DISCUSSION PURPOSE ONLY

JCM Project Development by JFE

July 2018

JFE Engineering Corporation

DISCUSSION PURPOSE ONLY

JFE Group Structure

NKK

Est. 1912

KAWATETSU

Est. 1951

JFE

JFE Holdings, Inc.
(est. 2002)

Equity-method affiliate

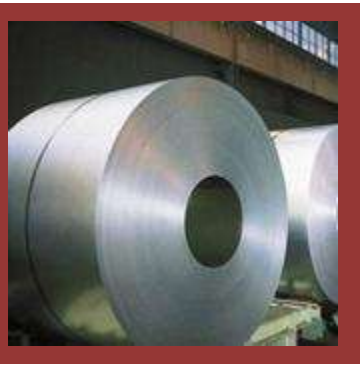
Japan Marine United

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

(FY2017)

DISCUSSION PURPOSE ONLY

Global Network

DISCUSSION PURPOSE ONLY

Smart Infrastructure for Global Environment


Waste-to-Energy

Waste Heat Recovery

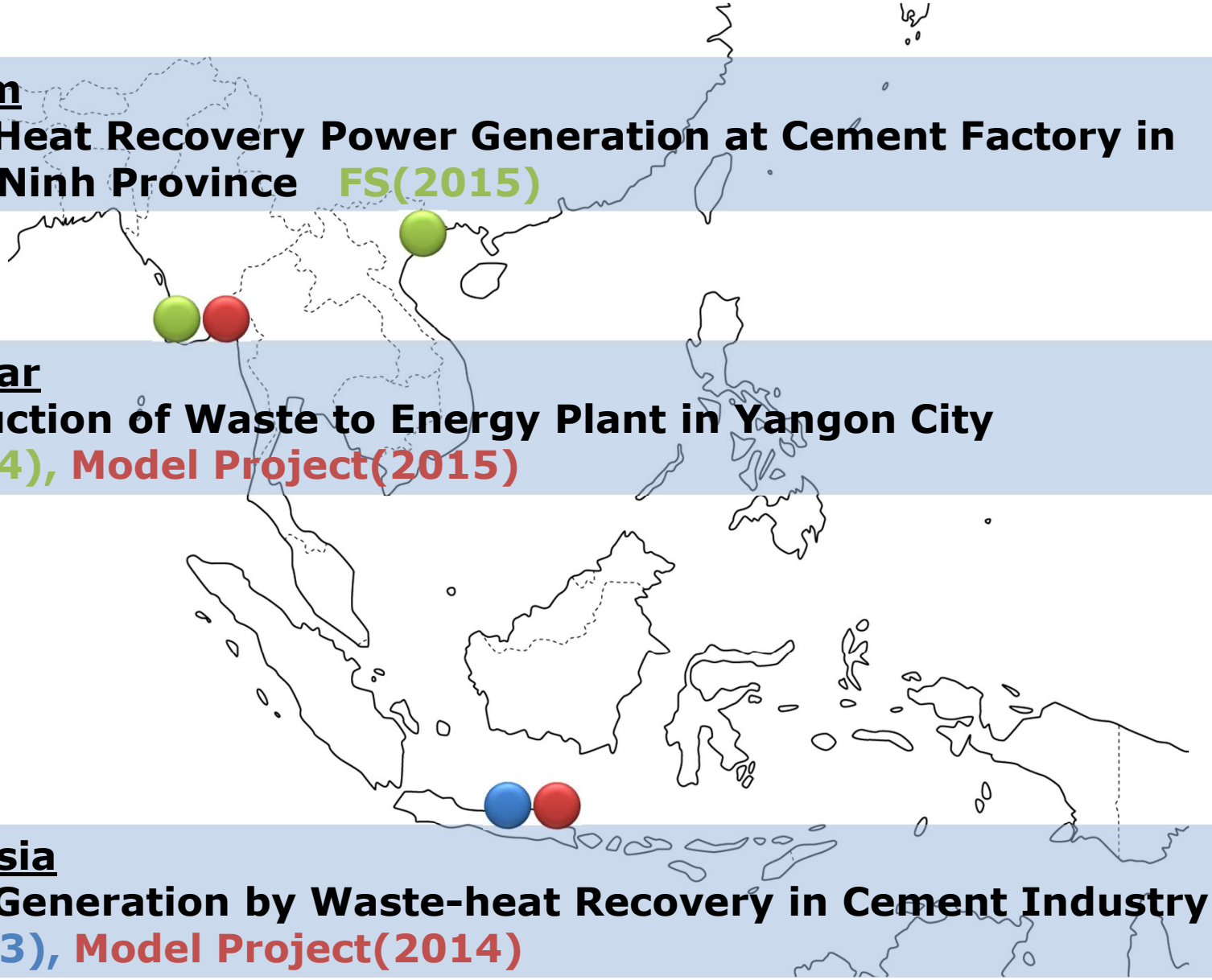
JFE offers the world leading technology


Biogas (Sludge Treatment)


Geothermal Power Plant

DISCUSSION PURPOSE ONLY

