METI Feasibility Study for JCM

Reduction of Global Warming Gases through torrefaction systems in which Indonesian biomass is used

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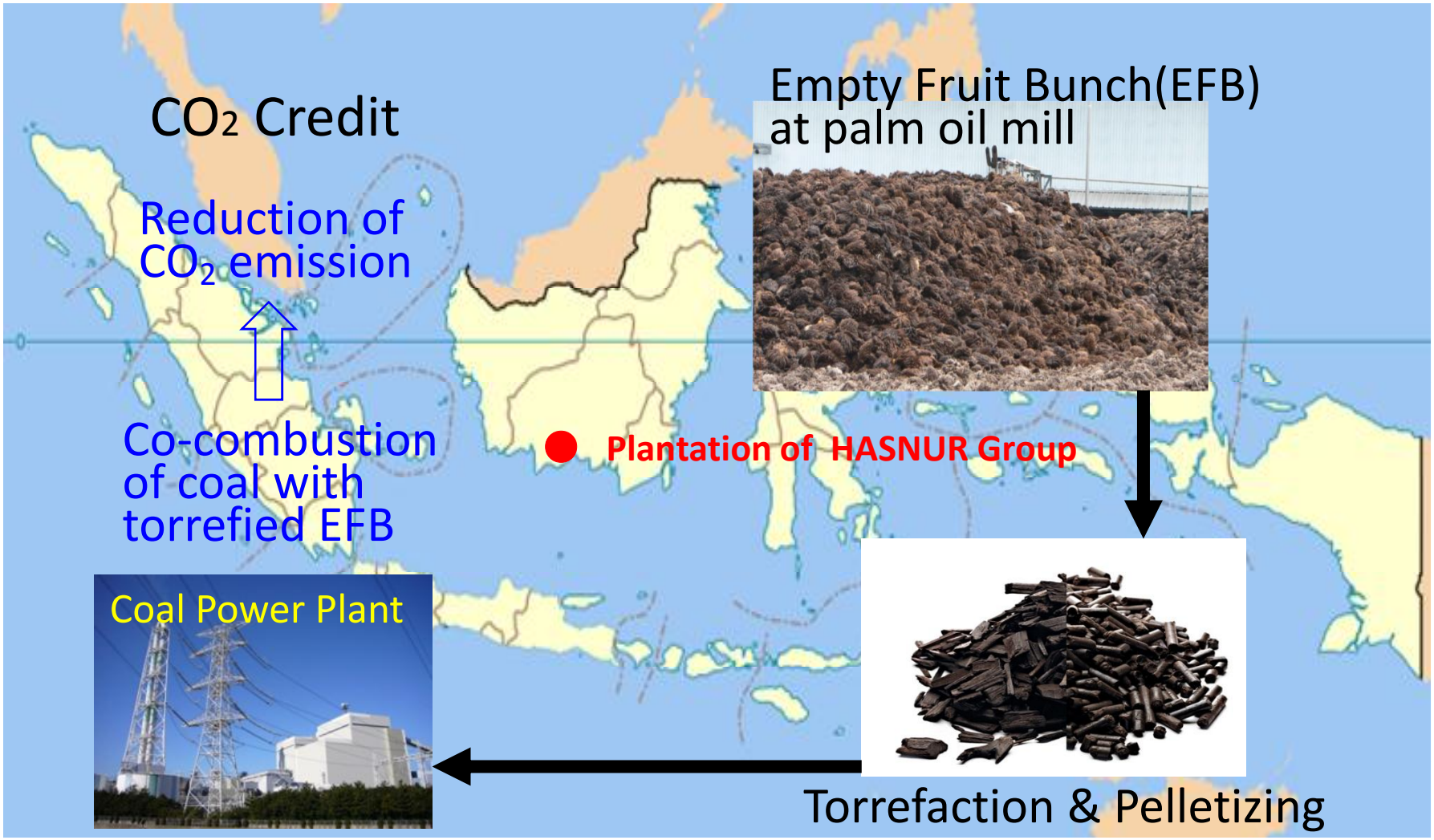
Japan Coal Energy Center
Mizuho Information & Research Institute, Inc.
YAMATO SANKO MFG.CO.,LTD.

