WASTE TO ELECTRICITY

Buvoca is capable of processing any type of waste into energy using the latest technologies. Our facilities have no chimney or stack. All gases and fumes are recycled back to the system gaining extra 18% efficiency.

Patent protection modular design – high availability, scalable and expandable modules.

General Information

- Net electric power (MW/H): 12.75
- Area (SQ./F): 122,400
- Main Fuel: Organic wastes
- Yearly fuel consumption (ton): 144 000
- Employees: (3 shifts) 66
- Split of responsibility for engineering, fabrication, transportation, installation, testing, and commissioning works: Buvoca & partners.
- Delivery time: 17 months
- Schedule for installation, testing, commissioning, and startup works: 2 months

Disclaimer / Confidentiality

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Project for processing MSW to generate electricity

Buvoca Ltd. owns conversion technologies and is prepared to deploy its technology globally to improve economic production, reduce emissions and produce electricity from municipal solid waste (MSW). Buvoca's mission is to provide cheap, clean consumable power and natural resources in emerging markets, preserving health, jobs, assets, and economic growth.

Buvoca Ltd. is focusing on production of electricity by shredding and dehydrating solid waste (MSW) with a waste converter technology. Due to a wide variety of functions available on converters, this technology is an ideal fit for diverse waste-producing industrial segments.

Buvoca Ltd. has accumulated significant technological and commercial capabilities deriving from a set of closely interrelated technologies in Power Generation technology based on efficient application of waste-to-energy solutions for industrial and municipal needs.

Buvoca Ltd.. technology is designed to process ANY types of industrial waste, municipal solid waste to be processed into electricity. For medium to large scale waste to energy projects in order to achieve best results it is highly recommendable to run a preliminary assessment study before supplying a complete turnkey solution as results of efficient waste utilization is highly dependent on numerous chemical and physical parameters of waste.

During the stage the final technological solution, which may involve the integration of conversion technology in existing infrastructure (for example using some of already landfilled waste) and facilities takes place, Buvoca may also be used to process the ash and other byproducts to produce organic fertilisers. In this case Buvoca can significantly reduce the operating costs and the volume of landfilled waste.

Buvoca Ltd. is highly committed to own technology and believes it could bring very fast and substantial economic benefits to its partners and clients. To control and speed up build-to-market time and guarantee quality assurance, Buvoca could structure its offer in two alternative ways:

1. Build-Own-Operate (BOO/BOOT), when Buvoca gets a concession from the owner for a period of 2049 years to operate upgraded PP. Buvoca installs its technology and operates the facility with the prime goal to recover the costs of investment and maintenance. Parties are also to agree on feedstock supply and electricity offtake conditions.

2. Build-Lease-Transfer (BLT), when Buvoca agrees to design and lease its technology to the owner of PP in a long term contract, where Buvoca assures that technology is delivering designed results and PP is guaranteeing reasonable “take or pay” conditions .

The Electricity production plant is processing organic waste materials abundantly found in municipal solid waste such as food, plant material and paper. The efficient output of Buvoca’s plants will depend on a steady input of organic waste. The processing rate of the technology is 17 tons of waste material input per hour to produce 8.5 MW per hour. Conversion occurs as a closed chemical gasification conversion process and will produce acceptable emission levels as defined by Ministry of the Environment regulations.

Buvoca’s technology complies with stringent Canadian environmental standards for waste to electricity processing. Increased production levels will allow Buvoca to take advantage of economies of scale in terms of power and labour costs.

Buvoca WTE plants will convert all feed stock as mention in the list below to clean Electricity.

- Municipal Solid Waste (MSW)
- Residual plastics
- Wood waste
- Medical waste
- Agricultural waste
- Hazardous waste
- Animal waste

Overview of WTE Plant

Size: the plant required concrete slab with shed or industrial building

Total floor space required for the plant: 360 feet long by 340 feet wide for a total of 122,400 square feet and is subdivided as follows:

- Material handling = 220 x 106 feet = 23,320 square feet
- Pyrolysis flue gas cleaning = 100 x 206 feet = 20,600 square feet
- Electricity generation = 40 x 106 feet = 4,240 square feet

The plant's **outside space** requirements: total outside space required for the plant is 17,640 square feet and is allocated as follows:

Syn-fuel storage tanks = 32 x 40 feet = 4,280 square feet.

