CHANGHWA ENERGY Co., LTD

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Production year : 2020

CHANG HWA
Energy Co., Ltd.

CHANG HWA

CONTENTS

GREETING

The technologies of CHANGHWA ENERGY, developed with a great deal of effort, are eco-friendly technology suitable for the low carbon period.
We have achieved mature customer satisfaction based on the technical skills that we have accumulated over time, which became the source of new development and we have established a production system by developing and manufacturing eco-friendly Complex Multi-tube boilers as the result of excellent technical development/research.
Based on such technology, we would like to provide abundant life to many people by providing high quality products at low cost as well as become the absolute needs of the world by researching and developing technologies that meet the national energy and environmental strategy.

All executives and staff members of
CHANGHWA ENERGY Co., Ltd.

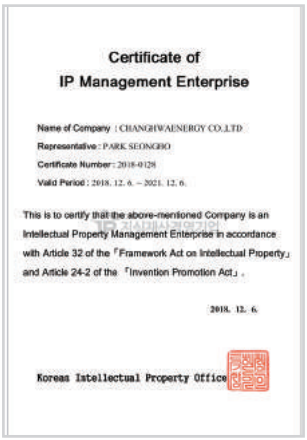
CHANG HWA

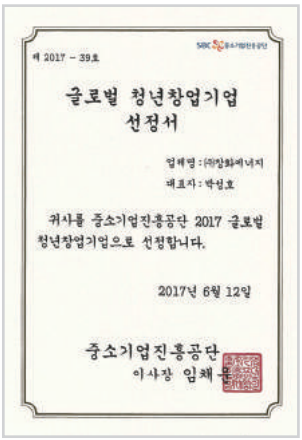
Industrial boiler, incinerator, electric boiler, electric air heater, industrial heater, dryer
Renewable fuel steam supply and power generation system, all sorts of drying equipment, all sorts of heating equipment

ABOUT CHANGHWA

About CHANGHWA ENERGY Co., Ltd.

▶ Quality management system & venture certification & intellectual property management certification





▶ Company History

1970.05	Established Ewha fan blower (Environmental equipment and fan blower)
1985.04	Changed the name of Ewha industrial machine (Environmental equipment and fan blower, production of boiler)
1995.06 / 2000.02	Ewha industrial machine (Environmental equipment, production of power generation department) Developed Complex Multi-tube boiler/ incinerator
2006.05	2006.05 SEENTEC Co., Ltd. (Agreement on generating unit, boiler department)
2010. 01	Solid fuel boiler/ incinerator system, solid fuel hot air system Developed Complex Multi-tube electric boiler (hot water, steam, hot air)
2015. 06	Established CHANGHWA ENERGY Co., Ltd.

▶ Business Field

Design and production field

Total Engineering Service based on professional design engineer

New technology due to continuous research and development

Establishment of infrastructure through specialists

CERTIFICATE

Certificate of CHANGHWA ENERGY Co., Ltd.

▶ 20 patents (including 3 trademarks and 3 PCT)



















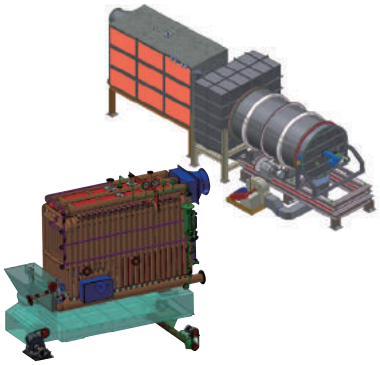

TECHNOLOGY

Holding technology of CHANGHWA ENERGY Co., Ltd.

Industrial boiler (Heating medium) LPG, diesel, etc.

Industrial wood pellet(coal)boiler

Rotary Kiln(Storker) Bumer / Incinerator Boiler



Steam turbine

Movable heater

Industrial (farmhouse) heater

Electric air blower

Small (hot water, heat, steam) electric boiler, steam car wash

Heating medium electric boiler

Complex Multi-tube boiler

Classification		Small multitube boiler			Industrial multitube boiler			
		0.5 ton/hr	1 ton/hr	3 ton/hr	5 ton/hr	10 ton/hr	15 ton/hr	20 ton/hr
Operating Pressure kg/cm^2		General data : 1~10kg/cm^2 (Special data : 20~40kg/cm^2)						
Evaporation loss kg/hr		500	1,000	3,000	5,000	10,000	15,000	20,000
Efficiency %		Not less than 93%						
Heating surface area m^2 of fossil fuel (1000℃)		36	72	215	359	720	1,080	1,440
Heating surface area m^2 solid fuel (850℃) other than SRF		41	81	243	405	801	1,213	1,620
Dimension (mm)	Width(W)	1,550	2,000	2,600	2,800	3,500	4,000	4,200
	Length(L)	2,500	3,500	4,500	5,000	9,500	11,000	12,500
	Height(H)	2,200	2,800	3,000	3,500	6,000	6,500	7,000

※ The above specifications may change according to performance improvement and site condition.
※ The efficiency and heat unit may change according to measurement error and site condition.

▶ Small multitube boiler

▶ Industrial multitube boiler

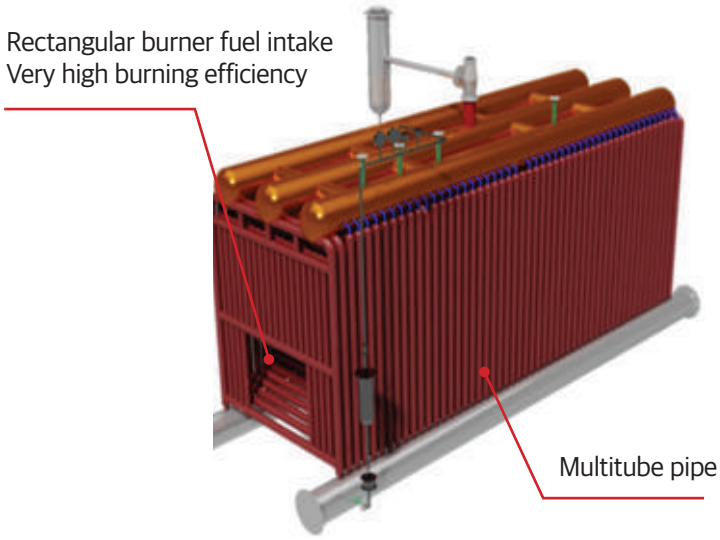
▶ Industrial wood pellet boiler

■ Main Features

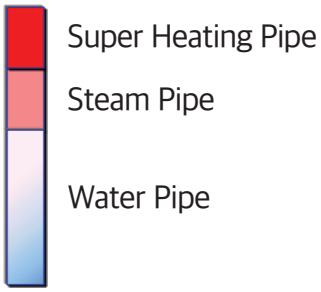
· Fast steaming: About 98% of dry steam arises within 5 minutes after ignition
· The heating surface area is more than 20% bigger and the exterior is a small highly efficient boiler
· The space of the boiler combustion chamber is a rectangular tunnel structure
· Structure suitable for new renewable fuel burner
· World's first front, top/bottom, left/right 5Ppass fuel boiler