1. Overview of JCM FS – Outline of the Project

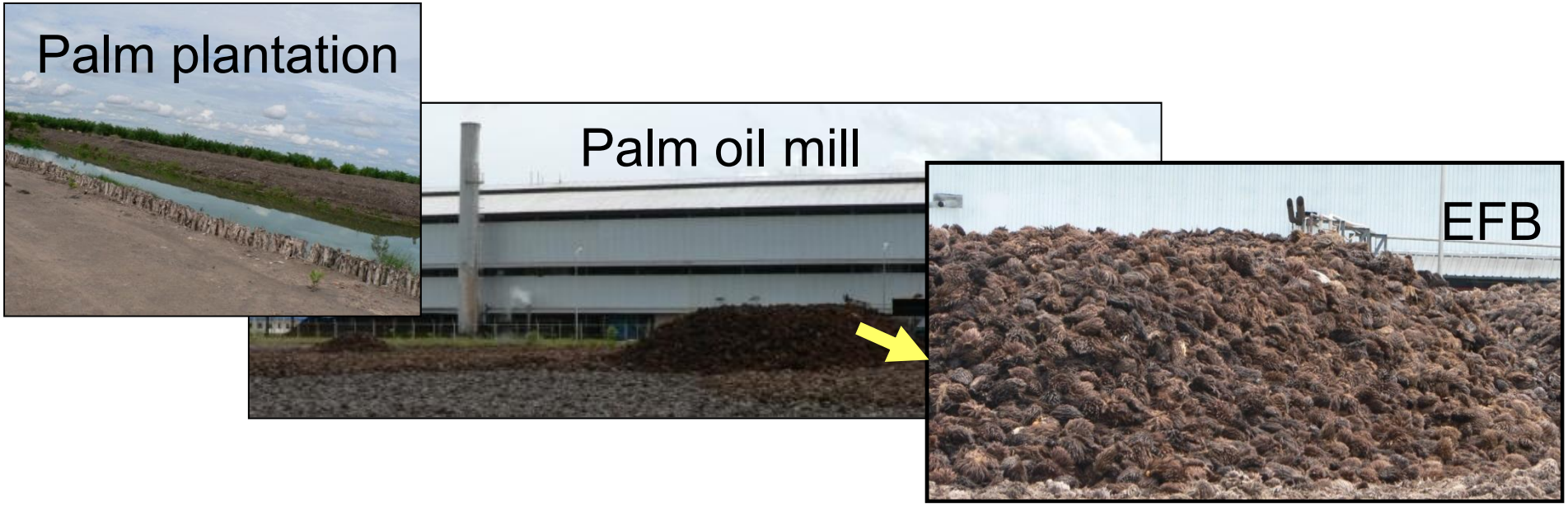
EFB is torrefied and supplied to coal power stations for co-combustion with coal. Torrefied EFB has much less moisture, higher calorific value, more homogeneous product, higher bulk density and better grindability than the original EFB.



(Source: JCOAL)

1. Overview of JCM FS - Counter partner

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.



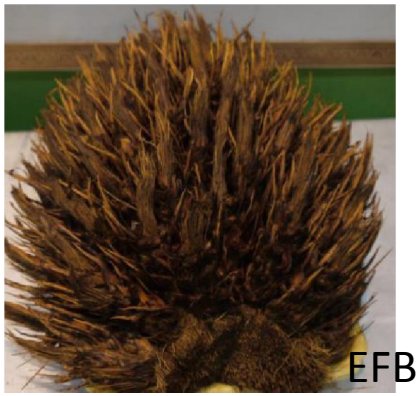
Yield of EFB : 30,000 t/y (at present) ⇒ 40,000 t/y (in future) (Source: JCOAL)

1. Overview of JCM FS - Empty Fruit Bunch (EFB)

Empty Fruit Bunch (EFB)

Products	Weight %
FFB (Fresh Fruit Bunch)	100
Crude Palm Oil (CPO)	20
Palm Kernel Oil (PKO)	7
Palm Kernel Shell (PKS)	7
Empty Fruit Bunch (EFB)	23
Fiber	13
Others	30


