Response to State of Connecticut Request for Information

for a

Solid Waste Processing Operation

EnviroPower Renewable, Inc.

April 2023

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Glossary

ACPU / APCS: Air pollution cleanup unit (system): an assembly of process units for removing pollutants from flue gas, these may include one or more of the following: electrostatic precipitator (ESP), selective catalytic reduction (SCR), dry scrubber, and baghouse.

Baghouse. A municipal waste combustion facility air emission control device consisting of a series of fabric filters through which flue gases are passed to remove particulates prior to atmospheric dispersion.

Bottom Ash. Comprises heterogeneous material discharged from the burning grate of the incinerator (grate ash) or the ash discharge unit of a rotary kiln.

Btu (British thermal unit). A unit of measure for the amount of energy a given material contains (e.g., energy released as heat during combustion is measured in Btu's.) Technically, one Btu is the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit.

Calorific Value, Heating value of a combustible material often expressed in terms of BTU/lb.

CHP. Combined Heat and Power produces electricity and heat in the same process.

CO. Carbon Monoxide

CO_2. Carbon Dioxide

Construction and Demolition Waste (C&D). Materials resulting from the construction, remodeling. repair, or demolition of buildings, bridges, pavements, and other structures.

Daily Cover Material. Material, usually soil which is used in a landfill to cover the refuse after it has been compacted at the end of each day. The cover is placed mainly to ward off animals and for odor control.

EPC Engineering Procurement and Construction firm. Firm that serves as a prime contractor for construction projects such as the building of a power plant.

ESP. Electrostatic precipitator is a device that removes fine particulate from an airstream by using a high strength electrical field to induce an electrical charge on the particle, where after the particle is attracted to an electrode plate of the opposite polarity and held there.

Ferrous Metals. Metals derived from iron. They can be removed from commingled materials using large magnets at separation facilities.

Flue Gas. All gasses and products of combustion that leave a furnace by way of a flue or duct.

Flue Gas Recirculation (FGR) is a process to reduce NOx formation in which a part of the flue gas exiting the boiler is returned to the gasifier, reformer, and oxidizer units to provide hot oxidant and thus conserve heat otherwise lost to the heating ambient air.

Fly Ash. Small, solid particles of ash and soot generated when coal, oil, or waste materials are burned. Fly ash is suspended in the flue gas after combustion and is removed by pollution control equipment.

Gasification. A form of Waste to Energy which thermally converts waste to a synthesis gas using thermal reduction, and then combusts the synthesis gas to produce energy.

Green Waste. Green waste consists of grass clippings, scrubs, trees, and other organic waste materials generated by landscaping activities.

GW gigawatt (10 exp 9) watts of electrical power

Hazardous Waste. A waste or combination of wastes of a solid, liquid, contained gaseous, or semisolid form which may cause, or contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness, taking into account the toxicity of such waste, its persistence and degradability in nature, its potential for accumulation or concentration in tissue, and other factors that may otherwise cause or contribute to adverse acute or chronic effects on the health of persons or other organisms.

Heating Value. Heat generated per unit weight or volume of combustible material completely burned.

HHV. Higher Heating Value is the gross energy or upper heating value or gross calorific value of a material (fuel) and is determined by bringing all the products of combustion back to the original pre-combustion temperature, and in particular condensing any vapor produced.

HRSG. Heat recovery steam generator is a type of steam boiler in which the heat is provided from the exhaust of an upstream process unit such as a gas turbine engine or gasifier oxidizer.

kW. Kilowatt, equal to one thousand watts

kWh. Kilowatt hour, a measure of electrical energy equal to 1000 watts expended for 1 hour.

MAF. Moisture and ash free,

Mechanical Separation. The separation of waste into components using mechanical means, such as cyclones, Trommels, and screens.

Magnetic Separation. A system to remove ferrous metals from other materials in a mixed municipal waste stream. Magnets are used to collect the ferrous metals.

MMBtu Million British thermal units of thermal energy.

Moisture Content. The fraction or percentage of a substance or soil that is water.

Municipal Solid Waste (MSW). Household waste, commercial solid waste, non-hazardous sludge, conditionally exempt small quantity hazardous waste, and industrial solid waste.

MW. Megawatts is a unit of power equal to one million watts.

MWe: Megawatts of electrical power.

NOx. Mono-nitrogen oxides (NO and NO2), produced mainly from fuel bound nitrogen during combustion.

Oxidizer Gasifier section in which the producer gas is oxidized to generate heat for raising steam in a boiler.

Parasitic Power. Power required to operate internal plant machinery such as kiln drive motors, blowers, pumps, etc., and represents part of the difference between "Nameplate Capacity" of a generating plant and its delivered "Power to the Grid".)

Particulate Matter (PM). Tiny pieces of matter resulting from the combustion process. PM can have harmful health effects when breathed. Pollution control at combustion facilities is designed to limit particulate emissions.

Power Island. The gasification system power island Is comprised of the steam turbine and electrical switch gear for generation and distribution of electrical power.

Refuse Derived Fuel (RDF). Product of a mixed waste processing system in which certain recyclable and non-combustible materials are removed, with the remaining combustible material converted for use as a fuel to create energy.

Residue. The materials remaining after processing, incineration, composting, or recycling. Residues are usually disposed of in landfills.

Resource Recovery. A term describing the extraction and use of materials and energy from the waste stream. The term is sometimes used synonymously with energy recovery.

Rotary Kiln. A cylindrical thermal device that is mechanically rotated on its axis and used to raise materials to a high temperature in continuous processes including drying, calcining, incineration, and gasification.

Scrubber. Common anti-pollution device that uses a liquid or slurry spray to remove acid gases and particulates from municipal waste combustion facility flue gases.

Shredder. A mechanical device used to break waste materials into smaller pieces by tearing and impact action. Shredding solid waste is done to minimize its volume or make it more readily combustible.

Solid Waste. Any garbage, or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in irrigation return flows or industrial discharges.

SOx. Oxides of Sulphur

Thermal Island. Provides steam to the power island and is comprised of the rotary kiln gasifiers, reformer, oxidizer, boiler (HRSG) flue gas recirculation, and air pollution clean-up units.

Tipping Fee. A fee charged for the unloading or dumping of material at a landfill, transfer station, recycling center, or waste-to-energy facility, usually stated in dollars per ton. (Sometimes designated as a disposal or service fee.)

Tipping Floor. Unloading area for vehicles that are delivering municipal solid waste to a transfer station, sorting facility, or municipal waste combustion facility.

Toxicity. A characteristic of a hazardous waste whereby a material has a constituent concentration exceeding a maximum allowable concentration when testing the extract from a Toxicity Characteristic Leaching Procedure (TCLP) test.

Transfer Station. A permanent facility where waste materials are taken from smaller collection vehicles and placed in larger vehicles for transport, including truck trailers, railroad cars, or barges. Recycling and some processing may also take place at transfer stations.

Trommel Screen. A perforated, rotating, horizontal cylinder that may be used in resource recovery facilities to break open waste bags, remove glass in large enough pieces for easy recovery, and remove small abrasive items such as stones and dirt. Trommel screens have also been used to separate organics from mixed waste, and to process compost.

VOC: Volatile Organic Compounds are organic substances of concern (carbon chains or rings that also contain hydrogen) that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere (i.e., with a vapor pressure greater than 2mm of mercury (0.27 kPa) at 250oC or a boiling range of between 60 and 250 ^{o}C) excluding methane.

Waste-to-Energy System (WTE). A method of converting MSW into a usable form of energy, usually though combustion (thermal oxidation) or gasification (thermal reduction).

Waste Stream. A term describing the total flow of solid waste from homes, businesses, institutions, and manufacturing plants that must be recycled, burned, or disposed of in landfills; or any segment thereof, such as the “residential waste stream” or the “recyclable waste stream.

Response to Request for Information for a Solid Waste Processing Operation

EnviroPower Renewable, Inc.

Introduction

This document is provided in response to the Connecticut Material Management Infrastructure Request for Information dated February 9, 2023, for a Solid Waste Processing Operation to be constructed in the State of Connecticut. The qualification information presented in this document demonstrates the capability of EnviroPower Renewable Development, Inc. (EPR) to design, finance, build, own, and operate a clean and reliable Gasification Solid Waste to Energy Power Plant.

Data is provided herein for three different potential plant scales. The first is a baseline plant designed to process 1,000 tons per day of refuse derived fuel (RDF). Refuse derived fuel is waste that has been processed to remove non-combustible materials such as metal and glass leaving behind biodegradable materials and plastics. The second is a plant designed to process 1,300 ton per day of RDF corresponding to approximately 475,000 tons per year. The third is designed to process 2,300 tons per day of RDF. Depending on feedstock quality, 2,300 tons per day is the maximum capacity for which an EPR power plant could be operated as USEPA synthetic minor emission source at a single site.

Because waste to energy plants are paid to receive their fuel, thermal efficiency need not be the top priority in design as it is when fuel is an expense rather than revenue. The focus can then be on reliability and minimization of emissions and waste by-products. EPR has designed its gasification power plants from the ground up to be safe, reliable, and able to accept a wide range of feedstocks, including wet waste when required, with minimal environmental impact.

Equipment used in EPR plants is off the shelf and provided by well-known manufacturers, who guarantee the performance and reliability of their products. As described later, a key component in the EPR system is one or more rotary kiln gasifiers designed by EPR and manufactured and guaranteed by Metso-Outotec "Metso". The EPR design features reliable Metso calcining kilns, which comprise more than 70% of the calciners used worldwide.