Heat recovery system = 60 x 58 feet = 6,480 square feet.

Substation = 60 x 48 feet = 5,880 square feet.

Electricity: Not required, provides its own need from an internal turbines – self-sustained.
Water: Not required, provides some of its own need from an internal source.
Capacity Input: 17 Tons of feed stock per hour (144 000 MT per year for 360 days a year operation)
Capacity Output: up to 8.5 MW of electricity per hour (or up to
12.75 MW with a high efficiency waste heat generation system). The calculation of output electricity made by standard Canadian morphology of the MSW.
If the plant processes hazard and medical waste, the output of electricity will be lower (the more combustion gas going to up the internal temperature of the plant's reactor)
Scheduled maintenance: As in maintenance schedule, during working shifts.

The ideal morphology of MSW that Buvoca WTE plants can convert:

Components	General %	Content, %		
		Fraction (mm)		
		+200	200+/-80	80-
Waste paper (paper, cardboard, etc.)	22,00	6,60	11,40	4,00
Food and vegetable waste	35,00	0,00	9,20	25,80
Textile	5,50	3,30	2,00	0,20
Plastic	2,00	0,15	1,60	0,25
Polymers, plastic bags	4,00	1,45	2,50	0,05
Leather, rubber	1,50	0,05	1,45	0,00
Wood	1,50	1,30	0,20	0,00
Bones	1,00	0,00	0,30	0,70
Ferrous metals	4,00	1,30	2,50	0,20
Non-ferrous metals	0,70	0,00	0,70	0,00
Glass	7,00	0,00	6,80	0,20
Stones, ceramics	1,50	0,75	0,55	0,20
Other (incl. dropouts)	14,30	1,00	5,00	8,30
Total:	**100,00**	**15,90**	**44,20**	**39,90**

Advantages of Buvoca WTE Plants:

- Fast return on investment
- Substitution of natural gas and fossil fuels
- Disposal of organic waste in the area
- Direct production of heat through thermal power stations
- Energy efficient use of the complete energy content

WASTE HANDLING

Waste handling involves taking the waste delivered to the plant by the waste pick up companies and putting it into the plant processing system. This sub-system utilizes scales to weigh the waste and transfers the waste from concrete pits where it has been deposited by the garbage trucks to the plant hopper using specialized cranes with waste grapples.

The process is fairly standard regardless of the type of WTE plant being used. Current waste handling technology has been used for at least twenty years. Once the waste is in the plant process, it is transported by conveyors.

MATERIALS SORTING AND SEPARATION

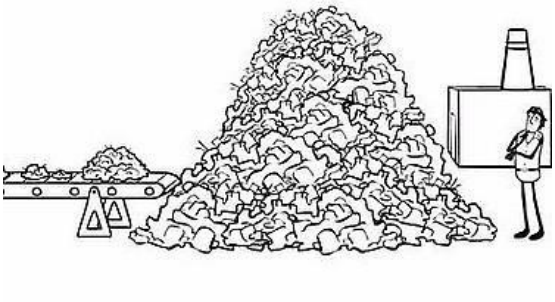
Buvoca uses a multi-treatment sub-system to separate non-flammable materials from flammable ones. The process begins by sorting non-flammable materials from the waste stream until only the flammable materials are left. Flammable materials are delivered to the pyrolysis gasification sub-system. The non-flammable materials are sorted according to ferrous metals, non-ferrous metals, and glass, using the equipment shown on the following pages.

SEPARATION OF FERROUS METALS FROM OTHER MATERIALS

Electromagnetic drum system for separating ferrous metals - Designed to be fed from underneath, the axial pole electromagnetic drums are the best in-line solution for superior ferrous metal recovery at high production rates. In addition, to strong drum shells, limiting ring, bearing housing and adjustment arm designs, the axial pole system flips and cleans the scrap before releasing it.

SEPARATION OF ALUMINIUM FROM OTHER MATERIALS

The Eddy Current Separator – Eccentric Pole System Technology shown below uses an eccentric rotor that is self-cleaning and can be adjusted for the best performance given a specific waste stream. High-quality neodymium magnets, a thin conveyor belt and non-conductive drum shell maximize separation forces. This system is especially efficient in sorting aluminium cans and other coarse-grained aluminium from impure composites.



