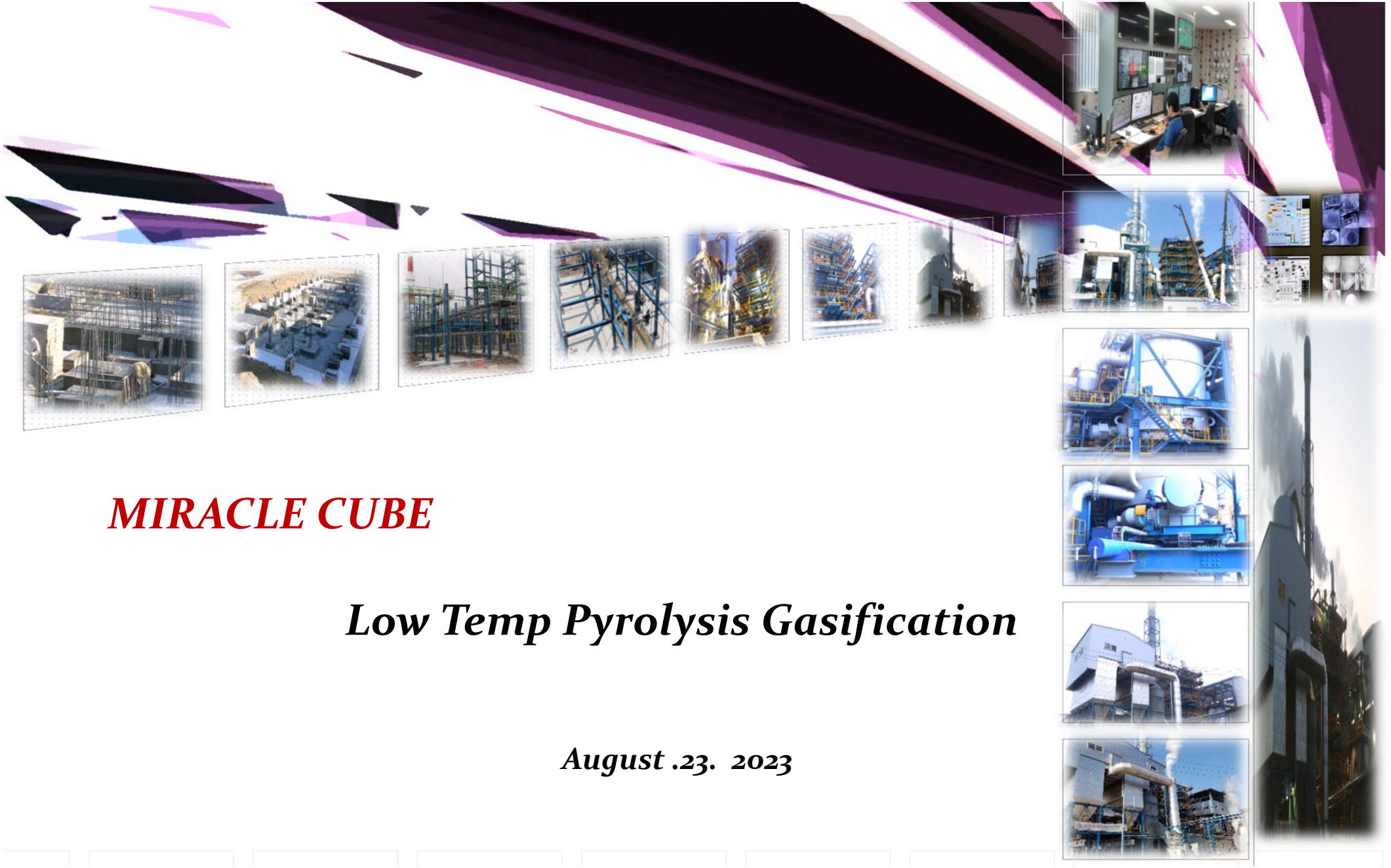

MIRACLE CUBE

Low Temp Pyrolysis Gasification

August .23. 2023

ADB Circular Economy Webinar Series Session 17

Low Temperature Gasification of Waste: Ultimate Solution for Energy/Waste/Climate

