



## A Beginners Guide to Vortex Combustion!

### Our “Did You Know?” Series

As part of our “Did You Know” series, we are offering this detailed description of our latest Firebird V-III™ technology, for non-technical folks! To learn more about this advanced type of incineration, you can read our White Paper on Vortex Combustion, or other documents in this series, available online at [www.AmericanEnergyGroup.org](http://www.AmericanEnergyGroup.org).

### General Description

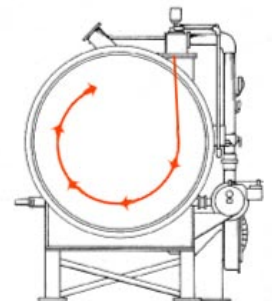
The V-III™ is a grateless combustion system (combustor) that uses high temperatures (2,000° F and above) with high speeds (a 90 mph tornado on its side) to more efficiently burn shredded waste material. This material then moves through the chamber towards the back wall, where (through a patented and proprietary method) it is re-introduced back into the vortex for continuous burning.

This overall process is known as “synergistic iteration.” As the waste material burns in suspension, it becomes its own fuel, mixing with controlled amounts of air (oxygen) to achieve complete and perfect combustion. Current technology incinerators allow the waste to sit or rest on a grate while burning, which produces the harmful emissions, gases, fly ash, and smoke, because of incomplete combustion. These require expensive and complex air scrubbers to remove the contaminants prior to entering the atmosphere. The V-III™ does not produce these same harmful outputs, and therefore does not require exhaust cleaning or scrubbing.

The V-III™ handles the municipal waste needs of a population of between 40,000 and 50,000 people, which includes a typical percentage of residential, commercial, and institutional. It boasts a small footprint, which combined with the lack of offensive odors and harmful emissions, allows the system to be installed closer to populated areas.

### Details

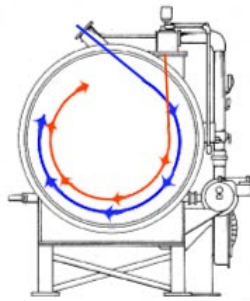
The process begins with the main chamber of the combustor being primed with a long flame that is introduced tangentially into the chamber. What this means is that the flame follows the contour of the inside of the chamber so as to begin the motion and direction of the vortex, as shown in the image to the right. Once at temperature, the waste material is introduced as described below. After a short period, the primer flame can be shut off.



**Did You Know...?**

... that the three "R"s of waste management are: Reduce, Recycle, & Reuse?

This part of the process starts off with pre-sorting of the waste material, especially for municipal waste purposes. This serves two purposes; one is to have better control over the composition of the waste material to be shredded and then burned, and the second is to satisfy people's concerns for recycling. Recycling came about as a solution to the problem that certain items were not biodegradable and would survive in a landfill until the end of time. As we know, the recycling process is also very expensive and energy consuming. Since our system can handle these items properly, the need for recycling is diminished. However, to properly manage the emotional issue that is encountered with combustion, we feel that the pre-sorting will be beneficial.



Once the material is fed into the shredder, it moves through a material handling manifold with the help of a fan supplying the primary air for the combustion chamber. This mixture of air and waste is introduced into the chamber tangentially, which again follows the contour of the chamber, and is blended with the motion and direction of the vortex flame, as shown with the blue curved line in the image to the left. This process now creates a super-heated vortex which burns the shredded waste material while fully in suspension. To achieve complete and perfect combustion, it is necessary to control the mixture of the waste, fuel, and oxygen. Turbulence is also a critical factor, which in this case comes about with the high-speed vortex rather than a shaker-grate as some standard incinerators use. Additionally, as the waste material is moving through the chamber, it is not only reducing in size, but becomes fuel for the process, which allows for a higher level of combustion and efficiency.

Some materials that are non-combustible are collected into a tray during this process. Because of the nature of the super-heated vortex, these materials will generally collect small amounts of ash as they are being deposited into the tray. These non-combustibles are sterile and neutralized, and perfectly safe for handling and proper disposal. The extremely hot air gas that exits during this process is reintroduced back upstream into the vortex to be burned off, as in the process of a manufacturing fume burner. This super-heated air acts to enhance the overall speed and temperature of the existing vortex, improving its efficiency.

The V-III™ has been designed with state-of-the-art programmable controllers for automation processing. It is also equipped with an array of sensors which allows complete and accurate control and monitoring of numerous factors, such as vortex temperature, vortex speed, secondary air dampers, and the air quality contained in the exhaust stack. The system is equipped with EPA-approved monitoring software, with remote access capability to provide continuous transmission of the data collected and reports directly to the state environmental protection agency.

With complete and perfect combustion, the only by-products are CO<sub>2</sub> and H<sub>2</sub>O. No harmful emissions, gases, fly ash, odors, or even smoke, are produced through the process of this vortex incineration, therefore no scrubber systems are needed. The exhaust that is released into the atmosphere is clean and harmless, far exceeding EPA air quality specifications and standards. Because this process doesn't allow for waste to sit or to collect, as well as not

**Did You Know...?**

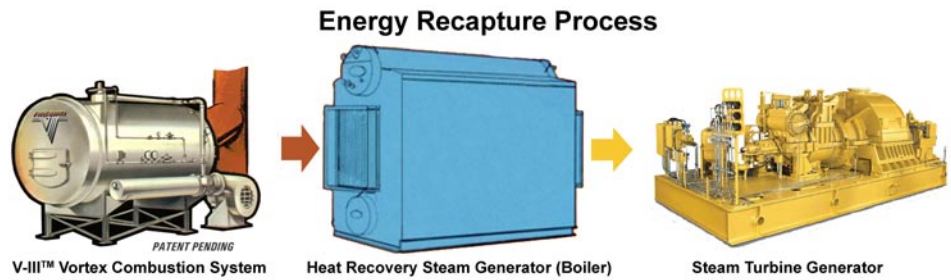
... that incineration has been used as a means of waste management since the 1800's?

**Did You Know...?**

... that in addition to being part of our breathing process, CO<sub>2</sub> is used for adding carbonation to sodas, and in the making of wine?

having soot or other messy residue build-up, there is very little maintenance required as found with current technology systems.

This system can be used as a stand-alone waste combustor, or as part of a waste-to-energy (WtE) system, where the super-heated exhaust can be directed to a heat recovery steam generator, or boiler, and then to a steam turbine for the production of electricity. By processing the waste from a community of 40-50,000, the energy output is sufficient to supplement most if not all of the electricity requirements for that municipality. Smaller steam turbines can be used for communities or organizations that require less electricity.



Previous versions of this technology have been used in various applications, such as the disposal of contaminated materials from a nuclear fuel-rod facility, and infectious waste disposal. We have adapted this technology to dispose of municipal and industrial waste, enhancing the electronics and control systems. Previous versions are also installed in 14 countries around the world.

**Summary:**

The V-III™ offers a high level of efficiency through the unique blending of extreme temperatures and high speeds, along with a patented process of reintroduction of particulate matter for continuous burning to achieve complete and perfect combustion. Because of this process, the system does not produce harmful emissions and gases, odors, fly ash, or smoke. With a small footprint, this system can be installed closer to populated areas, and offers a unique, modular design for rapid replacement or modification. The V-III™ can also be used as an eco-friendly solution for mobile needs, and can also be configured with smaller boiler/steam turbine combinations to produce electricity on a temporary basis.

**Did You Know...?**

... that one V-III™ system with energy recapture can generate more electricity than 4 large wind turbines?