



WPPENERGY
World Power Production

WPP ENERGY PRESENTS

"VORAX"

A SCIENTIFIC BREAKTHROUGH IN SOLID WASTE TREATMENT





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Introduction

WPP Energy presents VORAX, a scientific breakthrough in the ideal treatment of nearly all types of Waste such as MSW/Urban, Medical/Hazardous, Industrial, Pasty/Sludge, Liquid, Tires. There are 12 different models of Vorax which have capacities ranging from 2 Tons of Waste per day to our largest model which can treat 400 Tons of Waste per day. Models from 22T/day and up also have steam power generation packages available to create electricity, demonstrating VORAX's significant Waste to Energy (WtE) capability.



Vorax is in a technological classification of its own after more than 10 years of R&D from a brilliant team of scientists and in the invention of DuoTherm technology which puts Vorax ahead of plasma, Incineration, Gasification and also traditional pyrolysis. Vorax is thought of as a quantum leap over traditional Pyrolysis in part because two thermal processes, one at 900°C and the other at 1600°C, forming a thermal gradient, liquifying all solids completely, even inert materials such as sand or iron.



Vorax completely destroys the garbage effectively and safely, without combustion or an auxiliary equipment. Vorax requires no combustion of waste and disintegrates as a whole, completely destroying infectious, pathological and organochlorinated materials, having as a solid byproduct a ceramic matrix (do not produce ashes) and inert in the bottom of the fusion module, with commercial application - the gases formed in the process have no dioxins or furans and are of low volume because they only arise from the disintegration of the material and not from combustion or gasification traditional processes.

The fusion module, in turn, works in negative atmosphere, preventing gas leaks. The process is dry distillation of the waste, with absence of air, no combustion of waste, which provides extreme reduction of the exhaust gases as compared with conventional processes and, moreover, does not allow the formation of dioxins or furans, in view of lack of oxygen and high temperature. The garbage is not mixed with the atmospheric air and suffers a dry distillation, meaning it is completely disintegrated and liquified in the absence of air, which considerably reduces the formation of pollutants harmful to the environment and health, including carcinogens. The reduction in mass of organic waste in this process is by volume 100:1 up to 250:1, according to the category of waste processed.

The gases formed inside the fusion module, are suddenly sucked and cooled (quench) to then be treated and neutralized in an immersion tank, alkaline. Last generation filters, coal-based activated, ensure that the emissions meet environmental standards.

The fusion module is not refractory, as in conventional models, except in the melting pot. Therefore, it is lightweight and low maintenance equipment, suitable for use in hospitals, factories, ships, among other places of waste treatment.

For its operation, the Vorax - WTU DuoTherm only requires a 220V or 380V outlet. The equipment allows to operate continuously or intermittently, as needed by the user. Its power consumption is low and purely electric - for example a 2T/day model consumes only 40kWh, depending on the category of garbage.

Control and Operation of Vorax is automatic - After feeding no operator is required, from departure to the disconnection of its cycle. Anyone can feed the fusion module with the material to be treated, which operates automatically. The waste to be treated does not necessarily require selectivity – at first, everything can be processed: organic matter, iron, metals, and even sand.

Training for operating Vorax is performed at the installation site and requires only one full day of instruction.

The technology is patented in over 40 countries and is being made available for distribution globally by WPP Energy after initially being deployed in Brazil.

5 ton/day model shown below






The scientific challenge of waste treatment :

The fundamental challenge of garbage is to find an effective way to treat it. Modern garbage contains high doses of heavy metals, organochlorines, benzene, dioxins, furans, among others. Landfills emit pollution including methane and essentially many parts of the world are drowning in garbage.

Incineration, Gasification and Partial Pyrolysis (with presence of atmospheric air), even via plasma processes, are known techniques but they fall short. Incineration or gasification (even with plasma technology) involves the presence of atmospheric air and it is for this reason that these technologies create environmental problems. The presence of air entails introducing a lot of oxygen in the process for combustion or gasification. Incineration, Gasification and Partial Pyrolysis (with presence of atmospheric air), even via plasma processes, are the all too common techniques given their problems.

These techniques, despite reducing the weight and the initial volume of garbage, cannot be considered effective, they are unable to dispose the waste, once the waste remains toxic, being presented mainly in the form of ash. More seriously, it is produced large amounts of greenhouse gases, which need to be addressed. The ashes, despite concentrating on small volumes, are fine particulates of non- volatilizable materials and may contain high concentrations of active elements harmful to the environmental balance, such as heavy metals. The gases in turn require appropriate filters and intensive maintenance because they contain significant concentrations of pollutants.

Additionally, the combustion process can form at inappropriate temperatures, by means of reactions catalyzed by the ashes, a family of hydrocarbons, usually cyclical, high-destructive power of genomic features of human cells, which results in the production of cancer cells. Other procedures applied on a smaller scale such as autoclaving and destruction by radiation (including from sources of microwave), for not reducing the volume of disposable material, are not considered appropriate for the disposal of waste.



In the case of hospital and industrial waste, due to the components present in it, the quantity of heavy metals in the ash coming from the incineration is absurdly high, greatly increasing the risk of contamination of groundwater when accommodated in landfills.

The increased presence of chlorine components in these types of waste can also greatly enhance the generation of carcinogenic residues, which are present in the exhaust gases of combustion and in the generated microparticles.

The laws currently in force (as the National Solid Waste Policy, enacted in August 2010, which stipulates the prohibition of dumps) may become even more expensive the treatment of these special wastes, which practically requires the search for new technologies for waste treatment that can make the process cheaper and less polluting.

It is for all the reasons above that VORAX was invented as total solution to satisfy the scientific challenge summarized above. "Vorax", has appropriately received its name thanks to its power to "swallow" almost any type waste disposal and providing an economical and highly efficient environmental destination.

WPP Energy asserts to the world that the technology used in Vorax – "WTU DuoTherm of dry distillation", via thermal gradient WITHOUT the use of oxygen, is the most effective waste treatment solution in the world.

Waste types that vorax can process:

- Medical/Drugs/Sharpies
- Municipal and Urban Waste
- Industrial
- Pesticides and their containers
- Biomass
- Animal Housing
- Coal
- Ashes from incinerators
- Sewage
- Galvanic sludge
- Organic sludge from petrochemical
- Materials with low radioactivity
- Used oils
- Batteries
- Tires
- Waste of explosive material
- Hazardous industrial waste
- Plastics (no restrictions)





VORAX TREATS ALL WASTE TYPES & SOLVES THE UNIQUE PROBLEMS OF MEDICAL & BIOHAZARD


Medical waste generated at health care facilities, includes a large component of general waste and a smaller proportion of hazardous waste, which contain infectious agents, toxic chemicals or pharmaceuticals, radioactive and genotoxic.