JCM Project Development



Vietnam
Waste Heat Recovery Power Generation at Cement Factory in Quang Ninh Province FS(2015)

Myanmar
Introduction of Waste to Energy Plant in Yangon City
FS(2014), Model Project(2015)

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

DISCUSSION PURPOSE ONLY

<Project 1>
Power Generation by Waste-heat Recovery in Cement Industry

- Registered Project ID013,10 Jul. 2018

DISCUSSION PURPOSE ONLY

Project Summary

Counterpart	PT Semen Indonesia
Site	Tuban Plant, East Jawa
Power Generation	28MW
Expected GHG Reductions	149,063 tCO2/year

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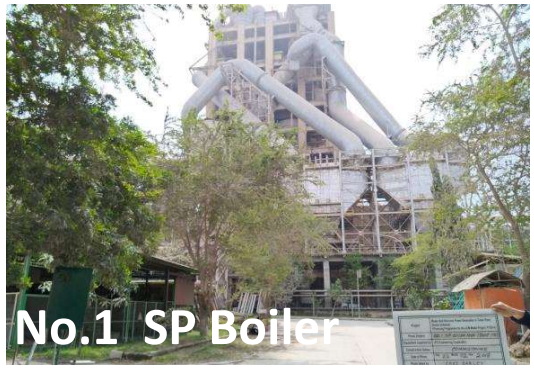
Current Project Implementation


