

# Waste to Energy and Challenge

**Everbright International    Zheru Shao**



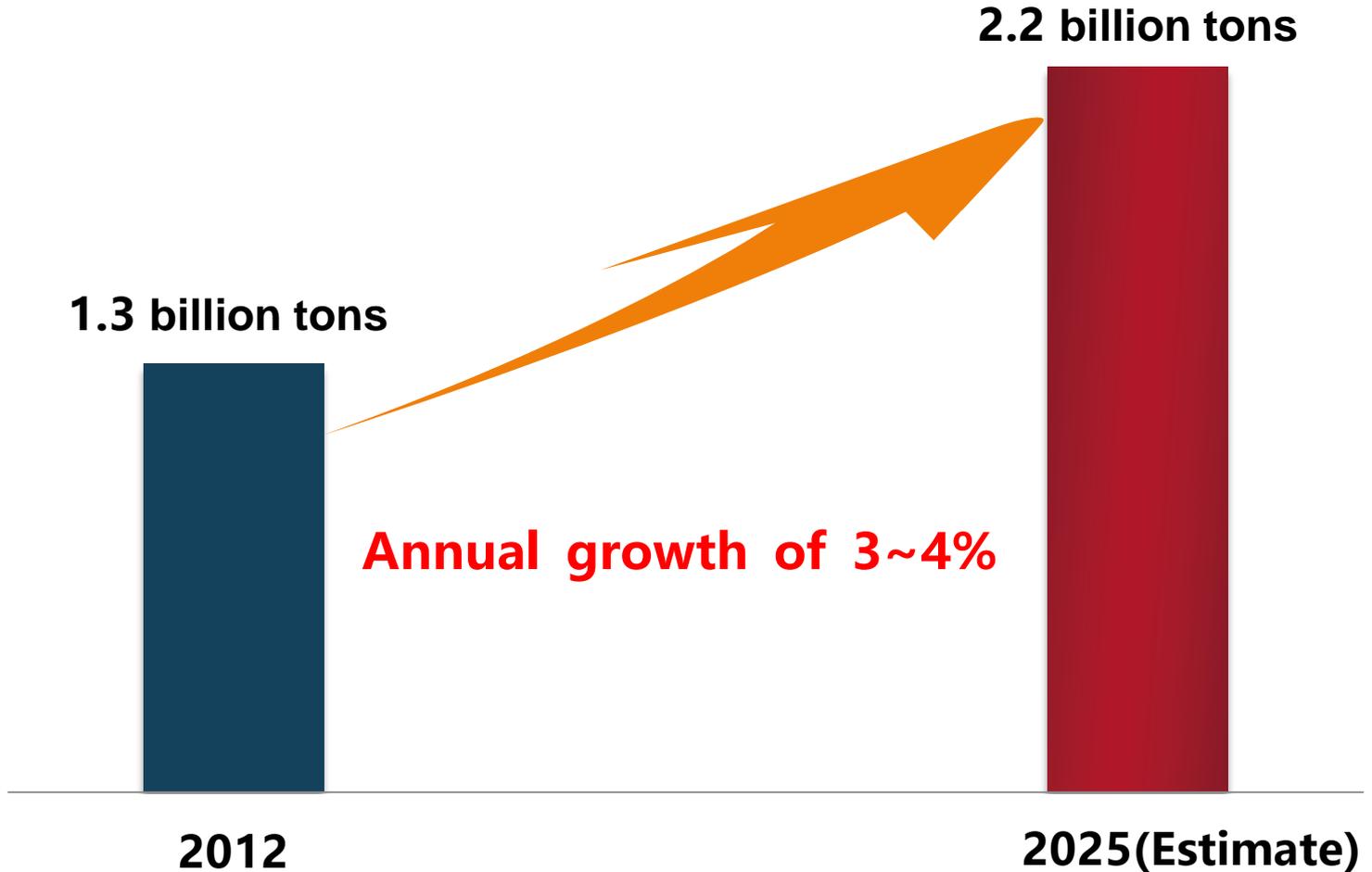
# **GREEN WORLD**

## **Content**

- **Status and treatment of waste in the world**
- **How to break NIMBY effect**
- **The best model for building WtE projects**
- **WtE Technology of Everbright**
- **Experience in improving the efficiency of WtE projects**

# Waste in the world

## 1. Waste production of the world announced by UN



# **Waste in the world**

**The environmental problems caused by municipal solid waste have attracted worldwide attention:**

**Waste siege**

**Damage the environment**

**Pollute the atmosphere, soil, ground water**

**Occupy massive amount of soil resources**

**Endanger human life, property and safety**



**Waste siege**



**Waste siege**



**Landfill waste**



**Landfill waste**



**Environment and Atmosphere Pollutions**

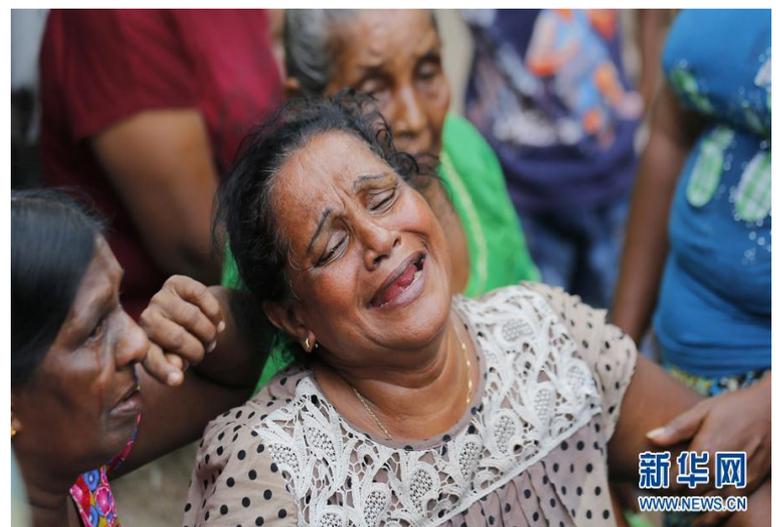


**Water system Pollutions**



**Waste Mountain**

**Waste mountain collapsed** and triggered a fire in Colombo, capital of Sri Lanka, surrounding **multiple houses were damaged** and hundreds of people were homeless. The collapse cause a consequence **of 30 people die**, including 6 children, reported by Sri Lankan military in April 17<sup>th</sup> ,2017.



**A landslide** occurred in a Waste mountain in the suburbs of Conakry, West Africa Guinea's capital, **multiple houses were damaged**, collapse caused dozens of people injured, **8 people die**, including 2 children, in August 22<sup>th</sup> ,2017.



**A landslide** occurred in a Waste mountain in Gazi Poole, east of New Delhi, **India**, about 50 tons of Waste collapsed from the Waste mountain, resulting in **2 deaths**, 5 people were injured, several road vehicles involved in the canal.



## 2、 Waste is a misplaced treasure



A crowd of people are Scavenging **available resources** in the **waste mountains** for living.

### 3 Waste must be classified

Municipal waste management has gradually developed from simple terminal treatment to source control and integrated management..

Waste classification and sorting not only can recycle resources, but also decrease the amount of waste and reduced emissions.