FFB


EFB

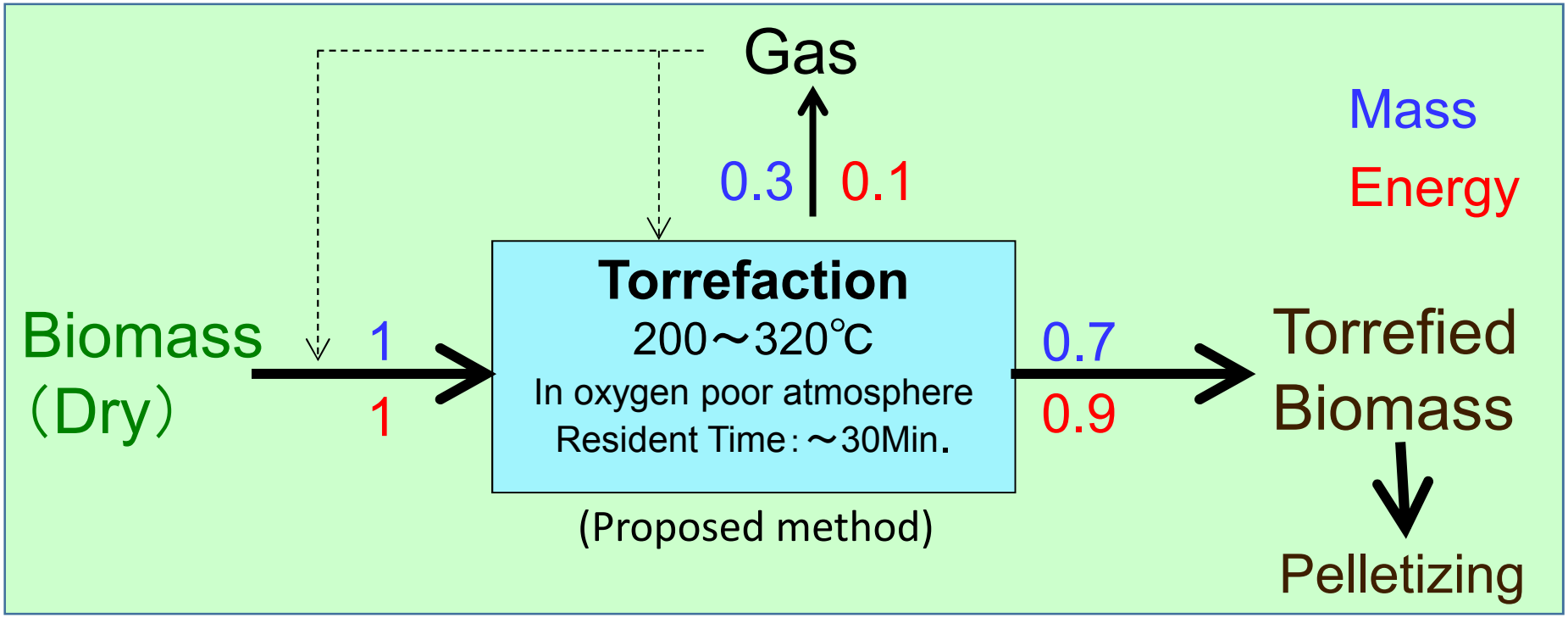
- EFB is produced around 26,000,000 ton a year in Indonesia.
- EFB properties : Moisture(AR): 50 – 60%
  Calorific Value(AD) : 2,200 kcal/kg

(Source: JCOAL)

1. Overview of JCM FS – Outline of torrefaction

What is torrefaction ?

A mild 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） $\frac{0.9}{0.7} = 1.3$