No.1 SP Boiler


No.1 AQC Boiler


Air Cooled Condenser

- 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

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Project Scheme

Indonesian Government

Japanese Government

JCM Agreement

GHG Reductions

Semen Indonesia's Budget	JCM Subsidy from Japan

SEMEN INDONESIA

- ✓ Construction
- ✓ Operation
- ✓ Maintenance
- ✓ MRV

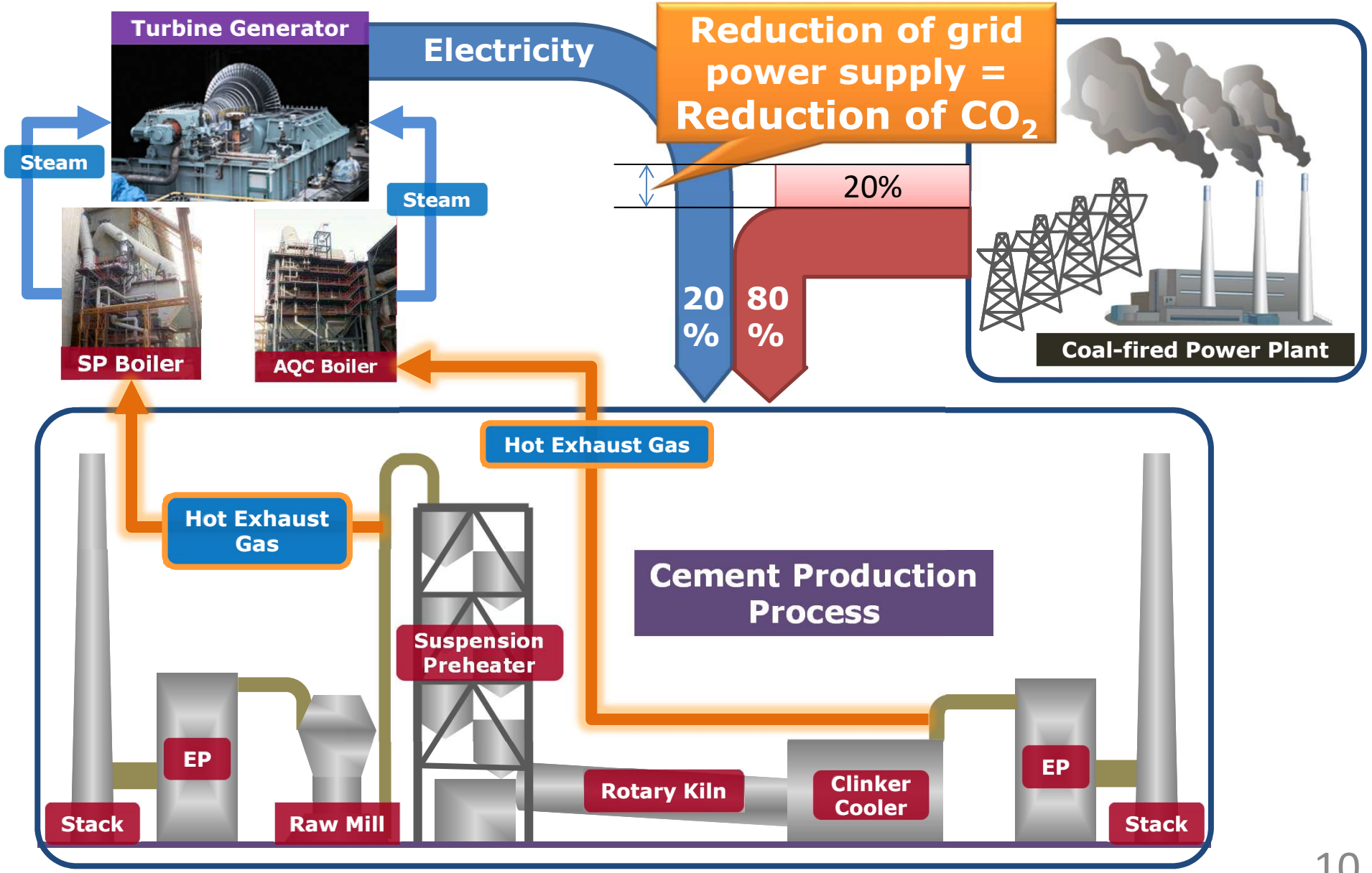
International Consortium

JFE

- ✓ Engineering
- ✓ Equipment Supply

DISCUSSION PURPOSE ONLY

Overview of WHR System



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Eligibility Criteria - Approved Methodology ID_AM001

Criterion 1	The project utilizes waste heat from **a cement production facility** by waste heat recovery (**WHR**) system to generate electricity
Criterion 2	WHR system consists of a Suspension Preheater boiler (**SP boiler**) and/or Air Quenching Cooler boiler (**AQC boiler**), **turbine generator** and **cooling tower**
Criterion 3	WHR system utilizes only waste heat and does **not** utilize **fossil fuels** as a heat source to generate steam for power generation
Criterion 4	WHR system has **not been introduced** to a corresponding **cement kiln** of the project prior to its implementation
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**.

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Calculation of Reference Emissions

		A	B	C	D	E(A*B*C*D)
Quantity of Electricity Generation		Generation Capacity (MW)	Operating day per year (days/y)	Time (hrs/day)	Operating Rate	Electricity (MWh)
	Dry Season	28	164.5	24	1	110,544
	Rainy Season	22	164.5	24	1	86,856
The quantity of electricity consumption		3.69	365	24	1	32,324
The quantity of net electricity generation by the WHR system which replaced grid electricity import						**165,076**