All individuals exposed to hazardous health-care waste are potentially at risk, including those within health-care establishments that generate hazardous waste, and those outside these sources who either handle such waste or are exposed to it as a consequence of careless management.

According to the U.S. Environment Protection Agency, improper management of discarded needles and other sharps can pose a health risk to the public and waste workers. For example, discarded needles may expose waste workers to potential needle stick injuries and potential infection when containers break open inside garbage trucks or needles are mistakenly sent to recycling facilities. Janitors and housekeepers also risk injury if loose sharps poke through plastic garbage bags. Used needles can transmit serious diseases, such as human immunodeficiency virus (HIV) and hepatitis.

Measures to ensure the safe and environmentally sound management of health care wastes can prevent adverse health and environmental impacts from such waste including the unintended release of chemical or biological hazards, including drug-resistant microorganisms, into the environment thus protecting the health of patients, health workers, and the general public.

Proper measures to deal with medical and biohazard waste typically come at a high cost of up to \$2500 per ton depending on the region.



Current best practices and often laws state that the hazardous waste must be separated, treated and disinfected. Common practice now is that all infectious medical wastes are disinfected by autoclaves, strong heated containers used for chemical reactions and other processes using high temperatures, and steps must be taken to dispose them.

Even the non hazardous medical waste is not often considered normal waste, as long as the governing bodies in a territory have not approved the wastes being harmless, in accordance with the waste management laws, medical wastes are still considered infectious.

Landfills are not equipped to handle the unique requirements of medical waste and often don't have the most basic infrastructure such as water, electricity and etc.

Infectious waste must not be dumped, it must be burned. Medical waste incineration devices (VORAX!) are needed.



**VORAX IS A TOTAL SOLUTION FOR
MEDICAL WASTE WITH NO PRESORTING OR
STERILIZING NEEDED**



Process

Incineration

VS

Vorax Duo Therm

- Low energy efficiency
 - Excess air and low temperature
- Produces ashes , dioxins and furans
 - High carcinogenic components
- High gas formation rate
 - Too much air for temperature control
- Inorganic pollutant portion
 - Heavy materials exposed to the environment
- Slow process initiation
 - There is risk of refractory break

- High energy efficiency
 - Does not use air in the process
- Does not produces ash, dioxins and furans
 - High temperature of 2^a source, breaks the molecules
- Low gas formation rate
 - Does not processes the waste in the presence of air
- Inert inorganic portion
 - Heavy materials are retained inside ceramic matrix
- Quick stop process
 - Turn on and off in only 4 min., without any damage

Material Reduction (Incineration versus Vorax)

Incineration

VOLUME:	5:1
MASS/WEIGHT	2:1

Vorax Duo Therm

VOLUME:	100:1 up to 250:1
MASS/WEIGHT	10:1



Inert ceramic product. Can be used in constructions as concrete load, cement, glass wool, asphalt, tile, etc.



Heavy materials such as lead, arsenic, cadmium, chromium, mercury, etc, are retained within the crystal structure.

Benefits

Vorax Benefits

Easy transportation

Easy setup

Easy maintenance

State of Art Technology

Easy Startup

Automatic operation

Internet operation

Reliability

Very Low Energy consumption

Low noise

All types of waste

Vorax Benefits

Volume reduction

Mass reduction

Waste inertization

Absence of Liquid pollutants

Reduced gases exhaust

No Ash production

No Dioxins & furans

Helpful subproducts

Energy cogeneration

Energy efficiency

Low Labor

VORAX - ENERGY BALANCE/CONSUMPTION

Sample Waste Composition:

Organic 55%	Textiles 4.3%
Paper 14%	Metal 3.3%
Plastic 14%	Glass 2.4%
Cardboard 6.7%	Wood .3%

Vorax Fusion Module(Power Source Only)Electric Consumption For Given Waste Composition (kWh/t)

See separate file, Excel Sheet titled: WASTE TO ENERGY VORAX`

Efficiency %	26				
	Lower Calorific Power PCI (kCal/kg)	Lower Calorific Power PCI (MWh/t)	Specific Energy (kWh/t)	Specific electrical energy consumption (kWh/t)	Net Specific Energy Vorax (kWh/t)
MSW (Example)	2,780.0	3.2	839.3	183.3	656.0
MSW - highest moisture	1,750.0	2.0	528.3	183.3	345.0
MSW - lowest moisture	3,250.0	3.8	981.1	170.2	810.9
WDF (Waste Derived Fuel)	4,500.0	5.2	1358.5	183.3	1175.2
TDF (Tire derived fuel)	7,000.0	8.1	2113.2	183.3	1929.9

VORAX ORION MSW Waste to Energy

Waste Capacity (400t/day)	Waste Capacity (t/h)	Total electric Power (MW)	Net Electric Power (MW)	Consumption electric power (MW)	~Efficiency (%)
400	16.67	13.99	10.93	3.06	26

Key Data Summary

Using 2780 kCal/kg 400 tons of waste per 24 hour day generates 10.93MWh (NET) or 262.32MW/24 hours

656kWh (NET) per ton of waste

1.525 tons of waste = 1MW (NET)

10.93MWh (NET) assumes MSW with PCI (Lower Calorific Value of 2780 kCal/kg). Higher outputs achievable depending on types of waste used as feedstock.

Example: TDF (tires) 7000 kCal/kg = 35.22MWh gross = 32.17MWh net (after Vorax electrical consumption).

Example: WDF 4500 kCal/kg = 22.64MWh gross = 19.59MWh net (after Vorax electrical consumption).

Solid Waste Treatment

VORAX Duo Therm vs Other Technologies

Item	Features	Load	Landfill		Incineration		Autoclave		Gasification		Plasma		Duotherm	
			Grade	Result	Grade	Result	Grade	Result	Grade	Result	Grade	Result	Grade	Result
1	Easy Transportation	1,0	0	0	0	0	4	4	4	4	4	4	5	5
2	Easy setup	1,0	1	1	1	1	4	4	3	3	2	2	5	5
3	Easy maintenance	5,0	1	5	1	5	3	15	3	15	1	5	5	25
4	Technology	3,0	0	0	1	3	1	3	2	6	4	12	5	15
5	Startup process	1,5	4	6	1	2	4	6	4	6	5	8	5	8
6	Automatic operation	2,0	0	0	1	2	0	0	0	0	0	0	5	10
7	Internet operation	1,5	0	0	0	0	0	0	0	0	0	0	5	8
8	Reliability	7,5	4	30	2	15	4	30	4	30	4	30	5	38
9	Energy consumption	10,0	4	40	2	20	3	30	3	30	0	0	5	50
10	Noise level	2,0	5	10	2	4	5	10	5	10	5	10	5	10
11	Type of waste	7,5	3	23	2	15	2	15	2	15	5	38	5	38
12	Volume reduction	3,5	0	0	3	11	2	7	2	7	5	18	5	18
13	Mass reduction	5,0	0	0	3	15	2	10	2	10	5	25	5	25
14	Waste inertization	6,0	0	0	0	0	0	0	0	0	5	30	5	30
15	Liquid pollutants absence	6,0	2	12	2	12	2	12	2	12	5	30	5	30
16	Reduced gases exhaust	6,0	1	6	1	6	3	18	1	6	1	6	5	30
17	Ash production	6,0	1	6	1	6	5	30	5	30	5	30	5	30
18	Dioxins & furans	8,0	1	8	1	8	3	24	3	24	5	40	5	40
19	Helpful subproducts	5,0	0	0	0	0	0	0	0	0	5	25	5	25
20	Energy cogeneration	3,5	4	14	4	14	0	0	3	11	5	18	5	18
21	Energy efficiency	4,0	0	0	1	4	2	8	2	8	4	16	5	20
22	Labor	5,0	0	0	1	5	2	10	2	10	4	20	5	25
Benefit (punctuation)				161		147		236		237		365		500
Benefit (percentual)			100,0	32%		29%		47%		47%		73%		100%

