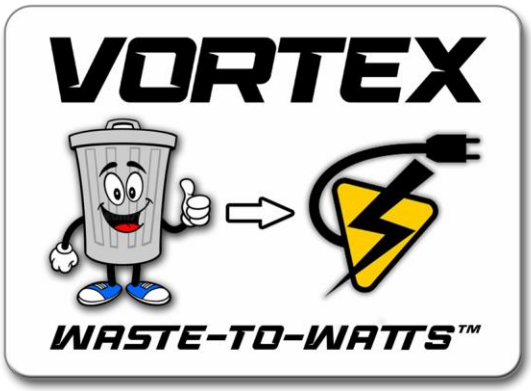


Everything You Always Wanted to Know About Waste-to-Energy And Other Stuff (But Were Afraid to Ask!)

Vortex Energy Group LLC
www.VortexEnergyGroup.com

Waste-to-Energy… A Global Issue

Following are a few pages that will offer a new glimpse into something that most of us over the years have never thought about… how to eliminate waste materials in an environmentally safe way, and try to get something else out of the process. That's where waste-to-energy comes in. Before we discuss our innovative technology, we should probably start things out with a definition: "Waste-to-energy (WtE) is defined as the process of generating useful energy, such as electricity or heat, from waste materials through combustion, particularly municipal solid waste." (www.ScienceDirect.com) ***(We also refer to this as Waste-to-Watts!)***

Our technology is not only innovative, it's revolutionary. Based on extensive research done as part of the patent process, we discovered that there is no technology anything like this in the world. That's not just a boastful comment, it's just that nobody has thought about a better way to dispose of waste materials based on a technology that was started in the late 1960s. We took a system that was so far ahead of its time and updated and upgraded it, so that now our patented design is smaller, has more capacity, and is more efficient than the previous design by double.

Today's technology is based on the principle of energy recovery, also known as recycled energy. The idea is simple – the high temperature exhaust from a powerful heat source goes into a waste heat boiler, where steam is created, and that steam then goes into a steam turbine generator that produces clean, sustainable energy (electricity). This concept of energy recovery is slightly older than the United States, with waste-to-energy concepts beginning more than 150 years ago.

Our thermal vortex technology takes advantages of some of those same proven concepts, and uses current advancements in computerization, miniaturization, and extensive raw materials, to offer something truly amazing. But it all started for me when I was 10 years old doing a science fair project on the original technology. In an almost Norman Rockwell style painting, I stood on a wooden crate as the front hatch was opened up, and I experienced 2,000˚F and a 90 mph tornado at the same time. I was hooked!

From those humble beginnings (I always wanted to say that!), and more than 50 years later, I began my redesign of that system. Even then, I never anticipated the full depth and breadth of not only the capabilities of this awesome and powerful technology, but also the impact it would have all over the world. On the following pages, you will read about the various markets that are available, which will also show just how immense this market is in the U.S., with many times over around the world.

As you go through these pages, if you have any questions, comments, or suggestions, we would love to hear from you. You can go to our website: www.VortexEnergyGroup.com, and after reviewing information and materials there, go to the Contact Us page, and send us a message.

Jim VanNatta
Founder / CEO

Eduardo Montemayor
Chief Operating Officer
Director of Latin American and Caribbean Operations

BTU Values and Characteristics of Combustible Waste Materials

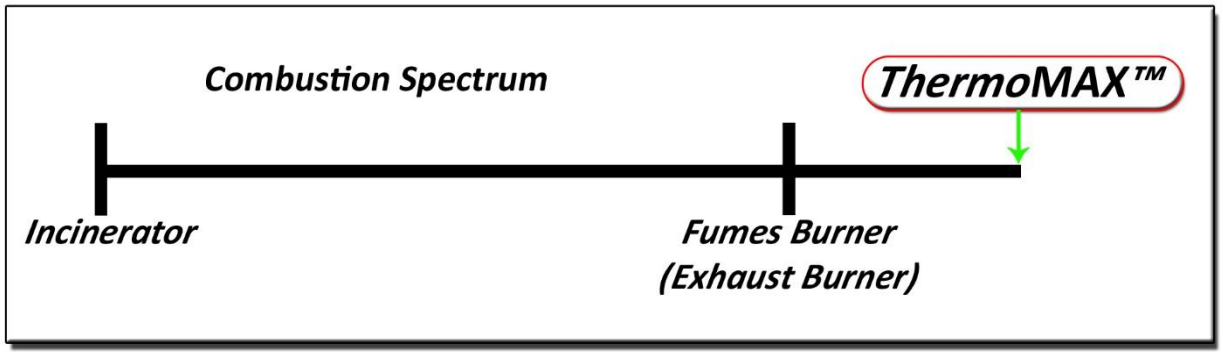
This chart lists the typical BTU values per pound of various combustible waste materials, along with estimated moisture content, ash content, and total energy per ton of material. These values are averages and can vary based on feedstock composition and pre-processing.

