Conditional Commercial Offer
For a 10 MWe energy from waste plant based on PRM Energy System Inc. technology

Supplier Company Name:

PRM Energy Systems Inc.

http://www.prmenergy.com/

Presented by:

Technical Partners

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Form of Business:

Energy from waste.

Combined heat and power cogeneration

Areas of expertise:

Energy from waste using Advanced Thermal Treatment (Gasification) technology

PROPOSAL: This proposal provides a conditional commercial offer for three sizes of energy from waste plants from PRM Energy Systems of the United States of America, using advanced thermal technology (ATT) in a combined heat and power (CHP) facility. All aspects of the proposal must be confirmed by PRM Energy prior to ordering.

FUEL: Fuels used includes biomass (agricultural waste) and Refuse Derived Fuels (RDF).

OFFER:

	USD (million)		
	2 MWe	5 MWe	10 MWe
Gasification systems	$3.675	$5.618	$10.815
Power island including boiler systems, condensing turbine/generator system, flue gas treatment and filter system, etc.	$6.415	$15.119	$28.867
Total system price ex works	**$10.090**	**$20.736**	**$39.682**
Included in the above:			
Preliminary design and engineering	$0.597	$0.622	$0.952

BASIC PARAMETERS:

	2 MWe	5 MWe	10 MWe
FUEL			
Refuse Derived Fuel (RDF) MJ/kg LHV	15.0	15.0	15.0
Maximum moisture	15%	15%	15%
Maximum particle size	10-30mm	10-30mm	10-30mm
Raw Municipal Solid Waste (MSW) tpd	108.0	267.8	531.4
Refuse Derived Fuel (RDF) tpd	60.0	148.8	295.2
ENERGY OUTPUT			
MWe Net	2.0	5.0	10.0
MWth (estimated)	2.5	6.0	12.0

Details and conditions below.

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1 Forward – About Advanced Thermal Treatment (ATT) Technology

Technical Partners is partnered with international specialists in providing services and systems related to energy from waste and/or biomass in Combined Heat and Power (CHP) plants using Advanced Thermal Treatment Technology (ATT).

ATT is based on the principles of pyrolysis and gasification.

ATT achieves a very high efficiency of energy generation and thermal recovery, enables processing of a wide range of biomass and/or waste and is economic at a small, local scale. Biomass (e.g. crops, grass, compost, timber, residue from agricultural production, sewage sludge) and/or waste (e.g. municipal solid waste, hazardous waste, tires, oil sludge, pesticides) can be transformed into a gas using gasification and pyrolysis. Note: some technologies can only use biomass. The gas is used to generate steam for use in a steam turbine or direct fuel a gas-engine producing electricity. The waste heat can be used for heating or refrigeration.

Residual waste or Municipal Solid Waste (MSW), that which remains after removal of useful recyclable material, is typically 60% biomass (or biodegradable materials). The use of waste as an energy source thus removes the need for landfill, with its associated problems. EfW is also a disposal route for hazardous materials. To the waste producer, EfW reduces costs and to the power producer, the fuel is a revenue stream.

A waste/biomass CHP plant provides:

- A ”green” solution to producing heat and electricity;
- lower heating costs;
- energy from renewable resources;
- a solution to waste management problems;
- a local waste disposal and energy (heat and/or electricity) solution not requiring massive investments.

The main advantage of this technology is the high efficiency achieved over conventional mass burn/incineration or boiler systems. Because of the way that ATT technology works the emissions are cleaner than from incineration, such as no fly ash, so the gas clean-up requirements are less, meaning higher standards of operation and lower capital and operating costs. There is no clear definition of what is meant by small but typically we would look at plants between 0.25 and 10MWe output. This keeps fuel supplies local, gives more opportunity for recovery of the heat to local uses and means easier connectivity to the grid. If biomass is used, this means fuel costs will be significantly less. If waste is used, there is the possibility of earning income from processing waste.

In theory, this is all wonderful: green energy production solving waste issues, using renewable energy sources or decreasing fuel costs. But it isn’t quite that simple.

The challenges

Although the principles are old, the technologies are new. Technology improvements are patented or carefully guarded secrets. Not all suppliers will be able to offer the same technical solution. Although some systems have been around for some 35 years, many are in the late development stages and have not yet proven themselves in the field. Major changes and improvements have taken place in the last five years and have to be considered carefully before investment decisions are made.

Gas fired boilers use one fuel. Gasification systems use a wide variety of fuels, all with different chemical and burning properties. Particle size and moisture content play an important role, as does source of supply, hence what goes in will affect what happens inside the EfW/B plant and what comes out. This issue cannot be taken

lightly.

Many clients work as if they are buying a car. Investing in a CHP plant is somewhat more complicated. Many questions need answering to determine the economic and practical feasibility. Heat and electricity output requirements must be known, as well as the nature and source of the fuel(s) to be used, labour costs, environmental laws, etc. Income can be earned from electricity and heat sales, and in the case of waste processing, from avoiding gate fees and environmental taxes. The energy from the biodegradable element of the fuel can also attract „green certificates".

The Solution

Technical Partners have been involved in energy from waste and biomass since 1997 with its own development projects, and with other projects helping clients chose equipment. We have seen many others fail and experienced difficulties ourselves, but through this we have developed a methodology that should be used by everyone to first determine if a CHP plant is even appropriate, and if it is, to make sure the project is successfully implemented.

This starts with a **Scoping Study** that identifies the client's conditions and associated costs. This includes all the questions associated with such a plant covering fuel, costs, incomes, regulations, etc. This is actually a comprehensive questionnaire based on our experience. We also have a specially designed financial model which quickly provides payback information once the data has been inserted, and based on rough estimates for equipment costs. This provides the preliminary economic basis for the project and takes only some 10-15 man days to complete. The development of a scoping study relies on the experience of our specialists and normally is a good learning experience for the client. The report is the property of the client. Costs related to the scoping study are refunded to the client if the client purchases equipment represented by our group. Otherwise, this should be treated as a consulting/information gathering expense.

Next is the **User Requirement Specification (URS)** based on the findings of the Scoping Study. The URS provides the information needed by the equipment supplier to provide a good budget quote, and allows a comparison between suppliers who are quoting on the same thing. This will give a much better idea of possible costs and will be the basis of the next step, possibly an engineering or full feasibility study. If the Client has information readily available, the URS may be prepared as part of the Scoping Study. Once the URS is available, we are in a position to suggest an appropriate technology.

This process saves everyone time and avoids confusion, and we would be happy to provide assistance to anyone wishing to implement a CHP plant project.

Technical Partners presents solutions from PRM Energy Systems (PRME) of the US.

PRME has been producing energy systems since 1982 and have delivered their systems internationally, and can be considered a reliable, knowledgeable supplier. Plant visitations are available on request.

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2 Gasification System Description

2.1 KC Reactor/Gasifier

The Biomass Gasification system includes: the fuel metering bin and structure, the proprietary refractory lined KC Reactor/Gasifier and cyclone, multi-staged gas combustion assembly, the gasifier cooling water system, water cooled ash discharge conveyor, multi-zoned gasification air supply, rotary feeder and instrumentation required to provide automatic control over the process. The system to be supplied is a PRME Model KC series Gasification System as described below.

The KC Reactor/Gasifier consists of a high temperature refractory lined cylindrical steel shell that is mounted in a vertical position on heavy structural steel supports. The lower portion of the reactor contains an appropriately sized fixed grate. The refractory lining of the gasifier consists of the appropriate thickness of insulating castable and high- temperature dense castable that is field applied by gunning. Stainless steel anchors welded to the shell secure the lining. The gasifier includes an emergency vent stack to safely exhaust gas to the atmosphere in the event of an unplanned shutdown of the gasification or downstream equipment.

Stored fuel is delivered to the gasifier by the system-metering bin. Fuel is metered to the gasifier from the fabricated steel-metering bin. The bin is equipped with level controls, an in-feed levelling conveyor and a variable speed out-feed conveyor that delivers fuel to the gasifier. The speed of the out-feed conveyor is automatically adjusted by the gasifier control system to match the demand for syngas from the heat recovery system or may be manually controlled. The discharge from the out-feed conveyor is directed through an impact weigh metering device that provides precise indication and control of the fuel feed rate. The feed system will be installed complete with the necessary support steel, platforms and access ladders. The gasifier temperature set point will be automatically maintained to produce the desired syngas quality.

Fuel is introduced into the gasifier by a water-cooled screw conveyor that discharges into the drying and heating zone of the gasifier. The gasification process is controlled by the proportioned application of air in a manner that auto-genetically supports efficient gasification. Residence time in the gasifier is varied by a residence time control system that is adjusted to achieve the desired carbon content of the ash discharged from the gasifier. The use of precise gasification air control and zoning produces a calorific syngas that is directed to the gas combustion assembly. The syngas is continuously evolved from the gasifier at temperatures ranging from 1,200 to 1,8000°F.

