The Outline of the JCM FS Description for Reduction of Global Warming Gases through torrefaction systems in which Indonesian biomass is usedby Mizuho Information & Research Institute, Inc.

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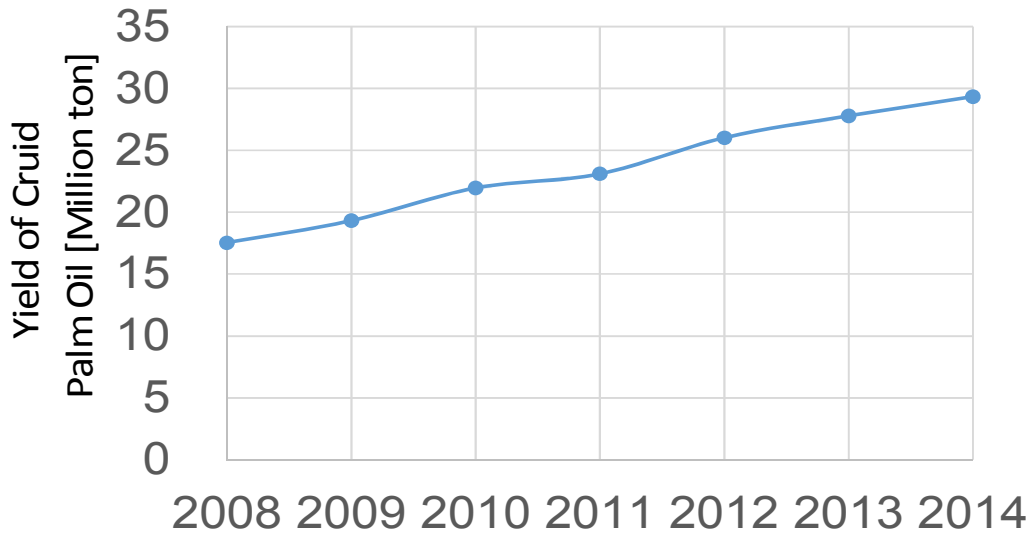
1. Project background

- EFB is produced around 25,000,000 ton a year in Indonesia.



- Empty Fruit Bunch (EFB) is not used and left at landfill in Indonesia mainly due to its low calorie(circa 2,200 kcal/kg) and bad grindability.

-Biomass is not that much used at the pulverized coal firing power plant due to the restriction of the grinder mill.

2. Objective of the FS

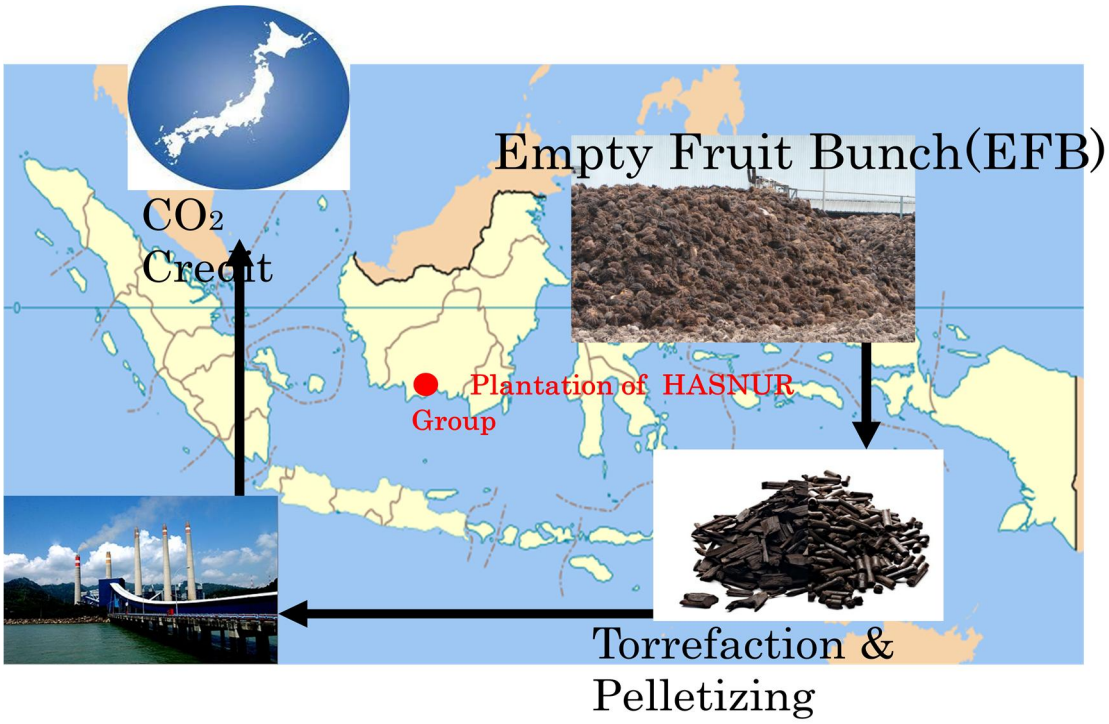
- Sorting out current policy and policy recommendations to Indonesian government for promotion of EFB utilization based on
  - understanding policy for promoting renewable energy utilization and investment
  - investigation of technical issue (torrefaction).

