Project on Low-Carbon and Environmentally Sustainable City Planning in Surabaya, Indonesia

Main Findings of the Low-Carbon Feasibility Study in Surabaya

16 November 2013

Side event at Japan Pavilion, COP19, Warsaw

Toshizo Maeda, IGES Kitakyushu Urban Centre

Project on Low-Carbon and ESC Planning in Surabaya

Objectives of the Project

- Assist Surabaya City in developing **low-carbon** and environmentally sustainable **city plans** in energy, transport, waste and water sectors
- **Identification of projects** which can reduce CO2 emissions (save energy and cost) in a short term
- **Identification of projects** which can reduce CO2 emissions and bring about multiple social, economical and environmental benefits in a long run
- Support development of **a data management system** to measure CO2 emission reductions and establish a CO2 measurement methodology

Inception Meeting in Surabaya on July 10th

Ir. Hermien Roosita M.M., Executive Secretary, Ministry of Environment, Indonesia (left); Ir. Tri Rismaharini, MT., Mayor of Surabaya City (center); Mr. Noboru Nomura, Consul General, Consulate General of Japan at Surabaya (right)

Project on Low-Carbon and ESC Planning in Surabaya

Japan-side

City of Kitakyushu

Project Management

IGES

Kitakyushu Asian Center for Low Carbon Society

Green Sister City (Nov. 2012)

Indonesia-side (counterpart)

City of Surabaya

Development Planning Agency（BAPPEKO）

Cooperation Div.

Energy sector

NTT DATA Institute of Management Consulting Inc., KPMG Azusa LCC, NTT Facilities Inc., Hohkohsya Inc., Green Prop Co., Ltd	FS for energy saving and dispersed power system ⇔	Local companies, city hall, universities, hospitals, shopping malls, data centres etc.
Cooperation: Fuji Electric Co., Ltd., Nippon Steel & Sumikin Engineering Co., Ltd.	Cogeneration technology ⇔	PT SIER, local companies, National Electricity Company (PLN)
Cooperation: Japan NUS Co., Ltd.	LED conversion at highway ⇔	National Highway Corporation (PERSERO)

Solid waste sector

IGES		
Cooperation: **Nishihara Corp. and NTT DATA Institute of Management Consulting Inc.**	Waste sorting, recycling, composting ⇔	Dept. of Cleanliness and Landscaping (DKP), Environment Dept. (BLH)
Hitachi Zosen Corp.	FS for incineration ⇔	Ministry of Energy and Mineral Resources, Ministry of Public Work, Ministry of Environment
Amita Corp.	Waste to energy for industrial waste ⇔	Local company, cement company

Transportation sector

Public transportation,
Improvement of traffic system for waste collection vehicles, low emission vehicles

ALMEC VPI Corp. ⇔ Transportation Section, Taxi company, DKP

Water resource sector

Matsuo Sekkei Corp., City of Kitakyushu, Kitakyushu City Waster and Sewer Bureau	Energy saving at water and sewage plant ⇔ Distributed sewage treatment	PDAM, Keputih sludge treatment plant, Industrial Estate Company (PT SIER)
Cooperation: TOTO Ltd.	⇔ Introducing water-saving equipment	Community, Hotels, etc.

Project on Low-Carbon and ESC Planning in Surabaya

Japan-side

City of Kitakyushu

Project Management

IGES Kitakyushu

Kitakyushu Asian Center for Low Carbon Society

Green Sister City (Nov. 2012)

Indonesia-side (counterpart)

City of Surabaya

Development Planning Agency（BAPPEKO）

Cooperation Div.

Energy sector

F/S supported by Kitakyushu City, funded by Ministry of Economy, Trade and Industry (METI), Japan

NTT DATA Institute of Management Consulting Inc. , KPMG Azusa LCC, NTT Facilities Inc., **Hohkohsya Inc., Green Prop Co., Ltd**

FS for energy saving and dispersed power

Local companies, city hall,

Cooperation: Fuji Electric Co., Ltd., Nippon Steel & Sumikin Engineering Co., Ltd.

Cogeneration technology

PT SIER, local companies, National Electricity Company (PLN)

Cooperation: Japan NUS Co., Ltd.

LED conversion at highway

National Highway Corporation (PERSERO)

Solid waste sector

F/S supported by Kitakyushu City, funded by Japan International Cooperation Agency (JICA)

IGES

Cooperation: **Nishihara Corp. and NTT DATA Institute of Management Consulting Inc.**

Waste sorting, recycling, composting

Dept. of Cleanliness and Landscaping (DKP), Environment Dept. (BLH)

Hitachi Zosen Corp.

FS for incineration

Ministry of Energy and Mineral Resources, Ministry of Public Work, Ministry of Environment

Amita Corp.

Waste to energy for industrial waste

Local company, cement company

Water resource sector

Matsuo Sekkei Corp., City of Kitakyushu, **Kitakyushu City Waster and Sewer Bureau**

Energy saving at water and sewage plant

PDAM, Keputih sludge treatment plant, Industrial Estate Company (PT SIER)

Distributed sewage treatment

Cooperation: **TOTO Ltd.**

Community, Hotels, etc.

Kitakyushu City-based companies

Transportation sector

Public transportation,
Improvement of traffic system for waste collection vehicles, low emission vehicles

ALMEC VPI Corp.

Transportation Section, Taxi company, DKP

Project on Low-Carbon and ESC Planning in Surabaya

Targeted sectors and expected GHG emissions reduction

Energy sector

- **Co-generation** system at SIER Industrial Park
  38,000t-CO2/year
- **Energy saving** in buildings
  10,000t-CO2/year
- LED highway lights
  630t-CO2/year

Solid waste sector

- Solid waste sorting and **recycling**
  21,000 t-CO2/year
- **Waste-to-energy** project
  8,000 t-CO2/year
- **industrial waste** Incineration at cement kilns **12,000 t-CO2/year**

Total reduction: 120,000t-CO2/year

Transportation sector

- **Fuel switch** for vehicles (public buses, public vehicles, taxis)
  26,000t-CO2/year
- Waste hauling vehicles replaced with low-emission vehicles and operation management improvement
  3,000t-CO2/year

Water resource sector

- Energy saving at **water purification plants** and pumping stations
  900 t-CO2/year
- **Water** supply **leakage** reduction
  5,300 t-CO2/year
- Sewage treatment in SIER and Keputih **sludge** treatment plant **30 t-CO2/year**

Progress of Energy sector

CO2 emission reduction potential

NTT DATA

CO2 reduction potential of these activities in Surabaya is estimated at approximately 50,000 t-CO2/year in total.

Activities	CO2 emission reduction	Conditions of Estimation
CHP installation at SIER	About 38,000 t-CO2/year	Installing natural gas fueled CHP at SIER and supplying both power(16MW) and steam(37t/h) to factories located in SIER. • Baseline：Electricity supplied from PLN, Each factory produces steam by their natural gas-fueled boiler 112,000t-CO2/year • Project：Electricity and Steam supplied to each factory by natural gas-fueled CHP plant 74,000t-CO2 / year
Energy conservation in building	About10,000 t-CO2/year	Assuming 20% energy saving achieved at each building • Shopping mall:5,040t-CO2/year • Hotel: 2,350t-CO2/year • Data center: 170t-CO2/year • Hospital: 1,790t-CO2/year
Installation of LED at the highway lighting	About 630 t-CO2/year	Assuming 640 LED lights are installed at the 14km highway in Surabaya which is planned to be constructed this year. • Compared with conventional mercury lamps: 630t-CO2 / year • Compared with high pressure sodium lamps: 250t-CO2 / year

Progress of Energy sector

Image of our activity

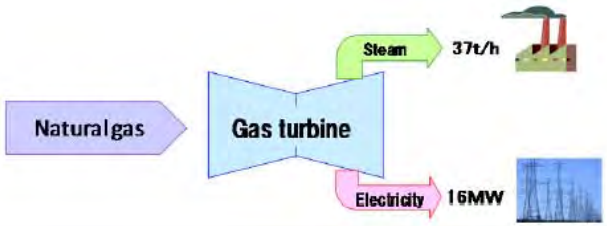
NTT DATA

A. Study on CHP installation at SIER





- We plan to do CHP business at SIER
- We found 5 potential users in SIER and specified candidate CHP (Electricity:16MW, Steam:37t/h)



B. Study on potential of ESCO, BEMS, dispersion type power source

Tunjungan complex

BAPPEKO

High way

Source：wikimapia, tripadvisor, etc

Progress of Energy sector

Listing candidate area for CHP

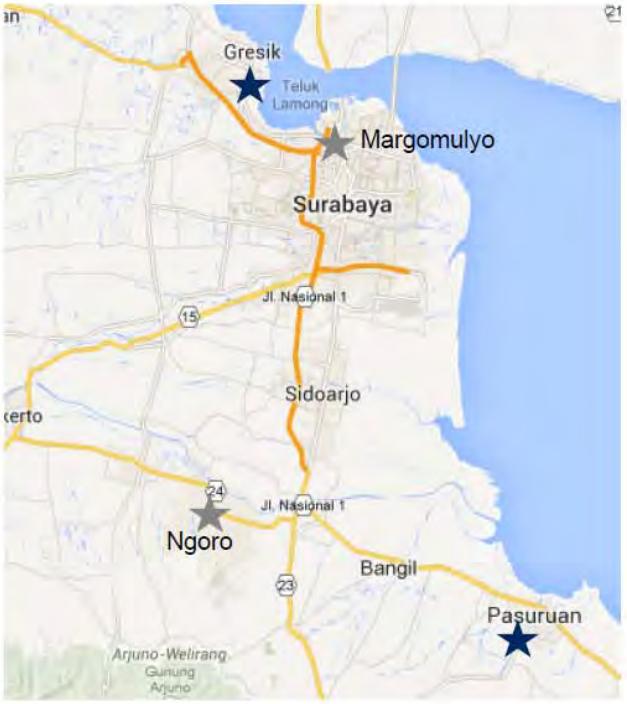
A. CHP

B. Energy Conservation

As a result of desk survey, we found 4 industrial estates located in neighboring or inside area of Surabaya, as potential sites for CHP.