Upon exiting the gasifier, the hot gases are first cleansed of entrained ash in a high temperature cyclone. The evolved gases are then oxidized in a series of stages for the proactive control of nitrogen oxides. The staged combustion of synthesis gas takes full advantage of the gasification of the solid feed by converting the fuel bound nitrogen into diatomic nitrogen (atmospheric N2) instead of oxides of nitrogen (NOx). The gas combustion chamber is vertically oriented, constructed of refractory lined carbon steel, designed to resist operating temperatures and mechanically designed to resist wind and earthquake loadings.

The entire gasification process is operated at a slightly negative pressure. The negative pressure is provided by the induced draft (ID) fan. The ID draft fan is located after the boiler and particulate removal system and will be sized for the mass flow and static pressures determined in detailed engineering. Negative pressure operation, in addition to superior process control, provides the added safety benefit of preventing leakage of flue gas. Any leakage of gas is in-leakage of ambient air into the controlled process conditions, and not out-leakage of gases to the uncontrolled atmosphere. Flow through the ID fan is controlled by a signal from the gasifier pressure controller.

2.2 High Pressure/Temperature Heat Recovery Steam Generator

PRME will provide a high efficiency Heat Recovery Steam Generator(s) designed to operate on the syngas produced from the proposed feedstock waste by the PRME Gasification System. The HRSG will be complete with access ladders/platforms, boiler controls, feed water pumps, valves, safety features with connections to the gasifier and steam turbine/generator.

2.3 Steam Turbine Generator

PRME will provide an efficient GE/Dresser-Rand or equivalent Steam Turbine/Generator/Condenser to match the steam conditions of the HRSG.

2.4 Ash Removal And Storage System

Located beneath the Gasifier is the pick-up point for ash removal. The ash discharged from the outlet nozzle of the gasifier is routed through an ash discharge and ash conditioning conveyor, discharging through an ash discharge valve and into a single pick up point for ash removal. Conveyors provided by the client will move the ash into an ash storage bin, also provided by the client, which should have a minimum twenty-four hour capacity at full design feed rate and be equipped with a dust suppression system.

2.5 Ancillary Equipment and Services

2.5.1 Control System: PRME will provide a fully integrated, freestanding, PLC based logic control with WonderWareTM or equivalent process logic software, LCD screen, loop controllers and motor controls. Field instrumentation and protective devices will be provided to accommodate continuous control, monitoring, interlocking and alarming for the entire gasification system. The LCD screen language will be English. This system will be capable of communicating with the balance of plant control system through a Modbus communication link. Should alternate hardware or software be desired, we will incorporate the selected software into the process logic.

2.5.2 2. Anchor Bolt Locations, Equipment Loadings and Foundations: PRME will design the equipment layout and provide equipment loadings, anchor bolt locations for design of equipment foundations by the client.

2.5.3 Erection and Installation Services, Operator Training and Start-up Assistance: Mechanical Erection and Installation costs **are not** included in the budget pricing and will depend on the location, available facilities and local resources. PRME would also provide 80 man-hours of on-site operator training. Operator Training sessions will be conducted in English. All required living and travel expenses relating to the provision of on-site services will be billed at cost plus 15%.

2.5.4 Operating Manuals: Two (2) copies of operating and maintenance manuals will be provided.

2.6 Equipment Summary

2.6.1 Gasification System

PRME Model No.	KC Series
Design Biomass Feed Rate:	TBD
Fuel:	Processed MSW (RDF)

Major Equipment:

- One PRME Model KC-224 Refractory lined Gasifier and cyclone, Gas Combustion Tube, including support structure; metering bin; in-feed conveying system with rotary air lock and mass flow control; ash discharge conveyor; ash conditioning conveyor; gasification and combustion air blowers, ducting, and valves; emergency vent; cooling water pumps, piping and valves.
- One – HRSG complete with boiler trim, controls, valves, gauges, safety alarms and equipment, designed for steam conditions of 45barg/399C.
- One – Condensing Steam Turbine/Generator, complete with all required controls and safety equipment.

2.6.2 Ancillary Equipment and Services

- Control System: Complete PLC based logic control with process logic software, loop controllers and motor controls.
- Process and utility piping for Gasifier
- Anchor Bolt Locations and Equipment Loading

3 Conditional Commercial Offer

3.1 Included in Commercial Offer

PRME Gasification to Energy Systems, budget price, installed, subject to confirmation, exclusive of bonds, union rates, insurance, taxes, tariffs, duties, and permits.

	USD (million)		
	2 MWe	5 MWe	10 MWe
Gasification systems	$3.675	$5.618	$10.815
Power island including boiler systems, condensing turbine/generator system, flue gas treatment and filter system, etc.	$6.415	$15.119	$28.867
Total system price ex works	**$10.090**	**$20.736**	**$39.682**
Included in the above:			
Preliminary design and engineering	$0.597	$0.622	$0.952

- Estimated Delivery: 12 – 14 months
- Shipping terms: Ex Works
- Estimated erection time: Approximately 4 – 6 months after delivery
- Pricing Validity: Budget pricing
- Terms and conditions of sale: PRME's Standard Terms and Conditions of Sale

Terms of Payment: Forty-five percent down payment with order. Balance of payment in progressive milestone payments drawn against buyer's letter of credit or bank guarantee inform and substance acceptable to PRME.

F.O.B. Shipping Condition:
- Major Equipment: Assembled to the maximum extent to allow ocean and inland transportation.
- Piping: Larger than 2" NPS process piping shop fabricated with some field position welds, 2" NPS and smaller piping shipped in bulk for field fabrication and routing.
- Controls: Shipped loose for field mounting and wiring.
- Refractory: Refractory systems will be installed and cured at site by PRME.
- Documentation: Included in the base pricing are two (2) copies of operating and maintenance manuals.

Note: This is a preliminary pricing, subject to confirmation. Actual pricing and expected performance may vary according to site conditions and fuel specifications and can only be confirmed after the engineering study is completed. This preliminary proposal should not be viewed as any type of representation or guarantee by PRME.

3.2 Not included in Commercial Offer

3.2.1 Fuel Preparation, Unloading and Storage Equipment

A Materials Recovery Facility (MRF) to receive and process MSW has not included in this proposal since such a system involves a great many variables. However, the following is an order of magnitude estimate of what such a system could cost.

	USD (million)		
	2 MWe	5 MWe	10 MWe
Fuel preparation, unloading and storage equipment	$6.000	$10.000	$15.000

For a 10 MWe please, approximately 530 tons/day of raw Municipal Solid Waste (MSW) could produce approximately 295 tpd of Refuge Derived Fuel (RDF). The MRF processing equipment includes all of the equipment necessary to convert typical MSW to an engineered fuel (RDF) ie. scales, conveyors, grinders, dryer, separation equipment, RDF storage etc. System output estimates are based upon gasifying uniformly blended

RDF containing 14.5MJ/kg LHV at maximum 20% moisture and maximum 10mm particle size as fired. PRME systems can handle most biomass and agricultural waste feed stocks. This proposal is based upon assumed feed stock analysis and composition as follows:

C - 40.3%
H - 4.7
N - 0.08
O - 31.1
Ash - 3.8
H2O - 20.0
LHV -14.5MJ/kg @ 20% moisture

Variations in feed stock composition may cause changes in performance and pricing.

3.2.2 Equipment/Services NOT Included, to be provided by Client

- Materials Recovery Facility (MRF)
- Installation and Erection
- Site utilities
- Ash Storage, Handling
- Civil works, foundations, Buildings etc.
- Compliance with Customer Specification, Foreign or Local Codes (All pricing for equipment and services are based on PRME standard specifications.) Consumable Chemicals and Supplies
- Air Pollution Control Equipment other than standard bag house filtration Emissions Monitoring Equipment
- Area Lighting
- Inland Freight, Import duties, permits, fees
- Landscaping, roads, etc.