Grade: 0 - Bad

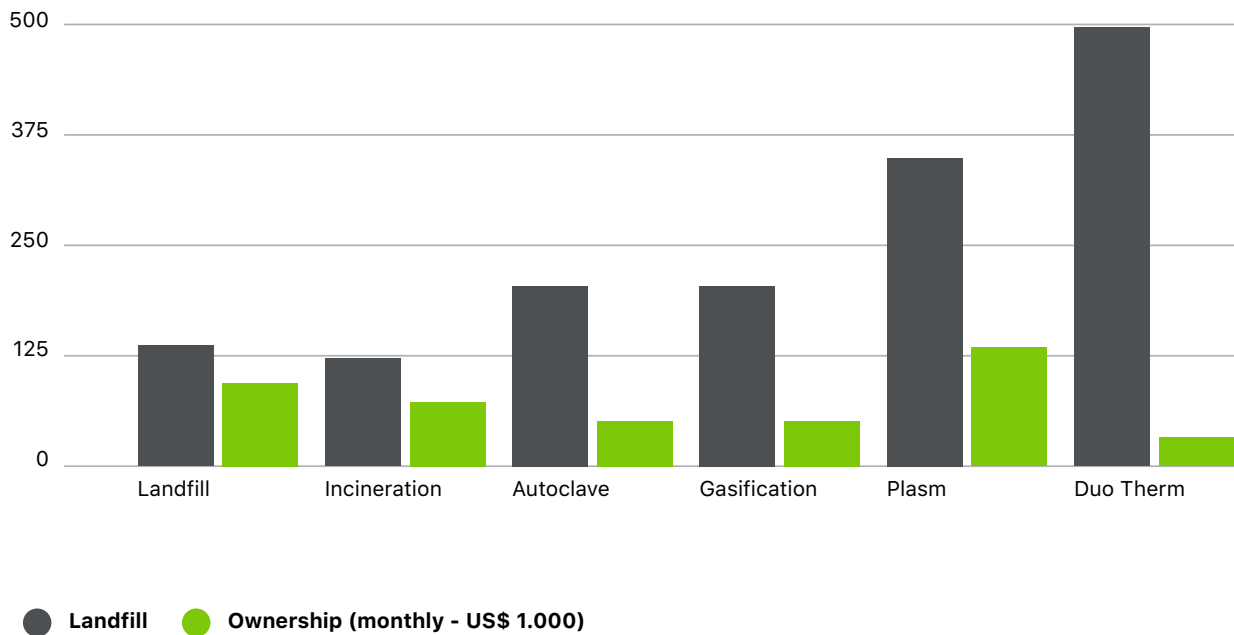
1 - Poor

3 - Good

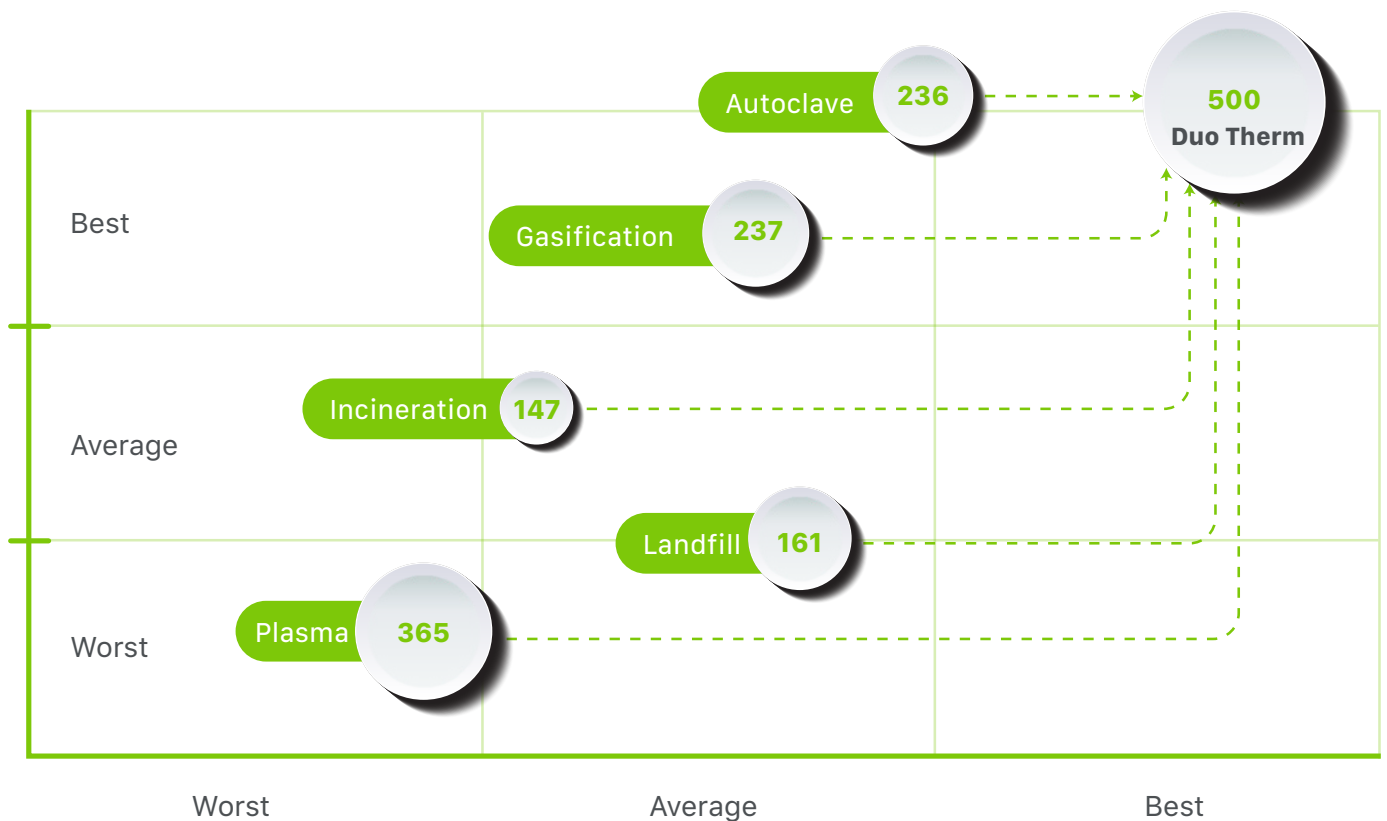
4 - Very good

5 - Excellent

Ownership X benefit



Cost x benefit



Buble Area = Benefit

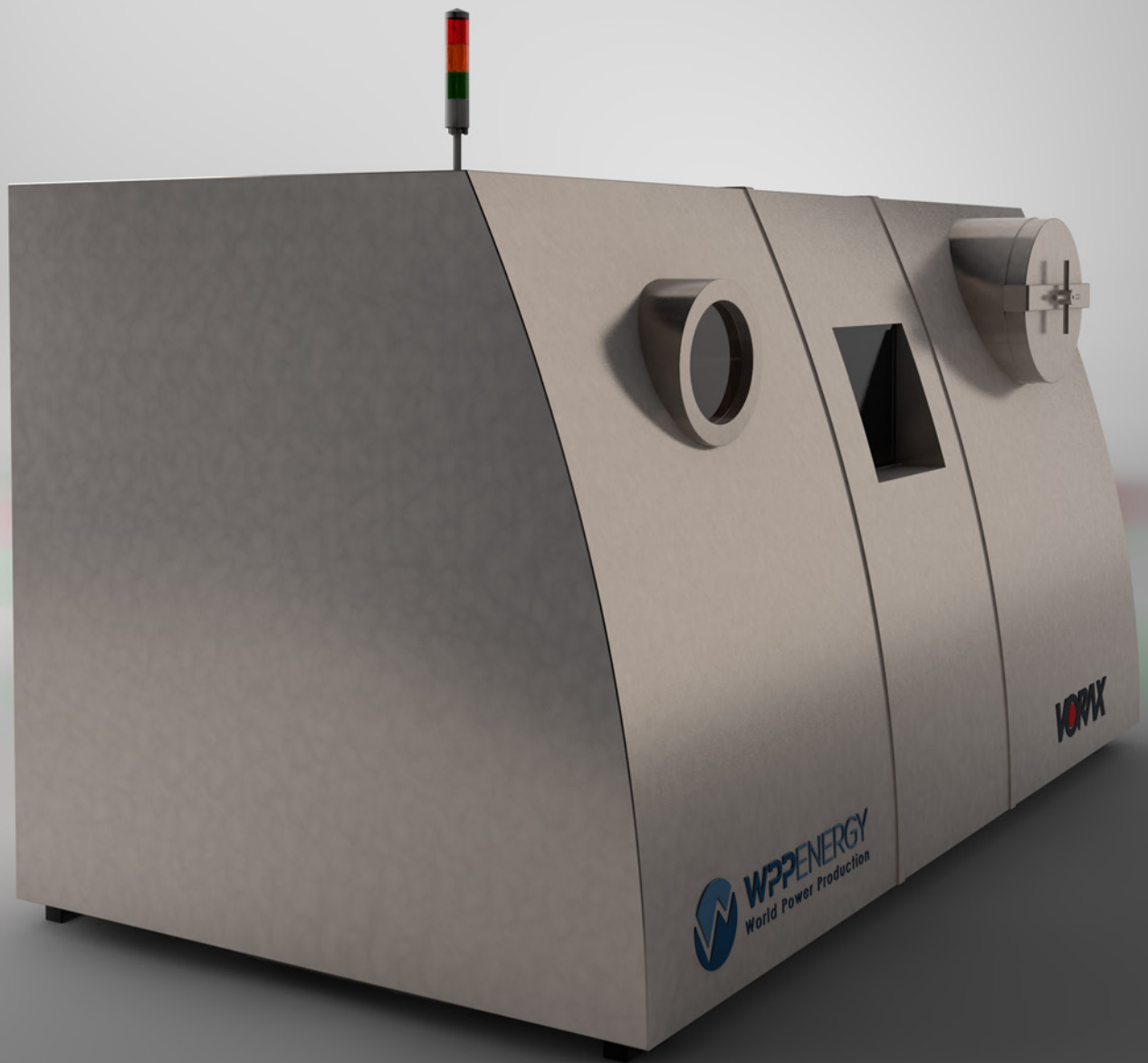
Technical Comparison

Item	Vorax Duo Therm	Incineration
Technology	State of art	Outdated
Operation	Automatic by WiFi	Manual
Processes	Any material	Restricted
Size	Small	Big
Transportation	Easy	Hard
Setup	Easy	Complex
Operating risk	Null	High
Noise	Low	Moderate
Capital expenditure	Low	High
Operation expenditure	Low	Moderate
Maintenance cost	Low	High

Benefits

Item	Vorax Duo Therm	Incineration
Process startup	Fast	Slow
Energy consumption	Low	Low
Volume reduction	100 a 250:1	5:1
Mass reduction	10:1	2:1
Gases exhaust	Low	High
Carcinogenic	Null	High
Liquid pollutants	Null	High
Solids sub products	Inert	Pollutants
Gravel production	Yes	No
Sub noble products	Yes	No
Energy cogeneration	Yes	No