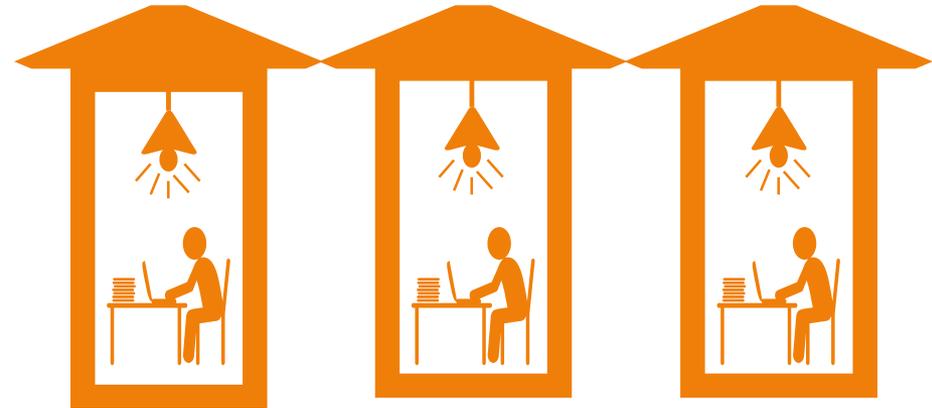


## 4 Building a WTE plant :

**One ton of waste can generate energy**



**Three households monthly electricity consumptions**



**Waste is misplaced renewable resources, is “oil”, is “treasure” !**

# 5 The treatment of waste

Harmless treatments: Landfill, Composting and WtE.

## ① Landfill :

Sanitary landfill has been widely used in many countries . **But it occupies large areas, pollutes environment, and is easy to explode as well as great maintenance cost.** So far many cities have no proper landfill sites.



**A methane explosion in landfill site**

# Harmless treatments: Landfill, Composting, WtE.

## ② Composting:

**High cost**

**Complex process**

**Low efficiency**



### ③ Waste to Energy :

- WtE is the final treatment for waste, it is

**NON-HAZARDOUS**

**REDUCTION**

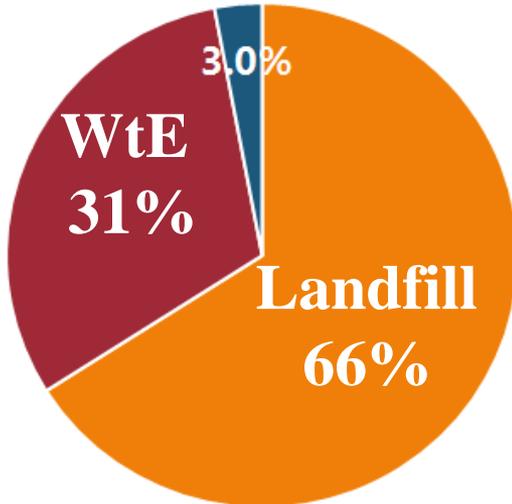
**RESOURCE UTILIZATION**

WtE has the advantages of **reaching the emission standard, not causing secondary pollution, less land occupation.**

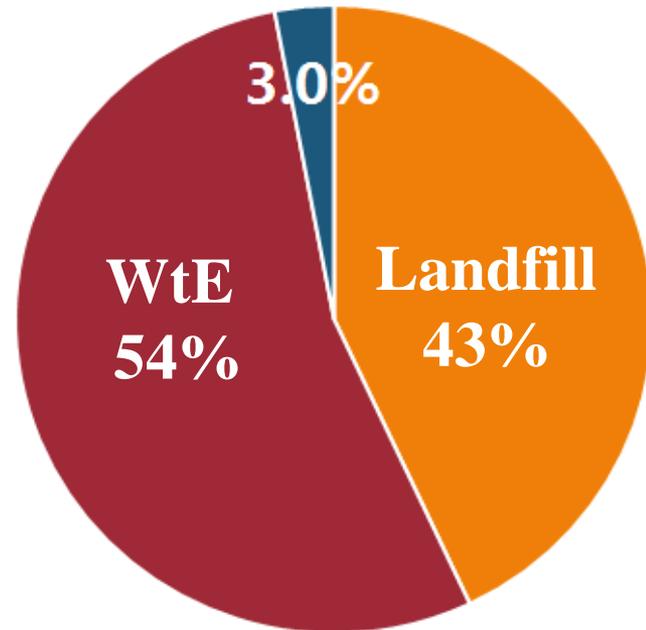
- The proportion of WtE in China is increasing.

**The proportion of waste treatment in 2020**

**The proportion of waste treatment in 2015**



**“12<sup>th</sup> Five-Year” Planning**



**“13<sup>th</sup> Five-Year” Planning**

### ③ Waste to Energy :

- Although WtE has many advantages, but still has many challenges :
- **Public acceptance:** Opponents deem the WtE will cause secondary pollution, especially **dioxins**, which is harmful to public health.
- **NIMBY:** Some people are not opposed to build WtE, but not in my backyard.
- **Affordable investment cost**  
Developed countries: **880\$/T**  
China : **228\$/T**



# How to break NIMBY effect

NIMBY effect is the primary problem of WtE project, because the public surrounding the project is concerned that once the WtE project is completed:

- Generate secondary pollution, dioxin, sewage, foul smell will destroy the surrounding ecological environment;
- Endanger the health of people;

Local people are very inconsistent with WtE project.



**The Hangzhou, China, government plans to build a WtE project at JiuFeng, which has been strongly opposed by the public:**

**A mass incident broke out at JiuFeng, the masses smashed vehicles and law enforcement officers were besieged in May 10, 2014.**



- The government organizes the public to visit the **Everbright WtE project**. **What they see is a garden factory without smelling and waste**. The WtE plants are very clean, with a strong contrast against imagination;
- The public learn more about the WtE plants' operation, management processes and pollutant emission controls;
- **The public held discussions and exchanges with residents around the WtE plants, recognizes the WtE plants DO NOT pollute the surrounding environment;**
- **The residents invite Everbright to build 3000t/d project at local area .**



# Garden type WtE plants



**Nanjing WtE plants**

# Suzhou WtE plants



## How to break NIMBY:

- ① The government should establish propagate, regulation law-enforcement systems, and establish a communication mechanism between the government, the enterprise and the public.
- ② To respect the public's right to know, participate in and supervise the WtE projects,



### ③ Enterprise self-discipline



The core values proposed by Everbright CEO Mr. Chen Xiaoping

**The enterprise is not only the creator of wealth**

**But also the undertaker of environment and social responsibility**

- According to the core values, protect the environment, emission controls, and secondary pollution prevention becomes the **primary goal of Everbright WtE project.**
- At present, all WtE project from Everbright has published the live pollutants emission value on the internet, and also take the supervision from the government and the public.

The WtE project located in the city centre, adjacent to residential areas, large supermarkets, hotels, receive **ZERO** complaint since 2010 when it started operation.

