Managing WTE Cost Recovery

TA 7294-PRC
Municipal Waste to Energy Project

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The Municipal Waste to Energy Project

TA Scope of Work

- Operational performance of WTE plants

- Environmental management and capacity development

The Municipal Waste to Energy Project

Work Program

- Kick-off meeting held in Hong Kong, June 22
- Submission of Inception Report, August 13
- Three Annual Workshops, 2010 and 2012-2013
- Interim Report submitted, 3rd quarter of 2013
- Final Report to be submitted, 1st quarter of 2015

CEIL WTE Facilities

CEIL WTE Facilities (Cont'd)

chengzhou

jiangyin

CEIL WTE Facilities (Cont'd)

jinan

suzhou

CEIL WTE Facilities (Cont'd)

yixing

zhengjiang

Managing WTE Cost Recovery

- Lower project risk on operating agreement and performance guarantee T&C
- Cost effectiveness operating and maintenance
- Overall success on favorable pricing and good revenue expectations

Refuse Handling and Mixing

- Removal of undesirable waste
- Good refuse mixing and pit operation
- Supplemental fuel and waste

Furnace Combustion

- Maximizing time, temperature and turbulence
- Adequate Combustion air
- Critical Temperature control

Repairs and Replacement

- Routine equipment maintenance
- Major overhaul
- Necessary repairs and replacement work

Overall WTE Performance

- The performance of all CEIL WTE facilities in the past few years has, for the most of the time, been better than originally designed ; and
- This is expected to continue as long as routine equipment maintenance and major overhaul, necessary repairs and replacement work been keep-up continuously.

O&M Benchmarking

- Boiler and Turbine Generation Availability
- Electricity Generation and Use
- Lime and Carbon Use