**PROCESSES
ANY MATERIAL**



WPP VORAX Product Line at a Glance

12 Models to Choose from!

See Q&A Section on (page 22) for more info

Name	Technology	Platform	Type	Components	Application	Model	Capacity	Utilization	Electric Power	Energy Generation
Vorax	Duo Therm	Volcano	UTR	Storage Crusher Feeder System Fusion Module Peripherals Monitoring and Control	Waste Treatment Only	Etna	2 ton/day	Solid, Medical	Not applicable	Not applicable
						Kilauea	4 ton/day	Solid, Medical		
						Kilimanjaro	5 ton/day	Solids, Liquids, Pasty, Medical		
						Krakatoa	10 ton/day	Solid, Liquid, Pasty, Medical		
		Solar One	UTE	Waste Storage System Crusher Feeder System Fusion Module Peripherals Monitoring and Control Steam Generator Boiler Compression Turbine Reductor Power Generator Unit Sub-station	Waste to Energy with Power Generation Package Included	Zeta One	22 ton/day	WDF - TDF 1,04t / MWh - 0,83t / MWh, Medical, Hazardous, Industrial, MSW, Solids, Liquids, Pasty, Medical	0,6 MW *	0.432 MWh
						Zeta Two	36 ton/day	WDF - TDF 1,35t / MWh - 0,83t / MWh Medical, Hazardous, Industrial, MSW, Solids, Liquids, Pasty, Medical	1,0 MW *	0.72 MWh
						Rigel One	60 ton/day	WDF - TDF 1,04t / MWh - 0,83t / MWh Medical, Hazardous, Industrial, MSW, Solids, Liquids, Pasty, Medical	1,6 MW *	1.152 MWh
						Rigel Two	72 ton/day	WDF - TDF 1,35t / MWh - 0,83t / MWh Medical, Hazardous, Industrial, MSW, Solids, Liquids, Pasty, Medical	2 MW *	1.44 MWh
						Altair One	110 ton/day	WDF - TDF 1,35t / MWh - 0,83t / MWh Medical, Hazardous, Industrial, MSW, Solids, Liquids, Pasty, Medical	3 MW *	2.44 MWh
						Altair Two	150 ton/day	WDF - TDF 1,04t / MWh - 0,83t / MWh Medical, Hazardous, Industrial, MSW, Solids, Liquids, Pasty, Medical	4,0 MW *	2.880 MWh
						Procyon	220 ton/day	WDF - TDF 1,35t / MWh - 0,83t / MWh Medical, Hazardous, Industrial, MSW, Solids, Liquids, Pasty, Medical	6,0 MW *	4.320 MWh
						Orion	400 ton/day	WDF - TDF 1,35t / MWh - 0,83t / MWh Medical, Hazardous, Industrial, MSW, Solids, Liquids, Pasty, Medical	11 MW *	7.92 MWh

ALL VORAX MODELS CAN BE OPERATED INDOORS OR OUTDOORS

7.92MWh assumes MSW with PCI (Lower Calorific Value of 2182 kCal/kg). Higher outputs achievable depending on types of waste used as feedstock.
Example: TDF (tires) 7000 kCal/kg = 35.22MWh gross = 32.17MWh net (after Vorax consumption).

* Calculation Basis - CDR

VORAX - Component Parts

- Waste Storage System (CDR / CDP, others)
- Waste Preparation System (Shredder)
- Feeding System: solid, liquid, pasty (silo, tipper, track, worm thread, valve feed lines)
- Thermal Unit: Fusion Module (fusion module - transient catalyst / plasma, gasifier, afterburner)
- Peripherals: gas scrubber, filters, hood, by-product collector, etc.
- Monitoring and Control Center
- Direct Labor: Teams, Consulting
- Power Generation Unit: boiler, turbine - condensation / back pressure, reducer, electric generator, substation

Note

1. WTUs Dimensions, Total Area and Costs: estimated values; they must be sharply determined after basic Power Plant project execution.
2. WTUs Prices (22 t/day 36 t/day, 60 t/day, 72 t/day, 110 t/day, 150 t/day, 220 t/day and 400 t/day): estimated values; they must be sharply determined after basic Power Plant project execution.

Legend

- WDF - Waste Derived Fuel
- TDF - Tire Derived Fuel
- WTU - Waste Treatment Unit
- TU - Thermoelectric Unit

WPP VORAX Product Line at a Glance

12 Models to Choose from!

ALL VORAX MODELS CAN BE OPERATED INDOORS OR OUTDOORS

Worst case scenario, expected actual production time is substantially less

50% Pre Payment required. 5% discount with 75% prepayment and 10% discount with 100% prepayment. Multi-Unit orders may be subject to additional discounts.

Name	Technology	Platform	Type	Components	Application	Model	Capacity	Dimensions	Manufacturing Time	Total Retail Price
Vorax	Duo Therm	Volcano	UTR	Storage Crusher Feeder System Fusion Module Peripherals Monitoring and Control	Waste Treatment Only	Etna	2 ton/day	5,0m x 2,5m x 2,3m	4 months	US\$ 920,5966
						Kilauea	4 ton/day	6,0m x 4,0m x 6,0m	5 months	US\$ 1,146,437
						Kilimanjaro	5 ton/day	8,0m x 4,0m x 6,0m	5 months	US\$ 1,237,137
						Krakatoa	10 ton/day	10,0m x 6,0m x 12,0m	8 months	US\$ 1,890,170
		Solar One	UTE	Waste Storage System Crusher Feeder System Fusion Module Peripherals Monitoring and Control Steam Generator Boiler Compression Turbine Reductor Power Generator Unit Sub-station	Waste to Energy with Power Generation Package Included	Zeta One	22 ton/day	18,0m x 8,0m x 10,0m	13 months	US\$ 7,435,208
						Zeta Two	36 ton/day	18,0m x 8,0m x 12,0m	16 months	US\$ 12,166,754
						Rigel One	60 ton/day	30,0m x 10,0m x 13,0m	18 months	US\$ 17,050,000
						Rigel Two	72 ton/day	30,0m x 10,0m x 15,0m	20 months	US\$ 19,422,691
						Altair One	110 ton/day	40,0m x 12,0m x 13,0m	22 months	US\$ 27,003,402
						Altair Two	150 ton/day	40,0m x 12,0m x 15,0m	24 months	US\$ 33,000,000
						Procyon	220 ton/day	50,0m x 18,0m x 15,0m	26 months	US\$ 38,958,284
						Orion	400 ton/day	60,0m x 24,0m x 15,0m	30 months	US\$ 55,957,783

