

WASTE MANAGEMENT in KITAKYUSHU CITY

International Environment Strategies Division
Environment Bureau Kitakyushu City

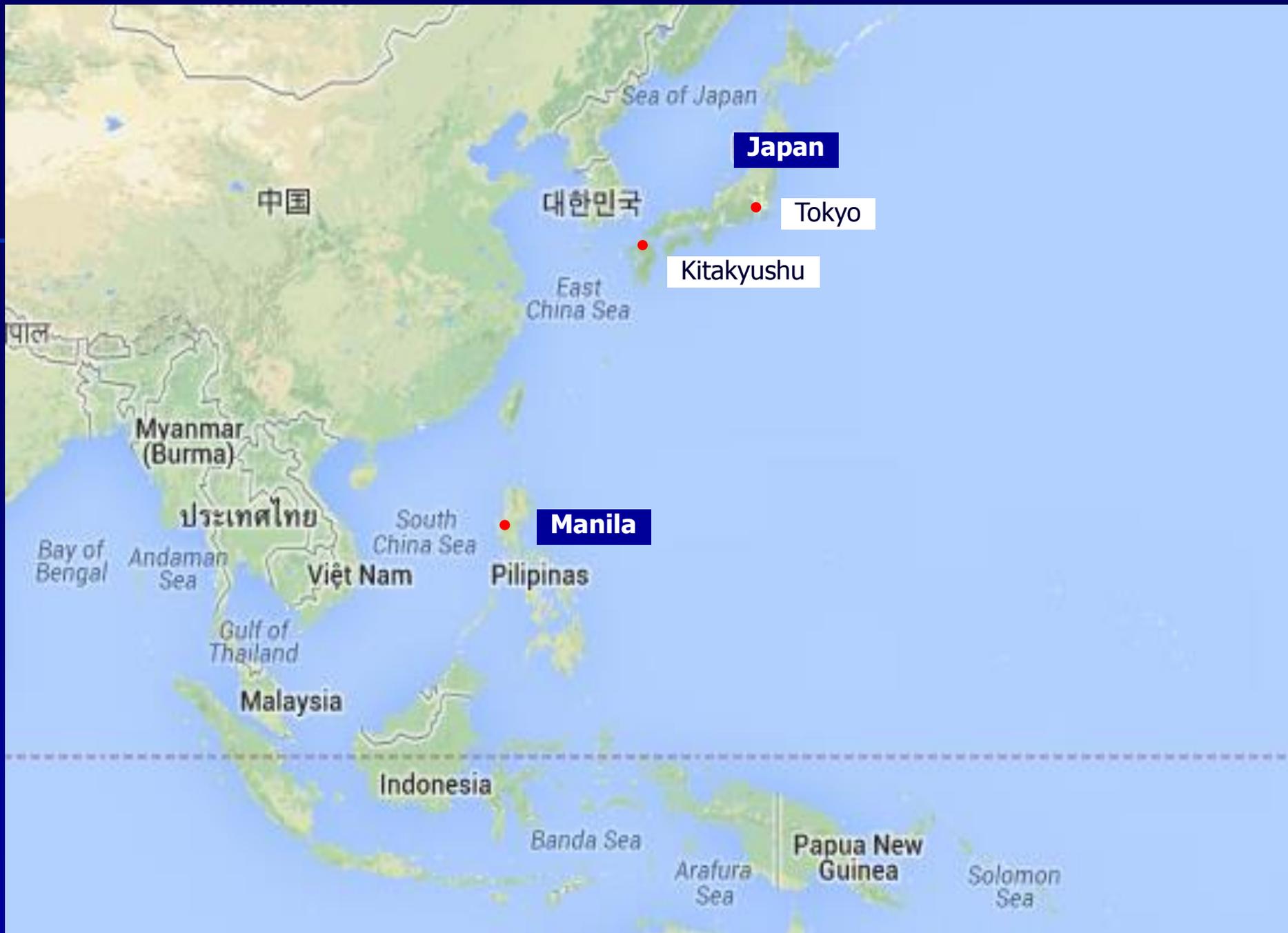
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(Money exchange rate : 1 US\$ = 100 yen)

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Japan

Tokyo

Kitakyushu

대한민국

中国

East China Sea

Sea of Japan

Myanmar (Burma)

