

Development of MSW Incineration Technology in China & Application of Tus-sound MSW Incineration Technology

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1

Present Situation of MSW Incineration and Power Generation in China

1. Present Situation of MSW Incineration and Power Generation in China

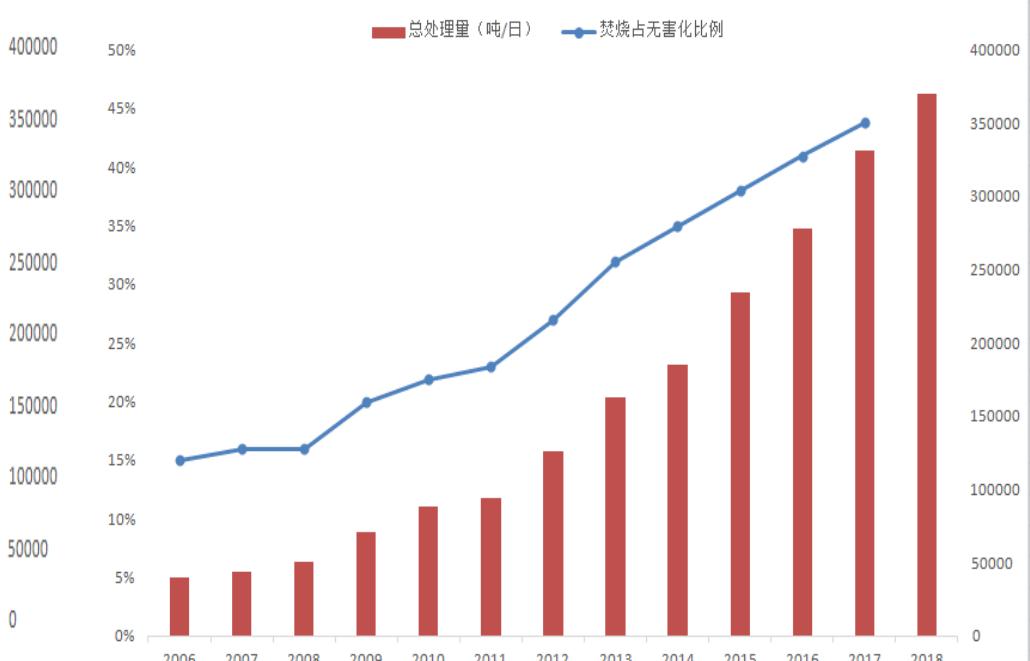
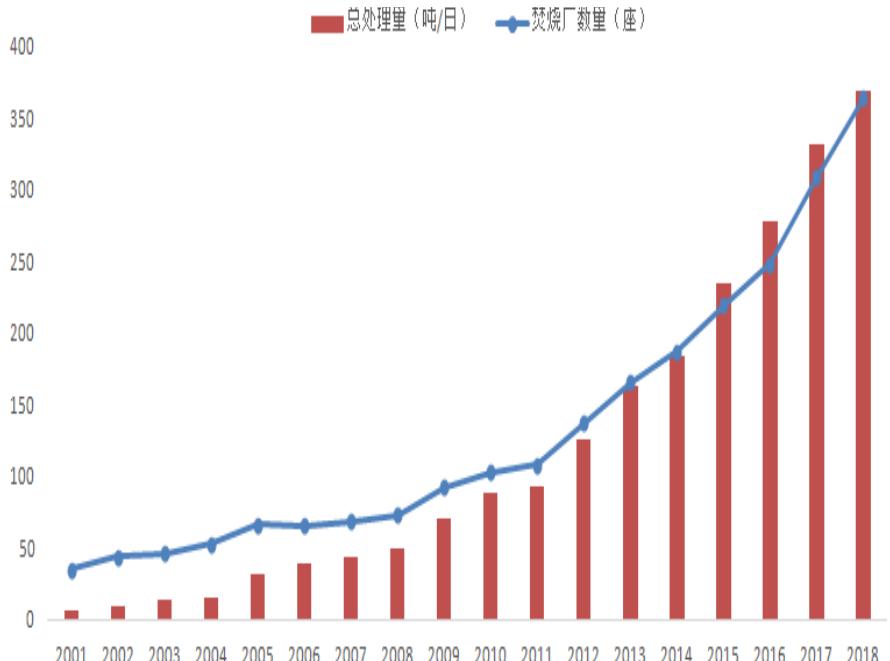
Since the 1960s, with the progress of waste incineration and flue gas treatment technology, domestic waste incineration power generation has been developed and popularized in Europe, North America and Japan.

China's first incinerator was built by Shenzhen Municipal Government in 1986 by introducing Japanese Mitsubishi heavy Industry equipment and technology. It was not until 2000 that the cause of waste incineration power generation in China really started, and grew rapidly and developed rapidly. Through the introduction of foreign advanced incineration equipment and technology digestion and absorption, the domestic has gone through the stage of industrialization research and development, localization of the plant and so on.

By the end of 2018, a total of 364 MSW incineration projects had been completed and operated throughout the country, with a disposal capacity of 370000 tons per day.

The National Plan for the Construction of innocuous treatment facilities for Municipal solid waste disclosed in the 13th five-year Plan that the proportion of incineration and disposal capacity of domestic waste will reach 54% by the end of 2020. In 2020, the national waste incineration capacity will reach 59.14 million tons / day;

According to the average investment of 500000 CNY / (ton / day), the space of the new MSW incineration market in the past two years is about 110 billion CNY.



2. Present situation of Domestic investors in Waste Incineration

1. Fierce competition among investors in waste incineration in the market

- Several waste incineration investors have their own incineration technology. For example : China Everbright International Ltd.,Chongqing Sanfeng,Tus-sound,Shanghai Environment,Wenzhou Weiming,GZ Environment Protection Investment Group Co., Ltd.,Shenzhen Energy,DYNAGREEN,Tianying and so on;
- The original equipment suppliers have also entered the field of incineration investment one after another. For example : Hangzhou New Century Energy Environmental Protection Engineering Co., Ltd.,Shanghai SUS Environment,Wuxi Huaguang Boiler Co., Ltd.,Fujian LongKing and so on;

2. Reducing construction costs and achieving sustained and stable development

- Get rid of the constraints of equipment prices and services by suppliers, and save 10% and 20% of the construction procurement cost;
- Set up your own debugging and running team, late debugging and running can be completely independent.
- The competition in garbage power generation market is becoming more and more fierce, and the subsidy fee is getting lower and lower. We can master the core technology of waste incineration and power generation, so that we can develop continuously and steadily in waste incineration industry.

3. Development Trend of Waste Incineration Power Generation in China



1) The environmental protection supervision policy is constantly strengthened, and the policy system is constantly improved to support the sustainable development of the industry;

2) The level of environmental protection continues to improve;

Under the condition that the emission standard is becoming more and more strict, the environmental protection standard of waste incineration power generation has been continuously improved. All the waste incineration power generation enterprises have taken advanced environmental protection measures to reduce the emission of pollutants, and some local standards have been close to or higher than those of the European Union and so on.

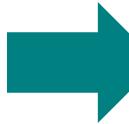
3) The technical level continues to improve;

Garbage collection and transportation device, grate furnace, medium temperature sub-high pressure boiler, flue gas ultra-low emission and other equipment and technology gradually localization, the overall technical level basically reached the international advanced level;

4) With the continuous improvement of industrial agglomeration, incineration enterprises will face multiple pressures, such as improving standards, low price competition and cost enhancement, so enterprises must take the road of "high quality".

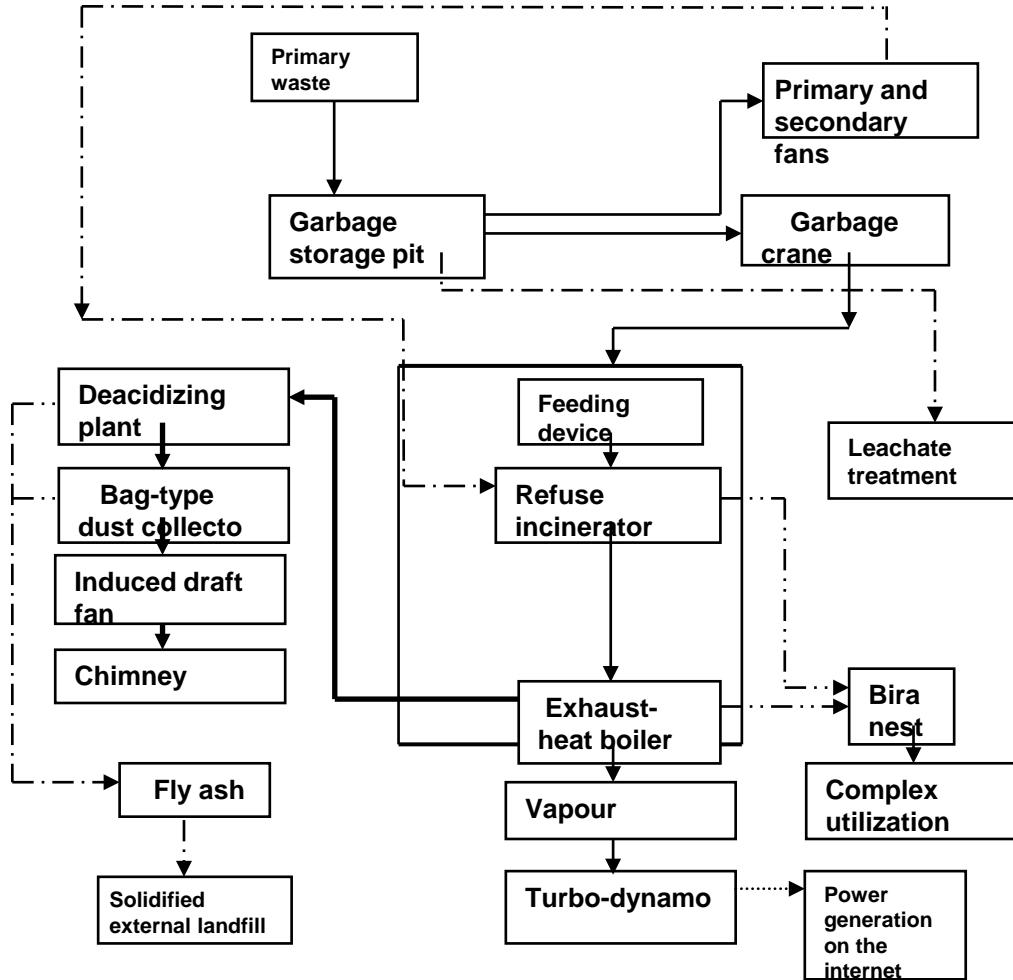
5) Enterprises realize the development of "going out";

Waste incineration power generation enterprises are also gradually moving towards the "Belt and Road Initiative" country, realizing the "going out" development of technology and production capacity.