$$RE_p = EG_p * EF_{grid}$$

$$= 165,076\ MWh/y * 0.903\ tCO_2e/MWh$$

$$= \mathbf{149,063\ tCO_2e/y}$$

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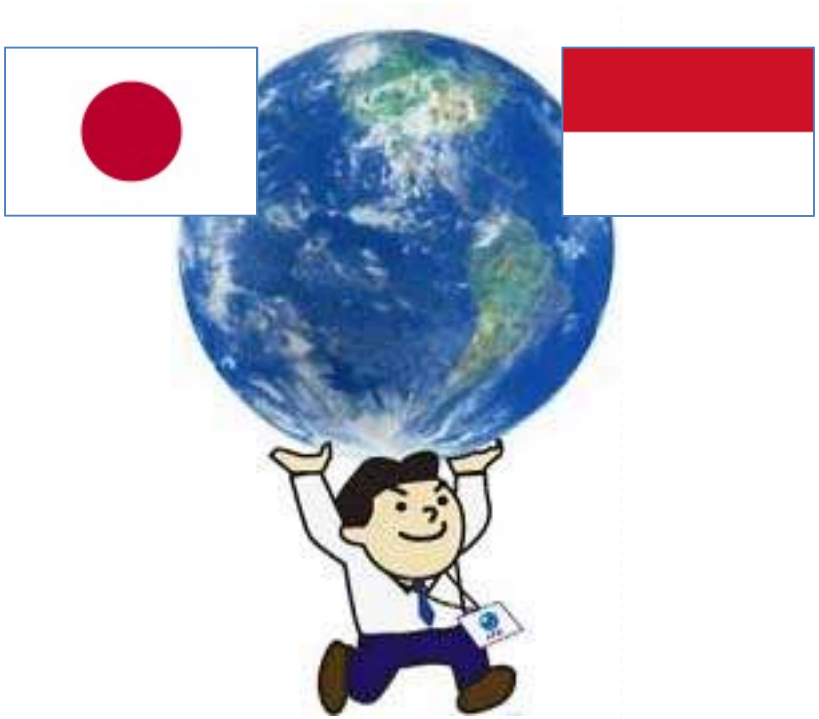
Potential Replication of WHR Technology

CO_2 Emission Reduction	Electricity Reserve for the Community
No Additional Fuel Required	Savings on Production Costs



Potential reduction of GHG emission : 1,150,000 tCO2/y @ 25 factories in Indonesia

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<Project 2>
Introduction of Waste to Energy Plant in Yangon City

- Approved Methodology MM_AM001

DISCUSSION PURPOSE ONLY

Project Summary

First WTE Project with JCM

First WTE Project in Myanmar

Counterpart	**Yangon City Development Committee**
Site	**Mingalardon area, Yangon City, MYANMAR**
Technology	**Waste to Energy(WTE)** **Incinerator : 60ton/day** **Generator : 0.7MW**
GHG Emission Reduction	**4,700t-CO_2/year**

Facility Opening Ceremony on April 7th

DISCUSSION PURPOSE ONLY

Project Scheme

Myanmar Government

September 16, 2015

JCM Agreement

Japanese Government

GHG Reductions

Yangon City's Budget	JCM Subsidy from Japan

Yangon City Development Committee

International Consortium

JFE Engineering Corporation

JFE

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

- ✓ Engineering
- ✓ Procurement
- ✓ Construction
- ✓ SV for commissioning

DISCUSSION PURPOSE ONLY

Benefit of Waste to Energy Project

CH4

CO2

Landfill

Power Generation

Baseline Scenario

Project Scenario

CH_4

CO2

CO_2

GHG Emission Reduction

Power generation (exported to the grid)

Reduction of CO2 emission from fossil fuel consumption at power plant

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Expected GHG Emission Reductions

4,732 tCO_2/ year

(2,358tCO_2 accounts for the energy-originated CO_2)

- ✓ The calculation is based on the condition of 60t of waste treated per day and operation of 310days per year, 24 hours per day (operating ratio: 85%).
- ✓ The emission factor refers to the latest CDM project in Myanmar (0.8tCO_2/MWh).

DISCUSSION PURPOSE ONLY

2 Phase Timeline toward Paradigm Shift

Small Scale WTE As a Model Project

Larger Scale WTE

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

Complete Integrated Waste Management

Thank you

http://www.jfe-eng.co.jp/en/