Changzhou WtE plants



光大环保能源(常州)有限公司  
通讯正常 2017年06月01日 16时49分18秒

项目	国标		欧标		单位	1#炉		2#炉		
	小时均值	日均值	小时均值	半小时均值		移动小时均值	移动小时均值	移动小时均值	移动小时均值	
TSP	30	20	10		mg/m <sup>3</sup>	1.7	4.4			
BCL	60	50	10		mg/m <sup>3</sup>	2.5	4.7			
SO <sub>2</sub>	100	80	50		mg/m <sup>3</sup>	19.3	5.2			
NO <sub>X</sub>	300	250	200		mg/m <sup>3</sup>	96.5	117.7			
CO	100	80	100		mg/m <sup>3</sup>	1.8	0.2			
炉膛温度(850℃/2S)						℃	941.5	993.1		

Emission value

The aerial map of Changzhou WtE plants

# The best model for building WtE projects: UN 'people first' sustainable development PPPs

## 1、 PPPs

'people first'  
PPPs is the  
best solution  
for developing  
countries to  
promote WtE.



PPP is a financing  
model as well as a  
management model,  
which fully embodies  
the cooperative  
relationship between  
the government and the  
private sector.



**Governments to take the lead; The private sector to take the principal part;  
The public to be the host.**

## 2、 Government taking the lead

- Under **the leadership of the government**, give full play to the advantages of private sector in **fund-raising** and **management** so as to improve the economic benefits of the project.
- **The government establishes and improves laws and regulations** to attract foreign investment: especially in fiscal policy, financing policy, industrial policy, creates fair competition and good investment environment.



- **Good publicity work**  
Promote the benefits of WtE projects to protect the environment, social benefits and economic development, and try to avoid the NIMBY effect.
- **To reinforce regulation on investment projects, preventing corruption and ensuring safety.**

### 3、 The private sector taking the principal part

- Requirements for private investors

Who need have **responsible, environmentally conscious, economic power, executive force and willing to serve the public sector** to undertake the WtE PPP project.

- In the process of PPP construction, investors should guarantee the input of project funds, impart advanced technology and management, cultivate talents and improve the economic benefits of projects.

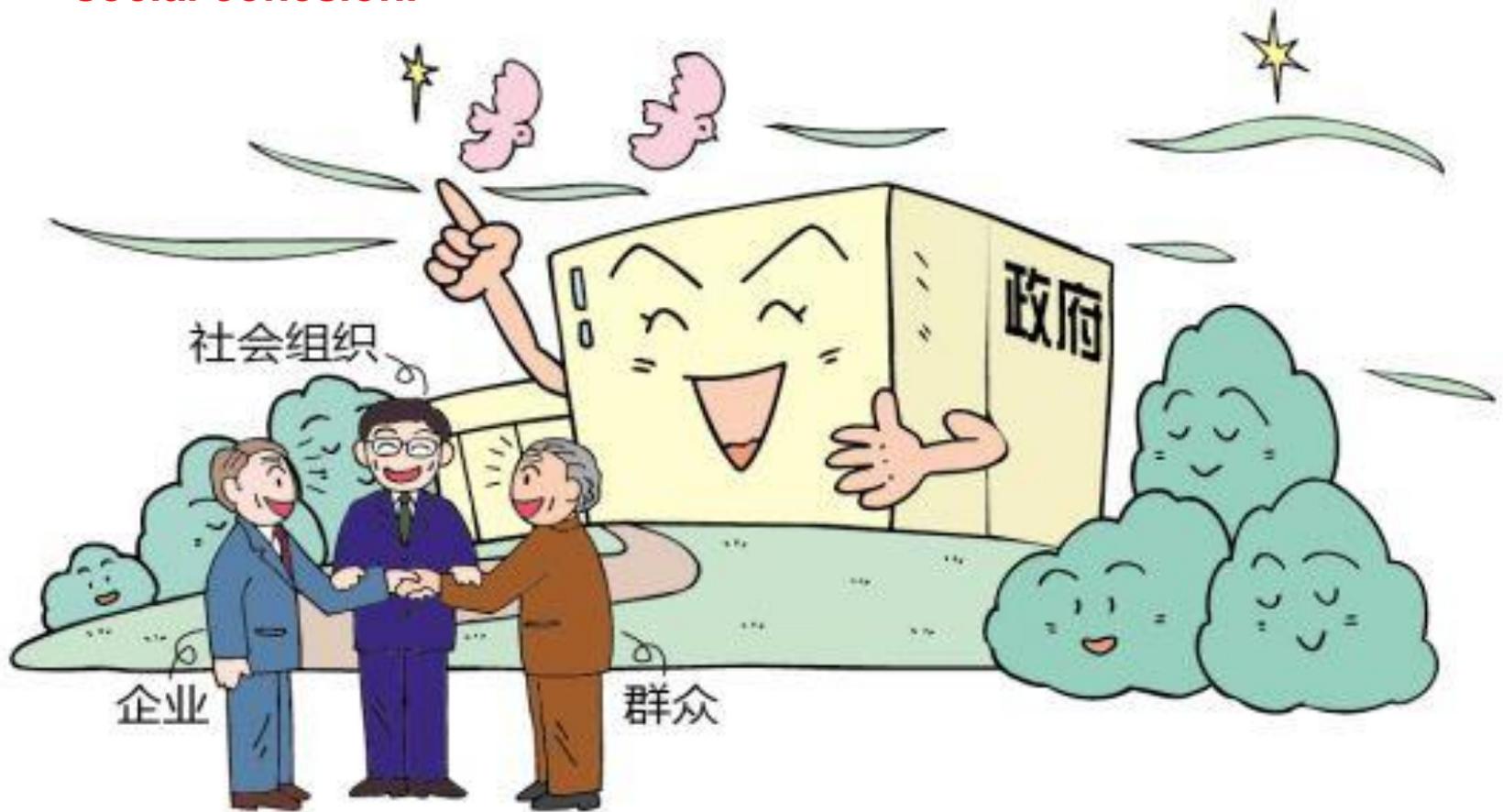


- Adoption of project construction:  
advanced technology, energy saving;  
strict emission standards, protect the ecology;  
small footprint;  
Make full use of resources,

- Investors accept the supervision of the government and the public, integrate into the society, create employment, and do a good job in public welfare.