 2

Development of MSW Incineration Technology in China

Flow chart of domestic waste incineration power generation process



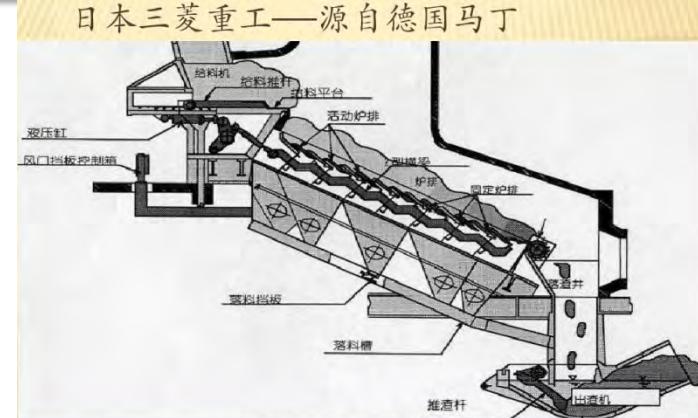
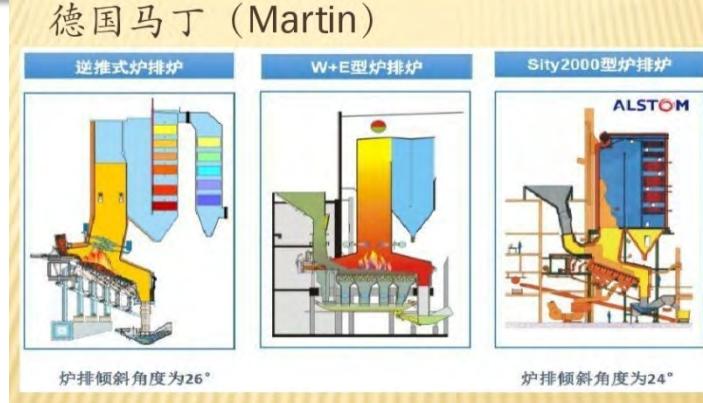
MSW incineration power generation system mainly includes:

1. Incinerator system (more than 80% of grate)
2. Exhaust-heat boiler system
3. Flue gas treatment system

1.1 Introduction of grate furnace technology in foreign countries

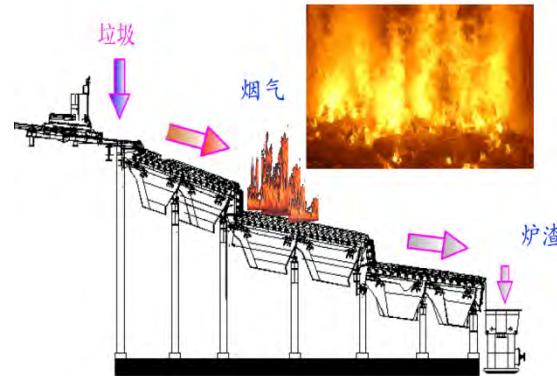
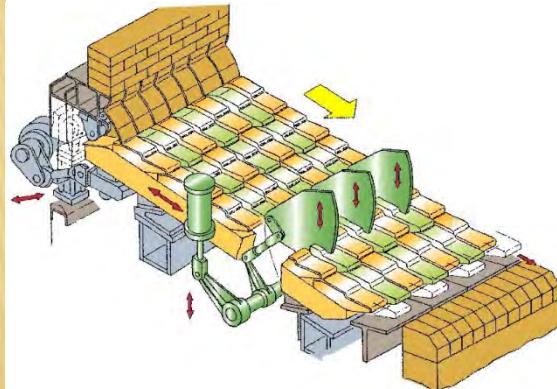
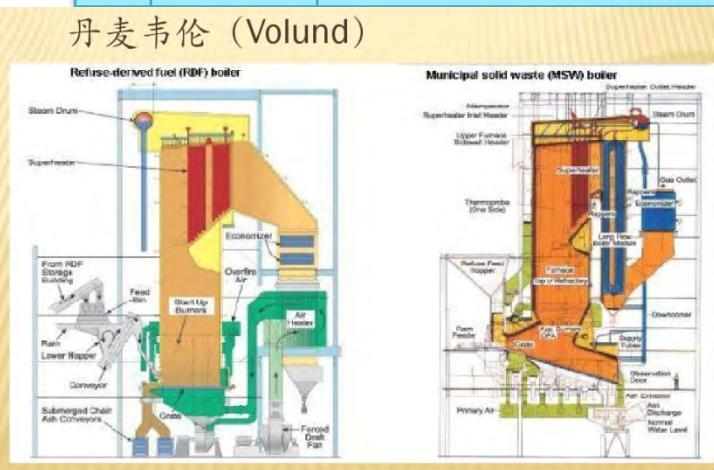
Introduction of Incineration Technology in Foreign countries

order number	corporate name	Sources and characteristics of technology	Domestic performance
1	Martin, Germany	The grate technology is characterized by backward push reciprocating grate (Martin is 26 degrees, SITY2000 is 24 degrees), which is composed of fixed grate and movable grate alternately. The movement direction of grate is opposite to that of garbage.	Martin has a number of projects, such as: Shenzhen Qingshui River, Zhongshan, Beijing Lujiashan, Laogang Phase II, Shanghai Jiading, etc.
2	Mitsubishi, Japan	Mitsubishi heavy Industry has been engaged in the construction of waste incinerator since 1964. In the 1970s, it became a partner in Martin Asia, Germany, and acquired German Martin technology.	

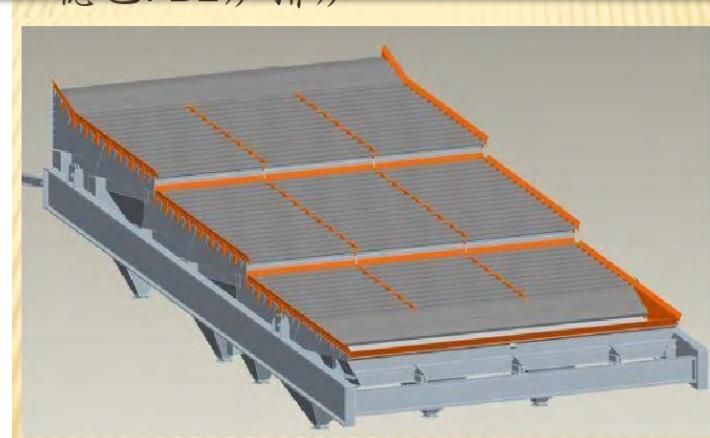
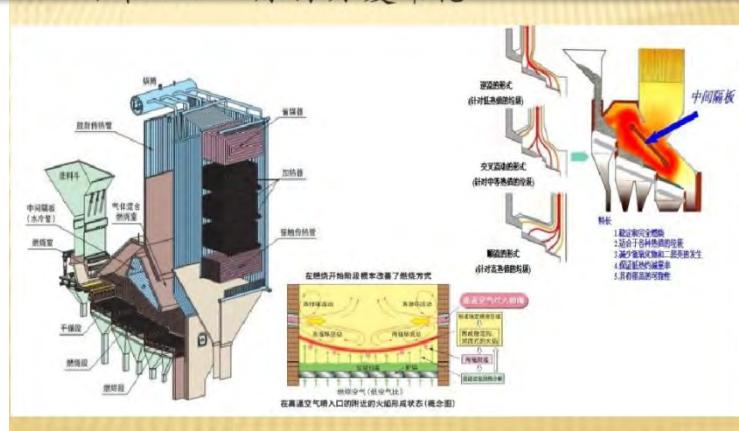


3	Volund, Denmark	<p>Volund, Denmark, firstly developed push grate technology; Authorized to Swiss Von Roll and then transfer to Hitachi Zosen in 1938;</p> <p>Japanese JFE obtained technical authorization from Weilun, Denmark, in 1970s.;</p> <p>The Weilun incinerator in Denmark is a three-stage forward push compound with a tilt of 15 °.</p>	Guangzhou Likeng Phase II and other projects in Guangzhou
4	Hitachi Zosen Corporati on	<p>Hitachi Zosen is authorized by Swiss VonRoll technology. The L-type is three-stage forward 15 degrees, which is interlaced with fixed and active columns, and the R-type is three-stage forward 18 degrees / 0 degrees, which is interlaced by fixed rows and active rows.</p>	Chengdu Luo Belt, Tianjin Binhai, Western Xiamen, Old Port Phase I Dalian Project, etc.

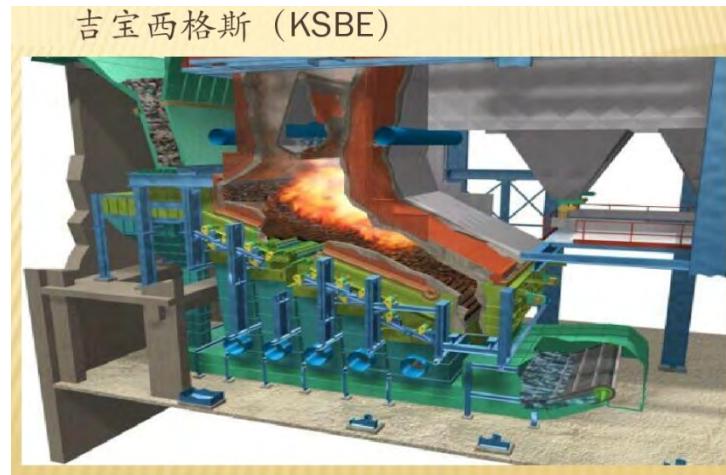
Hitachi Zosen L and R



5	Japan JFE	<p>Japanese JFE grate furnace technology was imported by Danish Volund Company in 1970. At the same time, JFE (Hyper Stoker) super reciprocating grate was developed by itself. The drying section and combustion section are tilted down by 10 degrees, and the horizontal arrangement of burnout section is carried out.</p>	<p>Shandong Qingdao, Shanghai Jinshan basically out of China at present.</p>
6	Germany FBE (Stan Miller)	<p>The company is formed by the integration of three waste incineration technology companies. The three-section and three-section of the grate of the grate are all 12.5 degrees, and the working condition adjustment can be carried out according to different garbage components and different garbage heat values.</p>	<p>Shanghai Jiangqiao Ningbo Fenglin Anhui Hefei Beijing Haidian and so on</p>



7	KSBE	<p>KSBE began to engage in waste incineration and disposal in 1985, and currently has more than 140 factories in Europe and Asia. The grate control system, which is separated by KSBE incinerator transportation action (horizontal motion), turning stirring and ventilation action (vertical motion), has strong applicability to garbage.</p>	<p>Tianjin Guanzhuang, Shenzhen Baoan, Nanshan, Jiangsu Suzhou, Jiangyin, Changzhou and other Everbright International and Deep Energy owner projects;</p>
8	Ehara, Japan	<p>In the early stage of Ehara in Japan, the fluidized bed waste incineration technology was made, and then the grate incineration technology was developed and popularized in Japan and China. The original grate is a three-stage push grate and a three-stage grate horizontal arrangement.</p>	<p>Application of Shanghai Environmental projects such as Weihai, Shandong, Nanjing, Jiangsu Province, Zhangzhou, Fujian Province, Songjiang, Shanghai, etc.</p>



