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
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
Project on Low-Carbon and ESC Planning in Surabaya

**Japan-side**

**City of Kitakyushu**

- Project Management: IGES
  - Kitakyushu Asian Center for Low Carbon Society

**Indonesia-side (counterpart)**

**City of Surabaya**

- Development Planning Agency (BAPPEKO)
  - Cooperation Div.

**Green Sister City (Nov. 2012)**

**Energy sector**

  - Cooperation: Japan NUS Co., Ltd.
- FS for energy saving and dispersed power system
- Cogeneration technology
- LED conversion at highway
- PT SIER, local companies, National Electricity Company (PLN)
- National Highway Corporation (PERSERO)

**Solid waste sector**

- IGES
  - Cooperation: Nishihara Corp. and NTT DATA Institute of Management Consulting Inc.
  - Hitachi Zosen Corp.
  - Amita Corp.
- Waste sorting, recycling, composting
- FS for incineration
- Waste to energy for industrial waste

**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
  - Introducing water-saving equipment

**Transportation sector**

- Public transportation, improvement of traffic system for waste collection vehicles, low emission vehicles
- ALMEC VPI Corp.
- Transportation Section, Taxi company, DKP
- Cooperation: TOTO Ltd.
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

**Indonesia-side** (counterpart)

**City of Surabaya**
Development Planning Agency (BAPPEKO)

Green Sister City (Nov. 2012)

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- FS for energy saving and dispersed power
- Cogeneration technology
- LED conversion at highway
- PT SIER, local companies, National Electricity Company (PLN)
- National Highway Corporation (PERSERO)
- FS supported by Kitakyushu City, funded by Ministry of Economy, Trade and Industry (METI), Japan

**Solid waste sector**

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  - Hitachi Zosen Corp.
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- Waste sorting, recycling, composting
- FS for incineration
- 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
- Distributed sewage treatment
- PDAM, Keputih sludge treatment plant, Industrial Estate Company (PT SIER)
- Community, Hotels, etc.

**Transportation sector**

- Public transportation, Improvement of traffic system for waste collection vehicles, low emission vehicles
- ALMEC VPI Corp.
- Transportation Section, Taxi company, DKP

**Cooperation**

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

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


Kitakyushu City-based companies
Targeted sectors and expected GHG emissions reduction

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

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

**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

**Total reduction:**
120,000 t-CO2/year
CO2 emission reduction potential of these activities in Surabaya is estimated at approximately 50,000 t-CO2/year in total.

<table>
<thead>
<tr>
<th>Activities</th>
<th>CO2 emission reduction</th>
<th>Conditions of Estimation</th>
</tr>
</thead>
</table>
| 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 112,000 t-CO2/year  
• Project: Electricity and Steam supplied to each factory by natural gas-fueled CHP plant 74,000 t-CO2/year |
| Energy conservation in building   | About 10,000 t-CO2/year | Assuming 20% energy saving achieved at each building  
• Shopping mall: 5,040 t-CO2/year  
• Hotel: 2,350 t-CO2/year  
• Data center: 170 t-CO2/year  
• Hospital: 1,790 t-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: 630 t-CO2 / year  
• Compared with high pressure sodium lamps: 250 t-CO2 / year |
Progress of Energy sector

Image of our activity

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

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 Industrial Estate Rembang (PIER)
- Gresik Industrial Estate (KIG)
- Ngoro Industrial Park (NIP) *
- Margomulyo Industrial Estate *

* Not yet visited
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.
Proposal to Hotel A

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.
  → Hotel will increase capacity of laundry service because of expansion plan at the adjacent shopping complex, in which a new hotel will be opened.
  → Similar needs may exist in many hotels because each hotel usually provide laundry service by themselves (not outsourcing)
Proposal to Hotel A

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%.
  → Hotel asked us to provide detailed information about how BEMS can reduce energy consumption. (now in preparation)

3. Installation of LED

- Hotel asked us to propose LED installation with profit sharing scheme.
  → Some manufactures made a proposal of installing LED.
  → Hotel 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.
Proposal to an Office Building 【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 CO₂ 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