Pasuruan	Pasuruan Industrial Estate Rembang (PIER)
Gresik	Gresik Industrial Estate (KIG)
Mojokerto	Ngoro Industrial Park (NIP) *
Surabaya	Margomulyo Industrial Estate*

* Not yet visited



Pasuruan Industrial Estate Rembang (PIER)

We have started interview survey and found a large amount of steam demand in PIER.
Interview survey will be continued for examining a possible capacity of CHP Plant.

Finding Candidate Factory → **Interview survey / Data Collection** → **Planning**

Company List


LIST OF COMPANY IN PIER

- Factory A
- Factory B
- Factory C
- Factory D

List up candidates based on business category

1st round survey
Oct 8 - 11

Steam Demand

Factory A : 20t/h
Factory B : 2t/h
Factory C : 2t/h

2nd round survey
Dec 3 – 5
(Tentative)

Visit factories not visited in 1st round survey

Sheraton hotel & towers -First meeting

Place	Sheraton hotel & towers
Date	9:00 – 10:00, August 27th, 2013
Outline	• 5 star hotel located in Tunjungan complex. • 28 stories building built in 1995 • 348 guest rooms
Meeting Attendees	Director, Mr. Noviadi Suryadarma Chief engineer, Mr. Ida Bagus Anom
Meeting Results	• Sheraton agreed to cooperate in NTTD's study and received inquiry sheet. • Sheraton has **reduction target** of **30%** for **energy consumption** and **20%** for **water consumption by 2020**. • **Energy audit** had been conducted by auditor from Hong Kong. • Some of the **lightings** were changed into **CFLs** or **LED** for energy conservation. • Electricity and heat are supplied from Tunjungan Plaza.
Next action	• Submit inquiry sheet and other related materials to NTTD team (Sheraton) • Energy diagnosis conducted by NTT Facilities based on field survey and inquiry sheet filled by Sheraton.

Souce: Tripadvisor, JTB website

Progress of Energy sector

Listing candidate buildings for energy conservation

A. CHP

B. Energy Conservation

As for building energy conservation, we have selected 8 buildings / offices for our case study so far.

Today's presentation

Municipal office	BAPPEKO	Mayor office
Hotel	Sheraton hotel & towers	Hotel Bumi Surabaya
Shopping mall	Tunjungan Plaza	
Office Building	Graha Pena (Jawa Pos)	
Data center	Omadata Indonesia	D Net

- Field survey has been completed and as a result, we cannot find any recommended measures at present, considering economics and CO2 reduction.
- Little rooms for improvement because facilities are rather new and small.
- The number of public data centers is very few in Surabaya , compared with Jakarta.

Proposal to Sheraton (1/2)

1. Replacement of **Laundry Machine**

- Existing Equipment : Using **old equipments**, both electricity consumption and water consumption can be reduced by installing new equipments.

→ We ask them to provide specification of each equipment. After receiving specification data, we will propose a plan in detail

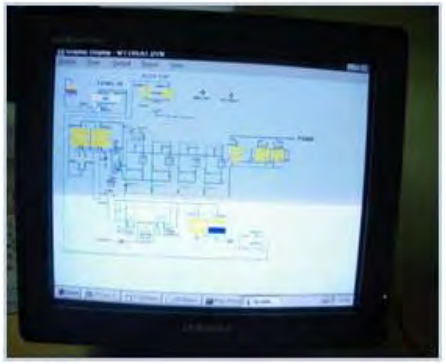
→ Sheraton hotel will increase capacity of laundry service because of expansion plan at Tunjugan Plaza, in which new hotel will be opened. Sheraton will aggregate laundry service.

→ Similar needs may exist in many hotels because each hotel usually provide laundry service by themselves (not outsourcing)

Proposal to Sheraton (2/2)

2. Installation of **BEMS**

- Existing Equipment : They install BAS (Building Automation System) which has limited functions. Installing BEMS by adding some functions, energy consumption may be reduced by 5%.
  - → Sheraton asked us to provide detailed information about how BEMS can reduce energy consumption.(now in preparation)



3. Installation of **LED**

- Sheraton asked us to propose LED installation with **profit sharing scheme**.
  - → Some manufactures including Philips and Panasonic made a proposal of installing LED.
  - → Sheraton would like not only to install LED but also to decrease initial cost with profit sharing scheme.
  - → Based on the request above, we are now revising our proposal.

Pakuwon Jati (Owner of the Tunjungan Plaza) –Survey Process

Having completed field survey, we are now preparing a proposal.

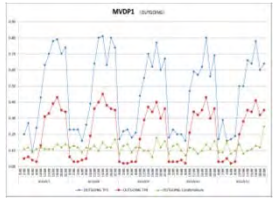
Walkthrough Survey / Data Collection

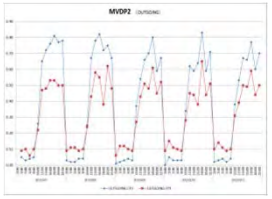
Walkthrough Survey :
11:00 -15:00, Sep 25

Data Collection

Questionnaire

Other related data





(Findings)

- Energy consumption of **cooling system** is the most important issue for them because its **power consumption** accounts for **more than 40%** of the total.
- Using **old chiller** and pumps
- Not effective **cooling tower**
- Using old type BAS
- **New boiler** installation plan based on TJ plaza expansion

Proposal & Discussion

1st Proposal meeting
14:00-15:00, Oct 29

Proposed items

- Replace existing chillers with high efficient type
- Install **BEMS (Building Energy Management System)**

Proposal is now being revised based on comments from Pakuwon

2nd Proposal meeting
Not decided

Revised proposal will be prepared, which includes chiller, pump, and cooling tower.

Proposal to Pakuwon Jati【Tentative/Example】

Existing equipment

- 600 RT x 1 set, 1,000 RT x 4 set

Proposed works

•Replace target chiller: 1,000RT x 4 -> 1,200RT x 3 (High efficient type)

•Chilled water pump is renewed sequentially equipment high efficiency type.

Saving calculation

•Power consumption: (695 kw x 2 + 692 kW x 2)=2,774 kW

•Load factor: 0.8

•Annual operation time: 12 h x 365 days = 4,380 h

•Total power consumption: 9,720,096 kWh/year

•Percent of saving: **20 %**

•Reduction of power consumption: 1,944,019 kWh/year

•Estimated cost to implement

•Reduction of operational cost benefits: 1,944,019 kWh x 1,000 Rp./kWh = **1,944,019,000 Rp.**

•Initial investment: 2,000,000,000 Rp .x 3 set = **6,000,000,000 Rp.**

Simple payback

- **3.1 years**

Showing an interest in replacing cooling system, we will make a proposal in detail, including not only chillers but also pumps and cooling towers.

1. Survey Activity

To assess potential environmental improvement and possible CO_2 emission reduction by way of **introduction of low carbon vehicles** and **improvement of operation efficiency**.

Target vehicles
■ Route Bus
■ City taxi
■ Intra-city public transport (angkot)
■ Garbage collector

×

Applicable Technologies
■ Introduction of low carbon vehicles
■ Improvement of operation efficiency

bus

taxi

angkot

garbage collector

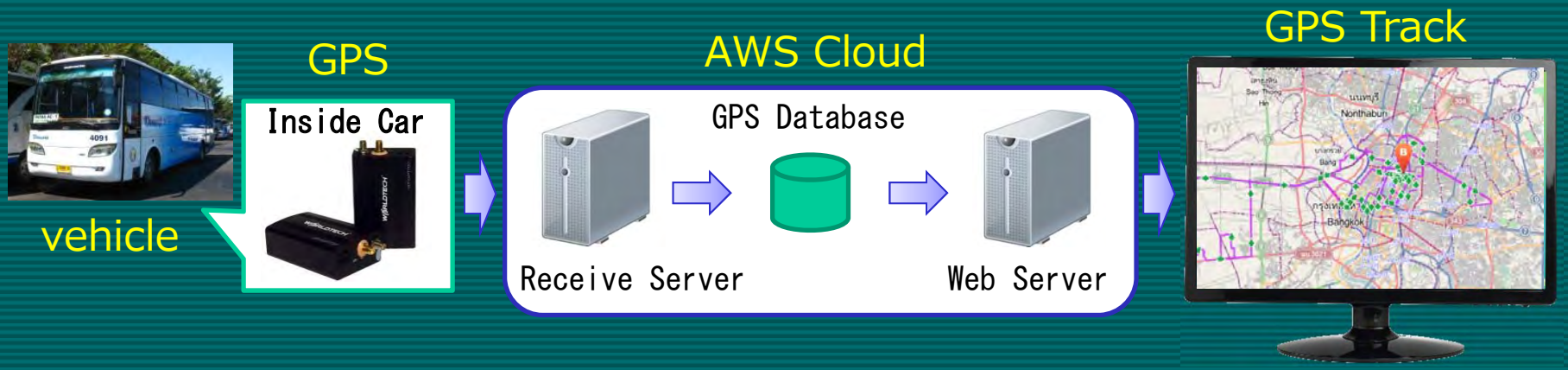
ALMEC
ALMEC CORPORATION

4. Outline of GPS Survey

To install GPS devices with communication function to the target vehicles and collect traffic data for one week.

