

PyroGenesis Canada Inc.

Shift towards multi-system sales and \$10MM+ contract sizes

Company Description

PyroGenesis Canada Inc. (“PyroGenesis”, the “Company”) is a global leader in the design, engineering, development, and commercialization of plasma based systems. The Company’s technology is used within the fields of waste treatment, additive manufacturing, oil & gas, mining & metallurgy, military and defense and the reduction of greenhouse gas emissions.

(Read more about what plasma is on page 4, and PyroGenesis’ plasma based products on page 18)

Investment Thesis

The Company’s solutions have been widely accepted within the marketplace and have proven the economic benefits of using plasma based systems in industrial applications. PyroGenesis has successfully shifted from a focus on research and development, to commercializing their line of plasma processes, as seen through their assorted list of commercial clients which includes the US Navy and Air Force, European NATO, as well as other clients in Asia, Europe, Canada and the United States. The Company’s diversification within five major industries presents an attainable market size of \$14.3+ billion, which leaves much room for PyroGenesis to expand its \$5.8MM revenue base.

(Read more about the Investment Thesis on page 2)

Catalysts

PyroGenesis has recently signed a contract with Yasui Facilities Inc., a Japanese architectural/engineering firm, in order to enter the Japanese market and gain local help to market and sell the Company’s systems. Yasui works with a consortium of companies that, amongst other things, build incinerators. The contract provides PyroGenesis with the much needed local expertise. In addition, PyroGenesis is expected to complete a \$12.5 million contract in 2016 for the development of 10 powder production systems, with one unit already shipped to the client.

(Read more about the Company’s Catalysts on page 13)

Financial Performance

The Company has steadily improved its operational performance over the past several years. Specifically, PyroGenesis has proved that there is a large market for plasma systems through its growing revenue base. The Company has successfully shifted from single-system sales to multi-systems, bundling its products, while also moving into multi-million dollar contract sizes. The Company has progressed from signing agreements for individual systems in the \$1-5MM range, to signing a multi-system contract in the \$10-15MM range last year, to now negotiating multi-system contracts in the +\$100MM range. The Company averages 40% EBITDA margins, and is on track for cash flow positive operations by Q4/15.

(Read more about the Company’s Financial Performance on page 14)



Market Data

Price (October 9, 2015)	\$0.26
Symbol	TSXV: PYR
52 Week Range	CAD \$0.24 - \$0.50
Market Cap (MM)	\$22.0
Shares Outstanding (MM)	84.8
Free Float	34.6%
Average Daily Volume (30 days)	64,986
Total Debt (MM)	\$3.8
Cash & ST Inv. (MM)	\$1.2
Total Assets (MM)	\$7.1

Financial Data (M):

	2014	2015E	2016E
Revenues	\$5.8	\$8.6	\$12.1
Operating Income	(\$3.3)	(\$2.3)	\$0.4
Net Income	(\$3.3)	(\$2.3)	\$0.0
Free Cash Flow	(\$5.5)	(\$1.5)	\$0.2

All figures in CAD unless otherwise stated.
Thomson Reuters 10/9/2015

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Executive Summary

PyroGenesis Canada Inc. (“PyroGenesis”, the “Company”) is a leader in the design, engineering, development, and commercialization of plasma based systems. The Company’s technology is applicable within the fields of waste treatment, additive manufacturing, oil & gas, mining & metallurgy, military and defense, and reducing greenhouse gas (GHG) emissions. PyroGenesis leverages its 20+ years of research and development, engineering and manufacturing expertise to provide customizable solutions for its broad range of clients which include the US Navy and Air Forces, European NATO, as well as other clients in Asia, Europe, Canada and United States. The Company’s CEO, Peter Pascali, alongside his father, Peter P. Pascali Sr., both own a combined 65.3% of the common shares outstanding, strictly aligning the CEO’s interest to the performance of the Company.

Over the past several years, PyroGenesis has proven that their systems and processes have large economic and environmental benefits within multi-billion dollar industries. The Company has successfully worked alongside the US Navy to design, construct, and deliver its Plasma Arc Waste Destruction System (PAWDS) for their aircraft carriers. Upon successful completion of the project in 2012, PyroGenesis was contracted for a reorder, demonstrating a need for such systems. Within the additive manufacturing industry, the Company signed a \$12.5MM contract with an Asian client for the delivery of 10 Powder Production Systems used for 3D printing. Additionally, PyroGenesis is making significant strides within oil & gas, through a signing of five separate contracts. Current results illustrate annual savings of \$40MM in disposal costs and additional value from recovered metal, a cost saving industry players desperately need at a time of depressed energy prices.

PyroGenesis is based out of Montreal, yet its products span across Asia, Europe and North America. Most recently, the Company has signed an exclusive marketing agreement with Yasui Facilities Inc. (“Yasui”) of Japan, to have them market PyroGenesis’ line of plasma waste processing systems in Japan for five years. Yasui provides the Company with local expertise, aiding with market penetration and permitting efforts. With a growing backlog currently standing at \$15.7MM, attainable operating margins of 40%, and an attainable market of \$14.3+ billion (*see Business Opportunities pg 4-12*), PyroGenesis has significant growth opportunities.

Investment Thesis

The Company’s systems target five large industries, diversifying the Company’s revenue base and providing it with major room for economic growth. Company’s revenues come from:

- **Waste Management:** the Company has developed six separate plasma waste processes and four plasma touches in order to destroy Municipal Solid Waste (MSW) and turn it into energy sources such as electricity and heat.
- **Military:** waste destruction system designed and installed on an aircraft carrier, and Plasma Resource Recovery System (PRRS) produced at an Air Force base in Florida.
- **Additive Manufacturing:** \$12.5MM contract signed with an Asian-based large scale manufacturer, for the delivery of 10 powder production systems
- **Treatment of Aluminum and Zinc dross:** first commercial sale of DROSRITE™ furnace system to North American automobile parts manufacturer.

- Processing of waste streams and a feasibility project for expanding production capability within the Oil & Gas industry: proved that plasma processing of waste streams can recover valuable metals and a significant 50 to 1 volume reduction, reducing disposal costs by more than 90%. Project testing is expected to be completed in H2/15, and if successful, a commercial system or set of systems would be needed to target a 300 tonnes per day (TPD) operation. In addition, a project designed to enhance and accelerate oil extraction is currently in its second phase of trials. This patent pending process costs less than 20% of that currently used and is an environmentally safe solution utilizing electricity as its only heat source.
- Feasibility project to test plasma can be used to refine ore into pure metal: contracted by a junior metals and mining Company, with expected project completion targeted for Q2/16
- Mobile Plasma System for the Destruction of Chemical Warfare Agents: Currently in the 2nd and Final Phase. System scheduled for delivery in Q3/15

PyroGenesis leads the industry with a highly concentrated expertise in plasma processes:

- 20+ years of research and development
- Company has successfully reinvented waste treatment through the use of plasma based processes, providing an environmentally safe solution
- Company has a diverse staff of 20 engineers with 120+ combined years of experience in design, engineering, and manufacturing. This expertise enables the Company to provide customized solutions to clients, while also offering highly specialized engineering services

Growing demand for Company's systems and processes, with current signed backlog at \$15.7MM:

- Geographic expansion into Europe and Japan through sales contracts and an exclusive marketing agreement
- Revenues diversified over five separate industries
- Backlog almost triple the Company's 2014 revenues of \$5.8MM
- On track to being cash flow positive by Q4/15

Business Opportunities, Technological Overview and Industry Size

1. Plasma Application within the industry for Municipal Solid Waste (MSW) treatment

PyroGenesis has an extensive amount of experience in developing plasma waste processes and plasma torches. These systems provide an environmentally sustainable solution to waste management, an industry that has been plagued by unsustainable practices. The following text discusses the technicality aspect of plasma processes, a comparison to current industry practices along with a summary of how PyroGenesis has penetrated the MSW industry.