3.3 Scope of material and equipment supply

TECHNICAL SPECIFICATION KC SERIES BIOFUEL GASIFIER

	1. GASIFICATION SYSTEM EQUIPMENT	
1	Metering Bin with variable speed discharge	2
2	Bucket Elevator from metering bin	2
3	Mass flow meter	2
4	Fuel Feed Rotary Air Lock	2
5	Fuel In-feed Conveyor (water cooled)	2
6	KC series Gasification System	1
7	Gasifier Cyclone	2
8	Gas Combustion Tube	1
9	Gasifier, Cyclone, Combustion Tube Refractory	1 lot
10	Emergency Relief Damper	1
11	Gasification Air Fan	2
12	Gasification Air Ducting, Piping, Valves	1 lot
13	Access and Support Structure	1 lot
14	Ash Discharge Conveyor (water cooled)	2
15	Ash Discharge Valve	2
16	Ash Conditioning Conveyor	1
17	Gasifier Cooling Water Piping	1 lot
18	Ducting from Gasifier to Cyclone	2
19	Overfire Combustion Air Assembly	2
20	Overfire Air Fan	1
21	Overfire Air Ducting	1
22	Synthesis Gas (Reox) Burner w/Refractory	1
23	Synthesis Gas (Reox) Air Fan	1
24	Reox Air Ducting	1
25	Air Cooled Heat Exchanger for Gasification System Cooling Water	1
	2. HEAT RECOVERY STEAM GENERATOR	1 lot
	3. STEAM TURBINE/GENERATOR	1 lot
	4. ELECTRICAL SYSTEM	
1	Essential Service AC & DC Systems (UPS) for PRME Scope	1
2	Motor Control Center	1

	5. INSTRUMENTATION & CONTROL SYSTEM	
1	Gasifier System Instruments & Controls	1 lot
2	PLC & DCS System for Gasification System	1 lot
	6. ENGINEERING & DRAFTING	
1	Drafting	1 lot
2	Process Engineering	1 lot
3	Structural Engineering	1 lot
4	Electrical Engineering	1 lot
5	Instruments & Controls Engineering	1 lot
6	Project Management	1 lot
7	Operating Manuals	2
8	Operating Training	1 lot
9	Start-up Assistance	1 lot

3.4 Standard Terms and Conditions of Sale

PRM ENERGY SYSTEM, INC.
Standard Terms and Conditions of Sale
(REV. 1/2007)

1. ACCEPTANCE

Orders for the purchase of products arising out of the quotation (the "Quotation") covered by these Standard Terms and Conditions of Sale (these "Terms") by a buyer of such products (hereinafter referred to as "Buyer") shall not be binding upon PRM ENERGY SYSTEMS, INC. (hereinafter referred to as "Seller") until such order is accepted and acknowledged in writing by Seller from Seller's home office.

2. PAYMENT OF INVOICES

(a) All invoices are due and payable in full within the stipulated period contained within the Quotation from the invoice date. All invoices not paid in full shall be delinquent. ALL DELINQUENT AMOUNTS WILL BE CHARGED INTEREST AT A MONTHLY RATE OF ONE AND ONE HALF PERCENT (1.5%) OR THE MAXIMUM LAWFUL AMOUNT, WHICHEVER IS LESS.
(b) If Buyer fails to fulfill terms of payment, Seller may defer further shipment, or cancel the unshipped balance.
(c) All payments shall be in U.S. Dollars, unless otherwise specified. The Buyer shall pay all money exchange charges, duties, taxes and the like not specifically included in Seller's quotation.
(d) To the maximum extent permitted by law, in the event any action or proceeding to collect any sum due to Seller (including in any bankruptcy proceeding), the Seller shall be entitled to reasonable attorney fees and costs.

3. DELAY OF DELIVERY; ACCEPTANCE

(a) In the event shipment is delayed or postponed at Buyer's request, the order shall be regarded as delivered and payment shall become due accordingly. In addition, Buyer shall pay Seller storage fees at the Seller's then current storage rates. Storage at Buyer's request shall be at Buyer's risk.
(b) Goods or other property sold pursuant hereto shall be inspected by Buyer on arrival, or if on-site installation is to be provided by Seller, upon completion of installation. If the goods or other property sold shall fail to conform in any way, Buyer shall notify Seller within ten (10) calendar days after arrival or upon Seller's completion of installation (the Acceptance Period) or they shall be deemed to have been accepted. Use of goods or products for purposes other than inspection during the Acceptance Period shall also constitute acceptance. If Buyer fails to notify Seller of any defect, damage, destruction, loss or discrepancy in quantity within such ten (10) calendar day period, or uses the goods for any purpose other than inspection, Buyer shall have accepted, and shall be deemed to have waived any rights and remedies regarding, such defect, damage, destruction, loss or discrepancy in quantity if such defect, damage, destruction, loss or discrepancy in quantity has been or could reasonably have been discovered during such inspection.
(c) In the event that installation materials and/or labour have been dispatched by Seller to the job-site at Buyer's request and site conditions are found to be inadequate so as to preclude Seller's off-loading of materials and/or installation activities, Buyer shall reimburse Seller for all expenses (including but not limited to travel, transportation, and living) related to the foregoing.

4. TAXES, PERMITS, NON-UNION LABOUR

(a) Seller shall not be liable for, nor shall Seller's quoted prices include any federal, state, local or foreign sales, excise or other taxes associated with the sale and/or use of the goods or services quoted herein, excepting state and federal income tax imposed on Seller for any price collected by Seller from Buyer under these Terms, unless specifically noted in the quotation. Buyer hereby indemnifies Seller from any and all

loss, cost, expense or liability arising from the imposition or attempted imposition of such tax.
(b) Erection/ installation prices are exclusive of state or local requirements for permits, special licenses and union labour. Expenses incurred by Seller to obtain such permits, licenses and/or union labour shall be to Buyer's account.

5. TITLE AND RISK OF LOSS; FREIGHT
(a) All quotations and sales are [Ex Works / F.C.A.] (INCOTERMS 2000) point of manufacture, unless otherwise noted. For the purpose of these Terms, F.C.A. is defined to mean that the title to and risk of loss for all goods sold pass to Buyer when loaded for delivery or, at Buyer's request, placed in storage, and otherwise in accordance with the INCOTERMS 2000.
(b) Job site freight expense contained in the quotation is an estimate and not warranted for accuracy by Seller. Actual job-site freight expense shall be prepaid by the Seller and invoiced to the Buyer at the actual expense, unless specifically stated otherwise in the quotation.

6. ASSIGNMENT
Neither this order, nor any interest therein, or any parties hereunder shall be assignable or delegable, either voluntary or involuntary, without the other party's prior written consent. Notwithstanding the foregoing, nothing contained herein shall prevent (1) Seller for assigning, pledging or otherwise hypothecate the monetary proceeds of the order as part of Seller's normal obligations or (2) subcontracting detail engineering, fabrication or erection.

7. TERMINATION AND DEFAULT
(a) Orders may be terminated only with the written consent of the Seller.
(b) In the event of cancellation or termination of the order by either party for any cause or for convenience, the Buyer shall pay Seller the cost incurred by the Seller plus a reasonable profit. Further, the Seller shall not be liable for Buyer's cost of termination or completion of the order.
(c) The Buyer shall be in default if the Buyer fails to make payments to Seller in accordance with the terms hereof, if the Buyer makes an assignment for the benefit of creditors or if bankruptcy proceedings are initiated for or against the Buyer, voluntarily or involuntarily.
(d) If Buyer is in default, Seller may, at its option, cancel any order by written notice and may pursue any remedy available under applicable law. All such remedies shall be cumulative and non-exclusive.

8. WARRANTIES
(a) Seller warrants only new products manufactured under Seller's direction against defective workmanship and/or materials under normal and proper use for a period of twelve (12) months from completion of installation of the product, or twelve (12) months after notification that the order is ready for shipment, whichever shall first occur.

(I) Seller's obligation to remedy defective workmanship or material shall be limited to repairing or replacing defective part or parts at Seller's point of manufacture. Freight costs to and from Seller's point of manufacture shall be borne by the Buyer. No allowances shall be granted for repairs made by Buyer without Seller's prior written approval. The decision to repair or replace shall be solely at Seller's election.

(II) Seller's warranty does not apply to parts requiring replacement because of normal wear and tear, erosion or corrosion, or improper storage.

(III) Seller's warranty does not apply to parts, which have been altered from their original state by either Buyer or any third party.

(b) The warranties set out above do not apply to refractory, products, components, accessories, parts or attachments manufactured by others, said refractory, products, components, accessories, parts or attachments being subject to actual manufacturer's warranty, if any, which Seller will pass on to the Buyer. Unless otherwise stated herein, Seller does not represent that the refractory, products, components, accessories, parts or other attachments manufactured by others are covered by any warranty whatsoever.
(c) Seller makes no warranty or representation that its product will conform to any federal, state, local or foreign laws, rules, statutes, ordinances, regulations, codes or standards of any type or purpose unless specifically agreed to in writing as part of the contract between Buyer and Seller. Seller's price does not include any cost of any related inspection, permit or inspector's fees.
(d) PROCESS WARRANTY, IF ANY, SHALL BE AS STATED IN THE QUOTATION.
(e) THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, ARISING BY LAW OR OTHERWISE INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE, AND IN LIEU OF ALL OTHER LIABILITIES OF SELLER INCLUDING DIRECT, INDIRECT, SPECIAL, INCIDENTAL AND CONSEQUENTIAL DAMAGES OR PENALTIES, EXPRESS OR IMPLIED, WHETHER ARISING OUT OF CONTRACT, NEGLIGENCE OR OTHER TORT.
(f) The Buyer warrants compliance with all laws governing the export of any of the goods or other property supplied hereunder and shall indemnify and defend Seller from all liability for violation thereof.

