

Wastewater: Moving Towards Low Carbon and Energy-generating Technologies

Jingmin Huang
Senior Urban Development Specialist
RSAS

Impacts of Climate Change

- Global climate change impacts will be on water
 - changes in hydrological cycle, increased variability and extreme weather conditions, and accelerated sea level rise.
 - climate change adaptation has to focus on water**



SA, SEA and EA affected

Need for Clean Technology in Asia: Why?

✿ **Water scarcity**

- ▣ gap between water supply and demand will be 40% across Asia in 2030

✿ **Water pollution – lessening freshwater resources**

- ▣ 80%-90% of wastewater in Asia is discharged without treatment

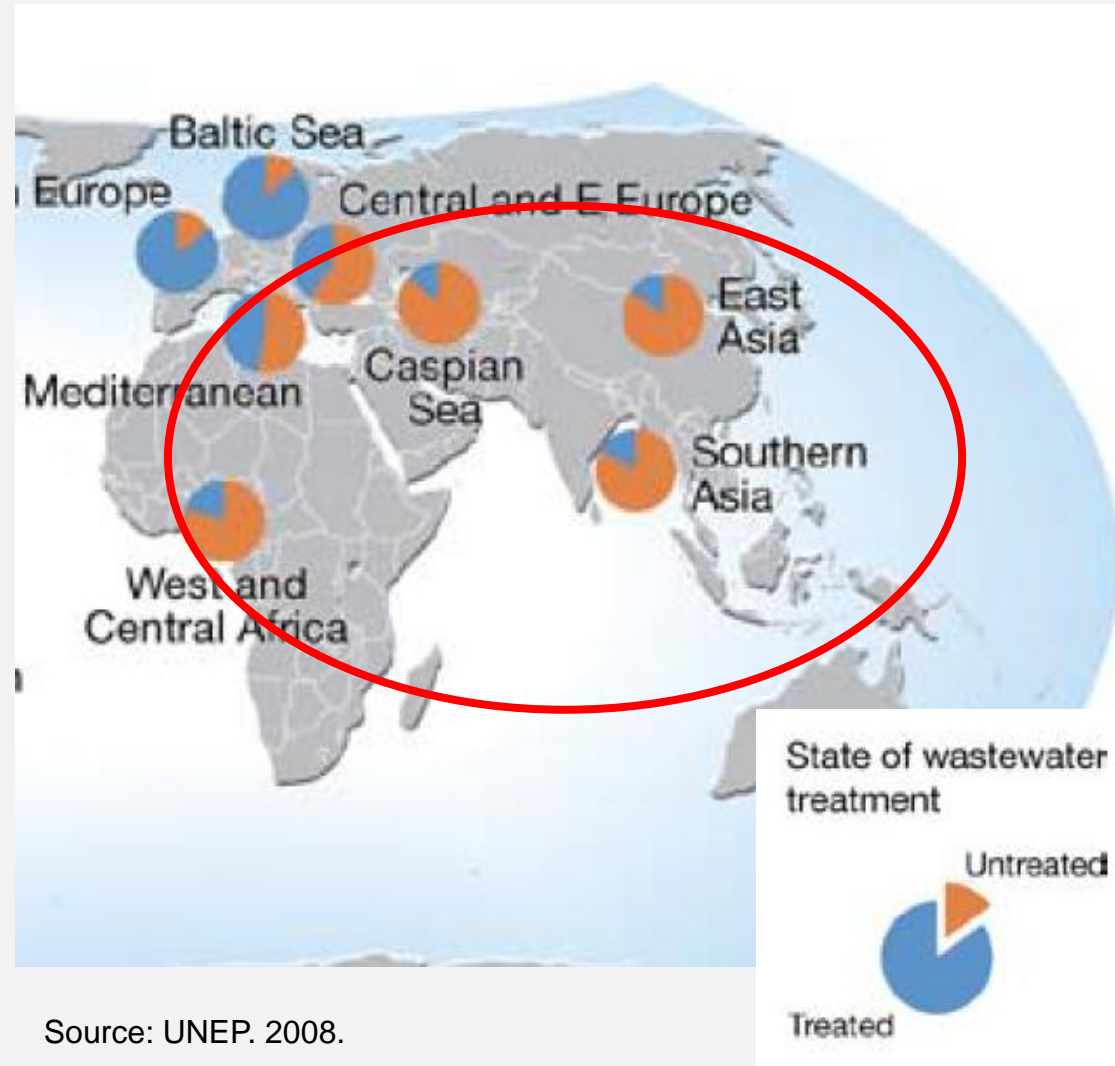
✿ **Energy needs**

- ▣ Asia's energy demand: 2.4% growth per year

Wastewater Management

☀ Pollution reduction and wastewater management:

- ▣ reduce stress on water resources
- ▣ achieve health benefits
- ▣ maintain ecosystems
- ▣ potential source of energy, water and nutrients



Source: UNEP. 2008.

