

EACP Committee

From: DICK KIM <sangheonkim@msn.com>
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EACP-17(5) presentation for 11/5 EACP Committee meeting



MARITECH SOLUTIONS, INC.

WASTE-TO-ENERGY PRESENTATION

MAUI, HAWAII

5 NOVEMBER 2019



MARITECH SOLUTIONS, INC.

- **Established 2008**
- **Developers of Alternative Energy Projects**
- **Waste-To-Energy; Wind, Solar, Geothermal**
- **Represent Dynamis Energy Technology**
- **Unique, patented WTE technology**



Modular, Upgradable and Fully Containerized Waste Management Plants with Optional Outputs for Power Generation, Desalination or Sewage processing



The WasteStation™

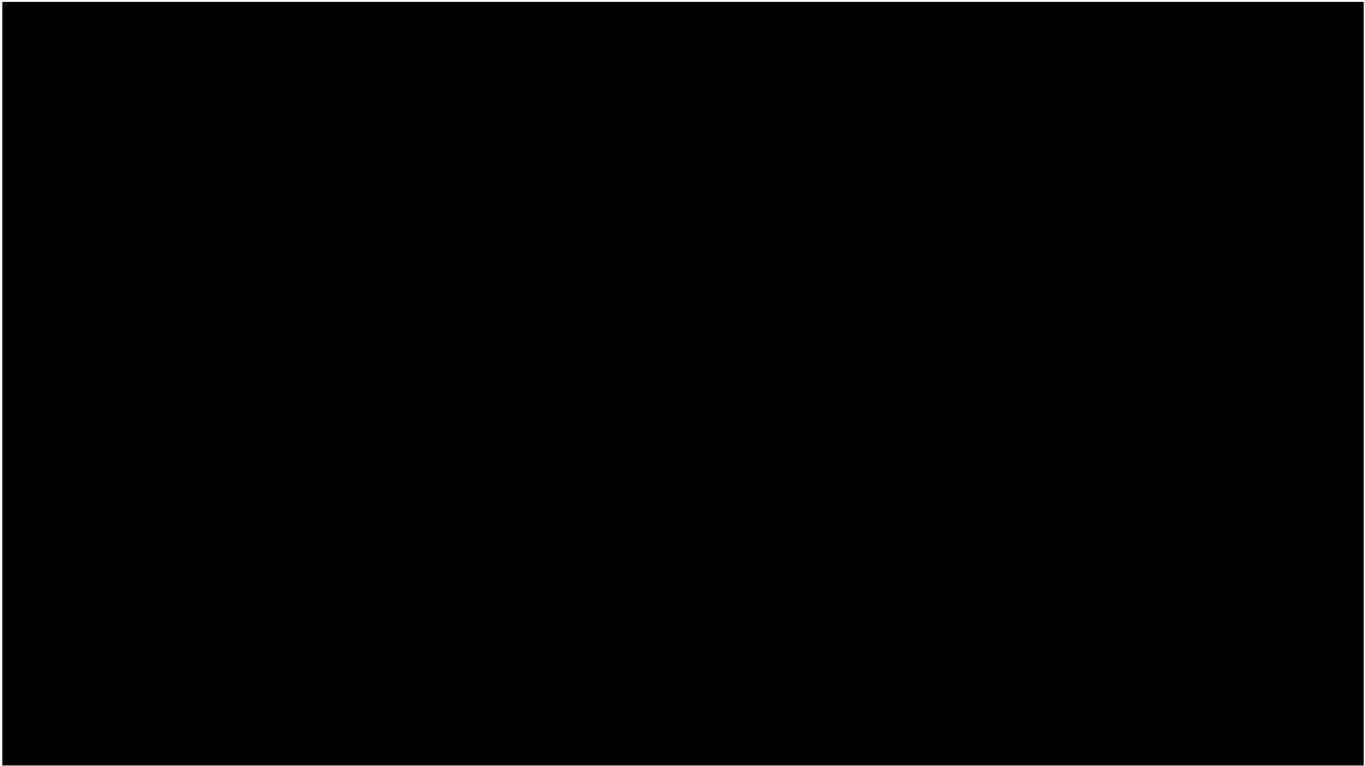
www.maritechsolutions.com



MARITECH SOLUTIONS, INC.

