represent a significant competitive presence in our industry.

Research and Development Program

Our research and development program includes pilot-scale research and participating customer site demonstrations. The experience and industry contacts of our management, board of directors, and consultants with potential customers in the petroleum, petrochemical, and industrial steam applications industries inform our research program. These are supported by field development agreements, research agreements, and memoranda of understanding with potential development partners, customers and research institutions. Our research and development activities make use of employees and consultants that are experts in the areas of industrial combustion, statistical experimental design, gas turbines, fluid mechanics, physics of particles and ions, and electric fields. We spent $4,712,000 and $4,831,000 on research and development for the years ended December 31, 2017 and 2016, respectively.

We have tested our Duplex and ECC technologies in our laboratory at capacities representative of industrial equipment. We have installed our Duplex technology on a retrofit basis in numerous field test sites, including our

Duplex Plug & Play product. Our research and development activities include the following: (1) scale up to commercially relevant sizes, (2) site demonstration at full scale, (3) complete first installation, (4) complete further installations to refine the product, its installation, and its reliability, and (5) enhance our intellectual property portfolio.

Intellectual Property Protection

We are pursuing an aggressive intellectual property strategy including:

- *Aggressive invention and ideation.* Thus far we have identified numerous specific inventions that we believe to be novel and patentable. We are pursuing a proven ideation process to enhance and continue these discoveries.

- *Development of a strong patent portfolio.* We have generated inventions that we believe to be patentable subject matter and for which we have been seeking protection through patent application filings. As of December 31, 2017, we have filed approximately 69 pending patent applications with the U.S. Patent and Trademark Office (USPTO) along with a number of applications with foreign regulatory bodies related to our Duplex and ECC technologies, which remain pending. We have been granted 7 U.S. patents related to our Duplex technology and 35 U.S. patents related to our ECC technology along with patents in other foreign jurisdictions. We cannot predict when our patent applications may result in issued patents, if at all. Further, we may modify a patent application in the future as we develop additional information. As a result, we may create additional patent applications from an existing application, consolidate existing patent applications, abandon applications, or otherwise modify applications based upon our judgment in order to protect our intellectual property in a reasonably cost beneficial manner.

Government Regulation

Government approval is not required in order for us to sell the principal products or services that we are developing. Government regulation, particularly environmental regulation, however, is likely to play an important role in shaping our product mix and offerings. Our Duplex technology includes enhancement of the combustion process and reduction of certain emissions at a lower cost than current air pollution control devices. Field implementation of our technologies requires permits from various local, state and federal agencies that regulate mechanical and electrical infrastructure and fire and air pollution control.

We believe that we offer major advances in emissions and efficiency reductions. We also believe emissions regulations could enhance market demand for technology if such regulations require a reduction in criteria pollutants such as NO_X, SO_X, and CO, or others such as CO_2, or mercury. In such cases, possible legislation on greenhouse gases, boiler MACT rules, or general reductions in required criteria pollutant levels could serve our business objectives. Although the timing of such regulations is uncertain, the general trend over the last decades continues to be government-mandated reduction for all criteria pollutants and the addition of new emissions to those regulated. Ultimately, it may be possible for our technology to achieve EPA BACT (Best Available Control Technology) designation. Although field development testing of our Duplex technology is ongoing, in September 2017 the South Coast Air Quality Management District governing the greater Los Angeles area approved a cooperative funding effort to work with a local refiner to implement a Duplex demonstration project in their regulatory area. The project scope,

overall budget and detailed requirements are currently being finalized. We believe the availability of our technology, by itself, could accelerate the government's willingness to adopt more stringent environmental regulations. Further, efficiency improvements include enhanced mixing, lower excess air requirements, and improved heat transfer to the process. We believe such efficiency improvements could generate market demand regardless of the existing regulatory framework because they could result in savings to businesses that adopt our technology.

Although the current U.S. administration has indicated that it plans to pursue the reduction of environmental regulations in order to promote economic activity and to eliminate or reduce perceived needless environmental regulations, the statements and actions to date have primarily referenced elimination of regulations associated with greenhouse gas emissions, an area with secondary benefit to our technologies, and the approval of oil pipelines, a step that may benefit our business and that of our customers in the energy sector. At this time, we are not aware of any current or proposed federal, state or local environmental compliance regulations that would have a material detrimental effect on our business objectives. We do not anticipate any major expenditures to be required in order for our technology to comply with any environmental protection statutes.

Employees

As of March 27, 2018, we had 17 full-time employees and 1 part-time employee. Our employees are not covered by collective bargaining agreements, and we believe our relationship with our employees is good.

