

Power Generation by Waste Heat Recovery in Cement Industry



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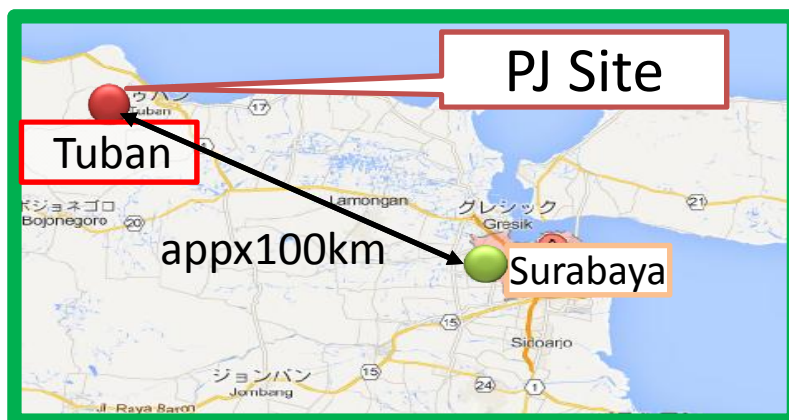
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JFE Engineering Corporation

JCM Model Project Summary

Counterpart	PT Semen Indonesia
Site	Tuban Plant, East Jawa
Power Generation	28MW
GHG Emission Reduction	122,000t-CO2 /year



Recent Project Photos -1

**All Critical Equipment Component Installed
The System under Commissioning**

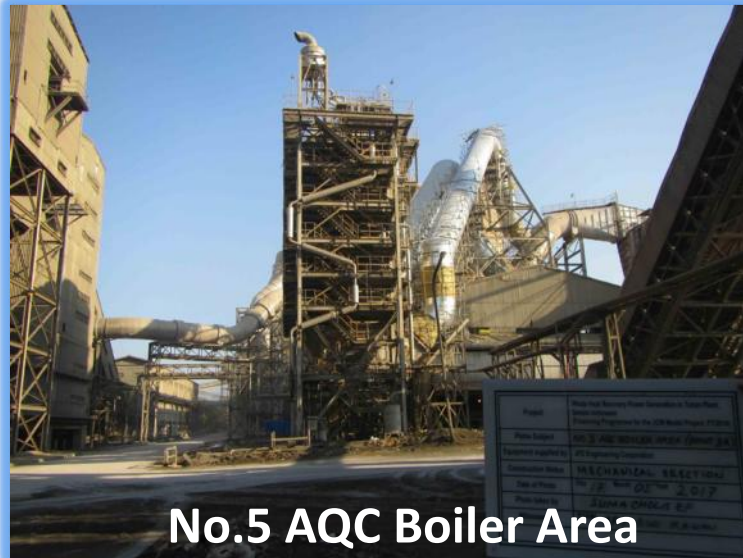


No.1 SP Boiler Area



No.1 AQC Boiler Area

Recent Project Photos -2



No.5 AQC Boiler Area



Air Cooled Condenser



STG Building



Steam Turbine & Generator

JCM Project Scheme

Indonesian Government



Japanese Government



Semen Indonesia's Budget

JCM Subsidy from Japan



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

International Consortium



- ✓ Engineering
- ✓ Equipment Supply

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	<p>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 ($24 \times 365 = 8,760$ hours), is not greater than the total amount of the electricity imported to the cement factory from the grid system:</p> <ul style="list-style-type: none"> > 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