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*bus*  *taxi*  *angkot*  *garbage collector*
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 devices removing : 27–30 August
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

### 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”**.
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.
Existing and planned CNG Stations in Surabaya

Source: Surabaya City (and Almec VPI Corporation)
0-1. Flow of Waste in Surabaya

**Households/Offices**
- Collection by communities
- Waste pickers (Several thousands)

**Transfer Station**
- Depo 160 facilities

**Landfill disposal cost:**
- USD12/t

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

**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
0-2 Outline of the project

**Households/Offices**
Collection by communities

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

**Super Depo**
• Recycle-based intermediate treatment facility

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

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

**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

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

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.

**Commission fee for treatment:**
USD12/t

**Super Depo (Recycle-based intermediate treatment facility)**

Selection and processing

Food waste ⇒ composting (Yield: 20%)

Valuables ⇒ Separation

Residuals

50%
20%
30%

20t
8t
12t
4t
8t
12t

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

Operate one Super Depo as a pilot project

Deployment of Super Depos in 40 locations within the city

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

Composting at the compost center
USD30-50/t

Sell to manufacturers as raw material
USD100/t

Transfer of waste

Landfill disposal cost:
USD12/t

Possible to reduce
Possible to reduce
Possible to reduce

Source: Nishihara Corporation
0-3 Current Progress

**SUPER-DEPO** (First step)
- Waste collection
- Plastic
- Paper scraps
- Metals
- Foreign materials
- Organic

**Compost center** (Second step)
- 60% ~ 70% reduction
- Transferred by DKP

**BENOWO**
- In operation (Since Mar 2013)
- 85% reduction

Sold to farmers

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

- Plastic
- Paper scraps
- Food waste

Source: Nishihara Corporation
4.2 GHG reduction potential

We calculated the GHG reduction potential from 3 patterns:
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.

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Amount of Waste (MSW) &amp; Organic waste</td>
<td>15t/day (MSW) 9.6t/day (Organic)</td>
<td>150t/day (MSW) 96t/day (Organic)</td>
<td>2642t/day (MSW) 1855t/day (Organic)</td>
</tr>
<tr>
<td>Reference GHG emission (RE)</td>
<td>1,840t-CO2/year</td>
<td>18,400t-CO2/year</td>
<td>344,000t-CO2/year</td>
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<tr>
<td>Project GHG emission (PE)</td>
<td>490t-CO2/year</td>
<td>4,900 t-CO2/year</td>
<td>94,790t-CO2/year</td>
</tr>
<tr>
<td>GHG reduction</td>
<td>1,350t-CO2/year</td>
<td>13,500t-CO2/year</td>
<td>249,210t-CO2/year</td>
</tr>
</tbody>
</table>
Progress of Solid Waste sector (waste sorting, recycling composting)

Key findings

1. Composition survey
   - 65% of the waste in Super Depo will be suitable for 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 => Calculation of Project GHG emission
# 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 order to Landfill  
**Sampling date:** 25/09/2013

<table>
<thead>
<tr>
<th>No.</th>
<th>Composition</th>
<th>Physical composition (% dry weight basis)</th>
<th>Physical composition (% wet weight basis)</th>
<th>Moisture content, at 105°C (%)</th>
<th>Ash, at 550°C (%)</th>
<th>VS (%)</th>
<th>Gross Calorific (Cal/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Food waste</td>
<td>47.05</td>
<td>57.50</td>
<td>53.89</td>
<td>27.08</td>
<td>72.92</td>
<td>3642.33</td>
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<tr>
<td>2</td>
<td>Papers</td>
<td>21.31</td>
<td>16.77</td>
<td>28.41</td>
<td>11.81</td>
<td>88.19</td>
<td>3625.04</td>
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<tr>
<td>3</td>
<td>Diaper</td>
<td>1.25</td>
<td>1.47</td>
<td>52.11</td>
<td>0.29</td>
<td>99.71</td>
<td>4688.22</td>
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<tr>
<td>4</td>
<td>Plastics</td>
<td>17.34</td>
<td>13.99</td>
<td>30.16</td>
<td>32.07</td>
<td>67.93</td>
<td>5860.82</td>
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<tr>
<td>5</td>
<td>Textiles</td>
<td>0.36</td>
<td>0.26</td>
<td>22.84</td>
<td>2.13</td>
<td>97.87</td>
<td>4374.25</td>
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<tr>
<td>6</td>
<td>Woods</td>
<td>6.89</td>
<td>6.73</td>
<td>42.31</td>
<td>7.74</td>
<td>92.26</td>
<td>4192.78</td>
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<tr>
<td>7</td>
<td>Rubber and leather</td>
<td>0.13</td>
<td>0.08</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Metal</td>
<td>4.40</td>
<td>2.48</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Inorganic</td>
<td>0.87</td>
<td>0.49</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Shell</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Others</td>
<td>0.40</td>
<td>0.23</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Measuring/analyzing method:**  
- ASTM 3301-07  
- ASTM D 3174-07  
- ASTM D 3175-07  
- ASTM D 5865-07