(g) If these Terms are accompanied by other instruments or agreement as set forth in Section 15 of these Terms, and such instrument or agreement contains a warranty section with warranties by Seller and/or a disclaimer of warranties, such warranties and disclaimer of warranties shall override the provisions of paragraphs (a), (b), and (d) of this Section 8 and the warranties therein by Seller if and to the extent that such warranties are narrower and such disclaimer is broader for Seller; otherwise, to such extent that is not the case, the additional protections afforded by paragraphs (a), (b) and/or (d) of this Section 8 shall apply.

9. LIMITED LIABILITY

(a) THE SELLER'S LIABILITY FOR DAMAGES, REGARDLESS OF WHAT THE CAUSE OR NATURE THEREOF MAY BE, SHALL BE LIMITED TO THE REPAIR OR REPLACEMENT OF THE DEFECTIVE PART OR PARTS OF THE PRODUCT. In no event shall Seller be liable to the Buyer for delays, curtailment of operation, loss of profits, any consequential damages including without limitation, costs for removing any part of equipment to be repaired or replaced, transportation and installation charges in connection with the repair, replacement or servicing of any parts or equipment.

(b) THE SELLER SHALL NOT BE LIABLE FOR ANY INDIRECT, INCIDENTAL OR CONSEQUENTIAL OR EXEMPLARY DAMAGES DUE TO ANY CAUSE WHATSOEVER.

(c) SELLER'S MAXIMUM LIABILITY HEREUNDER WHETHER IN CONTRACT, TORT OR OTHERWISE SHALL IN NO EVENT EXCEED THE TOTAL AMOUNT OF THE ORDER RESULTING FROM THIS QUOTATION.

(d) Buyer shall in no event bring cause of action for breach of any of the conditions of this agreement more than one (1) year from the date of accrual of the cause of action for breach.

(e) Any drawing and/or general information furnished to aid the Buyer in the installation or erection of materials sold are furnished gratis and form no part of this agreement. Such drawings must not be used until checked and approved by the Seller, his engineer, and any such other persons as he may select.

(f) If these Terms are accompanied by other instruments or agreement as set forth in Section 15 of these Terms, and such instrument or agreement contains a limitation of liability provision with a limitation of liability by Seller, such limitation of liability provision shall override the provisions of paragraphs (a), (b), and (c) of this Section 9 if and to the extent that such limitation of liability provision is more protective for Seller; otherwise, to such extent that is not the case, the additional protections afforded by paragraphs (a), (b) and/or (c) of this Section 9 shall apply.

10. MEDIATION, CONTROLLING LAW, SEVERABILITY

(a) The parties agree that any disputes arising hereunder that the parties cannot resolve between themselves through mutual discussions shall be submitted to mediation by an impartial third party or professional mediator agreed to by all of the parties. If the parties cannot agree on a mediator, or cannot come to an agreement after mediation, then they shall submit the matter to binding arbitration by the American Arbitration Association in accordance with its [International Dispute Resolution Procedures / the Commercial Arbitration Rules] then in effect (the "Rules") ; provided, however, that in the event of conflict between the Rules and the terms of this Agreement, the terms of this Agreement shall govern. The arbitration shall be conducted in English and the arbitrator(s) shall apply the law chosen as the governing law in paragraph (b) of this Section 10, and within the confines of such law, shall recognize the rights of all parties and commercial realities of the marketplace. The parties shall abide by the terms of the arbitrator's decision and shall cooperate fully and do any acts necessary to implement such decision. Both parties in equal amounts shall advance the costs of the arbitrator(s), and the arbitrator(s) may make any allocation of arbitration costs he or she or they feel is reasonable and equitable based on the decision on the merits of the case. Either party may invoke this paragraph after providing thirty (30) days written notice to the other party. Any mediation or arbitration shall take place in Dallas, Texas. Neither party shall be obligated to submit any Exempted Dispute to discussion, mediation or arbitration under this Section 10(a). For the purposes of this Section 10(a) of these Terms, an "Exempted Dispute" means (i) any dispute involving any right or claim regarding any infringement, threatened or alleged infringement, right to, title to or ownership of, or provision in this Agreement relating to, any intellectual property right of a party or any of its affiliates, or (ii) any legal proceeding threatened, initiated or brought by a third party against both parties or either party, or any cross-claim or third-party claim in such third party's legal proceeding by either party against the other party. Except where clearly prevented by the area in dispute, the parties agree to continue to perform their obligations under this Agreement while the dispute is being resolved unless and until this Agreement expires or is terminated in accordance with its terms.

(b) These terms and the transaction hereunder shall be governed by U.S. federal laws, as applicable, and the laws of the State of Arkansas, United States, without regard to conflict of laws principles that may require the application of the laws of any other jurisdiction. The parties expressly exclude the application of the United Nations Convention for the International Sale of Goods, and all of its terms, conditions and provisions, which shall not apply to these Terms or any transaction between the parties hereunder or pursuant hereto.

(c) If any provision of any term or condition herein is or becomes illegal or otherwise unenforceable under applicable federal or state law, such provisions shall be considered severed here from and all other

provisions herein shall remain enforceable and in effect.

11. INFORMATION OF SELLER, ANCHOR BOLTS, CONSTRUCTION ACCESSIBILITY

(a) Drawings, data, designs, operating instructions, calculations, and other such technical information supplied by Seller shall be held in confidence by Buyer. Such information shall not be reproduced, used, or disclosed by Buyer without Seller's prior written consent. All technical information supplied by Seller shall remain the property of Seller.

(b) Contained in Seller's information are the locations and elevation of anchor bolts and equipment loadings necessary for proper assembly. The Buyer shall be responsible for maintaining the indicated locations and elevations of the anchor bolts and a foundation sufficient for the indicated loadings. In the event anchor bolts are improperly positioned or foundations inadequate, the Buyer shall bear all costs associated with remedy including, but not limited to construction downtime.

(c) In the event that Seller's scope includes on-site erection, Buyer shall insure that equipment foundation(s) is accessible from two (2) adjoining sides.

12. FORCE MAJEURE

Seller shall not be liable for non-performance of any contract created as a result of this quotation, subsequent offers and acceptance, where such performance is prevented by strike, labour controversy, war, act of God, the elements, embargoes, governmental orders or restrictions, inability to secure materials, unavailability of transportation, or any other cause whether similar or dissimilar to those listed herein, beyond the reasonable control of Seller.

13. WAIVER

The failure of Seller in any one or more instances to enforce one or more of the terms and conditions herein or to exercise any right or privilege hereunder or the waiver by Seller of any breach of the terms or conditions shall not be construed as subsequently waiving any such terms, conditions, rights or privileges, and the same shall continue and remain in force and effect.

14. ENTIRE AGREEMENT

These Terms and such other instruments or agreement that accompany it shall constitute the entire agreement between Seller and Buyer. Should there be any conflict or matters between the terms and conditions set forth herein and those contained in any permitted instrument or agreement incorporated herein by reference or accompanying these Terms, then the provisions in such other document or agreement which more specifically concern such matters shall prevail, subject to the terms in Sections 8(g) and 9(f) of these Terms. No changes may be made in the agreement between the Buyer and Seller unless specifically authorized and acknowledged in writing by an authorized officer of the Seller.

