Explanation of the Major Advantages of the APS Technology

Pyrolysis Methodology (The process of using heat to break down complex substances into simpler substances by the use of heat)	APS Technology	Competitive Pyrolysis Systems
1. Feedstock Inputs and methodology	The leading edge APS technology is a continuous feedstock system which operates under normal pressures making it easier to control the explosive fuel gas containing hydrogen and which is discharged during the pyrolysis process. This makes the APS technology much safer than the traditional systems used by APS's competitors which operate under high pressures. The APS technology operates continuously, it does not have to be shut down and therefore is much more energy efficient than the batch system used by some competitors.	Competitors use a batch system or a different version of the continuous system which both operate under high pressures. This increases the danger of leakage in the explosive fuel gas created in the pyrolysis process, which increases the risk and danger of explosion. Further under the batch system the operator can only reload the feedstock once the pressures are reduced and the high temperature is cooled. This process of shutting down the pyrolysis operation to accommodate the cooling of temperatures and reducing of pressures results in energy loss and operation time, thereby making it a much less efficient pyrolysis system.

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2. Heat Sources	The APS technology uses a mixed heat source incorporating the use of a gas, or diesel heat source together with steam. By incorporating the use of steam the feedstock materials are heated uniformly throughout as the steam penetrates into the center of the feedstock materials creating a more uniform heated feedstock rather than the single heat source used by APS's competitors. Further, using the APS technology, once the process is initiated, fuel gas is created in the combustion chamber. This fuel gas is captured and transferred to the proprietary condensing system which eliminates the dioxins. This is done by returning the light hydrocarbons together with steam back to the furnace. The proprietary process in the furnace converts the low burning fuel gas and steam into a fuel gas with a higher BTU rating. In essence the APS technology, once started, creates its own fuel, thereby eliminating the need for an external fuel source.	Competitors use a single heat source which chars the surface of the feedstock, but does not penetrate effectively below the surface of the feedstock material resulting in the internal portions of the feedstock materials remaining significantly cooler than the surface. This results in incomplete cracking (the breakdown of complex substances into smaller molecules using heat) of the feedstock material. This process results in a lower quality of carbon black. The conventional competitive pyrolysis systems simply burn off the fuel gas released, thereby releasing dioxins and sulfur into the atmosphere, creating an environmental hazard.

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3. Pyrolysis and Heating Process	The APS technology uses a Three stage process which is steam activated and uses an indirect heating system incorporating direct steam heating. This system results in a fast pyrolysis, short processing time, minimal energy consumption, complete treatment of the organic material, high quality by-products and a safer pyrolysis process through the use of steam. The APS technology can operate at a temperate up to 700℃ in its third stage. The reason a Three stage process is required is that different organic waste materials require different temperatures to treat them. It is impossible to treat a wide range of organic compounds in the stage one process. Although most organic compounds can be cracked between 350℃ and 420℃ and 95% of organic compounds will be decomposed to become fuel oil and fuel gas under 450℃ leaving 5% of the organic material unprocessed. To treat the remaining 5% of organic material a higher temperature is required, so a three stage process is used which can operate at temperatures up to 700℃. To crack used tires a suggested temperature of 500℃ and	Competitors use indirect heating systems which operate at processing temperature less than 450℃. As this method does not effectively penetrate heat into the internal feedstock materials, a longer processing time is required. Further, it often results in an incomplete treatment which results in a lower quality of by-products. Also the poor thermal conductivity of this process requires more energy consumption and reduces the safety of pyrolysis process.

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Pyrolysis Methodology **(The process of using heat to break down complex substances into simpler substances by the use of heat)**	**APS Technology**	**Competitive Pyrolysis Systems**
3. Pyrolysis and Heating Process (continued)	600℃ for coal is required in the Third Stage of the APS technology. These are temperatures that the competitor's single heat source systems do not achieve.	
4. Cracking Time for Tire Chips	The APS technology takes approximately 2 minutes to completely decompose 10cm^2 of used tire chips to fuel oil and fuel gas at 400℃. The standard cracking time for tire chips is less than 18 minutes.	The traditional indirect heat system alone used by the competitors takes in excess of 8 minutes to decompose 10cm^2 of used tire chips. The standard cracking time for the conventional batch system is greater than 1.2 hours and greater than 35 minutes for the conventional continuous system for each ton of feedstock.
5. Energy Efficiency	The APS technology operates at an energy efficiency exceeding 85%	The competitor batch systems operate at an efficiency level of less than 30%. The traditional continuous competitive systems operate at an efficiency level of less than 50%.

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6. Product Quality (a) Oil, sulfur content	The APS technology uses steam to produce a light fuel oil similar to diesel fuel containing less than 1% sulfur and can achieve sulfur content as low as 0.3% without the use of a catalyst. This lower sulfur content oil commands a higher selling price. Further the APS proprietary condensing system reduces the build up of tar in the piping and condensing system making the APS equipment safer to operate while producing by-products more attractive to buyers.	Competitors using the traditional pyrolysis systems cannot normally produce oil having a sulfur content of less than 2 % without the use of catalysts. Further the competitors' traditional pyrolysis systems cause a tar sand problem and produce dirty oil.
(b) Carbon Quality	The APS technology produces a carbon black with less than 0.1% oil content which with the addition of an acid purification system meets the N220 or N330 carbon black specifications and has a *BET rating or 120-800 ("Absorption Surface Area"). The resulting carbon black has a high iodine absorption rate and high surface area making it a desirable by-product. The fact that there is an indiscernible amount of oil is significant because carbon black with high oil content will cause a chemical reaction and affect the process in plastic or rubber production. If carbon black contains an oil compound it will burn and cannot be sold.	The competitors using the traditional systems cannot produce a carbon black having less than 1% oil content which makes for a non saleable carbon waste with a *BET rating of less than 60. Further the iodine absorption and surface area are low.

Note: *BET – Higher rating translates to higher absorption