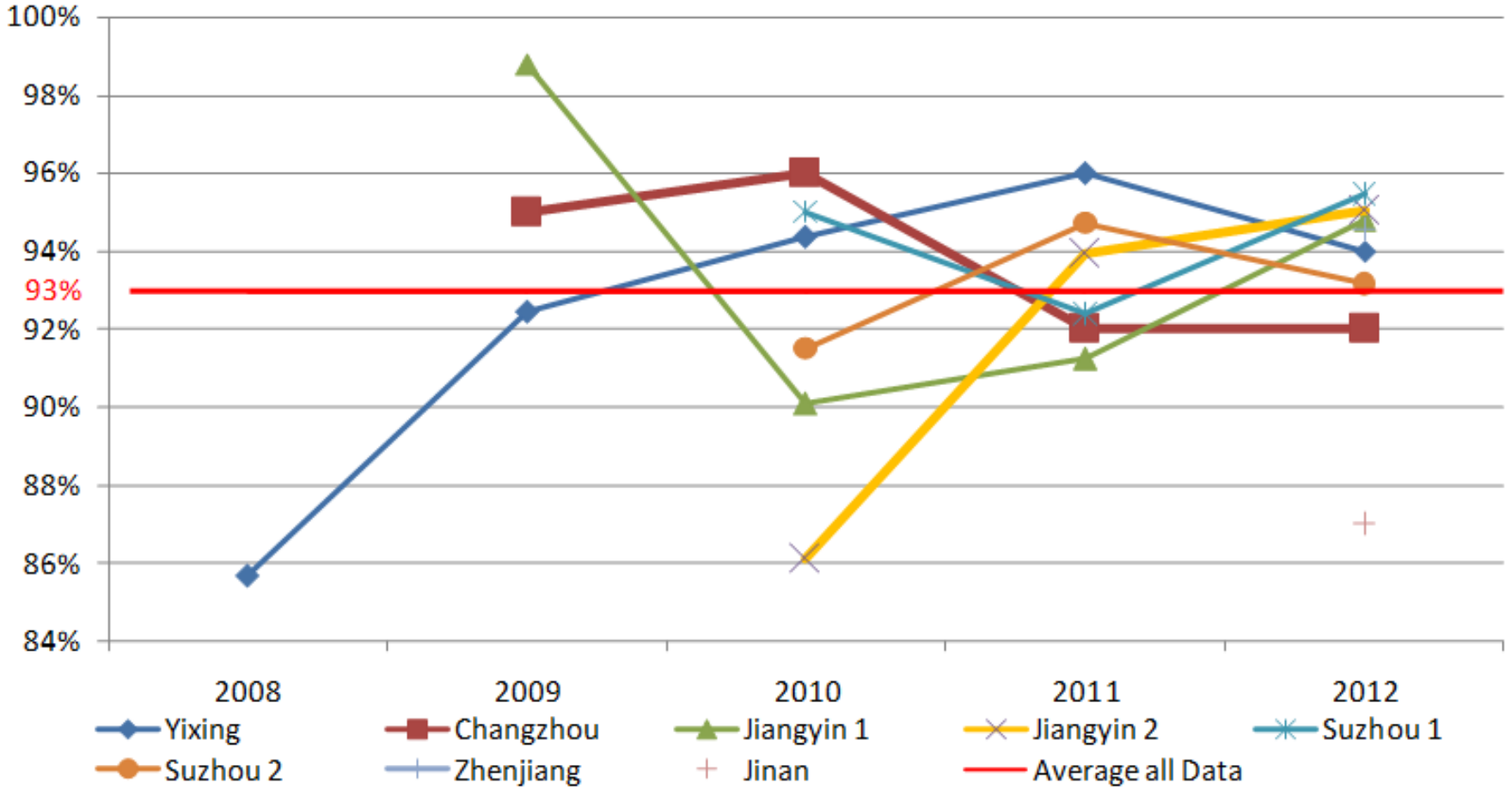
Boiler and Turbine Generator

- The percentage of time that each combustion unit and the turbine- generator operated during the year
- Combustion unit and turbine-generator availability have a direct effect on the amount of waste that a facility can process and the amount of electricity it can generate