1.2 Introduction to domestic grate furnace technology

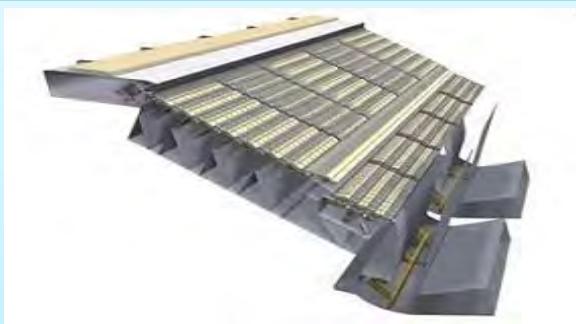
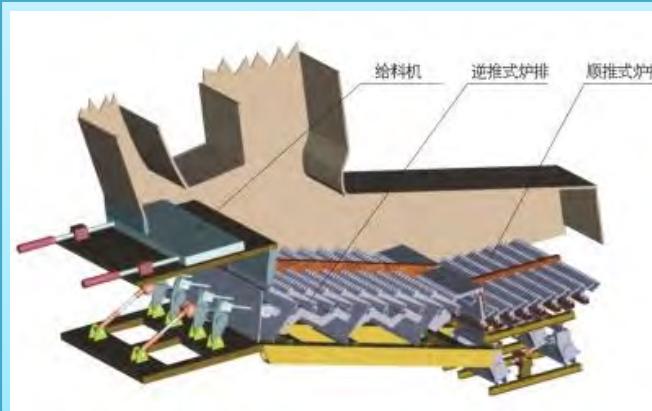


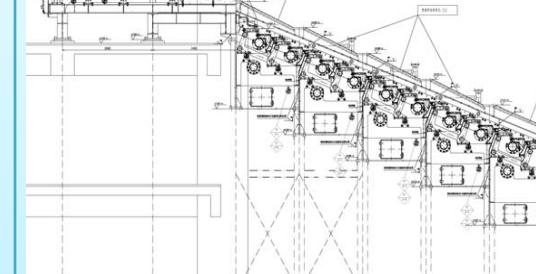
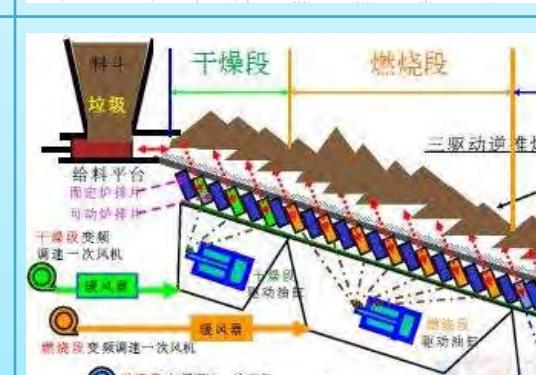
1) Master the core technology of waste incineration power generation by obtaining foreign technical authorization

order number	corporate name	Technology source
1	Chongqing Sanfeng	In October 2000, he obtained the technology transfer and license of Martin-Sity2000 grate in Germany, manufactured the grate furnace in China, and successfully constructed many waste incinerators such as Tongxing, Fuzhou Hongmiaoling and so on through digestion and absorption.
2	Guangzhou Environmental Protection Investment, Zhongke Group, Oriental Boiler	In 2007, he obtained the technology transfer and license of Volund grate in Denmark, and promoted and built the incinerator plant in Guangzhou (Guanghuan Investment). In December 2015, China Ke Group introduced Danish Volund grate technology (Zhongke Group); In 2016, the introduction of Danish Volund grate technology transfer and license, the establishment of grate assembly base in Henan Province, the promotion of waste incineration project (Oriental boiler);
3	Shenzhen Energy and Environmental Protection Co., Ltd.	They have obtained the license of Singapore Jibaoxigus grate technology, and used this technology to build Nanshan, salt field, Baoan and other waste incineration plants in Shenzhen.

4	Shanghai SUS Environment, Wuxi Huaguang	In March 2009, Hitachi Zosen L-shaped grate technology transfer was obtained, and this technology was used to participate in Jiangsu Rudong, Shandong Yantai incinerator and other incinerators in China. After Citic Industry Fund took a stake in 2013, it also invested in waste incineration project (Shanghai SUS Environment). In May 2009, Hitachi Zosen L-shaped grate technology transfer, in the domestic construction of Changshu Stage II, Hubei Xiangyang and other waste incineration plants (Wuxi Huaguang);
5	China Tianying	In 2012, the Belgian waterleau horizontal reciprocating grate furnace manufacturing technology was introduced, which was mainly used and popularized in its own BOT project after 2012.
6	China Everbright International Ltd.	On December 28, 2012, Everbright and Martin, Germany, signed the Martin SITY-2000 grate technology introduction agreement;
7	Conch Venture	In November 2013, Japan Kawasaki grate furnace technology was introduced and applied in its own investment in waste incineration projects.
8	Shanghai Environment Group , Beijing Capital Co., Ltd	In 2011, the Japanese Ehara waste incineration technology (Shanghai Environment) was introduced, and the "Strategic Cooperation Agreement" was signed with Qingdao Ehara in April 2018 to produce the core equipment of the incineration line (Beijing Capital CO., Ltd).

2) Domestic independent research and development technology

order number	corporate name	Technology source	fire grate photo
1	Hangzhou New Century Energy and Environmental Protection Co., Ltd.	On the basis of Mitsubishi Martin grate furnace in Japan, the domestic "reverse push two-stage" two-stage grate technology is developed to form its own grate technology, and the technology is used in Dongzhuang, Jinjiang, Yixing, Kaifeng and Huian in Wenzhou, China. Fuan and other incinerators have been popularized and applied.	
2	Zhejiang Weiming Environmental Protection Co., Ltd.	In 2001 with Hangzhou New Century Energy and Environmental Protection Co., Ltd. took the two-section fire grate technology in Dongzhuang, Wenzhou, and then the fire grate technology was promoted independently, and it was applied to the incineration plants such as Kunshan, Zhejiang, Cangnan and Qinhuangdao in Jiangsu.	

3	<p>Everbright international co., Ltd.</p> <p>On the basis of KSBE grate, the multi-stage hydraulic mechanical incinerator is developed to form its own grate technology, which has been used in Jiangsu Wu Jiang, Ningbo Beilun, Hainan Sanya incinerator and other incinerators in recent years.</p>	
4	<p>DYNAGRE EN environmental protection group Co., Ltd</p> <p>Own the self-developed three-drive reverse push grate technology. A reverse push grate developed on Martin grate technology has been applied in Changzhou Wujin, Zhejiang Yongjia, Haining and other waste incineration plants.</p>	

1.3 Development trend of grate furnace technology in China

1) Grate incineration technology must be suitable for future development trend. With the development of national economy, the calorific value of waste has changed from low calorific value to high calorific value. At present, the calorific value of municipal solid waste in China, such as Shanghai, Guangzhou, Shenzhen and so on, can reach more than 1800Kcal/kg.

High calorific value waste water-cooled furnace row, water-cooled furnace wall technology is the development direction;

2) Large-scale, modular, high automation and environment-friendly waste incineration technology is the development direction in the future.

For example, the early domestic single furnace 250-300t/d processing capacity to the current large-scale single furnace 600-1000t/d transition;

3) High efficiency ACC system; Real-time Monitoring, Combustion Imaging, automatic Precision Regulation.

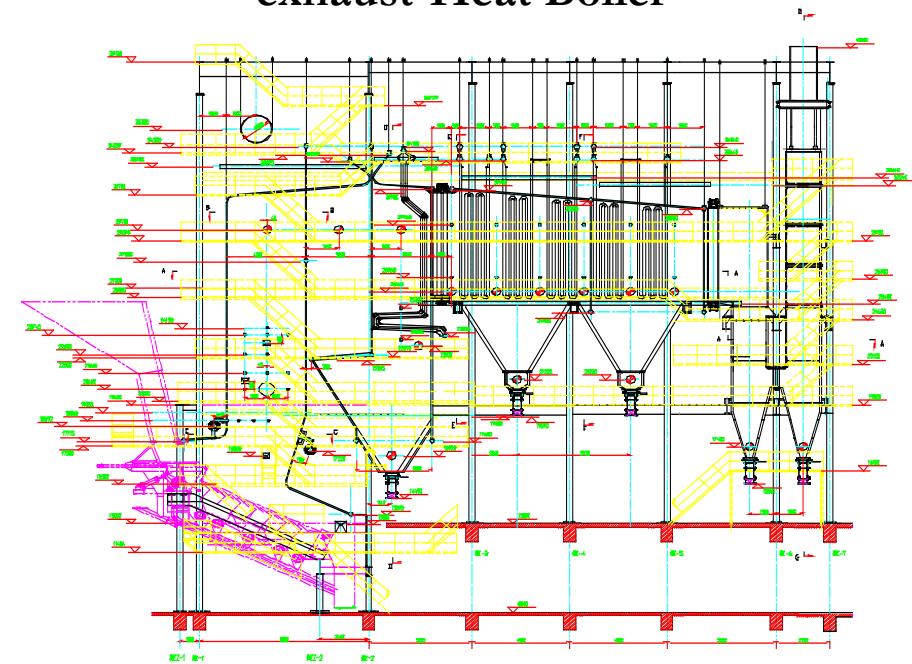
2.1 Technical status of Exhaust-Heat Boiler in China

- 1) The exhaust-heat boiler mainly cooperates with the incinerator structure and the waste heat utilization design. Generally, the incinerator design manufacturer provides the basic design, and the boiler plant with the design and processing qualification is refined into the manufacturing drawing.

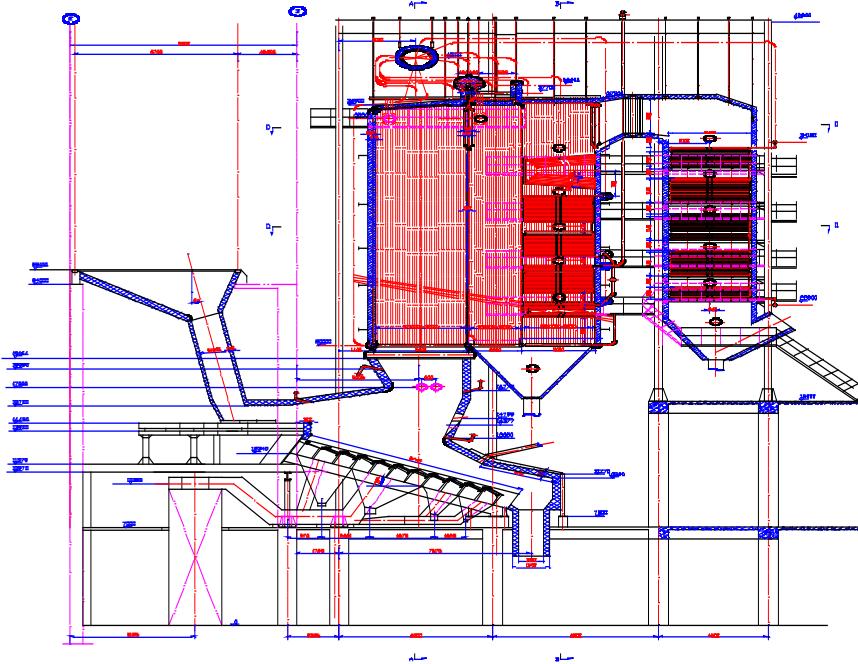
Basic design: cooperate with boiler support of grate, front and rear arch structure, flow rate requirement of flue and economizer quench area, smoke temperature of second and third flue entrance, transverse and longitudinal spacing requirements of superheater and evaporator tube, etc.