3.5 General Technical Information

Cogeneration
Energy from waste or biomass
using
Advanced Thermal Treatment (ATT) technology
from

of the US

For the production of

- steam to generate electricity for use or sale
- steam for industrial process steam
- lower waste disposal costs
- gas for I/C Engine/gen-sets
- gas for co-firing of utility boilers
- direct firing of thermal oxidizers
- heat for the direct firing of dry kilns

3.5.1 Fuel

1. Types of Fuels Handled
   - 18 Biomass fuel materials
   - 10 Waste stream materials
   - 3 Fossil fuel materials

2. Specific Fuels Handled
   - wood and wood waste
   - agricultural residues
   - paper mill sludge
   - waste water treatment sludge
   - processed municipal solid waste (RDF)

3. Fuel - Commercially Proven
   - Refuse Derived Fuel
   - Wood Chips
   - Bio solids (Waste water treatment)
   - Saw Dust
   - Wood Flour
   - Coal
   - Rice Hulls
   - Rice Straw
   - Oat Hulls
   - Carpet Wastes
   - Tannery Residue
   - Olive Waste (Sanza)
   - Wine (distillery) Residue

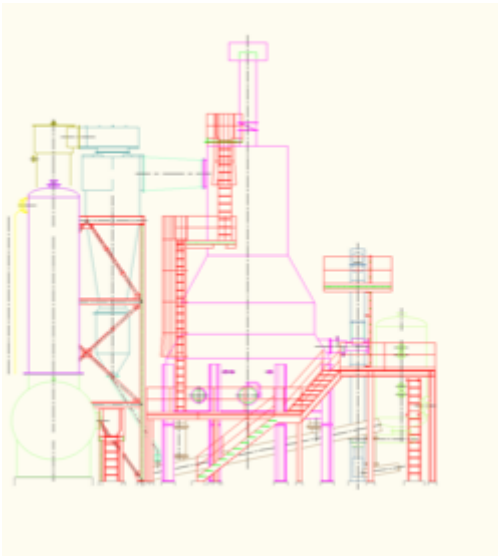
4. Fuel - Successfully Tested
   - Tire Derived Fuel
   - Sander Dust
   - Switch grass
   - Urban Green Waste
   - Masonite™ Dust
   - Whole Tree Waste
   - Sugar Cane Bagasse

- Furfural Residue
- Chicken Litter – Rice Hull Bedding
- Chicken Litter – Wood Bedding
- Turkey Litter
- Pine Tree Bark
- DDGS

5. Waste Feed Stock
   - C - 40.3%
   - H - 4.7
   - N - 0.08
   - O - 31.1
   - Ash - 3.8
   - H2O - 20.0
   - LHV - 14.5MJ/kg @ 20% moisture

3.5.2 The Gasification System

The PRM Energy KC-Reactor® gasification system is a sub-stoichiometric, updraft system with:

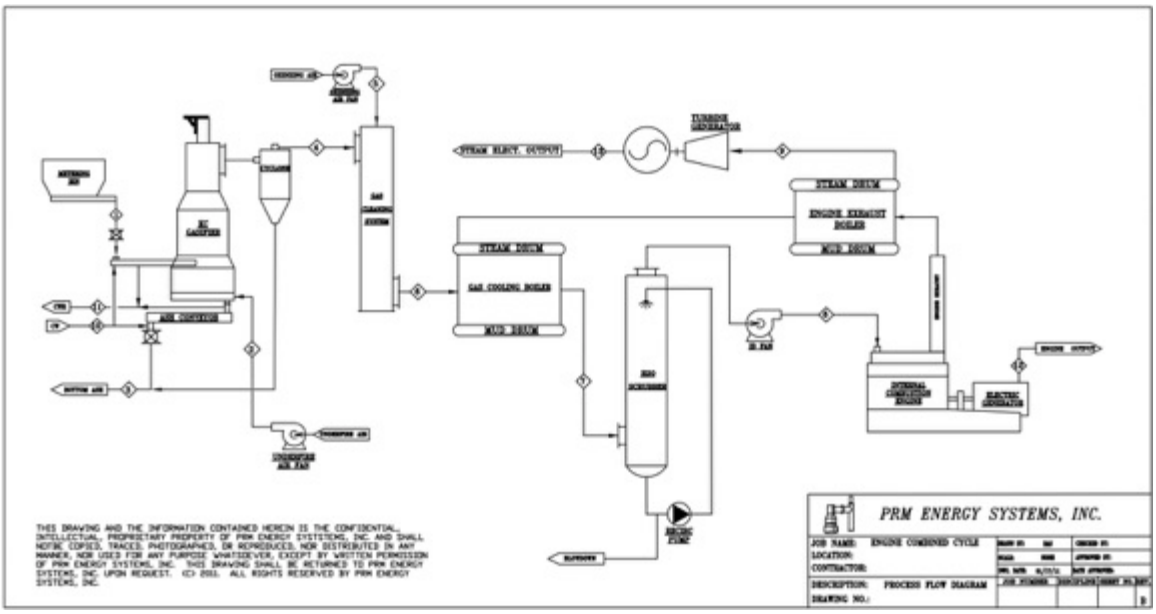


- Metered and measured feeding system.
- Water cooled components.
- Fixed grate, updraft.

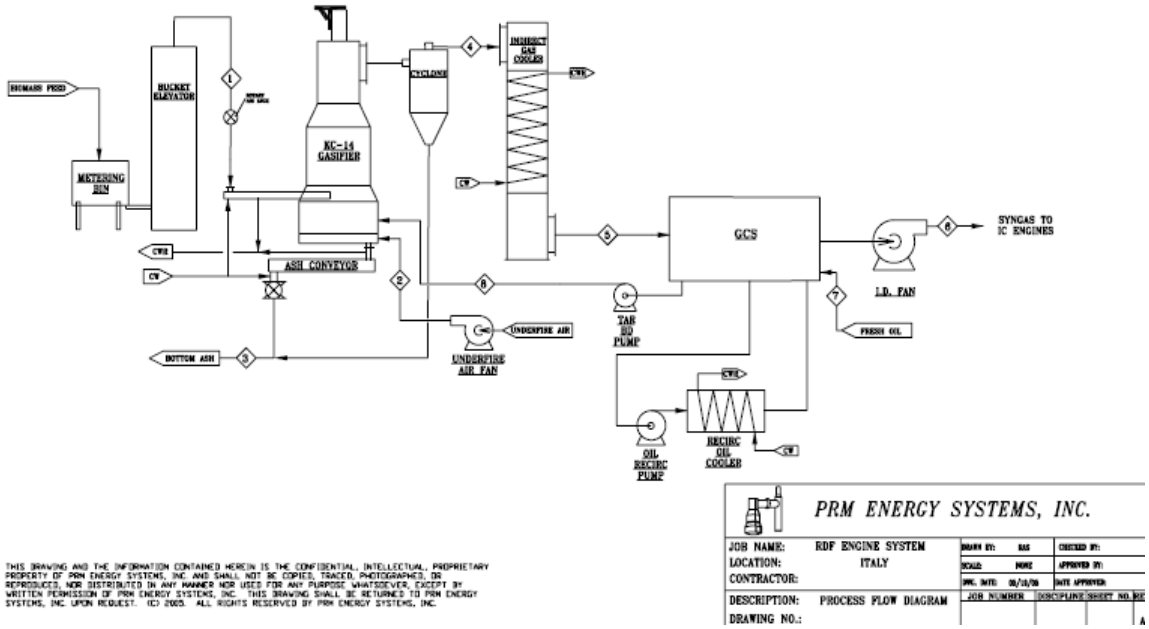
- Precisely controlled gasification air to achieve desired syngas quality.
- Adjustable depth, agitated bed to control residence time and carbon conversion.
- Continuous ash discharge.

- Optional high temperature cyclone.
- Optional staged combustion systems.
- Optional syngas conditioning system.