What is Plasma?

Plasma is the fourth state of matter, the others being solid, liquid, and gas. Plasma is a hot ionized gas consisting of approximately equal numbers of positively charged ions and negatively charged electrons. The sun is made up of plasma with an inside temperature reaching 10,000,000°C. Examples of man-made plasma include the light produced by a neon tube, as well as plasma cutting systems used to slice through metal. Thermal plasma can readily reach temperatures in excess of 10,000°C. PyroGenesis harnesses the properties of thermal plasma to melt and transform metal, to carry out high temperature chemical reactions and to convert waste into energy.

Waste to Energy - Plasma Gasification

Gasification is the process of converting organic/fossil fuel based carbon-containing materials into synthetic gas (syngas), which is a gas mixture of carbon monoxide (CO), hydrogen (H₂) and carbon dioxide (CO₂). This process is achieved by reacting the materials at high temperatures (>700°C), without combustion, with the use of very little oxygen and steam. The general raw materials used for gasification are coal, petroleum-based materials, or other materials that would be rejected as waste. From these materials, a feedstock is prepared. The feedstock is inserted into the gasifier, where it reacts in an oxygen-starved environment with steam at elevated pressure and temperature to produce syngas. One of the uses of this syngas is as a fuel to manufacture steam or electricity. Another use is as a basic chemical building block for many petrochemical and refining processes.

Plasma gasification is the process of gasifying feedstock using very high temperatures achievable with plasma. Plasma gasification differs from non-plasma gasification in one key area – temperature. Non-plasma gasifiers typically operate between 800 and 900°C. The temperatures inside plasma gasifiers reach over 3,000°C. The syngas exits the gasifier at 950°C. The slag flows out of the gasifier at 1,650°C. The higher temperatures inside the plasma gasifier result in the complete destruction of tars, something that is not achievable with non-plasma technologies. It is not feasible to remove tars downstream of the gasifier and therefore the utility of the syngas produced by non-plasma gasifiers is very limited. It can be burned immediately but it cannot be conditioned for use in gas turbines, reciprocating engines or for conversion into liquid fuels.

Plasma gasification is used for commercial purposes as a Waste-to-Energy (WTE) system, which converts MSW, hazardous chemical/medical waste, and sewage sludge into syngas that can be used to generate power. PyroGenesis has developed a proprietary system, the Plasma Resource Recovery System (PRRS), which was commissioned and installed at the US Air Force military base in Florida, USA, and has since been redeployed into Europe.

Figure 1: Plasma Resource Recovery System (PRRS)



Source: Company website

Apart from the PRRS, the Company has designed five other plasma waste management systems, which vary by waste processing capacity, type of waste handled, and the resulting byproducts. The systems are PAWDS Land, PAWDS Marine, SPARC, Tactical PACWADS and PAGV, which are further explained in Appendix B.

Municipal Solid Waste Industry (i.e. trash/garbage)

It was [estimated by the World Bank](#) that global municipal solid waste reached 1.3 billion tonnes a year in 2012. This is a staggering figure, which may be visualized as filling up 174 football fields with blocks of garbage as tall as the CN Tower (Figure 2). This figure is expected to grow to 2.2 billion by 2025.

The current methods of waste disposal include:

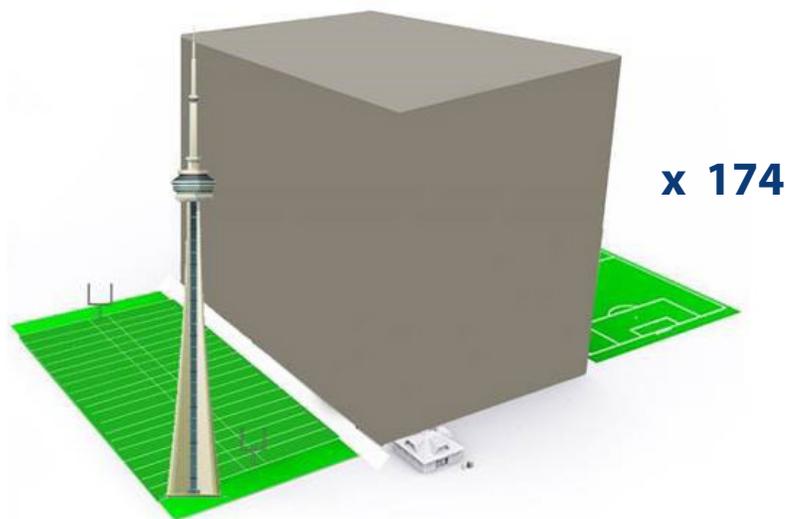
- Recovery: recycling (blue bin – plastic is reused for future needs, with no hazardous impact on the environment); composting (green bin – used for soil amendment and fertilization)
- Combustion with energy recovery: incineration (burning garbage) and gasification (which relates to waste to energy)
- Disposal: landfills (digging up space in the ground for storing garbage)

The U.S. Environmental Protection Agency developed a hierarchy, ranking the most environmentally sound strategies for MSW management. The hierarchy places emphasis on reducing, reusing and recycling the majority of waste, followed by energy recovery methods, with landfills as the most undesirable strategy.

Market Size

Economically sizing this market would be to calculate the current cost of disposing such large sums of waste. PyroGenesis is approaching the industry by providing a plasma gasification solution in an effort to diminish undesirable methods for waste management. It is estimated that a 33 acre landfill costs \$13 million to build, and is capable of storing 1.1 million tonnes of waste, with an annual processing capacity of 200,000 tonnes. Moreover, \$600,000 in annual operating costs must be paid for staffing, utilities, and equipment operations. The landfill operator would earn his return from processing MSW at a tipping fee of \$50 per ton. In comparison, a PyroGenesis system would be able to process 1-100 tonnes of MSW per day, with much lower upfront capital costs, minimal operating expenses, and the added benefit of energy recovery. The attainable size of the market is conservatively limited to a Canadian and U.S. combined annual MSW production of 290 million tonnes, and assuming that 50% of the waste is sent to landfills, the opportunity for WTE processes is therefore estimated at 145 million tonnes a year. Using the current U.S. tipping fee of \$50 per ton, PyroGenesis' attainable market equals \$7.25 billion. However, handling 145 million tonnes of MSW/year would require 3,973 PyroGenesis systems with a processing capacity of 100 TPD. Although the total size of the opportunity is estimated at \$7.25 billion, PyroGenesis may not be able to cater to this large market need.

