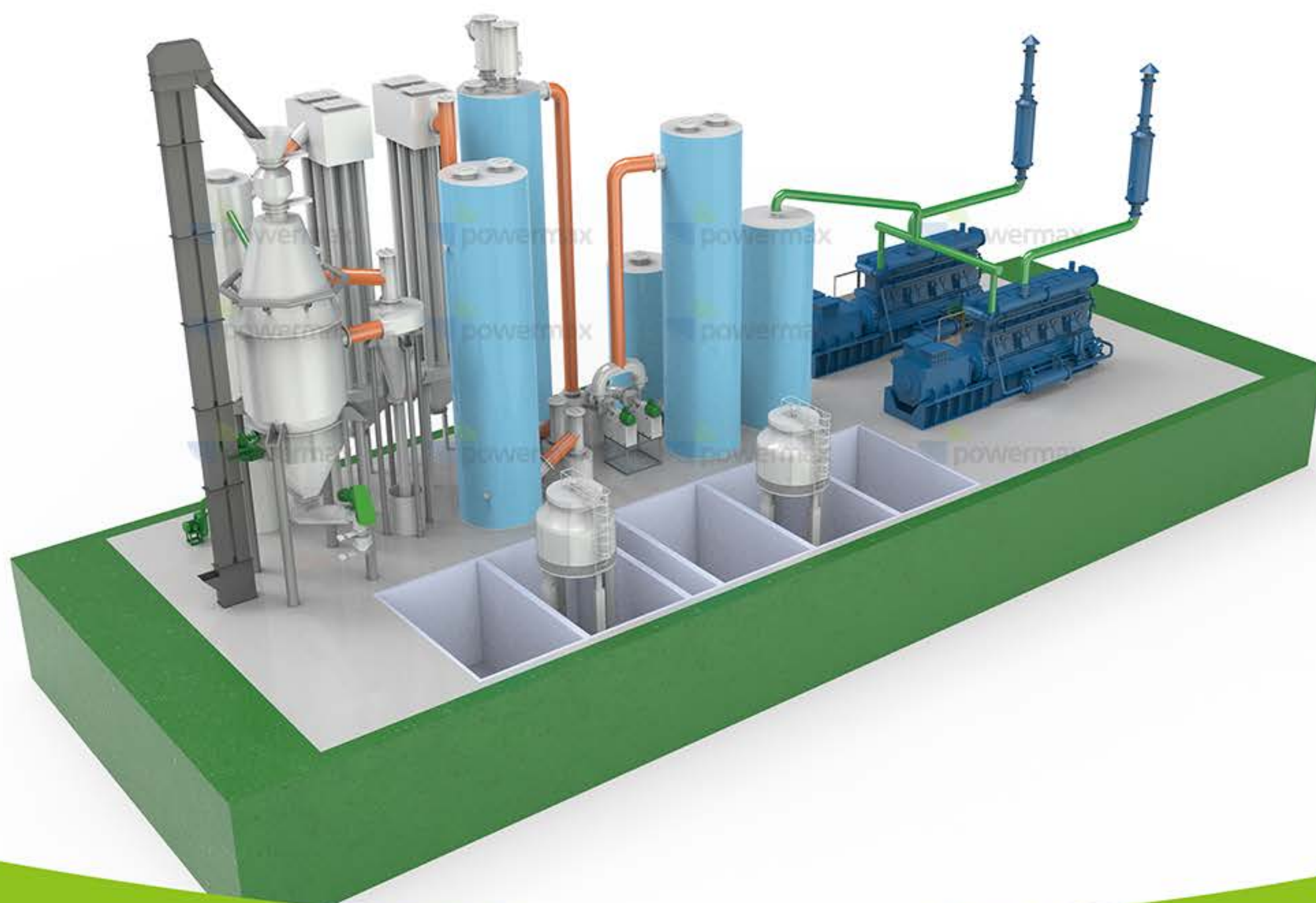


Comprehensive Treatment of MSW Recycling of Renewable Resources



Craft contrast

Comparison between POWERMAX' s Comprehensive Waste Treatment Technology and other Treatment Methods

Methods		Sanitary Landfill Method		Combustion Method		Biological Treatment Method		POWERMAX Comprehensive Treatment Method	
Item									
Performance	Operational Safety	Relatively good; needs to pay attention to fire prevention		Good		Good		Good	
	Technical Reliability	Reliable		Reliable		Reliable and have rich experience in the country		Reliable	
	Land Occupation	Large		Small		Middle		Smallest	
Conditions	Site Selection	Relatively difficult; topography and geology need to be taken into consideration; surface and underground water pollution must be prevented; generally far away from downtown and has long transportation distance		Easy; can be built near downtown and has short transportation distance		Relatively easy; needs to avoid residents communities; smell affects a distance of radius 2000m; moderate transportation distance		Very easy with no restrictions, anywhere around the city is OK	
	Applicable Conditions	Inorganic Matter > 60% Water Content < 30% Density > 0.5 t/m ³		When the lower heat value of the waste > 3000KJ/kg, no need to add auxiliary fuel		From a harmless point of view, when the biodegradable organic matter in the waste ≥ 10%, the output of fertilizer > 40%		Comprehensive Sorting	
	Final Treatment	None		Only the residue needs landfill treatment, it' s about 10% of the original amount		Materials can' t be composted need landfill treatment, it' s about 20-25% of the original amount		Realization of reduction, harmlessness and resource recovery	
Economy	Volume Reduction	10-20%		50-70%		60-80%		85-100%	
	Product Market	The methane gas can be recycled to generate electricity		Heat or electricity can be generated		Hard to establish stable compost fertilizer market		Syngas Product	
	Construction Investment	Relatively low; it will cost over 50 million CNY to build a landfill plant in the domestic; large land occupation and tends to expand limitlessly		Relatively high; it will cost 0.6 billion CNY to treat 1000 tons of waste daily; high equipments investment and running cost		Relatively High		Moderate	
	Resource Recovery	No previous examples of on site sorting and recycling, but with potential possibility		Some materials can be recycled in the pre-treatment process but it depends on the proportion of usable materials in the waste		Some materials can be recycled in the pre-treatment process but it depends on the proportion of usable materials in the waste		The resources after treatment can be utilized completely	
Pollution	Air Pollution	Large amount of CH ₄ , HCL and toxic gases are generated, among which the mercurial gas accounts for the largest amount		Dioxin and other toxic matters are generated		Some residual toxicity and bacteria may cause pollution		Stink smell is generated	
	Surface Water Pollution	Stratum displacement caused by floods and earthquakes may cause pollution to the surface and		Possible but the possibility can be reduced by taking measure		After treatment, the possibility of causing pollution to the surface water when burying the ash is lower than normal landfill treatment		When burying the matters that are not compostable, it is similar with the sanitary landfill treatment	
	Underground Water Pollution	underground water sources when burying the waste		Possible leakage		The ash residue has no organic matters but contains large amount of heavy metal. Curing measures must be taken when burying to prevent pollution		Heavy metal may pollute the underground water together with the compost fertilizer	
	Soil Pollution	Occupies large amount of land, damages soil structure and causes garbage siege situation		The residue after treatment still needs burying which may cause pollution		The content of heavy metals in compost products should be controlled		None	
Trends	Carbon ash income	None		Little		None		Yes	
	Unit Cost	60-90		150-230		80-120		70-90	
	Auxiliary Energy Consumption	0		200-400		40-60		Resource Cyclic Utilization	
	Development Prospect	Be weeded out gradually		Needs to be improved continuously		Not suitable for small-scale		Develop rapidly	