- 2) The entry threshold is relatively low, including Hangzhou boiler, Wuxi Huaguang, Jiangxi Jianglian, Sichuan boiler and so on. Subsequently, Nantong Wanda, Jinan boiler and the current east pot, ha pot, pot and other large, medium and small boiler manufacturers have been applied in this field.

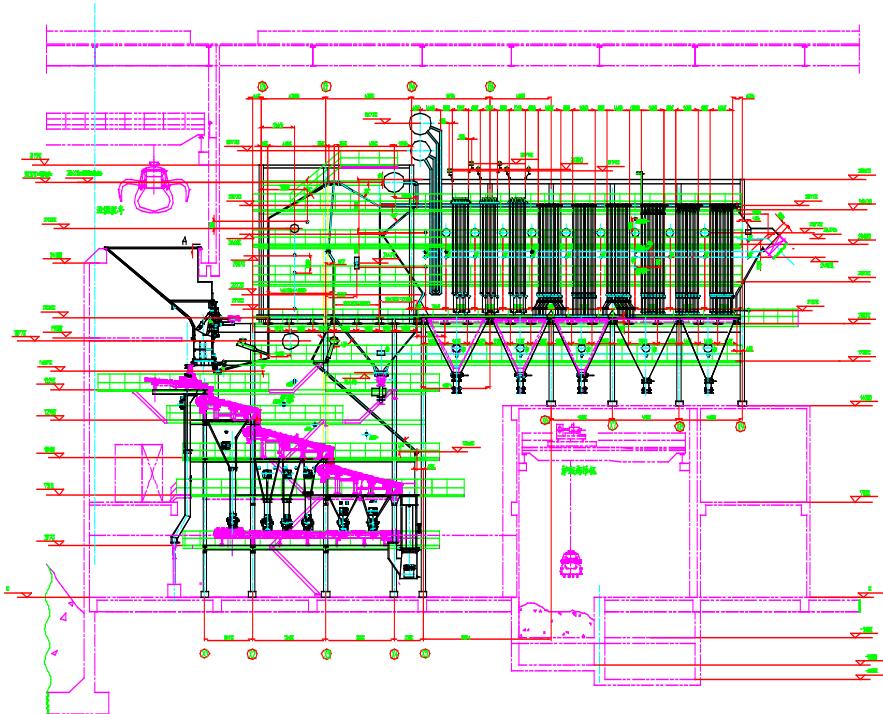
Mitsubishi Martin-General Diagram of exhaust-Heat Boiler



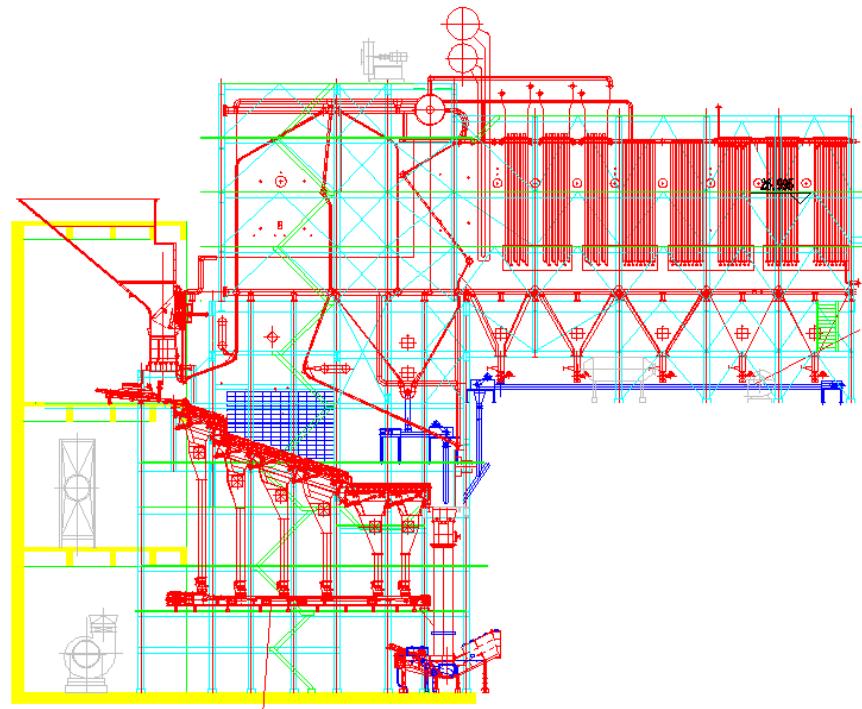
General diagram of exhaust-heat boiler



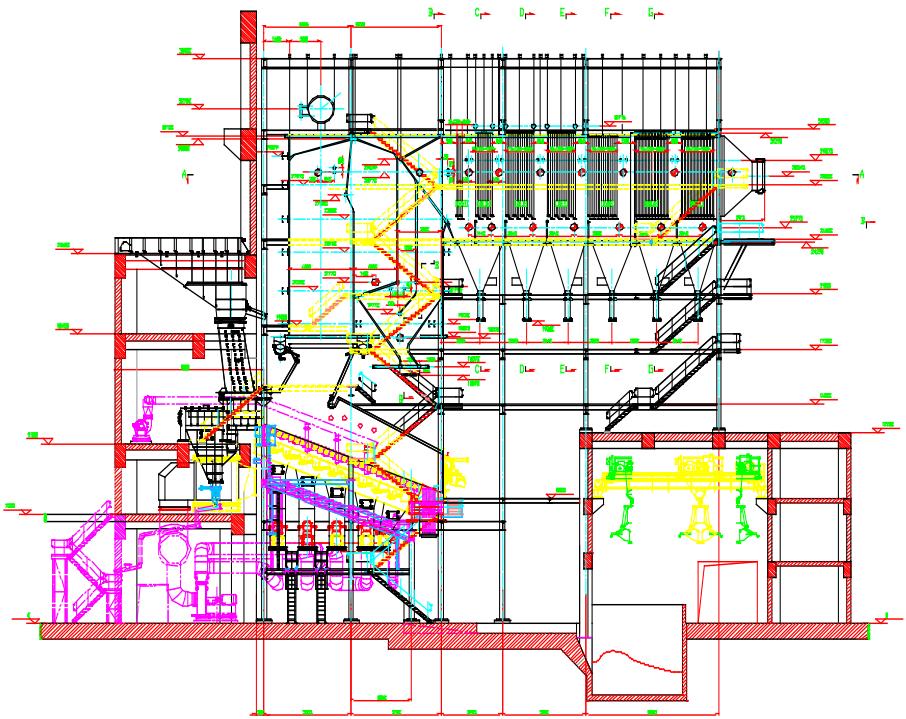
General Diagram of L shaped-exhaust-Heat
Boiler in Hitachi Zosen



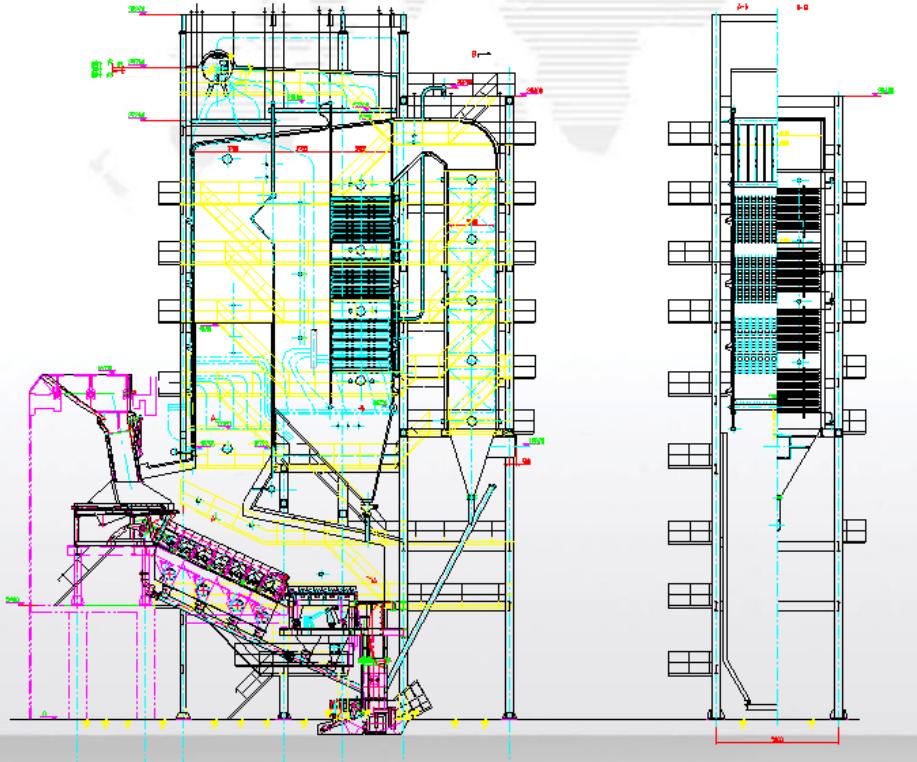
General Diagram of R shaped-exhaust-Heat
Boiler in Hitachi Zosen



KSBE-General Diagram of exhaust-Heat Boiler



General diagram of domestic two-stage exhaust-heat boiler



2.2 Development trend of exhaust-Heat Boiler Technology in China

1) With the development of the industry, higher energy efficiency has also been put on the agenda; The steam parameters of exhaust-heat boiler also transition from traditional medium temperature medium pressure (4.0 MPA, 400 °C) to medium temperature subhigh pressure (6.4 MPA, 450 °C), medium temperature ultra high pressure (13 MPA, 450 °C), Likeng, Guangzhou, Wuhan, Jiangbei, Wuhan. The steam parameters of medium temperature, subhigh pressure and other projects have been adopted in Jinan, Shandong Province.

When the medium temperature sub-high pressure parameter boiler is used, the thermal efficiency of the whole plant can be increased to 25%.

When the high feed water temperature of medium temperature ultra high pressure and high speed steam turbine is adopted, the thermal efficiency of the whole plant can be increased to about 29%.