Figure 2: Global Municipal Solid Waste, 2012



Source: Ubika Research, World Bank

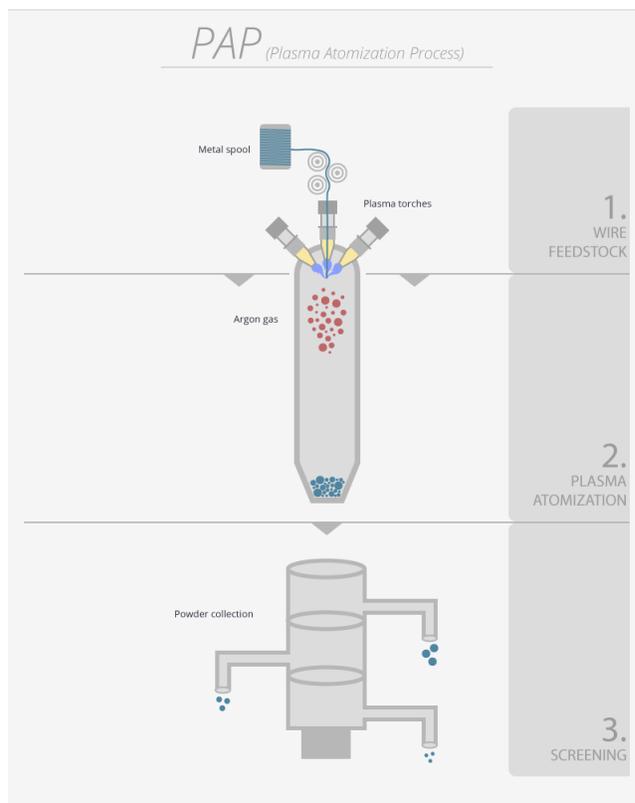
2. Plasma Application within the 3D Printing industry

3D printing, or additive manufacturing, is a process of making three dimensional solid objects from a digital file. Many different materials can be used for 3D printing, such as plastics, powders, resins, and others. The market for 3D printing was estimated at over \$2 billion USD in 2014 and is expected to triple in the next few years according to Gartner, IBIS World and AMR, to \$6 billion USD.

PyroGenesis uses the Plasma Atomization Process (PAP), which takes wire as a feedstock and uses 10,000°C plasma plumes to melt the incoming wire and shear off the metal, creating tiny molten metal droplets. The process produces very pure spherical metallic powders that can address the growing 3D printing industry. Using plasma to produce metal powders is different from current industry practice of using gas atomization. The Company's PAP technology has the distinction of producing highly flowable and very pure spherical metallic powders.

In July 2014, the Company was contracted by an Asian client to provide 10 powder production systems for \$12.5MM. To date, the Company has built and shipped one unit, with the rest planned to be constructed once the first system is fully installed and commissioned. We expect that the completion of this project would increase the Company's ability to attain additional contracts within the 3D printing industry.

Figure 3: Plasma Atomization Process (PAP)



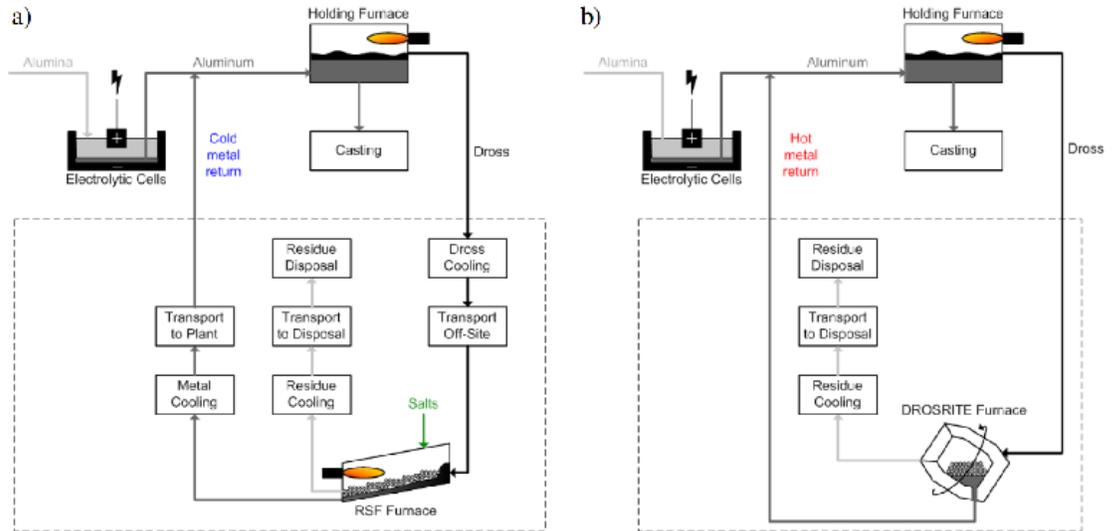
Source: Company website

3. Patented DROSSRITE™ Technology to tackle Aluminum and Zinc Dross Industries

The Company has recently signed a deal with a North American automobile part manufacturer, for a \$600,000 sale of their patented DROSSRITE™ furnace system. This system was designed to treat dross, a waste generated within the metals industry. More technically, dross is a material which forms on the surface of molten non-ferrous metal (such as aluminum and zinc) as it comes into contact with a reactive atmosphere. This often wasted material largely consists of molten-free (unreacted) metal, which is highly desirable to extract for economic reasons. PyroGenesis developed this technology in light of common environmentally unacceptable industry practices for treating dross.

In the case of aluminum, PyroGenesis' focus metal, dross is treated in a furnace at high temperatures. The conventional aluminum dross treatment process utilizes gas or oil-heated rotary salt furnace (RSF), which has a negative environmental impact from the salt slag and CO₂ created from the combustion of fossil fuels. In comparison, DROSSRITE™ does not require fluxing salts nor any external energy input. Overall, PyroGenesis' system of treating dross is superior to conventional RSF methods because DROSSRITE™ has no harmful effects on the environment, is 83% less costly to operate, and extracts significantly more aluminum.