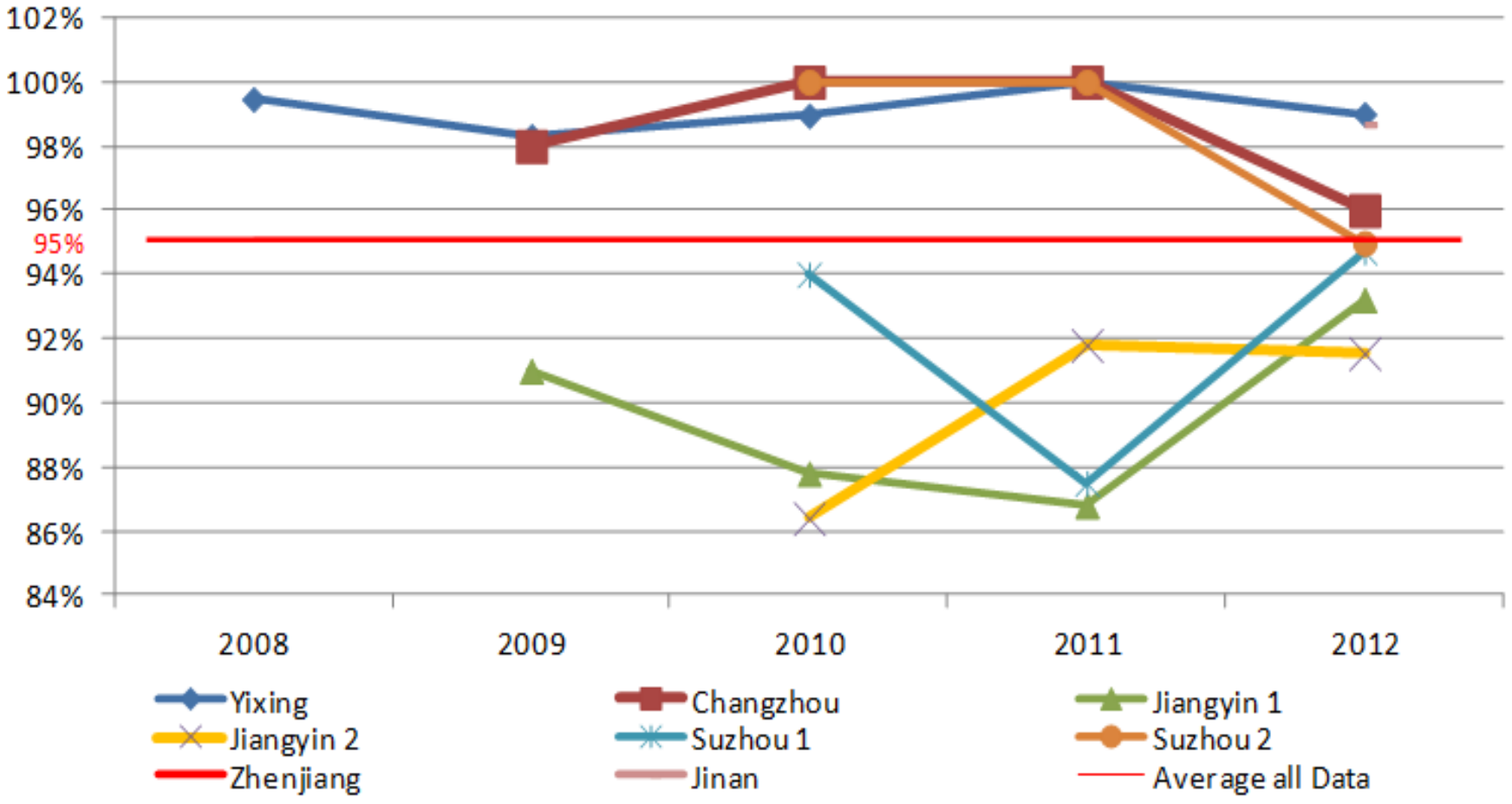
Boiler and Turbine Generator

- Average boiler and turbine-generator availability is 93% and 95%, respectively, higher than 90.3% or closer to 96.6%, of the average values of fifteen WTE s in the States
- Boiler steam capacity utilization varies 88-106 % , average of 95.6%, near the average 96% been cited in the States

