

Frequently asked Questions

I've heard about REI's Recovered Energy System™, recycling Municipal Solid Waste (MSW) into electricity, and ethanol. What is it and how does it work?

Instead of landfilling or incinerating MSW, this new facility, using a Plasma Gasification process, converts all types of waste streams (gas, liquid or solid) into a fuel gas composed primarily of carbon monoxide, hydrogen, nitrogen and water. This fuel gas is then used to generate electrical power or is converted into liquid fuel such as ethanol. The process is very efficient. Over 99% of the waste that is input into the system is converted to energy or other salable products. Typical gasification or incineration plants generate up to 30% residual waste that must be hauled to a landfill. The Thermal Transformation process uses a high temperature (up to 8,000 degrees Fahrenheit.) plasma arc technology to “gasify” carbon based materials into an energy rich fuel gas with a BTU value about 1/3 that of natural gas. The fuel gas is then cleaned and cooled so that it can either be used in a gas turbine to generate electricity or used in the ethanol conversion process. Non carbon based material is primarily into vitrified glass or recyclable metal.

Is waste a liability?

Waste is not a liability. It is one of the most significant and valuable resources we have. Society has made waste a liability because of the way it has chosen in the past to handle the waste. The Recovered Energy System™ treats waste as the valuable asset that it is and recovers and recycles over 99% of this valuable asset.

Isn't this “Plasma Gasification” process the same as incineration? Does the plasma gasification process “burn” the waste?

Incineration is the burning of carbon based (organic) material in an oxygen-rich environment, much the same as burning wood in a wood stove. Organic matter contains energy. The burning process requires a large amount of oxygen (O₂). The carbon contained in the organic matter reacts with the oxygen to form carbon dioxide (CO₂) and water (H₂O). The combustion is highly exothermic and releases the energy in the organic material in the form of heat. The combustion of the carbon-based material is incomplete, leaving ash and char that contains heavy metals and toxic substances requiring it to be sent to a special landfill. Non carbon based (inorganic) materials such as metal, glass, soil, concrete, silica, etc. are not affected by the burning process and become part of the ash. The total unburned material left over can be as high as 30% by weight. Incineration results in high levels of tars, furans, NO_x, dioxins and sulfur dioxide, which are expensive to clean from the exhaust.

Plasma Gasification is not incineration and it does not burn the waste. It is the transformation of carbon based material in an oxygen-starved environment using an external high heat source (plasma) to produce a fuel gas (also called a syngas) that can be used in other applications. Even though the temperatures are much higher than with incineration, the

organic material does not burn because there is not enough oxygen. The process controls the amount of oxygen and allows only enough oxygen to form carbon monoxide. The organic matter is transformed to a fuel gas composed of carbon monoxide (CO) and hydrogen (H₂) in a chemical reaction known as pyrolysis. Only a small amount of energy is released when the carbon and oxygen molecules combine. The carbon monoxide still contains substantial chemical energy and can be used in a variety of ways. The high temperatures of the Plasma Gasification process melt metals, glass, silica, soil, etc., which flow out of the bottom of the reactor. The metals are recycled and the other inorganic materials become vitrified (molten) glass. Because of the high temperatures and lack of oxygen there are no tars, dioxins or furans and Nox and Sox are much lower. The net result is that only a fraction of 1% of the waste is not converted to salable products.

What is Plasma?

Plasma is a gas that is essentially ionized, superheated air. A special plasma torch heats regular air to internal temperatures (inside the torch) as high as 25,000 degrees Fahrenheit and external temperatures (point of contact with the material) as high as 8,000 degrees Fahrenheit. The source of energy for the torch is electricity. The superheated air is used to thermally decompose whatever it comes in contact with. Steel foundries have used plasma to smelt steel for many years. Plasma is a well-established technology in many industries.

What is the difference between Plasma Gasification and standard gasification?

Standard gasification technologies operate the reactor in the 700 – 1500 degrees Fahrenheit range. They do not use any external heat source and rely on the process itself to sustain the reaction. The gasification process produces a fuel gas similar to the gas produced by the plasma process, although it is much dirtier and contains char and tars. The lower temperatures cannot break down all the materials. Another significant difference is that many materials must be sorted out of the waste stream before the reactor and landfilled or processed in other ways. The gas that is produced has tars that are difficult to remove and other contaminants that must be further cleaned up. Char residue remains that is up to 15% of the weight of the incoming material and must still be landfilled. In addition to these drawbacks, most standard gasification systems can not feed MSW directly from the truck. The refuse must be dried to an acceptable moisture content, and processed into a uniform size and consistency further adding to the cost and complexity.