Complex Multi-tube boiler

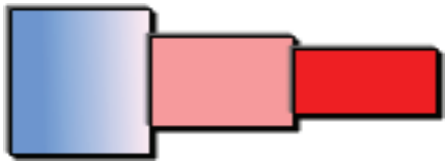
▶ Structure



Steam Drum



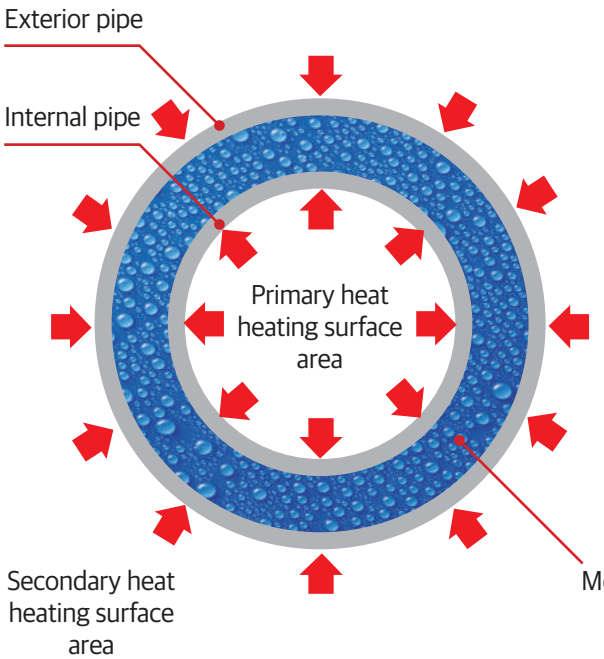
Array of steam



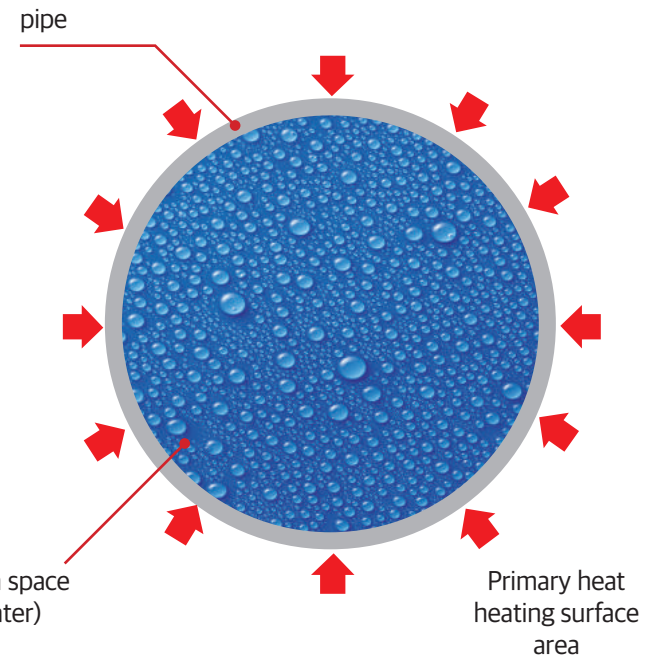
Physical dispersion Multitube method
Suitable for high temperature and high pressure

Excellent for electricity generation and high pressure

▶ Structure of multitube boiler



▶ Structure of general waterpipe boiler

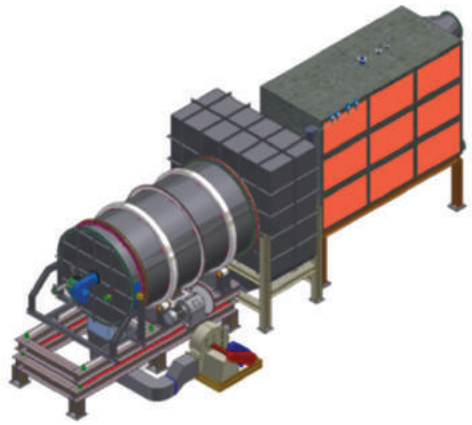


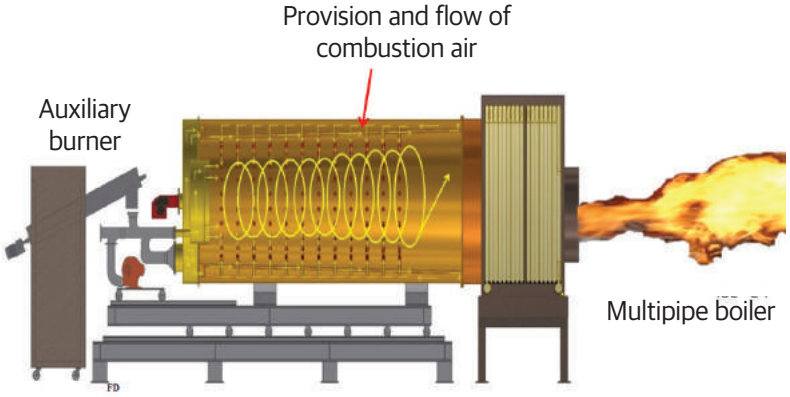
New renewable fuel burner

▶ New renewable fuel burner - Rotary Burner

Classification	Unit	Function (Specification)			Remark
		Based on 10 ton/hr	Based on 15 ton/hr	Based on 20 ton/hr	
Volume	Kcal	6,000,000	9,000,000	12,000,000	
Fuel Consumption	Kg/hr	About 1,000	About 1,500	About 2,000	Based on 7,000kal
Fuel Input Method		Air method (Access tube : ∮ 200)	Air method (Access tube : ∮ 300)	Air method (Access tube : ∮ 350)	
Fuel Type	mm	Length : 50 / Diameter : 50	Length : 50 / Diameter : 50	Length : 50 / Diameter : 50	
Power Consumption	Kw	About 60	About 85	About 100	
Initial Ignition Method	Burner	1.5 million Kcal burner	2.0 million Kcal burner	2.5 million Kcal burner	Auxiliary burner LPG or diesel
Burner installation area	mm	L9000 X W3600 X H5000	L14000 X W3800 X H5400	L16000 X W4500 X H6000	

※ The above specifications may change according to performance improvement and site condition.
※ The efficiency and heat unit may change according to measurement error and site condition
※ Input quantity may change depending on the heating value



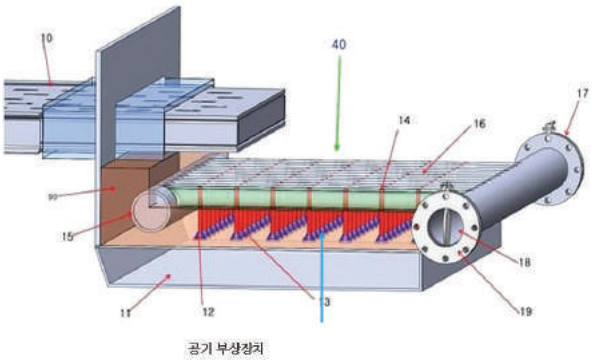


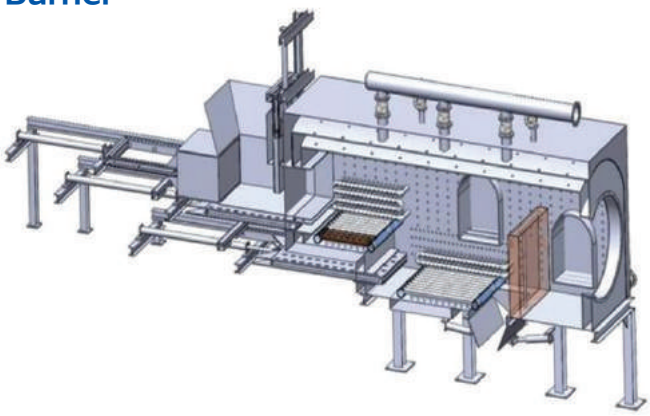
■ Major Features

- The exterior and method is similar to the rotary kiln but the function and performance is very different
- Reduces facility cost because the equipment size is more than 50% smaller
- Can freely control heat energy