Among the features that enhance safety, reliability and efficiency of EPR designed plants are flue gas recirculation with a Lo NOx oxidizer unit to reduce NOx emissions, quenching of the hot gas entering the HRSG boiler to a temperature below that which would cause corrosion and fouling the superheater tubes, and highly automated multi-point process control system. EPR designs also incorporate a sintering kiln so that the resultant waste by-product is inert. Information requested in the RFI question set is provided below according to the question number.

Question 1: What type of solid waste processing operation are you interested in developing in Connecticut?

Response 1. EPR proposes to provide a rotary kiln-based gasification waste to energy power plant that can meet the strictest environmental regulations. This plant design can be scaled to operate at up to 2,300 tons per day as an EPA synthetic minor emission source. In general, the plant can be scaled to any capacity required. Shown in **Figure 1** is a high-level block diagram of a waste sorting facility and gasification power plant.

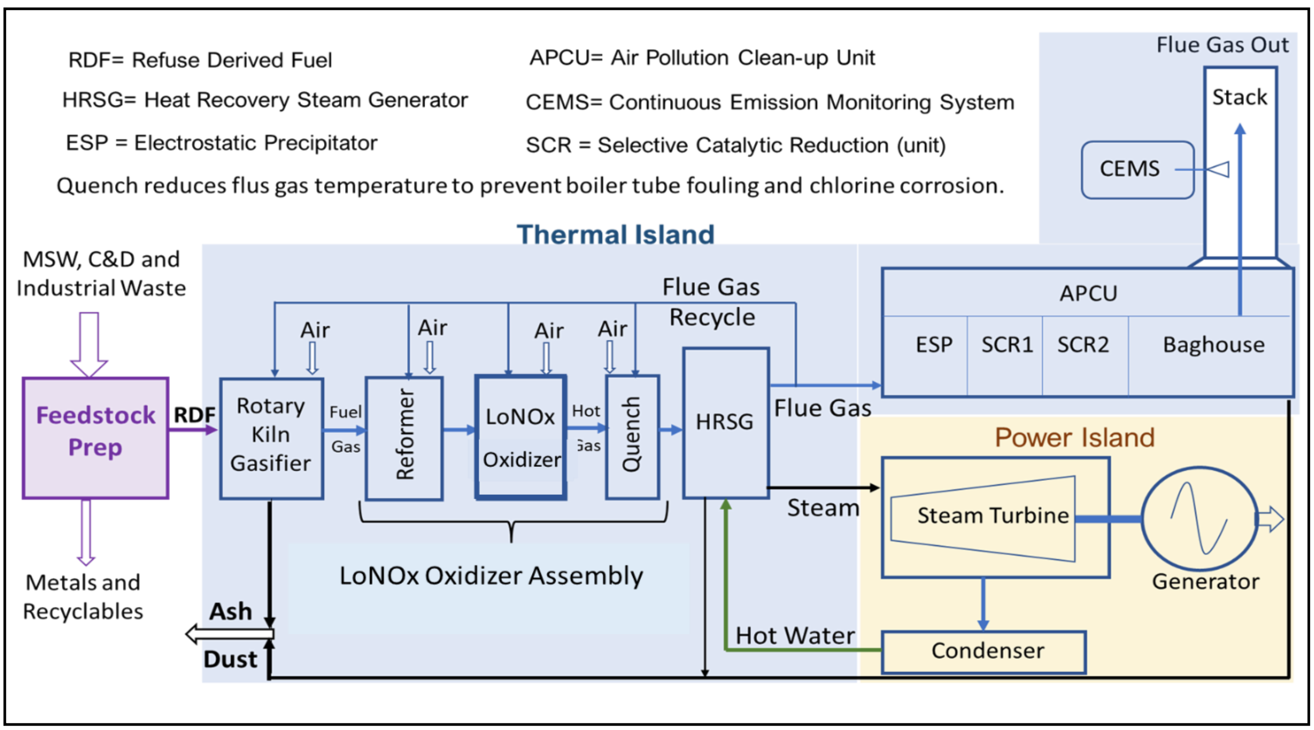


Figure 1 Block diagram of a gasification power plant showing the RDF preparation facility, the thermal island, and the power island, color-coded in purple, blue, and beige respectively.

Incoming waste is sorted in the feedstock prep section to remove recyclables, hazardous materials, metals, and oversized items. This feedstock prep or sorting facility will be operated by existing MRF's or our project partners, Connecticut Gasification. The resulting refuse derived fuel, or RDF, is then fed to a rotary kiln gasifier where it is converted to a fuel gas and an inert sintered ash. Fuel gas leaving the gasifier is reformed to crack any tars and clean the gas, which is then combusted in a LoNOx oxidizer using a mixture of recycled flue gas and air as the oxidant.

Hot gas from the Lo NOx oxidizer is quenched to reduce its temperature before entering the heat recovery steam generator (HRSG) boiler. Steam from the HRSG is fed to a turbine generator to produce electrical power. A portion of the exhaust gas exiting the HRSG at approximately 400 degrees F is recirculated (recycled) to the gasifier, reformer and LoNOx oxidizer. This reduces oxygen content of the gas, thus limiting flame temperature to below that which results in thermal NOx formation. The remainder of the exhaust gas is cleaned and polished by a multi-stage atmospheric pollution control unit before release to the atmosphere.

The completed solid waste gasification power plant will be comprised of the following major components:

- Administration and staff building
- Guardhouse and weighbridge
- Tipping floor and waste sorting facility for RDF production
- RDF ready area adjacent to the gasifiers
- Covered RDF storage area for gasifier feedstock reserve.
- Gasification plant thermal island with flue gas recirculation
- APCU for flue gas clean-up comprised of ESP, SCR, and baghouse.
- Power island with steam turbine powerhouse, substation. and switchgear
- Power plant control room
- Emergency power generator with fuel storage and black start capability
- Maintenance shop and warehouse
- Water treatment plant
- Small analytical laboratory for water and reagent testing
- Stormwater pond and effluent water management system

- Sintered aggregate temporary storage silo.
- Perimeter security fence
- Optional: Visitors Center

Question 2A. **Please describe in detail the technology proposed, and potential capacity and throughput in tons per day and tons per year.**

Response 2A. Depending on feedstock quality, the EPR rotary kiln gasification plant can be scaled to a capacity of up to approximately 2,300 tons per day and still be permitted as a synthetic minor source, both in terms of gravimetric emissions and stack concentration criteria (at 7% oxygen). The Plant can be reasonably scaled to increase volume of feedstock. However, beyond the 2,300 tons per day capacity, the plant is may to require a Title V air permit based on gravimetric air emission limits. **Figure 2** below, shows the four reaction zones of the EPR counter current rotary kiln gasifier with on board fan and camera.

EPR gasifiers feature:

a. Rotary kilns that operate in counter current mode
b. Patented flue gas recirculation to reduce NOx formation and flue gas volume.
c. State of the art fuel gas clean-up system combined with the inherently low emissions makes the EPR LoNOx gasification system the cleanest thermal conversion system available.
d. Counter current operation that enables a sintered, carbon-free bottom ash
e. Complete carbon conversion indicates higher thermal efficiency.
f. Horizontal lay-out that reduces structural steel costs and wind loading as well as improving access for maintenance.
g. For a given waste conversion capacity, rotary kiln gasifiers are less expensive to build and operate, and easier to maintain, than incinerators.
h. EPR gasifiers operate at lower temperatures with less mass flow through the main reactor compared to incinerators.
i. Rotary kiln gasifier thermal efficiency inside the ACT boundary box is higher than that of incinerators because rotary kilns convert a higher proportion of the

carbon in the fuel than do incinerators. (The ACT or Advanced Conversion Technology designation is used in the UK to distinguish between gasification and incineration processes. EPR gasification power plants are ACT compliant.)

j. Reduced flue gas volume allows a flue gas clean-up system that is cheaper to build and operate.

k. The quench feature on the EPR gasifier limits the gas temperature in the HRSG superheater, thus extending the service life of the HRSG.