	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	182.5	24	0.85	104,244
Rainy Season	22	182.5	24	0.85	81,906
The quantity of electricity consumption	2.4	365	24	1	21,024
The quantity of net electricity generation by the WHR system which replaced grid electricity import					165,126

$$RE_y = EG_y * EF_{\text{grid}}$$

$$= 165,126 \text{ MWh/y} * 0.741 \text{ tCO}_2 \text{ e/MWh}$$

$$= \mathbf{122,358 \text{ tCO}_2 \text{ e/y}}$$

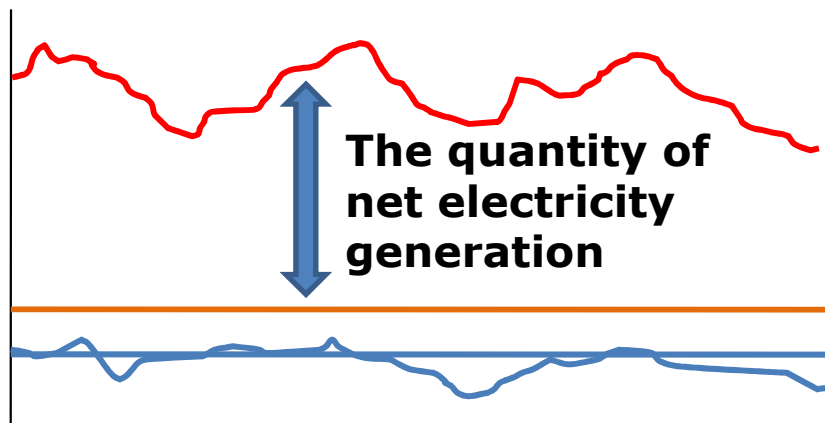
Reference Emissions

Reference

Reference is the situation where WHR system has not been introduced. Diffusion rate of WHR system is very low in Indonesian Cement Industry 1 plant installed / 25 plants total

Conservativeness

Electricity consumption of WHR system is calculated by the theoretically maximum load of auxiliary equipment
=> Rated capacity of installed equipment (EG_{CAP}) related to WHR system and max. hours/period