Material	Typical BTU/lb	Moisture Content (%)	Ash Content (%)	Energy per Ton (BTU)
Polyethylene (PE)	19,000	1.0	0.5	38,000,000
Waste Oil	19,000	0.5	0.1	38,000,000
Plastic (Mixed)	18,000	2.0	6.0	36,000,000
PVC Plastic	16,000	1.0	10.0	32,000,000
Tires (Shredded)	16,000	1.0	5.0	32,000,000
Coal Fines	12,000	10.0	15.0	24,000,000
Polyethylene Terephthalate (PET)	11,000	0.6	0.02	22,000,000
Woody Biomass (Softwoods)	9,000	15.0	2.0	18,000,000
Woody Biomass (Mixed Hardwoods)	8,500	20.0	3.0	17,000,000
Construction & Demolition Wood	8,500	10.0	2.0	17,000,000
Cardboard	8,000	5.0	8.0	16,000,000
Waste Wood Chips	8,000	15.0	5.0	16,000,000
Textiles	8,000	10.0	10.0	16,000,000
Agricultural Biomass (Bagasse)	7,500	50.0	3.0	15,000,000
Agricultural Biomass (Corn Stover)	7,200	15.0	5.0	14,400,000
Paper (Mixed)	7,000	6.0	10.0	14,000,000
Sewage Sludge (Dry)	6,500	10.0	30.0	13,000,000
Agricultural Biomass (Rice Husk)	6,200	10.0	15.0	12,400,000
Sargassum Seaweed (Dry)	6,000	15.0	15.0	12,000,000
Animal Manure (Dry)	5,000	15.0	25.0	10,000,000
Municipal Solid Waste (MSW)	4,000	25.0	20.0	8,000,000
Yard Waste	3,500	55.0	10.0	7,000,000
Sargassum Seaweed (Wet)	2,800	85.0	35.0	5,600,000
Food Waste	2,500	70.0	8.0	5,000,000

Waste-to-Energy FAQs

Q: What about the ash – fly ash and residual ash?

A: This is probably the most asked question… for every application and type of waste material. Two factors are used in our process – 1) We achieve complete and perfect combustion, meaning that we have complete control over the atmosphere inside the unit. With incomplete combustion, such as a conventional incinerator, the waste material sits on a grate, and with a constant fuel source, is allowed to rest and smolder. If you see smoke or smell fumes, it's incomplete. In our technology, the waste material doesn't sit and rest, but burns in full suspension in the vortex. The waste material becomes its own fuel. 2) In addition, the second part of the internal process is similar to a fumes burner, where any combustible material is reintroduced back upstream into the vortex to go back through the process. Based on our patented and exclusive design, the combustible material will repeat that process over and over until it has gone through a complete transformation to a gas.



Q: *So, w*here exactly does the ash go?

A: (One of our favorite questions!) The technical'ish answer is that because of our patented process, no ash material is allowed to exit through the exhaust, because of being reintroduced into the vortex in a controlled manner, so that any remaining combustible material after it goes through the immediate destruction/transformation phase repeats that process until it's totally gone. Imagine tossing something into a fire, and instead of leaving behind ashes, the fire keeps pulling them back in and burning them down until there's nothing left. The 90 mph vortex (tornado) and 2,000^{0}F heat keep reusing the ash until it's completely gone – like a self-cleaning fire that leaves no mess behind.

Q: Do you have to only use one type of waste material in the vortex system?

A: Short answer – no. Again, armed with the knowledge that our patented technology is the only one of its kind in the world (for now), our system offers an extreme level of efficiency. If we weren't doing waste-to-energy (WtE), then we could always push the capacity to the highest level without compromising the process or efficiency. However, when we are in a WtE process, the only thing we need to ensure is that we are getting 32,000,000 BTUs being processed. We have a thermal efficiency of 98%, meaning we only have a 2% heat loss. When the system has 2,000^{0}F temperature inside, due to the level of refractory brick, the outer steel shell will be whatever the ambient temperature. So, if you mix and match the waste materials, you only need to add up the various volumes so that the inherent BTU value of the various materials adds up to 32 million BTUs. This is an important feature, since sargassum has a season that runs from March to October. When energy recovery is occurring, there will need to be a sufficient volume of other waste materials to augment the volume of the sargassum available.