Collect data of Positioning, Time, Speed of the target vehicles with sampling rate of 30 seconds, and analyze to identify following;

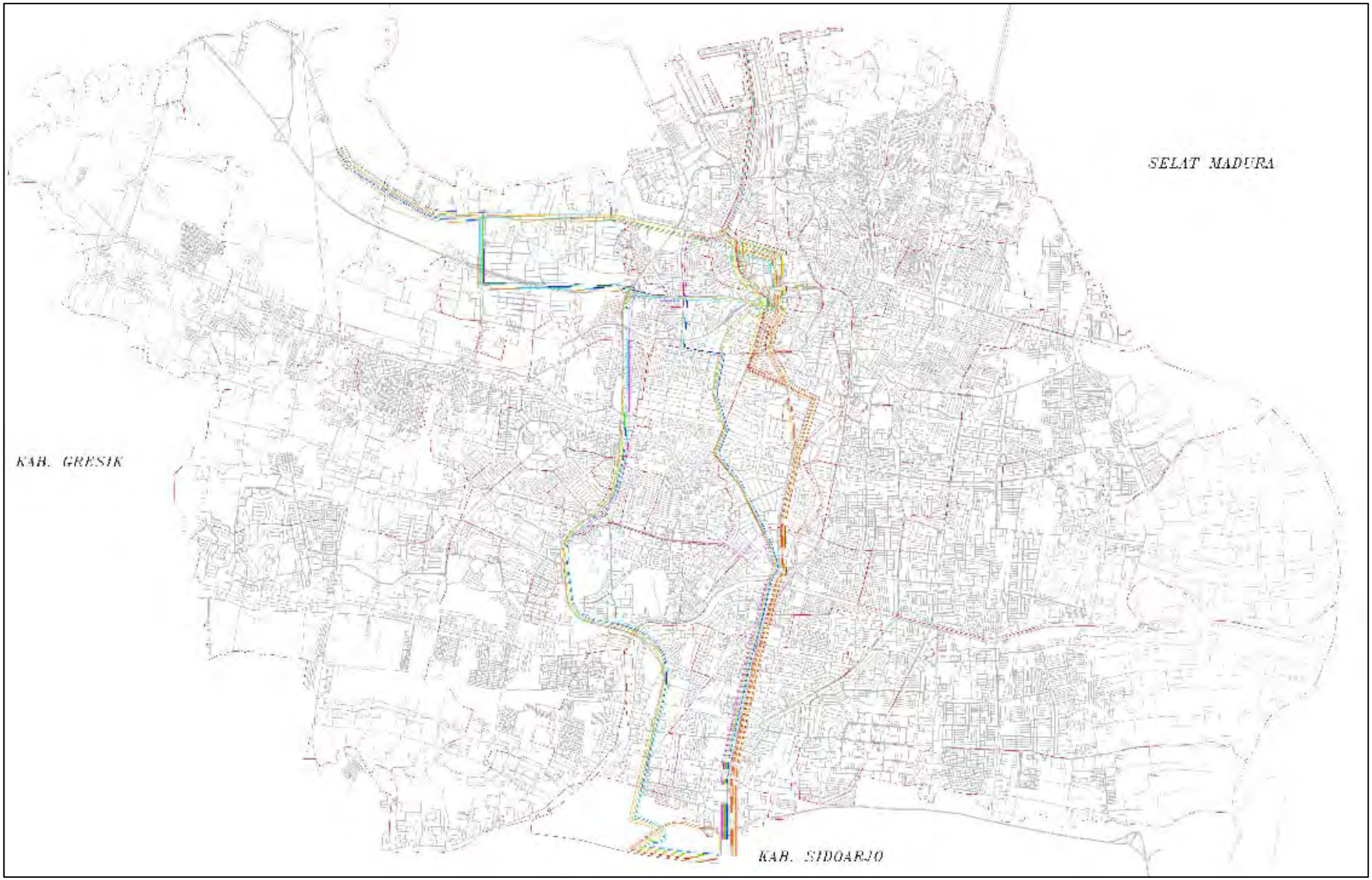
- any inefficient operational route
- any traffic congestion on the operational route



GPS devices installation : 19-22 August
GPS devises removing : 27-30 August

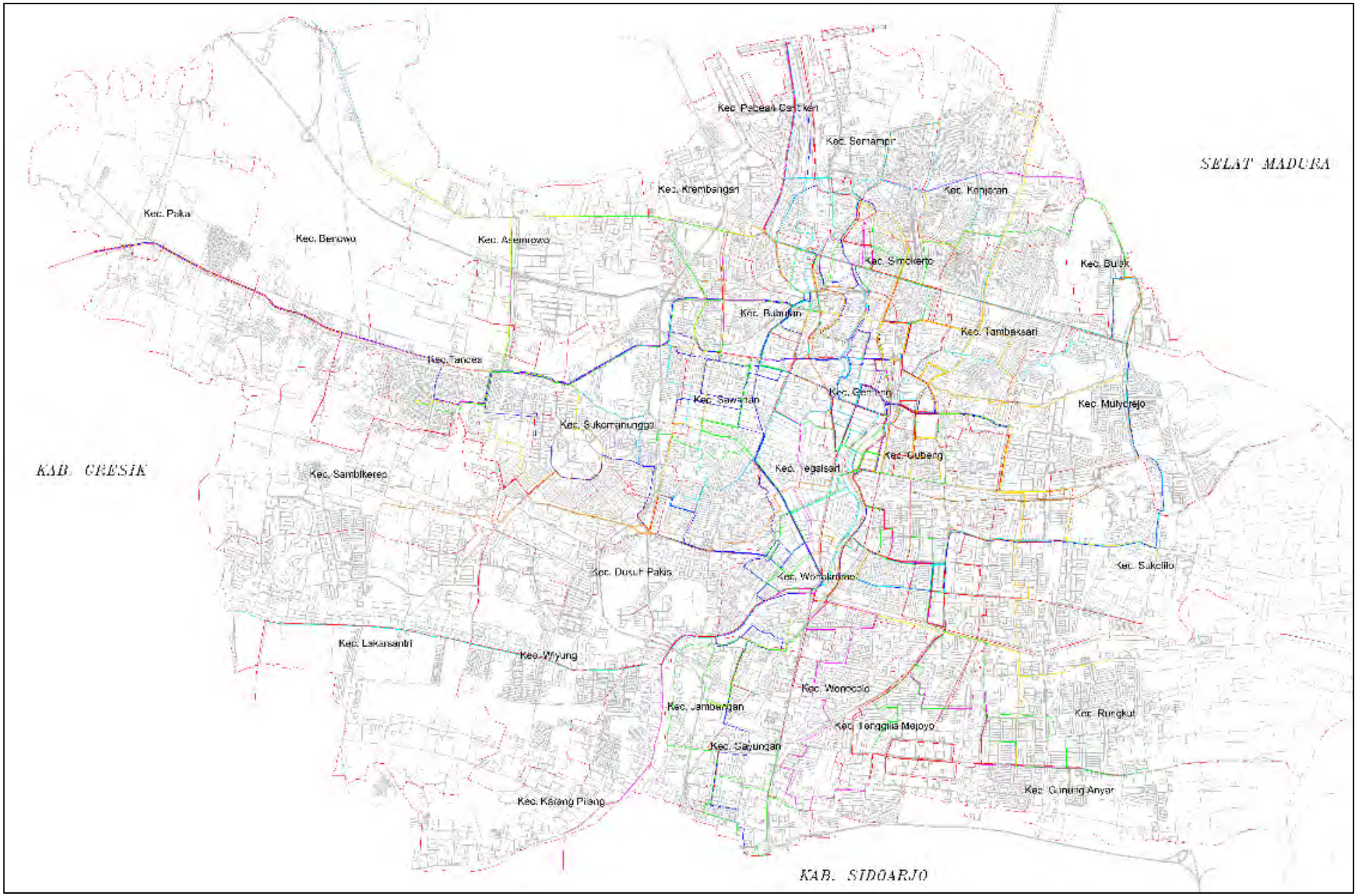
ALMEC
ALMEC CORPORATION

Bus Operation Routes in Surabaya (2,000 buses by 32 companies)



Source: Surabaya City (and Almec VPI Corporation)

Angkot Operation Routes in Surabaya (79 routes, 3,000 vehicles)



Source: Surabaya City (and Almec VPI Corporation)

Result of GPS Survey

EV Angkot

Angkot

✔Travel time ratio is low (under 50%) and the results are considerably different in vehicles.

→Improvement of management and traffic efficiency are expected by the **reduction of the number of the vehicles**.

Bus

✔Travel time ratio is high and the results are not different much in vehicles.

→Taking an approach against each vehicle is more effective than the improvement of operation efficiency. (e.g. Replace existing vehicle by low-carbon vehicles)

→Survey of the availability of **CNG**

✔The idle time ratio is quite high.

→Reduction of energy is expected by turning off a vehicle engine when stopped every time 「**idling stop**」.

✔Travel speed varies widely

→Energy reduction is expected by “**Eco-driving**”.