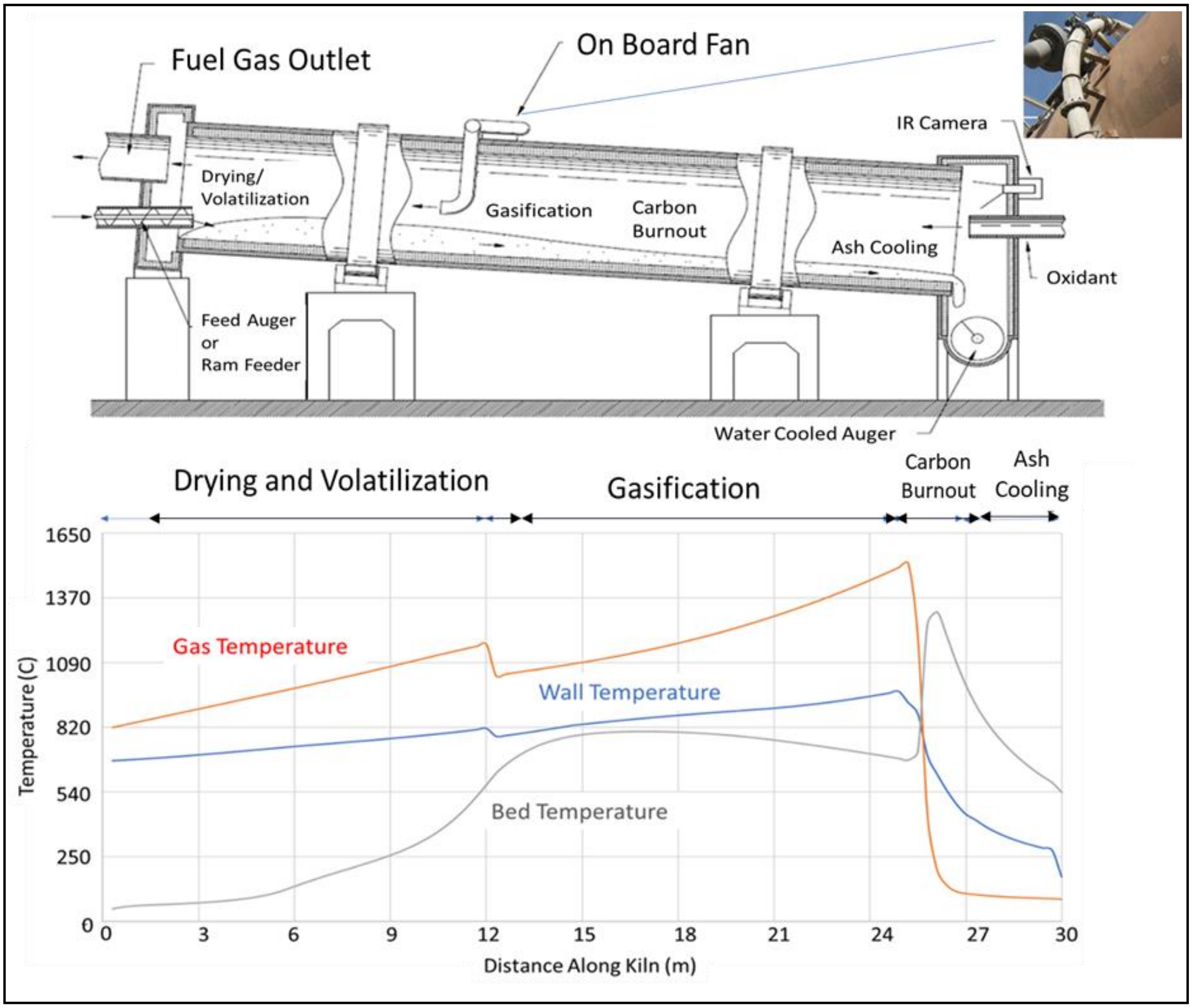


Figure 2 (Top) elevation view of an EPR rotary kiln showing the 4 primary reaction zones in counter current mode in which the main gas flow is in the opposite direction of the solid material or bed flow. **(Bottom)** Temperature profiles for the gas, refractory wall, and material bed along the length of the kiln.

Waste Receiving and Sorting Facility for RDF Preparation

Following is a high-level description of how the waste receiving and sorting facility infeed material to produce RDF feedstock for the rotary kiln gasifier will flow through the mainly mechanical separation system. The four main points considered in the sorting facility design are:

- Maximum Flexibility
- Automation
- Experience/Proven Technology
- Produce Support – Parts and Service.

The mechanical separation system homogenizes and separates the infeed material into manageable fractions. These are then processed by specialized sorting equipment that can effectively detect and separate the various economically recoverable materials. This separation results in several recyclable fractions that are either baled or stored in bunkers/bins and a combustible RDF fraction as a feedstock for power generation.

After the primary size reduction and bag opening, the system divides the material into four lines (fines, lights, mediums and heavies) by size, shape and density. This is accomplished through a series of sizing screens, density classification and sensor-based sorting.

Material stream #1 (Fines) is designed to separate out all the fine material (<2") and process it to remove all ferrous/Non-Ferrous metals. These residual, mainly inert, fines go directly to an automated load out system.

Material stream #2 (Heavies) is produced by density classification, which separates out all low-volume, high density materials such as any remaining metals. An overbelt magnet removes ferrous metals and the remaining fraction goes to manual post-sorting line. Metal recyclables can be manually sorted into several storage bunkers.

Material stream #3 (Mediums) is produced by density classification that separates out all medium-volumemetal cans. Overbelt magnets remove the ferrous metals before the eddy currents remove the non-ferrous metals. Optical sorting units would be utilized to negatively sort out and recover gasifcation feedstock. The positvely sorted materials from this unit would be select metals and non-desirable fuel feedstock such as PVC plastics. These positively sorting materials to their own manual post sorting line. Metal recyclables can be manually sorted into several designated storage bunkers as required for sale.

Maximum Flexibility Commercial waste and residential MSW/C&D have a highly variable input material composition as opposed to say single stream recyclables; therefore, the design of these processing systems needs to account for these variations. Our design will offer the flexibility which can process independently or blended composition streams.

Extensive Automation = High Throughput and High Recovery Excessive manual sorting or pre-sorting MSW/C&D material at any significant throughput is un-safe, ineffective, and requires a large number of sorters (at a high labor cost). Even pre-sorting this material prior to any separation technology is not recommended. The difficulty in visibly seeing and hand sorting materials at 50+ tons/hour is ineffective - we equate this to trying to sort 'needles out of a haystack'. With manual systems, you need more and more sorters (at higher and higher labor) to try to achieve the recovery goals.

Question 2B: **Please describe how your project is consistent with the State's solid waste hierarchy and the state's goal of 60 percent diversion from landfill and combustion.**

Response 2B: The EPR gasification power plant can be designed to divert between 480,000 tons to 860,000 tons per year. For this section we will demonstrate the need for an approximate 480,000 tons of waste diverted from export to landfills. This will reduce the approximate 30,000 tons of fossil derived carbon dioxide emissions from diesel trucks hauling waste out of state by up to 90%.

Because the cost of hauling will be reduced, the proposed project should allow reduction in residential solid waste management fees. The sorting facility associated with the power plant will recover recyclable materials that would otherwise go to landfill. To the extent that the feedstock for the plant is biomass, the net non-renewable carbon emission contribution from the plant will be negative (See **Figure 3** below), the plant will generate renewable electricity reducing the need for electrical power generated by fossil fuels.

Question 3: **What kinds of site characteristics are needed for your operation?**

Response 3:

a. **Acreage needs:** A 1,300 ton per day plant requires four kilns and up to 20-25 acres depending on whether the sorting facility is located onsite or remotely. A plant that processes 2,300 to 3,000 tons per day may require 30 to 35 acres.

b. Utility requirements:

I. Construction power: A temporary on site 440 V three phase power drop with appropriate switchgear will be required for construction.

II. Grid interconnect: The generator substation is within the scope of the project and will include a generator step-up transformer and substation switches and breakers. Output voltage from the substation can be matched to local requirements up to 128 kV.

III. Water: a 1,300 ton per day plant requires approximately 50,000 gallons per day. Well water will require treatment for potable water use, as well as for boiler make up water use.

IV. Natural Gas availability would be an advantage. Natural gas or diesel fuel is required for pre-heating of the rotary kilns for cold start and for operation of emergency generators. If no natural gas is available, additional diesel fuel such as that otherwise used for mobile equipment and truck fuel, can be used for pre-heating of the rotary kilns during start-up. Ideally, the kilns are shut down once a year for routine maintenance. If kiln repair requiring shutdown occurs at other times during the year, this can normally be accomplished by shutting down the affected kiln while temporarily increasing the load on the remaining operating kilns to maintain power output.

Access needs: Vehicle ingress and egress routes including at least two independent points of vehicle access from a main road or highway are required. This is to allow smooth flow of truck traffic into and out of the facility as well as to ensure access in case of a fire or other emergency. Rail access would be an advantage at larger plant scales but is not required.

Question 4: **What are the input and output requirements to make development feasible?**

Response 4:

a. Inputs

i. What type of feedstock is required for your facility?

Rotary kiln gasifiers can operate on mixed MSW, including C&D, as well as a limited amount of tire shreds, having a bulk calorific value (HHV) of 4,500 Btu/lb. at a moisture content of less than 35% to 40% (depending on HHV). Moisture content greater than approximately 40% may require pre-drying of the waste using rotary dryers operating on waste heat.

ii. Are there any specific characteristics needed to make the feedstock viable or processing limitations (e.g., food scraps must be source separated)?

Rotary kiln gasifiers can operate on unsorted MSW from which hazardous materials, and oversized items, such as white goods and mattresses, have been removed. However, it is preferable to operate on waste from which recyclables have been removed and which includes minimized food waste if possible.

It is assumed that large volumes of food waste will be separated and processed by other parties for anaerobic digestion or further sorted and used as animal feed for livestock such as hogs.

iii. What are the tonnage/ volume needs to make your facility viable? Provide a range or a minimum if applicable.

As described above, the rotary kiln plants that generate electrical power can be economically operated at scales of between approximately 300 tons per day (10 MW) and 3,000 tons per day (110 MW).

iv. Can you provide tip fee estimates?

The tipping fee needs will be lower than the MIRA schedule of tip fees for 2023, the amount of discount is largely dependent on the revenue from electric sales.

b. Outputs

i. What are the outputs of your process (e.g., electricity, renewable natural gas, compost, baled material, etc.)?

EPR gasification power plants generate renewable electrical power using one or more steam turbines. Depending on the net calorific value of the feedstock, a 1,300 ton per day plant will generate between 45 and 50 MW nameplate with 39 MW to 44 MW net to the grid. A 2,300 ton per day plant will generate between 85 and 90 MW nameplate with74MW to 78MW net to the grid.