24 August 2023
10:00-11:00 a.m.
Manila Time (UTC +8)
Online via Zoom

ADB

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From the People of Japan

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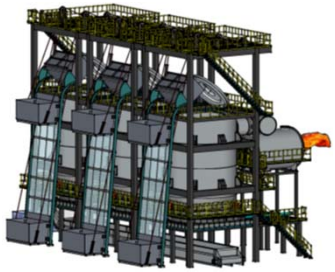
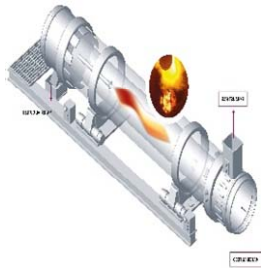
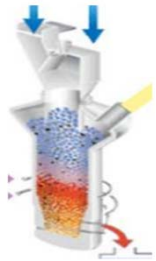
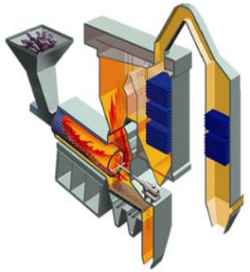
Technology Overview
Comparison with other incinerators

TITLE	Pros and cons of each incinerator				
	Low Temp Pyrolysis Gasification	Anaerobic pyrolysis (Rotary Kiln)	High temperature melting pyrolysis (with shaft)	stoker-type incinerator	Fluid phase incinerator
Facility Photos					
Advantages	- It is okay even if the calorific value/moisture rate is high - Small-scale prevention facilities available due to low amount of exhaust gas - Low bottom ash generation - Low operation and maintenance costs - Low pollutant emission - Almost no failure factors due to absence of internal driving module - Waste can be treated as it is, and no pre-treatment is required	- Depending on the processing conditions, the incineration speed and dwell time can be adjusted accordingly - Good waste mix during processing - Simple structure makes maintenance easy	About 1% of bottom ash - The pyrolysis, gasification, and melting processes are integrated, so oxygen input can be adjusted for the imbalance of waste input. - Low emission of air pollutants such as dioxin	- It has many achievements and is technically stable for household waste incineration. - Large-capacity design production is possible - It can be used by recovering heat energy from exhaust gas as steam - Relatively low power consumption	- Required area is relatively small - Good intermittent driving - It is possible of mixed burning of liquid waste - High furnace load factor - Easy heat recovery - Relatively low amount of flue gas - Easy to dispose of small municipal waste - Simple structure and easy maintenance - Possible to remove acidic gas such as HCl by directly injecting solid alkali agent into the furnace
Disadvantages	- The techniques is in the early stage of application, the line must be separated for more than 300 ton/day	- Due to the characteristics of the rotary furnace, it is difficult to check the inside of the furnace - It is difficult to maintain uniform furnace conditions along the length of the rotary furnace. - Possible outflow of unburned carbon - Low thermal efficiency - Frequent replacement of insulation materials due to frequent corrosion - Pretreatment facilities required	- The construction and operation cost is expensive because of the high temperature of process temperature and the compressive input of waste, which requires a good material choice against thermal stress, mechanical damage, wear, etc. - Materials other than the synthetic resin series are difficult to apply - Coke, limestone, oxygen, etc. require excessive maintenance costs	- Wastes with high calorific value/moisture content are unsuitable - Exhaust gas is relatively large - It takes a long time to stop the operation - High generation of bottom ash - Waste pretreatment facilities are required - Pollutant emission concentration is relatively high - Frequent failure of internal driving module	- Pre-processing such as shredding is required - A lot of dust is generated - Unstable due to instantaneous combustion - Fluid medium supplement required - Sensitive to changes in the properties of input waste - Large amount of fly ash including dioxin - Not suitable for medium-large scale - The pressure loss in a furnace is large, so the static air pressure must be high