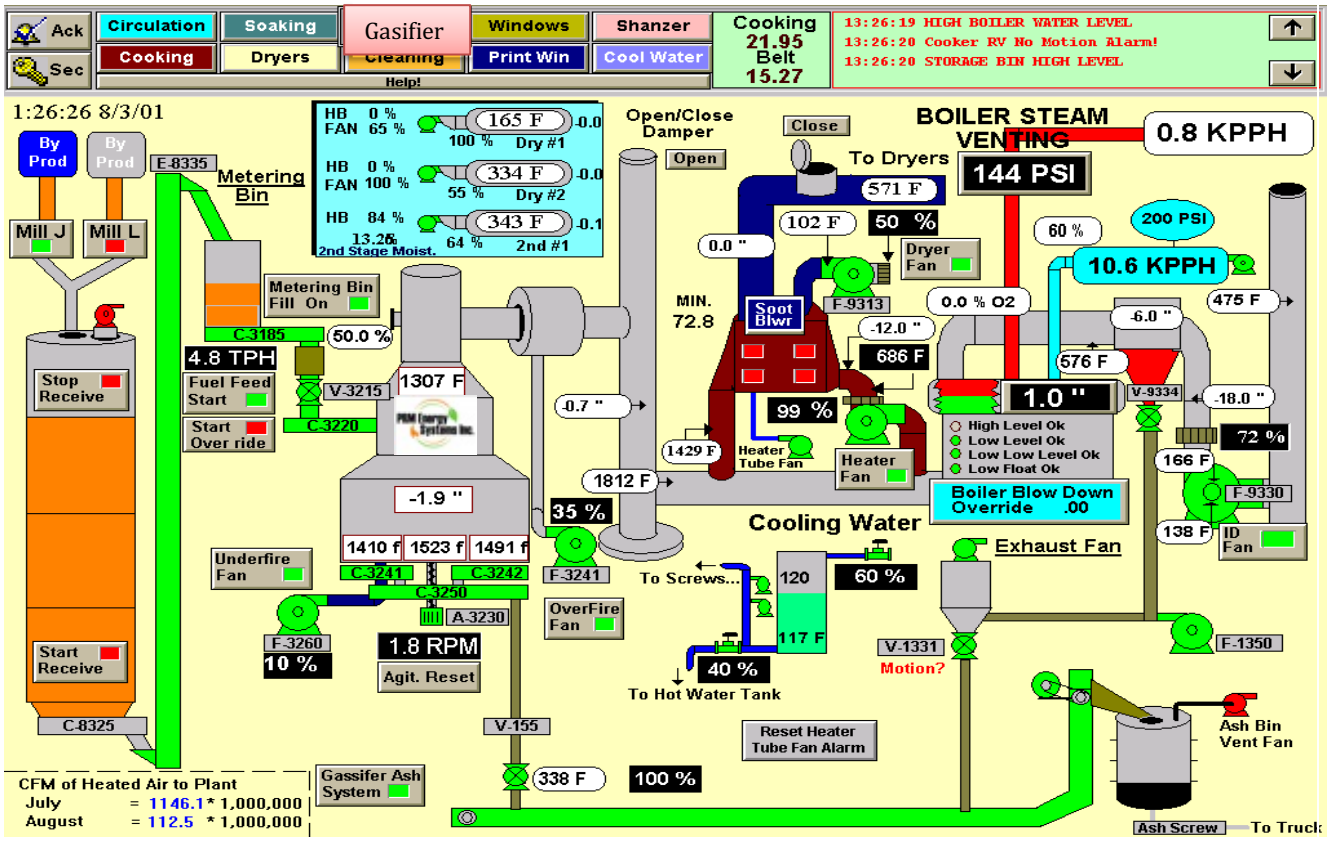
3.5.3 Process Flow Steam/Power Generation



3.5.4 Process Flow Engine Generation



3.5.5 Process Steam & Drying



3.5.6 Standards

Built to meet EU and local Environmental standards.

3.5.7 Model Capacities

Model	Biomass Input MT/hr at 6000 Btu/lb (3333 kcal/kg	Range of Gross Potential Power Generation (kWe)		
KC-8®	1.00	861.6	–	1,077.0
KC-10®	1.56	1,346.2	–	1,682.7
KC-12®	2.25	1,938.5	–	2,423.2
KC-14®	3.06	2,638.6	–	3,298.2
KC-16®	4.00	3,446.3	–	4,307.8
KC-18®	5.06	4,361.7	–	5,452.1
KC-20®	6.25	5,384.8	–	6,731.0
KC-22®	7.56	6,515.6	–	8,144.5
KC-24®	9.00	7,754.1	–	9,692.6

3.5.8 Delivery Times

Estimated Delivery: 12 – 18 months
Estimated erection time: Approximately 4 – 6 months after delivery

4 The Company

32 years of designing, building and operating gasifiers

PRM Energy Systems, Inc., Arkansas, U.S.A
incorporated in 1973

- Technology developed and patented by Mr. Ron Bailey, Sr.
- The first two gasifiers installed in 1982
- During the period 1984-88, many types of biomass fuels were tested including i.e.: rice hulls, rice straw, chicken litter, green bark, sawdust and chips, peat, wheat straw, corn cobs and stubble, peanut hulls, RDF (fluff, flake and pellet), petroleum coke, cotton gin waste, cotton seed hulls and low grade coal. All successfully converted to clean syngas.
- PRME's gasification technology since
  - 1982 in the United States,
  - 1985 in Australia,
  - 1987 in Malaysia and
  - 1995 in Costa Rica.
  - 2014 in France

4.1 Installed Gasification Systems

Model	Location/ Original Owner	Output Capacity	Year Completed	Application
KC-12*	Arkansas Producer's Rice Mill	7.5 MWt	1982	Process steam and heat for drying parboiled rice
KC-12*	Arkansas Producer's Rice Mill	7.5 MWt	1983	Process heat for drying parboiled rice
KC-6*	Arkansas Producer's Rice Mill	1.9 MWt	1984	Test/demo model
KC-14*	*Australia Rice Growers Cooperative	10.6 MWt	1985	Drying citrus waste
KC-12*	Texas Archer Daniel Midland	4 MWt	1985	Process heat
KC-8*	Malaysia Bernas Berhad	3.8 MWt	1987	Drying paddy rice (seasonal)
KC-8*	Malaysia Bernas Berhad	3.8 MWt	1988	Drying paddy rice (seasonal)
KC-8*	Malaysia Bernas Berhad	3.8 MWt	1988	250kWe + Drying paddy rice
KC-8*	Malaysia Bernas Berhad	3.8 MWt	1988	Drying paddy rice (seasonal)
KC-8*	Malaysia Bernas Berhad	3.8 MWt	1991	Drying paddy rice (seasonal)
KC-8*	Malaysia Bernas Berhad	3.8 MWt	1992	Drying paddy rice (seasonal)
KC-8*	Malaysia Bernas Berhad	3.8 MWt	1993	Drying paddy rice (seasonal)
KC-8*	Costa Rica El Pelon De La Bajura, S.A.,	3.8 MWt	1995	Process Heat & Steam

Model	Location/ Original Owner	Output Capacity	Year Completed	Application
KC-218*	Mississippi Cargill, Inc.	7.5 MWe	1995	Cogeneration
KC-318*	Arkansas Riceland Foods, Inc.	13 MWe	1996	Cogeneration
KC-18*	Arkansas Riceland Foods, Inc.	17.0 MWt	1996	Steam for rice parboiling, heat for parboiled rice drying
KC-18*	Rossano, Italy Rossano Energia	3.8 MWe	2002	Biomass Fired Engine Generator
KC-12*	*Pennsylvania	7.5 MWt	2004	Biosolids drying
KC-20*	*Georgia Siemens Technologies	18.0 MWt	2005	Steam for Process
KC-24*	*Minnesota	32.0 MWt	2006	Heat for drying, steam, electricity
KC-8*	Moissannes, France ENERIA	1.1 MWe	2006	Demonstration model for Biomass Fired Engine Generator
KC-8*	Scotland SLG Technology	3.0 MWt	2009	Thermal Oxidizer & Waste Heat boiler
KC-24*	Morcenx , France CHO-Power	9MWe	2014	Engine and Steam Power Generation

4.2 PRM Energy Plants in Operation

4.2.1 PRME Cogeneration (CHP) Plants

Wood Chip Gasification – 2006 | U.S.A.

Rice Husk / Straw Gasification System – 1995 | Central America

Rice Husk / Straw Gasification System – 1995 | U.S.A.

Rice Husk / Straw Gasification – 1996 | U.S.A.

4.2.2 PRME Electrical Generation

Olive Residue Gasification – 2001 | Europe

RDF, Wood & Wood Waste Gasification – 2014 | U.S.A.

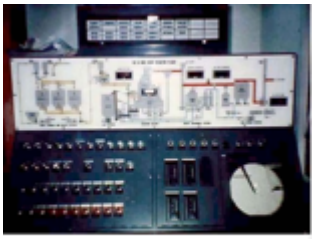
Demonstration & Test Facility – 1998 | U.S.A.

Wood Fuel and/or Distillery Residue Gasification System – 2006 | Europe

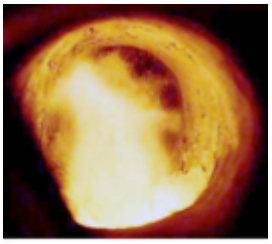
Technical Partners, Vienības gatve 109, Riga, Latvia, LV-1058
+371 29 255 223, SKYPE: ed.kalvins, ed.kalvins@technicalpartners.ca, www.tpriga.lv,

4.2.3 PRME Thermal Applications

Rice Husk / Straw Gasification System – 1997 | U.S.A.



Rice Husk / Straw Gasification Plants | 1988-1993 | Southeast Asia



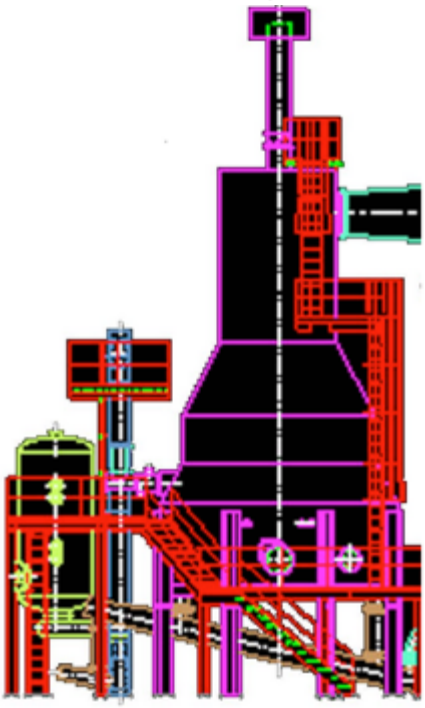
Rice Husk / Straw Gasification System – 1983 | U.S.A.