New renewable fuel burner

▶ New renewable fuel burner - Stoker Burner





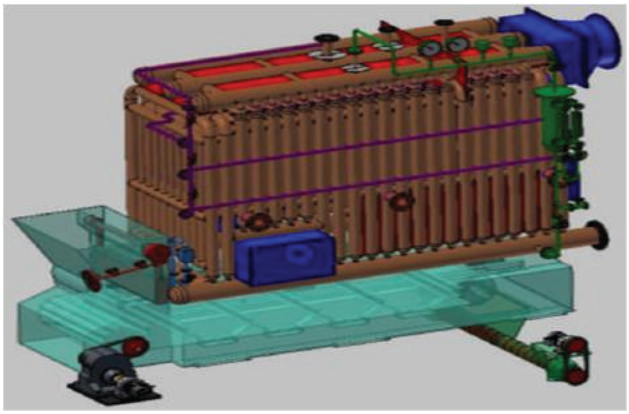
Grate burner

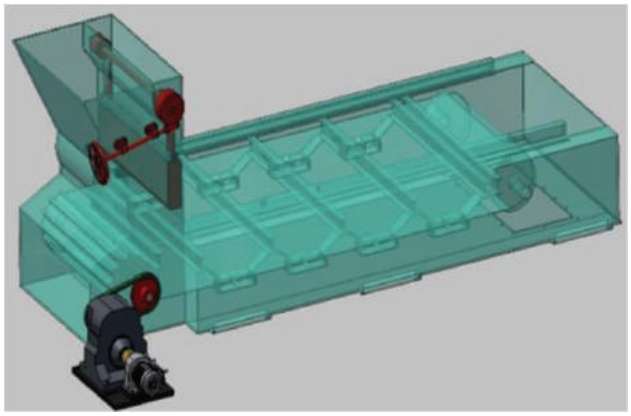
Used fuel : RPF, WOOD, waste fiber, synthetic resins

■ Major Features

· Various solid fuels can be combusted at the same time with one burner
· Small occurrence of clinker and ash
· Low maintenance cost and excellent durability

▶ New renewable fuel burner - Coal(Pellet) Feeder





Coal(Pellet) Feeder(Chain Stoker)

■ Major Features

· Prepared with perfect combustion conditions
· Long combustion gas residence time
· Provide fixed pellet
· Automatic screw ash handling equipment
· Excellent at removing sludge foreign substance and ash

Classification	Unit	Function (Specification)	Remark
		2ton / Basis	
Volume	Kcal	1,200,000	
Heat transfer area	m^2	3.1	
Fuel Input		FEEDER method	Chain stoker
Fuel Consumption	Kg/hr	About 350	Based on 4,000kcal
Consumed Fuel	mm	Wood pellet, wood chip	
Initial Ignition Method	Burner	1.5 million Kcal burner	Auxiliary burner (Other than diesel)
Burner Specification	mm	4400 X 1500 X 1400	

※ The above specifications may change according to performance improvement and site condition.
※ The efficiency and heat unit may change according to measurement error and site condition.
※ Input quantity may change depending on the heating value.

Industrial (Pellet, Coal) Multitube Boiler

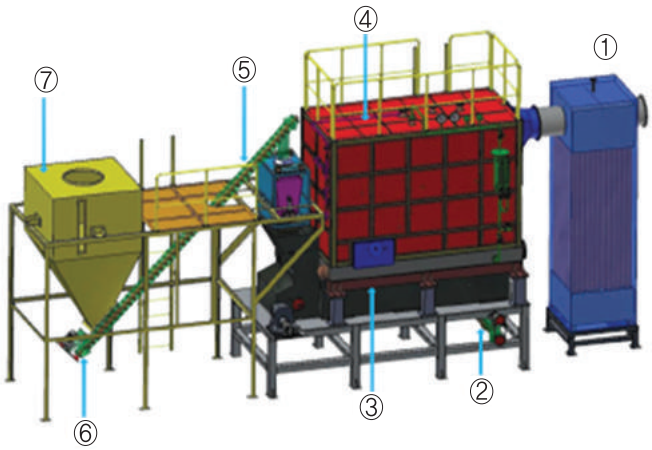


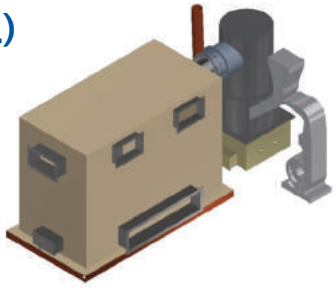
Diagram of Multitube Boiler

① Air preheater (Coal economizer)
② Ash handling equipment
③ Fuel (Pellet) transfer system
④ Double pipe boiler
⑤ Fuel provision measuring equipment (Load Cell)
⑥ Fuel supply equipment
⑦ Pellet Hooper

Industrial Heater



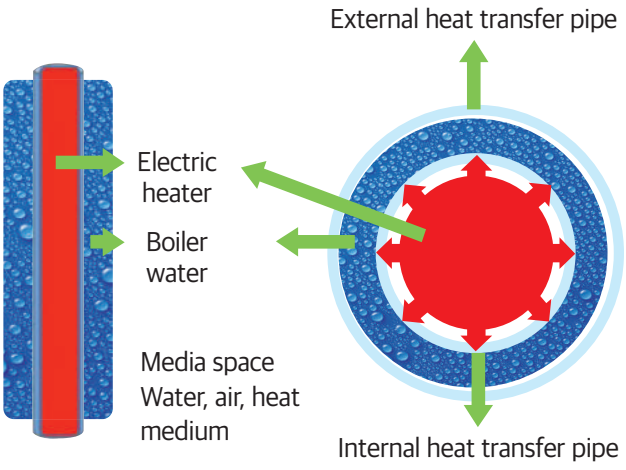
Industrial Use (Uses fuels such as oil (gas), coal, pellet, etc.)