Current Situation of Solid Waste

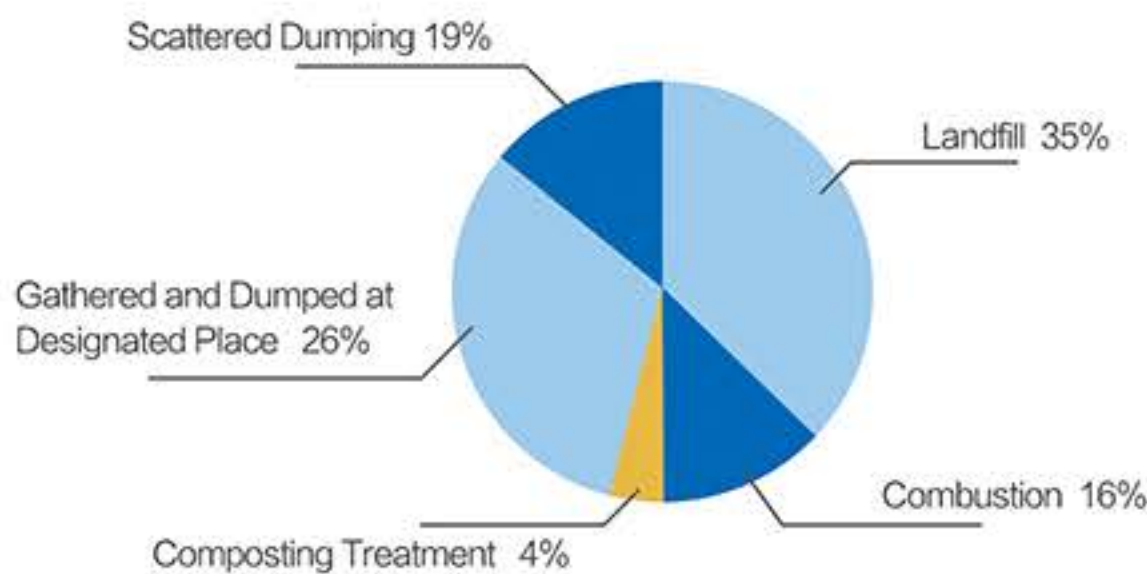
Current Treatment Methods and Problems of MSW

Treatment Method	Problems	Summary & Evaluation
Combustion	<ol style="list-style-type: none"> 1、 Large amount of greenhouse gas emissions such as CO、 CO2 2、 Dioxin will be generated when burning plastic which may cause cancer 3、 The ash after combustion contains highly toxic which needs to be treated safely 	Many countries with advanced environmental protections have reduced the amount of incinerator to treat the waste, and some countries in Europe have already clamped down on burning.
Landfill	<ol style="list-style-type: none"> 1、 Waste of land resources 2、 The percolate may cause underground water pollution 3、 Plastics can not be dissolved in short period of time 4、 Produce stink smell and grounds nearby can not be used and developed 	2/3 of the cities in China have seen the situation of garbage siege and farmlands occupation. It's urgent to find a better and more advanced alternative solution.
Biochemical Composting	<ol style="list-style-type: none"> 1、 Long fermentation time and greatly affected by season 2、 Stink smell generated and grounds nearby can not be used and developed 3、 Plastics can not be dissolved and still need landfill treatment 4、 Output organic fertilizer can hardly be accepted by farmers 	Low efficiency. The large amount of waste generated everyday can not be handled effectively. It can not be widely adopted.