ALMEC
ALMEC CORPORATION

CNG station

CNG conversion kit

Taxi

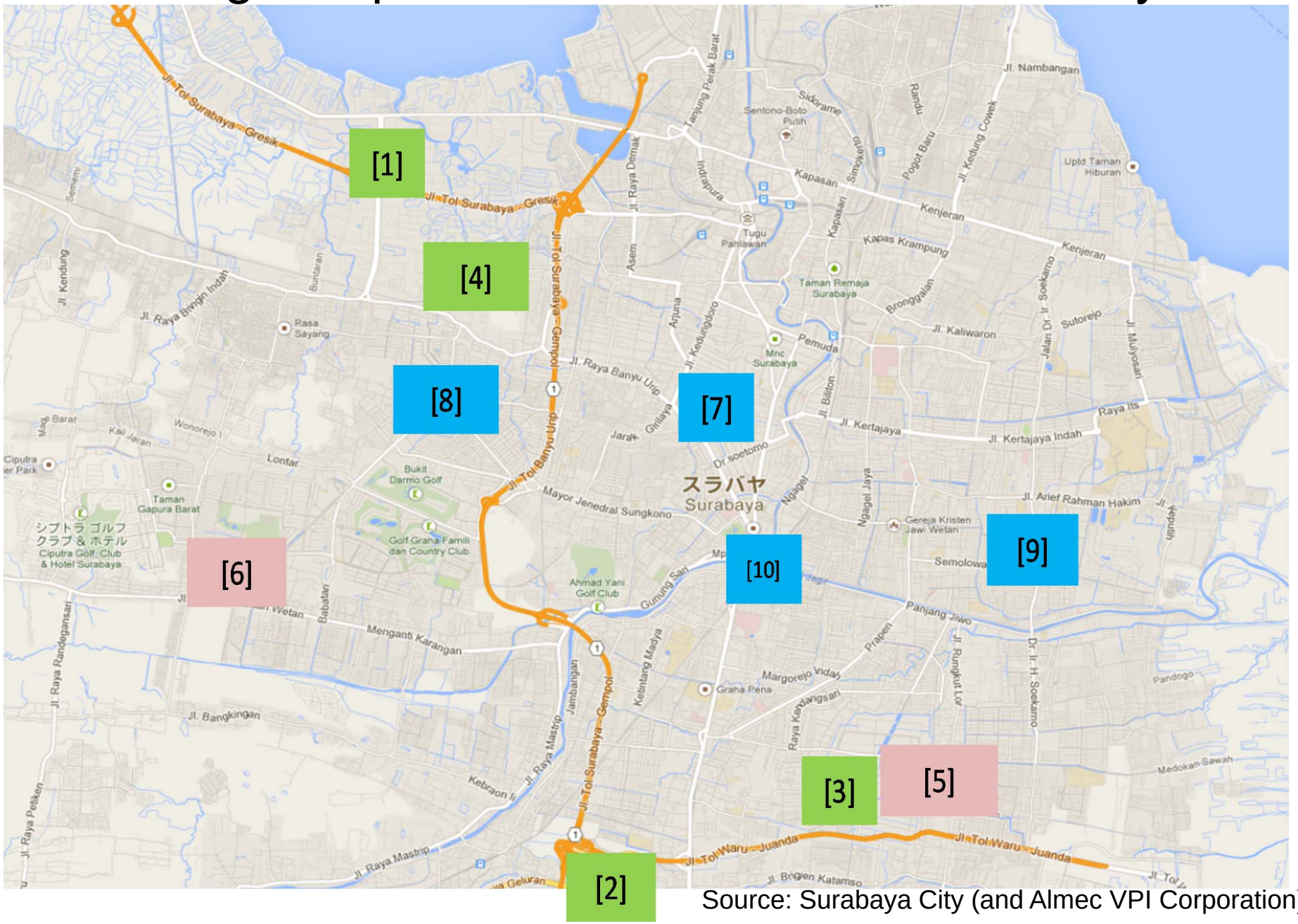
- ✔Travel speed varies widely
  - →Energy reduction is expected by “**Eco-driving**”.
- ✔Travel time ratio is moderately high and the results are not different much in vehicles.
  - →Taking an approach against each vehicle is more effective than the improvement of operation efficiency. (e.g. Replace existing vehicle by low-carbon vehicles)
  - →Survey of the availability of **CNG/Hybrid**

Garbage Truck

- ✔Travel time ratio is low
- ✔After the result of the on-going study on solid waste management, necessary measures will be proposed for transport.

ALMEC
ALMEC CORPORATION

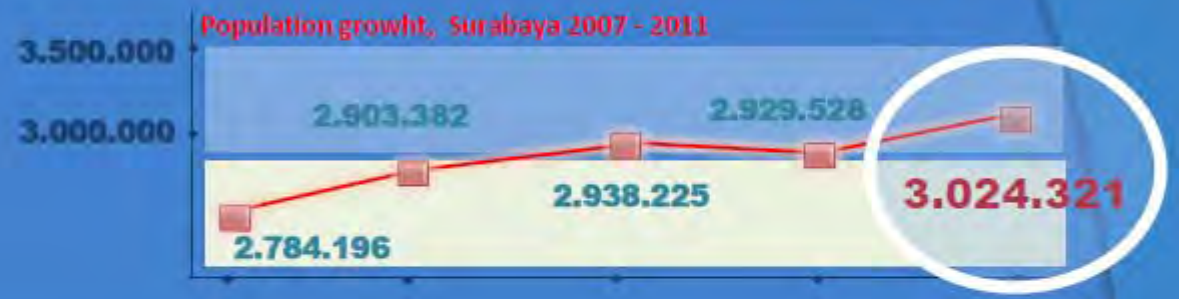
Existing and planned CNG Stations in Surabaya

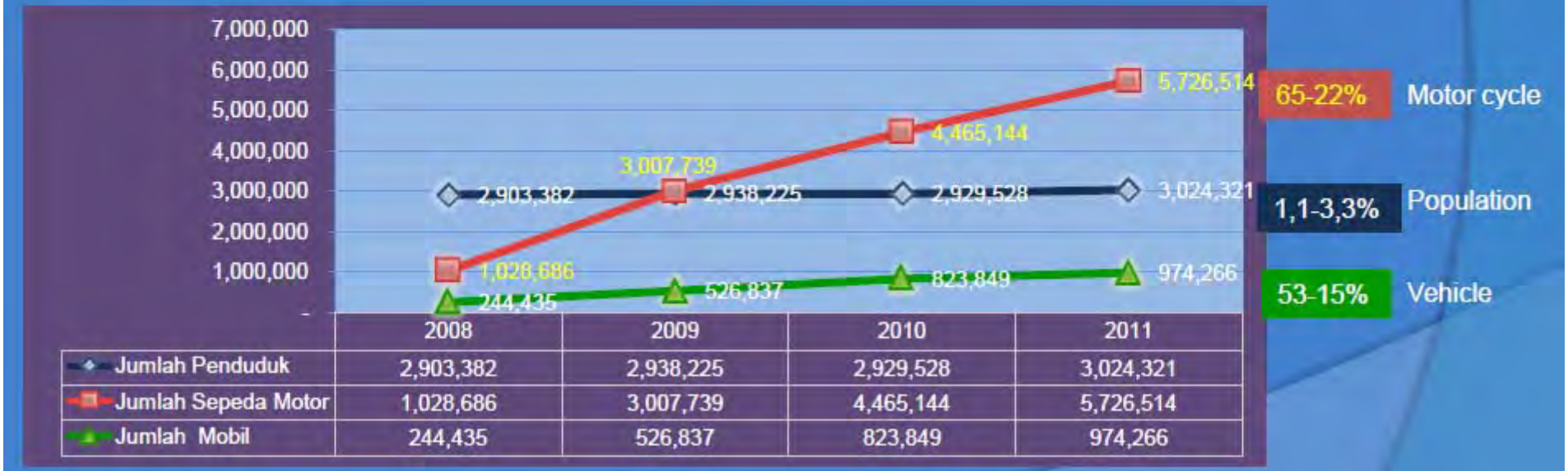


Source: Surabaya City (and Almec VPI Corporation)

DEVELOPING MASS TRANSPORT (Tram & Monorail) NO INNER CITY TOLL ROAD

POPULATION : 3.024.321 jiwa





	2008	2009	2010	2011
Jumlah Penduduk	2,903,382	2,938,225	2,929,528	3,024,321
Jumlah Sepeda Motor	1,028,686	3,007,739	4,465,144	5,726,514
Jumlah Mobil	244,435	526,837	823,849	974,266

Source: Surabaya City

SURABAYAMRT

MASS RAPID TRANSPORTATION SYSTEM

Surabaya Mass Rapid Transportation (SMART)