MAGNETIC SLAG MINERALS WOOD CHIPS GLASS MACHINE

The Magnetic Head Pulley removes tramp iron from the remaining waste stream after treatment from the Electromagnetic Drum System and the Eddy Current Separator.

GLASS SORTING SYSTEM

This system operates in a similar way to the non-ferrous metal color sorting system except that it works after the metals have been removed. All glass is sorted by color so they can be more readily sold and at higher prices than mixed color glass residue. The remaining material is flammable except for some non-flammable materials not automatically sorted.

MANUAL MATERIAL PICKING PROCESS

Automated systems are great and they catch most of the material that needs to be sorted but they are not perfect. Thus, Buvoca uses a manual picking system to refine the sorting process. The benefit of this part of the system is that very little additional sorting is required but that which is done, makes the fuel stream for the pyrolysis process just that more effective and allows it to produce pristine bio-fuel for use in the electricity generator internal combustion engine drivers.
This maximizes their efficiency and longevity.

PYROLYSIS GASIFICATION

Pyrolysis gasification is a transformation technology in which solid waste is changed in a furnace- like device to high energy gas. The transformation of solid waste takes place in an indirect heated vessel, which uses a proven super low nitrous oxide burner. There is little or no oxygen present in the system. The gasification process vaporizes the waste and creates a high heat value syn-gas.

The syn-gas is approximately 35% hydrogen with smaller amounts of carbon monoxide, carbon dioxide, methane and various other hydrocarbon gases. This syn-gas is then combusted in an internal combustion engine that drives a generator to produce electricity.

Waste is thermally degraded using an indirect external source of heat at ~500oC (In the processing hazardous waste we up the temperature to 930oC), - in the absence of free oxygen supply, the carbon is almost completely (> 99 %) thermally converted into a tar-free high-energy synthesis gas Solid residuals of the pyrolysis process are removed via a wet discharger.

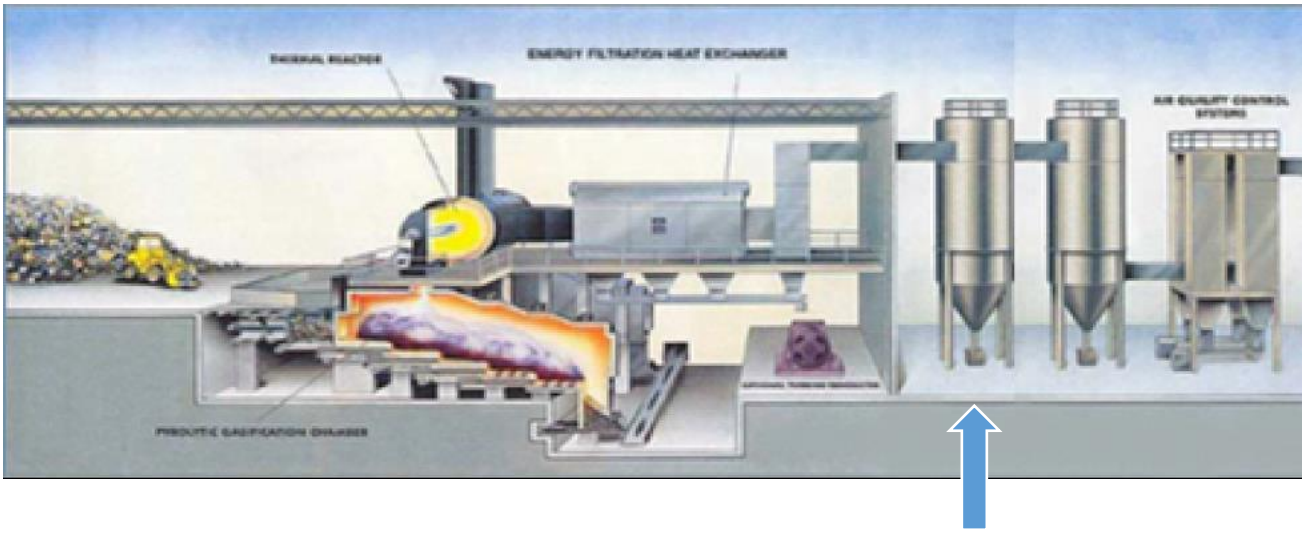
These Buvoca's systems are much more efficient than traditional mass burn technology that uses turbines in driving electricity generators. For example, a 400 metric ton per day mass burn plant will usually in average generate up to 8.5 MW of electricity per hour (or up to 12.75 MW with a high efficiency waste heat generation system).