Why hasn't Plasma Gasification been done before?

Plasma gasification has been used in the steel, wood and other industries for many years. A general abundance of inexpensive electrical power and ample landfills have limited the commercial viability of this technology for MSW. There are several plasma gasification MSW plants in operation internationally, but not in the US. Several plasma gasification plants are in operation in North America operating on hazardous waste. With the demand for energy always on the rise, closures of landfills, the high cost of opening new ones, and a growing market for ethanol that will triple over the next two years, the time has come for our Recovered Energy System™ using plasma technology to come to the forefront.

What is the Btu value of the fuel gas?

Carbon monoxide and hydrogen have a Btu value of 320 Btu per cubic foot, or about 1/3 the Btu value of methane (natural gas). When combined with the nitrogen and water in the gas stream, the fuel gas has an overall Btu value of about 160 Btu per cubic foot.

Are there gas turbines that will operate on such low Btu gas?

Yes. A standard gas turbine can be modified to operate on low Btu syngas. Many of the turbine manufacturers have designed turbines specifically for low Btu syngas. In fact, the same turbine rated for methane at X MW will have a higher MW rating with syngas.

Is the electricity produced by plasma gasification “green electricity”?

Green electricity is defined as electricity produced from renewable sources. Typically we think of solar, wind and geothermal power when we think of renewable energy. MSW and other wastes are renewable and the energy produced from waste is green electricity. There are several companies that market green electricity. They generally do not market power from incinerators because of the negative environmental impact and bad reputation of incinerators. However, plasma gasification does not have the negative impact of incinerators and will eventually be sold by the distributors of green electricity.

Doesn't the plant generate carbon dioxide? Does this carbon dioxide contribute to the greenhouse effect?

When the CO goes through the gas turbine it is combined with more oxygen and energy is released. The CO becomes CO₂ or carbon dioxide. Coal, diesel and natural gas power plants produce CO₂ and contribute to the greenhouse effect. These power plants are using petroleum based fuels that are introducing new CO₂ into the environment. The Recovered Energy System™ does not contribute to the greenhouse effect because it does not use new hydrocarbons as a fuel source. Our process is producing CO₂ that was already part of the base of organic material.

How much energy is contained in waste?

The United States produced 230 million tons of MSW in 1999. Industrial non-hazardous waste added another 7.6 billion tons. Medical waste and hazardous waste also add significant volumes of waste. If just the MSW were converted into electricity using our process it would generate over 30,000 mWh of electricity or an amount equal to more than 15 large coal fired power plants. Alternatively, if the MSW were converted into ethanol, it would generate enough ethanol to run every gas vehicle in the United States.

The Recovered Energy System™ can produce up to 60 gallons of ethanol for every ton of MSW processed. Plastics, tires and other types of waste can produce more. For a plant

processing 42 tons of waste per hour the annual production of ethanol is over 20 million gallons, after producing all the power for the internal plant requirements. If the same size plant is designed for electrical power only, more than 30 megawatts per hour of “green” power will be produced.

How will a Recovered Energy System™ plant affect the local citizens and the environment?

REI's Recovered Energy System is very environmentally sensitive recycling process. It will provide a long-term solution for disposing of residential, commercial, and industrial wastes. It will stabilize disposal fees, eliminate the threat of pollution associated with landfills or incineration. At the same time it will create jobs and provide a long-term income to the municipalities it serves.

How can you call this process recycling?

The American Heritage dictionary defines recycling as the extraction and reuse of useful substances found in waste. The Recovered Energy System is the ultimate form of recycling. Over 99% of the waste processed is recycled into other products and energy that can be reused.

What is ethanol and what is it used for?

Ethanol is denatured alcohol that can be used for fuel. The use of ethanol for transportation provides an environmentally friendly alternative to fossil fuels. As an oxygenate (ethanol contains 35% oxygen), ethanol enhances the combustion of gasoline, resulting in fewer emissions. The use of ethanol reduces emissions of all the major pollutants regulated by the U.S. Environmental Protection Agency (EPA), including ozone, carbon monoxide (CO), particulate matter (PM10) and oxides of nitrogen (NOx). Ethanol is also an effective tool for reducing air toxins such as benzene and 1,3 Butadiene in gasoline, which the EPA classifies as known or probable human carcinogens. Because ethanol is a renewable fuel, it reduces greenhouse gas emissions including carbon dioxide (CO₂), a major contributor to global warming. In the US it is used primarily for an octane booster in unleaded gasoline. It is also used as a fuel extender. When used as an octane booster, it is a direct replacement for MTBE (methyl-tert-butyl ether), which has now been classified as a hazardous additive that is still being used in most gasoline blends. According to the RFA (Renewable Fuels Association) the ethanol industry produced 1.6 billion gallons of fuel ethanol in 2000. The demand that will be created by phasing out MTBE will be over 3.2 billion gallons by 2004. A facility sized to process 1000 tons of Municipal Solid Waste (MSW) per day will produce over 20 million gallons of high-grade ethanol per year.