Data Sheet of National MSW

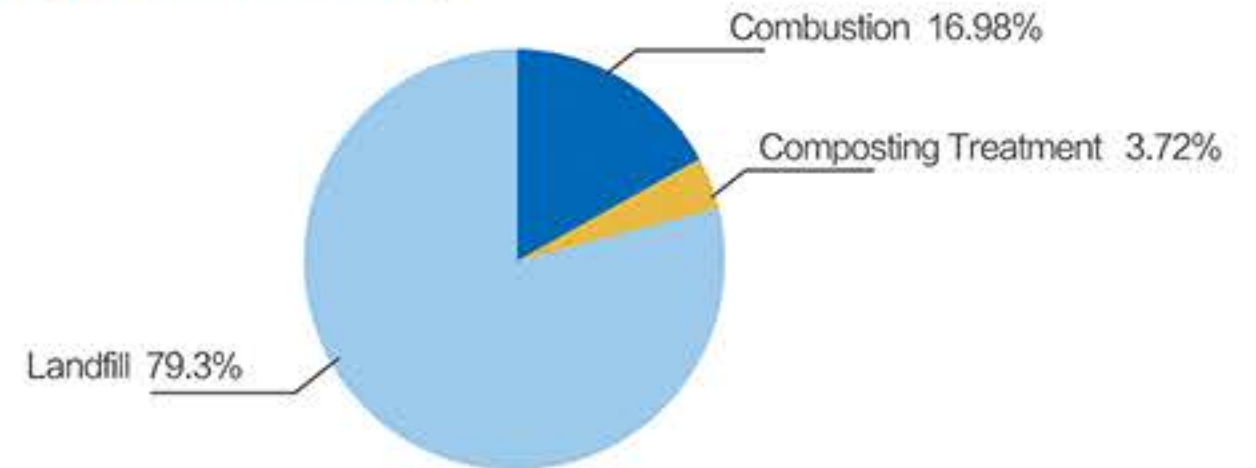
Flow of MSW

(All the wastes are calculated)