WasteStation™

VIDEO





ISLANDS RESORTS / Hotels



MILITARY INSTALLATIONS / REFUGEE CAMPS



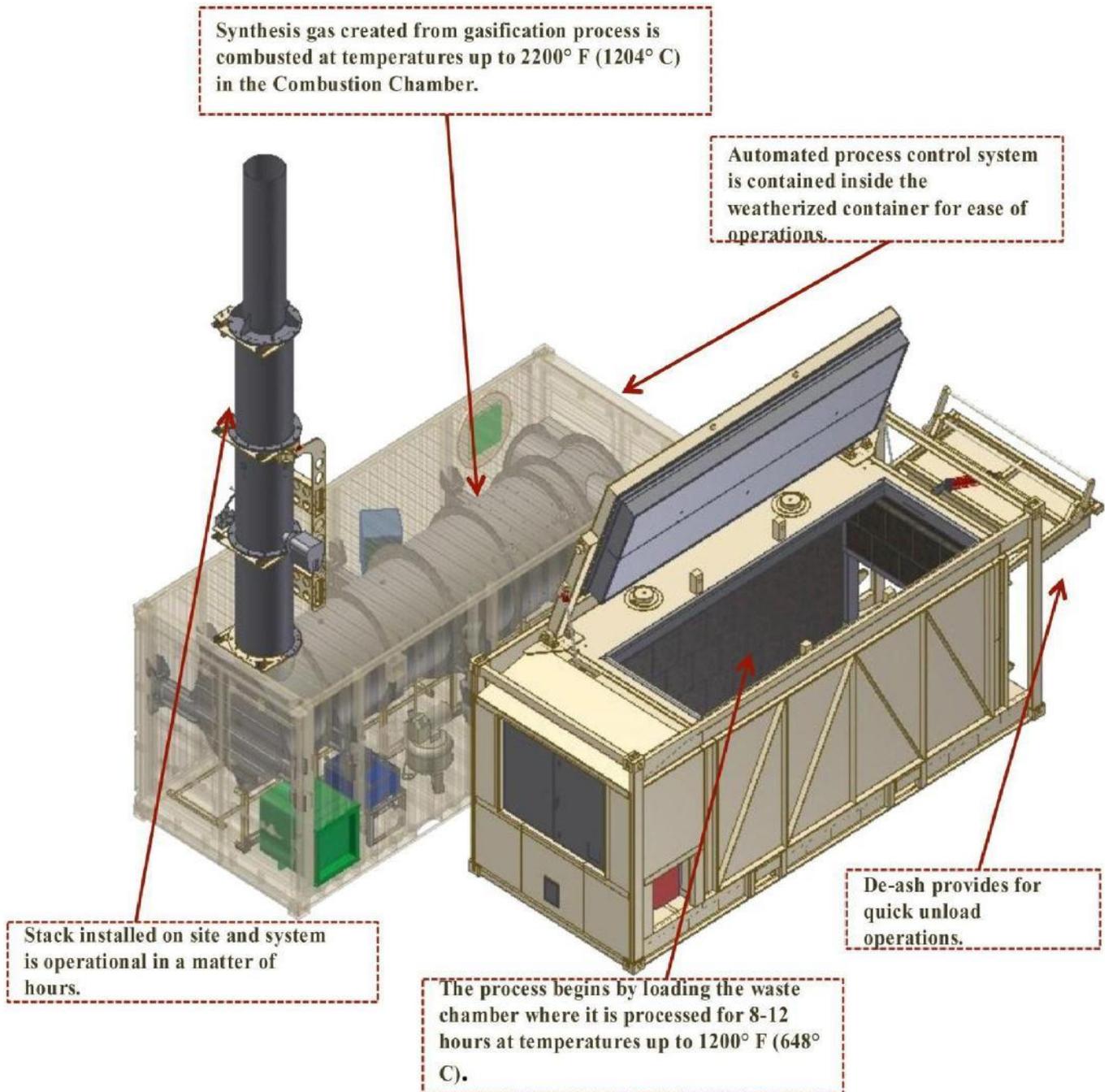
NATURAL DISASTERS / MUNICIPALITIES



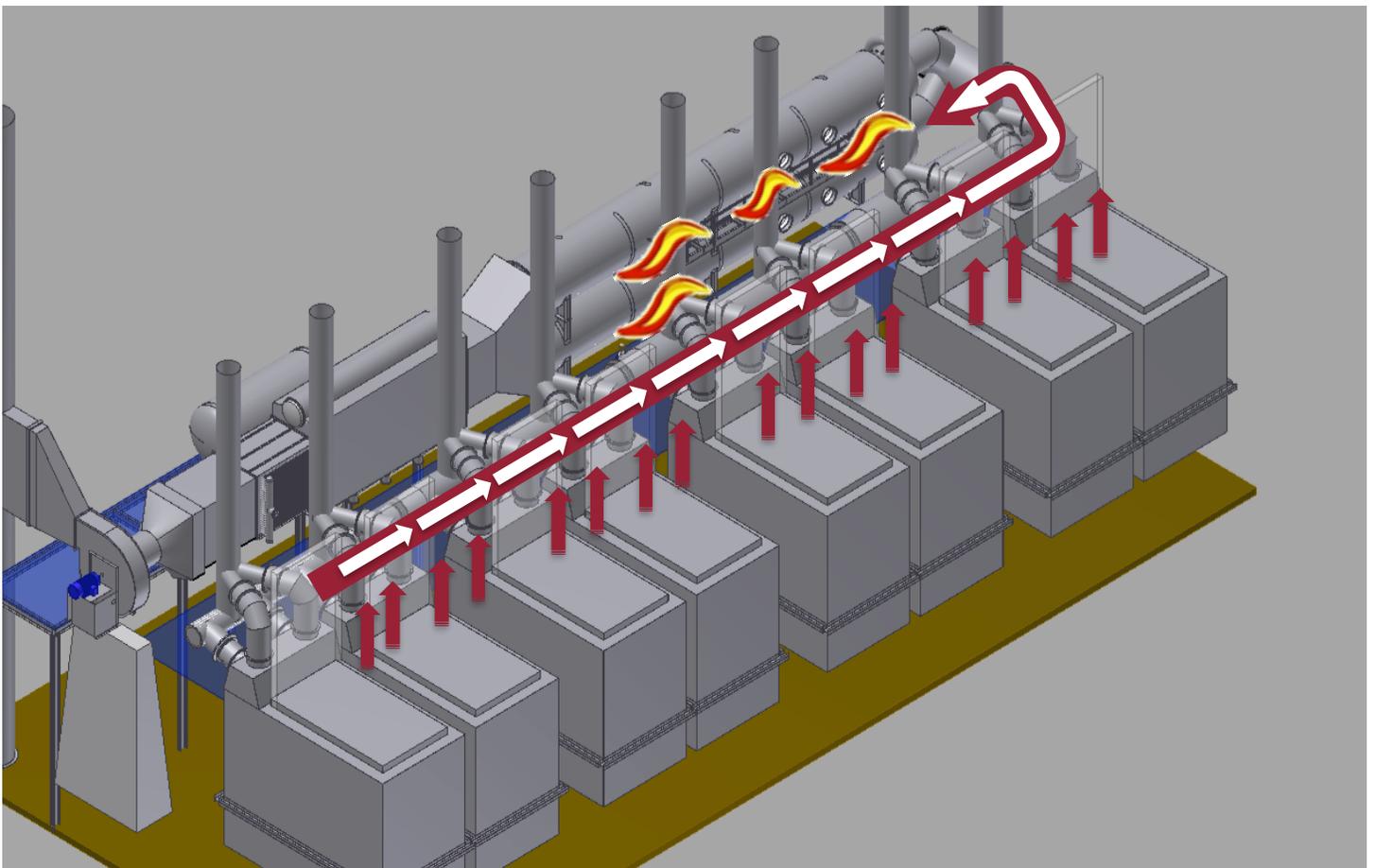
Medical Waste



How the WasteStation™ works

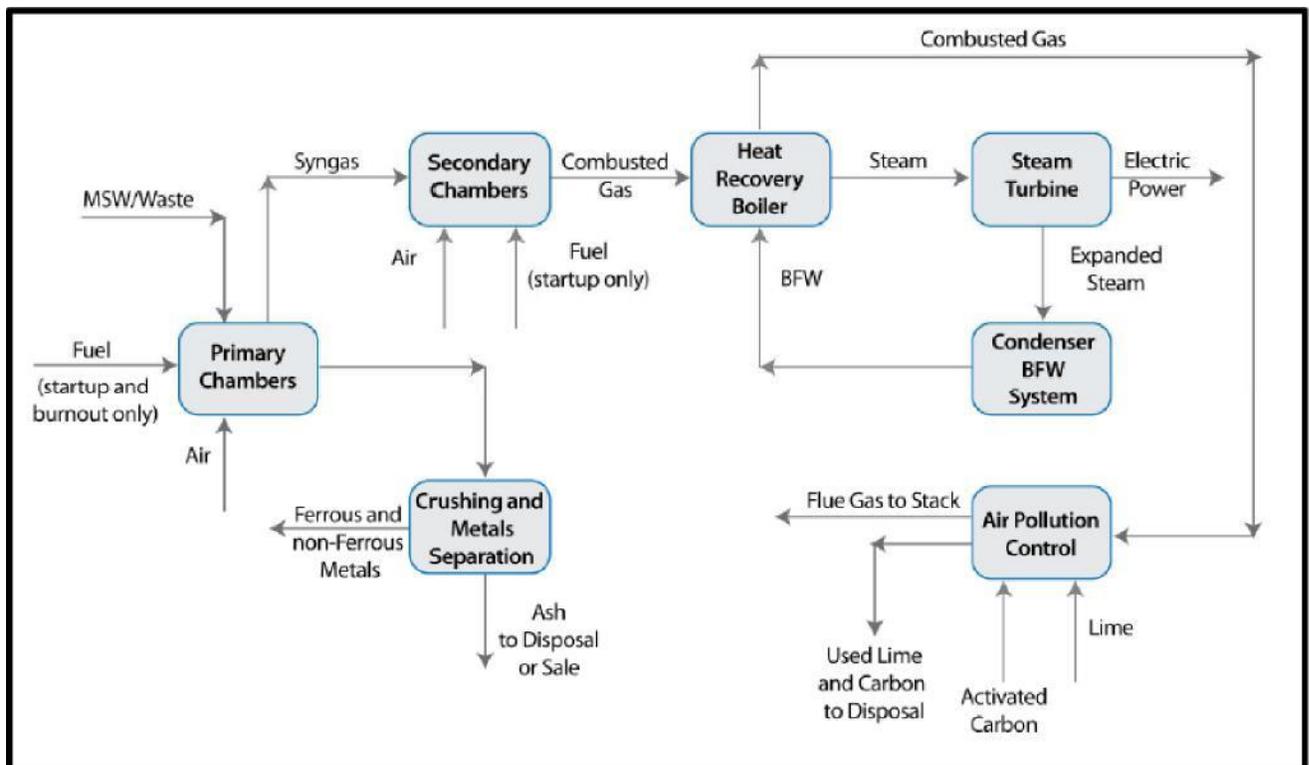


Flow Diagram



Waste Destruction Technology

The Dynamis Technology uses a modular concept, where the size of the proposed facility will dictate the number of dual primary chambers and the size of the secondary system chambers to be used. The number of primary chambers and the size of the secondary system chambers are a function of the daily-required throughput rate of MSW. The block flow diagram below shows the process.



Dynamis Process-Block Flow Diagram



INCINERATION VS GASIFICATION

INCINERATION

- **Waste is fuel source**
- **Combustion in oxygen rich environment**
- **Turbulent environment**
- **Heavy Fly Ash**
- **Airborne contaminates**