The quantity of gross electricity generation by waste heat

$$EG_{AUX,y} : 2.4MW(EG_{CAP}) * 24h/d * 365days$$

$$1.9MW(\text{Designed capacity}) * 24h/d * 365days$$

Emission Reduction / Monitoring

Emission Reductions = Reference Emissions

Replacement of Grid Electricity Generation

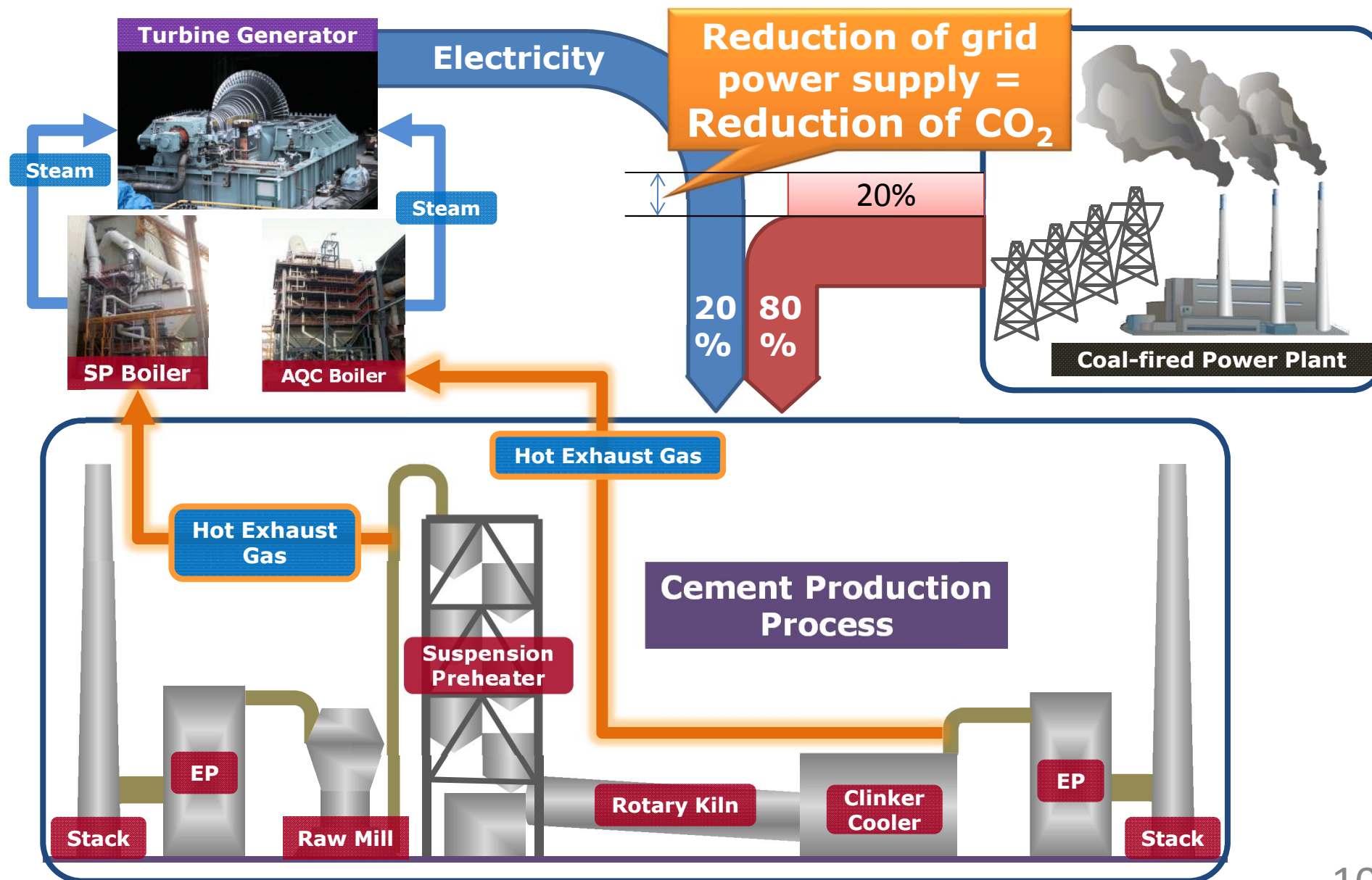
- **Calculation of reference/project emissions**
Emissions to be calculated in the methodology are those replaced by power generation of WHR system
- **Emission Reductions**
= Reference Emissions – Project Emissions
- **No additional fuel**
Project Emissions = 0

Monitoring

- ▶ **EG_{GEN/y}: Quantity of gross electricity generation**

Watt meter log data are saved:
every one minute in both electronic data in a server and on printed paper