2) the selection of higher boiler material under high parameters, and the welding of the nickel-based alloy of the superheater tube bundle;

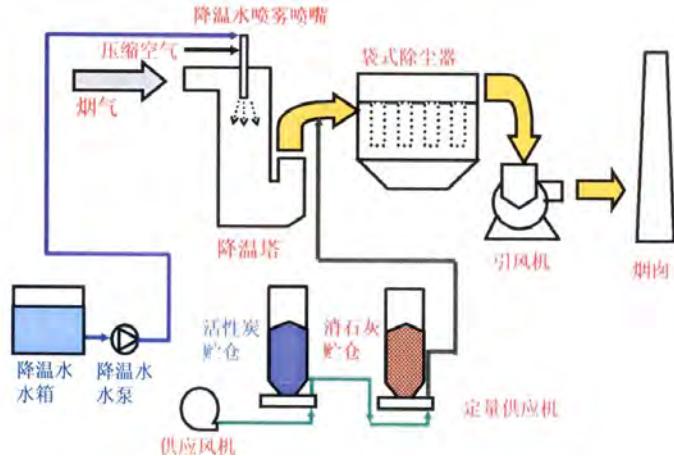
3) Application of efficient ash removal technology;Single gas pulse to steam gas pulse ash removal transition;

3.1 Present situation of flue Gas purification Technology in China

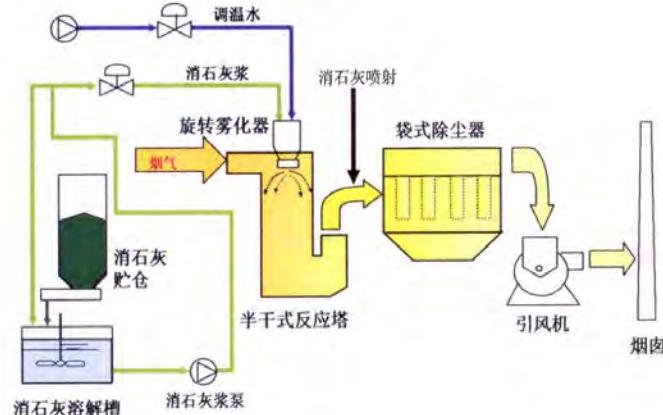


- 1) There are relatively few imported technologies for flue gas purification in China. At present, the introduction to Danish Nilu technology in Hangzhou and Wuxi Huaguang in Austria are mainly introduced into Austria.
- 2) At present, the flue gas treatment technology has been developed for several decades, the domestic basically has the independent research and development ability, the condition is also very mature, the core equipment can realize the domestic independent production;
- 3) At present, such as Wuxi Xuelang, Guangzhou D.C. environment Co., Ltd, Wuxi Huaxing, Tus-sound, New Century Energy Co., Ltd, Hangzhou, Shanghai Taixin and other manufacturers of flue gas technology are popularized and applied in China.

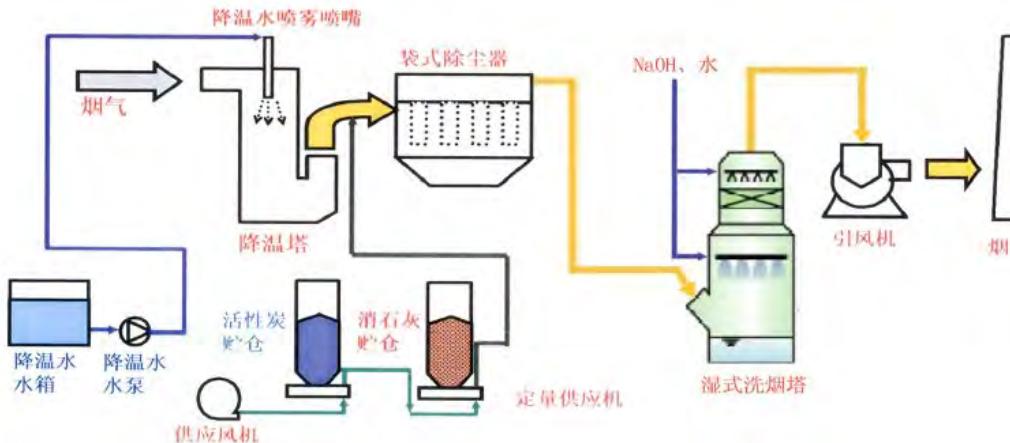
3.2 Deacidizing process



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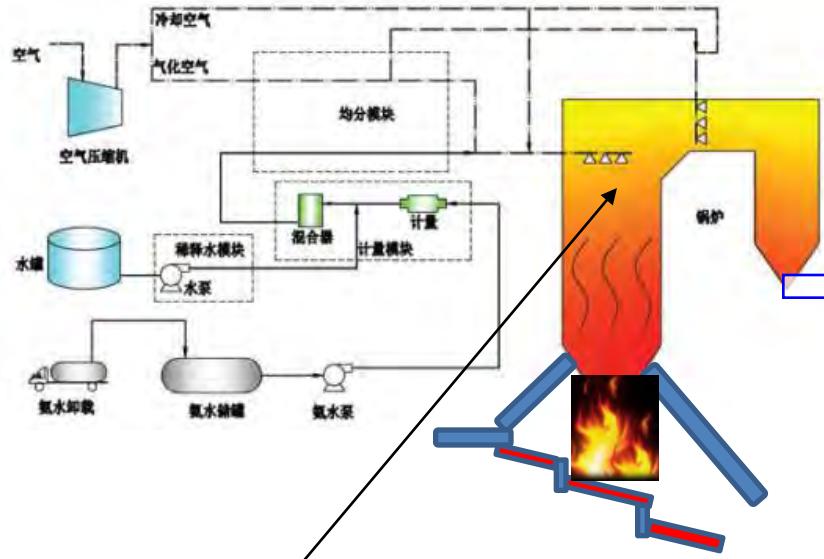
Comparison of three deacidizing processes



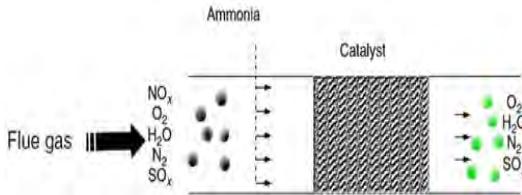
Deacidizing method	Process name	Main features	Main defect	Scope of application
Drying method	Dry powder injection	1) HCl removal rate ~ 70% 2) SOx removal rate ~ 50% 3) No waste water production 4) The system is simple and covers a small area of 5) low investment.	1) Low deacidification efficiency	Cooperate with semi-drying method to meet GB18485-2014, or EU 2000 standard
Semi-drying method	Rotating spray semi-drying method	1) HCl removal rate ~ 95% 2) SOx removal rate 70 ≤ 90% 3) No wastewater production	1) The cost of rotating sprayer is high.	Meet GB18485-2014, or EU 2000 standard
Wetting method	Na-alkali method	1) HCl removal rate ≥ 95% 2) SOx removal rate ≥ 90%	1) System is more complex 2) Set up the flue gas re-heating system, and the energy consumption is high 3) There are wastewater treatment problems, and the investment is large 4) High operating cost	Meet EU 2010 standard or ultra-low emissions

3.3 Denitrification process

SNCR Denitrification process



SCR Denitrification process



Comparison table of denitrification process

project	SNCR	low temperature SCR
Denitrification efficiency	30~60%	≥80%
equipment investment	No catalyst, low investment	High investment by using cryogenic catalysts
energy consumption	low	high
running cost	Only reductant and power consumption, low operating cost	in addition to that reduce agent and the power consumption, the operation cost is high because the catalyst is more expensive and the operation cost is high,
Running stability	stable	There are many factors affected, the catalyst is prone to poisoning and the operation is unstable.
land occupation	Only the reducing agent is used for preparing the conveying module, and the land occupation is small.	In addition to the preparation and transportation module of reductant, there are catalyst reactors and heating equipment, which occupy a large area.
pressure loss	none	1000~2500pa
Influence on induced draft fan	none	Due to the increase of pressure loss, the pressure and power of fan need to be increased.
main advantage	Low investment, small occupation of land and stable operation	High denitrification efficiency

3.4 The development trend of domestic flue gas purification technology



- 1) The current discharge of China undefineds garbage power plant<Standard for Pollution Control of Domestic Waste Incineration(GB184582014);
- 2) Some developed areas or areas with low atmospheric environmental bearing capacity shall be subject to stricter local standards or EU 2000 and 2010 standards;
- 3) In 2018, Hainan, Fujian and Shandong successively formulated and issued local standards and implemented stricter emission standards;
- 4) The future waste incineration will implement the concept of ``blue waste incineration`` , and all domestic emission standards will reach the ``strictest in history.``

project	unit	National standards GB18485-2001	National standards GB18485-2014	EU 2000/76/EC	EU 2010/75/EC	Hainan Provincial Local Standards-2018	Blue incineration ultra-low emission
particulate matter	mg/Nm ³	80	20	10	10	8	5
HCl	mg/Nm ³	75	50	10	5	8	
SOx	mg/Nm ³	260	80	50	50	20	10
NOx	mg/Nm ³	400	250	200	100	120	50
CO	mg/Nm ³	150	80	50	50	30	
HF	mg/Nm ³	--	--	1	1	1	
Dioxin	Ng-TEQ/Nm ³	1	0.1	0.1	0.1	0.05	0.01
Hg and its compounds	mg/Nm ³	0.2	0.05	0.05	0.03	0.02	
Cd and its compounds	mg/Nm ³	0.1	0.1	0.05	0.05	0.03	
Pb and its compounds	mg/Nm ³	1.6	1	0.5	0.5	0.3	

Emission standards are becoming more stringent!

Supervision stricter!

Comparison of current flue Gas purification process routes



Project	Process route 1	Process route 2	Process route 3	Process route 4
	SNCR rotating spray semi-drying activated carbon adsorption bag Dust Collector (+ low temperature SCR)	SNCR+Thermal towe+drying method+activated carbon adsorption +bag Dust Collector+wetting method	SNCR+Thermal towe+drying method+activated carbon adsorption+bag Dust Collector+low temperature SCR+wetting method	SNCR+Rotating spray semi-drying method+drying method+activated carbon adsorption+bag Dust Collector+low temperature SCR+wetting method
Reaching standard	Up to the national standard GB18485-2014 and EU 2000 standard	Up to EU 2000	Up to EU 2010 or ultra-low emissions	Up to EU 2010 or ultra-low emissions
Front-end investment	moderate	large	Relatively large	maximum
Running expense	minimum	large	Relatively large	maximum
Land occupation	moderate	large	Relatively large	maximum
Power consumption	moderate	large	Relatively large	maximum
Main advantage	No wastewater treatment and stable operation	High deacidification efficiency	Ultra-low emissions, equipment investment lower than route 4	Ultra-low emissions
Main defect	Atomizer depends on import	There is a problem of wastewater treatment.	There are some problems in wastewater treatment, such as high energy consumption and high operation cost.	There are wastewater treatment problems, atomizer depends on import, equipment investment is the largest, energy consumption is high, and the operation cost is the highest.
Situation of application	Domestic mainstream Technology (Jinan Project)	Shanghai Fengxian, Songjiang, Jiading	Shanghai Laogang Stage II	Hangzhou, Ningbo Project

→ 3

Introduction of Tus-sound



1 Enterprise introduction



Tus-sound Environmental Resources Co., Ltd. (hereinafter referred to as: Tus-sound) was founded on October 11, 1993, is a large professional environmental protection listed company in China (stock code 000826). Long-term commitment to the sustainable development of waste resources and environmental resources. Tsinghua Holdings became the actual controller in 2015, Tus-sound company (Tsinghua holding enterprises) to become the first largest shareholder, Sound Group became the second largest share holder.