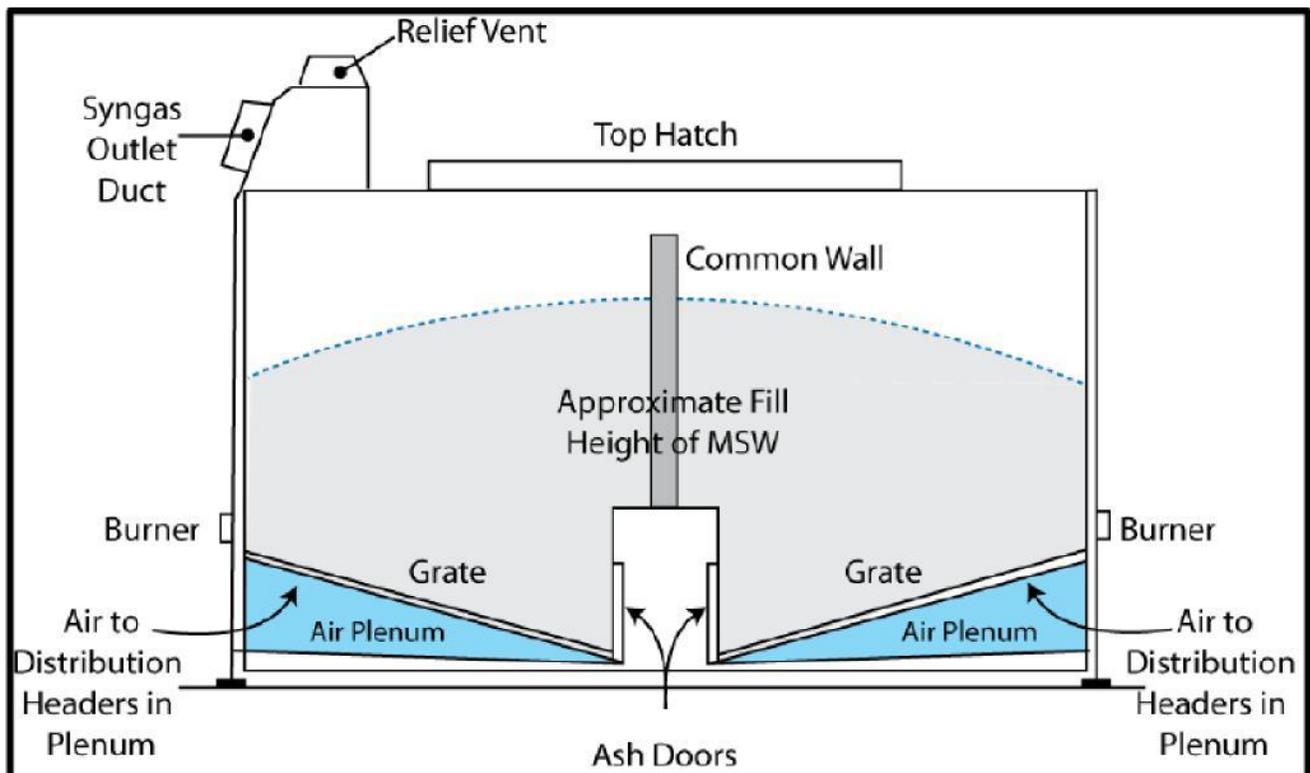


INCINERATION VS GASIFICATION

GASIFICATION

- **Waste is feedstock**
- **“Starved Oxygen” Environment**
- **Tranquil burn**
- **Miniscule Fly Ash**
- **Miniscule Airborne contaminants**
- **Produces Syngas**
- **EPA Approved**

The MSW is moved from the tipping floor by a front-end loader or a grapple crane or a conveyor that is to be used to feed dual (two) primary chambers that are mirror images of each other, share a common top feed hatch, and are to be operated in unison. The top feed hatch is opened and closed using a hydraulic motor. A cross-section view of the dual primary chambers is shown below. The two primary chambers also share a common ash removal conveyor and have a common wall that extends from the level of ash removal doors to approximately 40 inches from the ceiling of the chambers. MSW is to be fed through the hatch until approximately 70 percent of the volume of the two chambers is filled, forming a mound that tapers from a maximum height



Cross Section View-Dual Primary Chamber

in the middle/centerline area of the two chambers to minimums at the outer walls. The expected weight of MSW is approximately 2–3 tons per primary chamber .

Each primary chamber has an ash grate that supports the load of MSW and is also used to distribute air into the MSW above the grate. The grate is angled downward from the outer wall towards the centerline. The lower end of the grate terminates at an ash door that runs the width of the chamber.



Suitable Waste Streams



Before Processing After Processing

Dynamis Air Testing Results vs. Limits

Contaminant	Units	Dynamis	EPA	California	EU	Ontario	B.C.
Total Particulate Matter	mg/m ³	3.9	24	14	9	12	19
Hydrogen Chloride (HCl)	mg/m ³	.01491	37	27	9	19	69
Sulphur Dioxide (SO ₂)	mg/m ³	5.24	78	56	46	37	246
NO _x expressed as NO ₂	mg/m ³	62.09	282	202	183	207	344
Carbon Monoxide (CO)	mg/m ³	2.29	57	42	47	-	55
Mercury (Hg)	mg/m ³	.0000114	.080	.035	.046	.020	.19
Cadium (Cd)	mg/m ³	< .00001	.020	.007	.046	.014	.10
Lead	mg/m ³	.00000806	.2	.098	-	.142	.049
Dioxins and Furans	ng/m ³	.553	13	9	.9	.040	.5

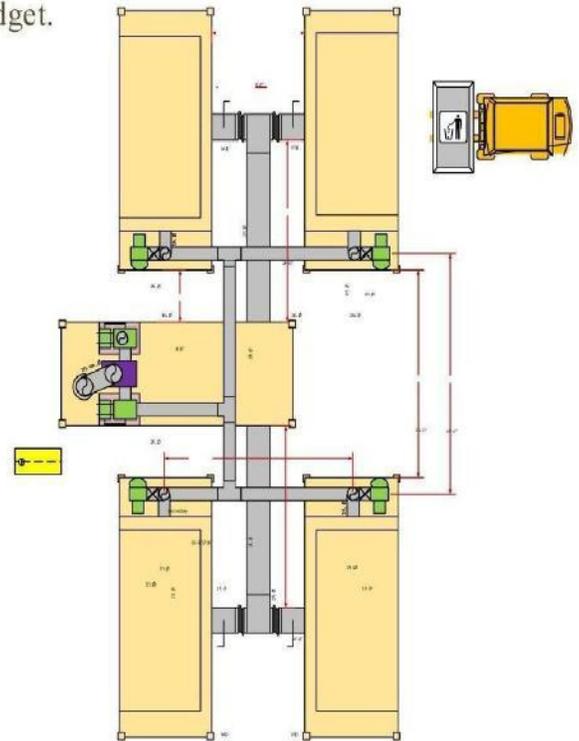
Dynamis exceeds by far, all required emission limits.
Results are from over 60 tests over the past 15 years.