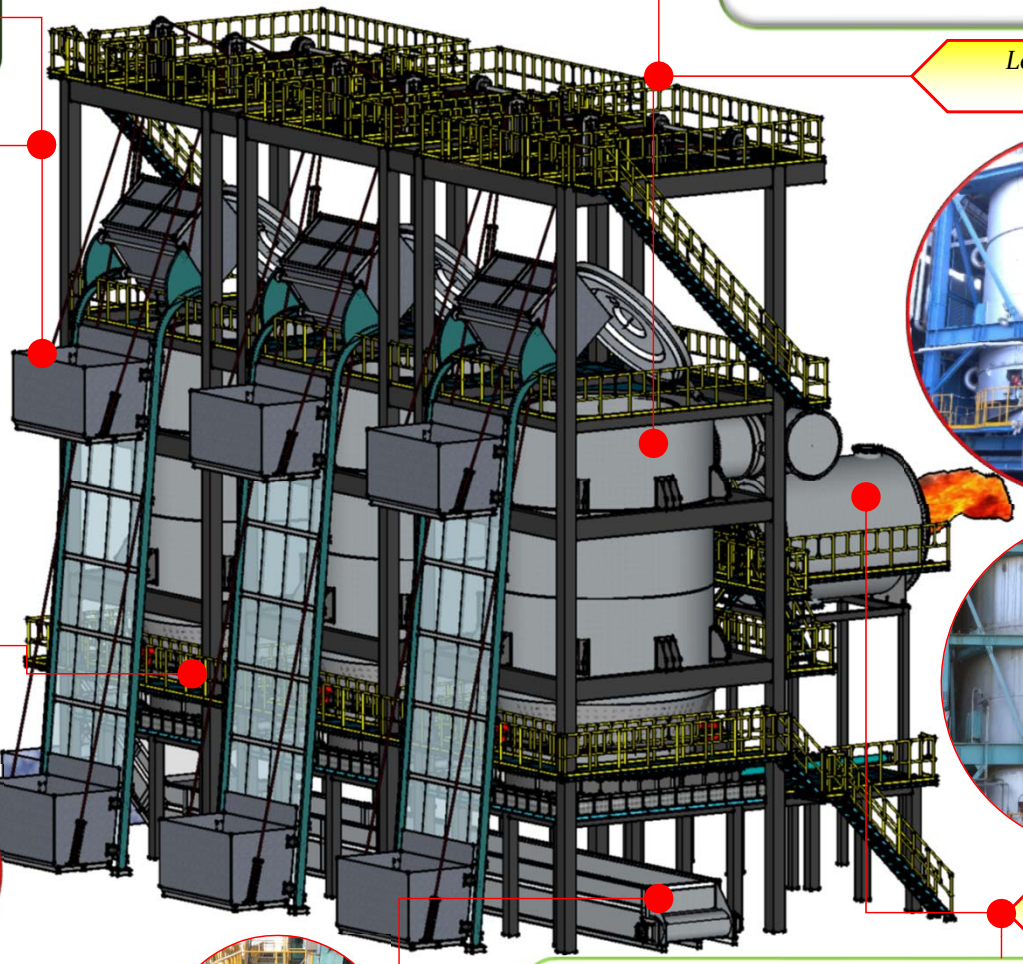
Low-temperature Pyrolysis [Technical Introduction]

LTPG is a stable system that dissolves solid matters into flammable gases in an extremely low oxygen supplied reduction process.
LTPG can dispose of all types of solid combustible wastes with high and stable energy efficiency at low maintenance costs.
Ignition burner is used only for initial ignition for 30 to 60 seconds.
Bottom ashes can be removed by automated bottom ashes remover.

Combustible solid wastes supplied twice per day by batch type buckets.
Skid hoist weighs and automatically supplies the wastes into the pyrolysis reactor.

Skid Bucket Hoist

Low-temperature Pyrolysis Gasification Furnace



Bottom Door [Open & Close]