Tram and Monorail Project

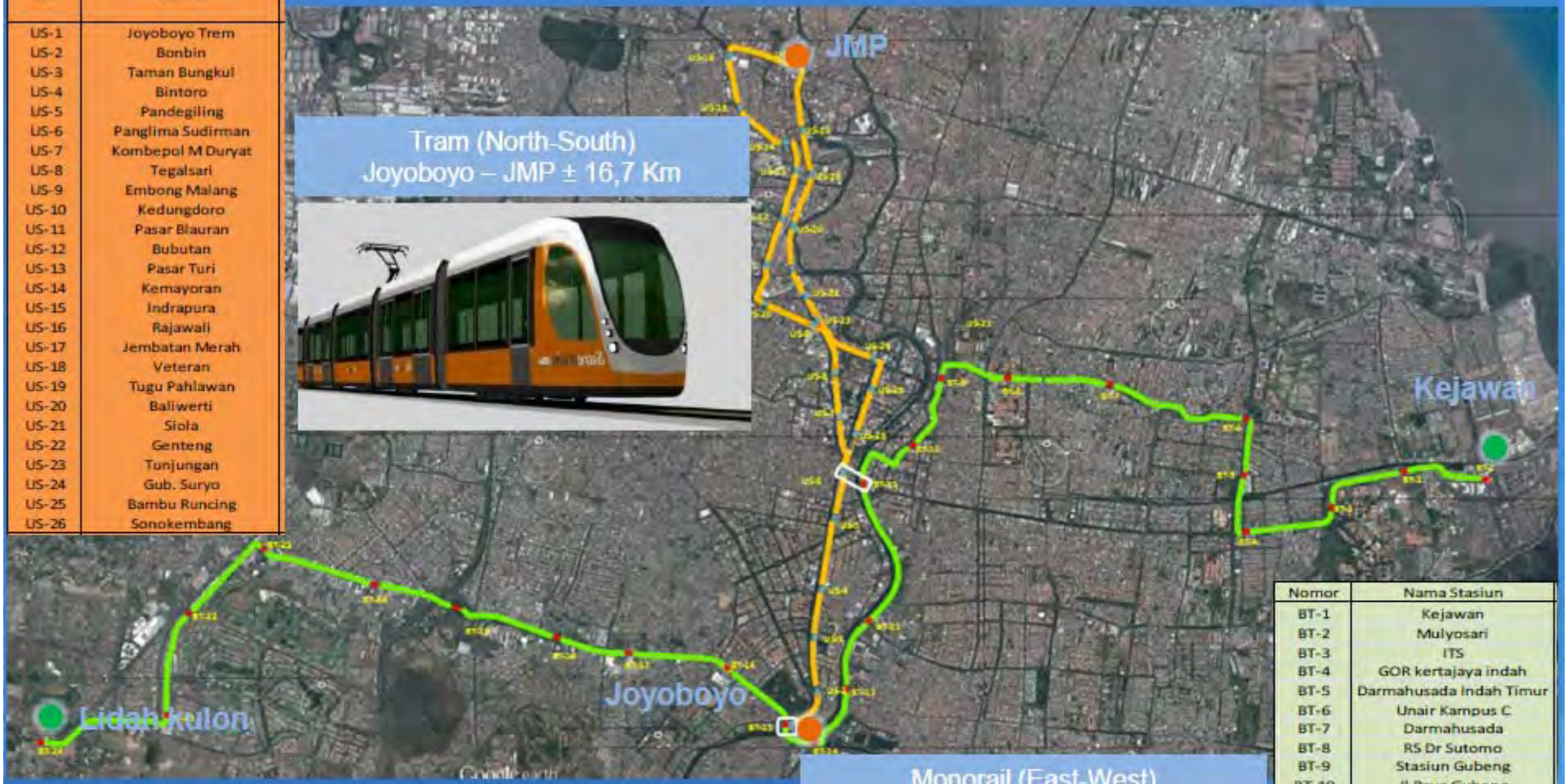
PEMERINTAH KOTA SURABAYA
TAHUN 2013

Source: Surabaya City

Monorail &TramLine

Source: Surabaya City

No	Stasiun
US-1	Joyoboyo Trem
US-2	Bonbin
US-3	Taman Bungkul
US-4	Bintoro
US-5	Pandegiling
US-6	Panglima Sudirman
US-7	Kombepol M Duryat
US-8	Tegalsari
US-9	Embong Malang
US-10	Kedungdoro
US-11	Pasar Blauran
US-12	Bubutan
US-13	Pasar Turi
US-14	Kemayoran
US-15	Indrapura
US-16	Rajawali
US-17	Jembatan Merah
US-18	Veteran
US-19	Tugu Pahlawan
US-20	Baliwerti
US-21	Siola
US-22	Genteng
US-23	Tunjungan
US-24	Gub. Suryo
US-25	Bambu Runcing
US-26	Sonokembang



Tram (North-South)
Joyoboyo – JMP ± 16,7 Km

Nomor	Nama Stasiun
BT-1	Kejawan
BT-2	Mulyosari
BT-3	ITS
BT-4	GOR kertajaya indah
BT-5	Darmahusada Indah Timur
BT-6	Unair Kampus C
BT-7	Darmahusada
BT-8	RS Dr Sutomo
BT-9	Stasiun Gubeng
BT-10	Jl Raya Gubeng
BT-11	Irian Barat
BT-12	Bung Tomo
BT-13	Ngagel
BT-14	Wonokromo
BT-15	Joyoboyo
BT-16	Adityawarman
BT-17	Pakis
BT-18	Dukuh Kupang
BT-19	Bundaran Satelit
BT-20	HR Muhammad
BT-21	Simpang Darmo Permai
BT-22	Lontar
BT-23	Unesa
BT-24	Lidah Kulon

Monorail (East-West)
Kejawan – Lidah kulon ± 23 Km

KETERANGAN :
- MONORAIL
- TRAM

Sumber :
Pra Studi Kelayakan AUMC Pemkot Sby (2012)

Source: Surabaya City

Source: Nishihara Corporation

ECO MANAGEMENT

SURABAYA

0-1.Flow of Waste in Surabaya

Landfill disposal cost:
USD12/t

Households/ Offices

Collection by communities

Transfer Station

- Depo
  160 facilities

Transfer of waste

Benowo Disposal Site

- Volume of waste received**: 1,200 t/day**
- Collection vehicles: 300 per day
- Cost for collection and treatment: USD11 million/year

Surabaya City Department of Cleanliness and Gardens (DKP) / Private operators

Waste pickers (Several thousands)

Waste pickers (Several thousands)

It is the only final disposal site, but its treatment capacity is nearing the limit.

Waste pickers 1,000 - 1,200 persons

Source: Nishihara Corporation

ECO MANAGEMENT
SURABAYA

0-2 Outline of the project

Landfill disposal cost:
USD12/t

Households/ Offices

Collection by communities

Waste pickers (Decrease naturally with employment at Super Depo, etc.)

Super Depo
• Recycle-based intermediate treatment facility

Currently brought directly to the final disposal site.

Benowo Disposal Site
• Volume of waste received: 1,200 tons
• Collection vehicles: 300 per day
• Cost for collection and treatment: 1.1 billion yen per year

Possible to reduce
Possible to reduce
Possible to reduce

Waste pickers (Decrease naturally with employment at Super Depo, etc.)

Upgrade existing transfer stations (Depos) to recycle-based intermediate facilities, or "Super Depos," which have functions of a wholesale.

Waste sent to the final disposal site will be 30% of the current amount (70% reduction), and the life of the disposal site could be extended.

Waste received: 1,200 tons
(40 tons per day × 30 facilities)

Commission fee for treatment:
USD12/t

Transfer of waste

Super Depo (Recycle-based intermediate treatment facility)

Selection and processing

50% 20t → Food waste ⇒ composting (Yield: 20%) → 4t
20% 8t → Valuables ⇒ Separation → 8t
30% 12t → Residuals → 12t

(50 persons employed in each facility)

Composting at the compost center
USD30-50/t

Sell to manufacturers as raw material
USD100/t

Outsource the treatment of residuals at the disposal site
- USD12/t

Return some portion of profit to communities

- Construction of day nurseries and primary schools
- Improvement of living conditions for informal sector

Policy of Surabaya City
Interested in reducing waste through the deployment of intermediate treatment facilities (TPST) within the city.

Deployment of Super Depos in 40 locations within the city

Operate one Super Depo as a pilot project

Source: Nishihara Corporation

ECO MANAGEMENT
SURABAYA

0-3 Current Progress

Waste collection

SUPER-DEPO (First step)

Plastic | Paper scraps | Metals | Foreign materials | Organic

13% | 4% | 0.3% | 5.6%

60% ~ 70%

Transferred by DKP

Compost center (Second step)

10%

Under construction (to be completed by Jan. or Feb., 2014)

Sold to farmers

BENOWO final disposal site

85% reduction

Sold to resource recovery operators

In operation (Since Mar 2013)

Plastic

Paper scraps

Food waste

Progress of Solid Waste sector (waste sorting, recycling composting)

Source: Nishihara Corporation

4.-2 GHG reduction potential

- We calculated the GHG reduction potential from 3 patters:
  1. Super Depo + Compost center (Project in 2013 and 2014)
  2. Large facility with Separation and Composting (Next project after 2016)
  3. Whole potential for compost in Surabaya
- In addition to Composting, Waste(MSW) has potential for GHG reduction.
  e.g.) transportation of waste, Waste to energy etc

	1.Super Depo + Compost center	2.Large facility with Separation and Composting	3.Potential in Surabaya city
Amount of Waste(MSW) & Organic waste	15t/day(MSW) 9.6t/day(Organic)	150t/day(MSW) 96t/day(Organic)	2642t/day(MSW) 1855t/day(Organic)
Reference GHG emission(RE)	1,840t-CO2/year	18,400t-CO2/year	344,000t-CO2/year
Project GHG emission(PE)	490t-CO2/year	4,900 t-CO2/year	94,790t-CO2/year
GHG reduction	1,350t-CO2/year	13,500t-CO2/year	249,210t-CO2/year

Progress of Solid Waste sector (waste sorting, recycling composting)

Source: Nishihara Corporation

Key findings

1. Composition survey

- 65% of the waste in Super Depo will be suitable fro composting

  To do =>Preparation of Composition survey

2. Macro data of Waste management in Surabaya

- the potential for composting is 1,855 ton/day in Surabaya.

  To do =>Updating of the data

3. Business model

- We are ready for constructing Compost center at Wonorejo

  To do =>Calculation of Initial and Running cost, in addition to quality control

4. GHG reduction

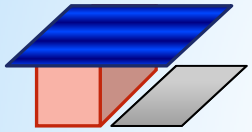
- Super Depo + Compost center 1,350t-CO2/year
- Large facility with Separation and Composting 13,500t-CO2/year
- Whole potential for compost in Surabaya 250,000t-CO2/year

  To do =>Culculation of Project GHG emission

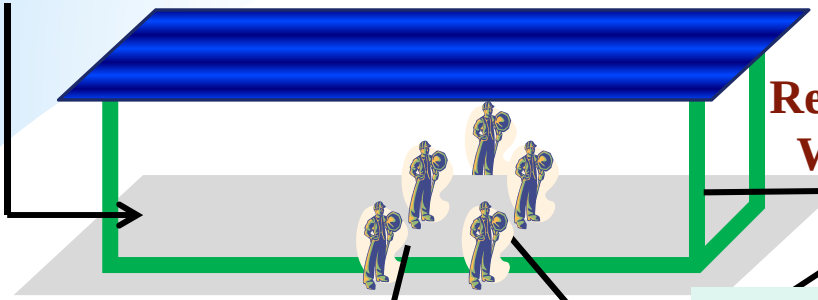
Treatment Flow

Source: Hitz Hitachi Zosen

Weighting Implement

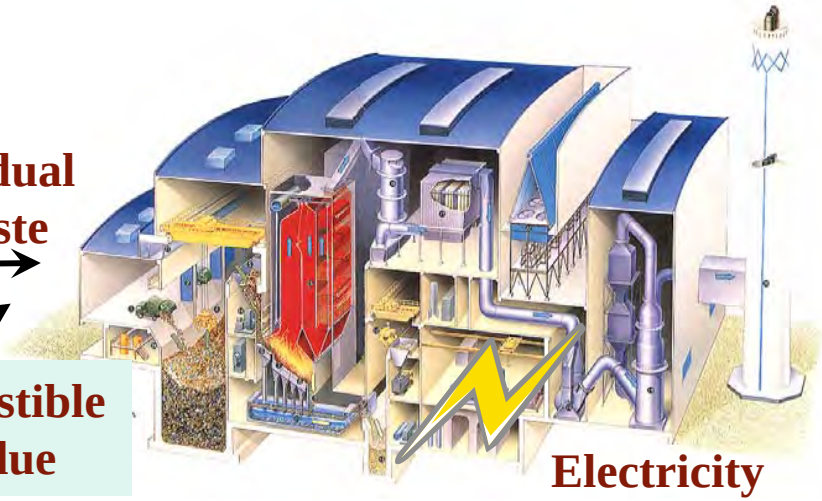


Super Depo



Residual Waste

Waste Incineration plant



Combustible Residue

Organic

Electricity

Bottom Ash

Compost plant

Valuables

Incombustible Residue

Final disposal site

Analyzing Result of Solid Waste

Location of sample : **SUPER DEPO SUTOREJO**
Address : Sutorejo Street, District of Mulyorejo, Surabaya City
Type of Sample : Solid waste at the Sutorejo in other to Landfill
Sampling date : 25/09/2013