ประเทศไทย

South China Sea

Manila

Pilipinas

Việt Nam

Bay of Bengal

Andaman Sea

Gulf of Thailand

Malaysia

Indonesia

Banda Sea

Arafura Sea

Papua New Guinea

Solomon Sea

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Content of the Presentation

1. Current waste management

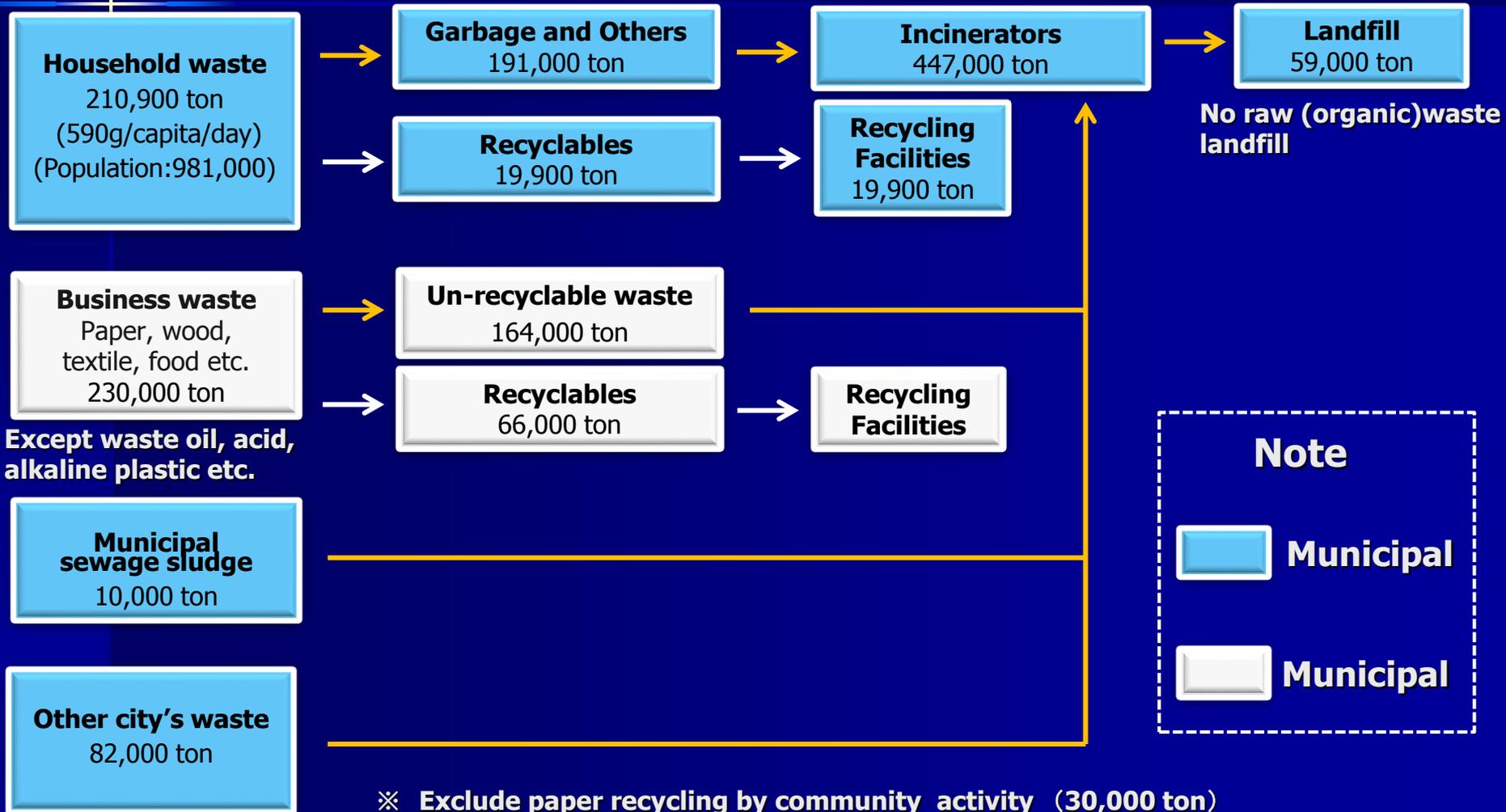
Waste collection, Recycling, Incineration and Landfill