The WasteStation™ expands to handle your growing waste needs

Increasing waste generation is a growing problem, but with the WasteStation™, and its expansion capabilities, you simply add another waste chamber to the system, as your waste demand increases. The WasteStation™ can be expanded from 1 to a maximum 4 waste chambers offering the flexibility to grow with your waste needs. Unlike similar options for waste destruction, the WasteStation™ allows you to plan for future needs, without impacting today's budget.

Waste Heat Recuperation Option

When you expand the WasteStation™ by adding additional waste chambers for waste handling, you have the option to add recuperation of the waste heat. This option allows the reuse of the superheated flue gas to pre-dry and start the gasification process of waste in awaiting chambers. This option will reduce the fuel usage and also prepare the unit for energy recovery. Adding this option would include a Heat Exchanger, allowing the addition of power generation equipment. Typically this option is added when using more than 1 waste chamber.



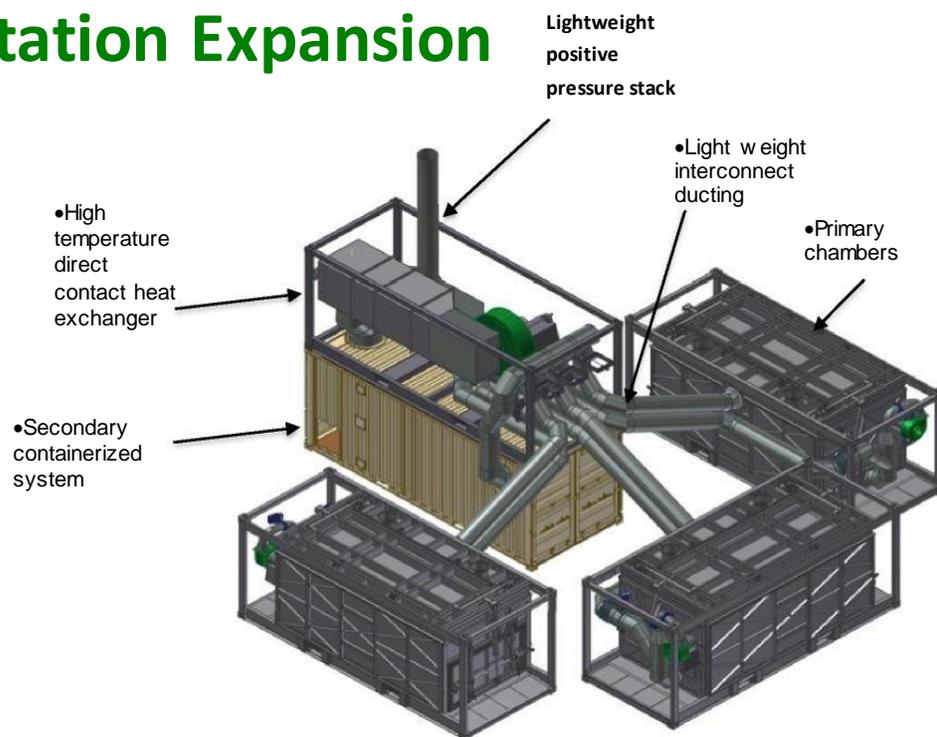
Heat Exchange Option

One of the options that can be added to the WasteStation is a Heat Exchanger. This option allows the customer to take advantage of waste heat. A Heat Exchanger is simply a heat exchanger with hot stack exhaust on one side and water on the other. Options include:

- Air-to-air heat exchangers can be used to provide pre-warmed fresh air back to process ovens, dryers and/or plant make up air units.
- Air-to-fluid heat exchangers can be used to transfer stack heat to boiler feed water, plant makeup water, process water, glycol and other thermal fluid loops.
- Allows the addition of power generation equipment.