Combined heat and power configuration: The thermal efficiency and economics of the power plant are increased if the otherwise rejected lower quality heat can be used to generate process steam or hot water for a local industry or a district heating system.

ii. What minimum revenues or revenue guarantees do you need for these outputs?

Electrical energy rates need to be to be assessed on a long-term basis in combination with the tip fee to make the project economically attractive to investors. The electrical off-take needs to be on a long-term basis with a utility or end-user for a minimum of 15 years.

The State can also assist with investor interest by creating renewable credits for the conversion of diverted waste to renewable energy, or by serving as a purchaser of the electricity generated by the plant.

Should the State have available state backed bond capacity, this is an effective means to structure the debt allocation of the capital stack requirements. If this is not available, the project can still pursue bonds or traditional forms of debt.

Question 5: **What are the environmental attributes associated with your facility?**

Response 5:

a. **Air emissions, and mitigation thereof:**
As shown below, EPR rotary kiln gasifiers are designed with mid-kiln oxidant injection, flue gas recirculation, and LoNOx oxidizers to be inherently low in NOx emissions. The reduced mass flow through the main reactor, as compared to incineration, results in inherently less particulate in the exhaust gas stream. Depending on local requirements and plant scale, the air pollution clean-up (APCU) section can include:
    - catalytic or non-catalytic selective reduction units for residual NOx abatement,
    - trona or bicarbonate injection for dry acid gas removal,
    - electrostatic precipitator units for particulate removal,
    - and activated carbon and/ or lime injection prior to the baghouse to remove VOCs and for final gas polishing prior to release.

EPR gasification power plants are designed such that air emissions remain safely below the 100 t/year major source threshold above which a Title V air permit with all the attendant monitoring and reporting equipment is required. Assuming that the plant site is not in a non-attainment area, a major source (Title V) permit is required according to the following general criteria:

A major source has actual or potential emissions at or above the major source threshold for any “air pollutant.”

The major source threshold for any air pollutant is 100 tons/year (this is the “default value”).

Lower thresholds apply in non-attainment areas (but only for the pollutant that are in non-attainment).

Major source thresholds for “hazardous air pollutants” (HAP) are 10 tons/year for a single HAP or 25 tons/year for any combination of HAP.

Table 1 below shows typical best available control technology (BACT) air pollution abatement equipment required for boilers generating more than 75 MMBtu per hour. As described on the Connecticut environmental permitting fact sheet, we anticipate that the gasification plant will be permitted in accordance with Title 40 CFR Parts 60, 61 and 63. Data shown below are from a 1000 t/d plant permitted under 40 CFR 60 Subpart Eb.

Table 2 on the following page shows the emissions of USEPA criterial pollutants from a 1,000 ton per day gasification power plant operating on RDF as compared to the emissions allowed under the applicable CFR regulations for this type of plant (40 CFR 60 subpart Eb).

https://portal.ct.gov/DEEP/Permits-and-Licenses/Factsheets-Air/Air-Emissions,

Table 1. Typical BACT requirements for boilers generating more than 75 MMBtu/h

Criteria Pollutant	Typical BACT Emission Control Technology	EPR Control Technology
NOx	LNB with FGR and SCR	Low NOx Oxidizer, Flue Gas Recirculation (FGR), Selective Catalytic Reduction (SCR) @ optimal 700°F
CO	Combustion Control	LNB has >2 sec at temperature (combustion control) to reduce CO and VOCs plus CO catalyst in the SCR
VOC	Combustion Control	
SO_2	Fuel Specification (Low Sulfur Fuel)	Measures are taken to reduce fuel sulfur. There is also a two-step dry acid gas scrubbing unit to remove SOx, reducing SOx by ~96%
TSP/.PM_{10}	Multi Cyclones	EPRD uses ESP and Fabric Filter remove particulate matter. This combination captures over 99% of PM

Table 2. Comparison of 40 CRF 60 Subpart Eb standards with 1,000 t/d plant emissions

Constituent	Stack Concentration	Adjusted Stack Concentration	Eb Standard	% of Actual to Standard
	μg/m^3	μg/m^3	μg/m^3	
CO	10.9	8.5	58.2	15%
NOx	11.6	9.0	286.9	3%
SOx	14.4	11.2	79.9	14%
PM	2.8	2.2	20	11%
VOC	1.2	0.9	20	5%
HCl	5.7	4.4	37.0	12%
Total	**60.7**	**47,1**		

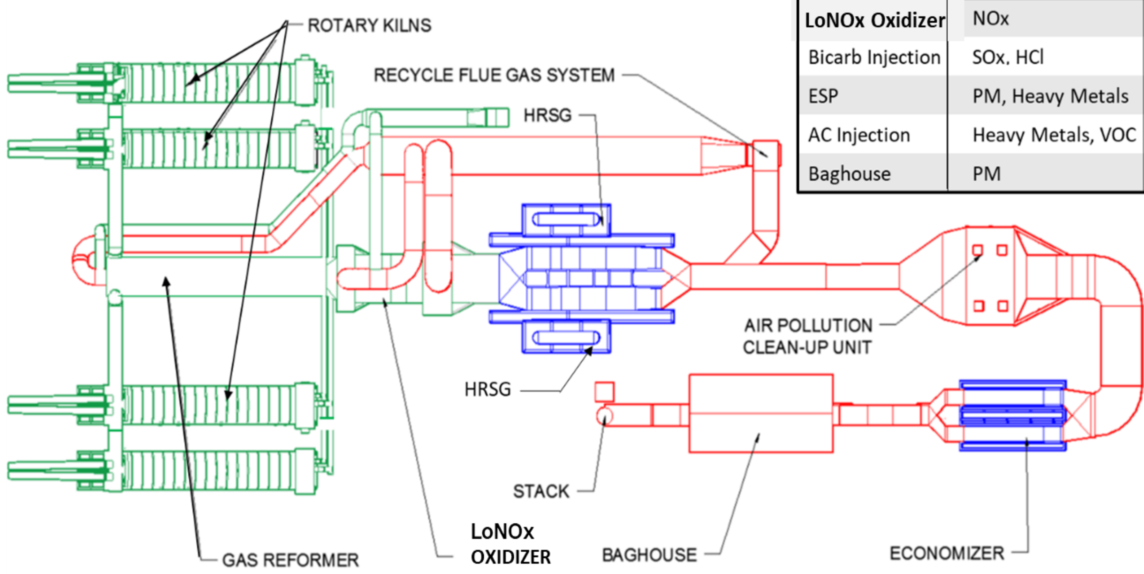
Copies of EPR synthetic stationary minor source air permits and California Renewable Energy pre-certifications are shown in **Appendix II.** As on the Clark County air permit, EPR rotary kiln gasification plants with capacities as high as 2,300 tons per day can be permitted as USEPA stationary synthetic minor air emission sources. The Californian Energy

Commission Renewable Energy Pre-certification allows power generated in Nevada to be sold as renewable in the state of California.

Figure 3 below shows the plan view of a 4-kiln gasifier with an insert indicating the removal efficiencies of the air pollution clean-up (APCU) principal components.

- Emphasis is on reducing air emission (components in red) throughout the system.
- Systems as large a 2,600 t/d @ 90 MWe net qualify as minor stationary sources.

Unit	Target Pollutant	Capture Rate
LoNOx Oxidizer	NOx	~90%
Bicarb Injection	SOx, HCl	90%, 95%
ESP	PM, Heavy Metals	90%
AC Injection	Heavy Metals, VOC	85%
Baghouse	PM	90%



Green: Gasification Components, Blue: Steam Generation (Boiler & Economizer), Red: Flue Gas Clean-up

Figure 3. Color coded layout view of a rotary kiln gasification power plant thermal island

Mitigation of odor from the waste receiving and sorting facility will be addressed as follows:

- The plant will operate 24/7, so long-term stockpiling of wet organic waste will not occur.
- There will be a minimum of a 5-day supply of baled dry waste stockpiled in case of any waste flow interruptions.
- Buildings housing the waste will be enclosed and held at negative air pressure to control odors.
- Exhaust air from the buildings will be used as oxidant for gasifier or oxidizer.

a. **Discharges,** including where discharges will occur and mitigation of discharges.
   Air emission discharges include the main exhaust stack with emissions mitigation equipment as described above. The exhaust stack will have an attached continuous emissions monitoring system (CEMS) for near real time monitoring of regulated emissions.

   Other potential air emission sources included in a typical air permit include the ash silo, loads from which will be wetted with process gray water before leaving the plant, and reagent storage skids or silos. Diesel operated mobile equipment will be listed as non-significant sources.

   The primary solid-state discharge is a sintered and carbon free rotary kiln bottom ash. This material will be wetted prior to transport and can be used as landfill daily cover, construction fill, or for road grit. Other solid-state discharges include baghouse shakedown dust, and dust collected from the HRSG unit both of which will be wetted and disposed of in a landfill along with the bottom ash not used for other purposes.

   Potential aqueous discharges are listed below for the construction and operation phases of the project.

