焚化爐於東南亞的應用

Application of incinerators in South East Asia

Ir Daniel M. Cheng, MH, JP
President, Hong Kong Environmental Industry Association
Deputy Chairman, Federation of Hong Kong Industries
Council Member, Hong Kong Productivity Council
Past Chairman, Hong Kong Waste Management Association

22th Nov 2013

Outline

1. Background
2. Japan
3. Singapore
4. South Korea
5. Summary

Outline

1. **Background**
2. Japan
3. Singapore
4. South Korea
5. Summary

Background



Background

•An overview of waste to energy Incinerator in other metropolitan cities

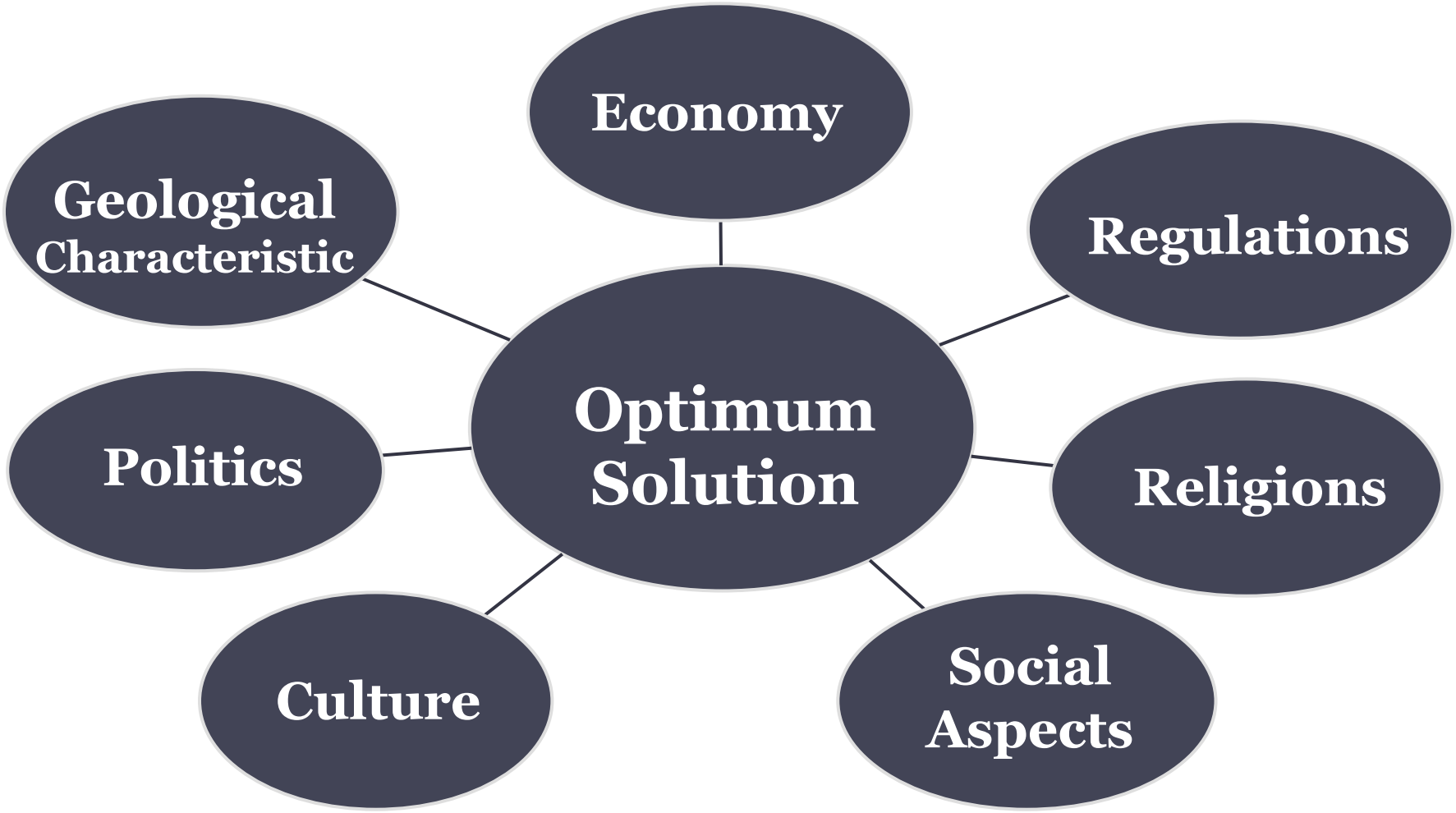
各地轉廢為能焚化廠一覽

Plant (Commencement) 廠房（啟用年份）	Capacity (tonnes/day) 容量（公噸／日）	Waste to Energy Capability (kW) 廢物轉化能源能力（千瓦）	Estimated No. of Households Supported 估計可供使用住戶數目（戶）
Roosendaal, The Netherlands (2011) 荷蘭羅森達爾（2011）	800 (2 lines) 800（2 條生產線）	30,000	70,000
Singapore (2000) 新加坡（2000）	3,000 (6 units) 3,000（6 個機組）	80,000 (2 units of steam turbine) 80,000（兩個蒸汽渦輪機）	125,000
Taipei (1998) 台北（1998）	1,800 (4 units) 1,800（4 個機組）	45,000 (1 units of steam turbine) 45,000（一個蒸汽渦輪機）	No official data – 37,000kW of electricity directly sold to local power company 並無官方數據 — 37,000 千瓦電力直接售予當地電力公司
Seoul, South Korea (2005) 韓國首爾（2005）	750 (3 units) 750（3 個機組）	About 20,000 約 20,000	11,700

•Municipal Solid Waste generated in **Hong Kong**: > **17,000** tonnes/day, about **9,000** tonnes/day is being landfilled.