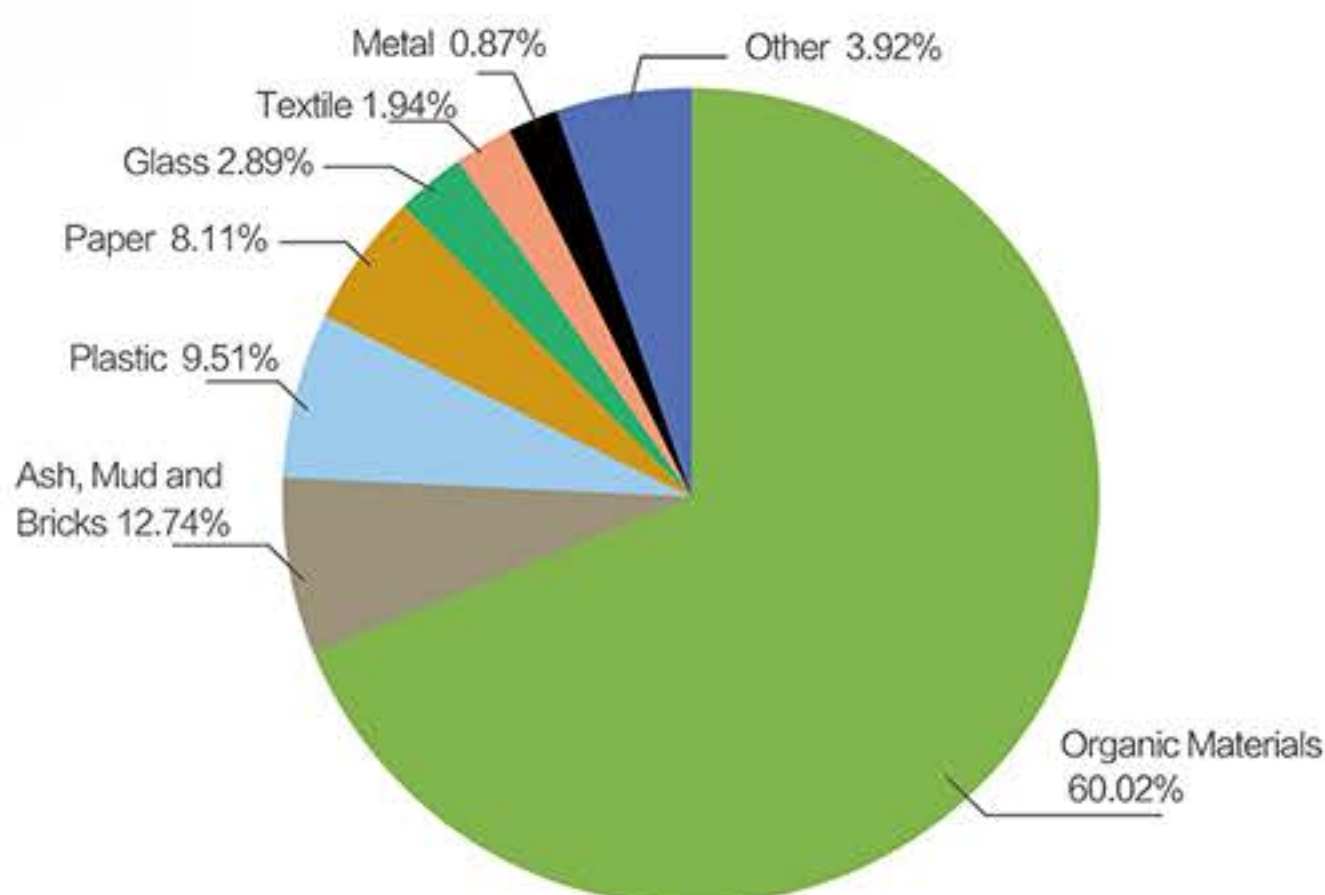


Treatment Methods of MSW

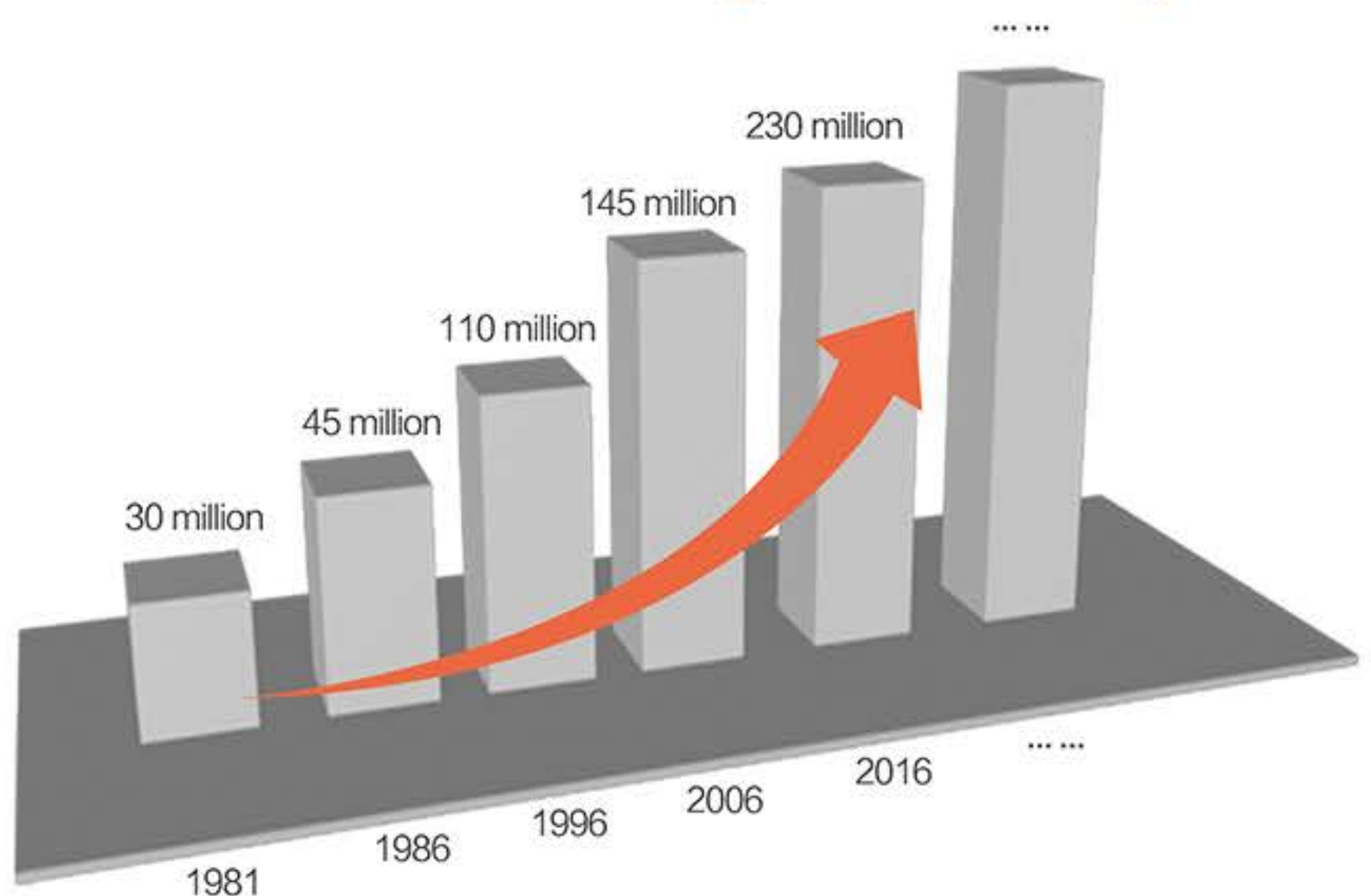
(Calculated as per actual treatment)