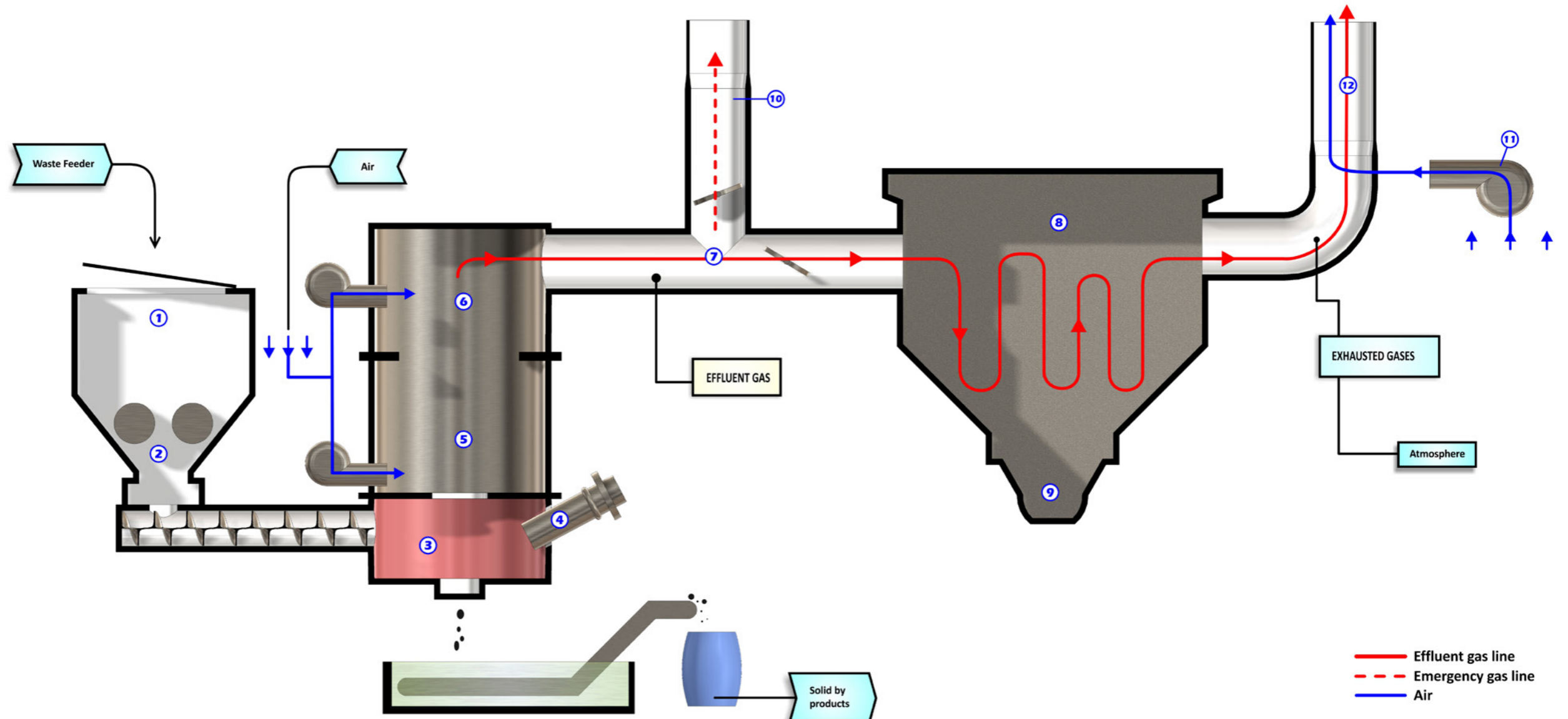
VORAX models 22T-400T/day have steam based power generation ability (required equipment is already included in the pricing above) from 2.5MWh up to over 30MWh depending on the waste composition being treated.



VORAX PROCESS FLOW SCHEMATIC FOR MODELS: 2T, 4T, 5T, 10T/Day

(No power generation package offered)

1. Feeder
2. Waste Shredder
3. Pyrolysis
4. Torch
5. Combustor
6. Afterburner
7. Safety Valve
8. Filter Sleeve
9. Particulates
10. Chimney Backup
11. Exhaust Fan
12. Chimney

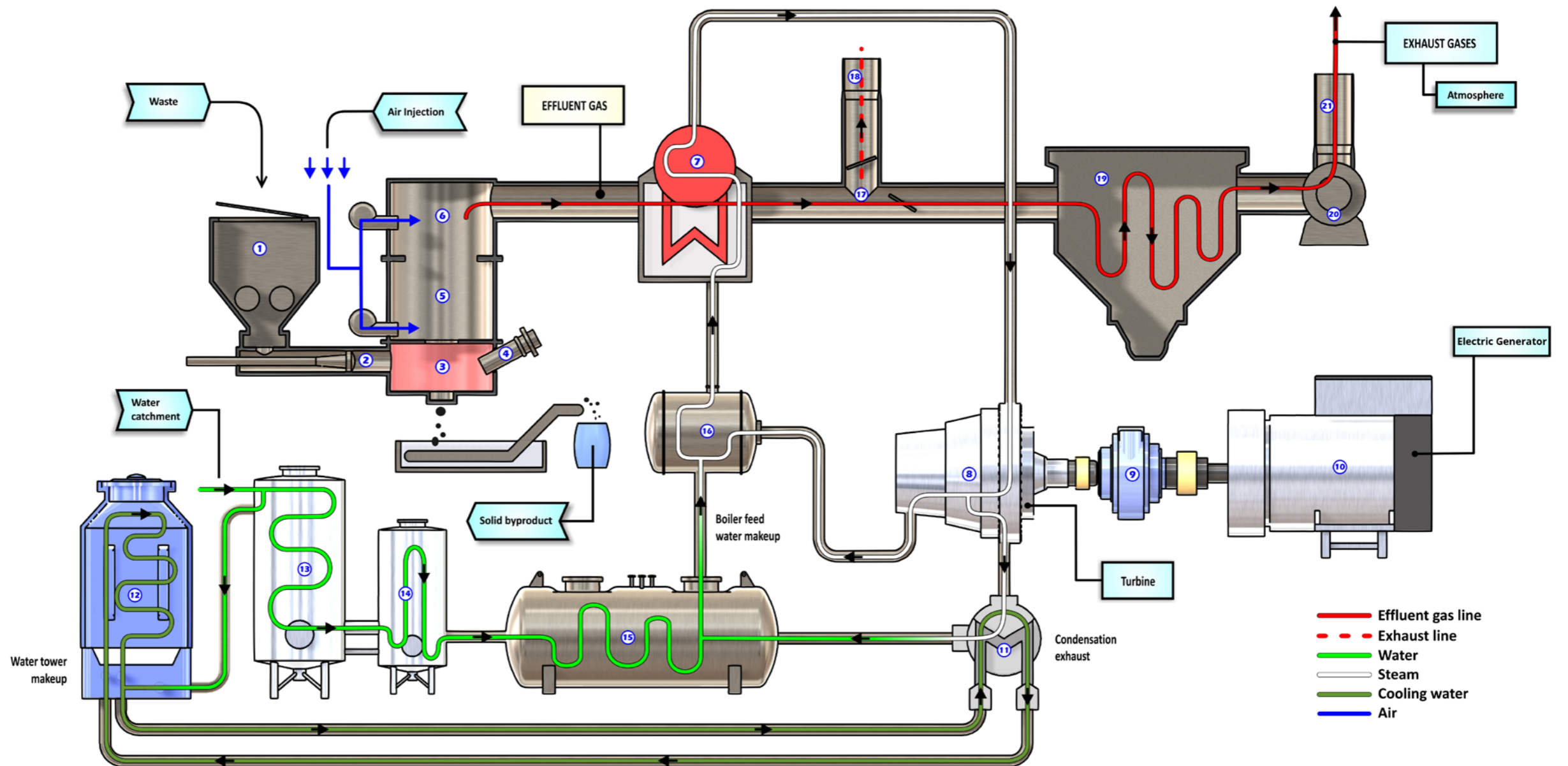


VORAX

VORAX PROCESS FLOW SCHEMATIC FOR MODELS: 22T, 36T, 60T, 72T, 110T, 150T, 220T, 400T/Day

(Power Generation Package Included, but not mandatory)

1. Feeder
2. Piston
3. Pyrolysis module
4. Torchs
5. Combustor
6. Pro Combustor
7. Steam Boiler
8. Turbine
9. Reducer
10. Generator
11. Condensation Outlet
12. Cooling Tower
13. Water Treatment Tower
14. Dehumidifier
15. Condesate Tank
16. Deaerator
17. By Pass Valve
18. Escape Chimney
19. Particulate Filter
20. Exhaust
21. Chimney



VORAX



INTERNATIONAL AWARD 2016



IN THE ENVIRONMENTAL CATEGORY

The technology is patented in over 40 countries and is being made available for distribution globally by WPP Energy after initially being deployed in Brazil.