Q: How exactly does that work, to be able to calculate the 32 million BTUs?

A: It's actually quite simple. All materials have an inherent BTU value. Obviously materials like tires or plastics have the highest, due to their composition, including hydrocarbons and rubber. For example:

🔥 **RECIPE 1: Balanced Waste Stream Blend**
Goal: Utilize a mix of common waste types (MSW, biomass, plastics, sargassum)

Waste Type	BTU/lb	Quantity (lbs)	BTU Contribution
MSW	4,000	2,500	10,000,000
Woody Biomass	8,000	1,000	8,000,000
Plastics	17,000	800	13,600,000
Water-Collected Sargassum	3,000	133	400,000
TOTAL		**4,433 lbs**	**32,000,000**

Please see this and other "recipes" in our publication:

"Recipes To Use In A Thermal Vortex Process"

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Recipes To Use In A Thermal Vortex Process

Here are four "recipes" (fuel blends) designed to reach a total 32 million BTUs for a Thermal Vortex Combustion process, using combinations of the materials and their BTU values you provided:

🔥 RECIPE 1: Balanced Waste Stream Blend

Goal: Utilize a mix of common waste types (MSW, biomass, plastics, sargassum)

Waste Type	BTU/lb	Quantity (lbs)	BTU Contribution
MSW	4,000	2,500	10,000,000
Woody Biomass	8,000	1,000	8,000,000
Plastics	17,000	800	13,600,000
Water-Collected Sargassum	3,000	133	400,000
TOTAL		**4,433 lbs**	**32,000,000**

🔥 RECIPE 2: Landfill + Tires + Red Bags

Goal: Focus on landfill material, with high-energy tires and medical waste for energy boost

Waste Type	BTU/lb	Quantity (lbs)	BTU Contribution
Combustible Landfill	3,500	4,000	14,000,000
Shredded Tires	16,000	1,000	16,000,000
Medical Waste – Red Bags	7,000	286	2,000,000
TOTAL		**5,286 lbs**	**32,000,000**

🔥 RECIPE 3: High-BTU Dominant

Goal: Minimize feedstock volume using mostly high-BTU waste (plastics + tires)

Waste Type	BTU/lb	Quantity (lbs)	BTU Contribution
Plastics	17,000	1,200	20,400,000
Shredded Tires	16,000	600	9,600,000
MSW	4,000	500	2,000,000
TOTAL		**2,300 lbs**	**32,000,000**

🔥 RECIPE 4: Coastal Waste + Combustible Landfill

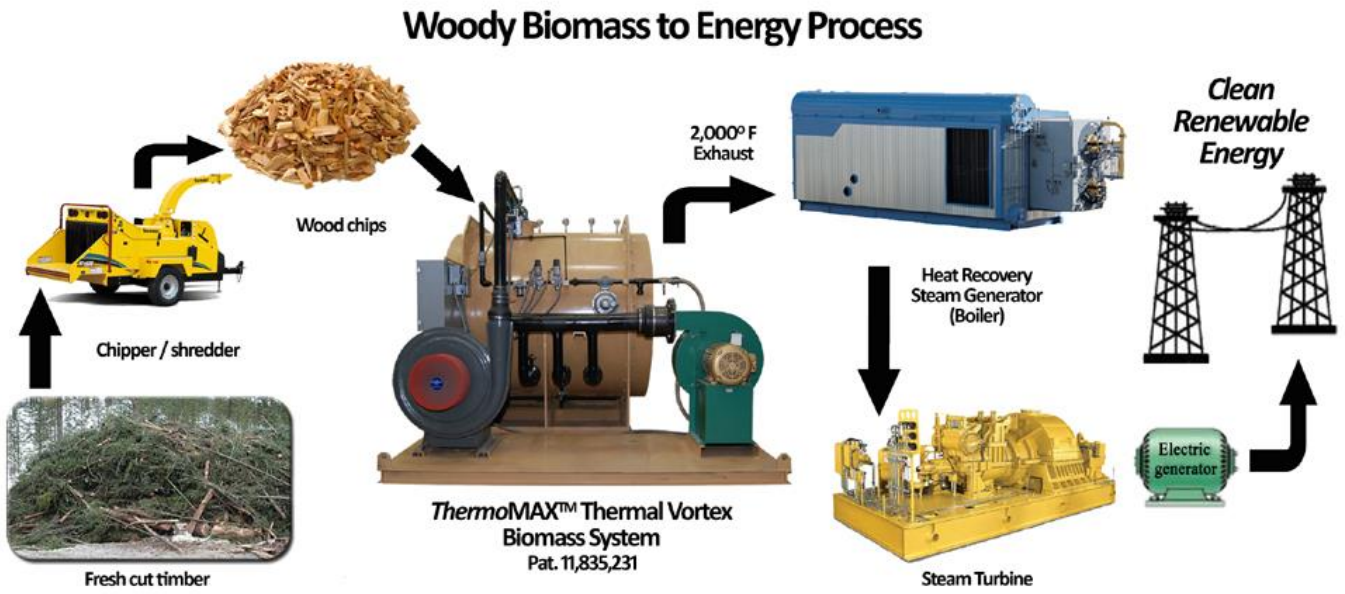
Goal: Highlight use of sargassum and landfill to hit target