## 4、 The public to be the host

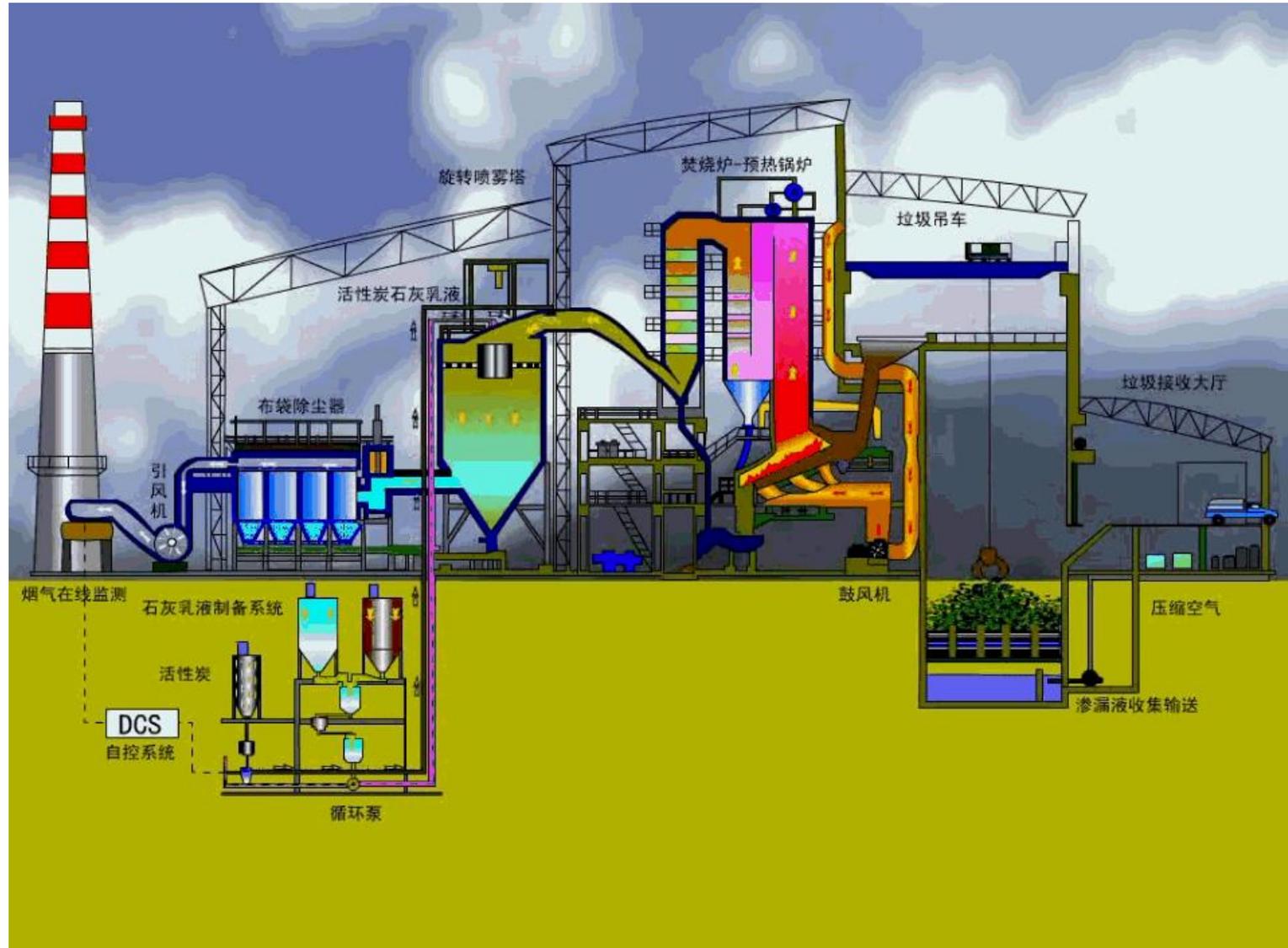
- The public should actively participate in the supervision of public services, maintain interaction with the government and enterprises, and create a favorable environment;
- **The public is the host in UN 'people first' PPPs, the public is the main beneficiary ,and should enhance the quality of life and promote social cohesion.**





May 10, 2017. Mr. Chen Xiaoping, CEO of China Everbright International, as the representative of the private sector to participated the HongKong High Level Debate — **“the UNECE International PPP forum”** . Mr. Chen as expert team Leader moderated **“the guideline on PPPs in WtE projects”** forum.

# WtE Technology of Everbright

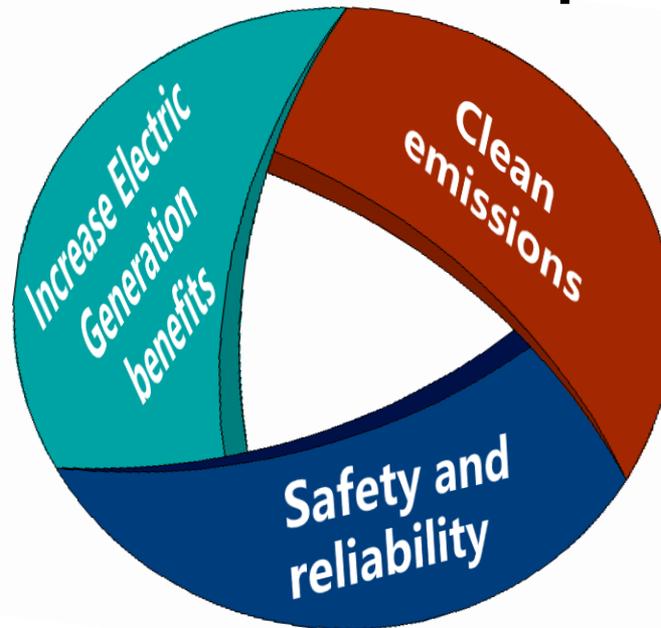


# Three focus point of WtE plant

- How to build a WtE project ?

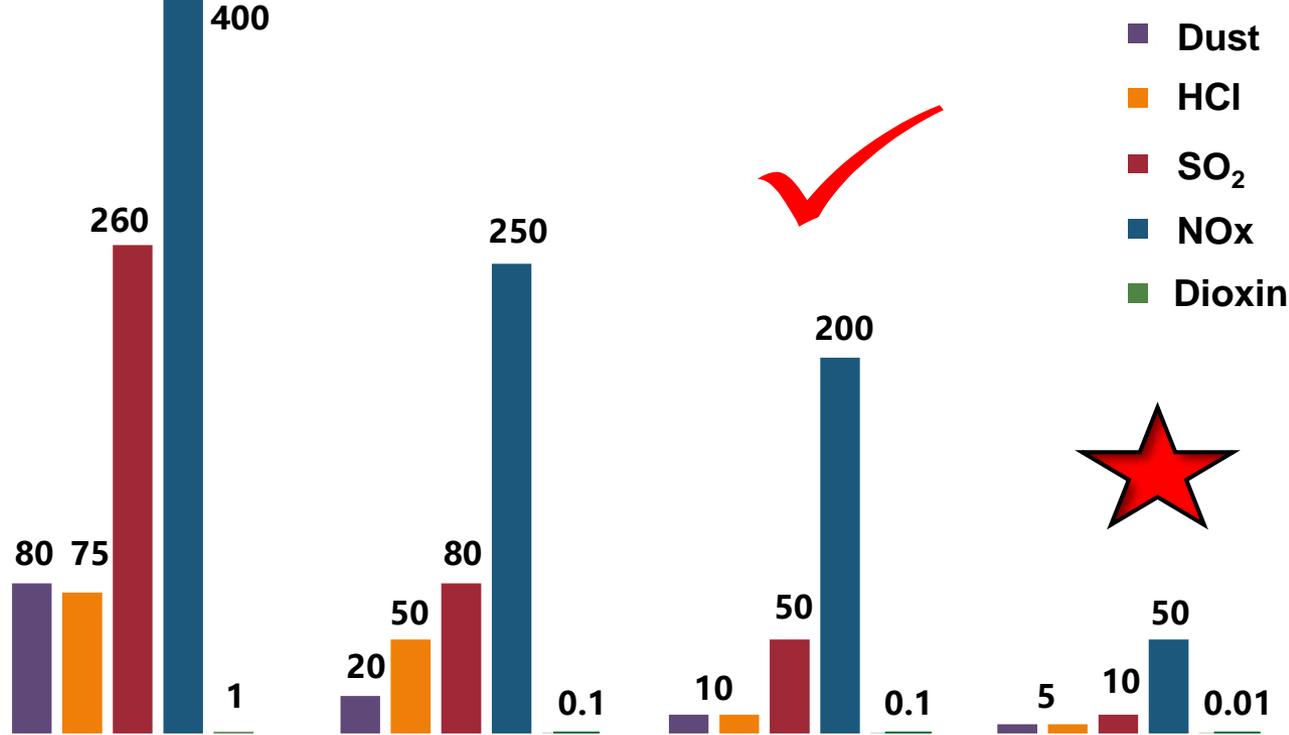
High starting point, strict standard, clean emission, more efficient, safer and less investment