- High value added industrial (farmhouse) use heater
- Stable provision of heat
- Saves energy with low cost and high efficiency
- Stable operation control
- Advanced concept eco-friendly heater
- Convenient repair and easy method of use

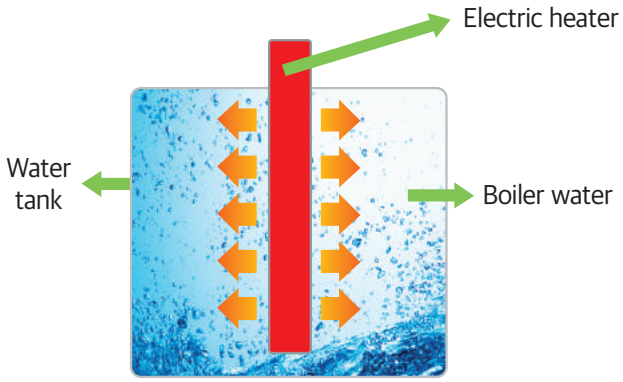
Electric Boiler

▶Structure of Complex Multi-tube electric boiler



- Utilize indirect heat with multipipe structure using only multiple heat exchange pipes
- Quickly heat water that moves through the thin gap between multipipe(There is no risk of short circuit, easy repair and no scale)

▶ Structure of general electric boiler



- Integral method of inputting electric heater within majority of wet pit
  Fast scale occurrence, risk of short circuit

▶ Multipipe electric boiler (hot water, Heating transfer medium Oil, heating)

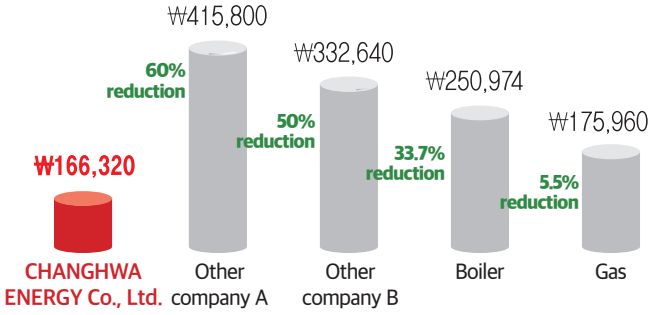
- Convenient repair and easy use due to indirect heating method
- Can be freely used with small amount
- There is no scale on the heater and the boiler is formed using only various heat exchange pipes
- Provides heat in a short period of time
- Saves energy with low cost and high efficiency
- Safe operation control with no risk of short circuit
- Cheap progressive tax when using sunlight for 3kw boiler
- Addition of 15% of fuel is saved compared to before when using heat transfer oil for heating water and there is no risk of freezing burst and fire

Classification	Small multipipe electric boiler (Make separate inquiries for boilers of large capacity)					
Heater power consumption	3KW	4KW	5KW	6KW	7KW	8KW
Heater calorific value(Kcal)	2,580	3,440	4,300	5,160	6,020	6,880
Heating area(m^2)	49.5	56.1	72.6	82.5	92.4	105.6
Power	220V				220V / 380V	
Specification	580 x 320 x 600	620 x 320 x 620	650 x 380 x 640	660 x 450 x 660	660 x 450 x 680	660 x 450 x 680

▶ Economical analysis summary

Classification		Amount of use		
		Party headquarters	Other company A	Other company B
Heating Standard	Power Consumption / Consumption	6KW	15KW	12KW
	Heating Standard Area	79.2m^2		
	The operation rate is about 70% based on 12 hours	50KW	126KW	101KW
Unit Price (Applies general electric charges)		110 KRW/KW	110 KRW/KW	110 KRW/KW
Daily Payment		5,544 KRW	13,860 KRW	11,088 KRW
Monthly Payment (30days)		166,320 KRW	415,800 KRW	332,640 KRW
Yearly Payment		1,995,840 KRW	4,989,600 KRW	3,991,680 KRW

▶ Monthly Payment (30Days)



- Twelve hours per day, based on 22 ~ 24 Pyeong (72.6~79.2m^2)
- Comply to the insulation condition prescribed by the heating efficiency building act
- Usage standards of general electricity (progressive tax is applied for home use)
- The heating area may vary depending on the external environment factors such as installation condition, area, insulation condition, house structure, etc.
- In the case of general house use, an increase of electric charge may occur due to application of progressive tax.

▶ Application field

· Installation other than Yangpyeong and Gyeonggi-do




· Other churches






· Many others

▶ Multitube electric steam boiler and steam car wash

· Can be freely used with small amount
· There is no scale on the heater and the boiler is formed using only various heat exchange pipes
· Occurrence of steam is fast (4~5 minutes after ignition) and 98% of dried steam arises
· Continuous injection of steam
· Safe operation control with no risk of short circuit
· High temperature and high pressure available
· Convenient repair and easy use due to indirect heating method
· Save energy with low cost and high efficiency

Classification	Complex Multi-tube electric boiler (Make separate inquiries for boilers of large capacity)					
Heater power consumption	3KW	5KW	8KW	12KW	15KW	20KW
Heater calorific value(Kcal)	2,580	4,300	6,880	10,320	12,900	17,200
Rated evaporation loss (Kg/hr)	5	7.5	12	18	22.5	30
Power	220V/380V					
Specification	Make separate inquiries for specification (Order production and size development are available)					

Heating medium electric boiler

▶ Small size

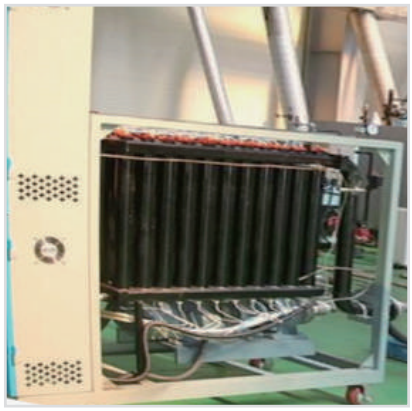
▶ Semi middle size

▶ Middle size

■ Major Features

- Forms a boiler using only multiple heat exchange pipes
- Occurrence of temperature is very fast because it moves through the thin gap between multipipe
- Advanced concept eco-friendly heater
- Convenient repair and easy use due to indirect heating method
- Saves energy with low cost and high efficiency

Complex Multi-tube electric Heating medium boiler (10KW~300KW)



Application Field

Public bath

Korean dry sauna (Jjimjilbang)

Water screen cultivation farm

Tropical crop farm

Flower farm

Electric heater

Electric heater integrated with multitube electric boiler

- Fan heater is installed on the structure of the electric boiler, which allows 1KW 5 Pyeong heating, meaning it can be used in offices, factories, homes, lounges, churches, temples, agricultural vinyl greenhouses, etc.
- The existing electric heater burns oxygen the atmosphere with direct heating method by directly heating the heat heater, which leads to headache due to lack of oxygen when used for a long period of time in limited space.

- It is an advanced concept heater that uses multitube heat transfer oil boiler of indirect heating
- The control and the operation are very easy due to the fully automatic room temperature automatic control adjusting device
- Creative energy reduction system that is absolutely different from the structures of basic heaters
- Indirect temperature of more than 70℃ for heating and drying is available
- There is absolutely no risk of fire because it uses indirect heating method
- There is no risk of short circuit and it is convenient to repair as well as easy to use

※ The hot air temperature and the thermal efficiency are high because the heat that has been provided through the heat exchanger with heat transfer oil that has been heated through the heat transfer oil boiler is injected with air through the fan blower, which makes a structure of providing hot air by making a whirl.