2. Waste reduction by new recycling system

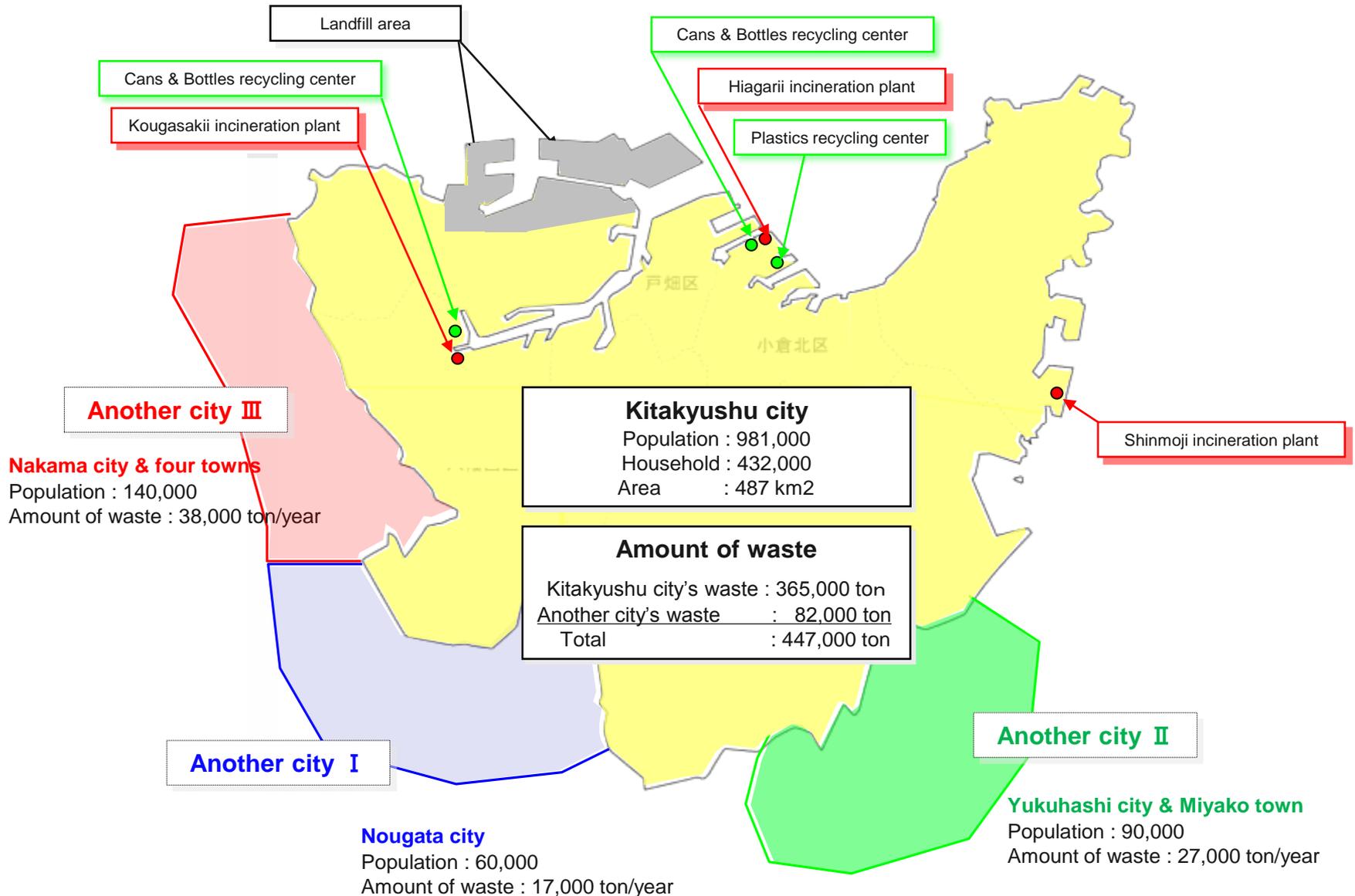
3. Future target of waste management

4. Cost of waste management

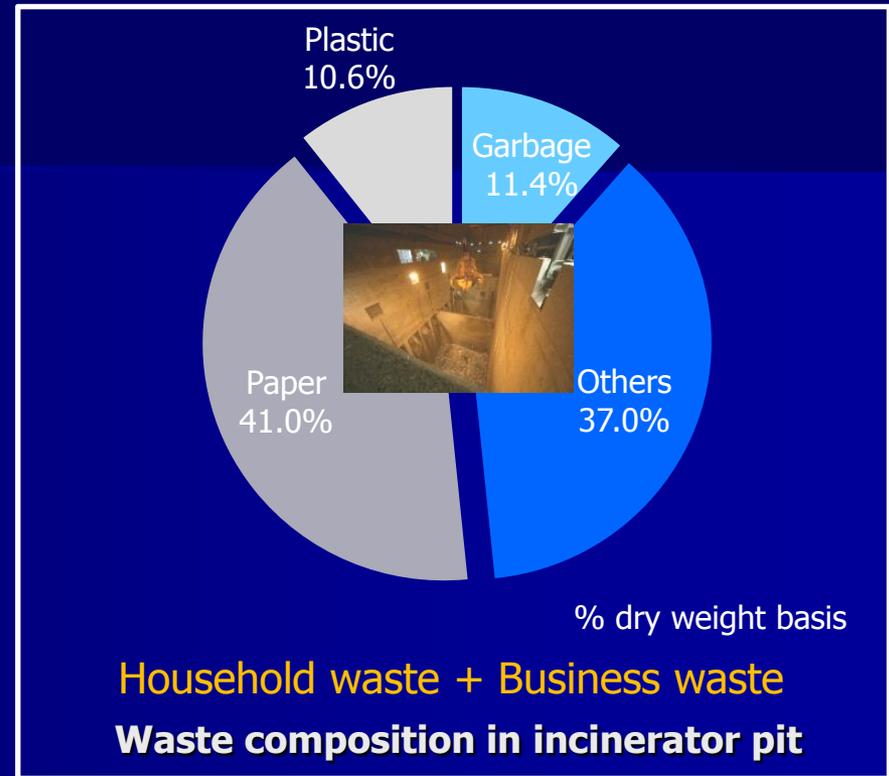
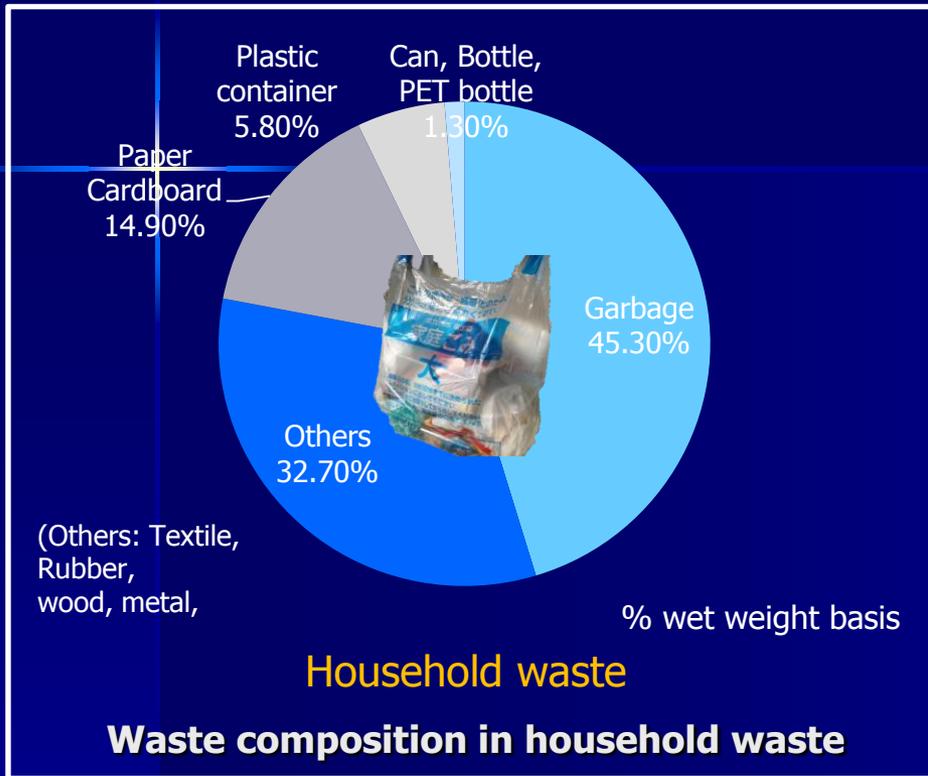
Waste Management Stream in Kitakyushu City (2009)



Waste treatment in Kitakyushu city in 2009



Two types of waste composition analysis (2009)



Household waste 273,000 ton/year (62%)
Business waste 164,000 ton/year (38%)

Waste three composition

| | |
|---------------|------|
| Water content | 25 % |
| Combustible | 58 % |
| Incombustible | 17 % |

Calorific value 2,700 kcal/kg

Treating method of Kitchen Garbage and Others

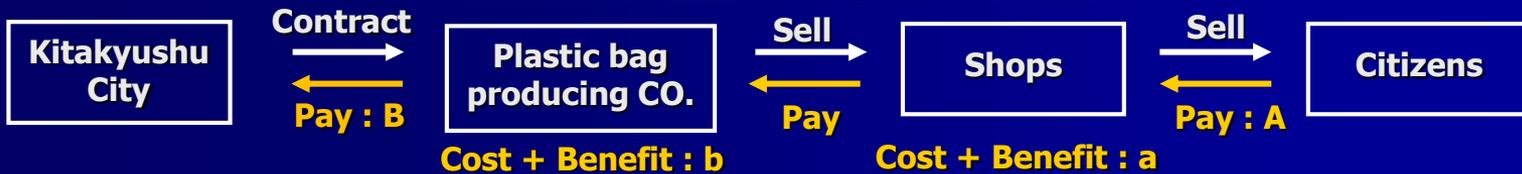
| | Collection day | Plastic bag Color | Plastic bag Price |
|-----------------------------------|----------------|------------------------------------------------------------------------------------------|-------------------------------------------------------|
| Kitchen garbage and others | Twice a week |  Blue | 20 liter : 22 ¢ 30 liter : 33 ¢ 45 liter : 50 ¢ |

Kitchen and others

- Kitchen garbage
- Plastic
- Paper
- Wood
- Used cloth and shoes etc.