The exhaust gas is thoroughly cleaned in the emission control subsystem in order to achieve the full compliance with the emissions limits. The volatile portion of the feedstock produces syngas, which is sent to the cooling, cleaning and compressing units and after that into gas turbine generator. The pyrolysis facility operation is monitored and controlled from the control room.

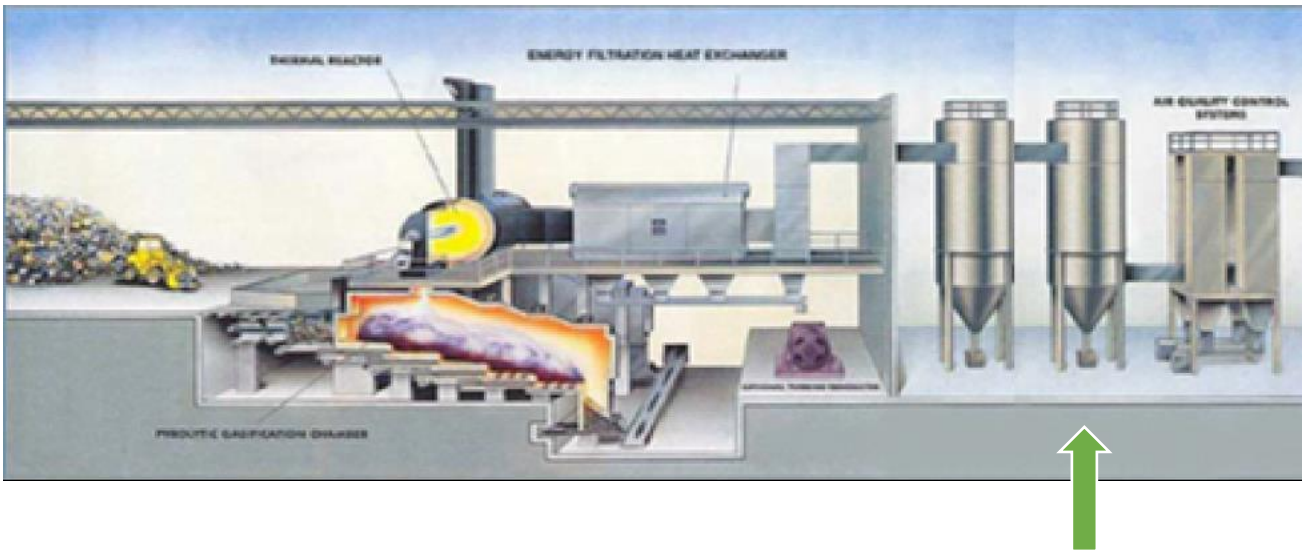
The prevailing conditions during the process exclude the build-up of pollutants like tar, dioxins and furans. Cleaning and cooling of the synthesis gas occurs in a multi-staged process. Hereby, the synthesis gas is conveyed through a heat exchanger cyclone, waste heat boiler, hot-gas filter and a multi-staged wet scrubber. After the treatment, the synthesis gas is completely free of dust and pollutants. The process-related residual heat is used for drying of the conditioned residues during the waste conditioning.