Economic power and effect

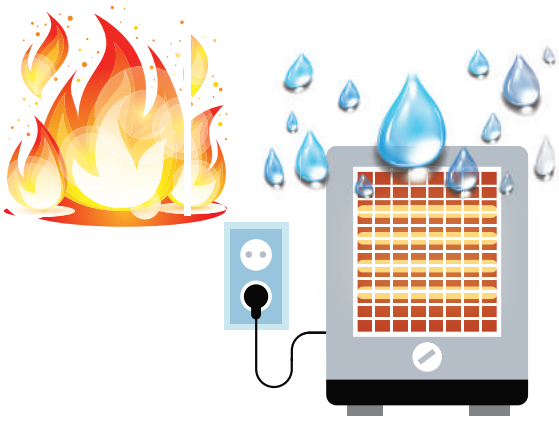
In terms of efficiency, the existing electric hot air blower covers 3Kw within 6 Pyeong but 3Kw can cover more than 15 Pyeong when replaced with our company product. Since this product uses indirect heating method instead of direct heating method, there is no need to burn oxygen in the atmosphere and has excellent efficiency because it maintains the humidity in the atmosphere.

By Model	Unit	EHA-3	EHA-5	EHA-7	EHA-10	EHA-12	EHA-15	EHA-20
Heating area	m^3	72.6	105.6	148.5	214.5	264	330	445.5
Used power	V	220/380						
Electric heater	Kw	3	5	7	10	12	15	20
Caloric Value	Kcal	2,580	4,300	6,020	8,600	10,320	12,900	17,200
Heat transfer oil pump	Kw	0.2	0.2	0.3	0.75	1.5	2.2	3.5
Air flow rate	m^3/min	16	28	42	56	116	167	223
Motor	Power	1/2	1/2	1	2	5	7.5	10
Specification	mm	W350 L700 H700	W350 L800 H700	W400 L900 H800	W400 L900 H900	W450 L1000 H1000	W500 L1000 H1100	W600 L1200 H1200

※ The external measurement may be change without any notice for performance improvement.

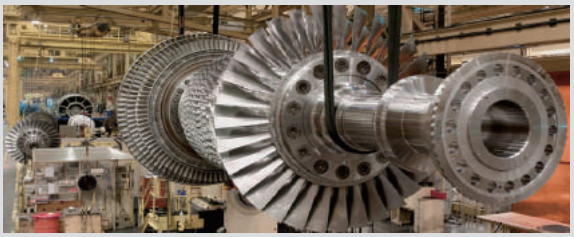
- The electric capacity may vary according to the area.
- The heating area may vary according to external environment factors such as installation condition, insulation condition, etc.
- Please refer to the party headquarters for inquiries about electric boilers with no specifications

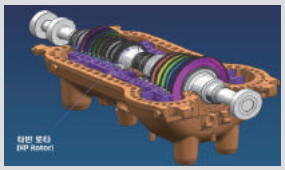
▶ The new item released by our company does no burn oxygen in the atmosphere even when operated for a long time because it uses the indirect heating method and it is an eco-friendly product because it heats while maintaining the existing humidity. In addition, it is suitable for vinyl greenhouses, as it does not affect the plants even if the air in the atmosphere is produced by hot air.

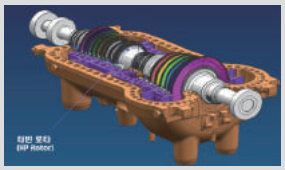


Steam turbine

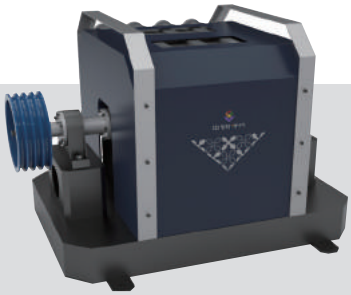
▶Technical comparison







Downside of existing turbine blade turbine
High-flying, high pressure, high temperature, low efficiency

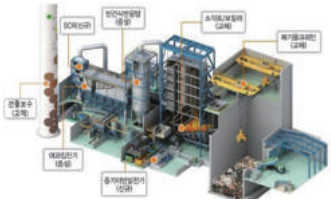


- Continuous use without waste of used fluid
- Technology that meets high efficiency conditions without fluid resistance in the fluid operation circulation CYCLE
- Designed to ease the production of fluid equipment
- Designed to guarantee excellent durability
- Stable use
- Extensive use technology that is easy to produce from small sizes to large sizes

▶Entry of application market

Surplus steam in each power plant in Korea

Waste incineration plant steam boiler



Other than paper-mill (laundry) (Using remaining heat of steam)

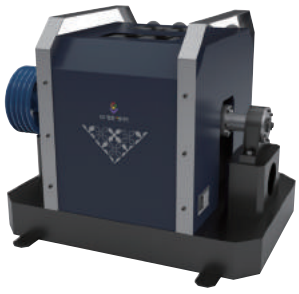
Wood pellet and coal boiler power generation

▶Excellence

Existing turbine	Remark	Multi-stage turbine
High temperature and high pressure	Temperature, pressure	Low temperature and low pressure
Big	Pressure, temperature loss	Small
Big	Pressure head	Small
Big	Input of steam	Small
Big	Thermal head	Small
Big	Volume	Small
High capacity	Appropriate capacity	Small capacity
High price	Production Cost	Low price
Frequent	Occurrence of A/S	Small

Efficiency ↑ Production Cost ↓ A/S ↓
Compared to the Existing Turbine

▶50KW/H~1000KW/H



Working pressure	Working temperature
16kg/cm^2 ~ 20kg/cm^2	220°C ~ 240°C
Amount of steam	**Amount of power**
0.5Ton/h	Within 80Kw

※ Make separate inquiries for each capacity

Collaborative Technology

▶ High efficiency environmental equipment system

- Equipment to prevent the discharge of which leads to air pollution
- High efficiency system
- High stability and durability
- Low initial equipment and operation costs
- Low maintenance cost

Classification	Unit
5ton	Standard amount of gas : 11,480 Nm^3/hr
10ton	Standard amount of gas : 23,000 Nm^3/hr
15ton	Standard amount of gas : 34,925 Nm^3/hr