Optimum Solutions

Each city has its own issues for waste management, and the optimum solutions may vary depending upon :



Outline

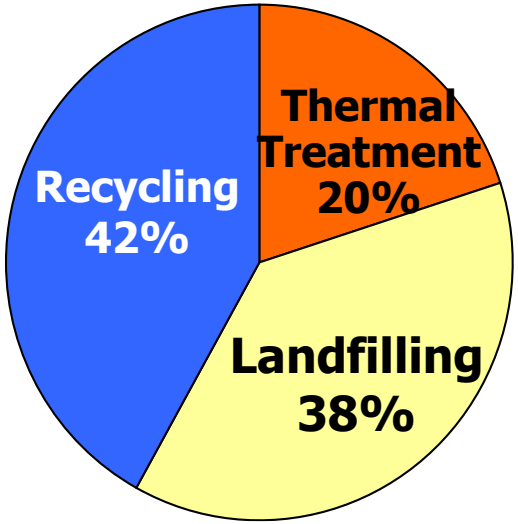
1. Background
2. **Japan**
3. Singapore
4. South Korea
5. Summary

JAPAN



Source: CEWEP

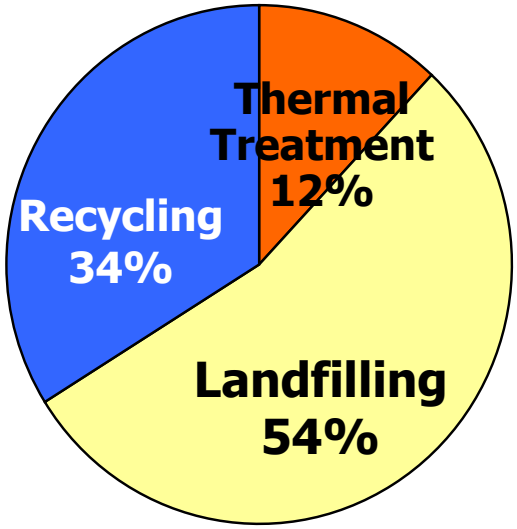
60 million ton/y - MSW
With 420 plants

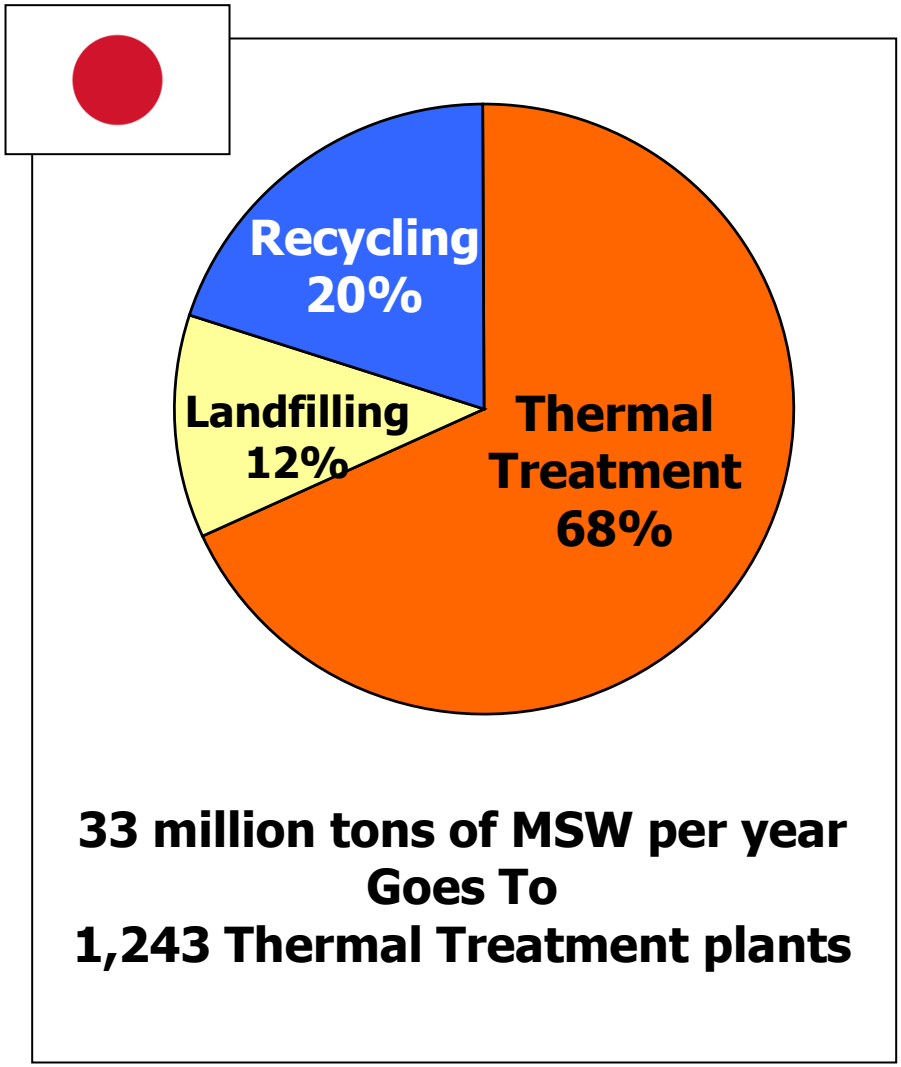




Source: USEPA

29 million ton/y - MSW
With 85 plants





Source: Ministry of Environment, Government of Japan



Hong Kong Japan Business Co-operation Delegation visit at Kawasaki in October 2009