At present, the company participates in holding Beijing Sound New Sanitation Investment Co., Ltd., Sound (Tianjin) Renewable Resources Investment holding Co., Ltd., Tus-sound Water Co., Ltd., Hejia New Energy Automobile Co., Ltd., Puhua Environmental Protection Co., Ltd. More than 400 enterprises, such as Thornton New Energy Technology Co., Ltd.

Cruising in the field of environmental protection for 25 years, has formed a collection of investment, R & D, consulting, design, construction, operation, manufacturing, green finance in one of the all-environmental protection industry chain, can provide a comprehensive, "one-stop" Urban Environmental Service and overall solution for Sustainable Development.

In the future, Tus-sound will carry forward the spirit of "endless for the environment" and continue to uphold the core values of "continuous innovation, the pursuit of perfection, the supremacy of honesty and credit, and the courage to bear responsibility". Towards becoming an international influence of comprehensive environmental protection enterprises stride forward.



2 Corporation Development

Tus-sound has maintained a long-term and stable sustainable development.

Total stock issue

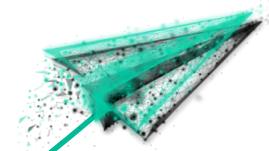
From 139,610,000 shares to 143,057,878,4 shares, an increase of **10.25 times**.

net asset

From 195 million yuan to 15.04 billion yuan, an increase of **77.28 times**.

general capital

From 437 million yuan to 35.185 billion yuan, an increase of **80.51 times**.



The deadline for the above data is 31 December 2018



3 Business domain and models

Business domain

Disposal and Utilization of solid waste	
Waste treatment and New Energy Project	
Organic waste treatment Project	
Ecological Infrastructure and	
Environmental improvement PPP Project	
Biomass fuel production, sales and	
electricity sales	

Internet sanitation
Environmental Health
Garden Greening
property Management
Municipal Engineering
Internet derivative
Business (including
Logistics supply chain,
Recycling of Renewable
Resources, Advertising
Business, etc.)

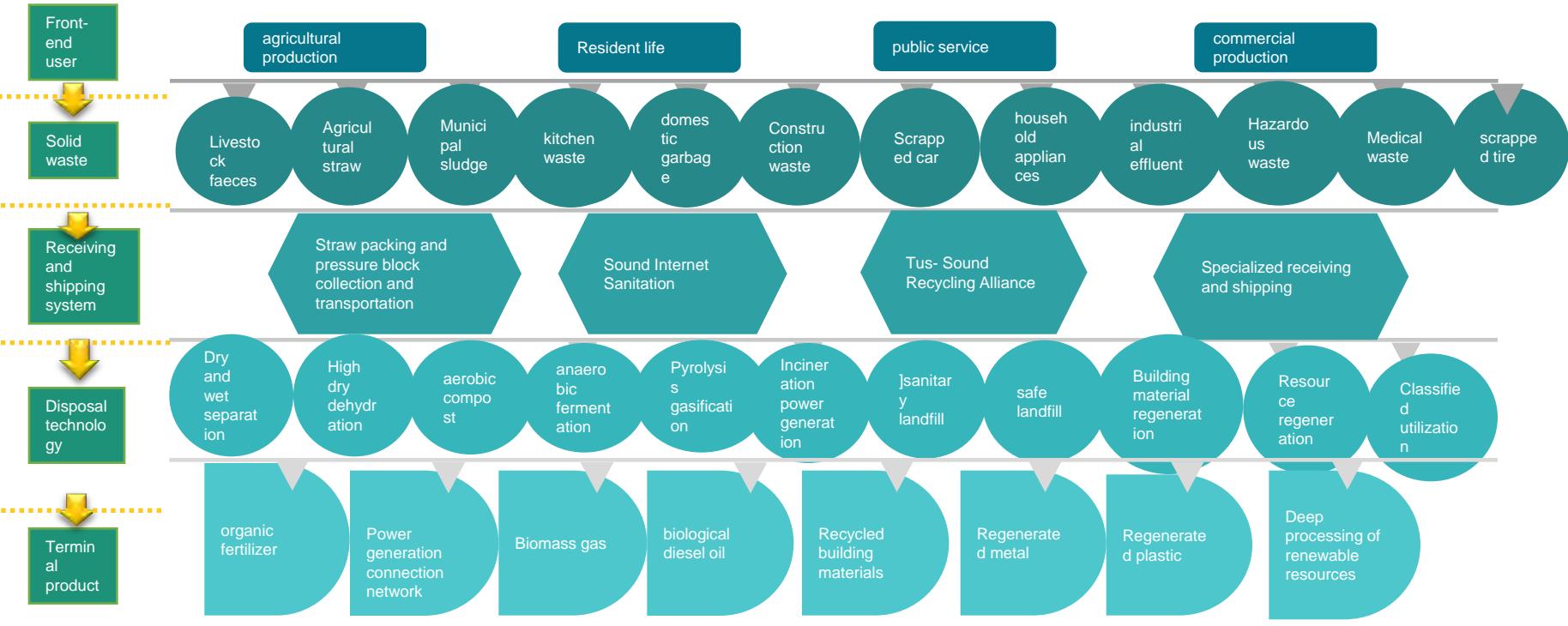
Recycling of renewable resources
Waste disposal and
Recycling O2O scrap
vehicle disassembly
and Recycling
Industrial Park
Hazardous waste
disposal Recycling
Resources Deep
processing

Comprehensive management of water affairs
Water investment, municipal sewage, water supply, small town sewage, industrial wastewater, environmental engineering
Combined manufacturing
Research and Development, manufacture and sales of New Energy Sanitation vehicles and Environmental Protection equipment

Business model

Urban environmental planning	Desing service	Electromechanical installation	system integration	facility manufacturing	Managed operation	contracting of project	Investment financing

4 Chart of the whole industrial chain



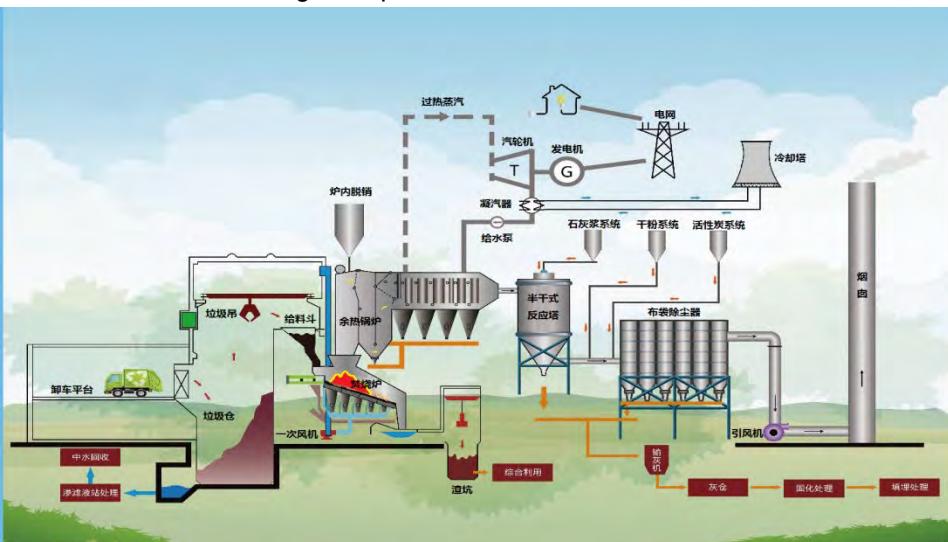


Application of Tus-Sound MSW Incineration Technology



Brief Introduction to the Technology

The invention relates to a process for treating urban domestic garbage, which refers to the process of converting toxic substances into non-toxic and harmless substances and by-product steam and electricity by using air as a combustion improver to reduce the thermal chemical reaction of the solid waste to the original 5 percent.



Technical advantages:

- Adopt advanced grate furnace incineration technology;
- The "SNCR+rotary spray semi-drying+activated carbon adsorption +bag dust removal+SCR" purification process was used for flue gas purification, and the flue gas emission standard was better than that of the national standard 18485 / 2014. the flue gas emission standard was better than that of the national standard 18485 / 2014.
- The steam parameters of some exasut-heat boilers are 6.4 MPA, 450 °C, which can improve the thermal efficiency of the whole plant;
- Suitable for more than 200 tons / day garbage treatment capacity;
- Near zero discharge of waste water from the whole plant;
- Garden factory design;

1 Core Technology of waste Incineration-grate Furnace



**Waste to Energy Project
in Julu County**

Processing scale 2000 tons /
day



**Waste to Energy Project
in Linfen County**

Processing scale 600 tons/ day



**Waste to Energy Project
in Kaizhou District**

Processing scale 600 tons/ day

Process introduction

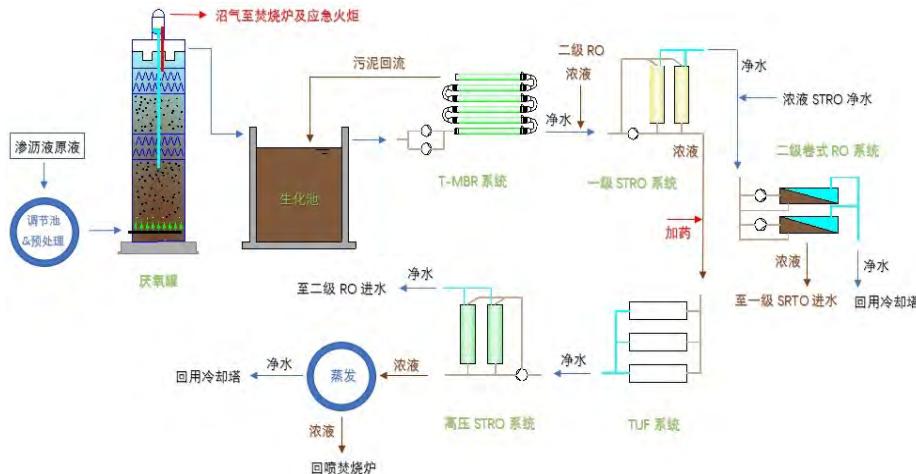
The combustion mode of grate furnace is layered combustion. The waste is dried in the incinerator successively, combusted, and the ash and slag is discharged out of the furnace, and the waste material layer is continuously loosened and fully contacted with air through the movement of grate and air supply at the bottom of the grate, so as to achieve full combustion. It has the characteristics of high automation, no need for waste pretreatment, long service life, stable and reliable. . .



2Core Technology of MSW Incineration-leachate Technology

Brief introduction of leachate technology

The main leachate treatment process of the Tus-Sound adopts "pretreated two-stage A/O-MBR two-stage STRO two-stage coil RO", and the concentrated liquid treatment process adopts "TUF high pressure STRO evaporation".