Cash flow of plastic bags distribution



$$\text{Kitakyushu City Income} = B = A - a - b$$

Total income (Garbage, Can, Bottle, PET, Plastic) in 2009 is 19 million US\$

Waste Collection



Collection Point

Blue net used for prevention of bird picking

- Number of collection point (32,000 points)
- One point consists of around 10-15 households
- Two times a week collection



Incineration plants in Kitakyushu City

Gasification Melting Type



Shinmoji incineration plant

Date of start : 2007

Capacity : 720 ton/day
(240 ton × 3)

Power generation : 23,500 Kw

Construction cost : 230 million US\$

Stoker Type



Kogasaki incineration plant

Date of start : 1998

Capacity : 810 ton/day
(270 ton × 3)

Power generation : 36,340 Kw

Construction cost : 350 million US\$

Stoker Type



Hiagari incineration plant

Date of start : 1991

Capacity : 600 ton/day
(200 ton × 3)

Power generation : 6,000Kw

Construction cost : 125 million US\$

These 3 plants are operated by each incinerator constructed company.

Kitakyushu City contracts with these companies under concession contract.

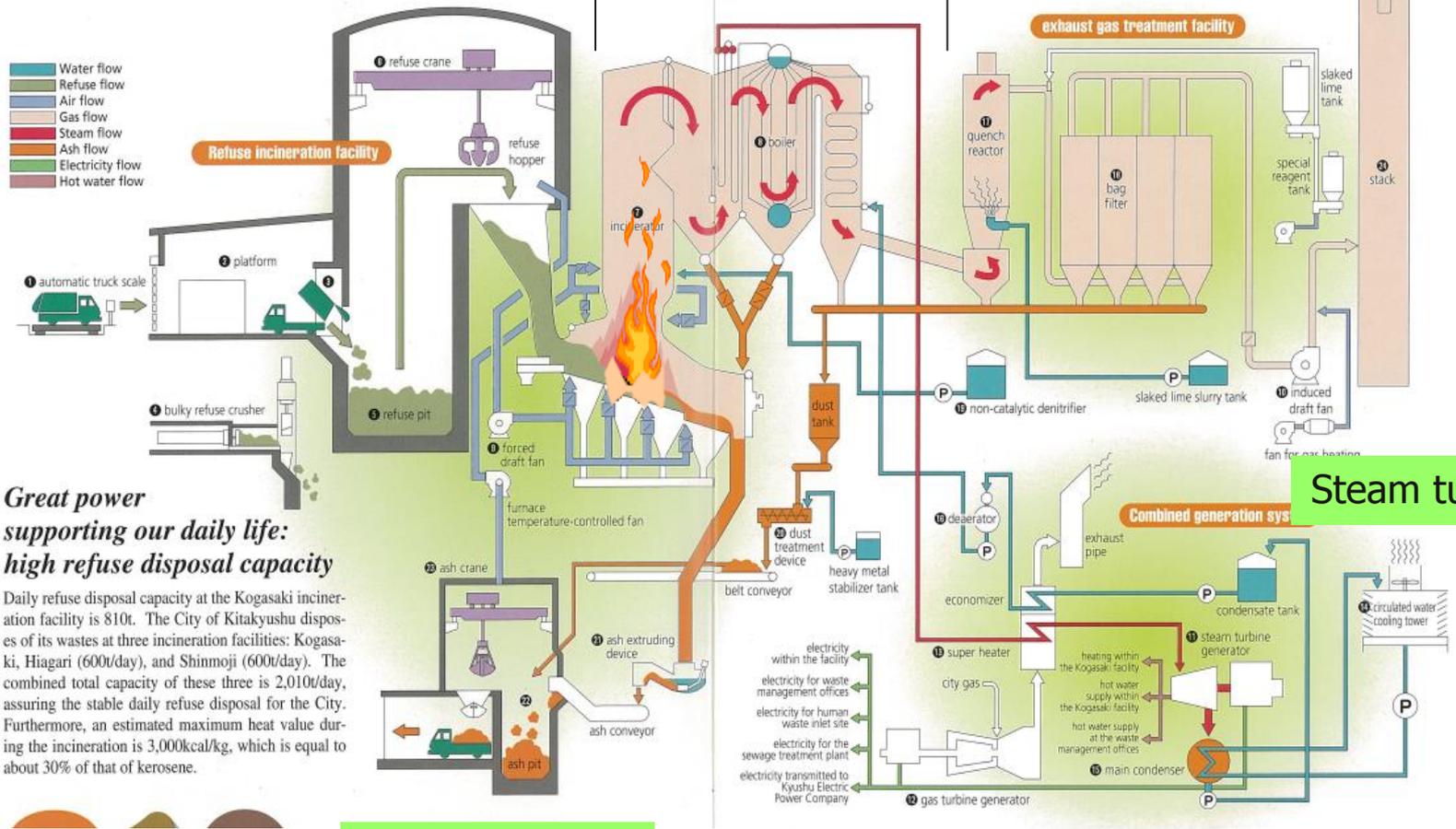
Because the incinerator operation and maintain require special technology included patent.

Waste dumping & storage pit

Steam boiler

Gas treatment equipment

- Water flow
- Refuse flow
- Air flow
- Gas flow
- Steam flow
- Ash flow
- Electricity flow
- Hot water flow



Great power supporting our daily life: high refuse disposal capacity

Daily refuse disposal capacity at the Kogasaki incineration facility is 810t. The City of Kitakyushu disposes of its wastes at three incineration facilities: Kogasaki, Hiagari (600t/day), and Shinmoji (600t/day). The combined total capacity of these three is 2,010t/day, assuring the stable daily refuse disposal for the City. Furthermore, an estimated maximum heat value during the incineration is 3,000kcal/kg, which is equal to about 30% of that of kerosene.