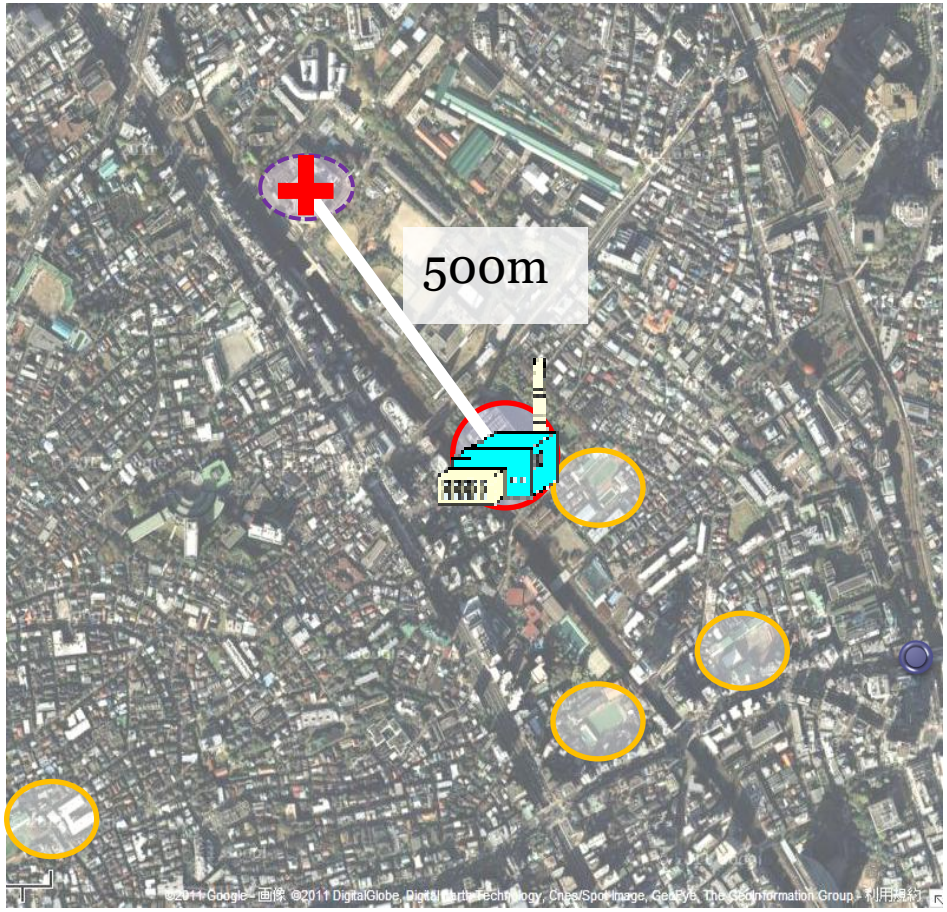






JAPAN





Name	**Meguro Plant (Tokyo)**
Input	**MSW**
Capacity	**600t/d (300t/d x 2)**
Completion	**1991**