CLEANING AND COOLING OF THE SYNTHESIS GAS OCCURS IN A MULTI-STAGED PROCESS

Flue Gas Cleaning – step one – cooling

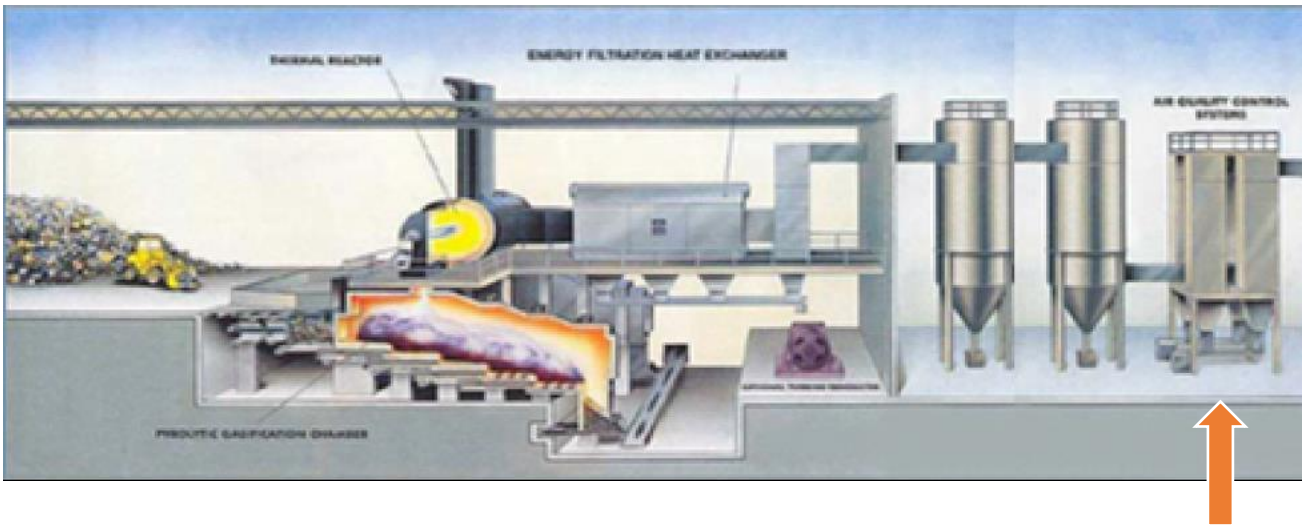


Flue Gas Cleaning – step two – dust removal and acidic gases

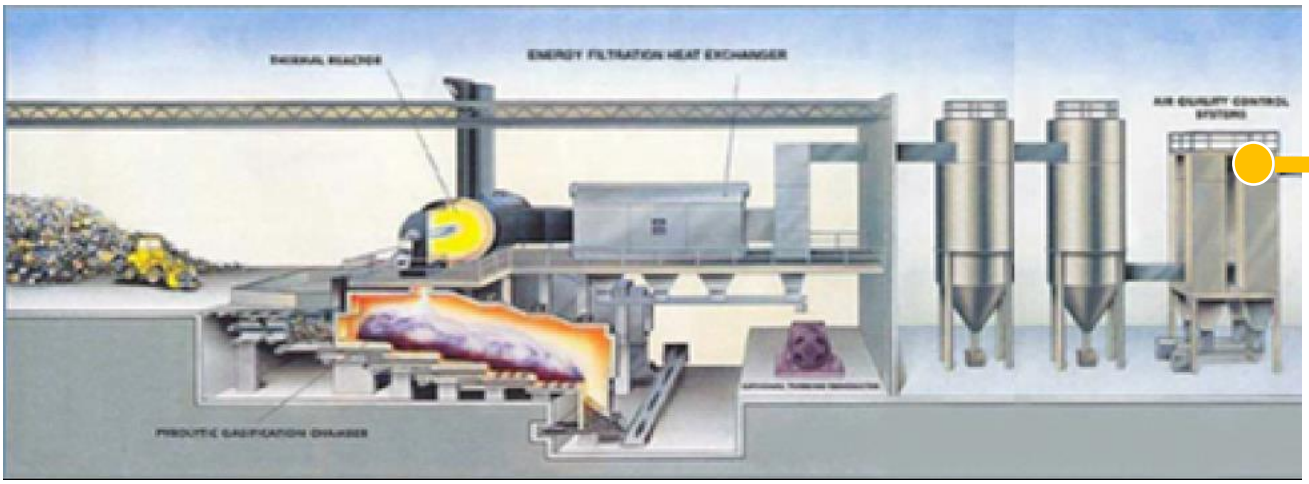


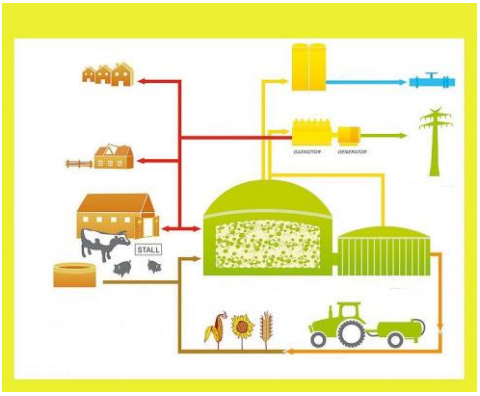
CLEANING AND COOLING OF THE SYNTHESIS GAS OCCURS IN A MULTI-STAGED PROCESS

Flue Gas Cleaning – step three – Dioxin treatment



Flue Gas Emission fully compliant to international standards (prior to discharge to atmosphere)