Waste Type	BTU/lb	Quantity (lbs)	BTU Contribution
Beach-Collected Sargassum	4,000	2,750	11,000,000
Combustible Landfill	3,500	6,000	21,000,000
TOTAL		**8,750 lbs**	**32,000,000**

Technology Brief

Our Technology (nothing is on the market that even comes close to this)

This newly patented technology is an upgraded version of a 150+ year old process for generating electricity, that consists of a heat source, waste heat boiler, and a steam turbine. What we have done is to replace the heat source such as a coal-fired furnace or gas turbine, with a smaller sized, more efficient, and more productive system. We can destroy a variety of waste materials (and the only technology that can mix waste materials) that burn in full suspension inside the vortex at 2,000°F in a 90mph tornado, or vortex. This now becomes an extremely efficient and powerful waste-to-energy (WtE) system.



Our smaller unit can process up to 4 tons per hour of municipal solid waste (MSW), or 96 tons per day. (Our larger unit processes up to 8 tons per hour of MSW, or 192 tons per day!) That's enough to handle all of Shelby County Indiana's MSW (excluding industrial, commercial, and institutional waste collection), and with the boiler and steam turbine added, can generate enough clean, sustainable electricity to power roughly 6,000 average sized homes, or 12,000 for the larger system.

Benefits

- Long life cycle on the vortex chamber that requires virtually no ongoing maintenance
- Small physical footprint (Full WtE facility can fit easily into a 15,000 square foot building)
- Extremely small carbon footprint. After 15 to 20 minutes, the external fuel source, whether natural gas, methane, or propane, can be shut off since the waste materials become their own fuel.
- Because of its relatively low up-front cost and very low maintenance or upkeep costs, using the revenues from the sale of the clean energy, a full WtE facility can reach a return on investment in as little as 12-18 months. This can be accomplished even without subsidies and some tax credits that virtually all other forms of energy production require.
- In terms of waste destruction, this system offers additional benefits not found in typical one-dimensional waste technologies with the addition of being able to integrate with energy production components.

Available Markets in the United States (Applications or fuel sources)

The following market amounts are based on using our most efficient system as part of a WtE facility, which is the lowest cost solution that will also generate significant revenues.

- Municipal Solid Waste (MSW)

  With a current population of 346,376,521 in the United States, and considering industry figures showing each American produces a whopping 1,800 pounds of waste each year on average, that means that there is approximately 291 million tons of waste. That means a potential annual market revenue of more than $46 billion.

- Landfill reclamation

  Although nearly 50% of MSW is deposited into the nearly 2,000 active landfills, this application focuses on reclamation efforts (reclaiming the land), to include the more than 10,000 closed landfills in the U.S. Based on the number of WtE systems in each landfill, it the potential market revenue can be between $134 billion and over $1.3 trillion.

- Waste coal (coal fines)

  Coal fines are the crumbled coal materials that are also referred to as residual coal, and typically has no market value. With an estimated 11,737,000 tons of coal fines remaining in the 991 active mines in the U.S. (there are more than 48,000 closed mines with no real estimate on coal residues), there is a potential market revenue of more than $3.7 billion.

- Woody biomass (forest thinning) / Agricultural waste (corn, sugar cane, rice hulls, sargassum…)

  According to a joint report by the USDA and the US Dept. of Energy regarding biomass materials available each year in the U.S., there is a total of 1.366 billion tons. That gives a potential annual market revenue of nearly $290 billion.