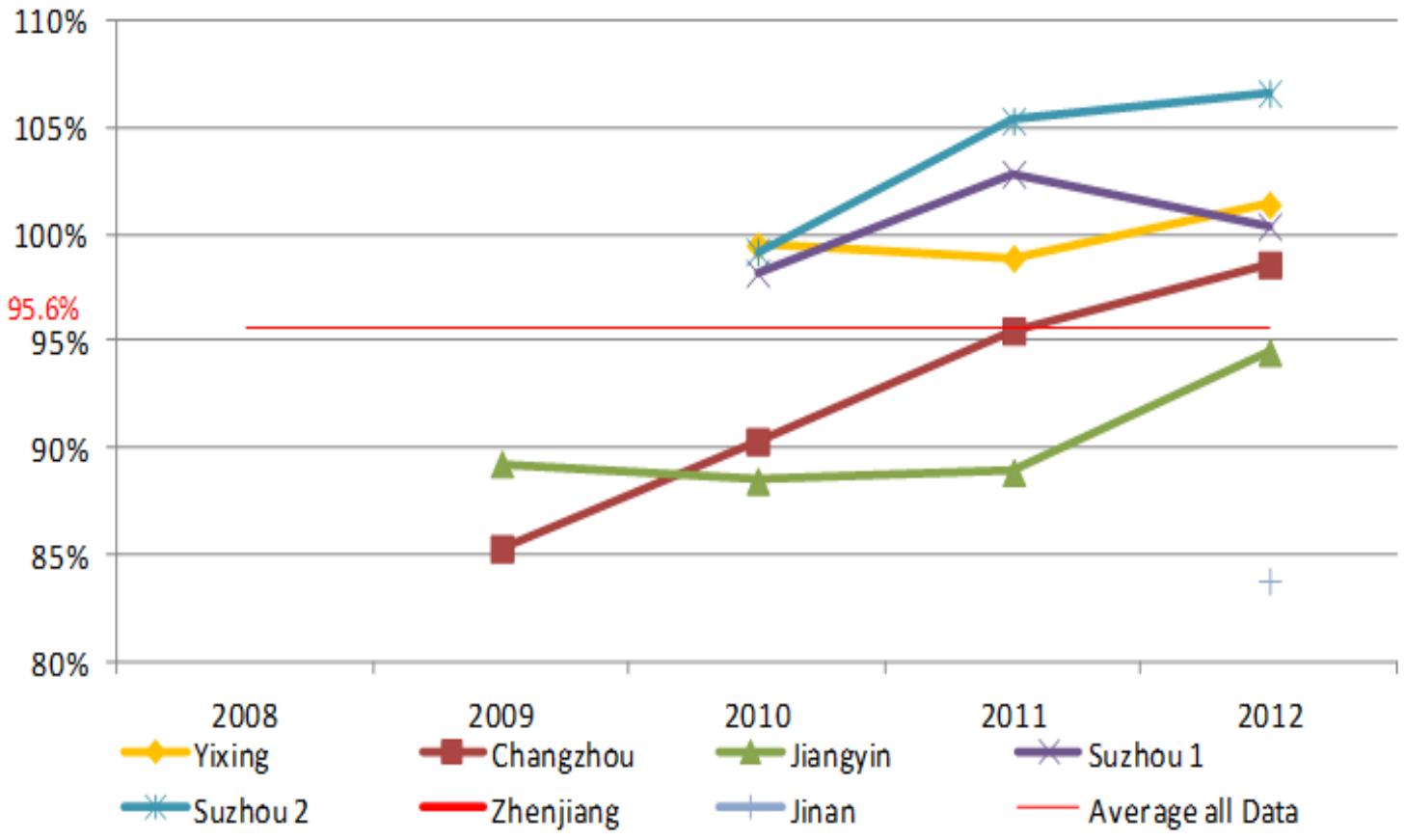
Boiler Availability



Turbine-Generator Availability



Boiler Steam Capacity Utilization



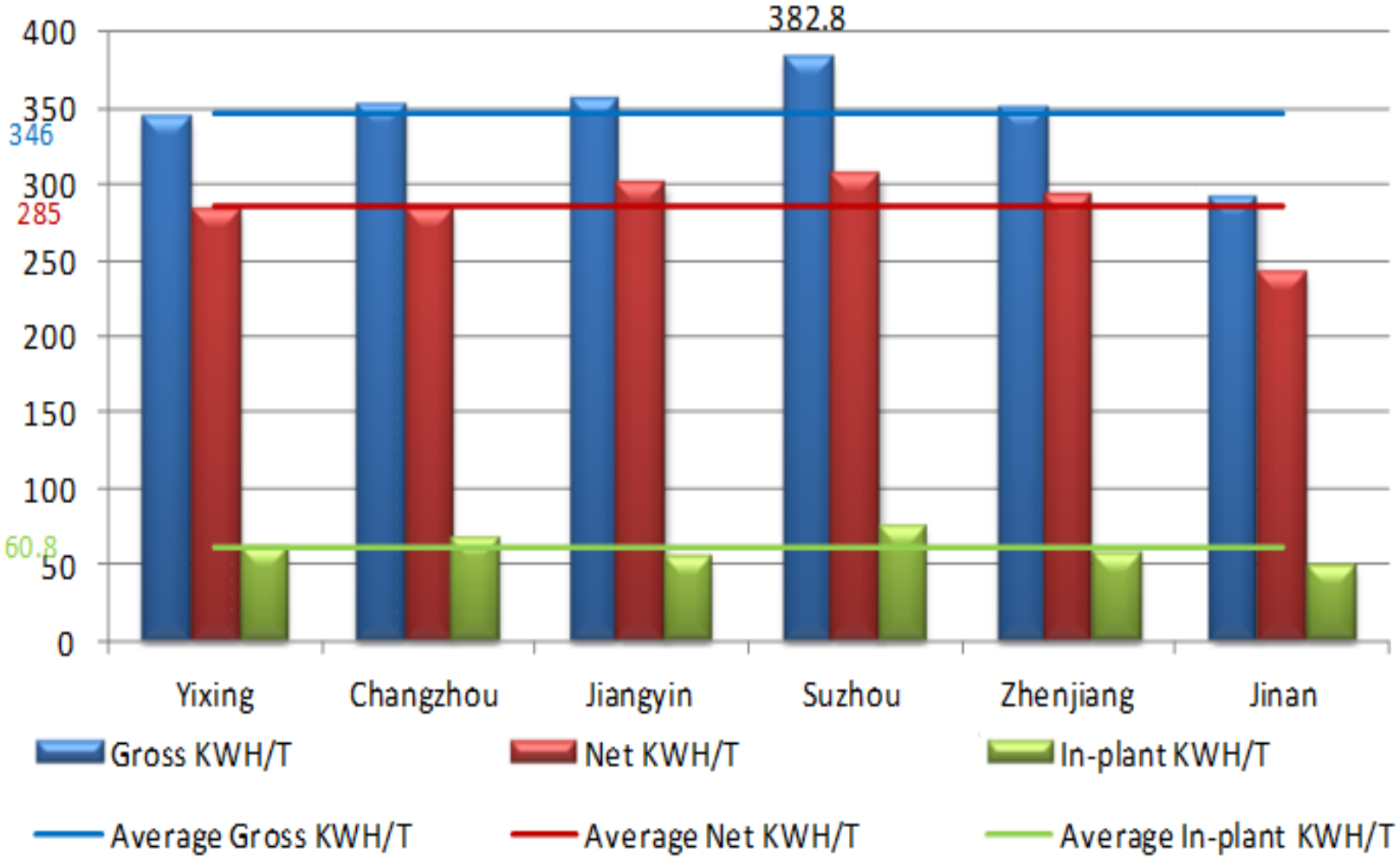
Electricity Generation

- Gross electricity, total amount of energy recovered from the combustion process and converted to electricity
- In-plant electricity, the amount of energy used to operate the WTE
- Net electricity, the amount of energy available for sale

Electricity Generation

- The average annual gross, 345-382 (ave. 346) KWH/ton
- Net electricity generation, 284-307 (ave. 285) KWH/ton
- In-plant electricity consumption, 55-75 (ave. 61) KWH/ton