Composition of MSW(dry weight) in Big and Middle Scale Cities

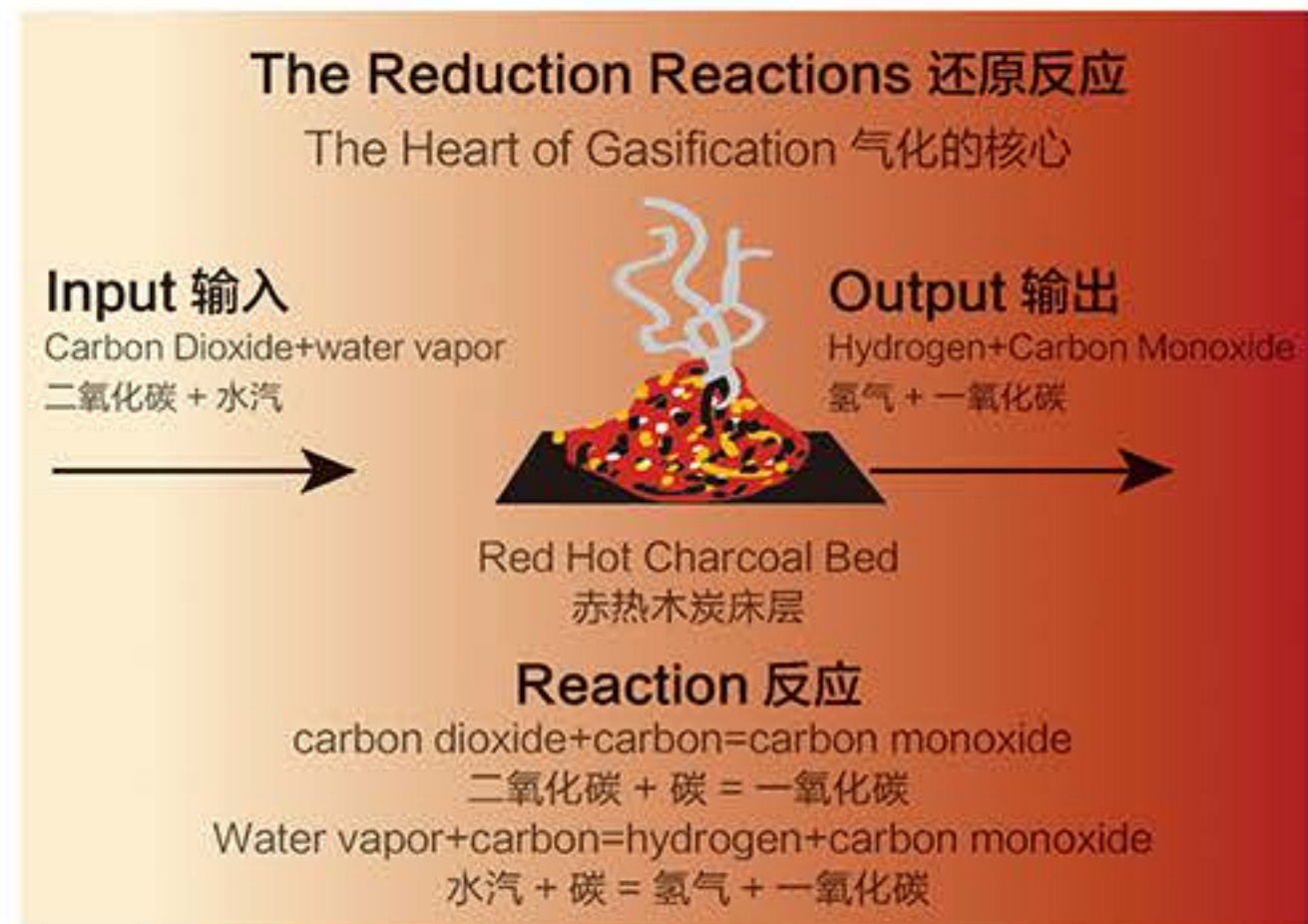
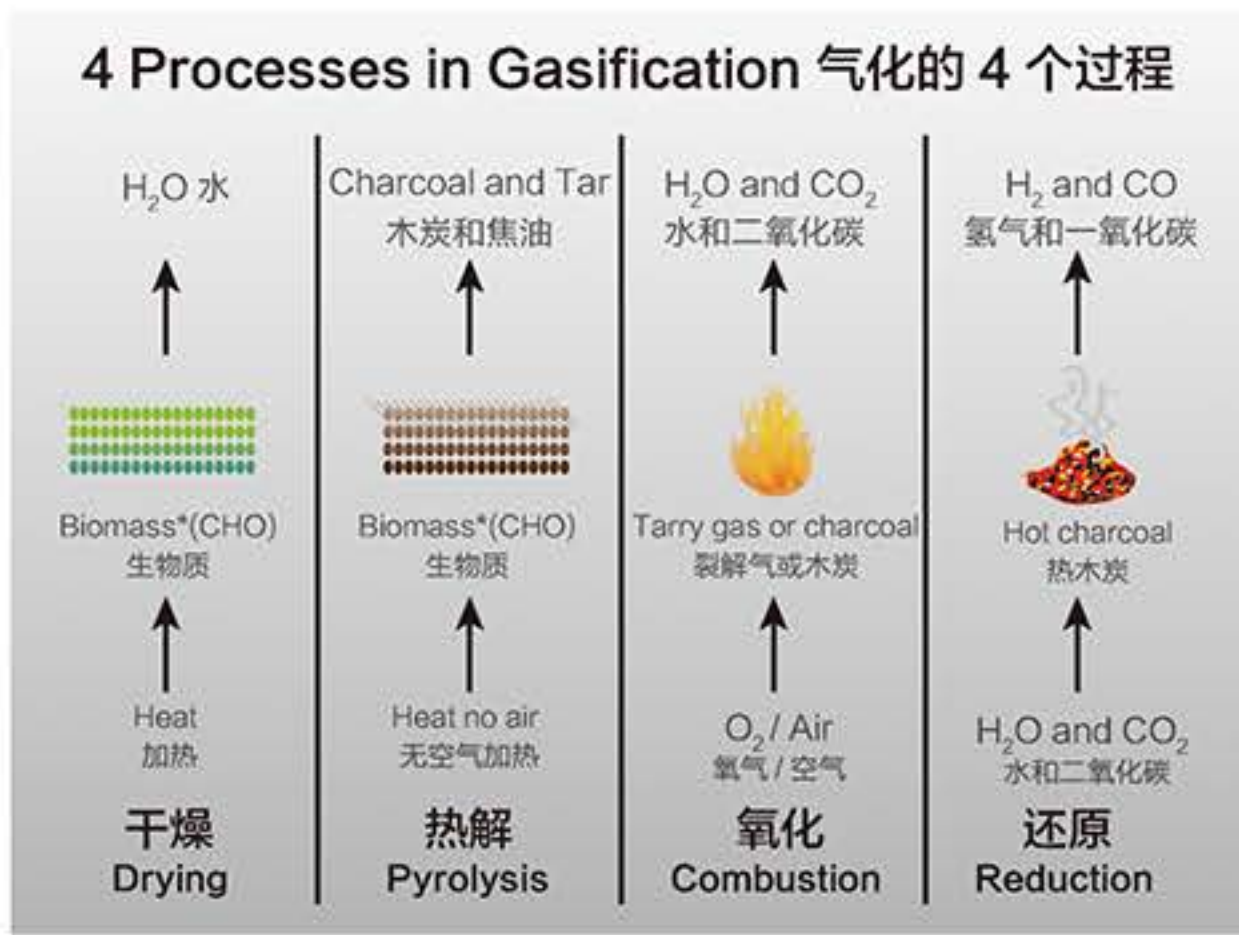