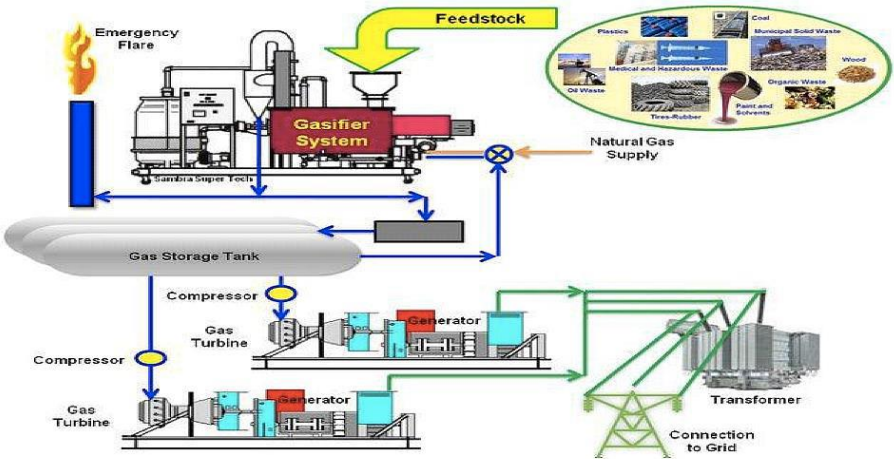


HIGHEST EFFICIENCY TECHNOLOGY

With new high efficiency generators being developed in conjunction with Enerovoxa exclusive sources, the electricity expected to be generated by the plant will rises to as high as 12.75 MW. The production of potable water for both systems is the same but no Bio-Char is available from the mass burn system. Instead that process produces bottom and fly ash that may be sold but not at the same value as Bio-Char. Usually, ash has to be disposed in a landfill. Another advantage of the pyrolysis gasification system over a mass burn plant is that the use of Syn-Gas makes the plant less vulnerable to variations in the input waste stream. Other advantages are:

- less pollution – by using no oxygen, very few polluting flue gas emissions are produced
- modular plants – provide flexibility of operation and redundancy to maximize operating time
- lower cost – systems are easier to construct and can be manufactured in automated plants
- products - pyrolysis gasification plants produce more useful by-products
- carbon credits - may be eligible for more carbon credits and other incentives

Here is schematic for a pyrolysis gasification plant and a picture of the same plant with components identified. Please note that the natural gas supply is only required for initial start-up. The diagram shows the use of gas turbines as driver for the electric generators but most waste to energy plants use internal combustion engines because the size of these waste to energy plant modules is too small for the efficient use of a gas turbine.



TURBINE GENERATOR (SIEMENS)

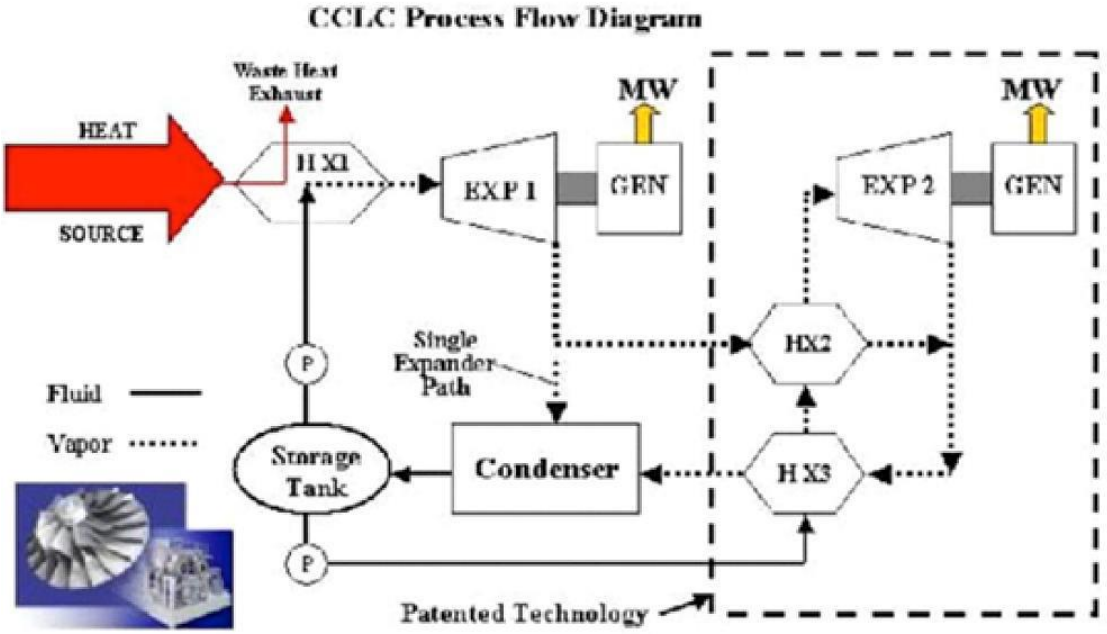
The twin-shaft turbine achieves a useful output of 14.3 MW(e) for power generation and 14.9 MW for mechanical drive. The turbine permits an electrical efficiency of up to 35.4% for operation in a simple cycle, gas-fired power plant.