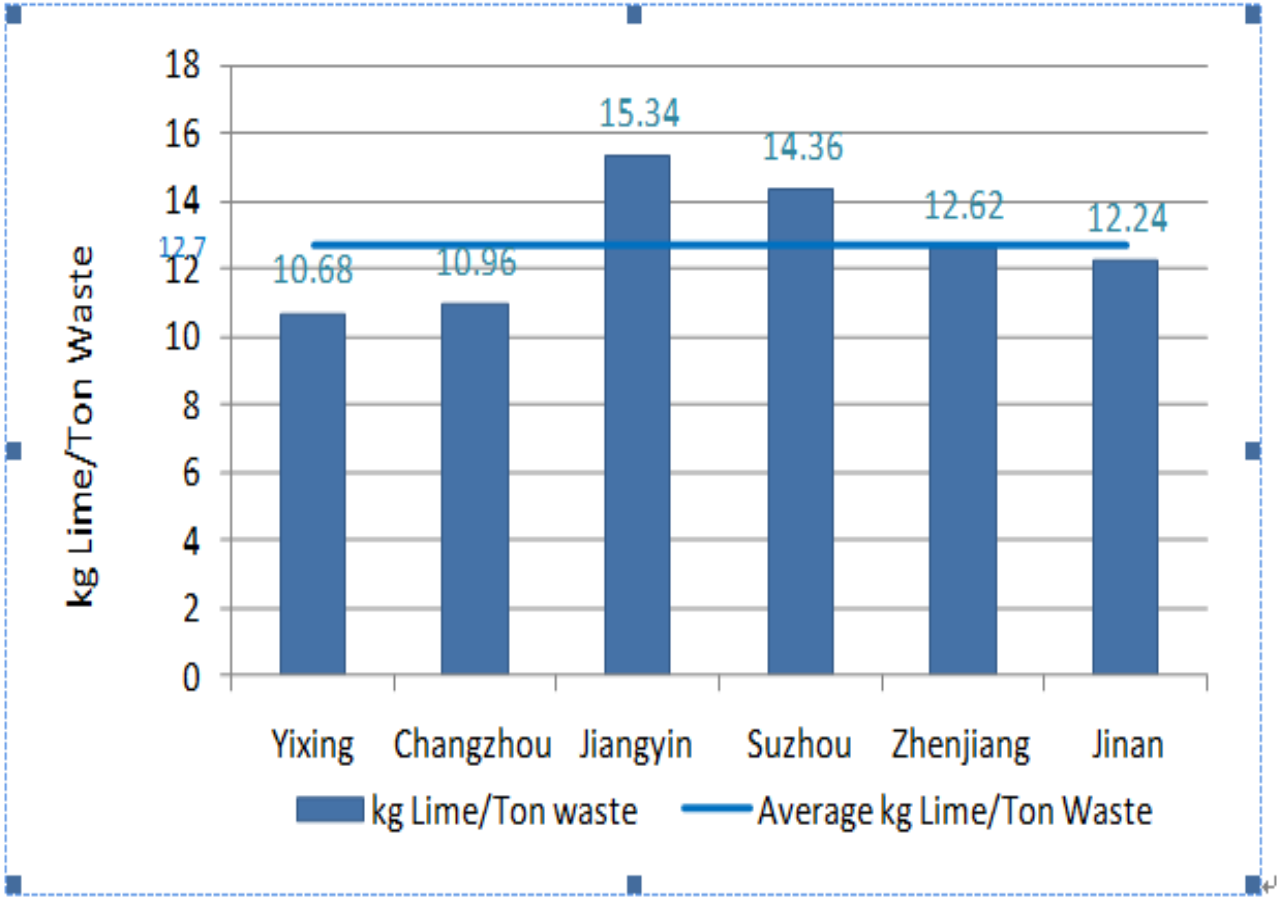
Electricity Generation and Use



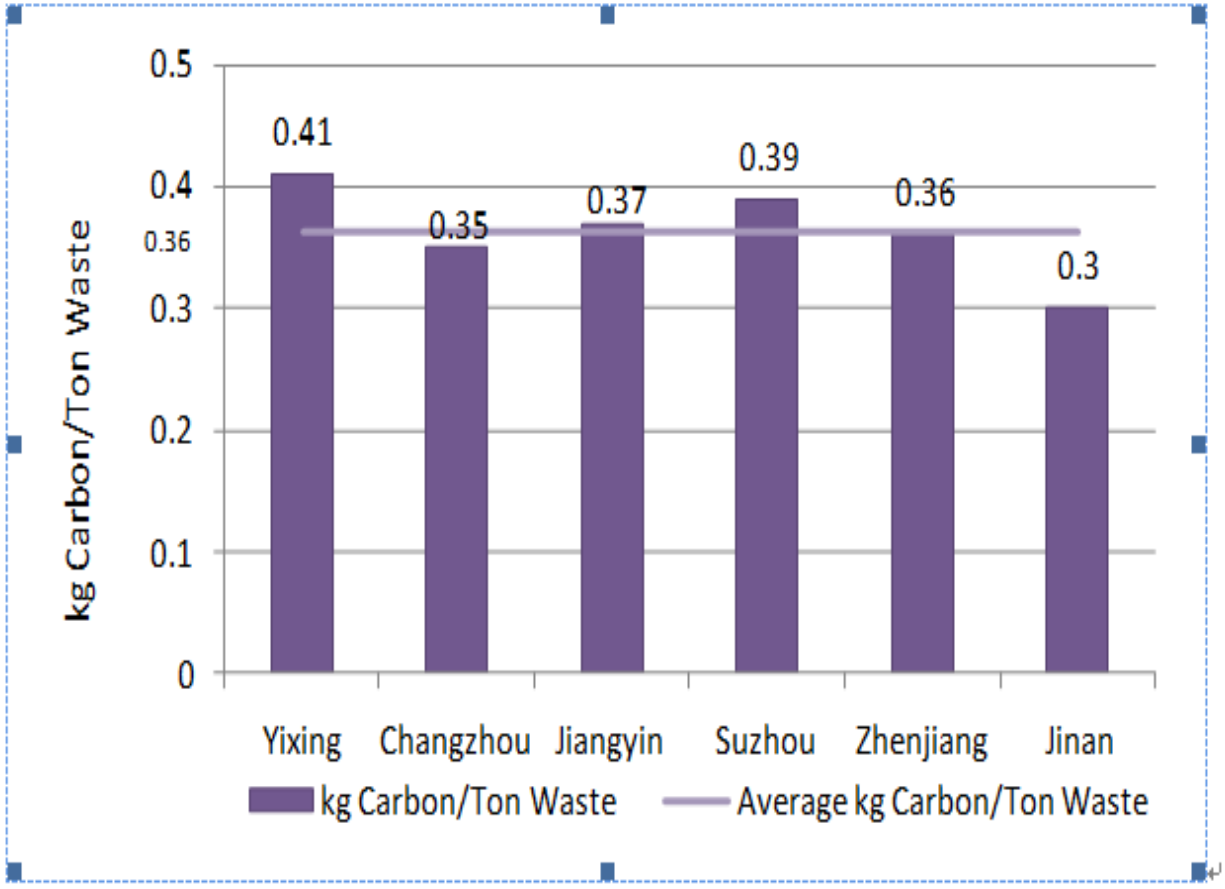
Lime and Carbon Use

- Lime and activated carbon are used at WTE facilities to control acid gases, and mercury/dioxins, respectively
- Average lime use is 12.7 kg/ ton in 2012, 25% higher than 10.02 kg/ ton in 2011, with the additions of scrubbers (higher than 9.66 kg/ ton, the average lime use been cited in the States)
- Average activated carbon usage rate, is 0.36kg/ ton of refuse

Lime Feed Rates



Carbon Feed Rates



Environment & Community Management

- Air Emission & Noise Control
- Leachate Treatment and reuse
- Ash and resides management
- Environmental monitoring
- Community relation

Air Emission & Noise Control

- Noise level of cooling water circulation to be monitored closely
- Selective Non-Catalytic Reduction (SNCR)was installed to reduce Nox
- Dry lime neutralization system was introduced to further reduce HCl emission
- Long term surrounding environment dioxin monitoring is highly recommended

Leachate Treatment and Reuse

- Advance leachate treatment was able to recycle treated leachate for in-plant use
- Methane-to-energy electricity generator system was adopted to generate electricity

Ash and Resides

- Stringent site management on fly and bottom ash on-site stabilization and storage is suggested
- Fly ash is stabilized and disposal off in the designated landfill
- Bottom ash is solidified and reused as construction material

Financial Sustainability

- The throughput and energy recovery is highly dependent on the refuse heating value, refuse throughput is inversely proportional to heating value, but energy recovery is proportional to refuse heating value
- Net electricity generation, financial projections rely heavily on the expected net electricity generation which establishes the expected energy revenues

Conclusion

- Strong government policy & great supports
- Diversify financing & government subsidies
- Advance engineering & reliable equipment
- Cost-effective operation & maintenance
- Stringent environmental compliance
- Good public relation and community supports

Integrated Solid Waste Management Workshop

- Our sincere appreciation on Bank’s strong support and CEIL's arrangements and courtesy been extended from CEIL’s China Operations and the Project Companies
- Thank you for this great opportunity to share our TA experience on WTE cost recovery in this ISWM Workshop