Ash storage pit

KOGASAKI Incineration Plant

(Stoker Type Incinerator)

Capacity : 810 ton/day (270 ton/day × 3 furnaces)

| | | | | | |
|---------------------------------|----------------|------------------------------------------------------------------|------------------|--------------------------------------------------------------------|--------------------------|
| ① automatic truck scale | 4 scales | ① forced draft fan | 3 fans | ① quench reactor | 3 reactors |
| ② platform | 1 platform | ② induced draft fan | 3 fans | ② bag filter | 3 filters |
| ③ refuse dumping gate | 15 gates | ③ turbo fan directly connected with an electric motor | 380KW | ③ non-catalytic denitrifier | 3 |
| ④ bulky refuse crusher | 1 crusher | ④ steam turbine generator | 1 generator | ④ urea solution spraying device | 1 set |
| ⑤ refuse pit & bulky refuse pit | 2 sets | ④ directly-connected extraction condensing turbine | output 28,300KW | ④ maximum gas amount | 91,000Nm ³ /h |
| ⑥ refuse crane | 2 cranes | ⑤ gas turbine generator | 1 generator | ⑤ non-catalytic denitrifier & urea solution spraying device | 1 set |
| ⑦ incinerator | 3 incinerators | ⑤ simple-open-one axial-type | output 8,000KW | ⑤ maximum gas amount | 73,900Nm ³ /h |
| ⑧ boiler | 3 boilers | ⑥ super heater | 1 super heater | ⑥ dust treatment device | 2 devices |
| | | ⑥ horizontal-meandering pipe, drainable pipe (with a spiral fin) | | ⑥ biaxial kneader type kneading machine | 2.26h |
| | | ⑦ circulated water cooling tower | 1 tower | ⑦ ash extruding device | 3 devices |
| | | ⑦ natural-circulation double-drum water pipe boiler | 24.0kg/hr 49.17h | ⑦ ash pit | 1 pit |
| | | ⑧ main condenser | 1 condenser | ⑧ capacity | 990l |
| | | ⑧ horizontal surface cooling type | | ⑧ ash crane | 2 cranes |
| | | ⑨ deaerator | 3 deaerators | ⑨ hydraulic overhead travelling crane with clamshell type bucket | 2 |
| | | ⑨ steam-pressure-spray type water treatment capacity | 60h | ⑨ stack | 1 stack |
| | | | | ⑨ reinforced concrete outer pipe and steel-plate inner pipe height | 85m |

Ash Pit and Ash Crane



**Content of landfill materials are only in-organics.
(Ash, Soil, Concrete, Rock, etc.)**

Hibikinada Landfill



Kogasaki
Volume of pit 950m³ (950 ton)
Crane Capacity 4.8 ton



Hibikinada sea side landfill managed by Kitakyushu city in 2010

Area of landfill : 70 ha

Capacity : 12,100,000 m³

Kind of waste : Domestic waste's incineration ash

Small & medium company 's concrete, sludge, plastics, glass and dust

Life span : from 1986 to around 2022

Monitoring of exhaust gas

Municipality has the responsibility of keeping the exhaust gas standard and state government has the right of inspection.

■ By City municipality

1. Monitoring every second by automatic analysis equipment.
2. Manual analysis 6 times a year.

■ By State government

1. Entering and inspection of incinerator sometimes.

Actual value in 2009

Shinmoji incinerator

HCl : 13 ppm
NOx : 21 ppm
SOx : 0.019 ppm
CO : 0.6 ppm
Dust : 0.00029 mg/Nm³
Dioxin : 0.003ng-TEQ/Nm³

Standard value

Shinmoji incinerator

HCl : 30 ppm
NOx : 50 ppm
SOx : 30 ppm
CO : 30 ppm
Dust : 10 mg/Nm³
Dioxin : 0.08 ng-TEQ/Nm³





Disclosing of exhaust gas analysis data

The indicator is located toward the public road.

Then people can get the information during 24 hours.

People also can check the former operation data at the incineration office.



Disclosing data

HCl, SO_x, NO_x, CO, Dust (Every second measurement)

Dioxin (Two times a year measurement)



Residential area

Office and factory area

Shinmoji
incineration plant

Construction and demolition waste
recycling company

How to cooperate with citizens lived near the incinerator

How to cooperate with citizens lived near incinerator

■ Before construction

1. Explain to the municipal assembly.
2. Explain to citizens lived near incinerator.
(Incinerator type, capacity, Pollution control, noise, EIA.....)

■ During construction

1. Explain to citizens lived near incinerator.
(Incinerator construction condition)
2. Observe the construction site by citizens.

■ After construction completion and starting operation

1. Observe the incinerator by citizens.
2. Disclose operation data to citizens.
(operation data and pollution control data)

Recycling method of Can, Glass Bottle and PET Bottle

| | Collection day | Plastic bag Color | Plastic bag Price |
|-----------------------------|----------------|--------------------------------------------------------------------------------------------|-------------------|
| Can and Glass Bottle | Wednesday |  Brown | 25 liter : 12 ¢ |
| PET Bottle | |  Orange | |



Can & Glass Bottle
〔Recycling started 1993〕



PET Bottle
(Recycling started 1997)



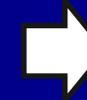
Recycling method of Plastic Container

| | Collection day | Plastic bag Color | Plastic bag Price |
|--------------------------|----------------|-------------------------------------------------------------------------------------------|------------------------------------|
| Plastic Container | Once a week |  Green | 25 liter : 12 ¢ 45 liter : 20 ¢ |



Plastic Container

- Egg package
- Noodle package
- Shampoo bottle
- Detergent bottle
- Food oil bottle
- Mayonnaise container
- Cap of PET bottle etc.



PET Bottle for recycling
needs pure quality.

Collection Point

PET Bottle



Can &
Glass Bottle

Number of collection point (11,000 points)

One point consists of around 40 households

Every Wednesday collection

PET bottles line

**Fresh air
supply duct**

Can and bottles line

Classification

Steel and aluminum can is separated by machine
Pet bottle and glass bottle separated by hand



Separation volume and recycling income of Can & Bottle in 2009

| | Volume (ton) | Income (US\$) |
|---------------------|--------------|---------------|
| Aluminum | 1,100 | 1,070,000 |
| Steel can | 1,300 | 290,000 |
| Glass bottle | 1,900 | 14,000 |
| PET bottle | 1,600 | 210,000 |
| Total | 5,900 | 1,584,000 |