No.	Composition	**Physical composition** (% dry weight basis)	**Physical composition** (% wet weight basis)	**Moisture content, at 105°C** (%)	**Ash, at 550°C** (%)	**VS** (%)	**Gross Calorific** (Cal/g)
1	Food waste	47,05	57,50	53,89	27,08	72,92	3642,33
2	Papers	21,31	16,77	28,41	11,81	88,19	3625,04
3	Diaper	1,25	1,47	52,11	0,29	99,71	4688,22
4	Plastics	17,34	13,99	30,16	32,07	67,93	5860,82
5	Textiles	0,36	0,26	22,84	2,13	97,87	4374,25
6	Woods	6,89	6,73	42,31	7,74	92,26	4192,78
7	Rubber and leather	0,13	0,08	-	-	-	-
8	Metal	4,40	2,48	-	-	-	-
9	Inorganic	0,87	0,49	-	-	-	-
10	Shell	-	-	-	-	-	-
11	Others	0,40	0,23	-	-	-	-
Measuring/analyzing method		-	-	**ASTM 3301-07**	**ASTM D 3174-07**	**ASTM D 3175-07**	**ASTM D 5865-07**

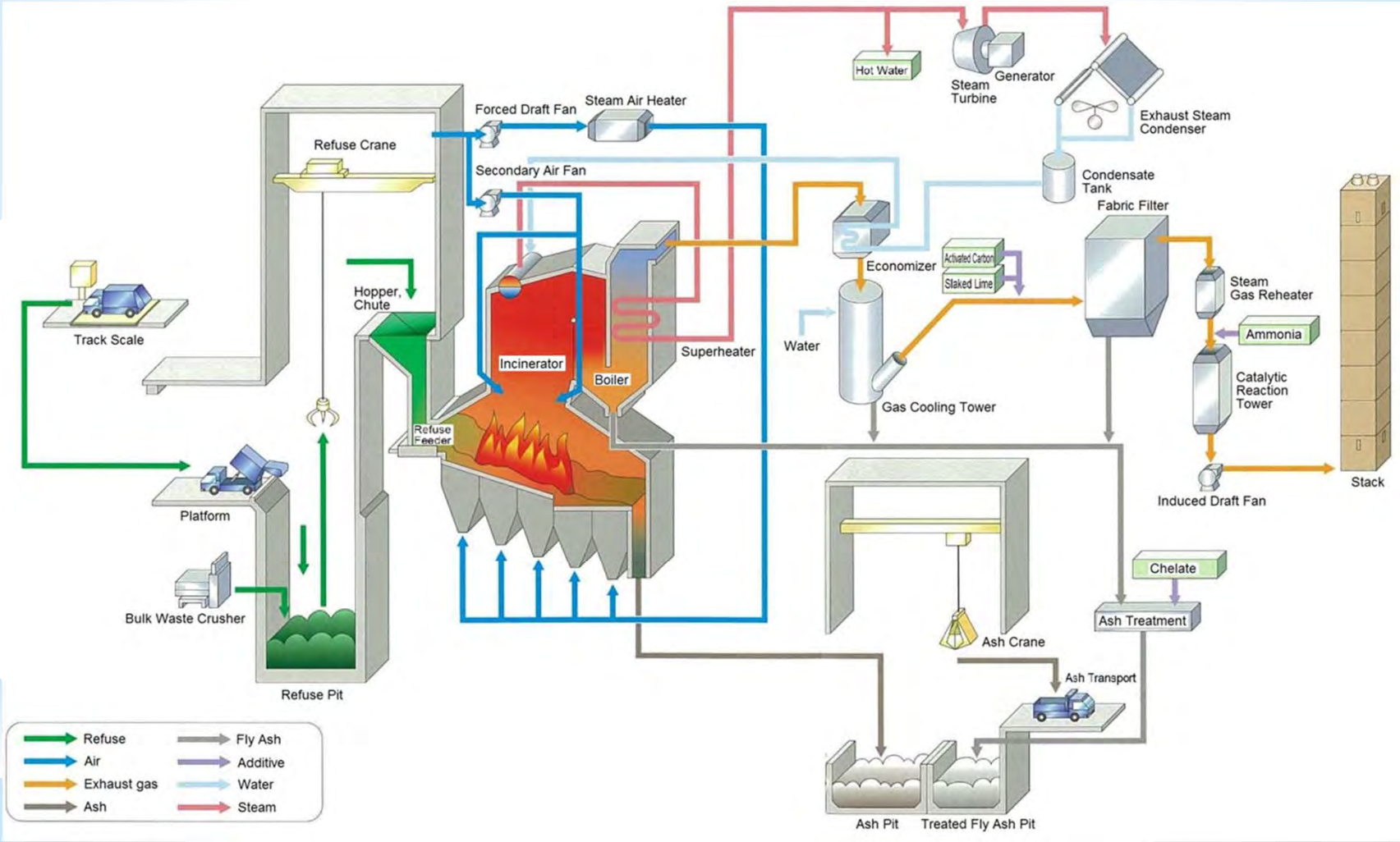
Moisture content, at 105°C (%)	**Ash, at 550oC (%)**	**VS (%)**	**LHV (Cal/g)**
49.44	15.32	41.04	**1,942**

Case Study for CO_2-Reduction by WtE
Specification of WtE-Plant

- ***Waste Treatment Capacity***
  500 ton/day x 1 line
- ***Waste Calorific Value (LHV)***
  1,942 kcal/kg (Above mentioned)
- ***Boiler Steam Condition***
  4 MPa x 400˚C
- ***Main Flow of WtE-Plant***
  See next page

Case Study for CO_2-Reduction by WtE

Waste Treatment Flow

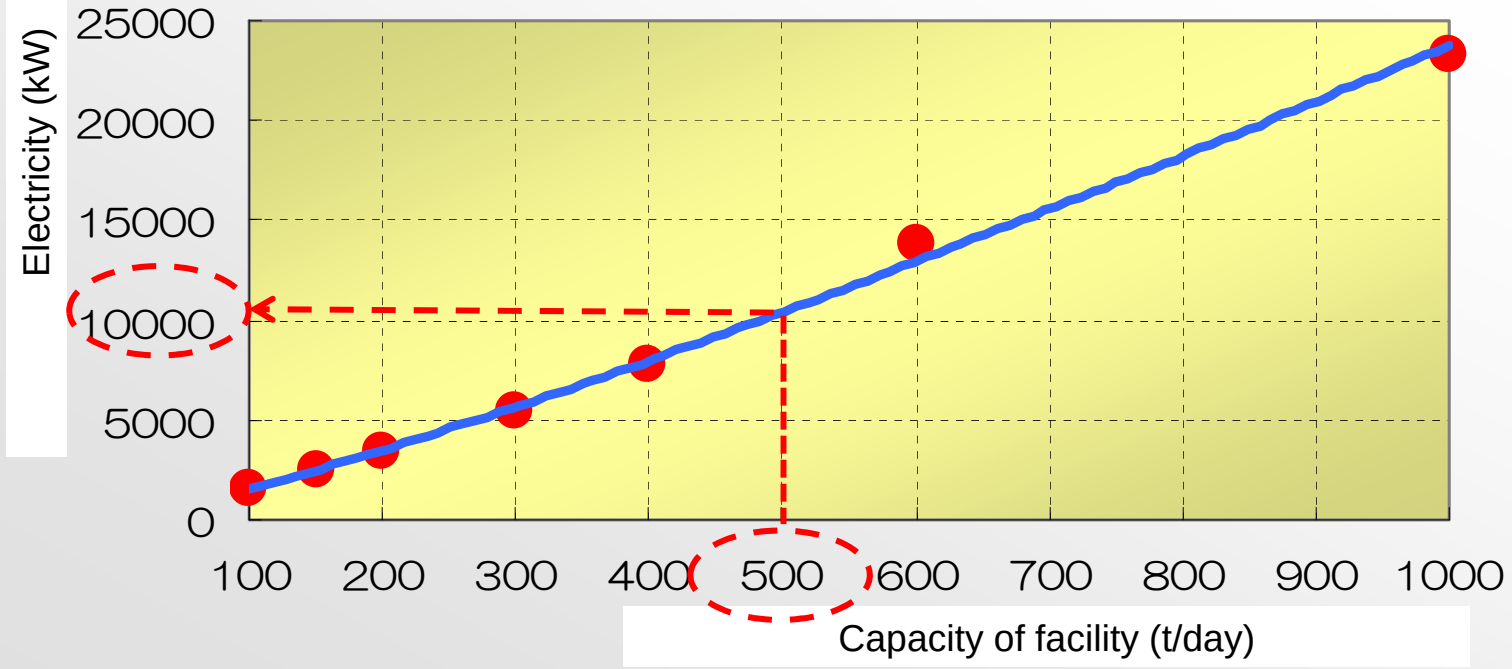


Case Study for CO_2-Reduction by WtE
Result of CO_2-Reduction

- ***Power Generation Capacity (Steam Turbine)***
  9,330 kW
- ***WtE-Plant Internal Electricity Consumption***
  2,580 kW
- ***Electricity for External supply***
  6,750 kW → 54,000 MWh/year (=8,000h)
- ***Result of CO_2-Reduction***
  30,240 ton-CO_2/year
  (CO_2-Emmission Coefficient = 0.560t-CO_2/MWh)