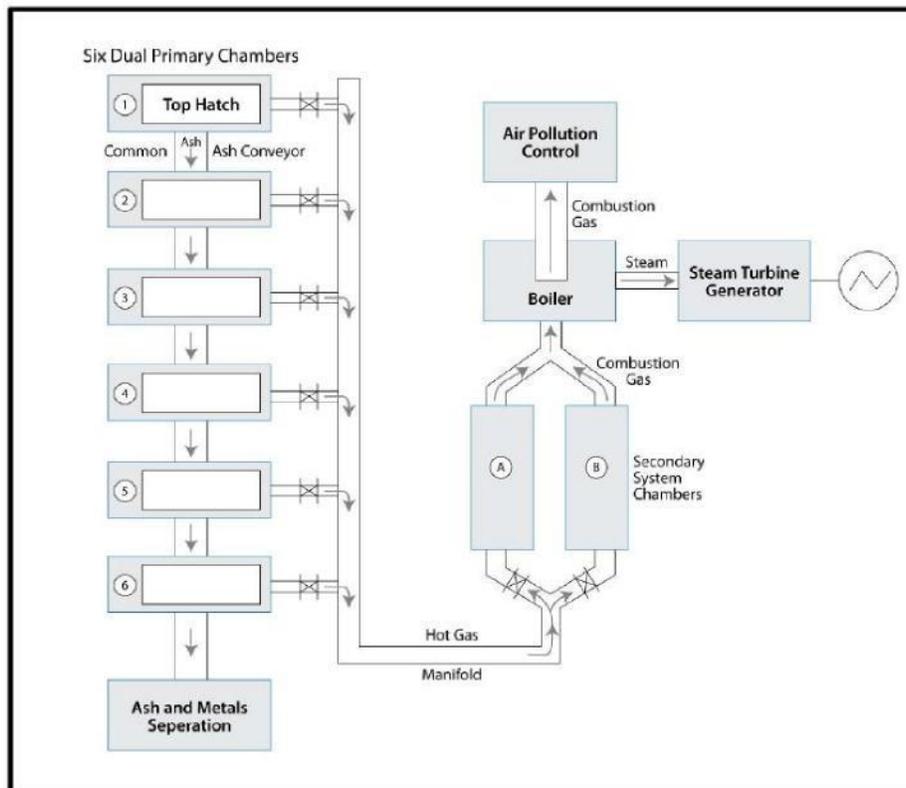
WasteStation Expansion

- Up to 4 Primary Chambers can be added
- Minimizes additional capex and operating costs
- Diagram shown with optional FGR System (Flue Gas Recirculation System) allows for waste heat recovery and reduced fuel usage
- Multiple units allow for more consistent power generation



Typical Dynamis Energy Installation

A typical installation will have several dual primary chambers connected to a dual-chambered secondary system through a common syngas manifold as shown below that (for convenience) shows six dual primary chambers and the secondary system. Dampers are located in the ductwork downstream of each dual primary chamber to control the flow from and to allow isolation of each dual primary chamber. Dampers are also located upstream of each secondary system chamber to balance the flow gas from the primary chambers between the secondary system chambers. The cycles of the primary chambers are designed to provide a uniform flow of syngas heating value and sensible heat (over a 24-hour cycle) to the secondary system and heat recovery boiler for an constant power output, or the cycles of the primary chambers can be staged to maximize the syngas flow and power output during peak value hours for electricity production with minimal syngas output to maintain temperature in the secondary system chambers during off-peak hours. If necessary, natural gas or another fuel can be substituted for syngas to maintain secondary system combustion gas exhaust and temperature output.



Typical Dynamis Installation Diagram





Annex 1

Pictures of the Barrow, Alaska Waste Plant





WasteStation™

Technical Specifications*

Power Requirement	480 VAC 3 Phase or 240 VAC 3 Phase or 208 VAC 3
Phase Load Capacity	18 Cubic Yards / 13.762 Cubic Meters
External Dimensions Each Container	Length: 20 Feet / 6.096 Meters Width: 8.0 Feet / 2.438 Meters Height: 8.6 Feet / 2.621 Meters - Traveling 25 Feet / 7.62 Meters -
Load Door Opening	Imperial: 160 in. wide by 54 in. deep Metric: 406.4 cm wide by 137.16 cm deep
Ash Door Opening	Imperial: 75 ½ in. wide by 31 in. tall Metric: 191.7 cm wide by 78.74 cm tall
Fuel	Natural Gas, Diesel, LPG, #2 Fuel Oil, JPT/JP8 Jet Fuel
Burners	Fully automatic, high efficiency burners with electronic ignition, flame recognition, and combustion control devices
Control System incorporate	Fully automatic state of the art process controls that digital displays for all major components to be monitored throughout each cycle.
Normal Operating Temperature Range - Primary	Imperial: 600-1200° Fahrenheit Metric: 315-648° Celsius
Normal Operating Temperature Range - Secondary	Imperial: 1,600- 2,200° Fahrenheit Metric: 871-1204° Celsius
Ash Removal	Ash removal to an ashbin when the process is complete, ash is safely landfilled.
Connectivity	Ethernet, GSM Cellular (requires subscription)

*Exact dimensions and specifications are subject to change.