- Considering the possibility of the co-combustion with coal in coal fired power station and calculation of a cost related to torrefaction through EFB torrefaction test in Japan.

- Making JCM methodologies based on
  - status of EFB utilization and disposing
  - a business plan in future.

3. Project description:

a. Project location



b. Indonesian partner(s)

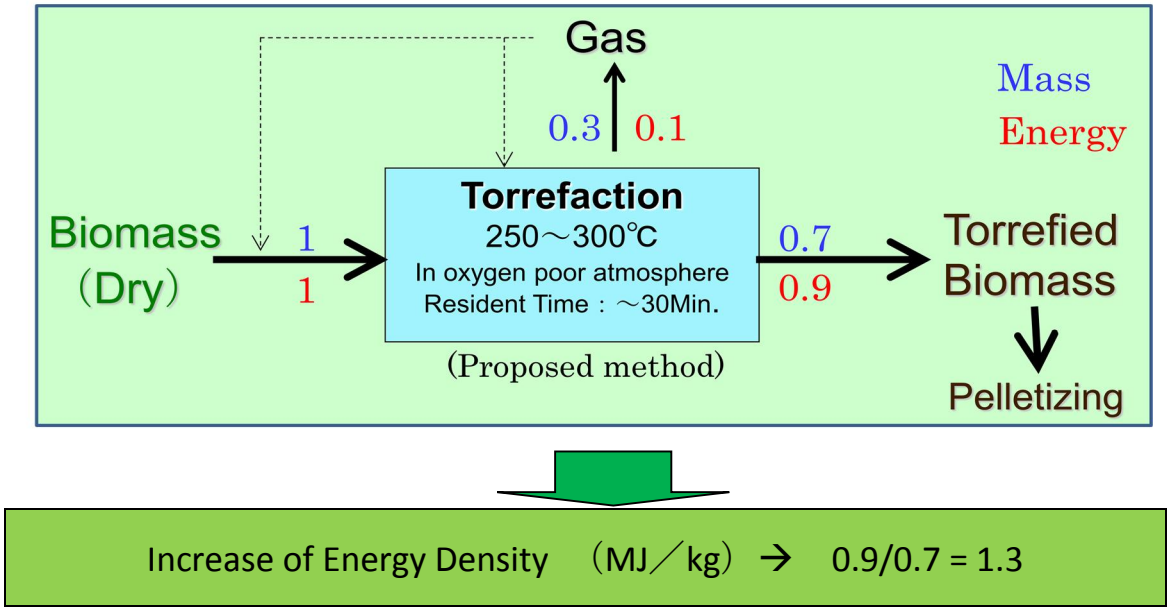
Hasnur Group is a holding group that was established in 1966 by a native Kalimantan entrepreneur. Hasnur Group's business activities, which started from river transportation, shipyard building & maintenance, ship building and forestry contractor, continues to grow and

develop to various other business sectors, including forestry, coal & iron ore mining, special port, agribusiness, media & printing, as well as transportation.