Figure 4: (a) The conventional rotary salt furnace (RSF) process and (b) the DROSSRITE™ process for aluminum dross treatment



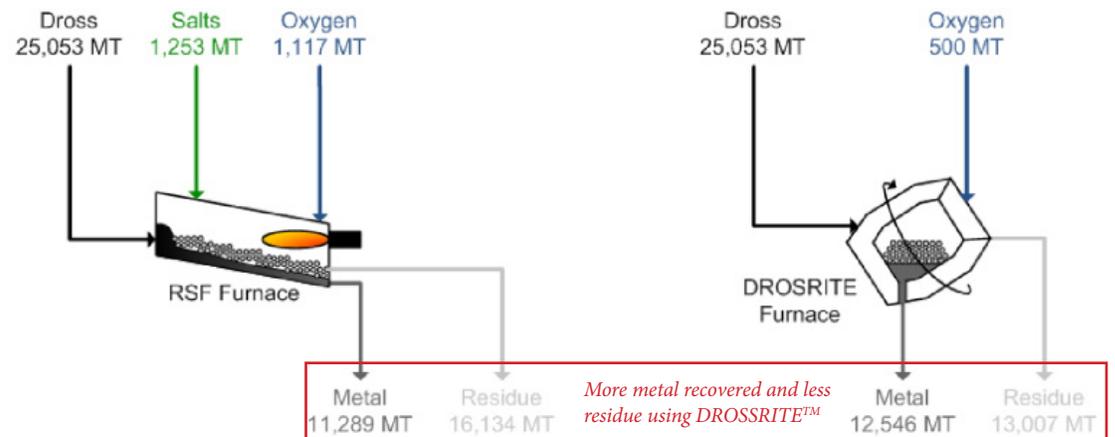
Source: *Technical paper: "Drossrite Plus™ Treatment of Aluminum and Zinc Drosses"; COM 2012*

Figure 5: Economic comparison RSF vs. DROSSRITE PLUS™ (per year)

Parameter	RSF	DROSSRITE PLUS™
Cost of transport of the dross to recycler (\$50/MT)	\$ 1,252,650	\$ 0
Cost of oil (\$ 3.65/US gallon)	\$ 573,799	\$ 0
Cost of oxygen injected (\$ 0.21/m ³)	\$ 340,716	\$ 73,500
Cost of electricity (\$ 0.1/kWh)	\$ 174,215	\$ 43,800
Cost of salt (\$165/MT)	\$ 206,745	\$ 0
Cost of metal burned (\$ 2,000/MT)	\$ 2,514,000	\$ 0
Cost of argon (\$ 1.25/m ³)	\$ 0	\$ 250,000
Cost of disposal of residue (\$ 46/MT)	\$ 742,164	\$ 598,322
Total cost	\$ 5,804,289	\$ 965,622
DROSSRITE PLUS™ economic advantage	\$ 4,838,667 or \$ 193/MT	
Return on investment (ROI)	< 1 year	

Source: *Technical paper: "Drossrite Plus™ Treatment of Aluminum and Zinc Drosses"; COM 2012*

Figure 6: Additional metal recovery and less residue created by DROSSRITE PLUS™ in comparison to RSF (per year)



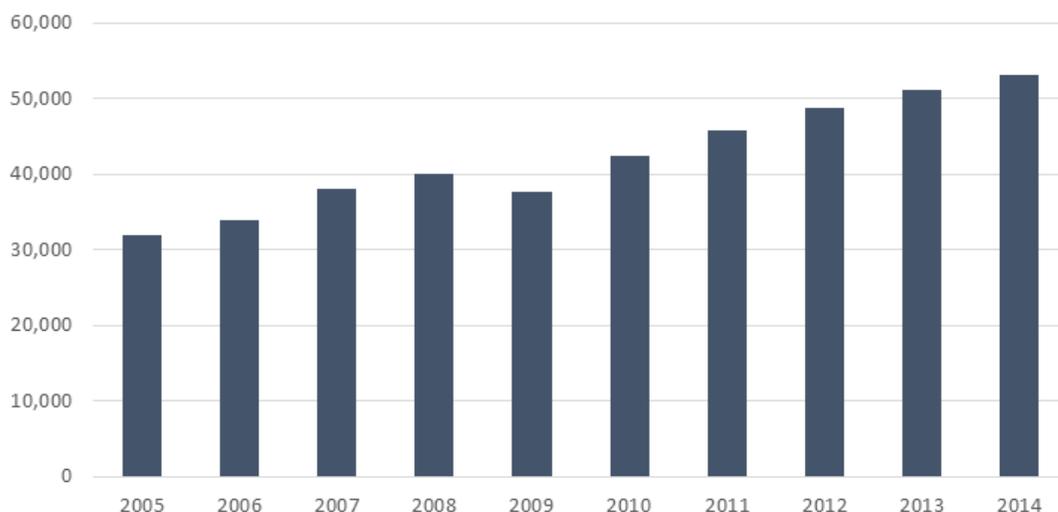
Source: *Technical paper: "Drossrite Plus™ Treatment of Aluminum and Zinc Drosses"; COM 2012*

The Company has received a \$340,000 down payment on the sale, and is expected to deliver the system by the end of 2015. The ability for PyroGenesis to secure a contract within the auto industry introduces a new market with a reoccurring line of business. Auto manufacturers work within small profitability margins and would benefit a lot from cost reductions. Once the system is delivered and proven operationally successful, we expect PyroGenesis to have a shorter sales cycle for future deals.

Market Size:

The market for aluminum dross is generated from aluminum manufacturing. In 2014, 53.1 million metric tonnes (MT) of aluminum was produced globally, an increase of 3.8% from 2013. Typical dross generation from a primary operation can be from 8% to 10% of Aluminum output. Therefore, global annual dross production is estimated to be between 4.25 and 5.31 million MT. Using the DROSRITE™ economic advantage of \$193/MT, we get a total attainable market size of \$820 - \$1,025 million.

Figure 7: Global Aluminum Production (2005 - 2014)



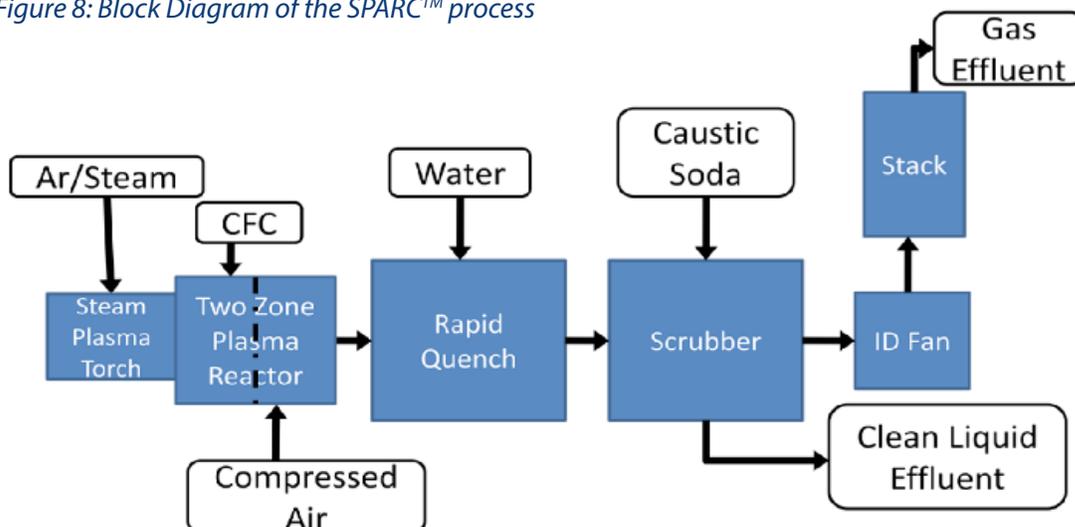
Source: [World Aluminum, primary aluminum global production](#)

4. Patented SPARC™ Technology to tackle GHG Emissions

The Steam Plasma Arc Refrigerant Cracking (SPARC) technology uses steam plasma to chemically decompose Chlorofluorocarbons (CFC's), a very strong Ozone Depleting Substance (ODS), and Hydrofluorocarbons (HFC's), a very strong Green House Gas (GHG), into smaller compounds (primarily CO, CO₂, HF, HCl, and H₂). The smaller compounds are then neutralized even further into harmless salts and clean liquid and gas waste.