- Medical / Hospital / Infectious waste

  The latest information states that there is an estimated 5.9 million tons of medical waste produced annually. That gives a potential annual market revenue of $1.5 billion.

- Scrap tires

  In the U.S. alone, we dispose of over 300 million tires each year. With an extremely high thermal value, or BTU value, it requires a smaller amount of shredded tires to produce the same amount of super-heated exhaust as 4 times that of MSW! The potential annual market value is just about $3 billion, plus currently stockpiled tires for an extra of $569 million.

- Wind turbine blades

  In the U.S. alone, we dispose of about 75,000 tons of broken, scrapped, or decommissioned wind turbine blades each year. That gives a potential market revenue of around $45 million. With the current stockpile of around 221,000 tons, it would add around $145 million.

- Great Pacific Garbage Patch

  With a total of 87,801 tons in the GPGP, the Ocean Cleanup project collects and brings to shore about 11,000 tons each year. That would give a market potential of $78 million. With a global volume of 165 million tons, that worldwide market would be approximately $63 billion.

- Salton Sea (this is a unique application, in that there is literally no potential competition)

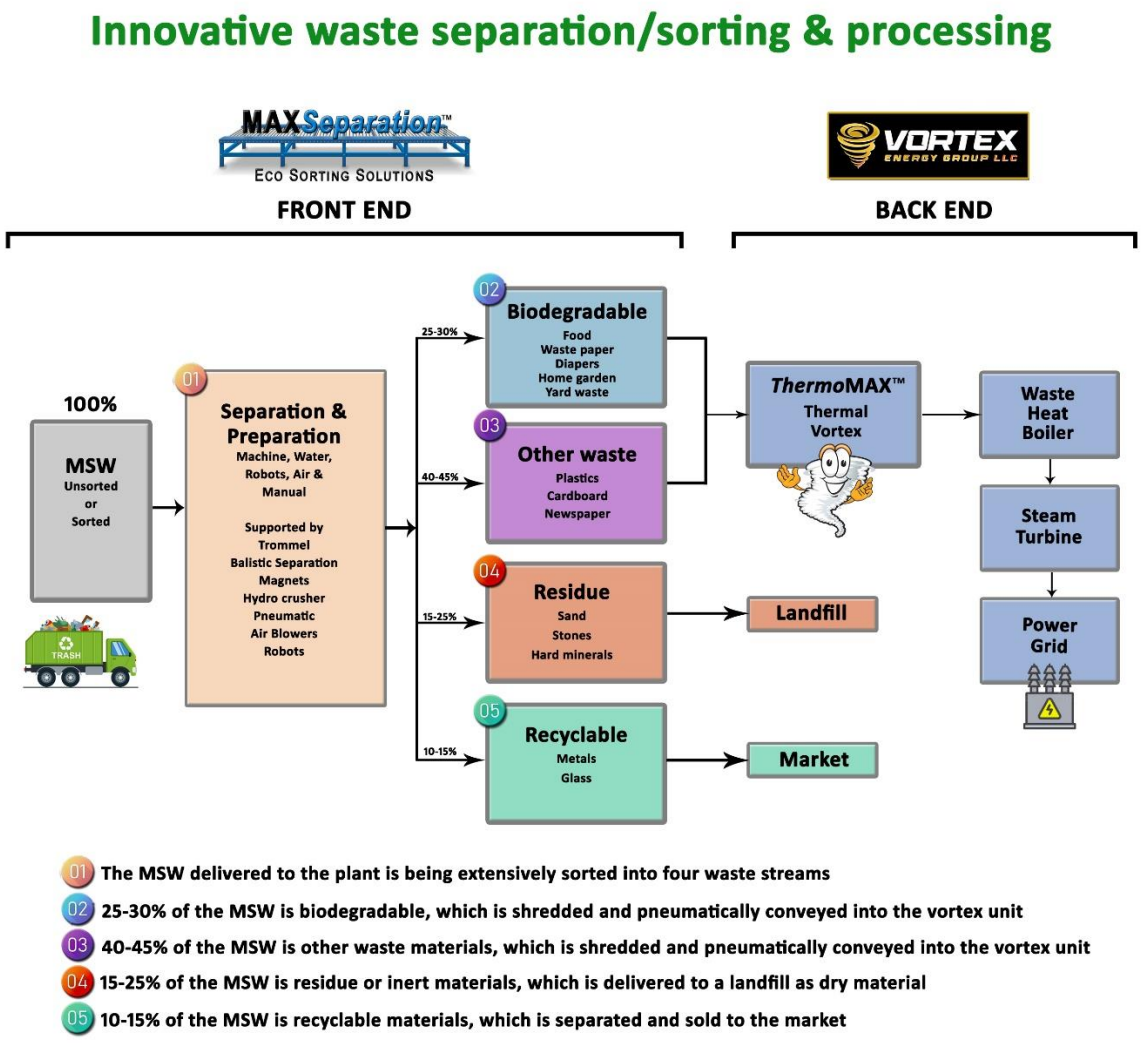
  This is one of my favorites! For many years, officials have been "looking" for a solution to the ongoing disaster at the Salton Sea in Southern California. Problem is that they just never wanted to "find" a solution! Based on the many studies, articles, and documents, the only preferred solution is one that would cost nearly $10 billion and take more than 20 years to complete. Our solution is to put 8 micro desalination and WtE facilities along the approximately 85 mile perimeter, and would cost around $960 million.