c. Description of the technology

(c-1)Outline of the Torrefaction technology

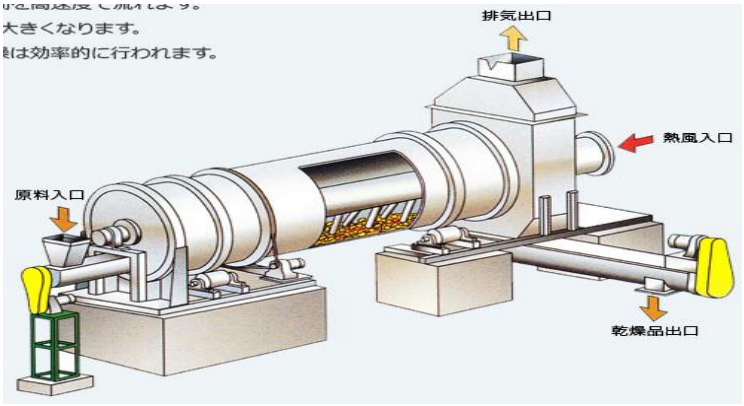
Torrefaction is a mild form of pyrolysis at temperatures typically between 200 and 320 degree C. Torrefaction changes biomass properties to provide a much better fuel quality for combustion

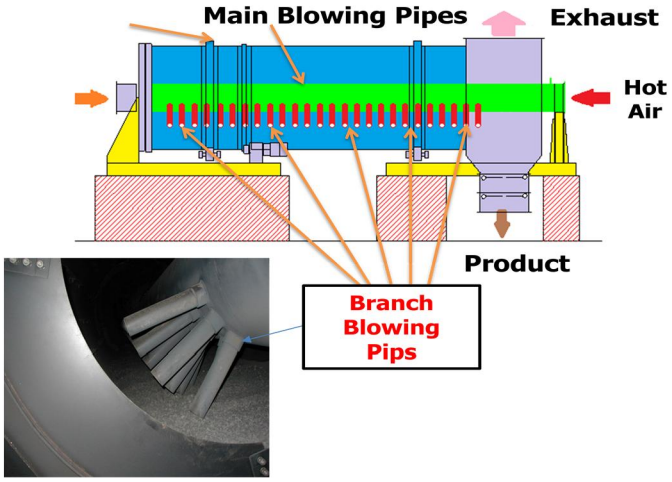


Increase of Energy Density （MJ／kg） → 0.9/0.7 = 1.3

(c-2) Torrefaction technology of YAMATO SANKO MFG.CO.,LTD.

Torrefaction technology of YAMATO SANKO MFG.CO.,LTD. is named Through Air Combination Rotary Dryer (TRD) (also named 'TACO Rotary Dryer') <Patent (JP)　2014-257471>





The unique rotary dryer, fixing many of hot air blowing pipes inside.

(c-3)Added value of torrefied biomass

- Increased energy density

  -Prevention of lowering of plant efficiency in power station

  -Reduction in transportation cost
- More homogeneous composition

  - Easer to make JCM methodologies
- Improved grindability

  -Increase blending ratio with coal up to 30 wt.%
- Hydrophobic behavior

  -Open air storage
- Elimination of biological activity

  -Stopping biological decomposition like rotting

d. Project details

(under study)

4. The result of the study

a. Current condition in Indonesia

Renewable energy potential and actual achievement are described in the table below.

	Potential	Actual achievement	Potential/ Actual achievement ratio
Hydro power	75,670MW	6,654MW	8.8%
Geo thermal	29,038MW	1,226MW	4.2%

Micro hydro	769.69MW	228.98MW	29.75%
Biomass	49,810MW	1,618MW	3.25%
photovoltaic generation	4.8kWh/m2/day	22.45MW	—
Wind power	3-6m/s	1.87MW	—

b. Regulation(s) and policy(ies) related to the project

Ministerial Regulation No 04/2012 on Electricity Purchase from Small and Medium Scale Renewable Energy and Excess Power introduced a differentiated feed-in tariff levels in Indonesia.