- Three main points to build a WtE plant:



- 1 Clean emissions, reduce secondary pollutions
- 2 Increase generation benefits and reduce generation costs
- 3 Safety and reliability

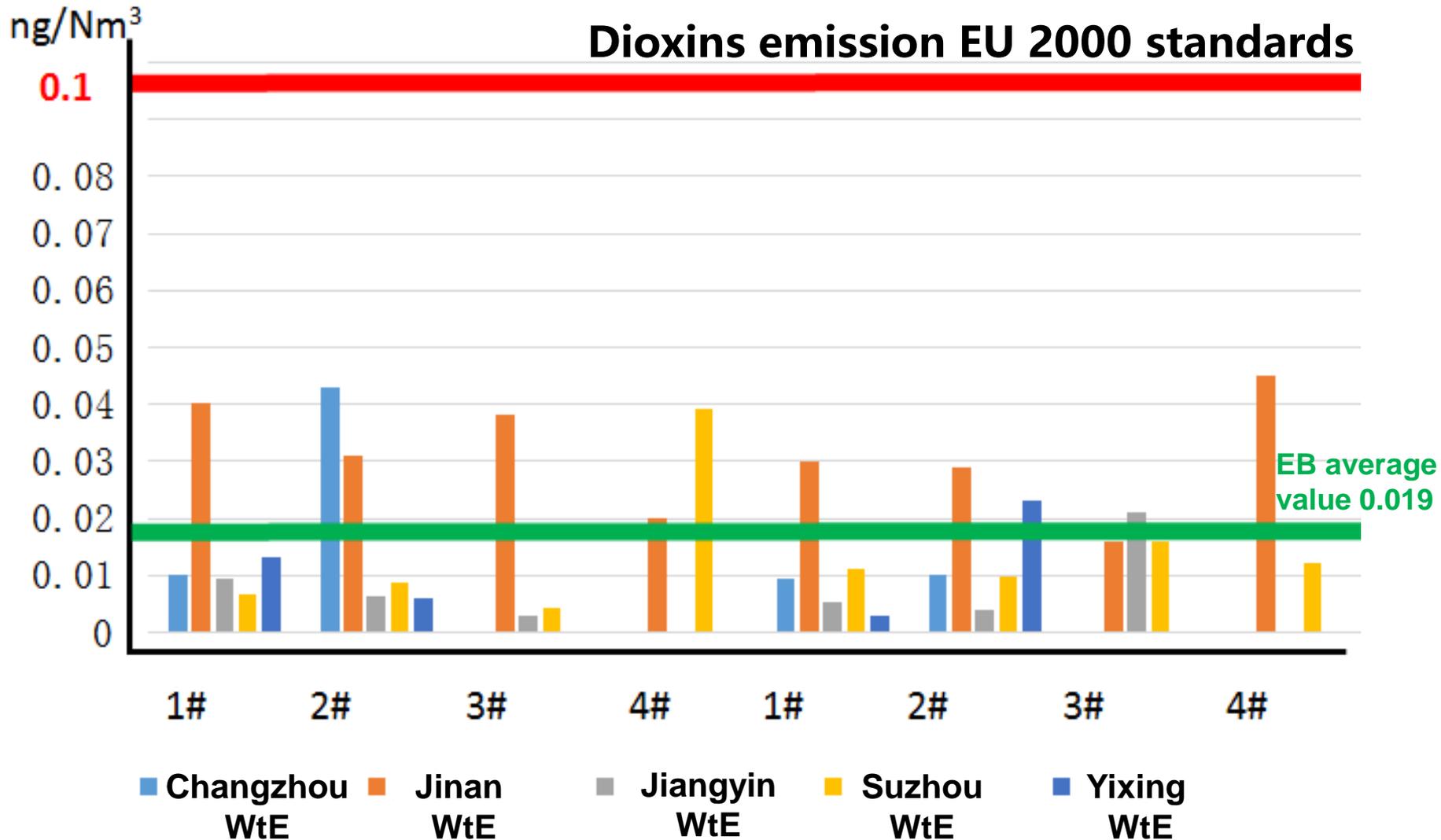
# 1 Clean emissions, reduce secondary pollution, **Everbright implements the EU 2010 standard**



Pollutant	China 2001 standard	China 2014 standard	EU 2010	Ultra-low emission	Unit
Dust	80	20	10	5	(mg/Nm <sup>3</sup> )
HCl	75	50	10	5	(mg/Nm <sup>3</sup> )
SO <sub>2</sub>	260	80	50	10	(mg/Nm <sup>3</sup> )
NO <sub>x</sub>	400	250	200	50	(mg/Nm <sup>3</sup> )
Dioxins	1	0.1	0.1	0.01	(ngTEQ/Nm <sup>3</sup> )

Since Everbright built the first WtE plant in 2004 which implemented the EU 2010 standard, at present Everbright has more than ten years and dozens of plants operating experience, such as Hangzhou, Suzhou, Nanjing and other WtE plants have reached ultra-low emissions.

■ Test data of **actual** emissions of dioxins in WtE plants of EB(2014)



All data were examined by Tsinghua University.



**Smoking one cigarette is containing 10pg-TEQ of dioxins. The average emission value of dioxins from Everbright's WtE projects is 19pg TEQ/Nm<sup>3</sup>.**