Brief Description of our Technology in a Waste-to-Energy Solution

Waste-to-energy (WtE) essentially means using waste materials as a fuel source to generate energy. It's also known as Recycled Energy, or Energy Recovery. WtE plants burn municipal solid waste (MSW), often called *garbage* or *trash*, to produce steam in a boiler, and the steam is used to power an electric generator turbine. Our unique technology and process accomplishes that using a variety of waste materials – MSW, coal fines, landfills, medical waste, woody biomass, agricultural waste, including sargasso, and even scrapped tires. It's the oldest, most efficient, and lowest cost method of generating electricity.

And there is ***no*** technology in the world even close to our patented technology.

Capacity: up to 4 tons/hour for our ***Thermo*MAX3™** and up to 8 tons/hour for our ***Thermo*MAX6™**
Operating temperature range: 1,800°F to 2,200°F, typical around 2,000°F
Turbulence: 90 mph tornado (vortex), rated as an F1 on the tornado scale



Advantages of Using Thermal Vortex Technology in Waste-to-Energy Applications

Executive Summary: The waste-to-energy sector seeks continuous innovation to increase energy recovery and decrease environmental impact. One promising advancement is Thermal Vortex Technology (TVT). This white paper delineates the numerous benefits of TVT in waste-to-energy applications.

1. **Enhanced Energy Efficiency:**
    - **Higher Caloric Value Recovery:** TVT allows for maximum extraction of the caloric value from waste, ensuring that less energy goes unutilized.
    - **Reduced Auxiliary Fuel:** By creating a more homogeneous mix of gases, TVT decreases the need for auxiliary fuels, thus reducing costs.
2. **Decreased Environmental Impact:**
    - **Lower Emissions:** TVT leads to more complete combustion, translating to reduced emissions of harmful pollutants.
    - **Reduced Ash Residue:** The advanced combustion process decreases the volume of ash produced, reducing the burden on landfills.
3. **Operational Benefits:**
    - **Scalability:** TVT units can be designed for various scales, making it suitable for both small and large waste-to-energy plants.
    - **Flexibility:** TVT can process a diverse range of wastes, including municipal solid waste, agricultural waste, and certain hazardous wastes.
    - **Less Maintenance:** Fewer moving parts and more robust designs result in reduced downtime and maintenance requirements.
4. **Economic Advantages:**
    - **Lower Operating Costs:** The combination of reduced auxiliary fuel needs, fewer emissions treatments, and decreased maintenance leads to reduced operating costs.
    - **Extended Equipment Lifespan:** As TVT provides a more even and controlled combustion process, equipment undergoes less wear and tear, increasing its lifespan.
5. **Innovative Waste Management:**
    - **Waste Reduction:** As TVT can handle various waste types and offers more complete combustion, it substantially reduces the amount of waste sent to landfills.
    - **Resource Recovery:** Beyond energy, TVT can facilitate the recovery of valuable metals and minerals from waste, offering additional revenue streams.
6. **Safety and Compliance:**
    - **Reduced Risk of Combustion-related Accidents:** The controlled environment of TVT minimizes the risk of uncontrolled combustion events.
    - **Easier Regulatory Compliance:** Due to its low emissions and environmental benefits, plants using TVT are often better positioned to meet stringent environmental regulations.

Conclusion: Thermal Vortex Technology presents a transformative approach to waste-to-energy applications. With its myriad advantages spanning efficiency, environmental sustainability, operational benefits, and economics, it stands as a beacon for the future of sustainable energy recovery from waste. Stakeholders in the waste-to-energy sector are encouraged to explore and adopt TVT as a means of revolutionizing waste management and energy production.