Steam hydrolysis offers many advantages over the conventional incineration process, such as lower flue gas flow rate and less pollutants. Due to the high energy density of steam plasma, the volume of flue gas produced is reduced by more than 60 times compared to a conventional incinerator. Destruction using steam plasma also has an important impact of reducing the amount of pollutants. Steam plasma is an improvement over oxygen plasma because oxygen reacts with ODS to form chlorine (Cl₂) and fluorine (F₂), which are toxic and difficult to remove. When steam is used in the destruction reaction, it forms hydrogen chloride (HCl) and hydrogen fluoride (HF) gases, which can be scrubbed much more easily than Cl₂ and F₂.

Figure 8: Block Diagram of the SPARC™ process



Source: [Technical paper: "Destruction of Ozone Depleting Substances using Steam Plasma," STEQ 2012](#)

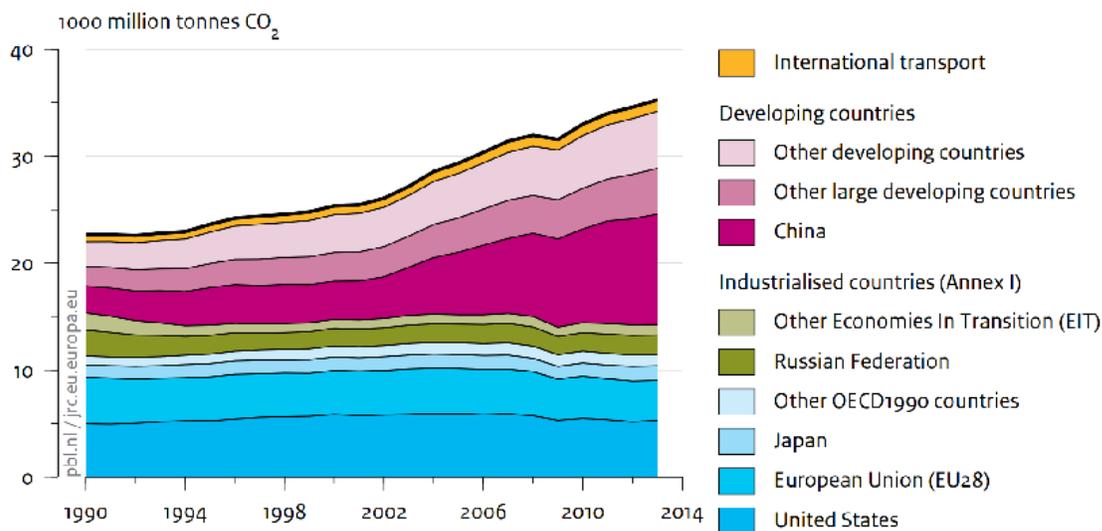
PyroGenesis has recently terminated a Development Use and Commercialization Agreement with a client relating to the SPARC™ technology, because the client wished to pursue the development of a solution for the destruction of ODS on their own. We believe this event to be positive, as it indicates the potential for the SPARC™ technology. The Company is currently in discussion to redeploy the technology in other promising areas where GHG regulation is much stricter such as Europe and the United States. PyroGenesis still retains all intellectual property for the system, and is currently protected by two patents in the United States, and have filed for additional patents in Europe, Japan, India, and China. We would also like to note that the former client cannot henceforth commercialize this technology in any matter.

Market Size:

The market for SPARC™ technology may be estimated by analyzing the global trends in the emissions of GHGs and ODSs. Global CO₂ emissions reached a new high of 36.3 billion tonnes CO₂ in 2013 (Figure 7), which is an increase of 0.7 billion tonnes CO₂ or 2.0% compared to the previous year. The government is becoming much more involved in setting policies at regulating the level of emissions, with most recently, Ontario joining Quebec and California in the cap and trade program. The governmental backing is estimated to help environmentally safe technologies break into this market.

The G7 leading industrial nations have [agreed to cut GHGs](#) (pg 12), completely phasing out the use of fossil fuels by the end of the century. A shorter-end target aims to reduce global GHG emissions at the upper end of a range of 40% - 70% by 2050, using 2010 as the baseline (33.7 billion tonnes CO₂). The [Canadian target](#) is to reduce GHGs by 30% below 2005 levels (749 million tonnes CO₂). *This implies a need to reduce 200 million tonnes of CO₂ by 2030 in Canada alone, and 26.2 billion tonnes of CO₂ by 2015 globally.*

Figure 9: Global CO₂ emissions per region from fossil-fuel use and cement production



Source: [EDGAR 4.2 FT2010 \(JRC/PBL 2012\)](#); [BP 2014](#); [NBS China 2014](#); [USGS 2014](#); [WSA 2014](#); [NOAA 2012](#)

5. Feasibility Projects within the Oil & Gas, Mining, and Military Industries

Oil & Gas – Metal Recovery from Waste Streams & Accelerated Oil Extraction

The Company has made successful strides within the oil & gas industry by leveraging their plasma expertise and engineering capacity in order to provide technological solutions to clients. To date, PyroGenesis has been contracted on five separate occasions, and are currently working on two feasibility projects. The first project is for the development of a pilot plant geared towards recovering valuable metal from waste streams. The second project is for the development of a plasma based solution, targeted at attempting to expand and accelerate the client's oil & gas production capacity.

Testing the feasibility of extracting valuable metal from oil & gas waste streams proved successful, as noted in the October 2, 2014 news release. It was concluded that plasma processing of these waste streams could recover valuable metals, and that there is also a significant 50 to 1 volume reduction in waste, reducing disposal costs by more than 90%. Data also indicated that a \$20MM PyroGenesis system could save the client over \$40MM in disposal costs and value from recovered metal. The Company is further testing this process at PyroGenesis' facility in Montreal, and expects to complete the project by the end of Q3/15. If successful, the Company would design, manufacture, and supply a commercial system to fit the need for a 300 TPD operation. At this point, current test results along with continuous positive feedback from the Company's engineering department points to positive results and multiple system orders are expected to be purchased by the client.