## 2 Increase generation benefits and reduce generation costs

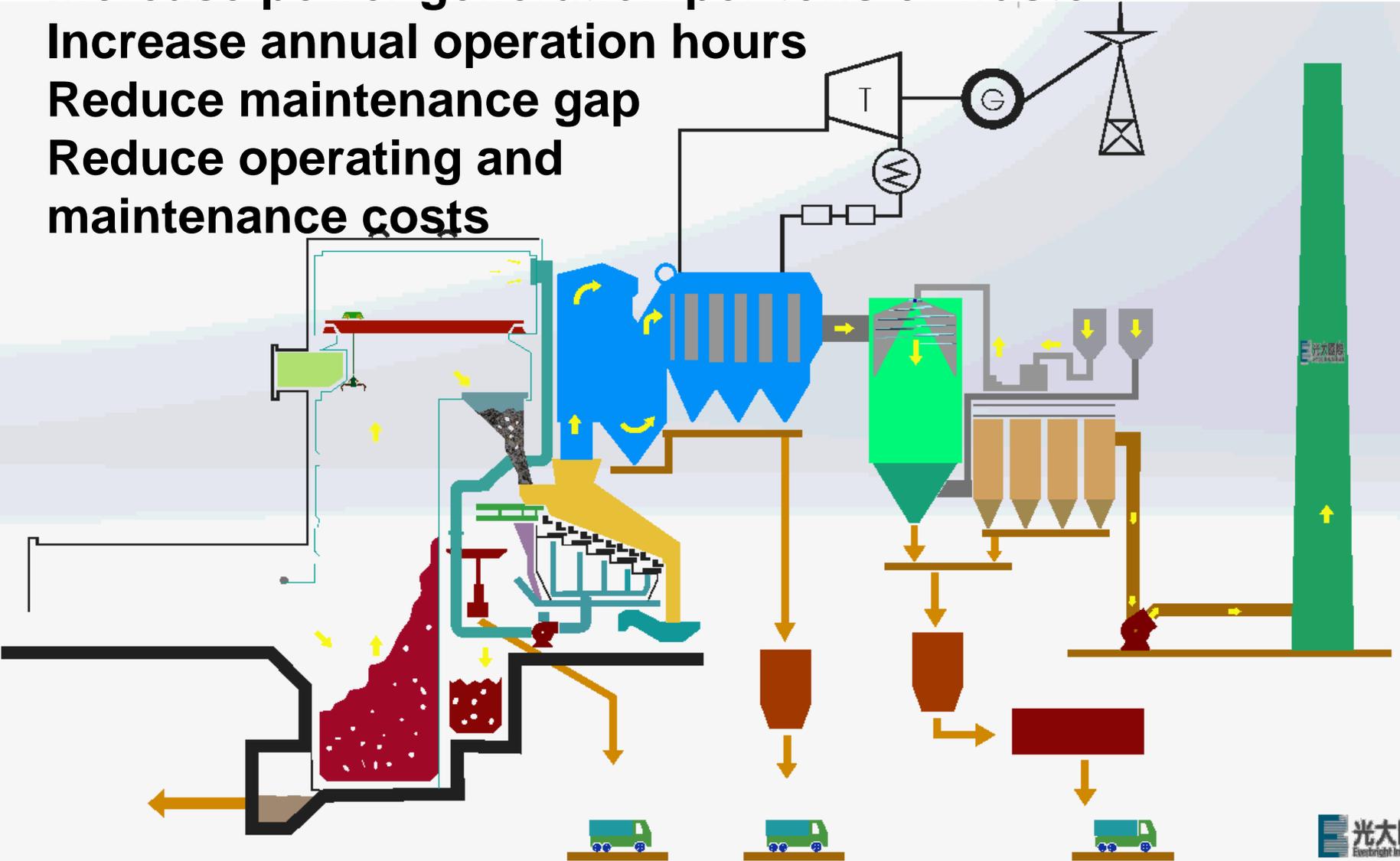
Increase thermal efficiency

Increase power generation per tons of waste

Increase annual operation hours

Reduce maintenance gap

Reduce operating and maintenance costs

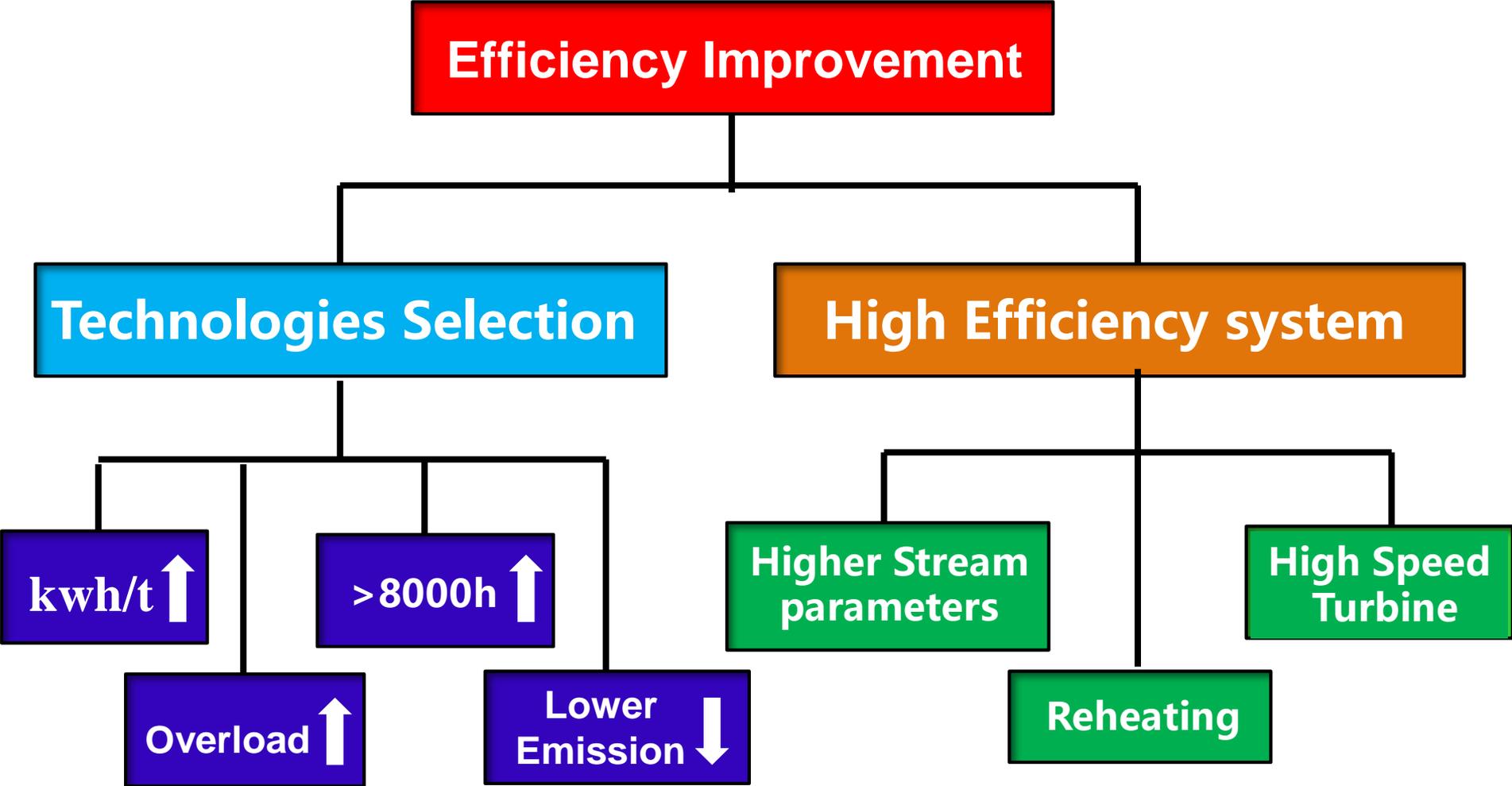


### **3、 Safety and reliability**

**Cleaner, more efficient, safer and less investment**



# Experience in improving the efficiency of WTE plants



- Wujiang WtE project has been operated for one year, the highest power generation per tons of waste is 608kwh/t
- Operation data of 3×750t/d Phase II project in Nanjing