   Construction Phase: Water discharge management during construction will be in compliance with a General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities

   Industrial Operations Phase

   (A) Major Sources of Wastewater Generation

   Water & Wastewater Treatment Systems RO-Rejects

   Leachate (Delivered in Waste Received)

   Released During Shredding & Handling

   Facility and Truck Wheel Wash System

   Storm-Water Runoff

   (B) Facility Wastewater Management & Regulatory Compliance

   Water & Wastewater Treatment Systems RO-Rejects

   Storage

Disposal of Wastewater Through Ash Management

Kiln Bottom Ash Temperature

APCS Collected Solids Temperature Control

Kiln Bottom Ash Dust Control in Transport Off-site

APCS Collected Solids Dust Control in Transport Off-site

Leachate Treatment System

Re-Use Quality Water On-Site Landscape Irrigation

Re-Use Quality Water for Facility Wash-Down & Wheel Wash Re-Use

Sludge Recycling to Gasifier

Storm-Water Runoff Management & Compliance

Waste material or residuals and description of disposal of such materials.

b. Beneficial uses.

Carbon free sintered ash from the rotary kilns can be used as construction fill, substitute concrete material or as a component of landfill daily cover.

Question 6: Please describe how the project will minimize negative environmental and health impacts of waste management, including minimizing greenhouse gases.

Response 6: Operation of an EPR rotary kiln LoNOx gasification waste to energy power plant will divert 1,000 to 2,300 tons, or more, per day from landfill.

Section 1.3 of the USEPA publication entitled Direct Emissions from Stationary Combustion Sources allows Greenhouse Gas Equivalent (GHGe) reduction credit for landfill diversion, as well as for recovered metals. The landfill diversion guidance in the USEPA WARM model allows for 0.5 tons of GHGe emission avoidance credit to be taken for every ton of mixed wet and dry, or dry, MSW diverted from landfill. Assuming that 480,000 tons of waste are diverted from out of state landfills, the total reduction in (GHGe) emissions would be 240,000 tons per year.

As shown in **Figure 4** below, operation of a power plant fired directly with biomass residue (green rectangle) is considered carbon negative compared to dedicated biomass integrated gasification combined cycle, pulverized coal firing, coal/biomass co-firing, and natural gas fired combined cycle thermal power plants. In terms of ambient air quality, emissions from a 40 MW waste to energy power plant are plotted against the EU standards threshold of concern concentrations for PM_{10} and $PM_{2.5}$ as well as highway right of way background (due in large part to diesel trucks) as shown below.

Regarding emissions from diesel trucks, as of 2018 Connecticut was reported to export some 860,000 tons of municipal solid waste annually out of the state to landfills or waste to-energy plants in Ohio, Pennsylvania, Virginia, New York, New Jersey, Massachusetts, and Rhode Island. Media reports indicated that more than 18,000 diesel truck trips were needed each year to haul this trash. In addition, exporting entails increased liability and attendant insurance costs.

As shown in **Figure 4** below, among the main hydrocarbon fuels used for power generation, direct fired biomass residue is the only one that has a net effect of reducing greenhouse gas emissions. This is because biomass is a renewable fuel, and the alternative is allowing the biomass to decompose in a landfill releasing methane and other GHG.

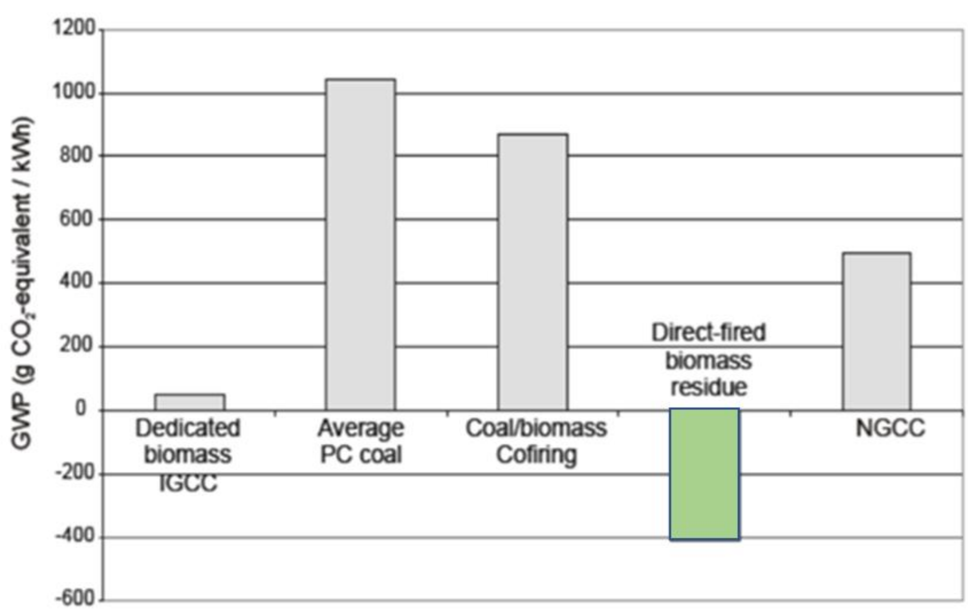


Figure 4 Net GHG emissions from use of common fuels for power generation in terms of CO_2 equivalent emissions per kWh generated

As a rough estimate, truck trips from central Connecticut to central Pennsylvania or upstate New York average approximately 250 miles one way. Trips to Virginia are in the range of 400 miles one way. A rough estimate of annual CO_2 emissions from out of state haulage of waste, using the published emission rate of 160 grams of CO_2 per ton-mile traveled, yields a total emission of more than 30,000 tons of CO_2 annually from diesel truck waste transport.

Processing the waste in state could be reasonably assumed to reduce diesel truck carbon emissions of waste hauling by 90%, or more. In addition to the reduction in carbon emissions, removal of an estimated18,000 truck trips per year, there is a concurrent reduction in emission of particulates, NOx and other criteria pollutants resulting from combustion of fossil fuels.

Figure 5 below shows the Republic of Ireland (EU) standard lower threshold of concern levels for PM_{10} and $PM_{2.5}$ particulate matter in ambient air at ground level. $PM_{2.5}$ has a lower threshold of concern in EU standards because these particles are deep lung respirable. Creation of PM 2.5 "nanoparticles" is characteristic of diesel engines operating on petroleum derived fuels. Nanoparticles are generally not formed in biomass gasification power plants.

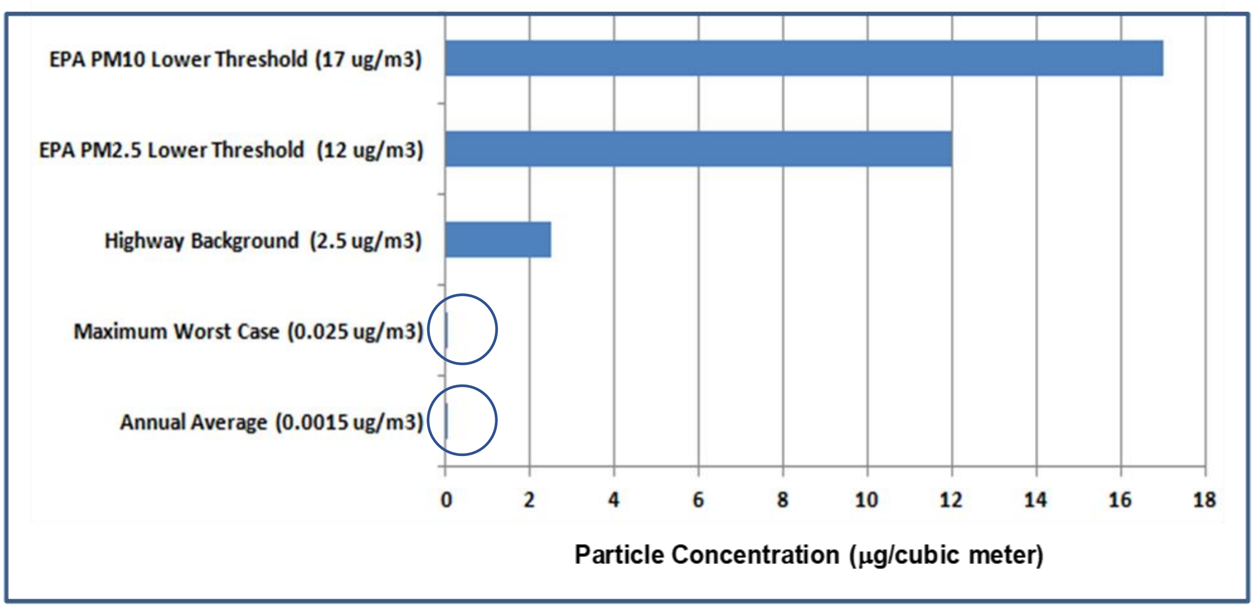


Figure 5 Comparison EU Particulate Matter (PM) Lower Threshold of Concern for PM_{10} and $PM_{2.5}$ compared to maximum and annual average ground level PM concentrations in ambient air for a 40 MW gasification power plant at 500 meters from the stack.

Particulate from diesel engines tends to be less than 10 microns in size (<PM_{10}) and therefore deep lung respirable. Truck tire wear particles contribute mainly to PM_{10} and larger aerodynamic particle sizes. A significant proportion of the particulate detected along highway rights of way was from diesel engines.

Compared to the EU lower threshold of concern for **$PM_{2.5}$** of 12 micrograms (μg) per cubic meter, current USEPA clean air standards limit 24-hour **$PM_{2.5}$** to **35 micrograms (μg)** per cubic meter. The USEPA is considering a reduction in **$PM_{2.5}$** to **25 micrograms (μg)** per cubic meter, which is still approximately twice the EU lower threshold of concern.

Note from **Figure 4** that the maximum total PM contribution at ground level ambient air from a 40 MW gasification power plant is 99% less than that measured along a highway right of way. The annual average PM levels at ground level are more than an order of magnitude lower than that at 0.0015 mg/m^3.