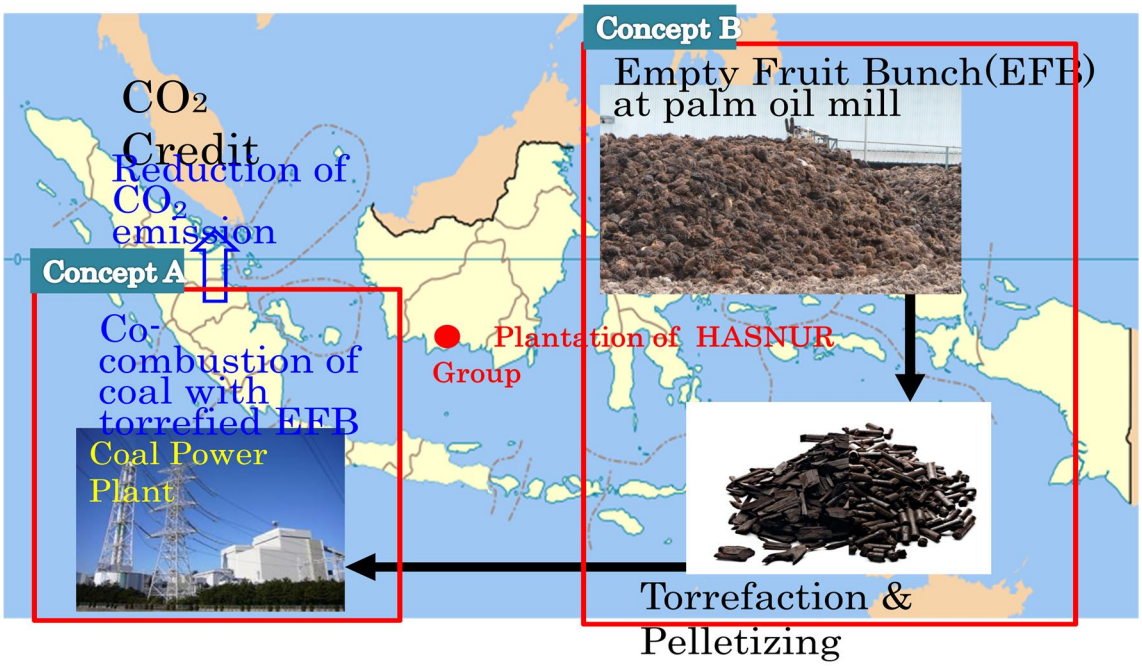
Renewable source	**Voltage**	**Power plant capacity**	**Feed-in tariff level in Rp/kWh**	**Territorial bonus (F)**
Biomass	medium	< 10 MW	975	Jawa and Bali Region: F = 1; Sumatera and Sulawesi Region: F = 1.2; Kalimantan, NTB and NTT Region: F = 1.3; Maluku and Papua Region: F = 1.5.
	low		1.325	
Hydropower	medium		656	
	low		1.004	
Municipal solid waste	medium		1.050	Jawa, Bali, and Sumatera region: F = 1; Kalimantan, Sulawesi, NTB and NTT regions: F = 1.2; Maluku and Papua region: F = 1.3.
	low		1.398	
Landfill gas	medium		850	
	low		1.198	

c. Role of each participants

(under study)

d.MRV methods and Reference scenario setting

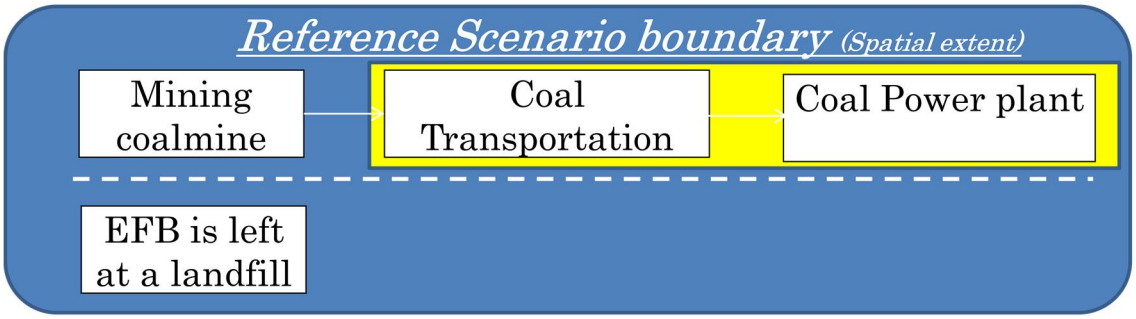
There could be 2 options(concepts) for making JCM methodology on biomass torrefaction.