1. Construction period: From Jan 2015 to Feb 2016, **total of 13 months**

2. 72+24 hour assessment test: From March 25 to 28,2017

3. Operating dataset :

1) Design LHV : **1800 kcal/kg**

★ 2) Capacity : 750t/d

3) 100%MCR : 40bar/400°C 73t/h

Max MCR : 80t/h

4) Ignition loss : **1.7-1.8 < 3%**

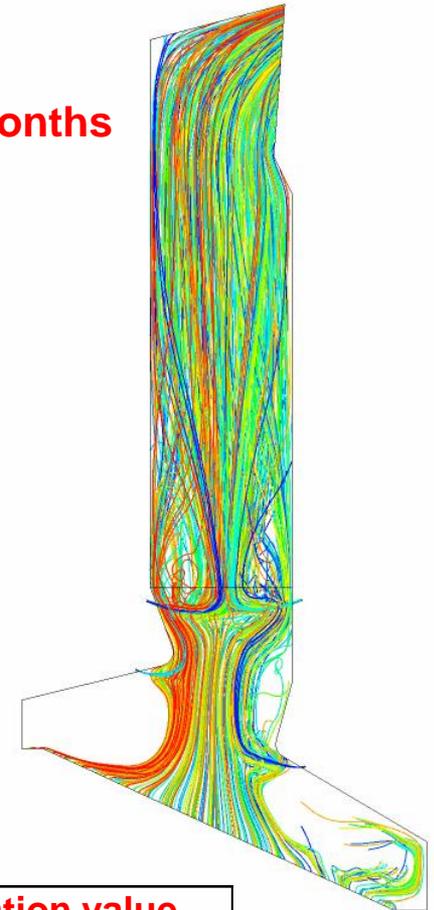
★ 5) Power generation per tons of waste : **570kwh/t**  
 Highest power generation per tons of waste : **600kwh/t**

6) Power consumption rate : **9.6%**

Ca(OH)<sub>2</sub> consumption : 12kg/t<sub>waste</sub>

Activated carbon consumption : 0.4kg/t<sub>waste</sub>

7) flue gas emission values :



	Unit	Design value	Actual operation value
Dust	mg/Nm <sup>3</sup>	10	<b>0.28</b>
HCL	mg/Nm <sup>3</sup>	10	<b>5.5</b>
HF	mg/Nm <sup>3</sup>	1	<b>0.1</b>
SO <sub>2</sub>	mg/Nm <sup>3</sup>	50	<b>9.8</b>
NOx	mg/Nm <sup>3</sup>	200	<b>150</b>
Dioxins	Ng/ Nm <sup>3</sup>	0.1	<b>0.010</b>

# The Development history of Everbright high efficiency system

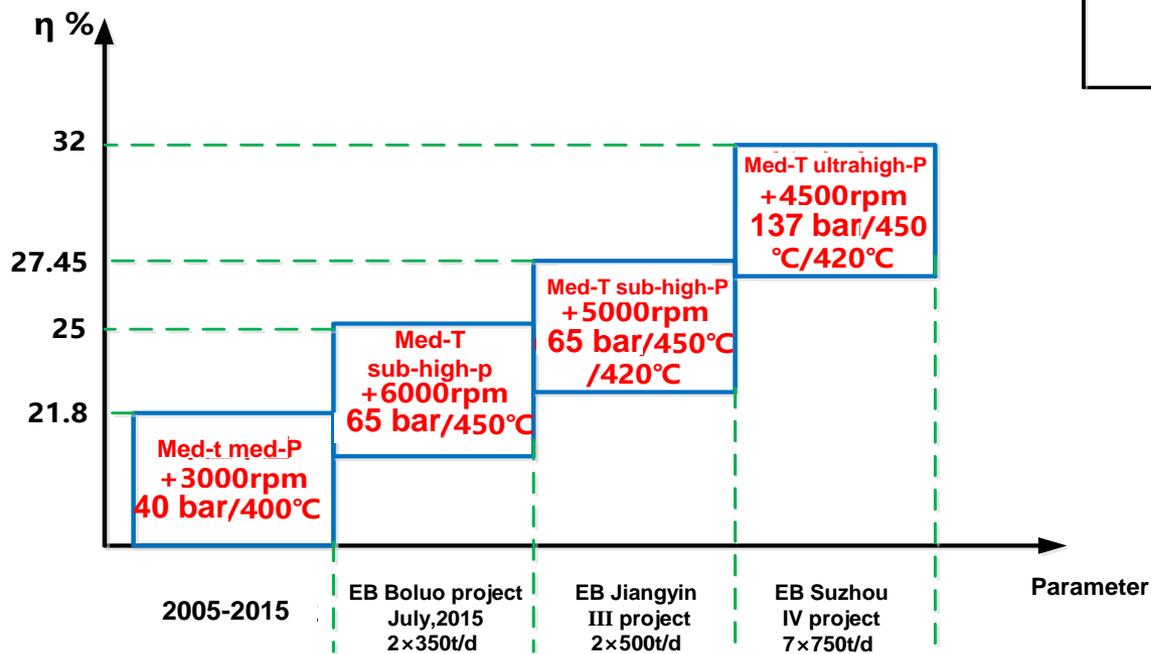


Fig1 Variation tendency chart between cycle thermal efficiency versus steam parameter

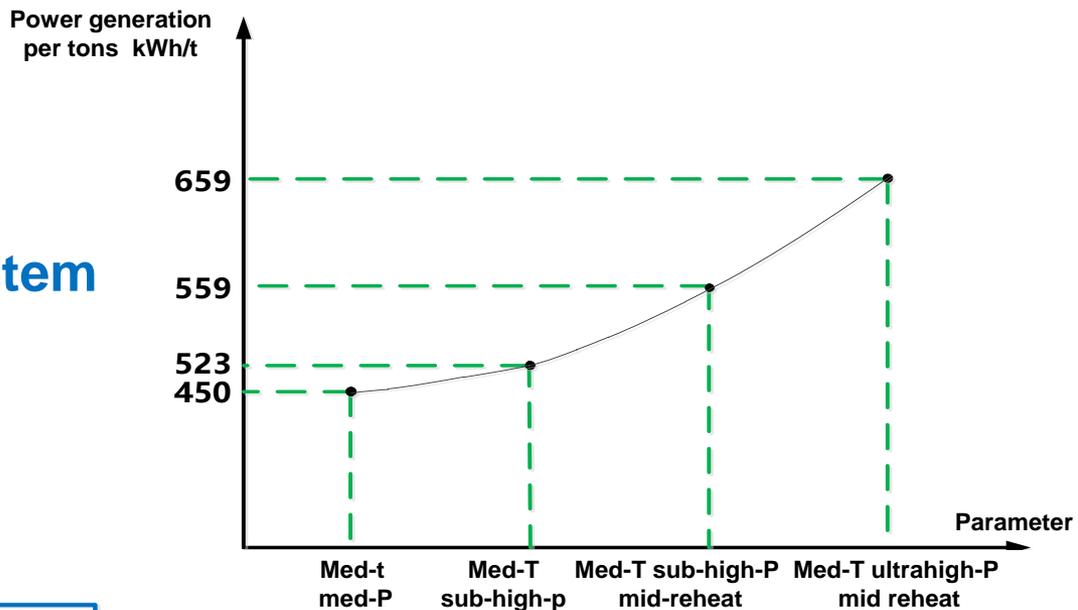


Fig2 Waste Design LHV=1800kcal/kg  
Diagram between power generation per tons versus stream parameter LHV

# Resource recycling and cyclic utilization

## Slag making brick

The waste slag produced by WtE can be reuse to make brick after inspection.