Reduction in Carbon Emissions from Landfill Diversion: The primary reduction in greenhouse gas equivalent emissions from gasification of MSW to generate power results from the diversion of waste from landfill. As described above, according to this allowance is generally taken to be o ton of carbon reduction for every ton of waste diverted.

Community Benefits

Question 7: **Please describe host community benefits that would be provided as part of your project, and how those benefits would be shared or realized including job creation and workforce training opportunities.**

Response 7:

Job Creation: Depending on the size of the plant, the plant will generate jobs for 50 to 90 full time equivalent (FTE) positions. Non-exempt workers will normally serve in one of 4 crews or teams that, among them, will operate the plant 24/7 in three shifts per day. These positions will be relatively well-paid jobs in a safe environment. Work schedules will be flexible for most staff.

Job Training: EPR will team with local vocational education programs to provide part time instructors and essential equipment for worker training. EPR will also provide assistance to those who wish to pursue a degree or vocational skill certification as skilled crafts as it aligns with the needs of the plant. If needed, EPR will provide educational equipment or materials and specialized instruction in specialty areas relevant to positions at the power plant.

Reduction in Solid Waste Collection and Disposal Fees: As previously described, the elimination of long-haul trucking costs as a result of instate solid waste processing should allow some reduction in residential solid waste management fees.

Visitors Center with Interpretive and Educational Outreach Capabilities: If sufficient land is available and local community interest is sufficient, EPR has plans for a visitors and interpretive center for the power plant. Visitors centers at waste management sites in Florida are popular tourist attractions and serve to educate the public on the environment and on use of solid waste collection and conversion as a means of energy production.

The visitors center would provide a self-guided experience including displays, looped animations, relevant videos, and models showing plant operations and benefits to the community. If school, professional, or tourist groups are interested, trained plant staff can act as guides for scheduled plant tours.

The Solid Waste Authority of Palm Beach County Florida is an excellent example of a popular and well-received community outreach program offering school and community education opportunities. The SWA facility has become a tourist attraction with visitors from around the US and around the world. https://swa.org/35/Education-Tours

Developer Experience

Question 8A. Please describe the project team's background and experience developing waste infrastructure projects, including the proposed technology, and your track record for successful development and/or operation.

Response 8A: EPR has experience contracting with several internationally recognized EPC firms. EnviroPower staff have developed a conceptual design and development approach for a renewable energy gasification power plant with a waste processing capacity ranging up to 3,000 tons per day. Nameplate generating capacity for these plants is in the range of 8 to 110 MWe. To enhance grid resiliency the plant will have fuel storage capacity for 5 days along with black start capability. Power plants and related facilities designed, build, managed, or operated by EPR staff are listed in **Table 3** below.

Table 3: Similar Projects Undertaken by the EnviroPower Renewable Team

Project	Location	Technology	Details
Deeside Energy from Waste Facility	North Wales, UK	MRF, AD Plant and Gasification facility	Provided planning and multi-disciplinary design. 10 MWe Gasification technology by Eqteq Spain. Owner – Logik Developments Manchester UK
Baddesley 10 Mwe Biomass Facility	Warwick, UK	10 Mwe RDF Incineration facility	Provided early development of complete facility. Owner – Equitix / GIB £61m
Haybridge Energy from Waste Plant	Somerset, UK	5 Mwe Pyrolysis CHP plant	Provided early development of facility. Owner – Aeternis Energy
Brenig Wind Farm, 30 Turbine	North Wales, UK	60 Mwe wind energy development	Provided planning, foundations, haul roads and grid connections. Owner – Germania Wind Energy Germany
Orthios Eco Park	Holyhead, North Wales, UK	RDF Incineration & Plastics to Fuel and Hydroponics	Provided various civil design to 300 MW Eco Park. Owner – Orthios Energy UK
Javelin Park	Gloucester, UK	190,000 tonnes MSW	Gifford Consulting – early planning and design engineering services for £500m EfW facility. Owner: Gloucester
BioMass Pellet Plant	Nahunta, GA	150,000 Metric Tonne plant	Expansion, construction, commissioning and operations. Owner – E Pellets
McIntosh Unit #5 501G Westinghouse Gas Turbine (now Siemens)	Lakeland, Florida, US	230MW Gas Turbine	Modified – EPC construction completion, commissioning and operations. Owner – Lakeland Electric
Winston Peaking Station	Lakeland, Florida, US	50MW quick start dual fuel source peaking and	Design, construct, commission and operate.

Project	Location	Technology	Details
		black-start generating station.	Owner – Lakeland Electric
DeBary Peaking Station and Natural Gas Fired Station	Volusia County, Florida, US	730 MW Natural Gas Fired Station	Permitting, liaison in public hearings, transmission, and substation construction.
The Princess Amalia Offshore Wind Farm Project	Netherlands	120Mwe offshore wind farm.	Programming and delay analysis for a 120Mwe wind farm comprising 60 nr 2MW Vestas wind turbines founded upon 54m long mono-piles constructed at a depth of 19-24m. Owner – Econcern/Eneco
Rugeley B Power Station-FDG Plant	Staffordshire, UK	1000MW Coal-fired power plant	r.c. slip-formed silos and foundations and infrastructure for the FGD plant. Owner – International Power / GDF Suez
Atherstone Renewable Energy Park	Warwickshire, UK	Renewable Energy Park, Anaerobic Digestion, Biomass	Design, construction strategy and implementation. Owner – Merevale Estates/Park Top Limited
Fujairah Wind	Fujairah, UAE	250MW Wind and 50MW Solar PV Development.	Feasibility study for the development and funding of the project.
Duqm Oman Integrated Waste Management System	Sultanate of Oman	Design of Integrated Waste Management System with Landfill and Gasification WTE.	Integrated waste management system waste characterization, EIS and preliminary design with RFP. Owner: be'ah, Sultanate of Oman

Question 8B. Please provide information on applications of the proposed technology demonstrating how widespread and how the technology has been proven through other development projects.

Response 8B Metso is a leading international manufacturer of rotary kilns for applications in cement making, mineral processing and thermal treatment of solid waste. Metso will manufacture, install, commission, and guarantee the rotary kiln, reformer, and oxidizer components of the EPR LoNOx gasification system for the project.

Metso rotary kilns with mid-kiln oxidant injection as used by EPR account for more than 70% of calciners worldwide with more than 50 calcination rotary kiln systems in operation in the US and overseas. Like the EPR kiln, these calciners operate in the counter current mode as previously described. Metso has applied their inhouse modelling capability to optimize the EPR kiln design as a multi-fuel gasifier. Metso stands ready to guarantee the EPR rotary kiln, reformer and LoNOx oxidizer assembly when used as a gasifier in a power plant thermal island. A copy of a letter from Metso stating their willingness to guarantee their rotary kilns, configured as gasifiers is shown in **Appendix III.**

The EPR LoNOx rotary Kiln gasifier design can be considered as an adaptation of rotary kiln calcining systems, in that the LoNOx gasifiers:

- Operate with a reducing (oxygen starved) atmosphere,
- Operate in counter current mode (feed flow direction opposite from gas flow direction),
- Operate over a similar temperature profile albeit at somewhat higher peak temperatures,
- Oxidizes the off gas (or fuel gas) produced in a separate chamber, and
- Like the EPR system, they operate with a mid-kiln oxidant insertion fan.

Shown below in **Figure 6** is an image of a Metso countercurrent gasifier with mid-kiln oxidant injection. Metso has suggested that their dual kiln waste to energy plant near Shanghai China as shown in **Figure 7** below would be a reasonable reference plant for demonstrating the ability of their rotary kiln systems to thermally treat a wide range of solid waste materials. The plant in Figure 7 has been built with a vertical construction configuration. EPR plants are built low profile and on a horizontal configuration.

Figure 6. Metso counter current rotary kiln with mid-kiln oxidant injection

Figure 7. Metso dual rotary kiln waste to energy plant near Shanghai, China.

EPR LoNOx Gasification Power Plant Features Summary

Since WTE plants are paid for their fuel, thermal efficiency need not be the top priority in design. EPR gasifiers were designed from the ground up to be reliable and safe with minimal environmental impact. State of the art fuel gas clean-up system combined with the inherently low emissions makes the EPR LoNOx gasification system the cleanest thermal conversion system available. Reduced exhaust gas volume due to flus gas recirculation allows an exhaust gas clean-up system that is cheaper to build and operate.

In addition to the other features listed above, and on Page 5, rotary kiln gasifiers have a horizontal lay-out that reduces structural steel costs and wind loading and provides improved access for maintenance compared to conventional boilers.

Depending on feedstock quality, air emissions from EPR rotary kiln gasifiers with capacities up to 2,300 tons/day of RDF will not exceed 100 tons/yr. of any criteria pollutant. This means that in most air quality attainment jurisdictions EPR gasification power plants scaled below 2,300 t/d processing capacity can be permitted as EPA synthetic minor stationary emission sources, thus avoiding the expense of a Title V major source air permit.

Financing Arrangements

Question 9: **Please describe the preferred and acceptable financing arrangements contemplated for the project, including contemplated financing, development, ownership, and operation of the facility; and needed commitments (including duration thereof) from municipalities and other entities with respect to tip fees, and the marketing of other materials and byproducts of the project.**

Response 9: Each EPRD project is structured in a separate Special Purpose Vehicle (SPV) that is a subsidiary of EPRD. This project will be in an SPV registered in the State of Connecticut. By holding this project in a separate SPV, the project is not subject to cross-collateralization and is insulated from other EPRD operations.