**Carried out New Recycling System
for waste reduction
in 2006**

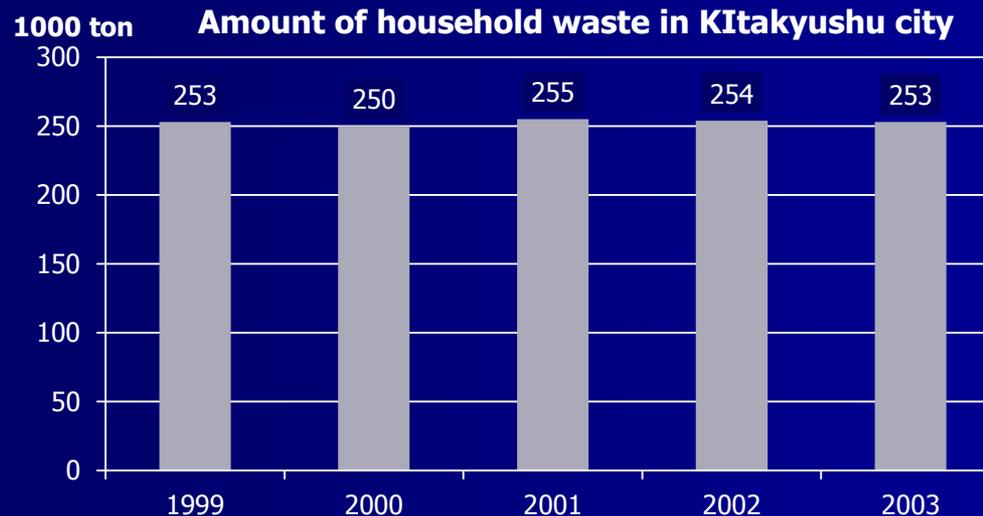
**Because we were struggling with huge
amount of waste at that time.**

Amount of household waste doesn't change in whole Japan.



Data : Ministry of Environment

Also in Kitakyushu City, amount of waste doesn't change.



Data : Kitakyushu city

**Due to decrease household waste,
the national government enforced**

“Household Waste Reduction Law” on March 2003.

The reduction target is 20%.

According to the law,

Kitakyushu City carried out

“Household Waste Reduction System” on July 2006.

The reduction target is 20%.

Kitakyushu city succeeded to accomplish 26% waste reduction in 2008.



Before



After

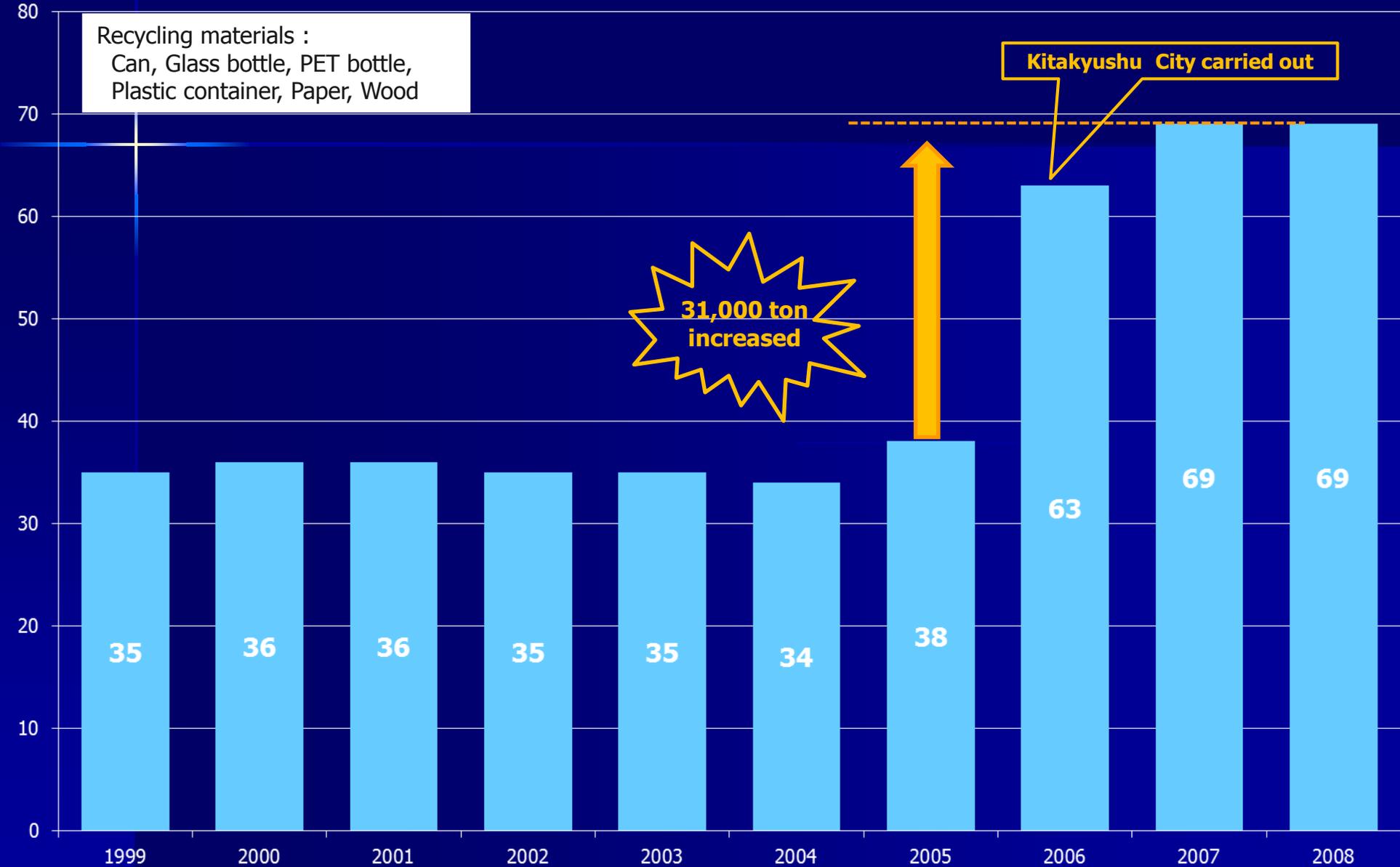
Amount of recycling articles in Kitakyushu city

1000 ton

Recycling materials :
Can, Glass bottle, PET bottle,
Plastic container, Paper, Wood

Kitakyushu City carried out

31,000 ton
increased



How to reduce household waste.

1. Carried out plastic container recycling system in 2006.



(1993)



(1997)

+



(2006)



| | |
|----------|------|
| 45 liter | 20 ¢ |
| 25 liter | 12 ¢ |

Low price effect
Waste recycling civil awareness appears

2. Increased the price of designated garbage plastic bag.

| | |
|----------|------|
| 45 liter | 15 ¢ |
|----------|------|



| | |
|----------|------|
| 45 liter | 50 ¢ |
| 30 liter | 33 ¢ |
| 20 liter | 22 ¢ |

High price effect
Waste reduction civil awareness appears



(Until 2006)



(2006)

45 liter garbage plastic bag
Average Weight : 6 kg/one bag
Treating cost : 2.5US\$/one bag
(Collection and Incineration)



How to recognize the new recycling system to citizens.