WtE Plant

Hospital

School

Train Station


ひろば金沢
ひろば
受付
土足厳禁


一般ごみステーション
資源物ステーション
プラスチック
製容器包装
びん
かん（飲料かん）
金属類
きんぞくるい
金属類
せんい
繊維類
紙　類


もえるゴミ
もえないゴミ


その他のごみ
その他のごみ
新聞・雑誌
ビン・カン
ペットボトル
JR東海
JR東海
JR東海
JR東海
JR東海

JAPAN

JFE

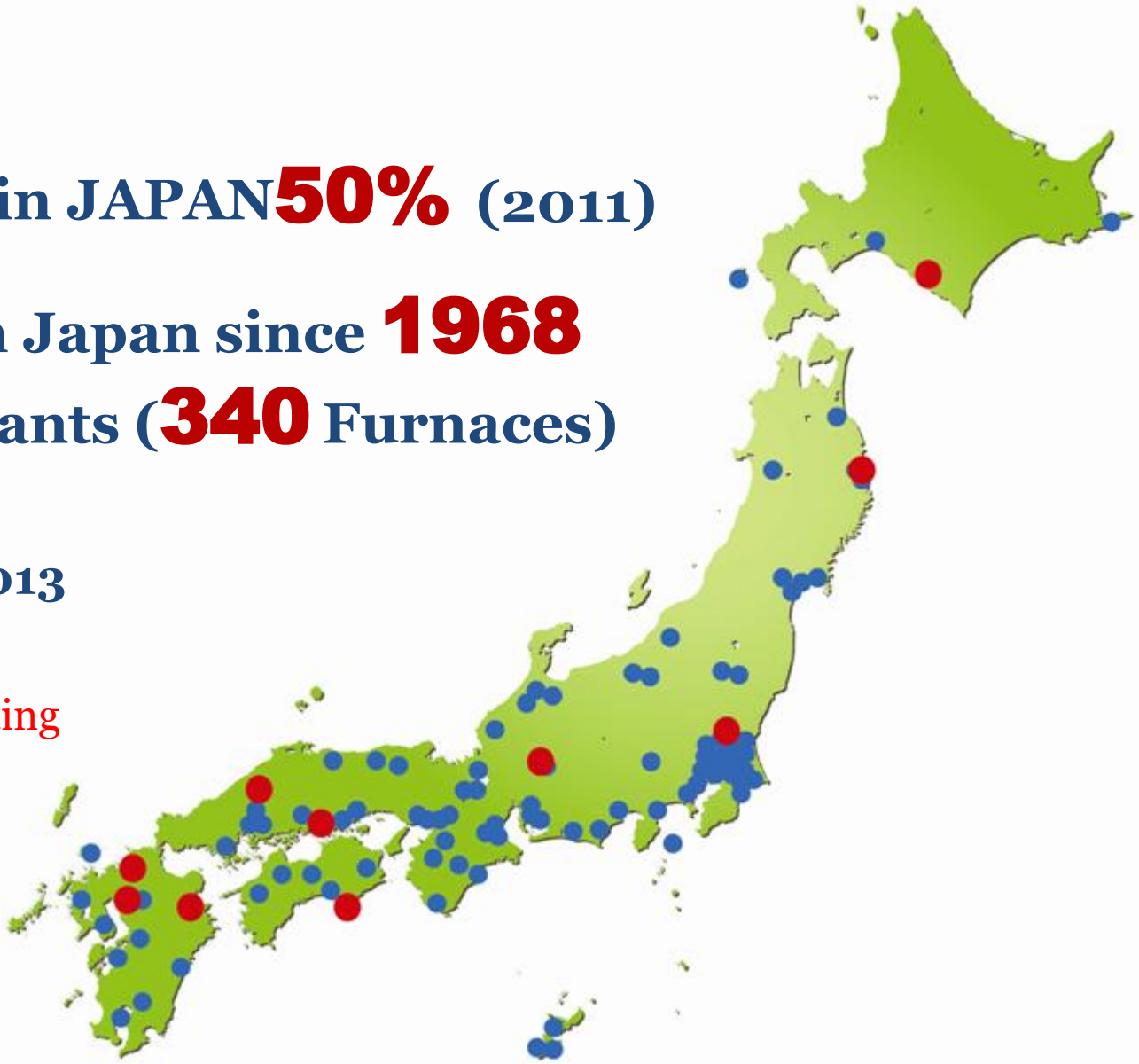
JFE's share in JAPAN 50% (2011)

Reference in Japan since 1968

Over 162 plants (340 Furnaces)

As of March 2013

- Gasifying & Melting
- Stoker & others



JFE

Italy
Gasifying 308t/d x 2



China
Stoker 500t/d x 3



China
Stoker 400t/d x 2



Thailand
Fluidized Bed 110t/d x 1









Thailand
Stoker 70t/d x 2

Reference
7 plants
(14 Furnaces)

Various Types of Wastes


Municipal solid waste


Waste tire

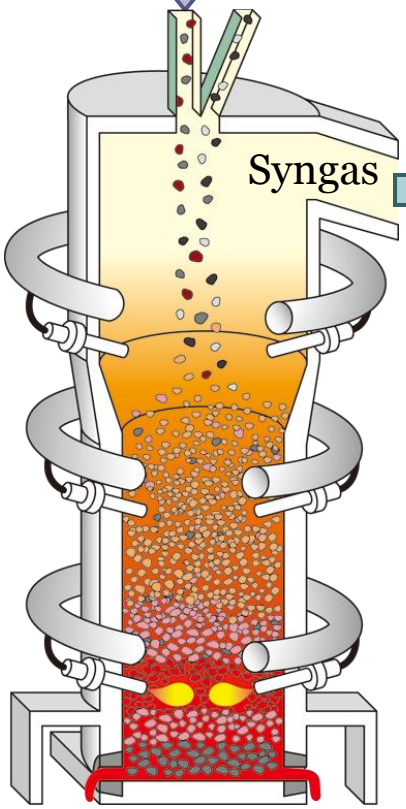

Refuse Derived Fuel (RDF)


Hazardous waste


Sewage sludge


Landfilled waste

Near-Zero Landfilling



Expected values and standard limits set by European Directive 2000/76/EC on the incineration of waste.



Dioxins and furans (PCDD + PCDF)

expected value	regulatory limit
ng-TEQ/m³	ng-TEQ/m³
<0.0001	0.1

Outline

1. Background
2. Japan
3. **Singapore**
4. South Korea
5. Summary

SINGAPORE INCINERATION PLANTS



SINGAPORE

Waste
19,862 t/d

7,475 t/d **37%** → **Waste to Energy (incineration)**

11,846 t/d
Recyclable
60%
→ **Recycle**

541 t/d
Non-Incinerable
3%
→ **SEMAKAU Landfill**

1,779 t/d
Ash
9%
→ **SEMAKAU Landfill**



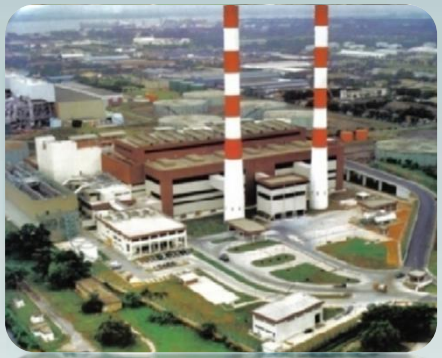
(Source : National Environment Agency's data in 2012)