Transportation Amount of MSW over the Year throughout the Country



Pyrolysis Distillation Gasification

Principle



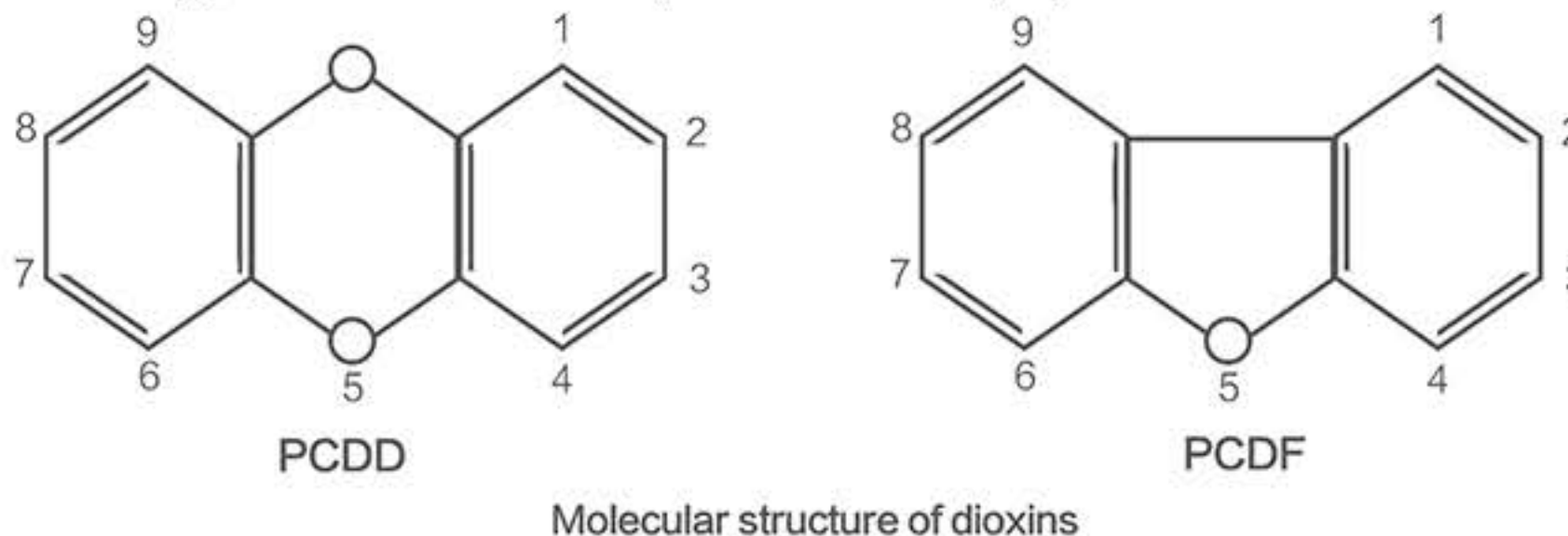
The pyrolysis distillation gasification process is a controllable thermal chemical reaction, the whole process is carried out under oxygen deficit conditions which can effectively inhibit the generation of Dioxins, PAHs and Aldehydes. No stink gases are produced and most of the sulphur and chlorine in the waste become slags as compounds and only a small part become SO_2 and HCl. The gas meets national emission standards after the exhaust gas treatment equipments.

After purification, the combustible gas can be used to generate electricity and the heat can be used for steam boilers and brick kiln. The high temperature flue gas can be used to dry the bricks and then be used as heating medium for the rotary dryer to dry the waste.

Characteristics

Prevent Dioxin effectively

The molecular structure of Dioxin is composed of 1 or 2 Oxygen atoms combined with 2 Benzene rings with Chlorine. The structure with 1 Oxygen atom is called PCDF and with 2 Oxygen atoms is called PCDD, which are called by a joint name of Dioxin.



It is showed in the molecular structure that Oxygen and Chlorine are the basic requirements for the formation of Dioxin.

During the pyrolysis distillation gasification process, the distillation process is happened under oxygen deficit conditions, as a result, combustible gas is generated and the wastes are carbonized after this process. Then the carbonized waste undergoes oxidation and reduction reactions with Oxygen and steam under high temperature which generates water gas. It's different from direct combustion, so the dioxin-like compounds can be effectively inhibited.

Resource Recycling Before the pyrolysis, distillation and gasification process, the gasifiable materials, mud, stone and ungasifiable materials in the household waste are completely sorted out. The gasifiable material goes to the pyrolysis distillation gasifier to generate combustible gas. The combustible gas becomes usable gas after purification(purify and compress) and is used for burning bricks and boilers, heating, electricity, cars and residents. The resource utilization rate approaches 100%.

Waste Reduction After the pyrolysis, distillation and gasification process, the gasifiable material in the MSW can be reduced by 85%. Mud, stone and ungasifiable materials together with the ash after gasification are all used for making bricks, thus no need of landfill or extra disposal. The material form of the waste is completely dissolved and the reduction rate approaches 100%.

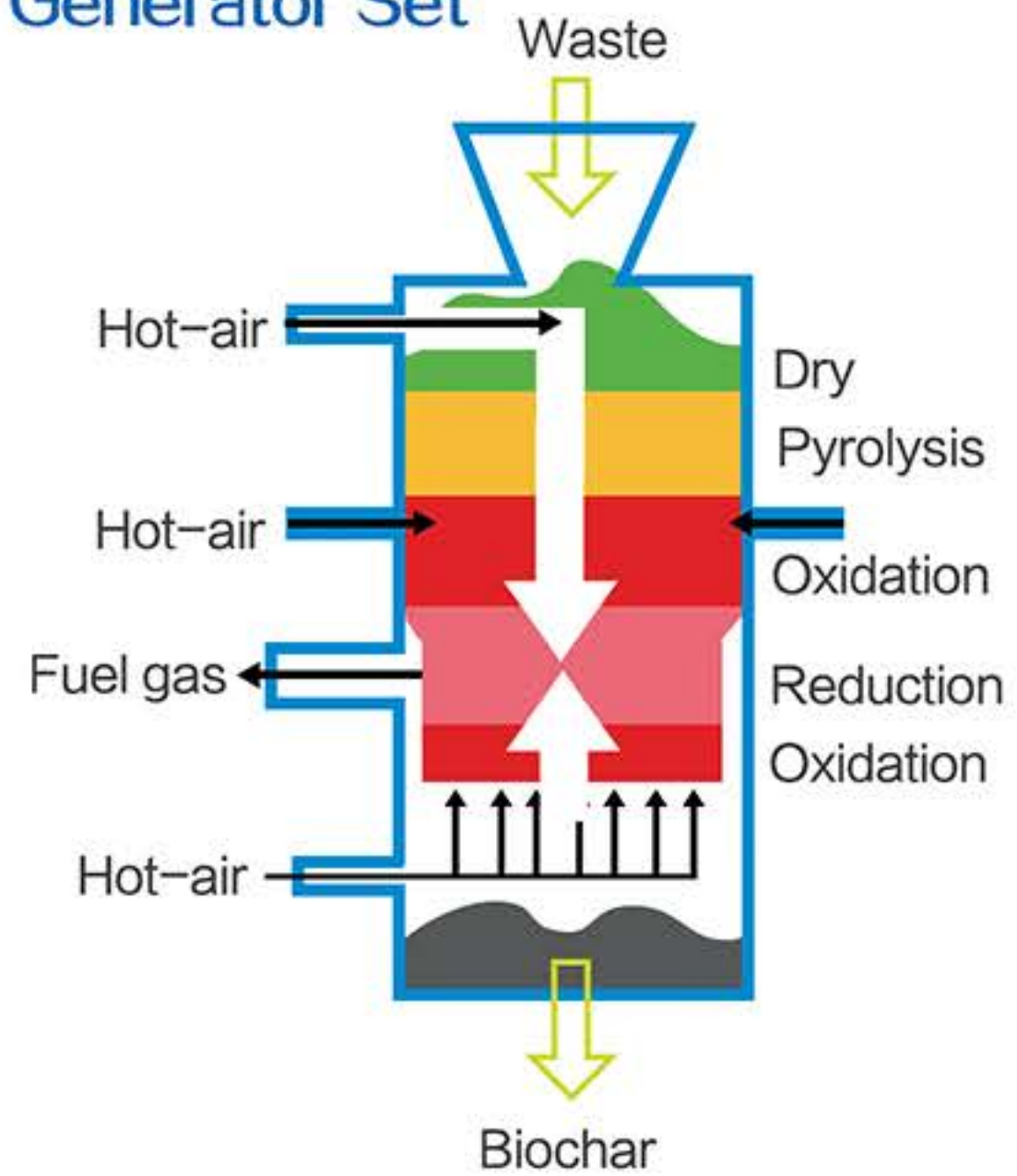
Harmlessness After the pyrolysis, distillation and gasification process, all kinds of harmful bacteria are killed off and the stink smell is completely removed. The Dioxin is effectively inhibited from being produced and disposed. The technology has reached international advanced level and the harmless treatment is very thorough.