Is ethanol made from plasma gasification the same as ethanol made from corn or a cellulose process?

Yes! The chemical composition and purity are identical. The Recovered Energy System™ process is more efficient and does not leave a residual solid that must be disposed of.

Is ethanol safe?

The ethanol industry has an excellent safety record. Storage, handling and transportation safety guidelines and practices are well established. Should a spill occur, there is no threat of groundwater contamination or damage to the environment. It is biodegradable and not toxic to human or animal life.

What types of waste can be processed?

The Recovered Energy System™ can process any type of waste with the same environmental cleanliness and complete breakdown and recycling efficiency. No pre-treating, sorting, or extra handling is required. Household garbage, yard waste, glass, incinerator ash, oil waste sludges, plastics, paints, contaminated soils, tires, etc. can all be processed and recycled.

Can the plant process hazardous waste?

The same technology can, with only procedural and permitting changes safely and profitably process hazardous waste. Hazardous waste will be processed only if proper permits can be obtained.

Will hazardous waste be processed at this facility?

Waste that is classified “Hazardous” will not be permitted to be processed with “non-hazardous” materials as they are handled in a completely different manner. Strict rules and guidelines will be enforced that prevent haulers from delivering hazardous materials, unless the facility is permitted for this type of waste. The Recovered Energy System will process and recycle a far greater range of wastes than were previously possible. Hard to dispose of items such as tires, used oil, oil contaminated soils, auto shredder residue, coal fines, incinerator ash, most construction and demolition waste, even metal and glass will be recycled.

Where will the plant be located?

The plant can be located at any site that has adequate services and access. No visual evidence will be present that will indicate that garbage and waste is processed.

Will there be any odors from the plant?

The receiving area for all of the refuse is enclosed and kept at a negative pressure. The air required for the process is pulled through the receiving and storage areas thereby pulling the odors into the gasifier. The off-hours storage is contained inside a building and is cycled every 3-4 days. Only enough material is stored to operate the plant when it is not accepting wastes, such as at night and weekends. Odors are first minimized and then contained and processed along with the waste.

What happens if the facility breaks down or doesn't work properly?

At no time will the municipality or citizens be affected by scheduled or unscheduled shutdowns. Many operational contingencies and procedures are engineered into the facility design. These contingency plans are reviewed and approved by the local waste management authority as well as all applicable state agencies. This ensures that waste and all byproducts are handled properly should any unforeseen events occur that cause the plant to go off-line.

Who watches over the facility to ensure it is operated in an environmentally responsible manner?

In addition to the local and state regulatory agencies that the facility is subject to, a community advisory group, consisting of local residents will be formed to monitor the plants activities. This group will be funded by the facility and will monitor all operations and environmental compliance. Further, all emissions and EPA compliance data will be available on-line on a web page hosted by the company.

How will the facility get its waste?

The facility will receive waste in the same manner as a landfill or transfer station. Municipalities will still be responsible to pickup waste and haul it to the facility or negotiate with private haulers for this service. The participating municipalities will sign waste contracts for a negotiated period to bring the waste to the facility and pay a negotiated tipping fee.

Won't we lose the income and positive environmental impact from the recycling program that we now have?

For some items the collecting and sorting out of the "recyclable" item such as glass and metal costs more than the income that is realized by the sale of such materials. The Recovered Energy System™ is a more efficient "recycling" method. We do not discourage traditional recycling programs. However, we offer the municipality an option to decide which items to recycle traditionally and which to send unsorted to the facility for 100% recycling into energy or useful byproducts.

What risks are there if this plant is built in my town?

The facility does not create any new waste streams and all emissions are closely monitored by the EPA and state agencies. The design of the plant incorporates the latest technologies for modern storage tanks, containment systems and fire control systems. Modern control systems assure safe operation and proper reaction in the event of an upset. Risks are actually much lower than the risks of conventional landfills.