Waste-to-Energy Plants

Location	Year		Capacity (t/d)
Tuas IP	1986		1,700
Senoko WTE	1992		2,100
Tuas South IP	2000		3,000
Keppel Seghers Tuas WTE	2009		800
		Total	7,600



Tuas IP


Senoko WTE Plant
(divested 2009)


Tuas South IP



Keppel Seghers Tuas WTE Plant
(DBOO IP)

Tuas South Incineration Plant



Built at a cost of $890 million
Commenced operation on 23 Jul 1999
Expected lifespan: 30 years (till 2030)

Largest incineration plant in Asia

Area: 10.5 hectares (sited on reclaimed land)

Tuas South Incineration Plant

Tuas South Incineration Plant Emission Data for 2011

(units in mg/Nm3 except otherwise indicated)

(Source: Brochure of Tuas South Incineration Plant, downloadable at http://app2.nea.gov.sg/docs/default-source/energy-waste/tsip-brochure.pdf?sfvrsn=2)

大士南焚化廠 2011 年排放數據（除另有指明外，單位為毫克 / 標準立方米）

（資料來源：大士南焚化廠資料小冊子，可於以下網址下載：http://app2.nea.gov.sg/docs/default-source/energy-waste/tsip-brochure.pdf?sfvrsn=2）

Parameter 項目	Limit(*) 限制	Plant Level 廠房排放水平
Particulate substances 粒子物質	100	1
Hydrogen chloride 氯化氫	200	177
Sulphur dioxide 二氧化硫	N.A. 不適用	235
Carbon monoxide 一氧化碳	625	22
Dioxin and furans 二噁英及呋喃	0.1 ngTEQ/Nm^3	0.0121 ngTEQ/Nm3(#)
Mercury and its compunds 汞及其化合物	3	<0.001

* Environmental Protection & Management (Air Impurities) Regulations of Singapore
新加坡環境保護及管理（空氣雜質含量）條例

The actual discharge level of dioxin and furans is lower than the background level in many cities
二噁英及呋喃的實際排放水平低於許多城市的背景水平

Outline

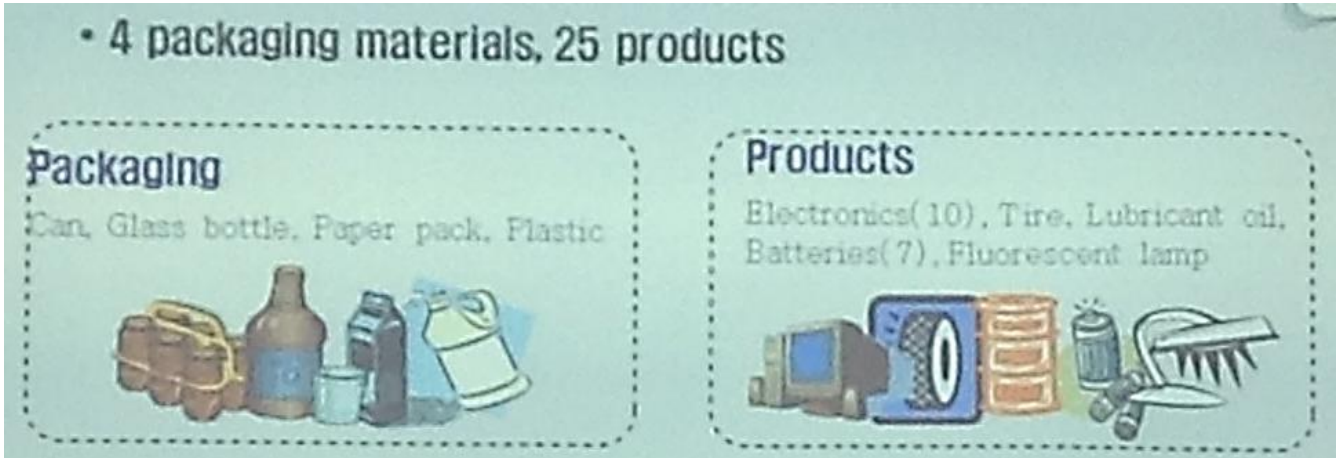
1. Background
2. Japan
3. Singapore
4. **South Korea**
5. Summary

Global Green Hub Korea 2013 (Incheon, Korea)



Extended Producers Responsibility

- Extended Producer Responsibility is a system that imposes a certain quota for the recycling of wastes from products or packaging materials on the manufacturer of the products or the manufacturer of products that use the packaging materials
  - ✓ If the quota is not complied with, a fine that is greater than the cost of implementing proper recycling shall be imposed to the manufacturer