Realizing the Opportunities of Wastewater Reuse

Wastewater in the water, food and energy nexus



Green agriculture:

Wastewater for irrigation

Composted excreta as fertilizer



Green transportation:

Biogas as fuel for buses:

- Kobe, Japan
- Delhi, India
- Europe



Green energy:

Biogas and dried biosolids as fuel for cooking and lighting

Clean technology on Solid Waste Management

- Material recovery facilities (MRFs)
- Anaerobic digesters (compost and biogas)
- Waste-to-Energy technology
- Bio-reactor landfills (designed and operated as anaerobic digesters)
- Landfill gas recovery (LGF) system





How ADB is Doing on Clean Technology

Viet Nam: Low carbon decentralized wastewater treatment technology

✿ Components:

- ▣ Gravity-fed sewer
- ▣ Primary settling unit
- ▣ Anaerobic baffled reactor
- ▣ Anaerobic filters
- ▣ Horizontal gravel filter



✿ Benefits:

- ▣ Minimum investment and O&M requirements (e.g., low energy cost)
- ▣ Suitable for low-income peri-urban communities
- ▣ Replicability

Batangas, Philippines: Industrial Wastewater Management

Absolut Distillers, Inc.

☀ Reuse of biogas:

- ▣ Total biogas generated annually: 8,712,000 m³
- ▣ Bunker fuel saved annually: 4,623,300 liters;
- ▣ Annual fuel savings: P161.8M (US\$ 3.6M)

☀ Climate change mitigation:

- ▣ Reduction of CO₂ emissions: 96,000 tonnes per year

☀ Distillery effluent as liquid fertilizer:

- ▣ Used in 1,400 hectares of sugarcane plantation



Fiji: Wastewater Management with Greenhouse Gas Reduction

Kinoya Wastewater Treatment Project

CDM benefit claimed for destruction of methane: around 20,000 tCO₂e

Total CDM expenditure: US\$330,000

Income from CDM: around **US\$1-2 million**, about 3 to 6 times the expenditure



Sequential Batch Reactors



Anaerobic Sludge Digester



Methane Vented Out



Sludge Drying Beds

Waste to Energy (W-T-E)

- ▣ ADB PSOD financed Everbright W-T-E projects in the PRC;
- ▣ Incineration plants using BOT model,
 - ▣ Changzhou city with capacity of 800 ton/day
 - ▣ Suzhou city with capacity of 3,550 ton/day
- ▣ Electricity generation