Technical specifications

- Twin-shaft, industrial
- Power generation: 14.3 MW(e)
- Frequency: 50 or 60 Hz
- Electrical efficiency: 34.8 %
- Heat rate: 10,355 kJ/kWh (9,815 Btu/kWh)
- Compressor pressure ratio: 16.8:1
- Exhaust gas flow: 39.4 kg/s (86.8 lb/s)
- Exhaust temperature: 555° C (1,031° F)
- Typical emissions: NOx <15 ppmV and CO <10 ppmV (corrected to 15 % O2 dry)
- Medium-calorific value fuels capability

WASTE HEAT RECOVERY AND SECONDARY GENERATION SYSTEM

The primary WTE plant converts forty percent of the heat produced by the pyrolysis combustion of waste into electricity. This means that sixty percent of the heat is wasted. Buvoca solves part of this problem by using a secondary heat recovery and conversion system to raise the total generation efficiency of between fifty to sixty percent depending on the generators used.



This system uses process that captures heat from several sources: 1) heat from the flue stack; 2) heat from the gas engines' radiators and 3) heat from the gas engines' exhaust gases. It then converts this heat into additional electricity using the system shown in the schematic below. Under ideal conditions, this increases the electricity generated by 2.6 MW from each 10.5 MW producing by Caterpillar Gas Generator.

In comparison with the best competing WTE process, the Buvoca pyrolysis gasification system is twenty seven percent more efficient than other pyrolysis gasification systems and one hundred percent more efficient than traditional mass burn systems.

Thermodynamically, one of the most efficient ways to convert thermal energy (heat) to mechanical energy is with an Organic Rankine Cycle (ORC). Steam Turbine plants are one of the most common and well-known ORC cycles, as shown in the CCLC Process Flow Diagram shown above. In these cycles, the discharge from the expander (EXP 1) goes directly to the condenser as shown by the small dotted arrow entering the condenser, rather than being directed to the HX2 heat exchanger. Cascading closed loop cycle (CCLC) power plant - ORC cycles are closed- loop cycles involving five (5) major steps:
a) fluid (water, propane, ammonia, Freon, etc.) is pumped (P) to pressure;
b) the pressurized fluid is vaporized in a heat exchanger (HK) using a heat source;
c) the pressurized vapor is expanded across the turbine (EXP) which is connected to a compressor, generator or pump to produce useful work.;
d) the vapor discharged from the turbine is condensed back to a liquid using a cooling tower or fin-fan heat exchanger and condenser;
e) the condensed liquid is returned to a storage tank from which it is pumped back to p-ressure to continuously repeat the cycle in a closed loop.

The CCLC system is simply a combined cycle turbo- expander system. The difference between a CCLC cycle and a single turbo-expander cycle is that two expanders and two fluid streams are used in series as shown in the rectangular dashed window of the CCLC Process Flow Diagram above. This allows the thermal energy (heat) from the discharge of the first expander to be used to vaporize a second propane stream that is expanded in a second turbo-expander to increase the efficiency as shown in the heat recovery.