※ Equipment production under the requirements of the customer is available

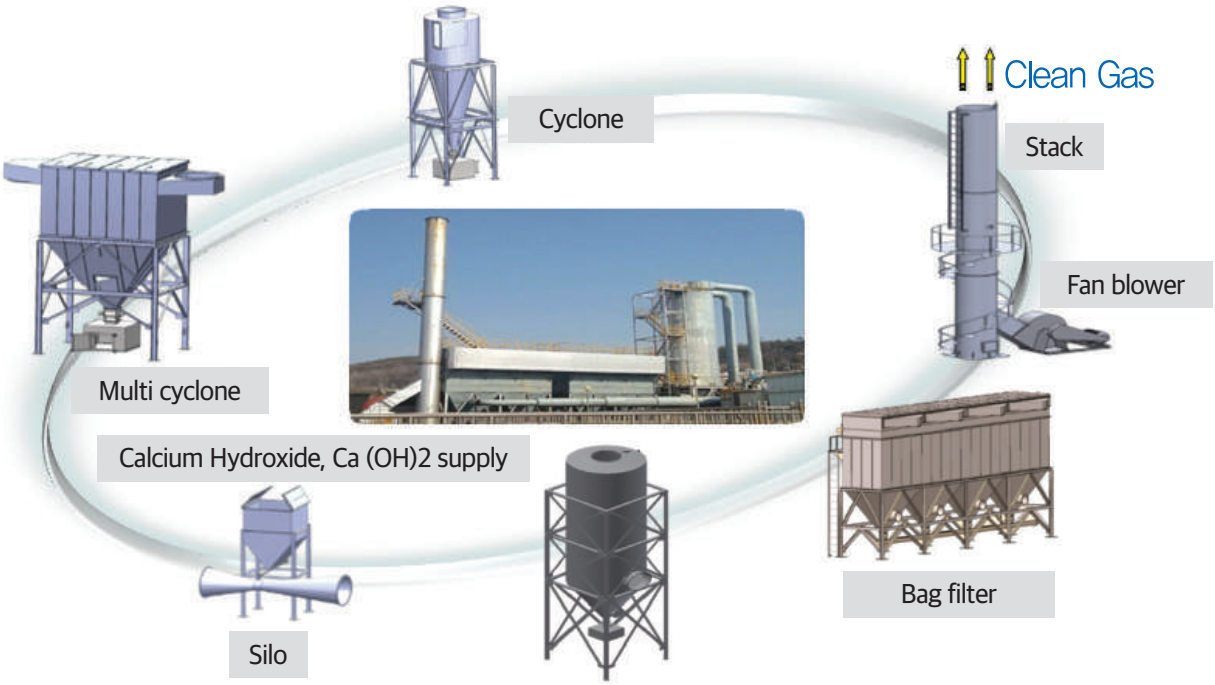


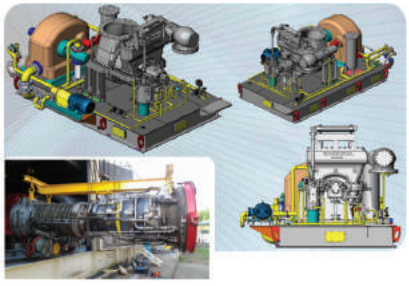
Diagram of environmental equipment system

▶ Steam Turbine Generator

Steam Turbine - Comdensing

Steam Turbine - Back Pressure

Steam Turbine - Multistage/Back Pressure

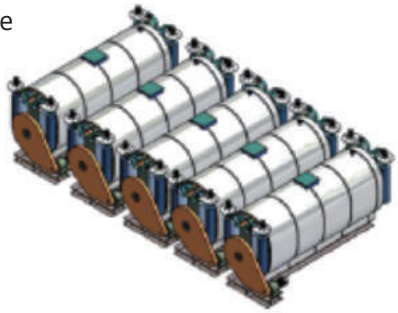


▶ Low temperature combined drying system

■ Advantages of the equipment

· Minimizes discharge of odor due to internal air sealed circulation method
· There is no emission of pollutants during drying due to indirect thermal method
· Reduces cost by using new renewable fuels (RPF/ wood pellet) burner and boiler
· Handles 10ton of dry matters with 0.5ton of steam or electricity within 200KW/h
· Controls the drying capacity to large capacity by multiplying the drying system capacity

· Food waste
· Agriculture and fishery by-product and waste
· Dyeing and leather wastewater sludge
· Chemical wastewater sludge
· Sewage, livestock sludge
· Other organic waste

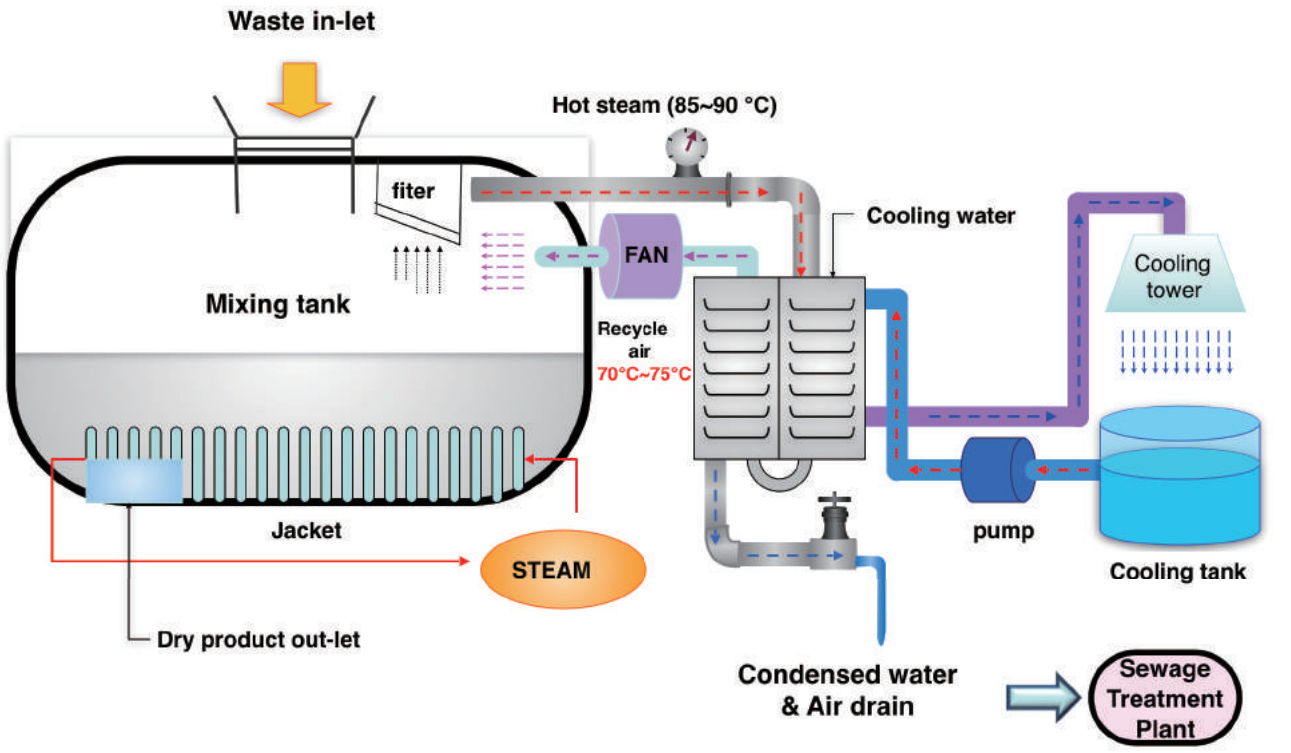


Small capacity: NMT 500kg/10h

Large capacity: NLT 10ton/10h

The drying capacity can be controlled (100ton/ 10h is possible)

Dryer Structure



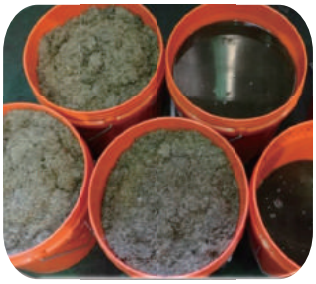
Comparing Before and After Drying


Before drying food waste sludge


After drying food waste sludge

Before drying
animal carcass

After drying
animal carcass



Before drying
salted seafood waste

After drying
salted seafood waste

Small steam supply and power generation

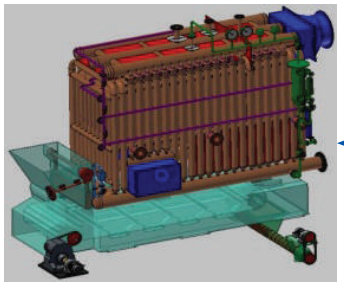
▶ Business contents

· Objective : Small cogeneration 1MVA Mini-Coal (Pellet) Power Plant Relocatable Compact Type

· Contents : We are an eco-friendly business that saves existing energy costs and meets the national policy of low carbon green growth with electricity generation by establishing steam supply system that supplies continuously for 24 hours.