<table>
<thead>
<tr>
<th>Moisture content, at 105°C (%)</th>
<th>Ash, at 550°C (%)</th>
<th>VS (%)</th>
<th>LHV (Cal/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>49.44</td>
<td>15.32</td>
<td>41.04</td>
<td>1,942</td>
</tr>
</tbody>
</table>
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

© Hitachi Zosen Corporation
Case Study for CO₂-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~

Virgin raw material
- CaO
- SiO₂
- Al₂O₃
- Fe₂O₃
- Coal

Mine

Waste Generator

100% Recycle (Reuse)

AMITA

Alternative raw material

SlurMix © CRM

Cement plant

※CRM is used as alternative SiO₂ & Al₂O₃

Landfill

Incinerator
Waste Utilization in Indonesia and Japan

<table>
<thead>
<tr>
<th></th>
<th>Indonesia</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>230,000,000</td>
<td>128,000,000</td>
</tr>
<tr>
<td>Area</td>
<td>1,910,931 km²</td>
<td>377,930 km²</td>
</tr>
<tr>
<td>Industrial waste generation</td>
<td>7,000,000 t / year</td>
<td>400,000,000 t / year</td>
</tr>
<tr>
<td>Cement production</td>
<td>55,000,000 t / year</td>
<td>57,579,000 t / year</td>
</tr>
<tr>
<td>Waste recycled amount by cement industry</td>
<td>? t / year</td>
<td>44,400,000 t / year</td>
</tr>
<tr>
<td>Waste consumption rate in cement industry</td>
<td>? kg / cement 1t</td>
<td>469 kg / cement 1t</td>
</tr>
</tbody>
</table>

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 company's status and figure out the potential ability for recycling.
- Study Waste Acceptance Criteria of all cement companies.
【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 \((25.2\,\text{m} \times 60\,\text{m}) + (8.5\,\text{m} \times 57\,\text{m}) + (4.4\,\text{m} \times 24\,\text{m}) = 2,102.1\,\text{m}^2\)
Reduction of CO₂
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

- CO₂ emission of coal is 2.33t/coal ton
  → Cement manufacture could save about 16,000t -CO₂/ Year by using CRM.
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

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
Key Investigation Results

- Aerator Renewal

Aerators consume 80% of whole electricity.

Source: Matsuo Sekkei Corporation
## Aerator Renewal

### Aerator Types

<table>
<thead>
<tr>
<th>Model</th>
<th>Horizontal shaft</th>
<th>Vertical shaft</th>
<th>Screw type</th>
<th>Axial flow pump</th>
<th>Propeller type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagram</td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>Function</td>
<td>The <strong>surface aeration system</strong> which aerates by mixing water surface with the horizontal brush rotor.</td>
<td>The <strong>surface aeration system</strong> by placing its drive section on the water surface of ditch and it transmit information to impeller. Then sumerged impeller performs aeration.</td>
<td>The <strong>Under-water aeration system</strong> It supplys air under the water as microscopic bubbles utilizing negative pressure created by screw rotation.</td>
<td>It is the combined system with axial flow impeller mixing &amp; diffusing pipe inlet. The air mixed water is pumped from the bottom of downstream tank.</td>
<td>The propeller under water performs chum &amp; mixing and diffusing plate supplys oxygen.</td>
</tr>
<tr>
<td>Oxygen Supply Efficiency</td>
<td>Relatively poor</td>
<td>Good</td>
<td>Good</td>
<td>Excellent</td>
<td>Excellent</td>
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<tr>
<td>Price</td>
<td>Excellent</td>
<td>Good</td>
<td>Good</td>
<td>Bad</td>
<td>Bad</td>
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</tbody>
</table>