ORC Turbine Generator for Waste heat recovery

SOLID AND GASEOUS POLLUTION FROM THE BUVOCA WTE PLANT IS VIRTUALLY ZERO

Based on the design of our pyrolysis gasification WTE system, significant pollution from flue gases and non- flammable solid waste is not expected and, thus, no treatment is required. This is because, most if not all, non- flammable materials are sorted out of the waste stream before the waste is treated in the pyrolysis gasification process. The pyrolysis process itself when used for gasification utilizes only low amounts of oxygen and this prevents the creation of pollutants that often are found in the flue gas from mass burn plants.

In the unlikely case where pollutants become a problem our system uses a process in which carbon dioxide, sulfur dioxide and nitrous oxide is combined with bio-char create sustainable fertilizer composed of Ammonium Bicarbonate, Ammonium Sulfate and Ammonium Nitrate. Studies have shown this form of fertilizer creates outstanding plant growth while eliminating polluting dioxides and oxides. The only other solid waste created by the pyrolysis gasification process is vitrified slag that can be used in road construction and cement products.

Scrubber are used as cleaning system

Scrubber are used as cleaning system ANDRITZ' dry flue gas cleaning technology : TurboSorp is the ideal solution for flue gas cleaning systems in biomass plants, RDF-fired boilers, or Energy-from-Waste plants and other industrial applications. The dry flue gas cleaning processes are based on well-proven circulating fluidized bed technology. The flue gas flows through a turbo-reactor from the bottom to the top and then enters a downstream particulate control device, which can be either a fabric filter or an electrostatic precipitator. Fly ash from incineration and fresh additives are dosed into the turbo-reactor, while a large part of the solid material from the reactor is fed back to the fluidized bed as recirculate. Water is also injected to lower the flue gas temperature and achieve higher separation performance. If needed, activated carbon serves to provide excellent heavy metal and dioxin removal. As a result of advanced process management with regard to the operational temperature, solids recirculation, and the dosed additives, material consumption and the quantities of residue are kept to a minimum. The end product of the process is a dry, powdery residue which – depending on its composition – can be landfilled or used as filler (e.g. road construction) after stabilization.

MONITORING CONTROL SYSTEM AND STABLE COMBUSTION CONTROL

System handles all of these sequences as well as the control of feedstock, reactor temperature and pressure, and drum level, and uses sensory inputs from a Yokogawa zirconium oxygen analyzer to optimize combustion of the fuel in the furnace, thereby assuring the stable year-round supply of electricity to the national grid. And when the power plant switches to island mode, the system adjusts the boiler firing rate to decrease the supply of steam to the plant's steam turbine, thereby decreasing power production to a level that meets the plant's own requirements. All of these sequences are also configured in the CENTUM CS 3000 system.

Graphic displays at the control stations give operators a clear view of what is going on throughout this system at any given time, ensuring that they have all the information needed to take quick and decisive action whenever intervention is required.

EMISSION MONITORING

An induced draft fan draws these flue gases into an electrostatic precipitator (ESP) that traps the lighter fly ash particles before the flue gases pass up the stack for discharge into the atmosphere. This flue gas is monitored by the system control, which measures CO, CO2, O2, NOx, and SOx concentrations for reporting to the government on a weekly and monthly basis. All water used in the plant is analyzed by a pH meter and conductivity meter so that it can be kept within an allowable range.

RESIDUE MATERIAL (ASH) – INERT

Non-Toxic | Non-Porous | Free from contaminate | Mineral composition Vitrified "bead like "structure | Dust free Sterile Totally inert

ORGANIC FERTILIZERS

Buvoca is owner of technology to produce absolutely clean and rich Organic Fertilizers (will use the additional unit) from bio-char (ash) that left after the processing MSW. (Humates)

Organic Fertilizers - category of agrochemicals which do not contribute directly plant, but on a cellular level activate life processes of the organism and increase their resistance to stress. Stress can be related both with the weather features and with the action necessarily made of plant protection products. Depends from the origin of the chemical nature, mechanisms and spectrum can be distinguished several interrelated classifications of stimulant drugs:

• natural and synthetic; • specific and nonspecific; • hormonal and non-hormonal; • simple and complex.

ADVANCED TECHNOLOGIES

Buvoca Ltd. Can process any type of waste and turn it into energy using state-of-the-art technologies and modern facilities. All gases and fumes are recycled back to the system gaining extra 18% efficiency.

For more information, visit our website
www.buvoca-il.com
or send us an inquiry to info@buvoca-il.com