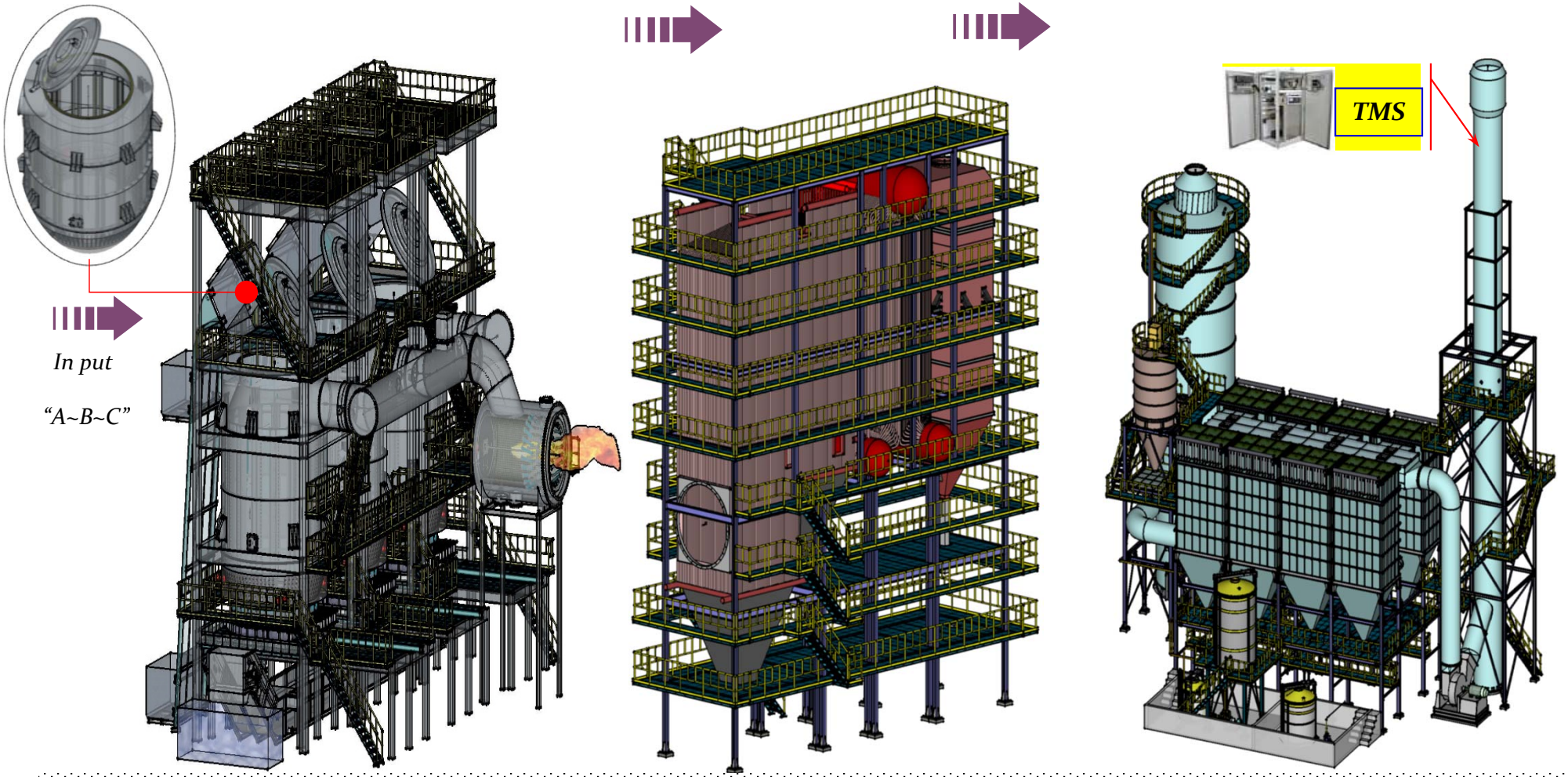
Burner Furnace

Bottom Ash Conveyor

Flammable gases can ignite by the supplementary burner.
Once ignition of flammable gases completed, supplementary burner is turned off and stable combustion is maintained by the heat from the combustion of flammable gases.
Optimum condition for the maintenance of stable temperature by controlling the flames of flammable gases through vortex of air supplied in a minimum quantity.