Zero Discharge of Waste Water The raw mixed household waste are selected and dried before going to the warehouse and no percolate is discharged. With gas purified, water recirculated and concentrated waste water used as the supplement water for making bricks, no waste water is discharged.

Automation The treatment technology can realize large-scale continuous production and all production facilities are closed. From the garbage truck entering the factory till the products(energy-saving and environmental-friendly bricks) leaving the factory, the whole waste treatment process is monitored through video and automatically controlled from remote.

Principle, Characteristics and Technical Appearance Diagram of Household Waste Pyrolysis, Distillation and Gasification Generator Set

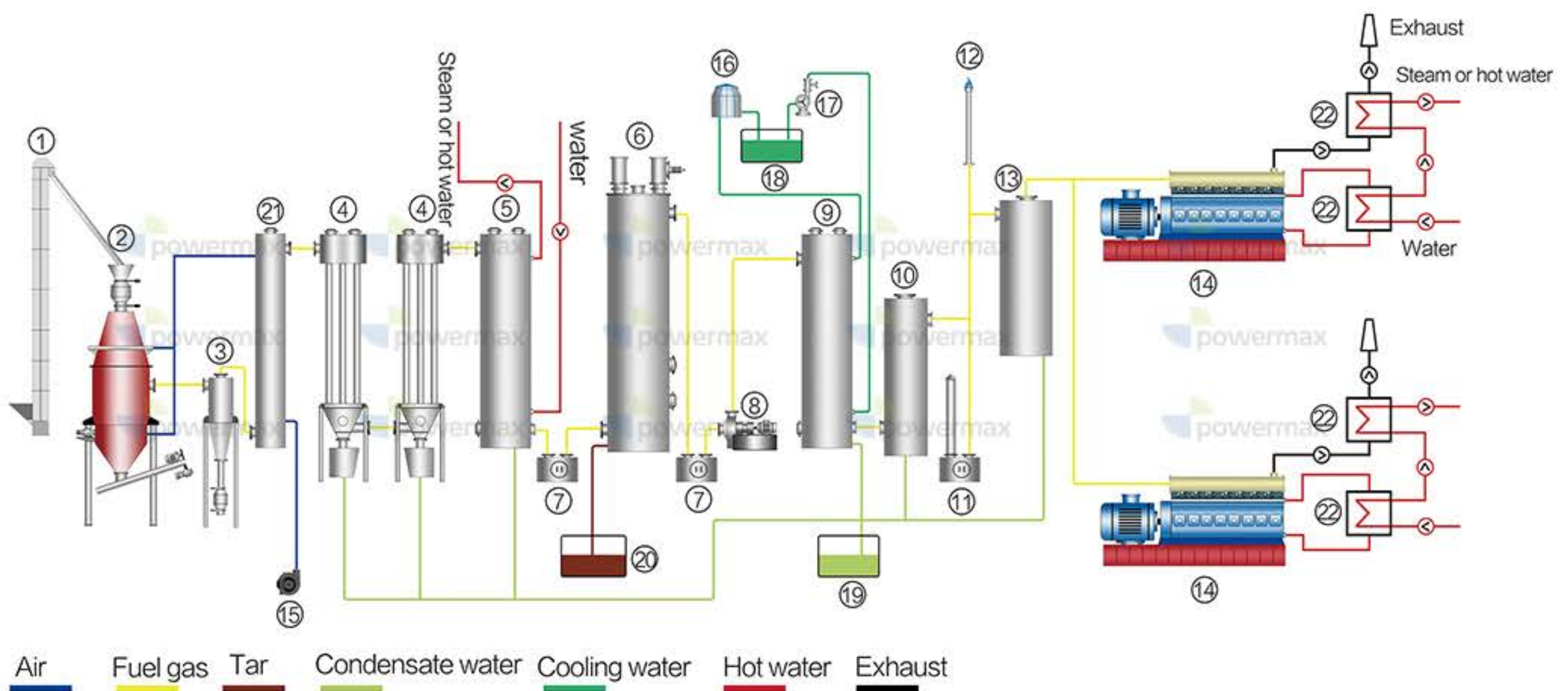
- ◆ Advanced International Technology
- ◆ No Dioxin Emissions
- ◆ 100% Utilization of Renewable Resources
- ◆ Airtight and No Second Pollution
- ◆ Easy Operation and Affordable
- ◆ Special Dual Fire Layer Structure
- ◆ High Efficiency in the Gasifier to Ensure the Output of Gas with Low Tar Content