ITEM 1A: RISK FACTORS

We are subject to various risks that may materially harm our business, prospects, financial condition and results of operations. An investment in our common stock is speculative and involves a high degree of risk. In evaluating an investment in shares of our common stock, you should carefully consider the risks described below, together with the other information included in this report.

The risks described below are not the only risks we face. If any of the events described in the following risk factors actually occurs, or if additional risks and uncertainties later materialize that are not presently known to us or that we currently deem immaterial, then our business, prospects, results of operations and financial condition could be materially adversely affected. In that event, the trading price of our common stock could decline, and you may lose all or part of your investment in our shares. The risks discussed below include forward-looking statements, and our actual results may differ substantially from those discussed in these forward-looking statements.

Risks Related to Our Business

We are a company with a limited operating history and our future profitability is uncertain. We anticipate future losses and negative cash flow and we may never be profitable.

We are a company with a limited operating history and limited revenues to date. We have incurred losses since our inception and expect to experience operating losses and negative cash flow for the foreseeable future. As of December 31, 2017, we had a total accumulated deficit of approximately $50.0 million. We anticipate our losses will continue to increase from current levels because we expect to incur additional costs and expenses related to prototype development, consulting costs, laboratory development costs, marketing and other promotional activities, the addition of engineering and manufacturing personnel, and our continued efforts to form relationships with strategic partners. We may never generate significant revenue and we may never be profitable.

If we do not receive additional financing when and as needed in the future, we may not be able to continue our research and development efforts or commercialization efforts and our business may fail.

Our business is capital-intensive, and requires capital investments in order for it to develop. Our cash on hand will likely not be sufficient to meet all of our future needs and we will likely require substantial additional funds in excess of our current financial resources for research, development and commercialization of our technology, to obtain and

maintain patents and other intellectual property rights in our technology, and for working capital and other purposes, the timing and amount of which are difficult to ascertain. Until our technology generates revenues sufficient to support our operations, we plan to obtain the necessary working capital for operations through the sale of our securities, but we may not be able to obtain financing in amounts sufficient to fund our business plans. Furthermore, if our target customers are slow to adopt our technology, we may require additional investment capital in order to continue our operations. If we cannot obtain additional funding when and as needed, our business might fail.

Market acceptance of our technology and business is difficult to predict. If our technology does not achieve market acceptance, our business could fail.

We are continuing to develop our technology, which is being tested in the field by various customers and markets. If we are unable to effectively develop and timely promote our technology, gain recognition in our market segments, and develop a critical level of successful sales and product installations, we may not be able to successfully achieve sales revenue and our results of operations and financial condition would then suffer. Our ability to achieve future revenue will depend significantly upon achieving a critical mass of market awareness and sales to potential customers of our products. While we plan to achieve this awareness over time, there can be no assurance that awareness of our company and technology will develop in a manner or pace that is necessary for us to achieve profitability in the near term.

Further we cannot predict the rate of adoption or acceptance of our technology by potential customers. While we may be able to effectively demonstrate the feasibility of our technology, this does not guarantee the industrial combustion and power generation market will accept it, nor can we control the rate at which such acceptance may be achieved. In certain of our market segments, there is a well-established channel with a limited number of companies engaged in reselling to our target customers. Failure to achieve productive relations with a sufficient number of these prospective partners may impede adoption of our technology. Additionally, some potential customers in our target industries are historically risk-averse and have been slow to adopt new technologies. If our technology is not accepted in the industrial combustion and power generation market, we may not earn enough by selling or licensing our technology to support our operations, recover our research and development costs or become profitable and our business could fail.

Our efforts may never demonstrate the feasibility of our product.

Our research and development efforts remain subject to all of the risks associated with the development of new products based on emerging and innovative technologies, including without limitation unanticipated technical or other problems, our ability to scale our technology to large industrial applications, conditions in the field during installation and the possible insufficiency of funds for completing development of these products. Technical problems, including those specific to customer site implementation, may result in delays and cause us to incur additional expenses that would increase our losses. If we cannot complete, or if we experience significant delays in completing, research and development of our technology for use in potential commercial applications, particularly after incurring significant expenditures, our business may fail.

Changes to environmental regulations could make our technology less desirable.

The negative environmental impacts of industrial activity have given rise to significant environmental regulation in industrialized countries. These regulations are important incentives in the adoption of technologies like ours. To the extent that environmental regulations in the United States and in other industrialized countries are modified in the future, or even relaxed, our technology may not produce the results required, or may even be unnecessary, to comply with the modified regulations. For example, although the current U.S. administration has indicated that it plans to pursue the reduction of environmental regulations in order to promote economic activity and to eliminate or reduce perceived needless environmental regulations, the administration’s statements to date have primarily referenced elimination of regulations associated with greenhouse gas emissions, an area unrelated to our technologies, and the approval of oil pipelines, a step that may benefit our business. However, if the Environmental Protection Agency relaxes the clean air regulations our technologies are designed to address, our business and results of operations could be materially adversely affected.