The feasibility of oil extraction acceleration has undergone the first round of trials, and was scheduled for second series of trials for Q4/14 upon regulatory approval. The results from the first round suggested cost reduction of 20% when comparing the process to current industry methods, as well as having zero negative environmental impact. The process is patent pending and the Company has yet to provide an update for the second phase trials.

Metals & Mining - Refining Ore into Pure Metal

PyroGenesis has recently been contacted by a junior metals & mining client (June 2015), to evaluate the feasibility of using plasma for the purpose of refining ore into pure metal. Specifically, PyroGenesis will test if it is possible to use plasma processes to convert quartz into pure silicon metal. The Company has given the client limited exclusive rights to the technology of converting quartz into silicon, and in exchange, PyroGenesis will receive 10% of sales, with set minimums, as royalty payments. The study is expected to be completed by Q1/16.

Military – Destruction of Chemical Warfare Agents

After successful project work with the US Navy and Air Forces, the Company has been contracted by an international military consortium. The project asked PyroGenesis to produce a mobile plasma system which would be capable of destroying hazardous chemicals and biological threats. The project will be completed in two phases, with phase 1 successfully completed in December 2014, and phase 2 is in progress. The Company has planned to ship this unit in Q3/15 to the client, for testing purposes using stimulated and actual chemical warfare agents.

Total attainable market size for PyroGenesis:

	Market Size
Municipal Solid Waste (plasma torches, gasifiers, military)	\$7.3 billion
3D Printing (2016)	\$6.0 billion
Dross Treatment	\$1.0 billion
GHG Emissions + Feasibility Projects (Mining, O&G)	-
Total	\$14.3 billion +

By combining all industry sectors, PyroGenesis has a total attainable market opportunity of more than \$14.3 billion. Even a 1% share of this total market represents a tremendous growth opportunity for the company. We foresee that the company has a unique opportunity to grow and address these large markets.

Catalysts and Upcoming Growth Plans

Expansion into Japan through Exclusive Marketing Agreement with Yasui Facilities Inc.

PyroGenesis has recently signed a contract with Yasui Facilities Inc. (“Yasui”), a Japanese architectural/engineering firm, in order to enter the Japanese market and gain local help to market and sell the Company’s waste management systems. Yasui works with a consortium of companies that, amongst other things, build incinerators. The contract provides PyroGenesis with much needed local expertise, including the Japanese permitting process, which will be fully taken care of and paid for by Yasui. In addition, Yasui will reimburse PyroGenesis for future costs incurred in developing the Japanese market, throughout their agreed five year exclusive marketing term. This method of market entry, significantly reduces the costs associated with the process, while also adding a solid helping hand with connections to the right target customer group.

Japan is the largest user of MSW gasification in the world. Japan has been a leader in developing and implementing traditional and novel thermal treatment technologies. This nation generates about 65 million tonnes of MSW, thermally treats 40 million tonnes, and recycles the rest. Japan is a leader in this industry with almost no MSW being disposed of in landfills (2%) and the rest being composted, recycled or thermally treated. The table below was prepared for the IDB Guidebook and lists all the different types of WTE technologies used in Japan.

Figure 10: WTE technologies used in Japan

	Number of plants	All plants, tonnes/day	Average tonnes/day per plant	Percentage of WTE capacity of Japan
Martin reverse acting grate	66	71,500	1,083	62%
JFE Volund grate (stoker)	54	10,100	187	9%
Martin horizontal grate	14	7,454	532	7%
Nippon Steel Direct melting	28	6,200	221	5%
JFE Hyper Grate (stoker)	17	4,700	276	4%
Rotary kiln	15	2,500	167	2%
JFE Thermoselect (gasification)	7	1,980	283	2%
All other fluid bed	15	1,800	120	2%
Other	94	8,380	89	7%
Total	310	114,614		100%
Total tonnes/year (at 330 days-24h/year)		37,822,620		
% of total MSW to grate combustion plants				84%

Source: [Municipal solid waste management and WTE in the United States, China and Japan](#)

Completion of \$12.5MM contract for the delivery of 10 Powder Production Systems for 3D printing

The Company has entered into this contract in July 2014, and has shipped its first unit in June 2015. The last nine units will be built once the first system is fully installed and commissioned in Asia, which is planned to be completed by summer’s end, and manufacturing of the last units to start shortly thereafter. The Company has received \$1,045,000 in payments so far for the work done under this contract and it is expected that the remainder of the units will be built and shipped by Q3/16.

Financial Analysis

Revenues, Back-log and Profitability

Over the past several years, the Company has seen revenues climb from \$3.3MM in 2012 to \$5.8MM in 2014 (Figure 13). Although almost all of this growth came in 2013, the Company has successfully shifted its strategy towards diversified lines of revenue and multi-unit contract sizes. The Company has a respectable list of clients, including the US Navy and Air Force, European NATO, as well as other clients in Asia, Europe, Canada and the United States. The Company last reported a backlog of \$15.7MM which is double the 2013's backlog of \$7.9MM and is almost triple the Company's 2014 revenues. The backlog is seen as a positive funnel for future reported revenues and is a sign of a growing demand for the Company's products.

The Company is currently operating at a loss, with cost of goods sold and SG&A being the largest cost contributors at \$4.1MM and \$4.5MM respectively for 2014. Gross margins have largely improved since the -46% level in 2012 to 29% in 2014. We expect gross margins to improve further, as the company completes its signed backlog orders. In addition, operating margins are improving, with the opportunity to operate profitability, while gaining \$15MM+ in revenue.

The Company's primary focus over the past year has been at growing its sales channel, as evident by the large backlog, advanced operations within the O&G and dross industries, as well as the expansion into Japan. Within the Q1/15 MD&A, the Company states "A key development impacting gross margins in the first quarter of fiscal 2015 was the utilization of many of the Company's engineering and research & development resources on accelerating the development and implementation of projects that would have otherwise been committed to advancing the implementation of current live projects". We expect PyroGenesis to return to gross margins of 40% in 2016.

Balance Sheet Improvements

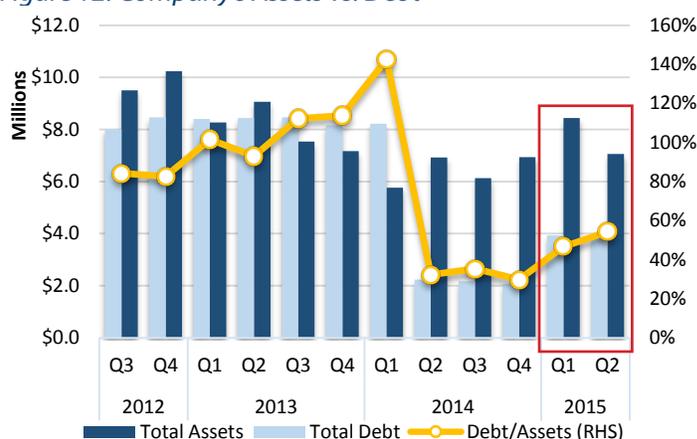
The Company's balance sheet has largely improved over the past three years, showing liquid capital levels of \$1.2MM in cash along with \$2.2MM in working capital. In addition, the Company has reduced its debt down to \$3.8MM from \$8.2MM in Q1/14. With current capital levels, and the 3D project nearing completion, the Company should be able to sustain operational and growth initiatives.