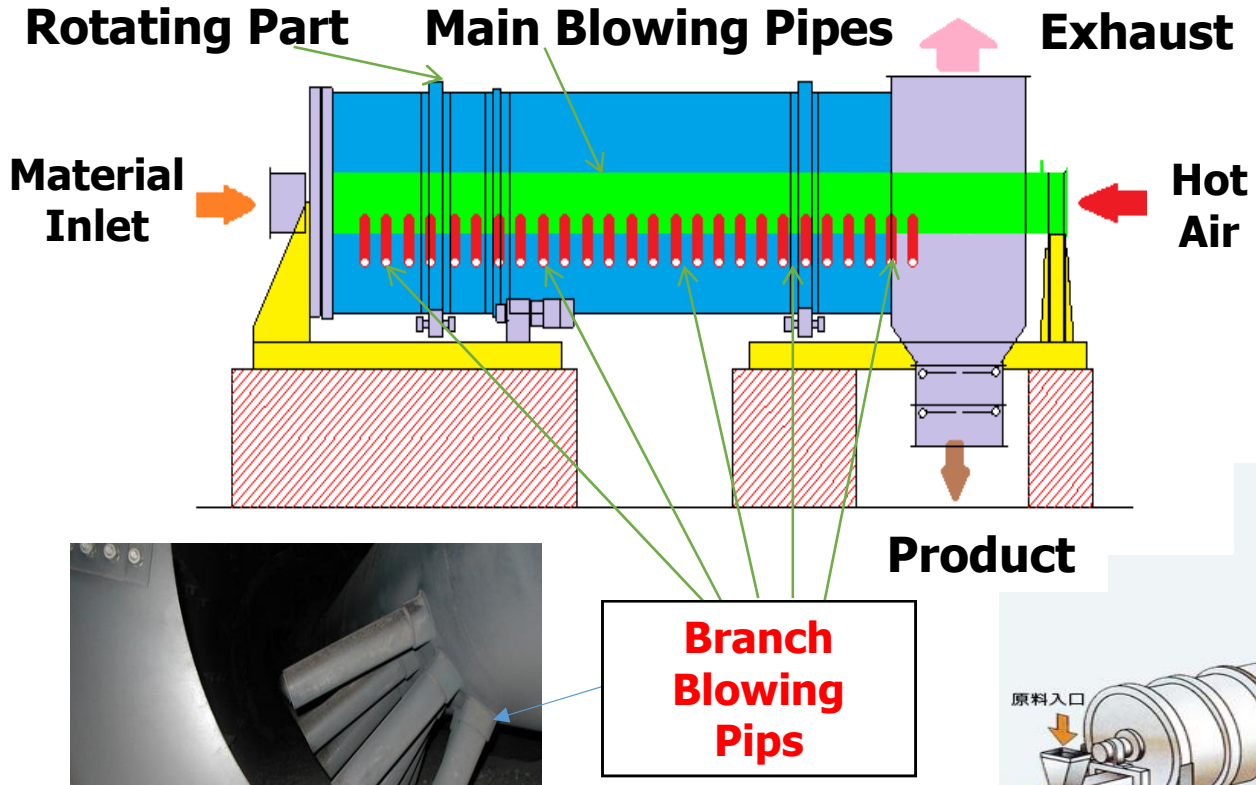
(Source: JCOAL, YAMATO SANKO MFG.CO.,LTD.)

1. Overview of JCM FS – Torrefaction technology

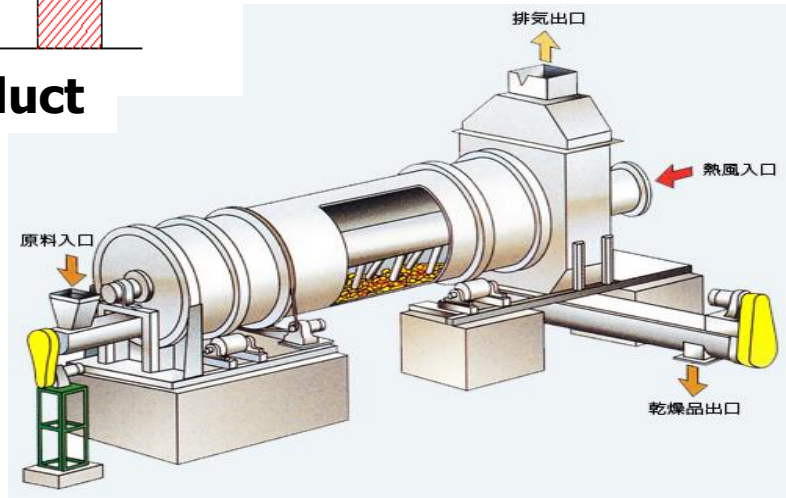
Torrefaction technology of YAMATO SANKO MFG.CO.,LTD.

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.



(Source: YAMATO SANKO MFG.CO.,LTD.)