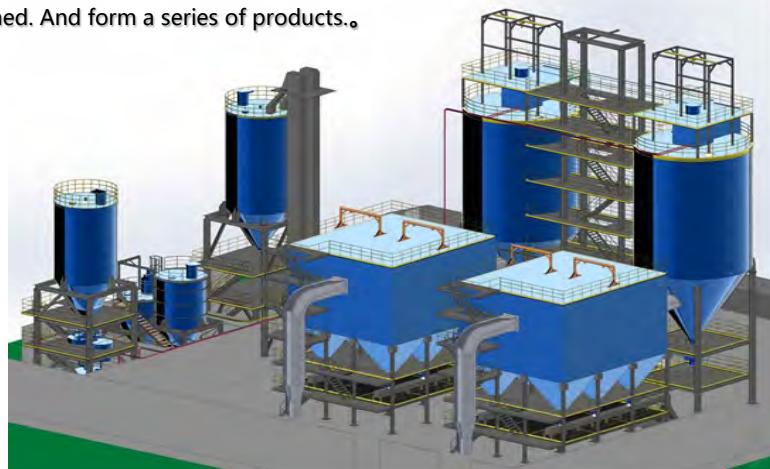
Technical characteristics

- Suitable for leachate raw materials with complex composition;
- The treatment problems of high COD, high TN, high salt and high hardness leachate were solved;
- The technological process is simple;
- The terminal wastewater shall be discharged as per the standard.

3 Core technology of waste incineration—Flue gas purification technology

Brief introduction to flue Gas purification Technology

On the basis of the research and comparison of the traditional flue gas purification process, after market analysis and research project experience, after several years of research and development, The "combined process of rotary spray semi-drying process + activated carbon adsorption + bag dust collector wet process" and "SNCR SCR" denitrification technology are formed by independent transformation, and the waste incineration flue gas purification technology and equipment with independent intellectual property rights of the Tus-Sound are formed. And form a series of products.。



Project
three-
dimensi-
onal
diagra-
m

Technical characteristics

01

- The processing capacity of the system can be adjusted ($60 \leq 120\%$), the control strategy is optimized in real time, and the efficiency and energy consumption are optimized.

02

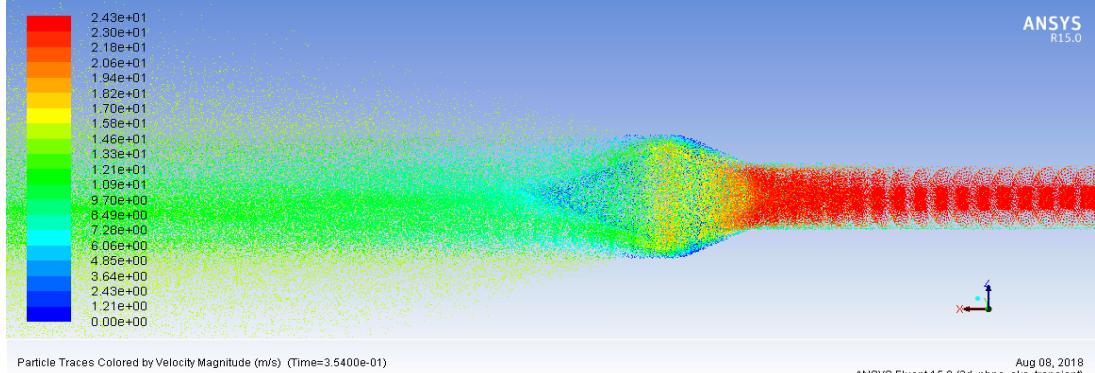
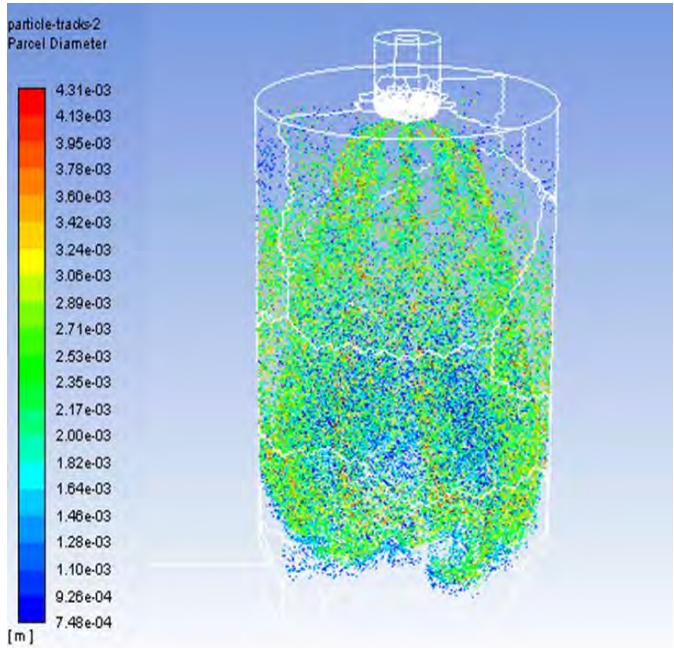
- It can be customized according to the requirements of regional emissions;

03

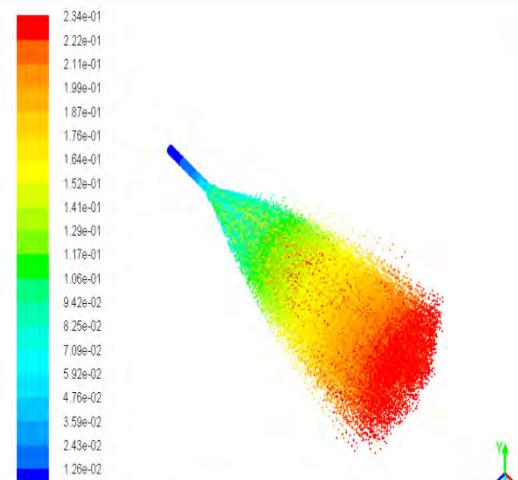
- The whole process equipment adopts 3D technology to simulate and optimize to ensure the purification efficiency and reduce the energy consumption of the system at the same time.

04

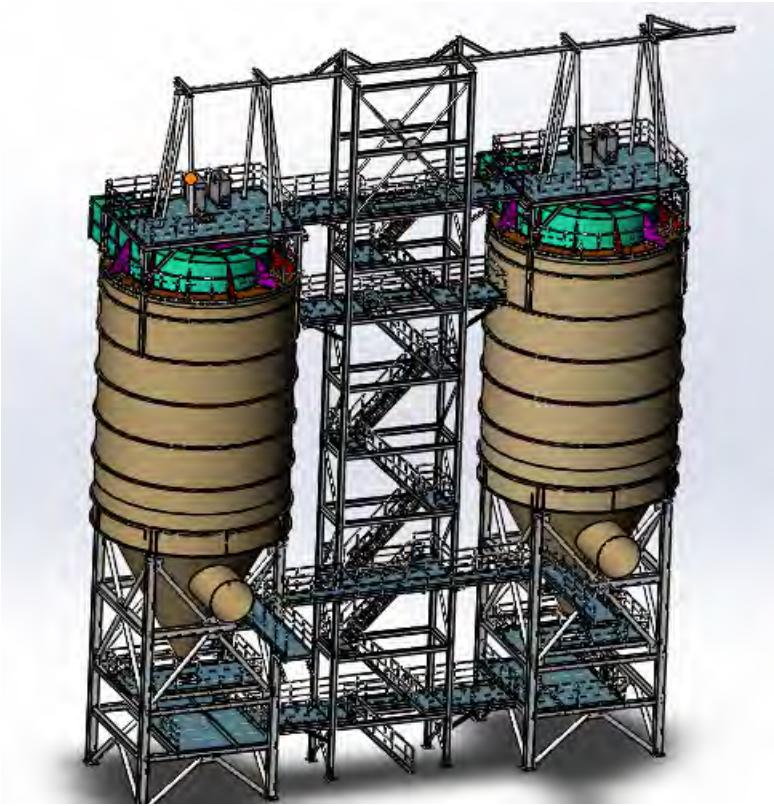
- The operation of the system is stable and reliable ($> 8000\text{h/a}$), and the emission index is better than the national standard or the European standard.



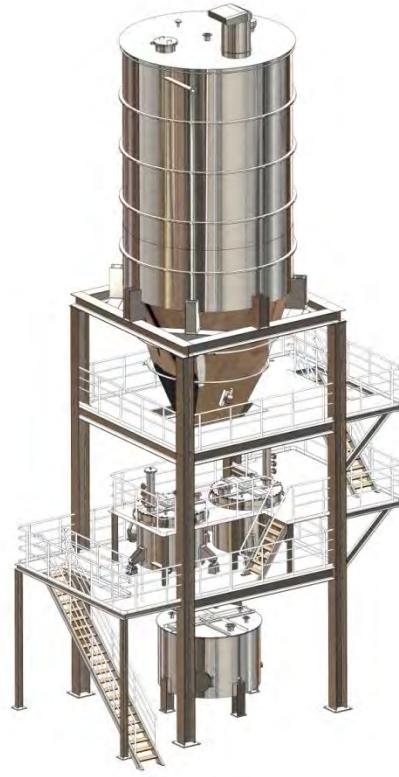
The CFD flow field simulation and practical verification of the reaction tower, the temperature field, the pressure field, the flow rate distribution and the flue gas residence time of more than 20s are optimized, and the high efficiency of the heat transfer of the three generations is ensured, and the consumption cost is reduced.



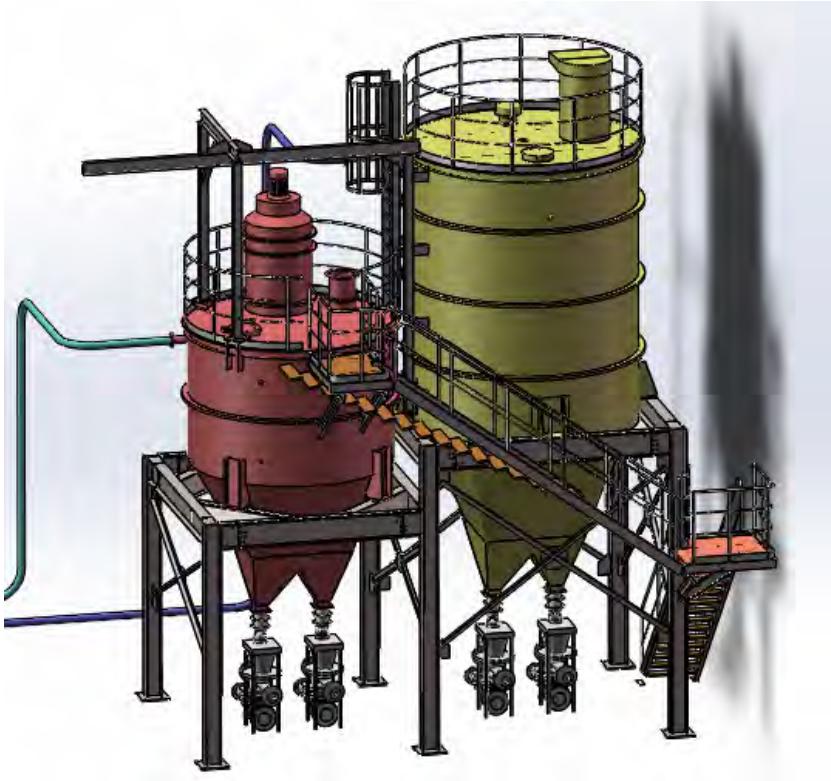
The activated carbon and dry injection system are optimized by CFD simulation, the nozzle design and injection point are optimized, and the lime and activated carbon are fully mixed with flue gas.