Dynamis Technology (Detailed Explanation)

The **Dynamis** Technology is based upon the principals of **Gasification** and **Pyrolysis**. These technologies are not considered incineration. Incineration is the burning of fuels in an oxygen rich environment, where the waste material combusts and produces heat, water and carbon dioxide, along with a variety of other pollutants. Gasification is the conversion of feedstock (raw material for processing) into combustible gas molecules and ash. The gas consists of carbon monoxide, hydrogen and methane forming what is known collectively as **Syngas**. This **Syngas** can then be burned to generate steam, used directly to run a combustion engine or create other products such as drinking water.

Gasification and **Advanced Thermal Conversion Technologies** are increasingly being used to convert municipal solid wastes (MSW) and biomass into usable forms of energy. While this type of waste has been burned or incinerated, for decades to produce heat and electricity, the **Dynamis** Technology represents significant advances over incineration. In order to understand the advantages of the **Dynamis** Technology when compared to incineration, it's important to understand the significant differences between the two processes.

The dictionary definition of incineration is to 'burn up completely; reduce to ash'. Incineration uses solid wastes as a fuel, burning it with high volumes of air to form hot gases, mainly Nitrogen, Carbon Dioxide, Oxygen and water vapor. These hot gases are then used to create steam, which is then used to generate electricity. The introduction of large volumes of air into the combusting waste causes a significant amount of combustion particles (PM), or fly ash, to be carried along with the hot gases. Fly ash contains many hazardous and toxic air pollutants such as un-combusted Carbon, Heavy Metals, Dioxins and Furans, to name but a few. Due to the large amount of PM generated, incineration flue gas must be filtered to remove the PM (fly ash) prior to venting it to the atmosphere. This step of filtration requires very large and expensive equipment that consumes a significant portion of the energy that is generated. Incineration also creates some hazardous colorless gases such as NOx and HCl. Large amounts of NOx are generated during incineration due to the combination of high temperatures (3000 F) and excess air that contains Nitrogen. NOx must then be removed from the flue gas by injecting additional chemicals into the flue that neutralize the NOx before it is vented to the atmosphere.

The **Dynamis** Technology operates in such a way that the production of fly ash, NOx and many other pollutants are significantly reduced. The result is that a Dynamis system can be built with fewer expensive emission controls and more energy can be generated with less waste. The **Dynamis** Technology uses the MSW not as a fuel directly, but as feedstock for a low temperature thermal chemical conversion process. The MSW reacts with a controlled amount



of Oxygen under closely controlled temperature well below the vaporization and oxidation temperature of most metals. Closely controlled conditions such as these breaks down the feedstock into simple molecules and converts it into **Syngas**. The **Syngas** is then completely combusted in a separate secondary combustion system to create a hot exhaust. This hot exhaust has significantly fewer pollutants, such as PM, NOx, Dioxin and Furans than in the incineration process. The exhaust heat is then used to produce Steam, electricity, water or to treat Sewage.

One of the main concerns with Incineration of MSW is the formation and reformation of toxic Dioxins and Furans, especially from PVC containing plastics and other materials that form these highly toxic substances when they burn. Incineration produces many times more Dioxins and Furans than the **Dynamis** Technology. These toxins end up in the exhaust streams by three distinct pathways:

- By decomposition, as smaller parts of larger molecules.
- By reforming when smaller molecules combine together; and/or
- By simply passing through the incinerator without change.

The direct incineration of waste does not control these processes, so all pollution control occurs after combustion in a cleanup stage. The **Dynamis** Technology actively controls these toxins in the following ways without the need of additional expensive scrubber systems:

- In the **Dynamis** thermal conversion process, large molecules (which may be in the form of Dioxins/Furans) present in the feedstock are broken down into the components of **Syngas**, which are then completely combusted in the secondary combustion system.
- Dioxins and Furans need sufficient Oxygen to form and re-form and the Oxygen deficient and controlled atmosphere in the **Dynamis** process does not provide the environment needed for Dioxins and Furans to form or re-form.
- Dioxins need fine particulates in the exhaust to act as a carrier. **Syngas** from the **Dynamis** process contains very little particulate matter to act as a carrier.

Dioxins are destroyed at temperatures above 1500° F so any trace amounts that do form, are totally destroyed in the secondary combustion chamber, which operates at temperatures way above 1500° F. The flue gas remains at 1800°-2000° F for more than 2 seconds, providing the time required to destroy these dangerous toxins.