Rice Husk / Straw Gasification System – 1985 | Australia

Tannery Sludge Gasification – 2010 | Scotland

PRM Energy Systems Inc.

Sewage Sludge Gasification – 2004 | U.S.A.



Carpet Waste & Wood Dust Gasification – 2005 | U.S.A.

Rice Husk / Straw Gasification System – 1982 | U.S.A.

PRM Energy Systems Inc.

Cotton Gin Waste Gasifier | U.S.A.

Malaysia (1 of 7 plants)

France - 2014

Technical Partners, Vienības gatve 109, Riga, Latvia, LV-1058
+371 29 255 223, SKYPE: ed.kalvins, ed.kalvins@technicalpartners.ca, www.tpriga.lv,

FOR OVER 30 YEARS
PLANTS OPERATING ON FIVE CONTINENTS

4.3 Letters of Recommendation

Letters of recommendation are available on request from satisfied customers, including:

- Riceland Foods, Inc. – the largest rice processor in the world. Riceland has two PRME systems at Stuttgart and Jonesboro. These two plants were both commissioned in December, 1996 and convert 685 tons per day of biomass to heat, steam and electricity.

- ENERIA, Moissannes (France)— ENERIA is the Caterpillar distributor for France, Poland, Romania, Algeria and Belgium. ENERIA purchased a test/demo PRME system in 2005 to confirm that the PRME Gasifier would produce a suitable syngas for firing the Caterpillar Internal Combustion Engine. ENERIA operated the plant for approximately 6 years to test the PRME system on various types of biomass fuels and processed municipal solid waste.

- PHILIPPE DAVERAT, retired Managing Director of ENERIA. Mr. Daverat was instrumental in the establishment of the PRME test/demo system in Moissannes and the monitoring of the tests and results of the PRME Gasification System operating on various waste fuels including MSW and RDF. After his retirement from ENERIA, Mr. Daverat was employed as a consultant by CHO Power to consult on the CHO gasification plant at Morcenx, France.

4.4 Insurance Protecting the Investor

Insurance may be available on request.

4.5 Written Descriptions / Papers (available on request)

- BioSolids Disposal
- Clean Heat, Steam and Electricity from Rice Hull Gasification
- PRME Recovery Systems
- Original PRME Gasifiers Installed 1982-83, Producers Rice Mill Inc. Stuttgart, Arkansas
- Refuse Derived Fuel (RDF) Gasification Test Report
- A Case Study of Two Biomass Gasification Systems Converting 650 Tons/Day of Rice Hulls to PRME NaturallygasTM
- Sludges

5 Frequently Asked Questions

5.1 Unique selling points

What's PRME's Unique Selling Points?

Early patents have expired; however, additional patents and proprietary technology have been added over the years, pertaining mainly with residence time of the fuel and the syngas, gasification air control, control system, syngas conditioning, etc.

PRM Energy has not only 33 years of experience in the gasification business, but have gasified more biomass than all other gasification technologies combined.

There are PRME systems operating today that have operated in high demand industrial applications for over 33 years. No other gasification technology can match PRME's track record.

There are many "gasification technology" companies out there in cyber-land making big claims with "USP". All you have to do is ask them, "Can we see one of your plants". Usually that will end the conversation because they don't have a plant. In PRME's case, the question is more like "which plant do you want to see". This will be based more on the type of materials the client wishes to process.

5.2 PRME Systems

1. PRME Waste Gasification Fired IC Engine/Generator System
2. PRME Waste Gasification Steam Cycle Systems

Which system is more efficient?
System number 1 is more efficient .With same fuel, number 1, in simple cycle, will generate approximately 17% more electricity than no. 2..

Which system is suitable for co-generation
Both systems can generate steam and electricity.

Which system has less opex?
Depending upon the fuel composition, opex is lower on no. 1.

Environmental Impact: Does PRME meet local disposal & environmental standards?
PRME has installed it's systems on five continents and all of the installations meet required emissions regulations.

System Stability
The PRME Gasification System makes automatic adjustments of operating parameters to maintain a high state of stability.

Apart from gas, what is generated by the syngas conditioning system?
The Gas Conditioning System is a gas cleaning application where tars and hydrocarbons are eliminated from the syngas prior to cooling of the syngas. This application is for IC Engine Systems – not for Steam Cycle Systems.

Do the estimated net electrical outputs for these systems take into consideration the power requirements of the MRF?
The estimated net electrical generation does NOT include consideration of the power requirement for the MRF.

If not, normally how much estimated power is required by MRF? Can MRF use the power/heat generated by PRME system itself?
The estimated power requirement for the MRF is about 500kWe/hour, depending upon the through-put and composition of the MSW.

How long is the lifetime of PRME system?
PRME has systems that have been in around the clock operation in high demand industrial applications for over 33 years.

The syngas is induced from the gasifier through a proprietary mechanisms that cool and condition the gas… the initial cooling is accomplished by indirect heat exchange with air or water'
How much water is required per day or per year by a KC-24 system?
How much water per day or per year is required by a KC-24 IC engine system?
The water used for cooling the syngas is recirculated. When water is used for the syngas, it is through a heat recovery steam generator, which produces steam that can be used either in a steam turbine to produce additional electricity, for indirect drying systems or other CHP systems.

PRME IC engine system start-up time. How long does it take from PRME gasifier is started up until IC engine start work. Please describe briefly the procedure.

PRME provides a "pre-heater" that is inserted into the gasifier to bring the gasifier temperature up to operating temperature (approximately 750C). This take approximately 6 to 8 hours. Once the gasifier temperature reaches operating temperature, the pre-heat burner is removed and the feed stock is started. If it is an engine system, the syngas will be "flared" and tested until it is suitable for operating the IC Engine. A suitable syngas will be produced in minutes and the IC engines will be started. If it is a steam cycle system, the syngas will be combusted on the way to the boiler.

Depending upon the analysis of the RDF being gasified, the ash is a "bio-char" that can be used as a soil enrichment, soil amendment and other land applications. Again, depending upon the analysis of the RDF, the ash can possibly be used in asphalt for road building and repairs. We have been selling ash produced from rice husk to steel mills in the US, Europe, Japan and South Africa to be used as an insulating topping for ladles and tundages. We have sold over ¼ million tons at a price of US$100.00 per ton bulk fob the gasification plant.

5.3 Cooperation

Would PRME a JV with one or more local parties?

No.

PRME sells equipment, provides erection advisory services, star-up assistance and commissioning and training of operators
PRME may License the fabrication the PRME systems, provide drawings for fabrication, assist with erection advisory services, provide proprietary patented equipment
We do not travel at our expense to attend "question and answer" meetings. We will be happy to participate in a "question and answer" telephone or skype conference call at most any time.

5.4 Inputs and Outputs

What are the inputs and outputs?

The input is the waste fuel.

The output is steam, heat and electricity.

The Gasification Process does not create dioxins. If dioxins are contained in the fuel being gasified, the temperature attained in the gasification/gas combustion process destroys the dioxins.
If heavy metals are present in the feed, the heavy metals will most likely not be volatilized and will remain in the ash. If some heavy metals are found in the syngas, lime injection and/or activated carbon filtration/absorption can remove them.

How much electric/heating are generated?
A typical RDF fuel will generate approximately 725 kWe per metric ton gross output.
The amount of electricity and heat generated are a direct result of the chemical analysis of the waste fuel.

5.5 Waste

What are the requirements of waste?

for PRME Waste Gasification Fired IC Engine/Generator Systems
The combustible syngas produced from the waste is conditioned and cooled for firing IC Engines.
the waste feed stock to be gasified must

- contain a minimum calorific value of 15.3MJ/kg at
- a maximum moisture content of 20% and
- maximum particle size of 10mm

for PRME Waste Gasification Steam Cycle Systems
The combustible syngas produced from the waste is fully combusted and fired directly into a Heat Recovery Steam Generator (HRSG) to raise steam for a steam turbine/generator or for process steam. The waste feed stock must

- contain a minimum calorific value of 12.0MJ/kg at
- a maximum moisture content of 30% and
- maximum particle size of 10mm

How much waste can be treated per annum?
The PRME Gasification System is modular and can handle an unlimited amount of waste.