Mapo Resource Recovery Facility



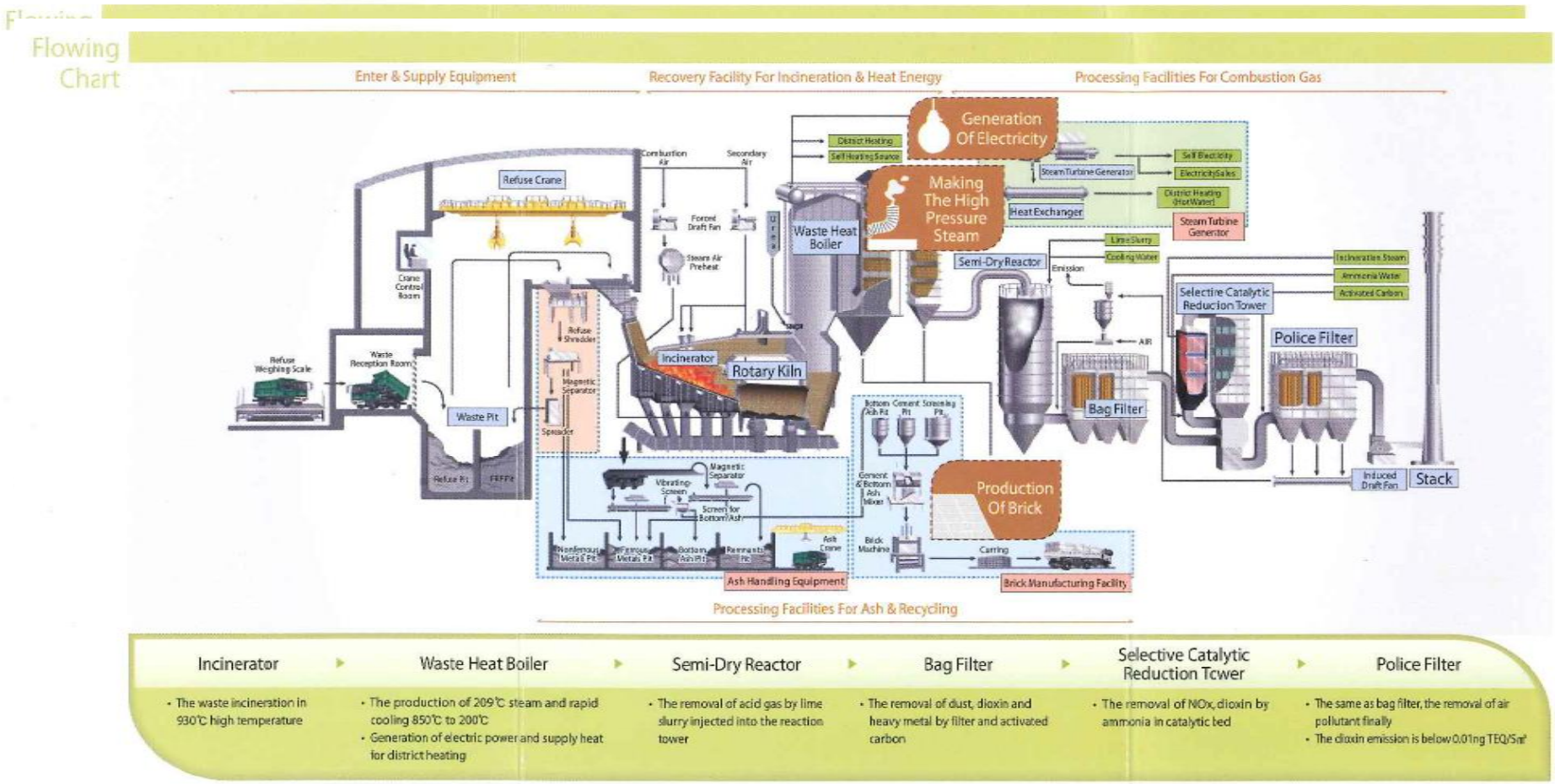
Mapo Resource Recovery Facility

- **Capacity: 250 ton/day X 3 units**
- **Incineration Temperature: 930°C**
- **Total Energy output : 520,000 Gcal**
  - **Self consumption: 200,000 Gcal**
  - **Sales: 320,000Gcal**
- **Electricity Generation: ~35 million kW/year**
  - **For use in 11,700 households**





Mapo Resource Recovery Facility



Mapo Resource Recovery Facility











SUDOKWON Complex--Incheon

1) Refuse Incineration Plant

- Capacity: 250 ton/day x 2 units
- Temperature: 850-900°C
- Electricity Generation:
  ~16 million kW/year