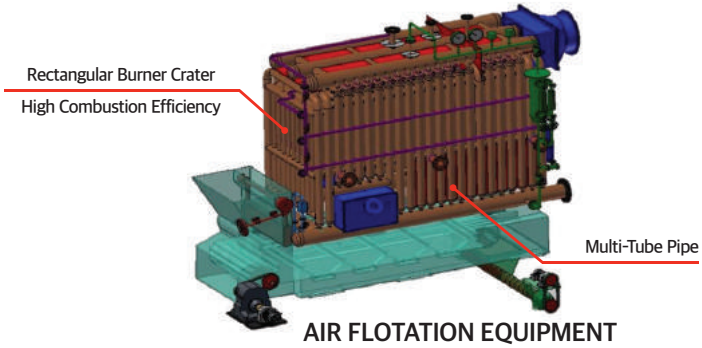
Industrialization

Complex Multi-tube boiler system → Steam supply → Electricity generation



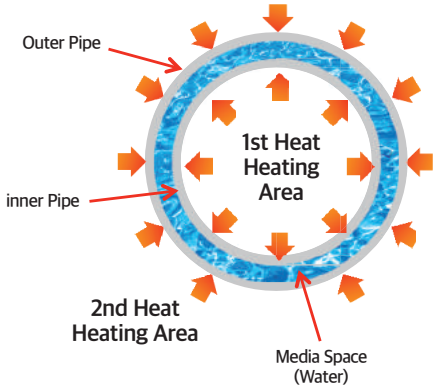
Exclusive combustion boiler — Operation at all times — Fuel supply (Coal, Pellet)

Multi-Tube Boiler

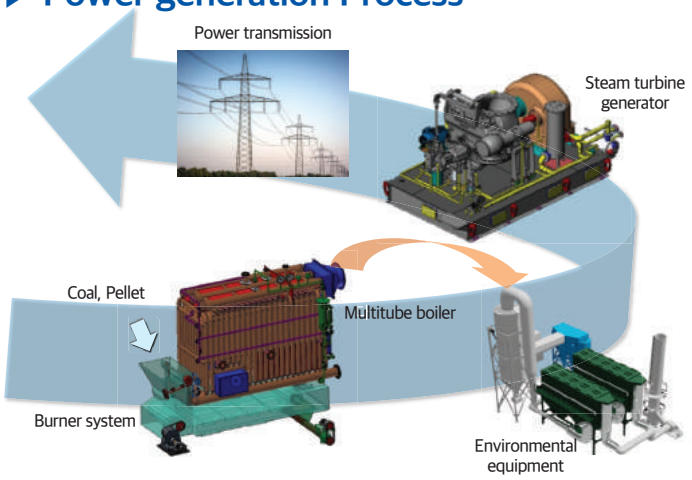


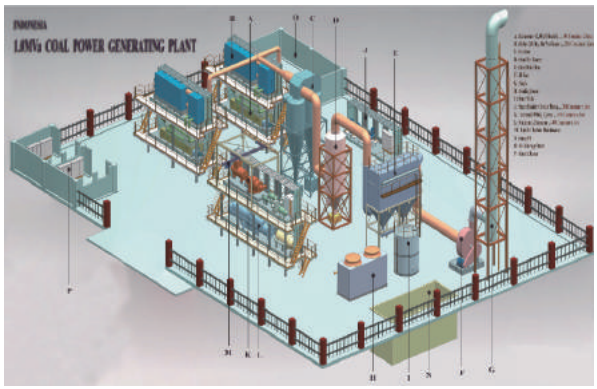
AIR FLOTATION EQUIPMENT

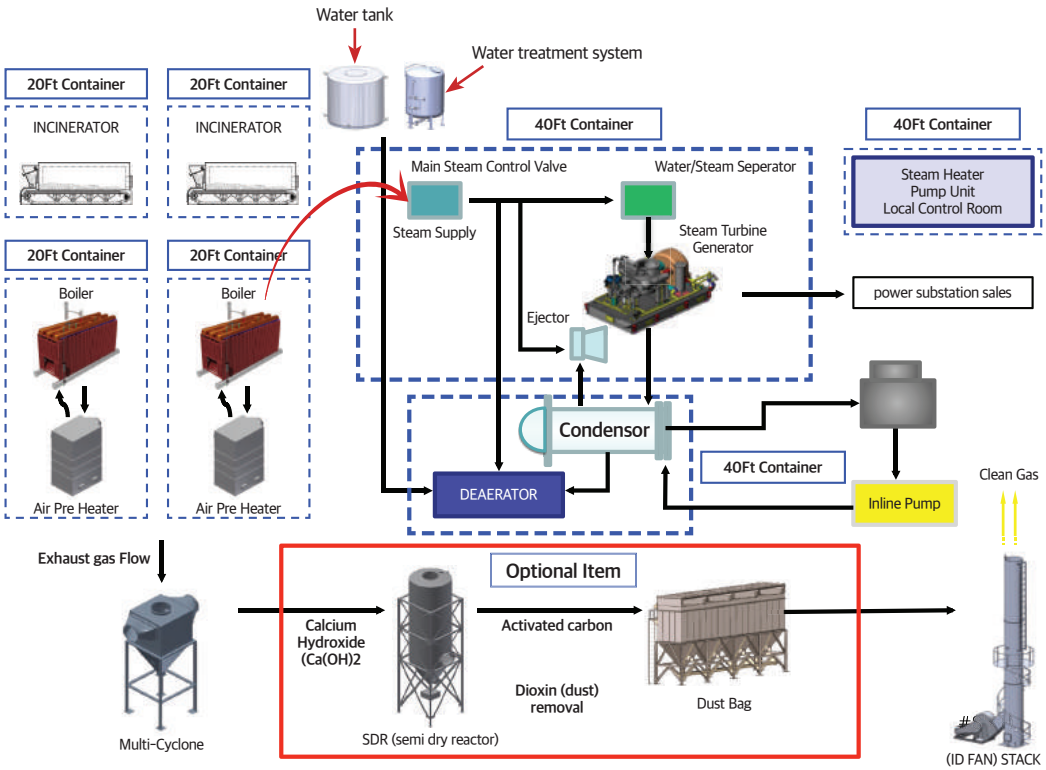
Feeder(Chain Stoker)