Could PRME gasifier be able to treat following:

Industrial sludge
We have a PRME plant gasifying dried industrial sludge. The sludge comes into the plant at approximately 20% solids. It is dried to approximately 80% solids and gasified to provide heat and steam to a process.

Industrial waste
Depends upon the composition of the industrial waste.

Clinical waste
Depends upon the composition of the clinical waste.

Can gasifiable waste can be completely gasified by PRME system?
Gasification (conversion efficiency) will range from roughly 60% to 95%, depending upon the actual chemical analysis of the fuel, whether the application is a steam cycle or IC Engine cycle and the operating parameters of the gasifier (temperature, retention time, addition of O^2/steam, ash fusion temperature etc. Generally, the ash will contain some unconverted carbon. If the client desires, we can add an ash carbon gasifier to further process the ash.

5.6 End Products

Apart from electricity and heat, syngas, what other end products are generated, in particular, are there any solids, fly ash, slag? Particular how much fly ash is generated.
Ash and flyash are produced - the amount depends upon how much ash is in the waste fuel.

How the end products are treated? E.g. fly ash
Ash and flyash are “conditioned” ie: cooled with a water quench.

If Ash is “conditioned” ie: cooled with a water quench, then what kind of product is produced after cooled with a water quench?
The ash is very small particle size and light weight. Mixed with asphalt, it would be good for roads.

What is ash fusion temperature
The ash fusion temperature for the RDF should be minimum 1200C. The ash fusion temperature is a very common specification and is determined by a lab that is licensed or authorized to perform analysis on fuels and by products. The area most likely to reach 1200C during the gasification process is on the grate at the bottom of the gasifier. The gasifier is programmed to operate below the ash fusion temperature to prevent ash fusion.

Solid (i.e. flyash) and waste water (from liquid scrubber) are also generated. How are the solid and waste water treated?
The flyash is blended back with the gasifier bottom ash. There is no presently no liquid scrubber employed.

How is the ash treated after being moved into the ash storage bin? Where does the ash go? Does it goes to landfill or bin?
The ash has been conditioned prior to moving to the ash storage bin. The ash can go to “land application” or landfill depending upon the analysis of the ash. It may qualify for addition to asphalt or road application.

Before ash goes to landfill, is the ash classified as ‘normal waste’ or ‘hazardous waste’?

Usually Normal Waste, depending on what was in the feedstock initially.

Is there any by-product need go to landfill or potentially cause second pollution?
All of the non-combustible material in the raw MSW will need to go to the landfill.

Emission control: How the emission air is treated?
Emissions are controlled with readily available emissions control equipment.

Normally how much cost will take to treat the end products and emission air?
The type of equipment and cost depends upon the contaminants contained in the waste fuel.

5.7 Capex

The Capital Cost of a plant depends upon the type and size of the plant and the type of waste fuel to be gasified.

How much would plant cost?

650 tons per day of raw MSW converted to
380 tons per day of RDF
containing a minimum LCV of 14.5MJ/kg
@ maximum 20% moisture and
maximum 10mm particle size
generates about 10 MWe
budget priced @US$35.0 million Ex Works.
budget priced at US$3,500 per kW Ex Works,

180 tons per day of RDF feedstock
containing a LCV of 14.0 MJ/kg
@ 15 per cent moisture and
maximum 10mm particle size
generates about 4.8 MWe
generates about 12 - 13 GJ/hr = 3.6 MWth
budget priced at US$18.2 million Ex Works.

90 tons per day of RDF feedstock
generates about 2.5 MWe
budget priced @US$12.6 million Ex Works.

including the Materials Recovery Facility to process the raw MSW to RDF.
This budget price is for the equipment only, not including any civil works, buildings etc.

5.8 Opex

What is the cost to generate 1KW/h of electricity?
A 10MWe system is estimated to cost 3 – 4 US cents/kWe.
The cost to generate 1kW/h of electricity is a direct function of the size and type of the plant and the fuel to be gasified.

How much is the Opex of a typical plant? What are the main costs of Opex?
Typical Opex for a 10MWe plant is estimated at 2 – 3 percent of CAPEX.
Labour in the MRF is the main expense.

Fuel oil
Does PRME require oil during operating? If yes, how much litres of oil are required per hour?
No.

5.9 Equipment

What equipment / devices are required for initial plants?

- The PRME Gasifier System,
- HRSG,
- T/G,
- Dust Collector,

- Cooling Tower,
- Fuel Receiving and Processing Facility (MRF).

Normally, how long would it take to complete one plant project? And what are the different stages involved?
Equipment shipment in 14 – 16 months.
Approximately 6 – 8 months for installation, start-up and commissioning.

5.10 Vital statistics

What is the plant height
The height of the plant is different for each size.
The highest point for a PRME Model KC-224 is approximately 65ft.

What is the plant footprint for a 10 MWe plant
The area required is estimated at 50m X 75m.

5.11 The latest French plant

The PRME Gasifier in France (2014) is essentially the same technology as the PRME Gasifier in Arkansas (1982).
The French Gasifier is larger and is making a "syngas" that is used for firing IC Engines.
The Arkansas Gasifier is direct firing a steam boiler.

How long did it take to build this plant?
Two years.

How long has the plant been operating/running?
One year

What type of waste is treated? i.e. msw
MSW RDF SRF

How much waste and RDF are treated?
200 tons per day

What model of PRME gasifier are used?
PRME Model KC-24

How is the ash been treated?
The ash is not treated. It is being directed to a "skip" bin and to reduce the dust, a water spray is applied to the "skip"

What is an 'ash carbon gasifier'
Generally, the ash will contain some unconverted carbon. If the client desires, an ash carbon gasifier can be added to further process the ash.
It will be a KC-8 gasifier.

How much ash go to landfill per day or per month of French plant?
The ash content in the fuel in France varies between 15 to 25%. The ash discharge from the system is between 28 and 48 tonnes per day.

Where does the ash go after leaving plant?
Landfill, depending upon the ash analysis, it may be used for land applications.

How the wastewater is treated?
There is no waste water.

How the odour is treated?
There is no odour. Normally, the MRF building will be under negative pressure.

Please provide an emission report to show the plant emission meet EU standard.
We do not have an emissions report. The plant is permitted and operates within the EU regulations.

Was additional air emission control or treatment systems added to the French plant apart from PRME standard gas condition system?
The French plant has “lime injection” for control of SO2 and HCl.

What man-power is required by the plant?
MRFs can contain varying amounts of automation. Depending upon the Client’s desire/ requirement for automation, the MRF will employ 5 – 15 per shift.

How often is regular or major maintenance work required for the PRME gasifier system of the French plant?
The PRME Gasifier requires a very minimum amount of small or big maintenance work. We recommend that the gasifier be scheduled for 2 weeks down time for maintenance per year.
There is no part that will be replaced regularly.
There will be a recommended spare parts inventory.
Estimated repairs are 1 – 2% of the Capital costs.

How often will maintenance work take place?
The MRF will operate approximately 20 hours per day 5 or 6 days per week. Regular Maintenance will be scheduled during the 4 hours of downtime each day. Major maintenance will be scheduled on week-ends.

What major part will be replaced regularly?
There is no part that will be replaced regularly. There will be a recommended spare parts inventory.

How much are replacement costs?
Estimated repairs are 1 – 2% of the Capital costs.

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6 Technical Partners Key Personnel

Ed Kalvins www.linkedin.com/in/ed-kalvins-6b4874a https://www.linkedin.com/in/ed-kalvins-6b4874a/ is a Latvian-Canadian who operates Technical Partners International Inc. of Canada and "TP Riga" SIA http://tpriga.lv/ of Latvia from offices in Riga, Latvia. He is a Canadian engineer with extensive Project, Production and Engineering experience in Canada and Latvia.. He is the President of the Canadian Chamber of Commerce in Latvia (http://cancham.lv/).

Rajiv Gurdayal Asthana, the owner of MASE Exim Private Limited of India and the U.A.E. is representative of Technical Partners in these regions.

Inguna Gustava – Director – International Projects, BA in mathematics (University of Latvia). MBA (Riga Business School, Riga Technical University, Latvia). Over 15 years trade, marketing and manufacturing management experience.

John Birchmore, the owner for SHREWS http://www.shrews.co.uk/wordpress/ is a partner company of Technical Partners involved in the development of energy from waste cogeneration projects. John 40 years experience in the forestry and wood processing industry and renewable energy, with 20 years' experience in Eastern Europe, especially Latvia. He has established several start-ups in the Baltics and Russia as well as the UK and acts as an advisor to UNDP and EBRD on development.

Alvis Līdums – BA – Economics – Manufacturing, BA – Business Administration, MA – Public Administration (University of Latvia). Project Manager. Industrial Engineering and Project Management experience. Cogeneration specialist for CHP plants.

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