Expectation of Electricity Generation

Relationship between
Capacity of facility and Electricity generated
(Calorific value of waste ; 2,132 Cal/g)



Progress of Solid Waste sector (Waste to energy for industrial waste)

Business Concept ～Waste Reuse in Cement Plant～

Mine

Virgin raw material

CaO　SiO_2　Al_2O_3　Fe_2O_3　Coal

Waste Generator

Waste

AMITA

100% Recycle (Reuse)

Alternative raw material

SlurMix® CRM

Cement plant

※CRM is used as alternative SiO_2&Al_2O_3

Landfill

Incinerator

Waste Utilization in Indonesia and Japan

	Indonesia	Japan
Population	230,000,000	128,000,000
Area	1,910,931 km^2	377,930 km^2
Industrial waste generation	7,000,000 t / year	400,000,000 t / year
Cement production	**55,000,000 t / year**	**57,579,000 t / year**
Waste recycled amount by cement industry	? t / year	**44,400,000 t / year**
Waste consumption rate in cement industry	? kg / cement 1t	**469 kg / cement 1t**

Findings

- Indonesian cement makers are utilizing mainly agricultural by-products, not much industrial by-products.
- Indonesian cement industry has huge capacity to accept industrial by-products.

Progress of Solid Waste sector (Waste to energy for industrial waste)

Survey items

【1】Baseline Survey (Future plans)

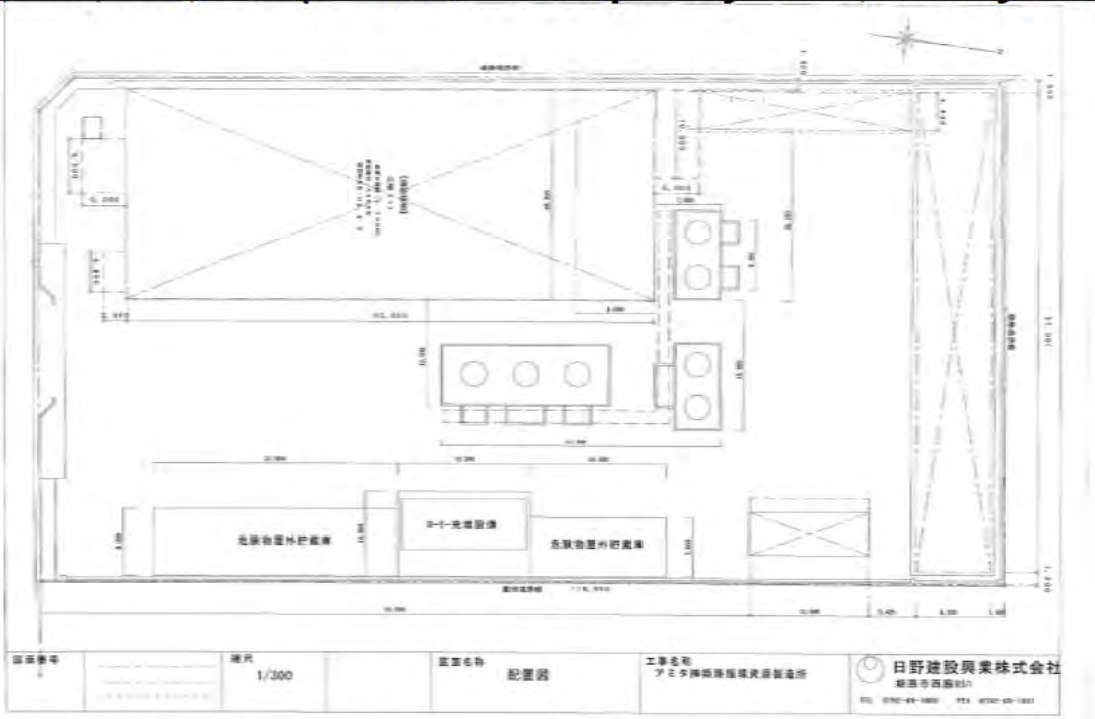
- Visit other cement companies as much as possible.
- Analyze each companies status and figure out the potential ability for recycling.
- Study Waste Acceptance Criteria of all cement companies.

Progress of Solid Waste sector (Waste to energy for industrial waste)

Survey items

【3】Feasibility Study (Achievements)

- Construction cost of intermediate treatment plant based on Japanese plant for CRM (Cement Raw Material).
  Rp. 5,440,000,000 (Treatment capacity: 100,000t/ year)



Warehouse Building ((25.2m x 60m) + (8.5m x 57m) + (4.4m x 24m) = 2,102.1m^2)

Progress of Solid Waste sector (Waste to energy for industrial waste)

Reduction of CO_2

Reduction of CO_2

Assumption: Constructing intermediate treatment plant in Indonesia

- Production of CRM: **24,000t**/ Year
- Calorific value of CRM: Ave. 1,800kcal/kg
  → 24,000t × 1,800kcal/kg =43,200,000kcal/kg
- Ave. calorific value of coal is 6,354kcal/kg
  → 6,800t of coal
- CO_2 emission of coal is 2.33t/coal ton
  → Cement manufacture could save about **16,000t** -CO_2/ Year by using CRM.

AMITA

Progress of Water resource sector

Proposals on Water Resource Areas

1. Current Proposals

A. Energy saving countermeasures of water treatment plant & pump station
B. Water leakage countermeasures for distribution pipes (Basic data planning)
C. Energy saving countermeasures of wastewater treatment facilities at Surabaya Industrial Estate Rungkut (SIER)
D. Energy saving countermeasures of Keputih septage treatment facility

2.Potential energy saving countermeasures require further study

E. Water leakage countermeasures for distribution pipes (detailed countermeasures)
F. Countermeasures for recycling of sanitary wastewater & sludge
G. Countermeasures for saving system of treated water

Source: Matsuo Sekkei Corporation

1.Current Proposals

A. Energy Saving Countermeasures of Water Treatment Plant & Pump Station

A-1.Water Treatment Plants

Source: Matsuo Sekkei Corporation

A-2.Booster Pump Stations

Reservoir (Tandon Air) Putat Gede
Dengan Kapasitas 5.000 m^3

Source: Matsuo Sekkei Corporation

Major Investigation Result

A-1. Water Treatment Plants

The degree of soundness of these plants are **managed by regular maintenance.** There is **no energy loss by facility aging**. Therefore, CO2 reduction effects by facility renewal is not feasible. Expecting future demand increase, the expansion plan of water treatment plant is under contemplation.

A-2. Pump Facilities

Pump facilities are also **managed by regular maintenance**, however, water transmission pump facilities in Ngagel Ⅰ water treatment plant system are **aging**. Therefore, they are unable to supply pump rated supply amount. Currently, the communication pipe (looped tube) from Karang Pilang water treatment facilities offset the shortage. Also, the capacity of transmission & distribution pipe in Ngagel Ⅰ water treatment plant system is from 3 times to 4 times larger than water processing ability. **It is possible to lower energy loss by adjusting capacity & number of unit in pump facilities when they are renewed.**

Source: Matsuo Sekkei Corporation

B.Water Leakage Countermeasures for Distribution Pipes (Basic Data Planning)

Source: Matsuo Sekkei Corporation

Major Investigation Result

(B-1) Water Transmission Block

The whole city is sectionalized **large 5 blocks**, then the 5 blocks are divided **middle-sized 149 blocks**. Finally, the middle-sized blocks are **formed a few small blocks** and this plan is under way. **Flow meters & pressure gauges are installed** & controlled flow rate & pressure in each large, middle & small blocks and **these block meters are maintained regularly** by replacing parts & meters and repairing pipeline as soon as their malfunctioning such as meter failure is found. The flow rate & pressure maintenances in large, middle & small blocks are systematically performed and the feasibility of energy loss reduction by replacement of block meters which is one of our proposals is low.

(B-2) Pipeline Rehabilitation

Pipeline Facilities are well maintained by Water Supply Corporation Surabaya. Small blocks are formed, detect **the location of water leakage** and conduct & plan **preventive countermeasures for aging pipeline**. According to the annual plan, pipeline rehabilitation is planning to perform. **Steel pipe** is used for middle-large diameter transmission & distribution pipes. Therefore**, water leak between joint is little**. As a result, the feasibility of energy loss reduction by pipe renewal which is one of our proposals is low.

Source: Matsuo Sekkei Corporation

C. Energy Saving Countermeasures of Wastewater Treatment Plant in Surabaya Industrial Estate Rungkut

Source: Matsuo Sekkei Corporation

Key Investigation Results

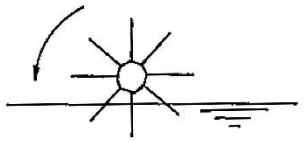
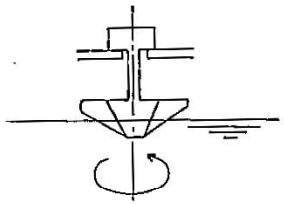
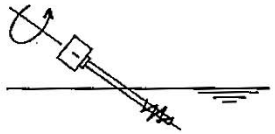
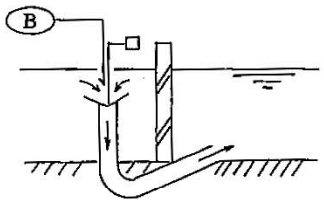
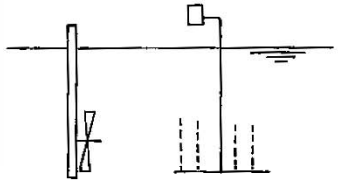
- Aerator Renewal

Aerators consume 80% of whole electricity.