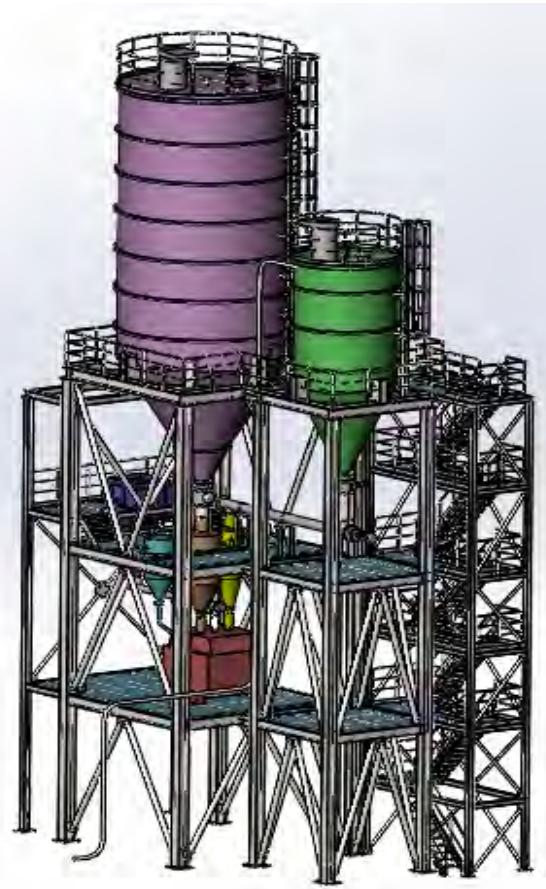
**Deacidizing tower+
graduation tower**



Lime pulp pulping system



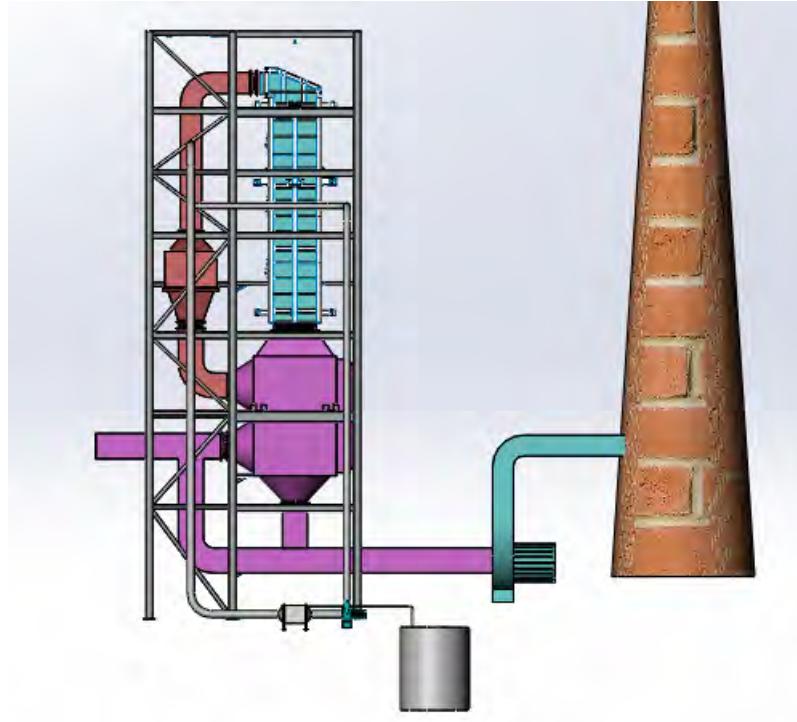
Activated carbon and dry powder system



Fly ash storage and curing system



**general drawing of wet
washing tower**



SCR reaction tower



Some patents

- 1 patent number : ZL 2013 2 0311719.8 Feeding device for Municipal solid waste Incineration Plant
- 2 patent number : ZL 2013 2 0311717.9 Tube bundle device of evaporato
- 3 patent number: ZL 2013 2 0313494.X Superheater tube bundle device
- 4 patent number: ZL 2014 2 0326118.9 Combustion Air temperature lifting device of Municipal solid waste Incineration
- 5 patent number: ZL 2014 2 0326424.2 Municipal solid waste Incineration Furnace Plate and grate
- 6 patent number: 201410273437.2 Container sealing device of MSW Incineration exhasut-Heat Boiler and MSW Incineration exhaust-Heat Boile
- 7 Appl.: 201621170952.9 A High chlorine Multi-component flue Gas purification device for Municipal solid waste Incineration
- 8 Appl.: 201621172183.6 A Wet flue Gas purification system for waste Incineration
- 9 Appl.: 201621142998.X Stabilization treatment device of fly Ash from Municipal solid waste Incineration
- 10 Appl.: 201621172213.3 A broken arch and ash remover for waste incineration fly ash bunke
- 11 Appl.: 201420326422.3 Low temperature SCR flue Gas denitrification Unit in Municipal solid waste Incineration Power Plant



4 Core technology of waste incineration—others

01

Management of garbage Warehouse in severe Cold area

In the process of design, construction and operation of Heilongjiang Shuangcheng, Jilin Dehui project, a variety of combined measures have been taken to ensure the temperature of garbage warehouse, promote the fermentation and drainage of waste, increase the calorific value of waste into the furnace, and ensure the incineration stability.

02

Other solid waste synergistic treatment

In Jinan project, Kaizhou project, Yishui project and other projects to coordinate the disposal of sludge, kitchen waste residue, etc.

03

Flue gas exhaust-heat recovery and heating

To make full use of the latent heat of steam gasification in flue gas and realize the cascade utilization of energy, a heating season has been run on the Texas project, which can provide 100000 flat heating area. There is no corrosion in the maintenance of the equipment after the shutdown.

04

Low air ratio/ flue gas recirculation technology

The low air ratio/ flue gas recirculation technology is to re-supply the outlet flue gas of the bag dust collector to the incinerator, and the reduction and combustion can inhibit the generation of the nitrogen oxides.



5 Case study of MSW incineration Power Generation Project

Tus-Sound Waste incineration power generation project (operated)			
order number	project name	project scale	project position
1	Shuangcheng Municipal Solid Waste Incineration Power Generation Project	2*500t/d	Harbin Shuangcheng District, Heilongjiang Province
2	Jixi Municipal Solid Waste Incineration Power Generation Project	2*600t/d+600t/d	Jixi City, Heilongjiang Province
3	Kaixian County Municipal Solid Waste Incineration Power Generation Project	2*300t/d	Kaixian County, Chongqing City
4	Bozhou Municipal Solid Waste Incineration Power Generation Project	2*300t/d	Bozhou City, Anhui Province
5	Dehui Municipal Solid Waste Incineration Power Generation Project	400t/d+400t/d	Dehui City, Changchun City, Jilin Province
6	Yishui Municipal Solid Waste Incineration Power Generation Project	300t/d+300t/d	Yishui County, Linyi City, Shandong Province
7	Lanling Municipal Solid Waste Incineration Power Generation Project	2*400t/d	Lanling County, Linyi City, Shandong Province
8	Linqi Municipal Solid Waste Incineration Power Generation Project	2*300t/d	Weifang City, Shandong Province
9	Linqing Municipal Solid Waste Incineration Power Generation Project	300t/d+300t/d	Liaocheng City, Shandong Province
10	Julu Municipal Solid Waste Incineration Power Generation Project	3*500t/d+500t/d	Julu County, Xingtai City, Hebei Province
11	Chuxiong Municipal Solid Waste Incineration Power Generation Project	2*350t/d	Chuxiong City, Yunnan Province
12	Chengwu Municipal Solid Waste Incineration Power Generation Project	300t/d+300t/d	Chengwu County, Heze City, Shandong Province
13	Weixian County Municipal Solid Waste Incineration Power Generation Project	2*400t/d	Weixian County, Handan City, Hebei Province

Total 13 operating projects, total processing capacity 11550t/d

Tus-Sound Waste incineration power generation project (under construction)			
order number	project name	project scale	project position
14	Lianshui Waste Incineration Power Generation Project	2*400t/d	Lianshui County, Jiangsu province
15	Xinji Waste Incineration Power Generation Project	2*300t/d	Xinji City, Hebei Province
16	Honghu Waste Incineration Power Generation Project	2*400t/d	Honghu City, Hubei Province
17	Qianan Municipal Solid Waste Incineration Power Generation Project	2*300t/d	Qianan City, Tangshan City, Hebei Province
18	Tongliao Waste Incineration Power Generation Project	2*400t/d	Tongliao City, Inner Mongolia Autonomous region
19	Jinan City (Changqing Mashan) Domestic waste and sewage sludge project	2*750t/d	Changqing District, Jinan City, Shandong Province
20	Haicheng Waste Incineration Power Generation Project	2*400t/d	Anshan City, Liaoning Province
21	Weishi County, Henan province Municipal Solid Waste Incineration Power Generation PPP Project	2*400t/d	Weishi County, Kaifeng City, Henan Province.
22	Xupu Municipal Solid Waste Incineration Power Generation Project	2*400t/d	Xupu County, Huaihua City, Hunan Province
23	Nehesang Municipal Solid Waste Incineration Power Generation Project	600t/d	Nehe City, Heilongjiang Province
24	Baicheng Municipal Solid Waste Incineration Power Generation Project	2*350t/d	Baicheng City, Jilin Province
25	Xingping Municipal Solid Waste Incineration Power Generation Project	500t/d+500t/d	Xingping City, Shaanxi Province
26	Qingzhou Municipal Solid Waste Incineration Power Generation Project	2*400t/d	Weifang, Shandong province
27	Kuche Municipal Solid Waste Incineration Power Generation Project	2*300t/d	Kuche County, Aksu District, Xinjiang

14 under construction, new processing capacity 10300t/d

Tus-Sound Waste incineration power generation project (preparation)			
order number	project number	project scale	project position
28	Yingkou Municipal Solid Waste Incineration Power Generation Project	2*400t/d	Yingkou City, Liaoning Province
29	Xinshao Municipal Solid Waste Incineration Power Generation Project	2*400t/d	Xinshao County, Shaoyang City, Hunan Province
30	Tianmen Municipal Solid Waste Incineration Power Generation Project	2*400t/d	Tianmen City, Hubei Province
31	Hunan Vein Industry Development Co., Ltd.	4*500t/d	Xiangtan City, Hunan Province
32	Yuncheng Municipal Solid Waste Incineration Power Generation Project	2*400t/d	Yuncheng City, Shanxi Province
33	Huainan Municipal Solid Waste Incineration Power Generation Project	1200t/d+600t/d	Huainan City

Total number of construction/ pending projects (6)



**2×300t/d
Lianshui Waste to Energy
Plant**



**2×400t/d
Haicheng Waste to Energy
Plant**



2×750t/d
Jinan Waste to Energy Plant



GREEN ECOLOGY
INSPIRE A BETTER LIFE

启迪美好生活

Thank you!

**Tus-sound-Solid waste and
Recycling Resource Center
FENG Bo
Technical support and Research
Centre Bureau Chief**