VORAX Q & A

What are the Pre-sorting requirements if any?

No pre-sorting, no pre-selection and no pre-classification is required, the waste of various categories can be processed simultaneously, solid, liquid and pasty waste.

Can Vorax accept Plastics?

Yes Vorax thrives on plastics of all types, no physical or chemical restrictions exist as to which plastics it can handle. Furthermore on our 22T-400Tpd models plastics provide very high energy output for electricity generation.

What is the expected downtime for VORAX per day/week or month?

The equipment will only be stopped for maintenance reasons, normal operation will occur 24 hours a day, 30 days a month. Maintenance is monthly, 1 stop per month for a maximum of 12 hours.

When necessary, a refractory inspection will take place on the fusion module. For faster maintenance a new fuser module should be purchased as replacement parts.

What is the expected life expectancy of a VORAX Model?

With all maintenance performed correctly, the expectation is that life expectancy exceeds 40 to 50 years, the equipment is made of steel, all components used are of industry standard, if necessary these components can be replaced by new ones not interfering with useful life.

What is VORAX's efficiency?

VORAX reduces in mass of 10: 1 and volume up to 250: 1. The ratio of total energy generated to net energy gives us an efficiency of 26.9%. Vorax Fusion Module Efficiency is 70%.

For more info refer to the [Energy Balance/Consumption Table \(page 11\)](#)

How loud is VORAX? Can I use it indoors and outdoors?

Well within accepted ranges, 77dB (2T to 10Tpd Models) up to 90dB (22T to 400Tpd Models).

Yes VORAX can be used both indoors and outdoors

What resources are needed to run/operate Vorax?

1. People power

2T/4T/5T/10T/22T	→	2 people	110T	→	5 people
36T	→	3 people	150T	→	5 people
60T	→	4 people	220T	→	6 people
72T	→	4 people	400T	→	10 people

2. Electrical energy input/consumption

Approximately 183.5 kWh electrical power consumed per ton of waste treated.

3. Natural gas input/consumption

For each ton of waste treatment Vorax requires/consumes approximately 100Nm³ of natural gas. The price of natural gas varies widely by region and according to market conditions. Some regions it can be as low as \$25 for per 100m³ and some regions closer to 2x.

4. Bicarbonate/Baking soda (Where applicable)


In cases where the waste composition causes the creation of NO_x, SO_x or chloride acid gases. By applying Sodium Bicarbonate/baking soda of up to 12kg per ton of waste. The purpose of the Bicarbonate is to neutralize acid gases like, If the waste does not have and does not generate these gases, the bicarbonate consumption becomes 0.

How much Electrical Energy can Vorax Produce? (22T-400Tpd models only)

At the upper end of the scale, using the largest Vorox Model "Orion" 400Tpd and burning very high calorie waste such as tires Vorax can produce 32MWh "net" after factoring for its own energy consumption requirements. Our smallest WtE model "Zeta One" capacity of 22Tpd, the net power produced (tires as feedstock) is 1.77MWh.

For MSW of varying compositions and moisture levels electrical energy outputs can be expected to be roughly within the range of 1/4 to 1/2 of the values provided in the Tires example above. Mixing MSW with Plastics and Tires increases the amount of electrical energy that can be produced.

Clients who submit details of the proposed waste composition will receive a more accurate estimate of the electrical power output to be expected.



Is steam based power generation from waste heat the only type of electrical energy that Vorax can produce?

No, Vorax can be configured to produce Syngas and also a future version will be available with the custom option of steam reforming and prism membranes technology to achieve 95% purity of H₂ in high production volumes. (400T/day Vorax Orion model = 11,000kg - 30,000kg per 24 hour day of H₂, depending on waste type).

What type of Warranty does Vorax come with?

Vorax comes with a standard Two Year Comprehensive Warranty with Warranty extension options available.

Does the total daily capacity need to be divided by 24 to determine the max loading capability per hour? What happens if we exceed that capacity?

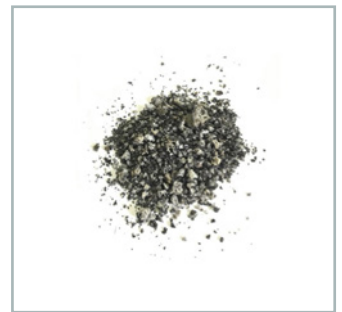
For each model the waste feeder will be set to this condition, the torch is set for processing this volume. For example: A 2t / day model processes 83.33kg/hour, the waste feeder will be set to that maximum accordingly.

Can you tell us more about the award that VORAX won?

VORAX equipment technology, received from the German government through the Germany – Brazil Chamber of Commerce the “Cities of the Future” award. This award was sponsored and delivered by BASF Chemical. Parallel to the award, VORAX’s state – of – the – art technology was also presented at the IV Germany-Brazil Innovation Seminar, which annually brings the main trends in innovation and technology.

What residual is left from VORAX?

The only residual product after the two thermal products is a saleable inert by-product material in demand by the construction and asphalt industry. The by-product can be used as an asphalt filler, ie as a complement to the asphalt mix itself, this by-product can be pressed and through this process produce bricks, it can also be aggregated into other materials. manufacturing of precast parts and lastly as a suggestion is the use with noble rubble. The byproduct with the characteristic of crushed sand, similar to crushed stone.



VORAX reduces in mass of 10: 1 and volume up to 250: 1



Heavy materials such as lead, arsenic, cadmium, chromium, mercury, etc, are retained within the crystal structure.

What's the risk of radioactivity on the Vorax and the inert residue considering the elemental disintegration of waste?

There is no radioactivity in the waste unless it is radioactive, but after processing at 1600 ° C this radioactivity is zero, ie the waste is inert and not hazardous. That's why VORAX uses high temperature processing.



What are the safety features of VORAX?

VORAX features a design that maximizes safety as it is equipped with anti-explosion systems. On top of the fusion module is installed a valve that moves as the internal pressure increases instantly, preventing explosions.