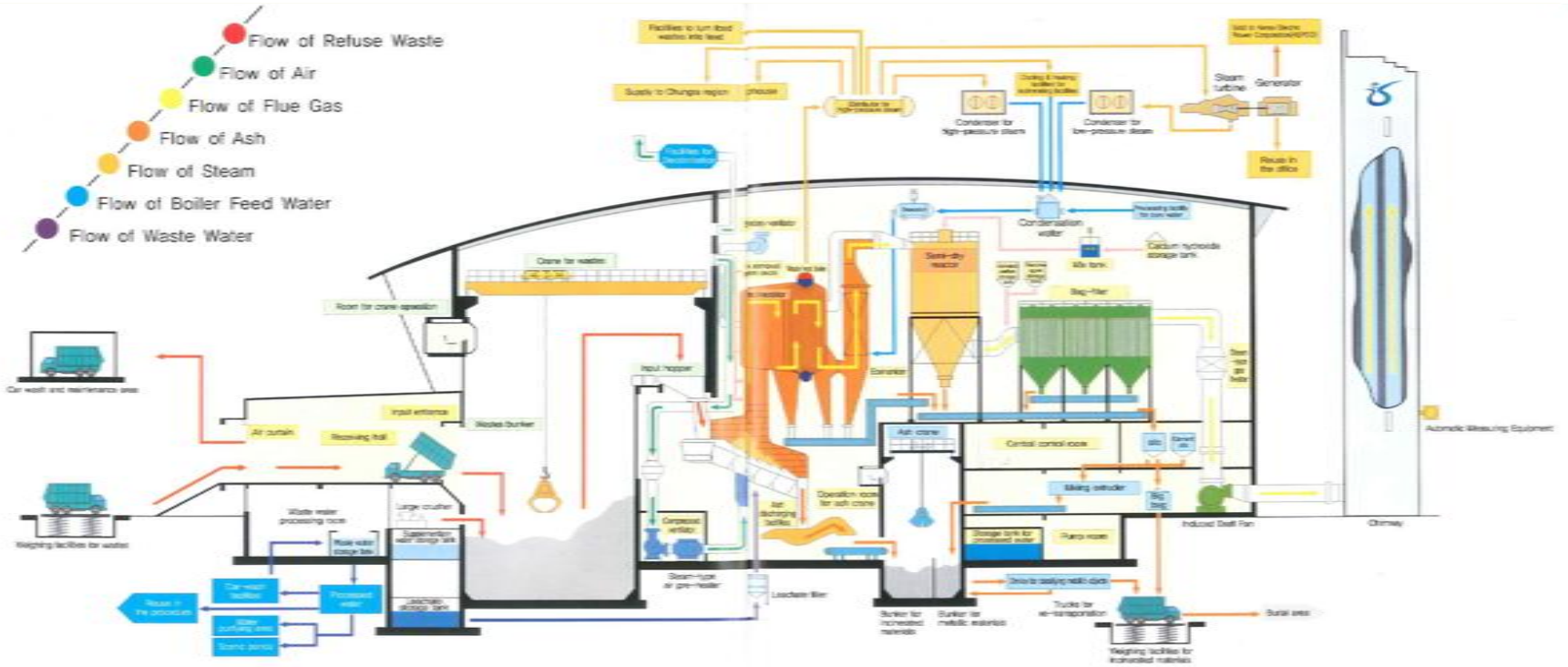
2) Fish Feed Manufacturing Facilities of Food Waste



SUDOKWON Complex--Incheon



SUDOKWON Incinerator--Incheon




Receiving Hall


Central Control Room


Incinerator


Combustion


NOx Removal System


Semi Dry Reactor


Bag-Filter


Activated Carbon Injection

Supply(De-Dioxin)

SUDOKWON Landfill --Incheon



SUDOKWON Complex--Incheon



SUDOKWON Complex--Incheon



Outline

1. Background
2. Japan
3. Singapore
4. South Korea
5. **Summary**

SUMMARY

- **Waste Minimization Policy:**
  Prevent waste generation at source

- **Recycling and PRS:**
  Industrial ,Commercial and Residential

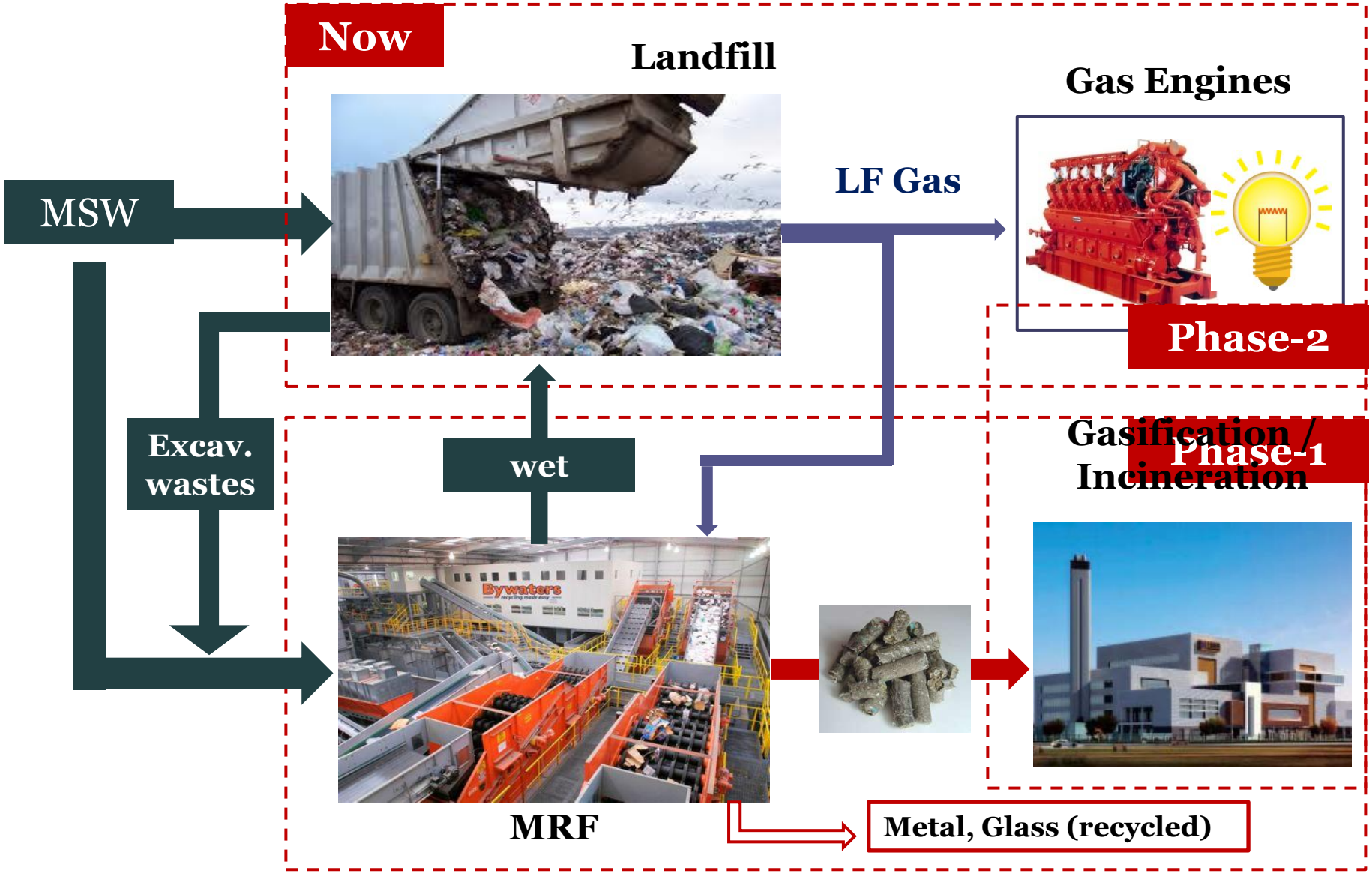
- **Integration with Local Community**
  A modern incinerator is more than just a solid waste processing facility, it attracts tourists and visitors