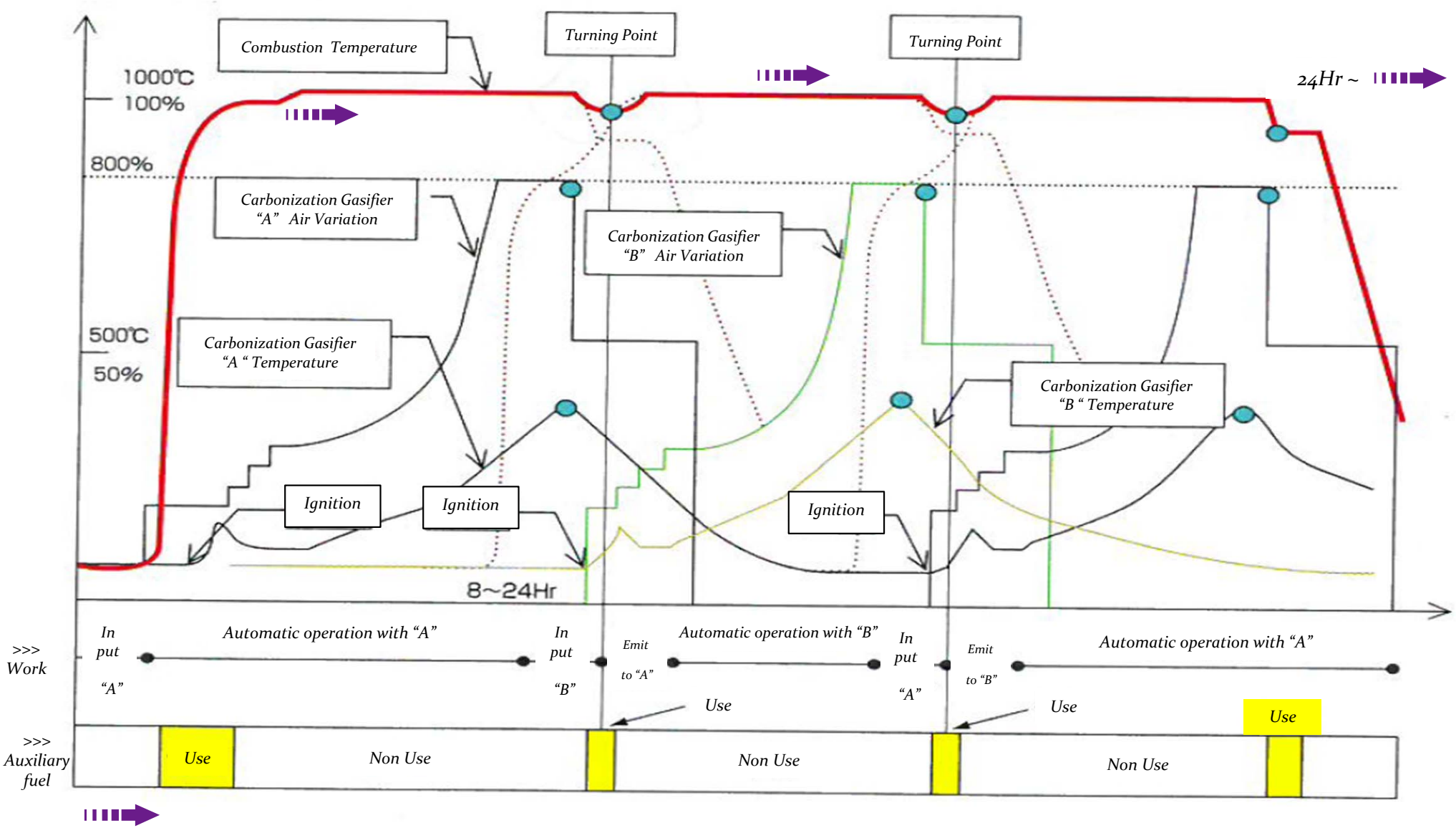
Low-temperature Pyrolysis [3D - Model Diagram]

Low-temperature Pyrolysis Gasification Facility → **Gas Cooling Facility** → **Air Pollution Prevention Facility**



Pyrolysis [Temperature Chart]

Degree of Change ~100%)



Technology Overview
Introduction to the concept

TITLE	TYPE	
	☑ ***Low Temp Pyrolysis Gasification***	***Incinerator Stoker***
Basic concepts	A) Residual carbon is burned by injecting a minimum of 5-10% of the required air into the pyrolysis gasification furnace as the primary step, and the wet waste is dried and pyrolyzed using the local combustion heat of 800-1,000 °C generated therein. It is an environmentally friendly techniques capable of complete combustion by burning the combustible gas such as LPG in the burner generated by pyrolysis. B) After pyrolysis of waste, this pyrolysis gas is completely burned in the secondary burner, so that the generation and regeneration of dioxins is low, and the formation of dust or carbon black (stoker type: 3,000-10,000 mg/Nm3, pyrolysis type: 200-600 mg/Nm3) is minimized to reduce secondary pollution. C) In addition, it has an advantage on the driving cost being low, and there is no driving module inside the furnace, which makes it easy to maintain	Most of the combustion air is injected from the combustion furnace and the combustion occurs at the same time.
Type of reaction	Endothermic reaction	Exothermic reaction
Physical and chemical reaction forms	Decomposition	Combustion
Blowing volume and emissions	The low amount of oxygen required provides minimized optimal air supply, resulting in low emissions	Excess air supply is required above the theoretical air volume for complete combustion, so the amount of exhaust gas is high in proportion to the blowing volume
Mode of the furnace	Sealed	Open
Energy recovery methods	Fuel on the gas is burned like LPG for district heating and power generation	District heating and power generation by waste heat recovery
2nd pollution	Low concentration of pollution in the exhaust gas.	Concern about 2nd order contaminants such as dioxins, heavy metals, etc
Energy supply	Synthesis gas generated by waste pyrolysis is combusted to produce secondary combustion heat	Self-combustion heat by incineration of waste
Maintenance fees	No driving decives inside the furnace causes maintenance costs to be lower than direct incinerator.	Maintenance costs increase over time

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Thank You

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