Figure 11: Cash & Working Capital



Source: Thomson Reuters

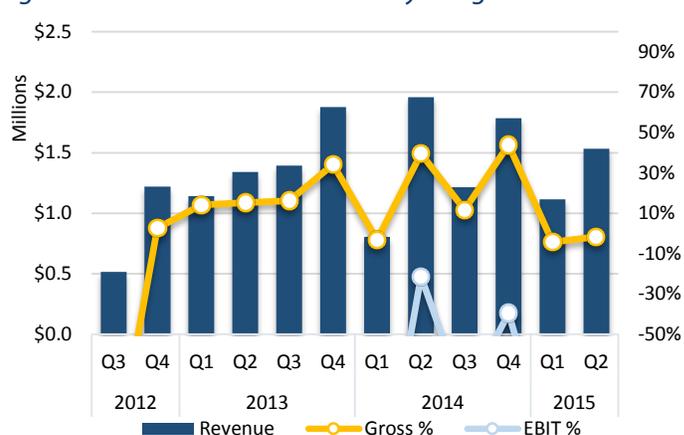
Figure 12: Company's Assets vs. Debt



Debt has dropped from \$8.2MM in Q1/14 to \$3.8MM

Source: Thomson Reuters

Figure 13: Revenues and Profitability Margins



Source: Thomson Reuters

Risks

Attaining Clients: The Company's future success depends on its ability to gain additional clients.

Ability to hit Profitability: The Company is currently operating at a net loss, and such results may be expected to continue for the near term. There is no assurance that the Company will ever generate any profits, however, the presented business opportunities on pages 4-12 give rise to potentially profitable operations by H2/16.

Foreign Currency Risk: The Company generates revenue through various geographies, exposing itself to currency exchange rate fluctuations.

Conclusion

PyroGenesis Canada Inc. is a market leader when it comes to advanced plasma processes. The Company has been developing its technology for over 20 years, with a current patent portfolio of 38 allowed, pending, and/or provisional, covering 14 different inventions. The Company's CEO, Peter Pascali, is a former investment banker and the largest shareholder of the company with 36.3% of outstanding shares. The Company's systems and processes have proven economic benefits within various, multi-billion dollar industries, and operate with no harmful impact on the environment.

With major project developments arising within the O&G, Additive Manufacturing, and Dross Treatment industries, as well as the geographic expansion into Japan, the Company's operations have truly evolved to a number of promising verticals. It appears that the Company will remain exceptionally busy throughout 2015 and 2016 with current projects. As mentioned, the Company's total attainable market is \$14.3+ billion, and with only six million in current revenues, the company has tremendous opportunity ahead.

Highlights to look for from PyroGenesis in 2015 & 2016:

- Manufacture the remaining nine powder production systems for 3D printing, and ship at least three by year end
- Deliver its first DROSSRITE™ product to North American auto parts manufacturer, with highly likely follow on contracts in 2016
- Complete O&G waste stream metal recovery project by year end, with high chance of signing a contract for the delivery of multiple 10-50 TPD units to client
- Complete the permitting process in Japan, and acquire clients in early 2016

Appendix A: Management

Peter Pascali – Founder, President & Chief Executive Officer

Mr. Pascali joined the Corporation in 1992 where he has been responsible for developing the business strategy and marketing focus for commercializing the Corporation's technologies and running the business. Mr. Pascali continues to develop the Corporation's strategy and oversee the operational management as the President and Chief Executive Officer. In his leadership role, Mr. Pascali spearheads the Strategic Management Team which is responsible for the strategic planning and execution of the company's business plan.

Pierre Carabin – Director of Engineering

Mr. Carabin has over twenty years of experience in process engineering and environmental technologies. He holds eight pending and issued patents related to high temperature chemical processes. After obtaining his Master's Degree in Chemical Engineering with honours from McGill University, he worked in pulp and paper field prior to joining PyroGenesis in 1998. As Director of Engineering since 2012, Mr. Carabin leads PyroGenesis' engineering and fabrication team for the design, development and fabrication of plasma systems. To date, he has contributed to more than 50 technical publications.

Vanessa Romano – Legal Counsel and Corporate Secretary

Mtre Romano joined PyroGenesis Canada Inc. in early 2014 as in-house Legal Counsel, responsible for providing advice on a wide range of matters including securities, employment, real-estate, contracts, intellectual property and promotional material. She is also responsible for providing and developing legal documentation as well as engaging in contract negotiations in support of business objectives. As a member of the Board of Directors, Mtre Romano also takes on the added responsibilities of Corporate Secretary.

Paul Simmons - Chief Financial Officer

Mr. Simmons joined PyroGenesis in June 2015. He brings over 30 years of international financial, business and administration experience to the Company and was most recently CFO for a Montreal-based research and development company listed in Canada and in the US, where he was instrumental in securing funding, including government-backed financing, and strategic IR activities.

Sophy Cesar - Vice President, Investor Relations and Communications

Ms. Cesar has over 15 years of experience specializing in marketing, branding and operations. Prior to joining PyroGenesis, she was responsible for the management and execution of the Investor Relations and Communications program for a TSX listed company. She successfully implemented investor awareness campaigns, supported the development of materials and deployed effective corporate communications strategies. During that time, the company successfully raised tens of millions of dollars and she supported its graduation from the TSX Venture Exchange to Toronto's senior exchange, the TSX.

Appendix B: Products

Plasma Waste Processes

Plasma Arc Gasification and Vitrification (PAGV) is a process which can convert fly ash into useful construction materials. PAGV is quite useful for municipalities, managers of incineration operations for industrial, hazardous, biomedical, and animal (slaughterhouse) waste, etc. The resulting product can be used in wide-ranging applications such as aggregate asphalt and flooring, and replacement for cement in concrete and jewelry.

Plasma Arc Waste Destruction System for Land (PAWDS-Land) is a plasma based waste treatment system ideal for remote communities like mining camps and military facilities. The PAWDS-Land system destroys waste, while generating electricity from excess heat. The system was developed in partnership with the U.S. Department of Defense.

Plasma Arc Waste Destruction System for Marine (PAWDS-Marine) is a plasma based waste treatment system which can destroy combustible wastes such as paper, plastics, food, oily rags, waste oil with minimal segregation. The system is developed in partnership with the U.S. Department of Defense and has been approved for the Gerald R. Ford Class supercarriers. The first two ships in this class, the CVN-78 USS Gerald R. Ford and the CVN-79 USS John F. Kennedy, have already ordered PAWDS-Marine. The system has already received Lloyds Register MED Type Approval.