How to explain the new recycling system to citizens.

1. Before enforcement

Many explanation meetings for citizens were held.

- **Public information sheets were delivered to citizens.**
- **Explanation meetings for citizens were held for 1,376 times. (Total number of attendance is about 47,000.)**
- **4,500 explanation videotapes were delivered to community centers.**
- **Many explanation advertisements were on TV.**

2. After enforcement

Early-Morning Training was held by citizen volunteers and city officers at waste collection point. (32,000 points)

- The training was carried out for 10 days.
- The time of the training was from 6:30am to 8:30am.
- The number of citizen volunteers was 13,200 per day.
- The number of city officers was 1,550 per day.



Future Target of Waste Management

1. Reduction of household waste

The target of the reduction should be fulfilled -7.1% until 2020 compared with 2009.

| 2009 | 2015 | 2020 |
|--------------------|--------------------|--------------------|
| 506 (g/capita/day) | 495 (g/capita/day) | 470 (g/capita/day) |
| — | -2.2% | -7.1% |

◆ Method of reduction

Kitchen garbage should be reduced 8% by people education.

(Reduction of food waste and drying of garbage)

Future Target of Waste Management

2. Improvement of recycling ratio

The target of the recycling ratio should be fulfilled 35% until 2010.

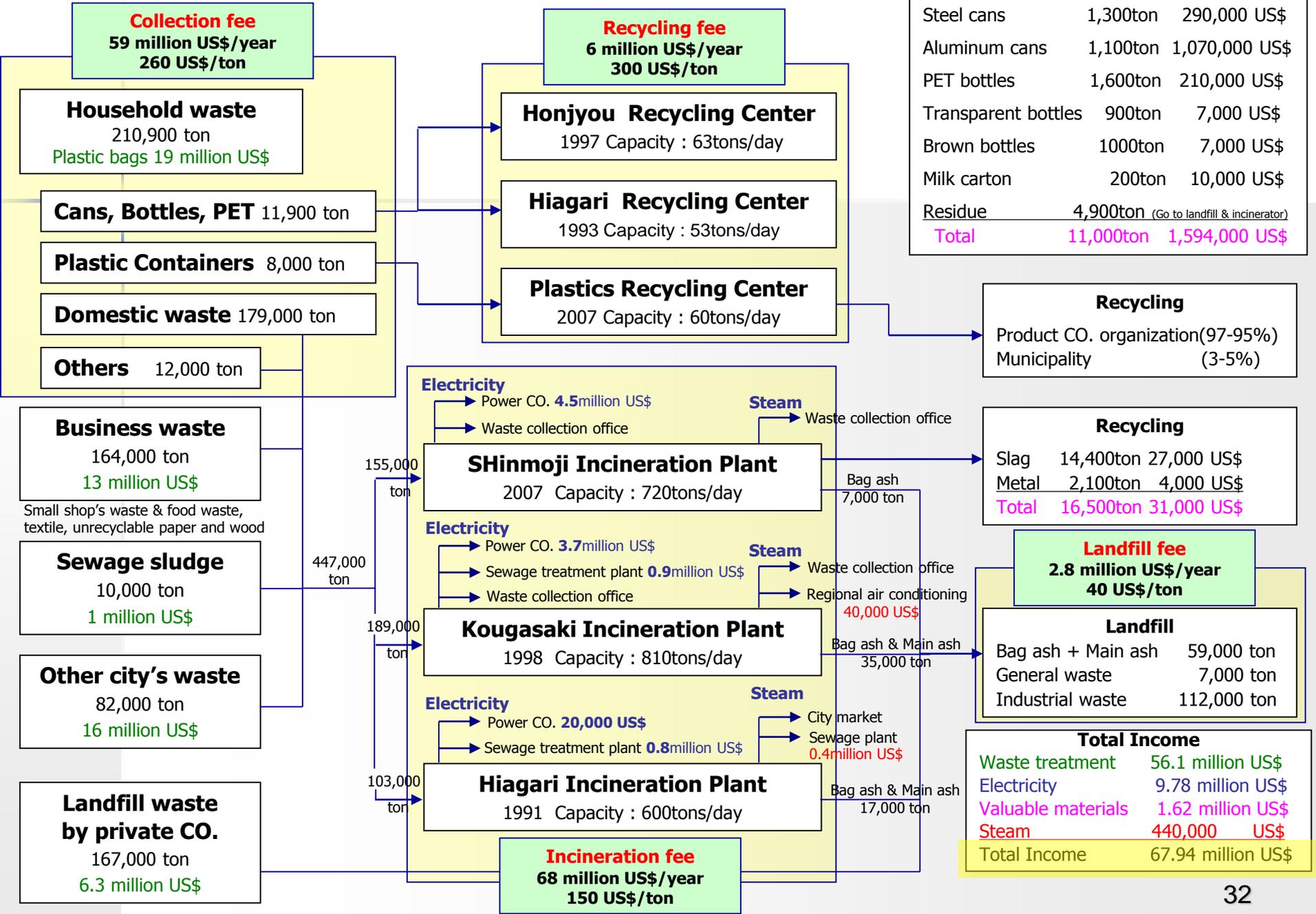
| | 2009 | 2015 | 2020 |
|----------------------------------|--------------------|--------------|--------------------|
| Recycling ratio (B)/(A) | 30.4% | 32.5% | 35% |
| Total amount of waste (A) | 497,000 ton | — | 476,000 ton |
| Recycled materials (B) | 147,000 ton | — | 162,000 ton |

◆ Method of improvement

Newspaper recycling ratio should be increased more 10%.

Plastic container recycling ratio should be increased more 15%.