In the event of a power outage, bypass valves are installed at the fusion module outlet that direct all the gas into the atmosphere to prevent this gas from standing still inside the fusion module.

In order for the melting torches to be supplied with gas and air, the system goes through a pressure and flow check control and also a leak check, if these parameters are incorrect a fault system is activated and the equipment is not supplied.

For safety reasons, for any fusion module door that is opened the grinding is paused, and only resumes when the doors close.

For any fault a visual and audible alarm is issued on the equipment control screen.

All equipment complies with safety regulations, Regulatory Standard 12 br, safety at machinery and equipment work Created by the Ministry of Labor and Employment, Regulatory Standard No. 12, aims to ensure that machinery and equipment are safe to use worker.

The equipment has level sensors that control the levels of waste feed so that there is no overload of the feeders. The same is true for sodium bicarbonate feeders.

If there is a pressure drop the system stops for the operator to check the leak location and failure.

What are the Emissions from Vorax?

Well below regulatory body limits, please refer to the chart below.


Parameter	Result
O2	8,4%
PM	13mg/Nm ³
SOx	3 mg/Nm ³
NOx	239 mg/Nm ³
CO	40 ppm
HCL_CL2	<0,002 kg/h
DIOXINS & FURANS	0,01 kg/Nm ³
CO2	6,5%
Cl2	<5,57 mg/Nm ³

What technology exists within the Vorax Fusion Module to be able to accomplish the dramatic increase in temperatures between the two chambers?

We are able to reach very high temperatures and transition between the first chamber at 900°C and the second chamber at 1600°C because Vorax is equipped with gas burners assisted by low-amperage (back-plasma) electric discharges. Transient because it is in the range between cold plasma and thermal plasma and has anomalous behavior: sometimes the amperage may increase with the discharge sometimes it may decrease, today we work with 3 amps, up to 10 amperes is still considered transient plasma.

How is Vorax different from the other technologies in the market?

Vorax is in a technological classification of its own after more than 10 years of R&D from a brilliant team of scientists and in the invention of DuoTherm technology which puts Vorax ahead of plasma, Incineration, Gasification and also traditional pyrolysis. Vorax is thought of as a quantum leap over traditional Pyrolysis in part because two thermal processes, one at 900°C and the other at 1600°C, forming a thermal gradient, liquifying all solids completely, even inert materials such as sand or iron.



Vorax completely destroys the garbage effectively and safely, without combustion or an auxiliary equipment.

Vorax requires no combustion of waste and disintegrates as a whole, completely destroying infectious, pathological and organochlorinated materials, having as a solid byproduct a ceramic matrix (do not produce ashes) and inert in the bottom of the fusion module, with commercial application - the gases formed in the process have no dioxins or furans and are of low volume because they only arise from the disintegration of the material and not from combustion or gasification traditional processes.

The fusion module, in turn, works in negative atmosphere, preventing gas leaks. The process is dry distillation of the waste, with absence of air, no combustion of waste, which provides extreme reduction of the exhaust gases as compared with conventional processes and moreover, does not allow the formation of dioxins or furans, in view of lack of oxygen and high temperature.

The garbage is not mixed with the atmospheric air and suffers a dry distillation, meaning it is completely disintegrated and liquified in the absence of air, which considerably reduces the formation of pollutants harmful to the environment and health, including carcinogens. The gases formed inside the fusion module, are suddenly sucked and cooled (quench) to then be treated and neutralized in an immersion tank, alkaline. Last generation filters, coal-based activated, ensure that the emissions meet environmental standards.

See chart on (Page 12): Solid Waste Treatment VORAX Duo Therm vs Other Technologies.



Landfills, a global environmental problem

Vorax was designed by a team of world class scientists and engineers to accept nearly every possible type of waste to address the global problem of landfills and the reality that the earth is drowning in garbage. After treating the waste Vorax leaves only an inert resalable Vorax byproduct, leaving nothing to dump at landfills.... saving money, real estate and pollution simultaneously.

VORAX can save governments the massive cost and the long list of problems that come from creating and maintaining landfills. VORAX can eliminate landfills and their harmful pollution caused by methane gas and carbon that landfills bring.

VORAX also has a Waste to Energy component where models from 22T-400Ton per day can be equipped to produce ample amount of electricity, turning trash into money.

VORAX owners can also benefit by collecting landfill tipping fees.

The need to take action now

Projected global waste increase of 2.2 billion tons annually by 2025

The staggering amount of landfill waste produced each year poses enormous challenges for the health of our planet. Despite efforts by many of us to “Reduce, Reuse and Recycle”, the fact is we’re generating more landfill trash now than ever before. Worse yet, our waste is projected to nearly double globally over the next 15 years.

Today, the average American throws out about 1,000 pounds of garbage each year. Americans generated about 250 million tons of trash last year, according to U.S. EPA estimates. Globally, we’re producing a colossal 1.3 billion tons of landfill waste annually, with a projected increase to 2.2 billion tons by 2025. The environmental problems caused by landfills are numerous. Due to massive global scale, some say the scope of our global trash crisis could exceed the challenges we currently face with climate change.

Tougher environmental standards instituted have resulted in waste management companies closing many facilities. Local dump sites have been replaced by a smaller number of regional “mega” landfills, often located hundreds of miles away.

Waste now must travel farther from a household trash-can to the landfill. The longer trips mean more greenhouse gas emissions from trucks, trains, and barges. Depending on the route, one ton of garbage traveling 500 miles by train could generate 115 pounds of carbon dioxide. Trucking is even less efficient and produces more air pollution.





Greenhouse gas pollution

Our landfill problems not only can be compared to climate change, but they also contribute to it. As organic material such as food scraps break down in a landfill, they eventually release methane into the atmosphere. This greenhouse gas is 21 times more potent than carbon dioxide. Methane from landfill sites account for 12% of total global methane emissions and almost 5% of total greenhouse gas emissions.

Ground water pollution

Toxic waste that leaches from landfills into our soil and groundwater are extremely harmful to human, animal and plant life. The protective barriers and stricter standards of modern landfills only delay the inevitable.

Even though today's landfills cannot legally receive "hazardous" wastes, they can still slip in, resulting in a dangerous toxic soup. Aside from industrial and household chemicals, growing amounts of electronic waste containing lead, cadmium, and mercury are serious threats to water quality issues.

The EPA reports that of the nearly 3 million tons of electronic waste, 25 percent or less were recycled. Noxious e-waste materials accumulate and can eventually penetrate landfill linings or be washed away periodically by rain and into our municipal water supplies. VORAX can process electronic waste.





A REVOLUTIONARY ENVIRONMENTAL WASTE TREATMENT TECHNOLOGY

All Vorax models come with a complete warranty and service. Please inquire for details.



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