We may fail to adequately protect our proprietary technology, which would allow our competitors to take advantage of our research and development efforts.

Our long-term success largely depends on our ability to market our technology. We rely on a combination of patents, trade secrets and other intellectual property laws, confidentiality and security procedures and contractual provisions to establish and protect our proprietary rights in our technology, products and processes. If we fail to obtain or maintain these protections, we may not be able to prevent third parties from using our proprietary technologies. Our pending or future patent applications may not result in issued patents. In addition, any patents issued to us in the future may not contain claims sufficiently broad to protect us against third parties with similar technologies or products or from third parties infringing such patents or misappropriating our trade secrets or provide us with any competitive advantage. In addition, effective patent and other intellectual property protection may be unenforceable or limited in foreign countries. If a third party initiates litigation regarding the validity of our patents, and is successful, a court could revoke our patents or limit the scope of coverage for those patents.

We also rely upon trade secrets, proprietary know-how and continuing technological innovation to remain competitive. We protect this information with reasonable security measures, including the use of confidentiality and invention assignment agreements with our employees and consultants and confidentiality agreements with strategic customers and partners. It is possible that these agreements may not be sufficient or that these individuals or companies may breach these agreements and that any remedies for a breach will be insufficient to allow us to recover our costs and damages. Furthermore, our trade secrets, know-how and other technology may otherwise become known or be independently discovered by our competitors.

We may incur substantial costs as a result of litigation or other proceedings relating to patent and other intellectual property rights.

A third party may sue us for infringing its intellectual property rights. Likewise, we may need to resort to litigation to enforce our patent rights or to determine the scope and validity of third-party intellectual property rights. The cost to us of any litigation or other proceeding relating to intellectual property rights, even if resolved in our favor, could be substantial, and the litigation would divert our efforts from our business activities. Some of our competitors may be able to sustain the costs of complex patent litigation more effectively than we can because they have substantially greater resources. If we do not prevail in this type of litigation, we may be required to pay monetary damages and/or expenses; stop commercial activities relating to our products; obtain one or more licenses in order to secure the rights to continue manufacturing or marketing our products; or attempt to compete in the market with substantially similar products. Uncertainties resulting from the initiation and continuation of any litigation could limit our ability to continue some of our operations.

We cannot guarantee that any research and development partnership we enter into will be successful.

We intend to form research and development arrangements to develop our technology within targeted segments. Collaborative arrangements involve risks that participating parties may disagree on business decisions and strategies. These disagreements could result in delays, additional costs, risks of litigation, and failure of the development of our technology within the combustion market segment. Success of any collaborative arrangements we enter into will depend in part on whether those with whom we collaborate fulfill their contractual obligations satisfactorily. If a party with whom we collaborate fails to perform its contractual obligations satisfactorily, we may be unable to make the additional investments or provide the added services that would be required to compensate for that failure. If we are unable to adequately address any such performance issues, our reputation may be materially adversely affected and we may be exposed to legal liability. Our inability to successfully maintain collaborative relationships, once we enter into them, or to enter into new collaborative arrangements, could have a material adverse effect on our results of operations.

If we are unable to keep up with rapid technological changes, our products may become obsolete.

The market for alternative environmental products is characterized by significant and rapid technological change and innovation. Although we intend to employ our technological capabilities to create innovative products and solutions that are practical and competitive in today's marketplace, future research and discoveries by others may make our products and solutions less attractive or even obsolete compared to other alternatives that may emerge.

Our technology and its industrial applications have not yet been safety tested.

There is inherent danger in dealing with the combustion process. There is additional danger in modifying this process in ways that are new and, as yet, untested on a commercial scale. Although we have not yet encountered any areas of risk in the development or testing of our products beyond those already inherent in the combustion process or those particular to an industrial site, we may be exposed to liabilities should an industrial accident occur during development, testing, or operation in our laboratory or during field implementation of our technology.

We will depend on approval from various local, state and federal agencies to implement and operate our technology. There is no assurance that these agencies will approve our technology.

Our technology includes enhancement of the combustion process, inclusion of a computer-controlled electric field to selectively promote, suppress, retard or accelerate chemical reactions as desired, and to reduce certain emissions at a lower cost than current air pollution control devices. Field implementation of our technology will therefore require permits from various local, state and federal agencies that regulate mechanical and electrical infrastructure and fire and air pollution control. Our technology may be subject to heightened scrutiny since it will be new to these governing bodies. As such, there may be delays or rejections in applications of portions of or all of our technology in the individual jurisdictions involved.

Because our technology has not yet been fully developed or implemented, we are uncertain of our profit margins an