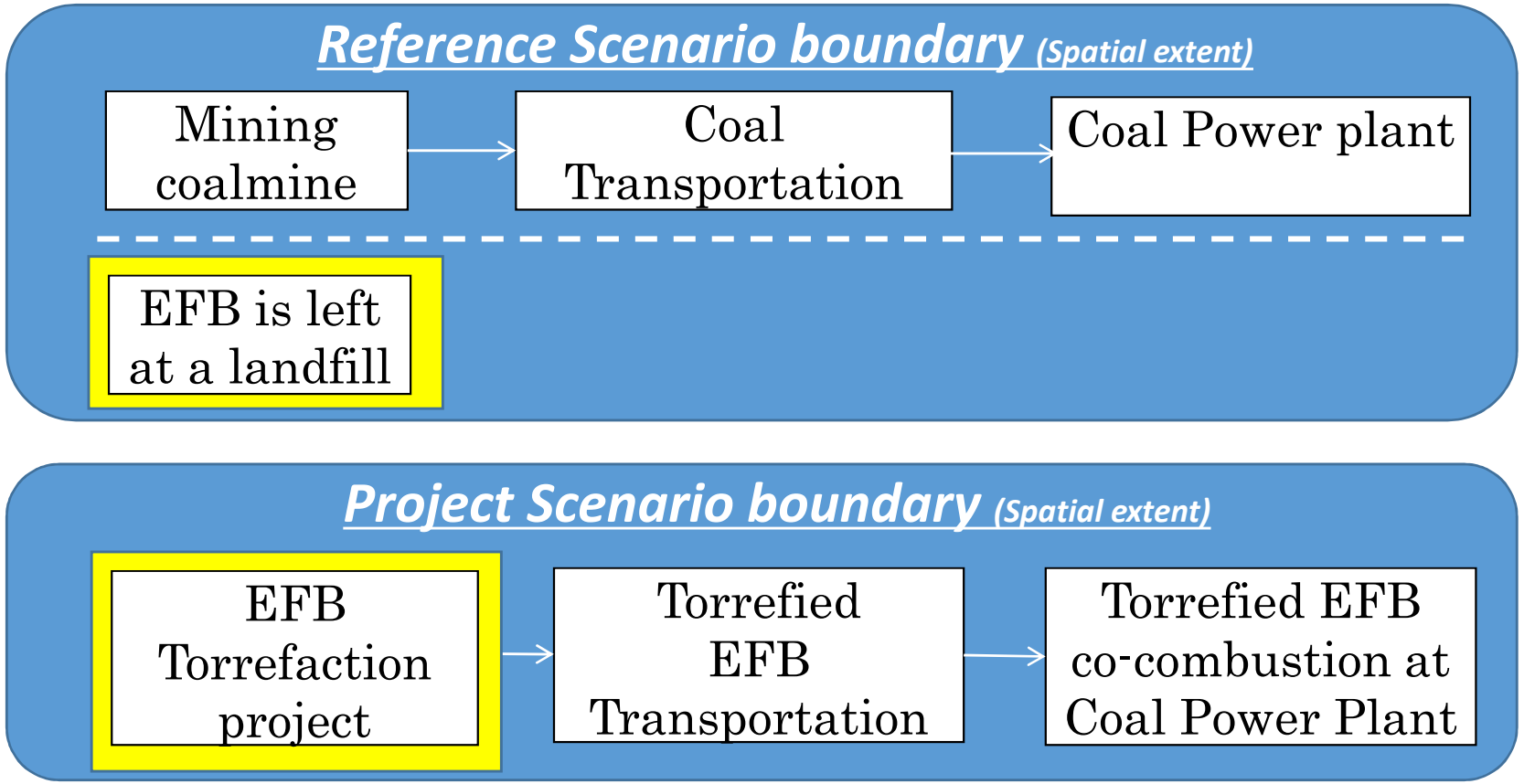
1. Overview of JCM FS - Added value by Torrefaction

- 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

(Source: JCOAL)

2. MRV method and Reference Scenario

JCM MRV methodology for this project is being made by reference to 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



(Source: Mizuho Information & Research Institute)

3. Monitoring method

Summary of gases and sources included in the project boundary is described in the below table.

	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

(Source: Mizuho Information & Research Institute)

4. Quantification of GHG emissions and their reductions

The formula to estimate the reference emission and the estimated emission reductions 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".

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

Project emissions were estimated based on the monitored LNG consumption during the EFB toreffaction test operation by YAMATO SANKO MFG.CO.,LTD.

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.

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

(Source: Mizuho Information & Research Institute)

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

5. Capacity Building Plan

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.

Session 1: "Outline of the JCM and method for reducing GHG emission by Empty Fruit Bunch (EFB) utilization"	Japan Coal Energy Center
Session 2: "Detail of the biomass torrefaction technology"	YAMATO SANKO MFG.CO.,LTD.
Session 3: "Policy recommendations toward the commercialization of EFB torrefaction/sales business and outline of the draft JCM methodology for "Biomass torrefaction project"	Mizuho Information & Research Institute, Inc.

(Source: Mizuho Information & Research Institute)

6. Others (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 CO_2 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).