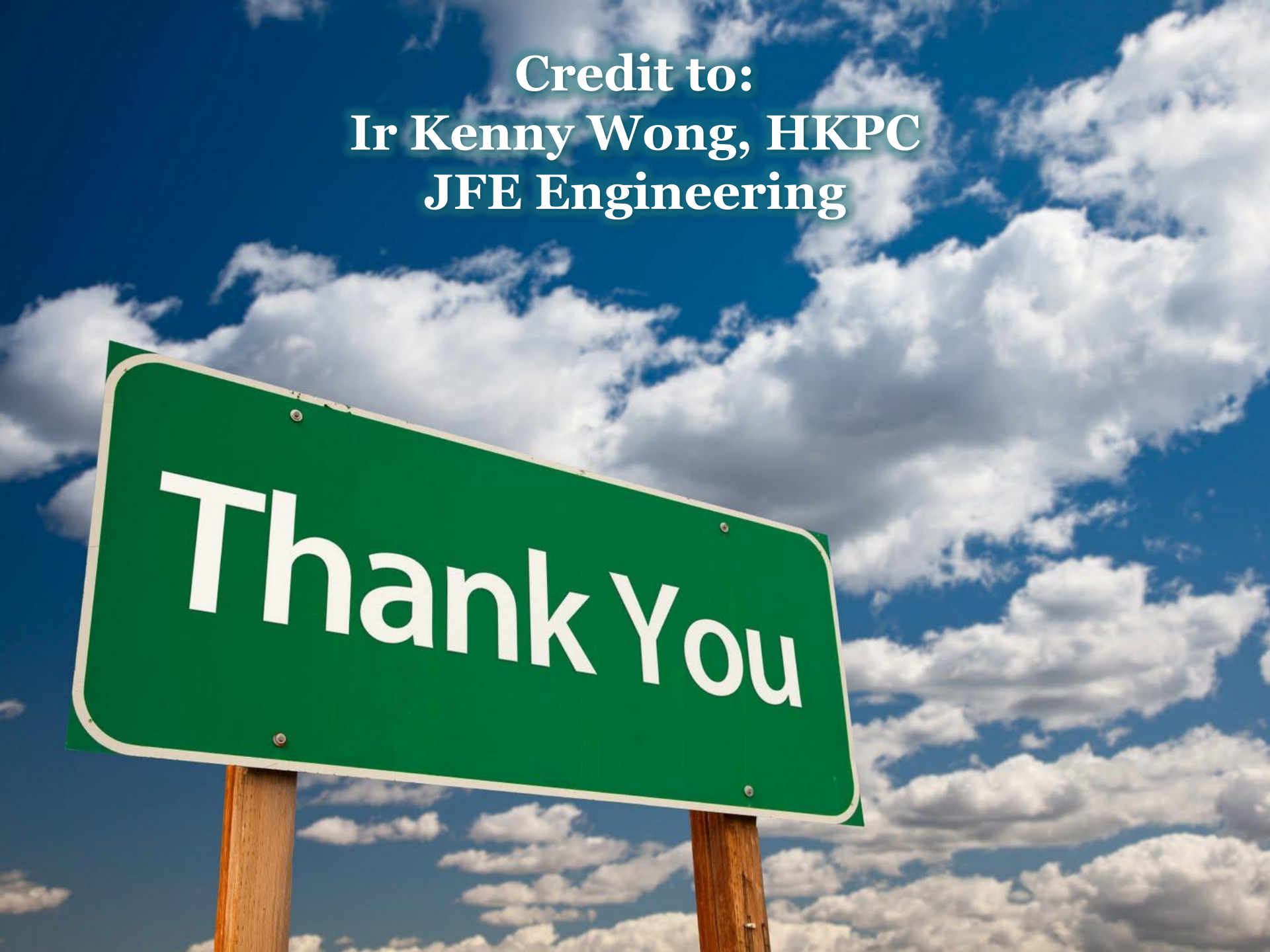
- **Education & Promotion**
  Education and promotion of the successful experience of modern incineration technology



The incinerator in Seoul, South Korea integrates well with the local community
南韓首爾的焚化爐建築群順利融入當地社區

POSSIBLE TREND?




Credit to:
Ir Kenny Wong, HKPC
JFE Engineering
Thank You