Each SPV is separately capitalized and financed. At this time, we have begun discussions with multiple parties that are interested in providing debt and/or equity financing for the project assuming that permitting, and long-term feedstock and offtake agreements are in place with predictable revenue streams.

EPRD is in the process of a competition for financial instruments of nearly $300m for a similar plant based in Scotland. The key requirements to secure funding include the following:

- Waste (feedstock) commitment- this will need to be for a range of 10 to 15 years at minimum. The pricing elements of the per ton fee will be lower than the MIRA 2023 tip fees of $111/ton Short Term and $116/ton Long Term. EPRD will offer a discount in proportion to the volume of waste, duration of commitment and the type of waste provided. The longer the term, greater volume and desirable feedstock will attract a lower tipping fee to those communities. The prices will be set FOB at the proposed plant weigh bridge.

- Renewable Energy Offtake Agreement- EPRD will be providing baseload renewable energy and will therefore require a long-term off-take (power purchase agreement) at a market price to an end-use customer, aggregator or utility. This will need to be for a term of 15 years at minimum. If allowed, EPRD can provide this energy to the government(s) in the surrounding area to minimize transmission charges at attractive price points.

- Land- the land will need to be identified and under a contractual control for the project pending the financial close. This land will need to have the appropriate permitting support from the proper jurisdictions.

- Interconnection- it will be critical to have a certainty of a path to interconnect to the transmission grid which will require potential easements to access the nearest transmission substation.

- Ash Disposal- EPRD will aspire to convert as much of the bottom ash to a sintered aggregate which can be utilized as landfill cover, construction aggregate or substitute concrete material. This will depend upon the characteristics of the feedstock provided to the plant. Fly ash and any sintered ash not suitable to the construction market will be transported to the designated landfill in Putnam, Connecticut operated by Wheelabrator Putnam Inc.

EPRD will place an Owners Engineering team over the construction of the project which will be built by a properly credentialed Engineering Procurement and Construction firm "EPC". The EPC will be required to fully guarantee the schedule to build the EPR designed plant, the generating capacity and the emissions through the commission testing phase. Upon commissioning the Owners Engineering team will convert to the ongoing operational management and operate the plant. The plant personnel will be retained and trained in their respective roles during the commissioning of the plant. EPRD has corporate staff engineering who will work with the plant engineers to instituting best practices.

Question 10: **Does the project contemplate any energy or environmental attribute offtake agreements under state jurisdiction, or federal funding of any type?**

Response 10: EPRD encourages the State to support establishing renewable credits to support the GHG reductions our technology can achieve in comparison to landfilling (in or out of state) and the current transportation impact associated with the export of waste as currently practiced.

If the State or local jurisdiction(s) are able to contract for renewable baseload energy on a long-term basis we would encourage a review of the current rate structures so we can make this a mutually beneficial arrangement for the long-term relationship. If the State or local governments are not able to contract on a long-term basis, then any support to achieve a long term off-take power purchase agreement at a reasonable market basis to support the project financing is desired.

Should the State of Connecticut have the availability of industrial or private activity bond capacity we would pursue this as a portion of the capital stack to fund debt on the project. EPRD has developed several relationships with private finance who can also make long term debt available, yet it may be higher priced than bonds. If the State is aware of any other incentives, this will assist with private financing.

Question 11: How will the proposed financing arrangement ensure stable and competitive pricing for municipalities?

Response 11: EPRD will plan an equity and debt structuring as the project financing package to support the entire project capital cost. We build into our financial models the full operating cost over the 30-year life and incorporate a capital maintenance and major equipment replacement fund to maintain baseload operations for the full thirty years of life. The cash flow of the project will support plant operations well beyond a 30-year life, yet the industry will only reference designs to support a 30-year plant design.

Traditional private financing terms are predicated on the length of contracts for the waste and the power purchase off-take which establish the duration of the loans. Typically loan terms are for 15-to-20-year terms.

Question 12: Within what approximate time frame (years) of contract execution would the project be able to commence operation, assuming timely state and local approvals?

Response 12: Construction of the project and commissioning are achieved in eighteen months. This eighteen-month period begins once the project financing is in place which is dependent upon permitting, site control, waste agreements, power purchase off-take agreement and the interconnection agreement., see further details in the response to question 9.

Question 13: **Please provide information on technology performance guarantees by the technology provider or project developer.**

Response 13: EPRD utilizes commercial off-the-shelf components to assemble our plant. The gasification island is based around the counter-current kiln technology with patented enhancements which will be guaranteed by Metso-Outotec “Metso” the manufacturer of the gasification island, please refer to Appendix III. Metso is the largest supplier of counter current kiln gasifiers in the world. The energy production island and the fuel preparation equipment will all have performance and schedule guarantees. All of these guarantees will flow to the EPC firm selected who will have a single insurance and/or bond guarantees to EPRD on the schedule to construct, the performance output and the emissions.

APPENDIX I
Management and Senior Staff Biosketches

Keith Hulbert (Chief Executive Officer) Keith Hulbert has more than 25 years of experience in the power industry and has been directly involved in project management and operational control over power generation plants, substations, transmission lines, and related energy infrastructure projects. Keith was Vice-President of Infrastructure for Serco in the North America, and served as CEO at Lakeland Electric, the 20th largest public power utility in the United States. Prior to that, Keith was Chief Operating Officer at Viasys, a multifaceted infrastructure and construction company focused on the energy, transportation, and telecommunications industries. He was also a senior executive and regional manager at Florida Power Corporation where he worked for over 18 years. Keith also holds an MBA from Florida Institute of Technology.

Craig Kettler (Chief Financial Officer): Craig has over 25 years of experience as a trusted business advisor, angel investor, and entrepreneur focused on value realization and maximization. He has experience in merger and acquisition advisory, business strategy, and business valuation both domestically and internationally. He has been co-founder of two businesses, including the first independently owned transmission company in the US, TransElect, focused on the acquisition and operation of transmission systems, the development and construction of new transmission lines and the upgrade of existing transmission systems. Craig earned his Bachelor of Science in Mechanical Engineering from Kansas State University and an MBA from Southern Methodist University.

Dr. Bary Wilson (Chief Technology Officer): Bary Wilson has founded or co-founded several technology companies in the US and overseas and served on the board of directors of ENER1, a publicly traded battery company, as well as on the boards of scientific journals. During his 24-year tenure at the Pacific Northwest National Laboratory, he designed and led projects in coal gasification and liquefaction and co-managed intellectual property for the National Security Division. He has conducted electric power related research for the US Department of Defense, the US Department of Energy and EPRI. He has extensive overseas project management experience, including design of the integrated solid waste management system for the Duqm Governorate in Oman. He has managed petroleum and energy related projects in the Middle East. With more than 150 publications and two books, he is an inventor on more than a dozen patents including several related to waste to energy gasification. Dr. Wilson holds a B.Sc. in Physics from the University of Washington, a Ph.D. from the University of London and served as a postdoctoral associate in chemistry at MIT.

Darren Lloyd, (Chief Commercial Officer): Darren is based in the UK and is a seasoned businessman with over 40 years' experience in marketing, negotiation, and program management with extensive overseas experience. During his early career he was part of a small senior team driving N Brown Group from a market cap £28 million to over £1 billion. More recently his executive experience includes ownership of marketing, printing and chemical companies with representation of WTE projects. He is a driven individual in project and financial management with experience in venture capitalist exits and negotiations.

Dr. Barry Liss, Ph.D., P.E. (Lead Engineer): Dr. Liss is an internationally recognized expert in the field of fluidization engineering and the design of solids gasification systems, as well in the design of compost plants, odor treatment systems, and wastewater treatment systems, including leachate treatment systems. Dr. Liss' Ph.D. was on the mathematical analysis of the dynamic behavior of particulate systems, and his post-doctoral work was on fluidized bed gasification. Dr. Liss has been involved in the design, development, planning, and financial analysis of more than 20 integrated solid waste management projects in the US and overseas. He is the lead inventor on two patents related to enhanced air pollution control by minimization of NOx emissions through practical control of NOx formation mechanisms and in the production of virtually inert, carbon-less aggregates by ash sintering gasification. as well as a recent patent pending for the conversion of plastics to liquid fuels via a combination of HTL and steam cracking.

Ray Bell (Construction Director - UK): Ray is a Chartered Engineer experienced in the construction of large-scale infrastructure, transport, marine, process and renewable energy projects. His wide-ranging experience includes project strategy, detailed planning, contracts preparation, procurement, and project delivery. He has UK and International experience in developing and constructing Wind Farms and EfW plants. His career includes senior management roles with Christiani & Nielsen, Trafalgar House (Skanska), Jacobs, Birse Group (Balfour Beatty) where his clients include BNFL, MoD, Network Rail, Manchester Airport, Severn Trent, Jaguar Land Rover & MDHC. Ray is a construction and commercial expert with DR experience in adjudication, arbitration, and mediation. He held the role of Director of CECA and Regional Chairman from 2007 to 2010.

Chris Butler (Technical Director – UK): Chris comes from a solid design background in civil engineering on major Waste to Energy projects, bridge structures, ports & harbors and general large building construction, Chris has a wealth of experience both in UK and Overseas. With over 15 years' experience spent in Tanzania and Pakistan and the United Arab Emirates. Chris has been involved in a broad range of projects across the whole of the Middle East GCC countries.