Twin-Fire Fixed bed Gasifier

Process Flow

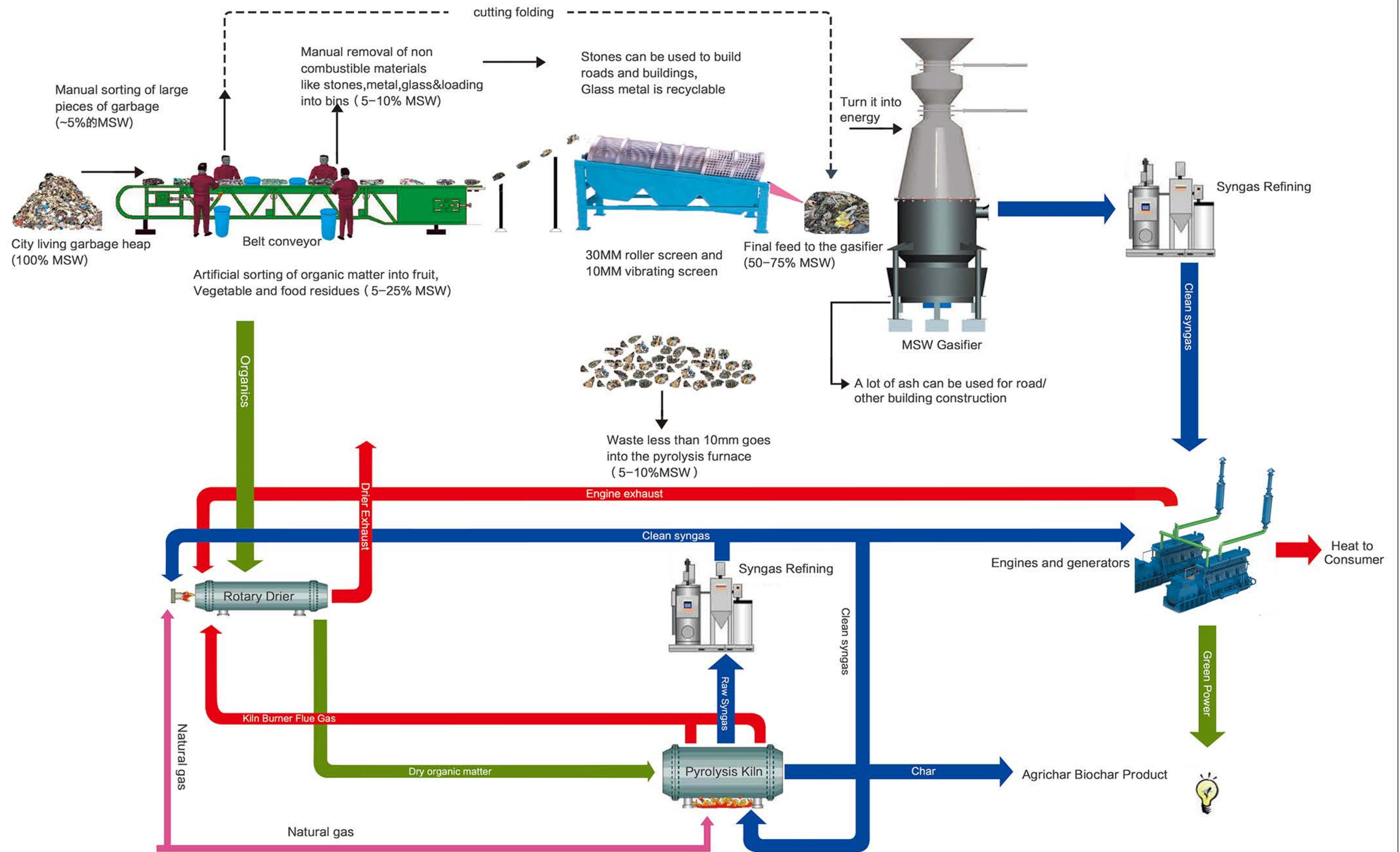
The raw waste material goes into the POWERMAX high-efficiency twin fire fixed bed gasifier through bucket elevator and then react in the gasifier. From top to the bottom, the waste materials go through drying, pyrolysis, oxidation, decomposition, reduction and oxidation reactions and high-temperature combustible gas is generated. Then the gas goes into the semi-dry gas purification system which is self-designed by POWERMAX to remove the dust and tar in the gas and also cooling the gas. The purification system includes cyclone dust collector, air-gas heat exchanger (get high-temperature air as gasify agent), air cooler (optional), indirect cooler, ESP, drop catcher and buffer tank. After the purification system, the gas becomes clean and goes into the gas generator set to generate electricity.



- | | | | | | | |
|----------------------------|-----------------------|------------------------|------------------------|---------------------------|-----------------|-------------------|
| 1. Elevator | 2. Gasifier | 3. Cyclone | 4. Air cooler | 5. Indirect cooler | 6. ESP | 7. Isolation seal |
| 8. Booster Fan | 9. Indirect cooler | 10. Water drop catcher | 11. Water bleeding | 12. Gas flare | 13. Buffer tank | 14. Gas set |
| 15. Air blower | 16. Cooling tar | 17. Water pump | 18. Cooling water pool | 19. Condensate water pool | 20. Tar tank | |
| 21. Hot air heat exchanger | 22. Waste heat boiler | | | | | |

System process flow chart

POWERMAX'S SOLUTION TURNS MSW INTO USABLE ENERGY



Minimal Pre-Processing. MSW is Fully Processed and Converted to Useful Streams. Landfilling is Totally Eliminated.



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