Waste management in 2009 (Cost of treating)



Collection fee
59 million US\$/year
260 US\$/ton

Recycling fee
6 million US\$/year
300 US\$/ton

Selling valuable materials

| | | |
|---------------------|-----------------------------------------|-----------------------|
| Steel cans | 1,300ton | 290,000 US\$ |
| Aluminum cans | 1,100ton | 1,070,000 US\$ |
| PET bottles | 1,600ton | 210,000 US\$ |
| Transparent bottles | 900ton | 7,000 US\$ |
| Brown bottles | 1000ton | 7,000 US\$ |
| Milk carton | 200ton | 10,000 US\$ |
| Residue | 4,900ton (Go to landfill & incinerator) | |
| Total | 11,000ton | 1,594,000 US\$ |

Household waste
210,900 ton
Plastic bags 19 million US\$

Honjyou Recycling Center
1997 Capacity : 63tons/day

Cans, Bottles, PET 11,900 ton

Hiagari Recycling Center
1993 Capacity : 53tons/day

Plastic Containers 8,000 ton

Plastics Recycling Center
2007 Capacity : 60tons/day

Domestic waste 179,000 ton

Others 12,000 ton

Recycling
Product CO. organization(97-95%)
Municipality (3-5%)

Business waste
164,000 ton
13 million US\$
Small shop's waste & food waste, textile, unrecyclable paper and wood

SHinmoji Incineration Plant
2007 Capacity : 720tons/day
Electricity: Power CO. 4.5million US\$, Waste collection office
Steam: Waste collection office

Recycling
Slag 14,400ton 27,000 US\$
Metal 2,100ton 4,000 US\$
Total 16,500ton 31,000 US\$

Sewage sludge
10,000 ton
1 million US\$

447,000 ton

Kougasaki Incineration Plant
1998 Capacity : 810tons/day
Electricity: Power CO. 3.7million US\$, Sewage treatment plant 0.9million US\$, Waste collection office
Steam: Waste collection office, Regional air conditioning 40,000 US\$

Landfill fee
2.8 million US\$/year
40 US\$/ton

Landfill
Bag ash + Main ash 59,000 ton
General waste 7,000 ton
Industrial waste 112,000 ton

Other city's waste
82,000 ton
16 million US\$

189,000 ton

Hiagari Incineration Plant
1991 Capacity : 600tons/day
Electricity: Power CO. 20,000 US\$, Sewage treatment plant 0.8million US\$
Steam: City market, Sewage plant 0.4million US\$

Total Income
Waste treatment 56.1 million US\$
Electricity 9.78 million US\$
Valuable materials 1.62 million US\$
Steam 440,000 US\$
Total Income 67.94 million US\$

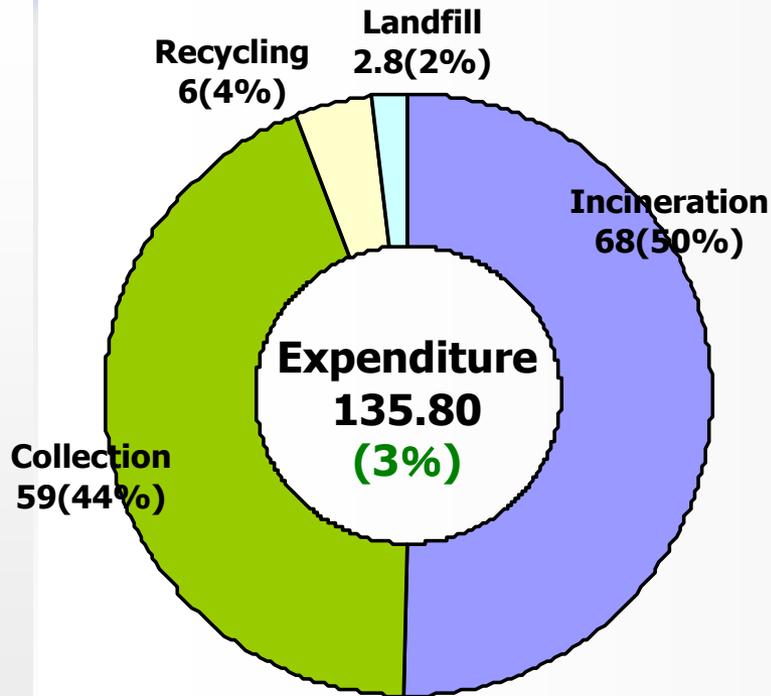
Landfill waste by private CO.
167,000 ton
6.3 million US\$

103,000 ton

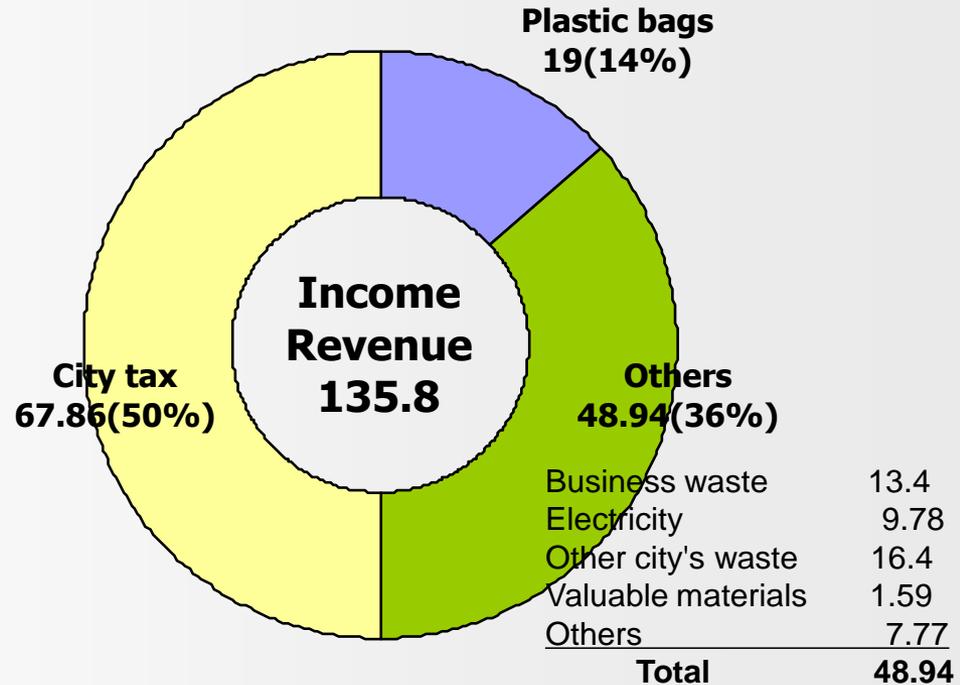
Incineration fee
68 million US\$/year
150 US\$/ton

Expenditure and Income in 2009

Expenditure
(Unit : million US\$)



Income
(Unit : million US\$)



Total general account city budget : 5,300 million US\$



THANK YOU
Sinsuke Takeuchi