With a great deal of experience in the Energy sector, Chris has worked with both offshore and onshore wind farms and a new generation of deep-water wind turbine foundations. He also has extensive experience in Waste to Energy working on D&B's / PFI's with leading UK contractors on Waste Recycling Centres and Energy from Waste projects.

John Barone (Managing Partner, CT Gasification LLC): John is a 24-year veteran of the Connecticut State Police and has years of experience in all aspects of waste collection and processing. Understanding the waste industry starts from collection, and John spent 8 years with Finicchio Brothers hauling waste in Greenwich CT. John then spent over 11 years at City Carting as Safety Manager, Transfer Station Manager, and assisted in the day-to-day operations of 8 transfer stations and over 100 trucks, front loaders, and rear loaders. The operation consisted of about 400 union and non-union employees. An operation of this size enabled John to fully understand all aspects of the waste industry. John obtained a bachelor's degree in criminal justice, with a minor in sociology, at the College of Bloomfield, in Bloomfield NJ. Currently John has been approved, and waiting receipt, of his A-901 License from the NJDEP.

Robert Gisolfi (Managing Partner, CT Gasification LLC): Robert is a Green-Focused Executive with more than 30 years of experience in construction, program management, alternative energy, and capital project implementation. This experience has been on the customer, supplier, and contractor side of the business. He has managed over $95 million energy budget for a national company, completed millions of dollars of infrastructure and energy related capital projects, and managed both union and non-union personnel. As both Director of Energy and National Energy Manager for nationwide companies, he had to develop capital projects that not only added value to the property but had a favorable return on investment. Most of his experience is concerning the Physical Plant and Operational Efficiency, working with on-site facility engineers, and coordinating outside design and construction professionals. Controlling and reducing operating expenses thru strategic commodity procurement, coordinating efficiency and capital project financing, and installing alternative renewable energy systems are just a few recipes for his success. Robert also has over 12 years of experience in the utility industry, designing, installing, and maintaining overhead and underground electric distribution systems. He completed his tenure at Orange and Rockland Utilities as the Manager of Estimating and Design, overseeing 3 divisions. Robert is a graduate of Manhattan College with a BS in Electrical Engineering. From there, he obtained his MMA from Polytechnic University.

APPENDIX II

California Energy Commission Renewable Certification, Nevada and TN Minor Source Air Permits

12/4/2017 RPS

CA.GOV CALIFORNIA ENERGY COMMISSION

HOME APPLICATIONS ACCT MGMT

Keith Hulbert | Help | Logout

EP Renewable LV

Facility Summary

RPS ID: 63667 Save Cancel

Facility Certification

Type: Pre-Certification
Facility Name: Apex Astra Renewable Energy Facility (AAREF)
Begin On: 11/03/2017

Applications

	Received Date	Facility Owner
Select	11/03/2017	EP Renewable, Las Vegas, Inc.
Select	10/11/2017	EP Renewable, Las Vegas, Inc.

Left to Right:

- CEC RPS Facility Pre-Certification for sale of renewable power from Nevada into California: ID 63667

- Clark County Nevada Synthetic Minor Source Air Permit 17399

- Tennessee Air Permit No. 971766

CLARK COUNTY
DEPARTMENT OF AIR QUALITY
4701 West Russell Road, Suite 200, Las Vegas, Nevada 89118
Synthetic Minor Source Permit
Source: 17399
Issued in accordance with the
Clark County Air Quality Regulations
(Section 12.1)

ISSUED TO: **EP Renewable Las Vegas, Inc.**
601 S. Federal Hwy, Suite 203
Boca Raton, FL 33432

SOURCE: **EnviroPower Renewable Las Vegas Gasification Facility**
Apex Industrial Park
Las Vegas, Nevada 89124

RESPONSIBLE OFFICIAL:
Name: Bary Wilson
Title: Chief Technical Officer
Phone: (561) 843-0843
E-Mail Address: barywilson@eprenewable.com

Permit Issuance: May 5, 2015 **Expiration Date: May 4, 2020**

ISSUED BY: CLARK COUNTY DEPARTMENT OF AIR QUALITY

Richard Beckstead
Permitting Manager, Clark County Department of Air Quality

STATE OF TENNESSEE
AIR POLLUTION CONTROL BOARD
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243

Permit to Construct or Modify and Air Contaminant Source Issued Pursuant to Tennessee Air Quality Act

Date Issued: October 14, 2016
Date Expires: October 13, 2018

Permit Number:
971766

Issued To:
EnviroPower Cumberland, LLC
at the Bi-County Renewable Energy Authority site

Installation Address:
3212 Dover Rd (Highway 76)
Woodlawn

Installation Description:
Municipal Waste Gasification Plant
Two identical lines for two-stage gasification with modular units for processing 854 tons/day of MSW that is sorted, construction and demolition waste, and shredded tires. Each gasification line has two shallow bed fluidized gasifiers feeding a rotary kiln gasifier, pollution control devices exhausted to a separate stack with steam generation with heat recovery steam generators (HRSG)/ boilers with 16 MWe per line and plant total of 32 MWe for electrical power generation. Each small municipal waste combustion unit (SMWCU) is below 250 tons/day and is a Class 1unit since plant aggregate exceeds 250 T/day
Source 01:A01 Boiler (224 MMBtu/hr), provided by B01 Gasifier (128MMBtu/hr), B02 Gasifier (128MMBtu/hr) and C01 Gasifier (90 MMBtu/hr) with a single stack
Source 02: A02 Boiler (224 MMBtu/hr), provided by B03 Gasifier (128MMBtu/hr), B04 Gasifier (128MMBtu/hr) and C02 Gasifier (90 MMBtu/hr) with a single stack

Emission Source Reference No.
63-0340-01 and 02
40 CFR 60 Subpart AAAA
Conditional Major Source

The holder of this permit shall comply with the conditions contained in this permit as well as all applicable provisions of the Tennessee Air Pollution Control Regulation.

1. The application that was utilized in the preparation of this permit is dated June 20, 2016 and signed by Bary Wilson, Chief Operations Officer for the permitted facility. If this person terminates employment or is assigned different duties and is no longer the responsible person to represent and bind the facility in environmental permitting affairs, the owner or operator of this air contaminant source shall notify the Technical Secretary of the change. Said notification shall be in writing and submitted within thirty (30) days of the change. The notification shall include the name and title of the new person assigned by the source owner or operator to represent and bind the facility in environmental permitting affairs. All representations, agreement to terms and conditions and covenants made by the former responsible person that were used in the establishment of limiting permit conditions on this permit will continue to be binding on the facility until such time that a revision to this permit is obtained that would change said representations, agreements and covenants.

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(continued on the next page)

TECHNICAL SECRETARY

No Authority is Granted by this Permit to Operate, Construct, or Maintain any Installation in Violation of any Law, Statute, Code, Ordinance, Rule, or Regulation of the State of Tennessee or any of its Political Subdivisions.

NON TRANSFERABLE **POST AT INSTALLATION ADDRESS**

APPENDIX III

Metso:Outotec

EnviroPower Renewable, Inc.
601 S. Federal Highway, Suite 203
Boca Raton, FL
33432 USA

Attention: Keith A. Hulbert
CEO, EnviroPower Renewable Inc.
Email: khulbert@eprenewable.com

Phone: +1 703 668 0486
Cellular: + 1 703 725 7687

Project Name:	Synergy World Power Avondale
Client Reference:	Avondale Scotland
Metso Outotec Proposal:	539843

Dear Mr. Hulbert

Thank you for inviting Metso Outotec (MO) to participate in the Synergy World Power Avondale, Scotland project. We have thoroughly reviewed the Heat and Material Balances that you have provided and understand your proposed process.

The functions of the kiln and multi-stage burner system are very familiar to MO as are the concepts associated with the proportioning of air, recycled flue gas, and steam to control the temperature profiles of the system for optimal devolatilization and combustion. If awarded a contract for the technical design and commercial supply of this equipment, MO would be pleased to provide both a mechanical warranty and a performance guarantee for this equipment. The performance guarantee could be based on achieving the devolatilization and combustion of a specified flow rate, composition, and heat content (HHV) of biomass thus enabling EPRenewable to maintain a steady heat load to the boilers.

MO typically offers performance guarantees on rotary kiln projects in-line with our customers' operational goals. For this type of project, we understand that the heat released from the waste stream and the heat content in the exhaust gases are the primary source of value, so we will guarantee the heat release for a prescribed biomass feed. For other kiln projects, we offer similar guarantees. For instance, for petroleum coke calcining projects, we guarantee the controlled devolatilization of green coke feed while also achieving quality parameters for the calcined petroleum coke product (CPC). For mineral processing systems, the guarantee is usually related to fuel consumption and quality of product. We don't keep a running list of projects executed with performance guarantees, but I'm quite certain the total is greater than 100 (and maybe much, much more).

Metso:Outotec

I would also like to point out that with all of the performance guarantees MO has offered for rotary kiln projects over many years, MO has never had to pay LD's for missed performance. In rare cases, we have fallen short of a performance target and settled amicably with our customer without paying LD's either by adjusting or modifying the machines to ultimately achieve the targets or by providing some other beneficial service/settlement. In either case, MO stands behind our commitments and honors our guarantees.

MO looks forward to working with Enviropower to develop this important project, if you have any questions or would like to discuss the project, please feel free to contact MO.

Best regards

Chris Urban, PE
Vice President

Heat Transfer Product Group

Metso Outotec USA, Inc
2715 Pleasant Valley Road
York, PA 17402, USA

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Mobile: +1 570 850 3251