After WHR System Installation



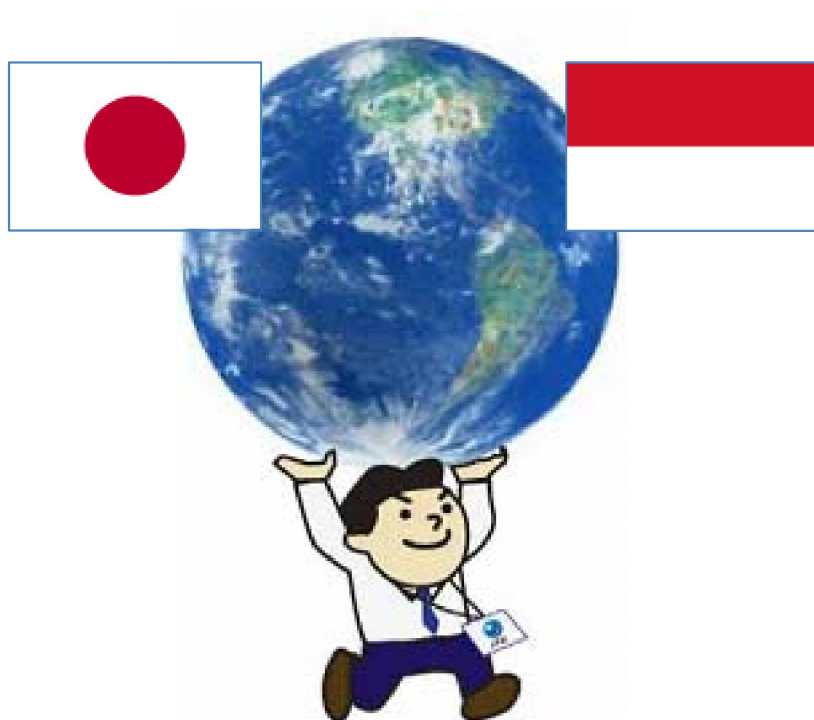
Waste Heat Recovery Benefits

CO₂ Emission Reduction

Electricity Reserve for the Community

No Additional Fuel Required

Savings on Production Costs



WHR System to other cement factory in Indonesia

More opportunities in further reduction of GHG emission



Reference : JCM WTE Project for Yangon City

First WTE Project with JCM

First WTE Project in Myanmar



Counterpart	Yangon City Development Committee
Technology	Waste to Energy(WTE) Incinerator : 60ton/day Generator : 0.7MW
GHG Emission Reduction	4,700t-CO₂/year
EPC Budget	Yangon City's Budget + JCM Subsidy from Japan
Schedule	EPC:FY2015-2016 (approx.1.5years) MRV:FY2017-2032 (15 years)



Facility Opening Ceremony on April 7th

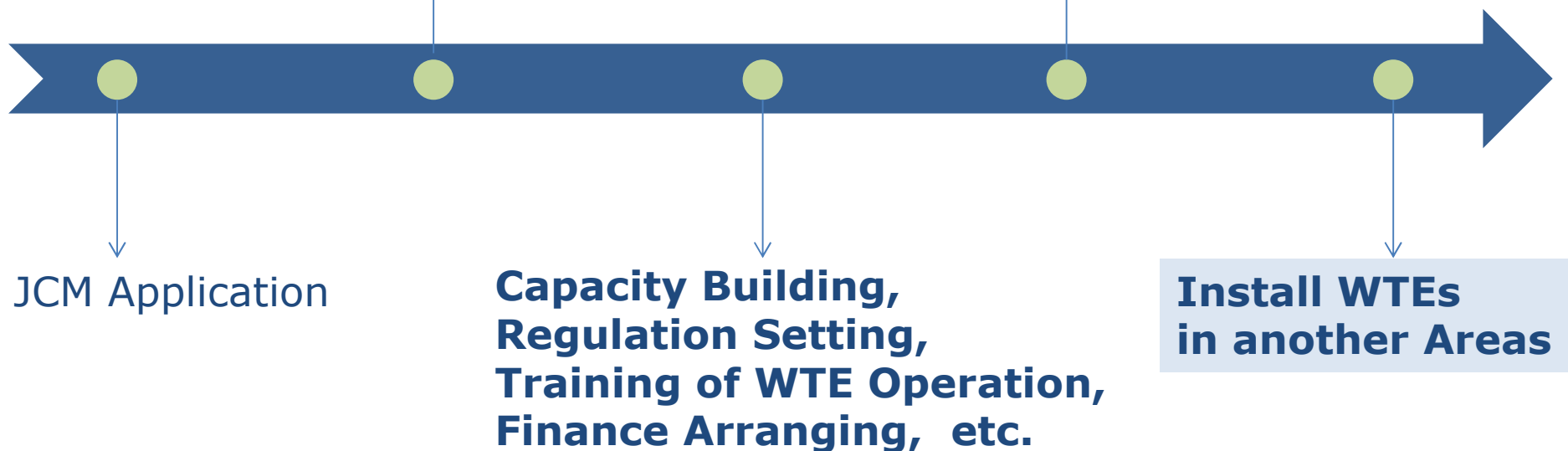
Proposing Timeline for 2 Phase Project



**Small Scale WTE
As JCM Model Project**



Larger Scale WTE





Thank you

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