Power generation Process

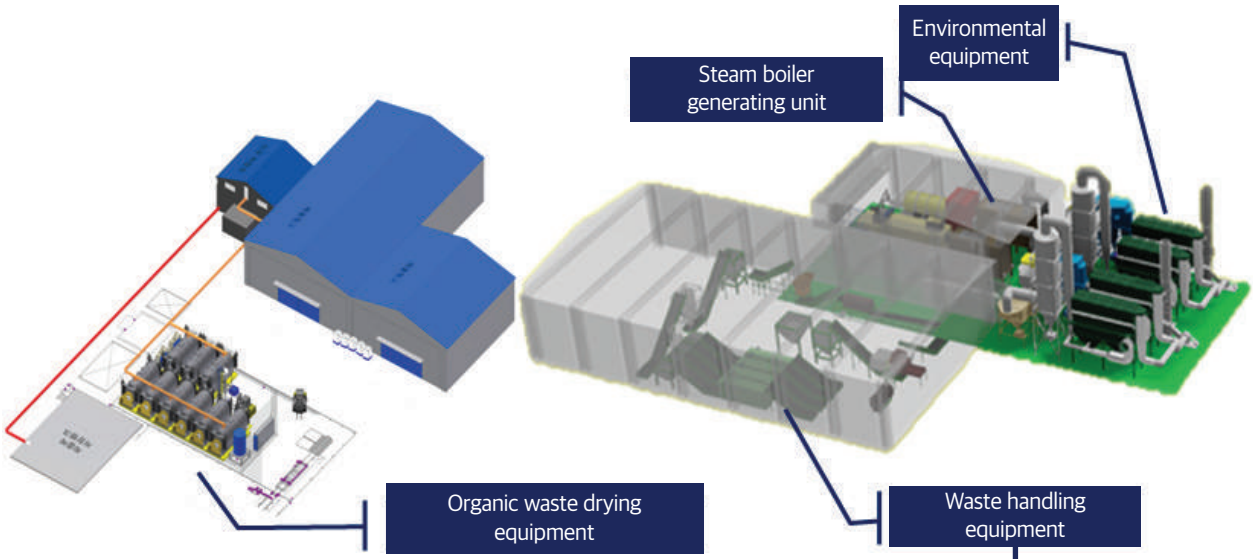


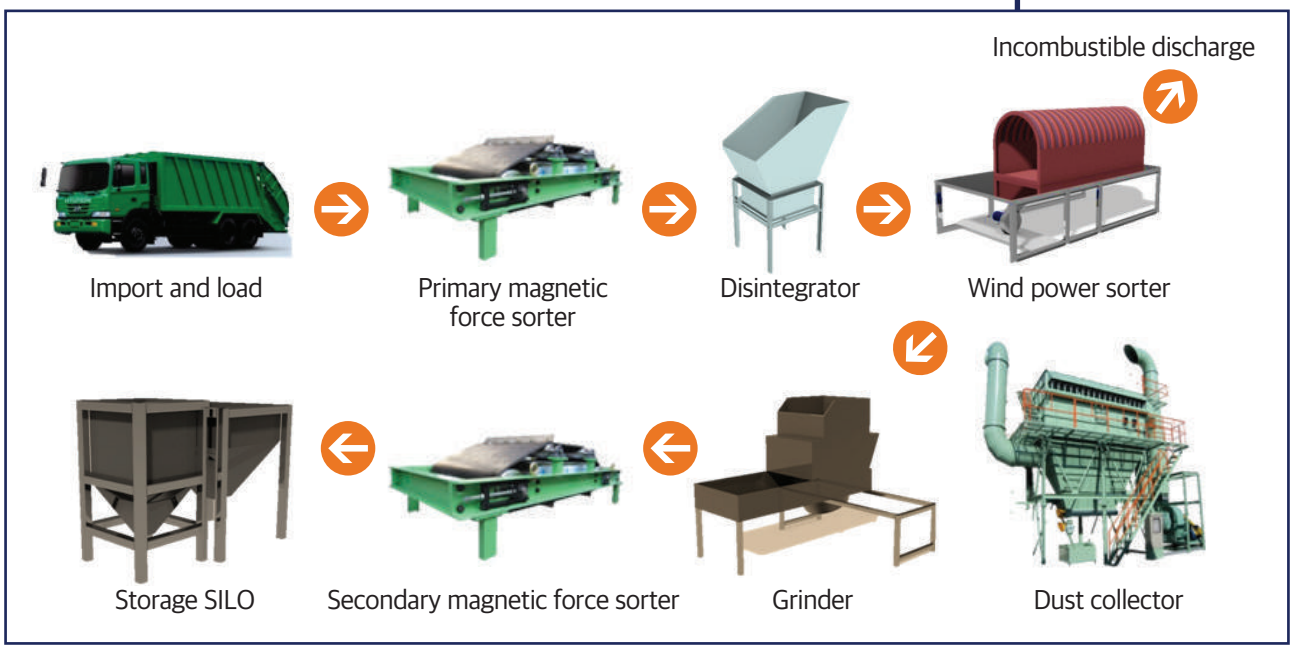




※ The specifications above may be changed for performance improvement
※ The design may be changed depending on site conditions

Combination System





■ Major Feature

- Drying of waste using incinerator-generated steam
- Blocking the source of leachate by drying waste
- Generation of fuel for combustion by drying waste and handling thermal decomposition
- Increase incineration and boiler thermal efficiency with high heat value regeneration fuel (NLT 80%)
- Various waste handling available: livestock excretion, dead livestock, food waste, sludge, etc.

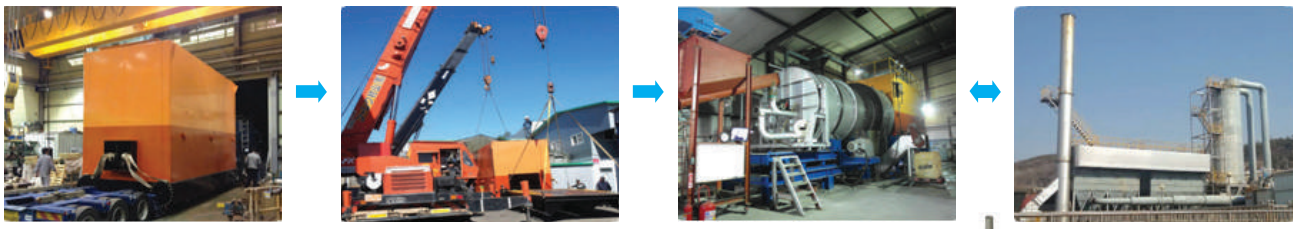
Facilities Air View

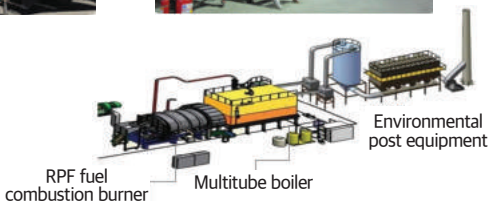
APPLICATION CASE

Cases about technology application of CHANGHWA ENERGY Co., Ltd.

▶ Steam sales business

Cases about installation & operation of steam sales business of new renewable fuel (RPF) combustion system(Steam sales capacity - 10ton/hr)





▶ Equipment production installation & construction field production

▶ Laundry plant

▶ High efficiency hot air system for ship block paint drying room

▶ Movable high efficiency heater

▶ Waste sludge drying plant