(d-1)Concept A

JCM MRV methodology(ConceptA) for this project is based on the CDM methodologyACM0020 / Version 01.0.0 “Co-firing of biomass residues for heat generation and/or electricity generation in grid connected power plants”

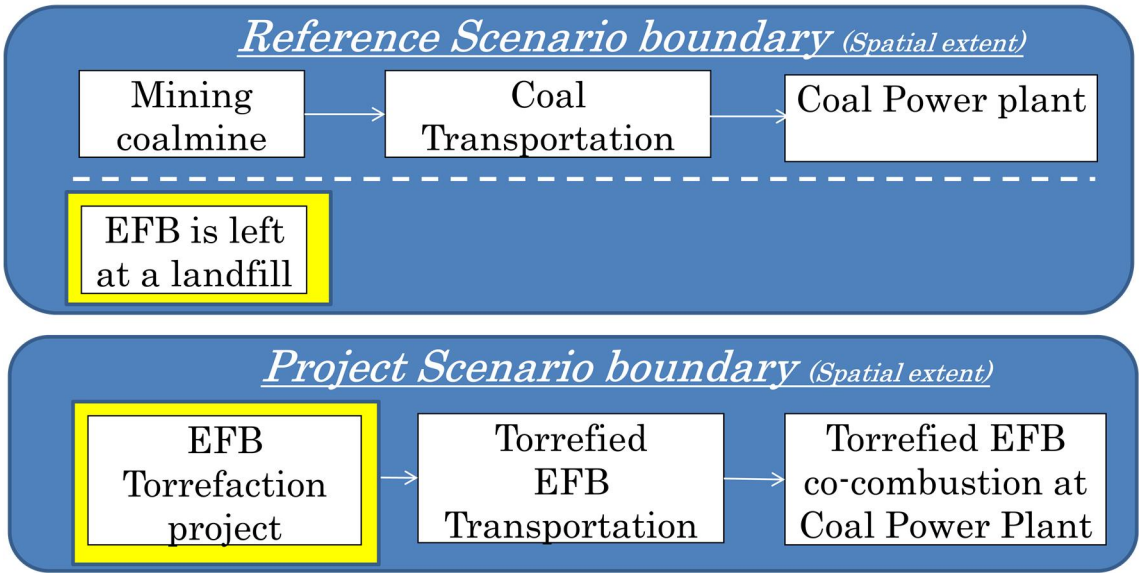
The yellow parts illustrated below are the spatial extent boundary respectively



(d-2)Concept B

JCM MRV methodology(Concept B) for this project is based on the CDM methodology AM0057:"Avoided emissions from biomass wastes through use as feed stock in pulp and paper, cardboard, fibreboard or bio-oil production" .

The yellow parts illustrated below are the spatial extent boundary respectively



We have chosen the Concept B as JCM MRV method for Biomass torrefaction project.

e. Monitoring methods

Summary of gases and sources included in the project boundary is described in the below table Emissions from Transportation of agriculture waste to the project site and Emission from the transport of waste produced in the plant from the manufacturing process to a disposal site are not included in the boundary. Because in the applicability conditions it will be defined that the torrefaction plant shall be constructed within the same site of Palm oil mill.

	Source	CO2	CH4	N2O
Reference	Emission from decomposition of agricultural waste at the landfill site	No	Yes	No

Project Activity	Transportation of agriculture waste to the project site	No(N/A)	No(N/A)	No(N/A)
	Emission from onsite use of fossil fuels	Yes	No	No
	Emission from onsite use of electricity	Yes	No	No
	Emission from the transport of waste produced in the plant from the manufacturing process to a disposal site	No(N/A)	No(N/A)	No(N/A)
	Emission of GHG in the off-gas from the pyrolysis process	No	Yes	Yes

f. Quantification of GHG emissions and their reductions

The formula to estimate the reference emissions are as follows.