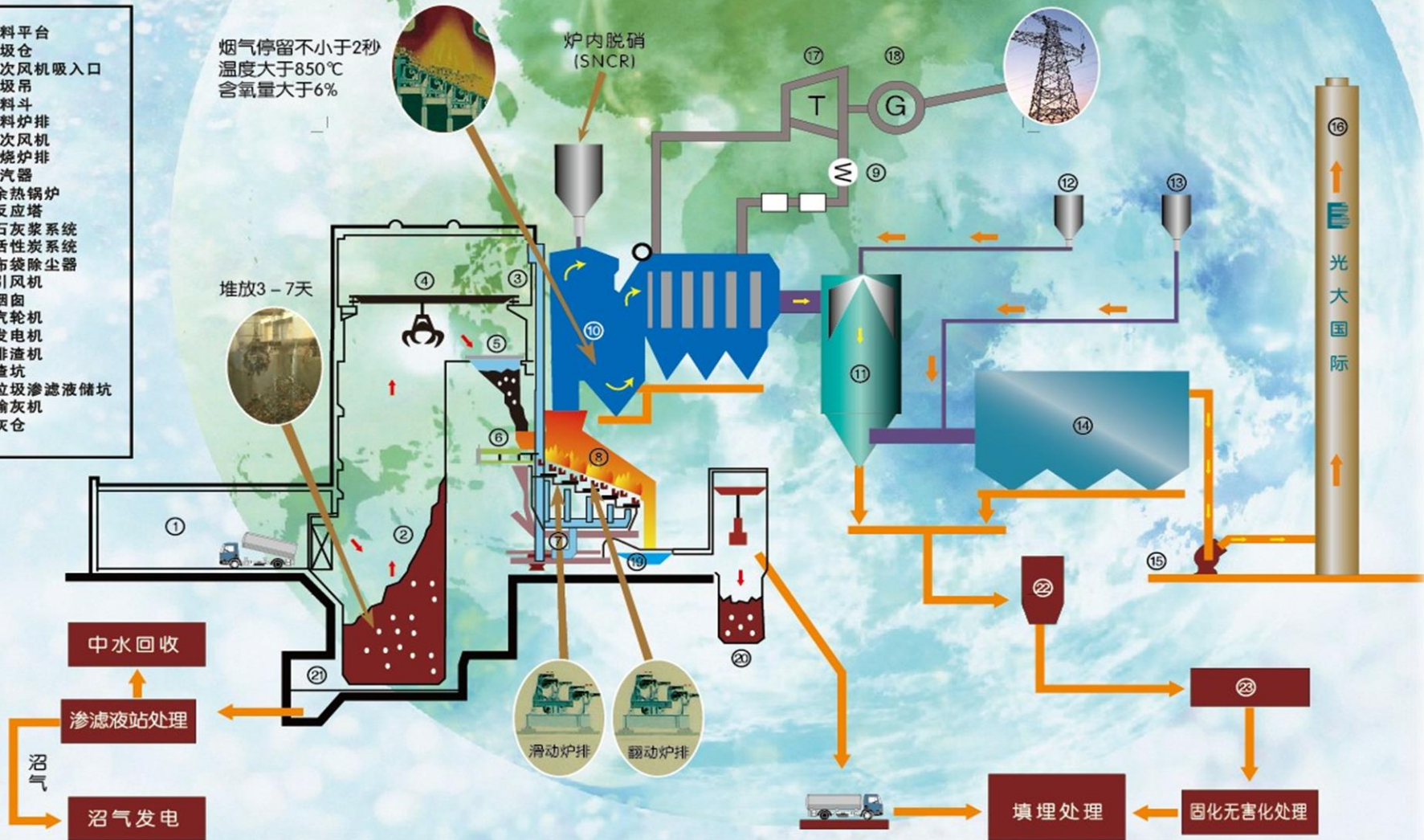
垃圾焚烧发电流程图

- 1、卸料平台
- 2、垃圾仓
- 3、一次风机吸入口
- 4、垃圾吊
- 5、给料斗
- 6、给料炉排
- 7、一次风机
- 8、燃烧炉排
- 9、凝汽器
- 10、余热锅炉
- 11、反应塔
- 12、石灰浆系统
- 13、活性炭系统
- 14、布袋除尘器
- 15、引风机
- 16、烟囱
- 17、汽轮机
- 18、发电机
- 19、排渣机
- 20、渣坑
- 21、垃圾渗滤液储坑
- 22、输灰机
- 23、灰仓

烟气停留不小于2秒
温度大于850℃
含氧量大于6%

炉内脱硝
(SNCR)

堆放3-7天



Operation Performance

- ✿ Significant reduction of waste volume, and
- ✿ Generated renewable energy
- ✿ Proper treatment of
 1. Flue Gas Treatment
 2. Leachate Treatment
 3. Solid residues
 4. Fly ash



W-T-E: PPP Based Sustainability

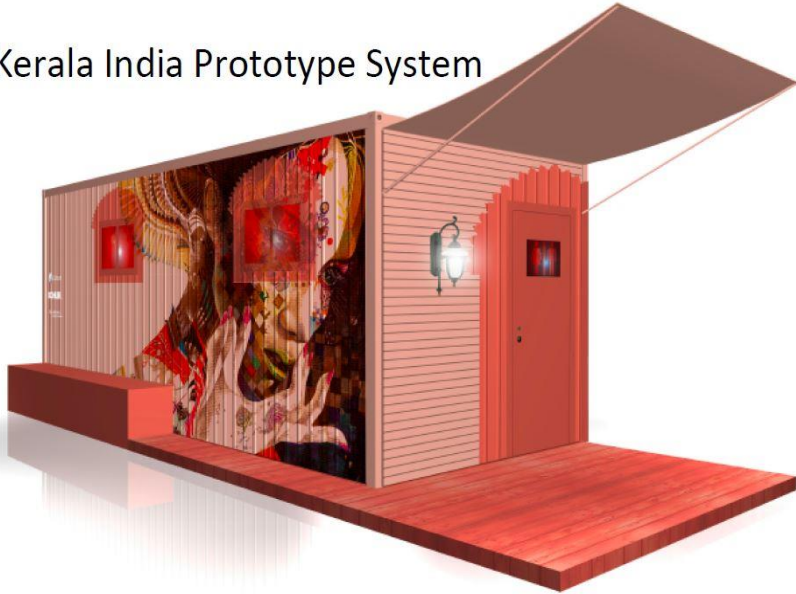
- Government's policy to provide financial incentive for electricity generated through renewable energy (\$0.11 /KWH vs \$0.07 /KWH)
- Adapted incineration technology
- Tipping fee at \$10-\$15/ton by municipal government, and
- the restrict control of emission standard and operation environment by the local government and the operators.



