DISCUSSION PURPOSE ONLY

JCM Project Development by JFE

July 2018
JFE Group Structure

JFE Holdings, Inc. (est. 2002)

NKK
Est. 1912

Kawatetsu
Est. 1951

JFE Engineering
Net Sales (million $)
3,900
Employees
9,300

JFE Steel
Net Sales (million $)
27,200
Employees
44,400

JFE Shoji Trade
Net Sales (million $)
19,100
Employees
6,800

Japan Marine United

Est. 1912

Est. 1951

Equity-method affiliate

(FY2017)
Global Network

Europe
Duisburg (Germany)
Rome (Italy)

Middle East
Al Khobar (Saudi Arabia)

Asia & Oceania
Singapore
Kuala Lumpur (Malaysia)
Jakarta (Indonesia)
Hanoi, Ho Chi Minh (Vietnam)
Bangkok (Thailand)
Yangon (Myanmar)
Manila (Philippines)
Delhi, Pune, Mumbai (India)
Shanghai, Beijing (China)

America
Long Beach (USA)

CEO Mr. Oshita
Smart Infrastructure for Global Environment

JFE offers the world leading technology

Waste-to-Energy

Biogas (Sludge Treatment)

Waste Heat Recovery

Geothermal Power Plant
Vietnam

Myanmar
Introduction of Waste to Energy Plant in Yangon City

Indonesia
Power Generation by Waste-heat Recovery in Cement Industry
PS(2013), Model Project(2014)
<Project 1>
Power Generation by Waste-heat Recovery in Cement Industry

- Registered Project ID013, 10 Jul. 2018
## Project Summary

<table>
<thead>
<tr>
<th>Counterpart</th>
<th>PT Semen Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Site</strong></td>
<td>Tuban Plant, East Jawa</td>
</tr>
<tr>
<td><strong>Power Generation</strong></td>
<td>28MW</td>
</tr>
<tr>
<td><strong>Expected GHG Reductions</strong></td>
<td>149,063 tCO2/year</td>
</tr>
</tbody>
</table>
Current Project Implementation

- 14 Mar 18  Request of registration
- 30 Apr 18  Starting date of project operation
- 10 Jul 18  Registration of project

Estimated emission reductions in each year:
- 99,375 (in 2018)
- 149,063 (in 2019)
- 149,063 (in 2020)

Expected operational lifetime: 9 years
Project Scheme

Indonesian Government

Japanese Government

JCM Agreement

GHG Reductions

Semen Indonesia’s Budget

JCM Subsidy from Japan

International Consortium

- Construction
- Operation
- Maintenance
- MRV

- Engineering
- Equipment Supply

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Overview of WHR System

Reduction of grid power supply = Reduction of CO₂

20% 80%

Cement Production Process

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<table>
<thead>
<tr>
<th>Criterion 1</th>
<th>The project utilizes waste heat from a cement production facility by waste heat recovery (WHR) system to generate electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criterion 2</td>
<td>WHR system consists of a Suspension Preheater boiler (SP boiler) and/or Air Quenching Cooler boiler (AQC boiler), turbine generator and cooling tower</td>
</tr>
<tr>
<td>Criterion 3</td>
<td>WHR system utilizes only waste heat and does not utilize fossil fuels as a heat source to generate steam for power generation</td>
</tr>
<tr>
<td>Criterion 4</td>
<td>WHR system has not been introduced to a corresponding cement kiln of the project prior to its implementation</td>
</tr>
</tbody>
</table>
| Criterion 5 | The cement factory where the project is implemented is connected to a grid system and the theoretical maximum electricity output of the WHR system, which is calculated by multiplying maximum electricity output of the WHR system by the maximum hours per year (24*365=8,760 hours), is not greater than the total amount of the electricity imported to the cement factory from the grid system:  
  > During the previous year before the validation, if the validation of the project is conducted before the operation of the project, or  
  > During the previous year before the operation of the project, if the validation of the project is conducted after the operation of the project |
| Criterion 6 | The WHR system is designed to be connected only to an internal power grid of the cement factory. |
### Calculation of Reference Emissions

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E(A<em>B</em>C*D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of Electricity Generation</td>
<td></td>
<td>Generation Capacity (MW)</td>
<td>Operating day per year (days/y)</td>
<td>Time (hrs/day)</td>
<td>Operating Rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>28</td>
<td>164.5</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22</td>
<td>164.5</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td>The quantity of electricity consumption</td>
<td>3.69</td>
<td>365</td>
<td>24</td>
<td>1</td>
<td>32,324</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The quantity of net electricity generation by the WHR system which replaced grid electricity import</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>165,076</td>
</tr>
</tbody>
</table>

\[
RE_p = EG_p \times EF_{grid}
\]

\[
= 165,076 \text{ MWh/yr} \times 0.903 \text{ tCO}_2\text{e/MWh}
\]

\[
= 149,063 \text{ tCO}_2\text{e/yr}
\]
## Potential Replication of WHR Technology

<table>
<thead>
<tr>
<th>CO₂ Emission Reduction</th>
<th>Electricity Reserve for the Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Additional Fuel Required</td>
<td>Savings on Production Costs</td>
</tr>
</tbody>
</table>

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Potential reduction of GHG emission:

1,150,000 tCO₂/y @ 25 factories in Indonesia
<Project 2>
Introduction of Waste to Energy Plant in Yangon City

- Approved Methodology MM_AM001
# Project Summary

**First WTE Project with JCM**

**First WTE Project in Myanmar**

<table>
<thead>
<tr>
<th>Counterpart</th>
<th>Yangon City Development Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Site</strong></td>
<td>Mingalardon area, Yangon City, MYANMAR</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Waste to Energy (WTE)</td>
</tr>
<tr>
<td></td>
<td>Incinerator : 60ton/day</td>
</tr>
<tr>
<td></td>
<td>Generator : 0.7MW</td>
</tr>
<tr>
<td><strong>GHG Emission Reduction</strong></td>
<td>4,700t-CO$_2$/year</td>
</tr>
</tbody>
</table>

Facility Opening Ceremony on April 7th

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**Project Scheme**

- **Myanmar Government**
- **Japanese Government**

**JCM Agreement**

- September 16, 2015

**GHG Reductions**

**Yangon City’s Budget**
- Yangon City Development Committee

**JCM Subsidy from Japan**
- JFE Engineering Corporation

**International Consortium**
- ✓ Engineering
- ✓ Procurement
- ✓ Construction
- ✓ SV for commissioning

- ✓ Operation
- ✓ Maintenance
- ✓ Monitoring
- ✓ Reporting

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Benefit of Waste to Energy Project

Baseline Scenario

Project Scenario

Reduction of CO2 emission from fossil fuel consumption at power plant

Power generation (exported to the grid)

GHG Emission Reduction
Expected GHG Emission Reductions

**4,732 tCO₂/ year**
(2,358tCO₂ accounts for the energy-originated CO₂)

- The calculation is based on the condition of 60t of waste treated per day and operation of 310 days per year, 24 hours per day (operating ratio: 85%).
- The emission factor refers to the latest CDM project in Myanmar (0.8tCO₂/MWh).
2 Phase Timeline toward Paradigm Shift

Small Scale WTE As a Model Project

- Capacity Building,
- Regulation Setting,
- Training of WTE Operation,
- Finance Arranging, etc.

Larger Scale WTE

- Complete Integrated Waste Management

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