PRRS, proven by U.S. Department of Defense, provides industry, municipalities and the defense sector a comprehensive solution to waste management while producing clean energy. There are several benefits of the process:

- Inorganic waste are transformed into inert, non-toxic materials
- The process simultaneously produces heat, which can be transformed into electricity, steam, hot water, and/or liquid fuels
- Easy to operate and can be maintained with minimal manpower requirements

SPARC™ is a patented destruction process for ozone depleting substances (refrigerants) and other environmentally hazardous chemicals. SPARCTM can effectively be used to generate offset credits in both the regulated and voluntary carbon market and has already been deployed by a major Canadian refrigerator recycler.

Tactical PACWADS is designed to quickly and safely destroy a wide range of chemical warfare agents (CWAs) and their precursor reagents in the field. This process eliminates the need to transport enemy's CWAs by providing in-situ destruction of the material.

Advanced Material Processing: Plasma Atomization Process (PAP), DROSRITE

The PAP is an enabling technology for 3D Printing as well as other additive manufacturing and powder metallurgy applications. PAP units can address the exacting requirements in terms of chemistry and properties required by the biomedical and aerospace industries. The PAP has the distinction of producing flowable and pure spherical metallic powders. Using wire as the feedstock to the PAP allows for a high level of traceability and unparalleled control of the particle size, a critical requirement for the industries that the process addresses.

Drosrite Process maximizes metal recovery from dross and is salt-free, highly cost-effective and targets primarily the aluminum and zinc industries. The process avoids costly loss of metals while reducing a smelter's carbon footprint and energy consumption. There are several benefits of the process:

- Metal recovery increased by more than 10% compared to third party treatment
- Lower operating cost compared to using a subcontractor
- Recyclable non-hazardous residue; no atmospheric emission; zero landfill usage
- Since carbon footprint is reduced, the process is ideal for high-greenhouse gas emitters (e.g. smelters); increasing regulations on greenhouse gas emission can impose huge penalty on large GHG emitters in the future.
- It can work well in controlling skimming practices with in-situ treatment

Plasma Torches

Some of the most demanding applications of plasma torch systems are Waste-to-energy applications, advanced material production, metallurgical processing, thermal treatment and nanotechnology manufacturing. The company manufactures four different types of torches:

- APT torches have been deployed by the US Department of Defense and can be used in waste treatment, gas heating, R&D and advanced materials production.
- MINIGUN can be used to produce high purity materials and nonmaterial, R&D, waste treatment and thermal spray coatings.
- Reverse Polarity Torch (RPT) is used in the production of spherical metallic powders, the fabrication of high purity metal, gas heating and production of carbon nanotubes.
- SPT plasma torch is used in the destruction of refrigerant and other CFC, HCFC, HFC and PFC. The technology also helps in cleaning effluent gas streams controlling C-H ratios in hydro cracking and biomass gasification applications

Engineering Services

The company currently provides:

Process/Product Development Services (Contract Research) – the company provides this service to industry/academia, which require lab, pilot or full-scale technical support for new products or services and assists in proof-of-concept, bench-scale testing, increasing-capacity pilot-scale testing, prototyping and finally full-scale implementation of the new process or product.

Custom Reactor/Furnace Design and Fabrication – the company provides custom reactors, and furnaces of all shapes and sizes to meet the needs of clients in the advanced materials, metallurgical, environmental and chemical fields.

Appendix C: Recent News

- September 29, 2015 **PyroGenesis files provisional patent for high purity silicon production**
The Company filed a provisional patent for a one step process using plasma for producing high purity silicon from silica. The PUREVAP™ is a proprietary process that uses a plasma arc within a vacuum furnace to produce high purity, metallurgical grade silicon (MG-Si), solar grade silicon (UMG Si) and polysilicon from quartz.
- September 28, 2015 **PyroGenesis Announces Receipt of an Order from US Navy to Train Sailors at its Manufacturing Facility in Montreal**
The Company received an order from Supervisor of Shipbuilding, Conversion & Repair (“SUP-SHIP”) to train US Navy sailors on its Plasma Arc Waste Destruction System (“PAWDS”) Engineering Design Model at its manufacturing facility in Montreal. The first group of sailors are expected to arrive in the fall of 2015.
- September 9, 2015 **PyroGenesis common shares start trading in the U.S. market (OTCQB)**
The Company’s common shares will begin trading under the symbol “PYRNF”.
- September 4, 2015 **PyroGenesis comments on September 3rd, 2015 trading activity**
A significant number of Company shares were offered for sale within a very short period of time creating downward pressure on the stock.
- August 31, 2015 **PyroGenesis announces Q2/15 results**
Q2/15 revenues increased by 37%, from \$1.1 million to \$1.5 million, over the previous quarter. The current backlog as at August 28, 2015 stands at \$15.7 million.
- August 4, 2015 **PyroGenesis Announces Termination of Development Use and Commercialization Agreement with Client for PyroGenesis’ SPARC Technology; Paves way for Commercial Opportunity with International Oil and Gas Company**
The reason for this decision was based on their common intention to pursue the development of solutions for the destruction of ozone depleting substances independently. Signed undertaking by PyroGenesis not to destroy ozone depleting substances in Canada before July 7, 2017. PyroGenesis has been in discussions to redeploy the Pilot System in a fully commercial environment, either in Asia or with an international oil and gas company in the United States.
- July 28, 2015 **PyroGenesis Announces Receipt of USD \$917,532 as Final Payment for Asian Plasma Torch Contract**
- July 20, 2015 **PyroGenesis Announces Receipt of \$340K Down Payment on Previously Announced Sale of Patented DROSRITE™ Furnace System to North American Automobile Parts Manufacturer**
The System is expected to become operational in Q1/16, and will showcase the transformative nature of PyroGenesis’ DROSRITE™ technology to an industry that has been plagued by rising electricity costs, large carbon footprint, and poor environmental legacies. It is expected that the Client will purchase two additional systems.
- June 17, 2015 **PyroGenesis Cancels Previously Announced Exclusive Asian Marketing Agreement in Favor of Exclusive License Agreement with Yasui Facilities Inc. of Japan**
Deal announced on March 4, 2015 is canceled. Yasui is a one of Japan’s preeminent Architectural/Engineering firms who works with a consortium of companies that built incinerators. Yasui provides the needed local engineering and permitting expertise that PyroGenesis requires to conclude various contracts under discussion. The Exclusive Marketing Agreement permits Yasui to market PyroGenesis’ line of plasma waste processing systems in Japan for a period of five years. Yasui undertakes to pay all costs associated with the Japanese permitting process, which are estimated to run into the \$100,000’s, and to reimburse PyroGenesis for costs incurred in developing the Japanese market. Furthermore, upon receipt of the permit, which is expected in less than one year, Yasui will pay PyroGenesis a onetime exclusivity fee of \$1.5MM in one installment.



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