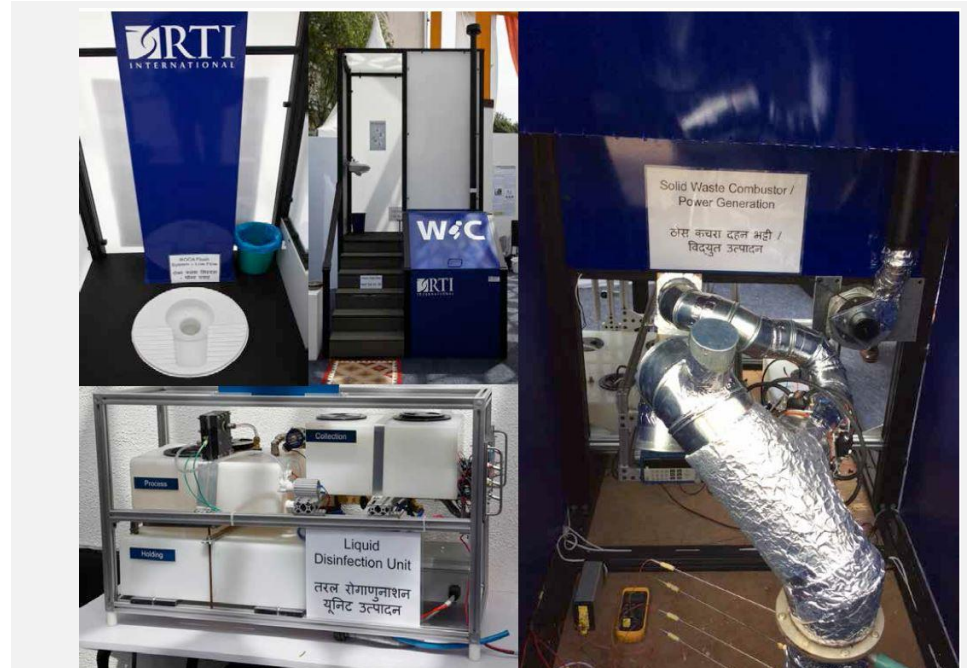
World-wide Best Practice

Toilets of the future

Kerala India Prototype System



A Working Solar Toilet Facility with Water Purification and Recycle



Toilet with Waste Combustion and Power Generation



Kobe, Japan: Biogas to fuel transport and homes

Generation of fuel savings: use of biogas to fuel buses and waste collection trucks (14,000 vehicles/yr)

Around 2,500 households benefitted from using biogas

Reduction of about 2,700 tons of CO₂ annually



Hong Kong: SWM with Biogas Recovery

SOLUTION

- Biogas **collection**
- Biogas **recovery in 3 ways**:
 - thermal leachate treatment
 - landfill site electricity supply
 - used as fuel in a thermal power plant
- **On site** collection and treatment of leachate

CONTEXT

Island territory

Very high environmental standards

OBJECTIVES

Biogas recovery to produce **heat and electricity**

Site total capacity: **35 million m³**

RESULTS

Every day:

- **1000 m³** of leachate treated
- **1.9 MW** production of electricity
- More than **25,000 m³ of biogas** treated and transferred to a thermal power plant
- **Generator capacity: 3 MW**

Conclusions

- ✿ There is growing demand for:
 - ▣ alternative sources of water;
 - ▣ alternative sources of energy.
- ✿ Technology always available.
- ✿ Potential area for green, low carbon growth:
Addressing the **Water-Energy-Food Nexus** simultaneously.
- ✿ Low carbon technologies in wastewater and solid waste: opportunities for cross-sector applications.

Thank you.

www.adb.org/water

www.wastewaterinfo.asia



www.wastewaterinfo.asia