Source: Matsuo Sekkei Corporation

Aerator Renewal

Aerator Types

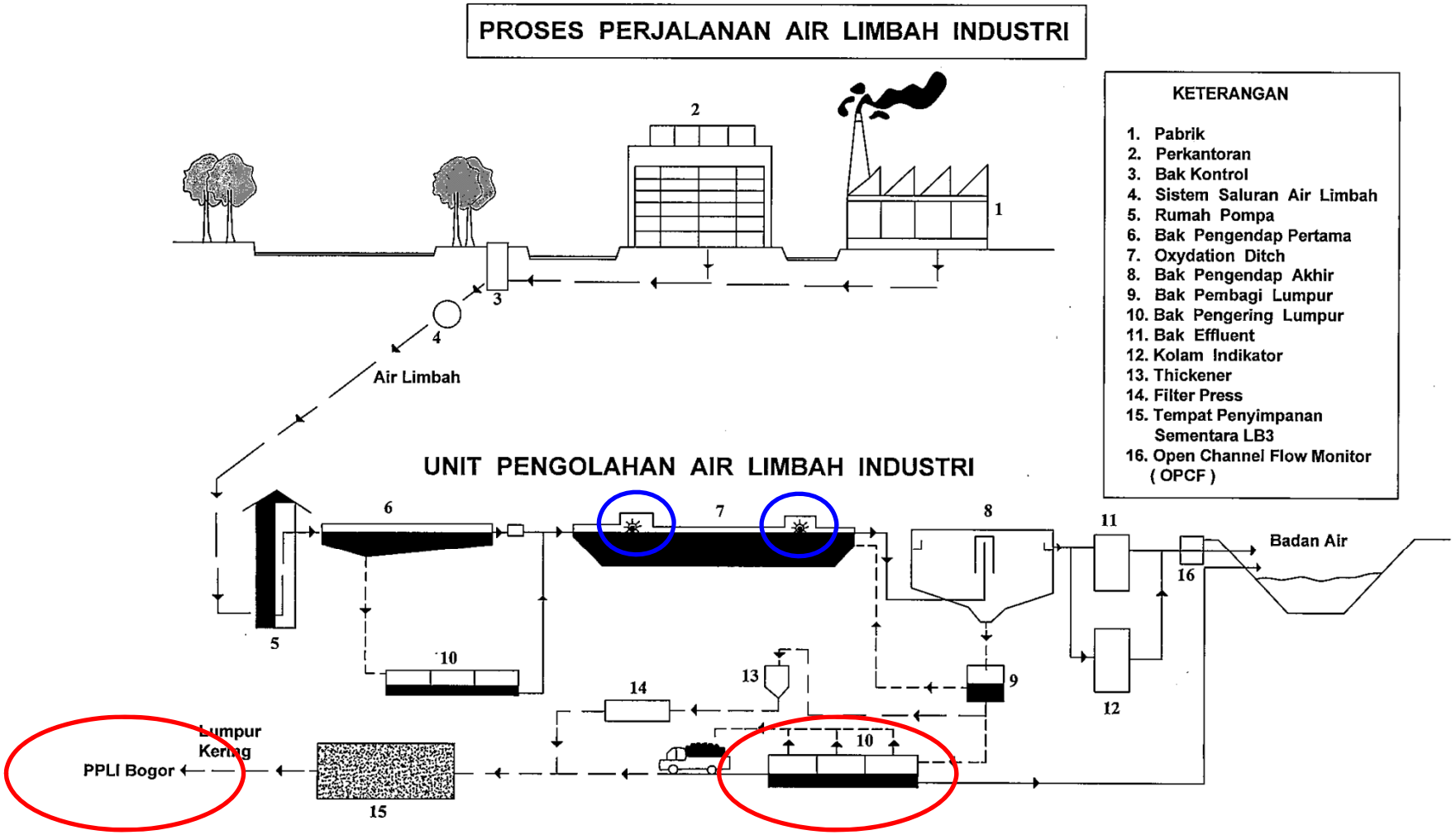
Model	Horizontal shaft	Vertical shaft	Screw type	Axial flow pump	Propeller type
Diagram					
Function	The surface aeraion system which aerates by mixing water surface with the horizontal brush roter.	The surface aeration system by placing its drive section on the water surface of ditch and it transmit information to impeller. Then sumerged impeller performs aeration.	The Under-water aeration system It supplys air under the water as microscopic bubbles utilizing negative pressure created by screw rotation.	It is the combined system with axial flow impeller mixing & diffusing pipe inlet. The air mixed water is pumped from the bottom of downsteam tank.	The propeller under water performs chum & mixing and diffusing plate supplys oxgen.
Oxgen Supply Efficiency	Relatively poor	Good	Good	Excellent	Excellent
Price	Excellent	Good	Good	Bad	Bad

Current aerator

Recommending aerator

Source: Matsuo Sekkei Corporation

Reduction of Sludge Moisture Content



Source: Matsuo Sekkei Corporation

Reduction of Sludge Moisture Content

The sludge is transported by auto truck from Surabaya to Bogor.
Sludge amount: 120～160 Ton/Month

Source: Matsuo Sekkei Corporation

Work Plan and Main Events

June 26	**Kick-off Meeting in Kitakyushu**
June 17 - July 5	JICA NAMA/MRV Capacity Development Training in Kitakyushu (2 officials from BAPPEKO Surabaya)
July 8 - 12	1st Field Survey, **July 10 (Wed): Inception Meeting**
July 23 - 24	International Forum for Sustainable Asia and the Pacific (ISAP) 2013, Yokohama (4 officials from Surabaya City)
Sep. 2 - 6	2nd Field Survey, **Sep. 5 (Thu): Progress Report**
Sep. 26 - 27	ASEAN + 3 Environment Ministers Meeting in Surabaya; site visit
Oct. 18 - 21	Kitakyushu City 50th Year Anniversary, co-jointly organized with International Forum on Future City and OECD Green City Forum (Surabaya Mayor)
Oct. 21 - 25	3rd Smart City Week, Yokohama Oct. 22 - 24: Low-Carbon and ESC Planning Sessions (Surabaya Mayor)
Nov. 18 - 22	3rd Field Survey, **Nov. 20 (Wed): Interim Meeting**
Feb. 3 - 10	4th Field Survey, **Feb. 10 (Mon): Project Output Seminar** *(t.b.c.)*
Late Feb. - early Mar.	Progress Reporting Workshop with DNPI *(t.b.c.)* 5th Regional 3R Forum in Asia, in Surabaya *(Feb. 24-26, t.b.c.)* 5th High Level Seminar on ESC in Surabaya? *(Feb. 28 – Mar. 1, t.b.c.)*

Project Implementation Plan (Energy and Transportation)

Sector	FY2014	FY2015	FY2016	Expected CO2 reduction
Energy Energy saving in buildings	● (1) Shopping mall: Replacement of a chiller plant ● (1) Office building: Replacement of a chiller plant and installation of BEMS and LED ● (1) Hotel: Replacement of laundry machines and installation of BEMS ● (2) Public buildings Installation of energy saving and green building technologies	● Shopping malls: Replacement of a chiller plant ● Office buildings: Replacement of a chiller plant ● Hotels: Installation of co-generation systems		**10,000 t-CO2/year**
co-generation system	**In-depth study** ● Design co-generation system targeting PIER (an industrial estate)	**In-depth study** ● Detailed design of co-generation system	**Project implementation** ● Construction of co-generation-system and its operation	**38,000 t-CO2/year**
Transportation	**Project implementation** ● Replacement 200 taxis to CNG vehicles ● Replacement 50 buses to CNG vehicles	● 1 CNG station ● Replacement 300 taxis to CNG vehicles ● Replacement 50 buses to CNG vehicles ● Replacement 300 angkots to CNG vehicles	● 3 CNG stations ● Replacement 300 taxis to CNG vehicles ● Replacement 100 buses to CNG vehicles ● Replacement 600 angkots to CNG vehicles	**5,000 t-CO2/year**

Project Implementation Plan (Solid waste and Water)

Sector	FY2014	FY2015	FY2016	Expected CO2 reduction
Solid waste Waste sorting, recycling, composting	**In-depth study** ● Design an intermediate treatment facility (100t/day) (currently in operation of a facility (15t/day)) ● Operation of a composting plant (10t/day) JICA project	**Project implementation** ● Construct an intermediate treatment facility (100t/day) and its operation ● F/S study for its business expansion	● Expansion of the business by setting up a foreign subsidiary company (SPC)	**14,500 t-CO2/year**
Incineration for MSW	**In-depth study** ● Design an incineration facility (1,000t/day)	**In-depth study** ● Detailed design and stakeholder consultations	**Project implementation** ● Construction of an incineration facility	**30,000 t-CO2/year**
Waste to energy for industrial waste	**In-depth study** ● Liquid fuel production (Input: B3 waste) ● RDF production	**Project implementation** ● Liquid fuel production (1,000t/month) ● RDF production (3,000t/month)	● Continuation of the business operation ● Set up a foreign subsidiary company (SPC)	**34,000 t-CO2/year** ● 12,000t/year (for liquid fuel) ● 22,000t/year (for RDF)
Water resource	**Feasibility study** ● Study on water delivery and distribution pumps in Ngagel ● Study on flow-meters to measure water leakage ● Selection of demonstration blocks for replacement of water distributing pipes	**In-depth study** ● Detailed design for replacement of water delivery and distribution pumps in Ngagel ● Installation of 31 magnetic flow-meters ● Replacement of water distributing pipes	**Project implementation** ● Replacement of water delivery and distribution pumps in Ngagel (34/38 pumps) ● Replacement of block meters ● Replacement of water distributing pipe (10km demonstration)	**3,200t-CO2/year**