Current aerator

Recommend aerator

Source: Matsuo Sekkei Corporation
Reduction of Sludge Moisture Content

Source: Matsuo Sekkei Corporation
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

<table>
<thead>
<tr>
<th>Date Range</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>June 26</td>
<td><strong>Kick-off Meeting in Kitakyushu</strong></td>
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<td>June 17 - July 5</td>
<td>JICA NAMA/MRV Capacity Development Training in Kitakyushu (2 officials from BAPPEKO Surabaya)</td>
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<tr>
<td>July 8 - 12</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Field Survey, <strong>July 10 (Wed): Inception Meeting</strong></td>
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<td>July 23 - 24</td>
<td>International Forum for Sustainable Asia and the Pacific (ISAP) 2013, Yokohama (4 officials from Surabaya City)</td>
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<tr>
<td>Sep. 2 - 6</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Field Survey, <strong>Sep. 5 (Thu): Progress Report</strong></td>
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<tr>
<td>Sep. 26 - 27</td>
<td>ASEAN + 3 Environment Ministers Meeting in Surabaya; site visit</td>
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<tr>
<td>Oct. 18 - 21</td>
<td>Kitakyushu City 50&lt;sup&gt;th&lt;/sup&gt; Year Anniversary, co-jointly organized with International Forum on Future City and OECD Green City Forum (Surabaya Mayor)</td>
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<tr>
<td>Oct. 21 - 25</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt; Smart City Week, Yokohama</td>
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<td>Oct. 22 - 24: Low-Carbon and ESC Planning Sessions (Surabaya Mayor)</td>
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<tr>
<td>Nov. 18 - 22</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt; Field Survey, <strong>Nov. 20 (Wed): Interim Meeting</strong></td>
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<tr>
<td>Feb. 3 - 10</td>
<td>4&lt;sup&gt;th&lt;/sup&gt; Field Survey, <strong>Feb. 10 (Mon): Project Output Seminar</strong></td>
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<td>(t.b.c.)</td>
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<td>Late Feb. - early Mar.</td>
<td>Progress Reporting Workshop with DNPI (t.b.c.)</td>
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<td>5&lt;sup&gt;th&lt;/sup&gt; Regional 3R Forum in Asia, in Surabaya (Feb. 24-26, t.b.c.)</td>
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<td>5&lt;sup&gt;th&lt;/sup&gt; High Level Seminar on ESC in Surabaya? (Feb. 28 – Mar. 1, t.b.c.)</td>
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<tr>
<td>Sector</td>
<td>FY2014</td>
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<tr>
<td>--------------------------------</td>
<td>------------------------------------------------------------------------</td>
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<tr>
<td><strong>Energy</strong></td>
<td>(1) Shopping mall: Replacement of a chiller plant</td>
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<td></td>
<td>(1) Office building: Replacement of a chiller plant and installation of BEMS and LED</td>
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<td></td>
<td>(1) Hotel: Replacement of laundry machines and installation of BEMS</td>
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<td>(2) Public buildings: Installation of energy saving and green building technologies</td>
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<tr>
<td><strong>co-generation system</strong></td>
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<tr>
<td><strong>Transportation</strong></td>
<td>Project implementation</td>
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<td></td>
<td>Replacement 200 taxis to CNG vehicles</td>
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<tr>
<td></td>
<td>Replacement 50 buses to CNG vehicles</td>
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## Project Implementation Plan (Solid waste and Water)

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