This is the same as the one described in the CDM Methodological tool "Emission from solid waste disposal sites v 07.0".

$$RE = \varphi_y \times (1 - f_y) \times GWP_{CH4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,y} \times MCF_y \times \sum_{x=1}^{y} \sum_{j} (W_{j,x} \times DOC_j \times e^{-kj \times (y-x)} \times (1 - e^{-kj})$$

The parameters used in the above formula are described as follows

Parameters	Value	Remarks
ϕ	0.85	Default value for the model correction factor to account for model uncertainties. 0.85 for Application A and Humid/wet conditions is applied
GWP-CH4	25	Default Value
OX	0.1	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	0.5	Fraction of methane in the SWDS gas (volume fraction)
DOCj	0.2	Fraction of degradable organic carbon in the waste type j (weight fraction) 0.2 for Garden, yard and park waste is applied
DOCf	0.5	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)
MCF	0.8	Methane correction factor for year y. 0.8 for unmanaged solid waste disposal sites – deep is applied.

Kj	0.17	Decay rate for the waste type j. In the case of EFB, as their characteristics are similar to garden waste, the parameter values correspondent of garden waste(0.17) shall be used.

The estimated emission reductions are as follows.

Year	Total Reference Emissions, RE (t CO_2e)	Total Project Emissions, PE (t CO_2e)	Emissions Reduction, ER (t CO2e)
1	5,556	4,411	1,145
2	10,243	4,411	5,832
3	14,197	4,411	9,786
4	17,533	4,411	13,122
5	20,348	4,411	15,937
6	22,722	4,411	18,312
7	24,726	4,411	20,315
8	26,416	4,411	22,005
9	27,842	4,411	23,431
10	29,045	4,411	24,634
Total	198,627	44,108	154,519
average	19,863	4,411	15,452

Remarks: The above results are tentative since our study is ongoing

g. Scale of investment & financial viability

In case the production capacity of torrefied biomass is around 10,000 and all the equipments are manufactured in Japan , the capital cost will be between 300 million JPY and 500 million. But YAMATO -SANKO is studying the possibility of cost reduction of the equipment by producing a part of the equipment in Indonesia.

h. Contribution to Indonesian Sustainable Development

- The converting system and method of EFB into co-combustion fuel can be applied for all palm plantation in Indonesia.
- Not only EFB but also other agricultural wastes could be torrefied, and more torrefied biomass wastes bring less CO2 emission.
- The amount of CO_2 reduction would be 8 million tons/year, calculating based on the

assumption of using 30 % of total EFB production (26 million tons per year), which is equivalent to 3.3 million tons of coal in calories (at 2,200 kcal/kg of EFB).

i. Proposed implementation schedule

(under study)

j. Capacity building to the host country

A seminar on EFB utilization and Joint Crediting Mechanism (JCM) will be held in Medan on 23rd February 2016 in cooperation with Environment Board of North Sumatra Province.

The draft agenda is described as follows.

Agenda

For the seminar on the EFB torrefaction project as JCM* Project in Medan

co-hosted by JAPAN COAL ENERGY CENTER(JCOAL) and MIZUHO INFORMATION & RESEARCH INSTITUTE and YAMATO SANKO MFG.CO.,LTD.

Supported by Ministry of Economy, Trade and Industry of Japan

Date: February 23rd, 2016

11:30 – 12:30	Registration	
12:00 – 13:00	Lunch	
13:00 – 13:10	Welcome Speech	Dr. Ir. Hj. Hidayati, Msi
13:10 – 13:15	Opening Address	JCOAL
13:15 – 14:05	Session 1: "Outline of the JCM and method for reducing GHG emission by Empty Fruit Bunch (EFB) utilization" Q&A	JCOAL
14:05 – 14:55	Session 2: "Detail of the biomass torrefaction technology"	YAMATO SANKO MFG.CO.,LTD.

	Q&A	
14:55 – 15:15	Coffee Break	
15:15 – 16:05	Session 3: “Policy recommendations toward the commercialization of EFB torrefaction/sales business and outline of the draft JCM methodology for “Biomass torrefaction project” Q&A	Mizuho Information & Research Institute, Inc.
16:05 – 16:15	Closing Address	JCOAL