# Resource recycling and cyclic utilization

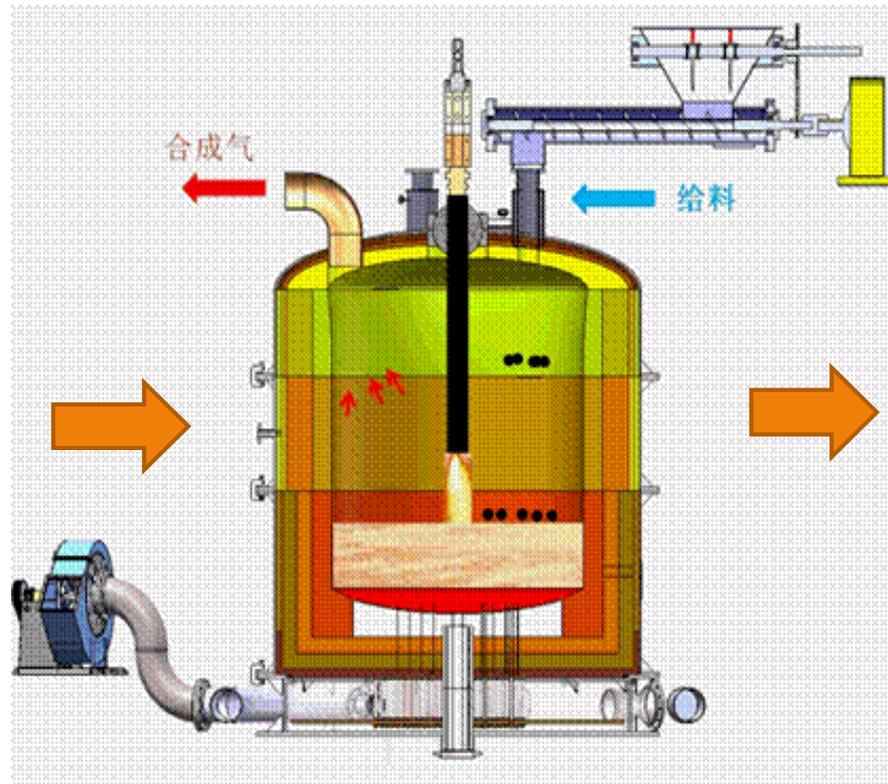
## Harmless treatment of fly ash

At present, harmless disposal of fly ash ends up in pollution-free landfill after solidification treatment.

Plasma fly ash fusion is in construction, the product is Plasma vitrification slag, can do building materials.



Fly ash in WtE



Plasma melting furnace

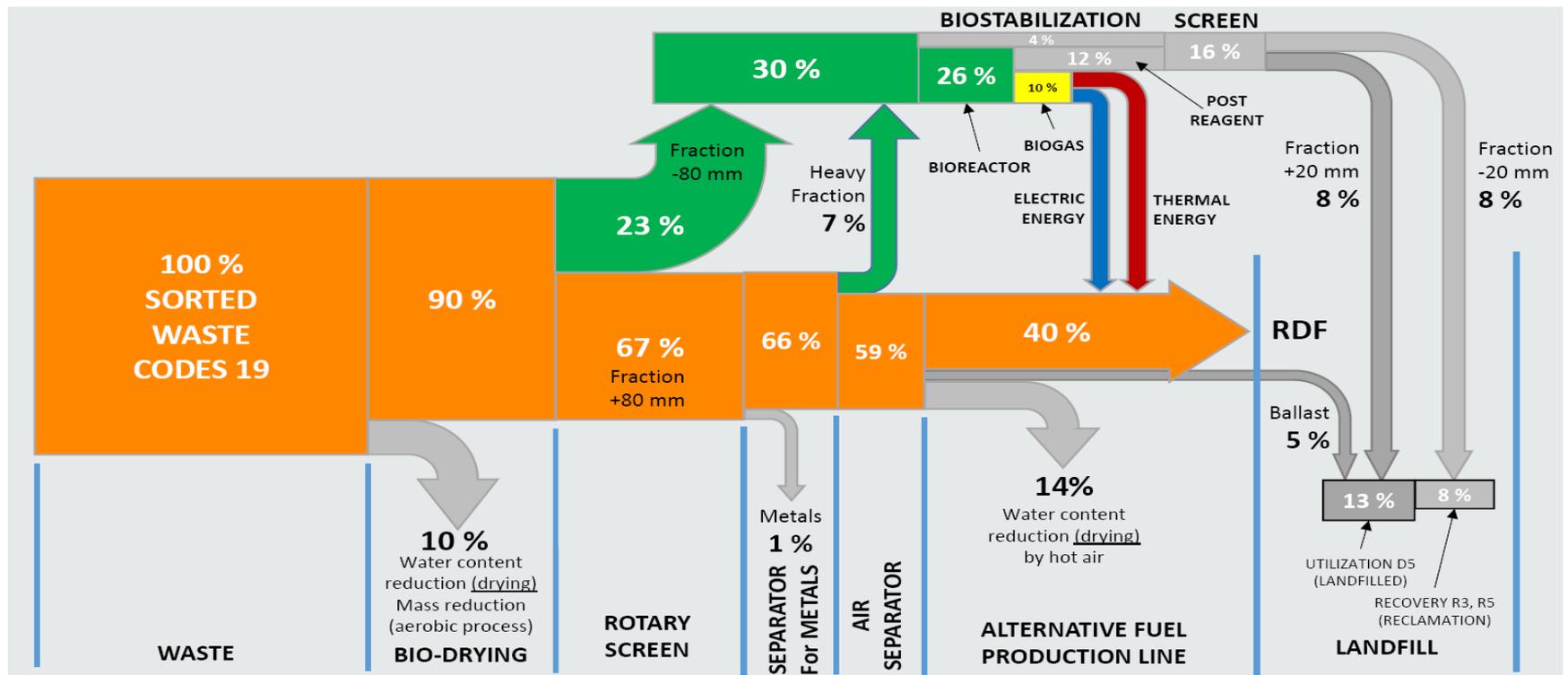


Plasma vitrification slag

# Everbright—Novago Poland

In August 2016, **Everbright** acquired Poland's largest waste disposal company **Novago**, the company's business scope covers waste disposal, landfill methane production, the production of **RDF**, **biogas cogeneration**, etc..

The anaerobic batch reactor (**ABR**) system is developed by Novago in order to dispose waste fraction that is not suitable for RDF production, whose function is the production of biogas from municipal waste under controlled conditions to generate electricity.



**Everbright would like to share the technologies and management experiences from over 70 projects whichever relate to investment, construction and operation knowledges. The UNECE PPP is the best model for developing environmental protection in developing countries .**

**Welcome to visit Everbright WtE Projects and Novago Poland.**

**THANK YOU !**

