Bio-energy, CCS and BECCS: Options for Indonesia
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Supply chain issue in developing Bioenergy in Indonesia

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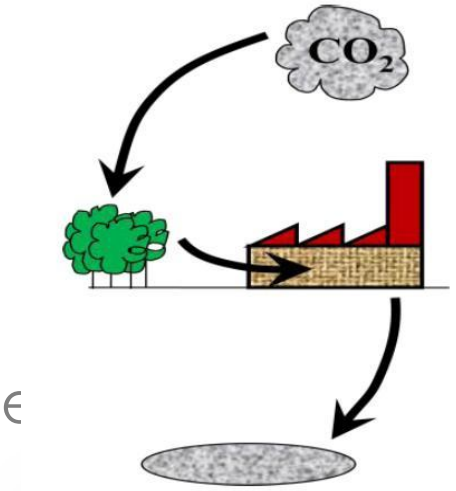
Recommendations

- Quantification of barriers:PEST
  - Policy (regulatory policy:i.e. Energy pricing, RPS, Net metering, Fit-in- tariff, mandate and obligations, tradable RE Certificate, etc.)
  - Economy (fiscal incentives: capital subsidy, grant, rebate,tax incentives,)
  - Social awareness (participation, perception)
  - Technology (user friendliness, cost)
- Supply chain to be managed by industry (solid fuel production)
  - Biomass from wastes (pellet,chip, briquette,etc.)
  - Energy farm(i.e. Leucaena Leucocephala Plantation)

The Bio-energy supply chain

- Supply side:
  - Biomass fuel supply and production to be managed by industry
  - Secure continuity of supply, JIT delivery
  - Maintain quality and standard of fuel
  - Economic benefit of bio-energy by quantification of barriers
- Demand side
  - Large scale power generation
  - Small scale fuel and power usages (rural development , industrialization initiatives)
  - Economic benefit of bio-energy by quantification of barriers
  - Application of BE-CCS
- MoEMR, Regulation No.4/2012:on bio-ene generation tariff



Biomass fuel production and services: (conditions:ROI>current interest rates,pay backtime< 4 years)

Φ(B)*100 Gross benfit US$	P (electicity tariff US$/kWh)	E (Interest rates)%/ann.	S (number of costumers)	T (Cost of technology, x100,USD
113,8	5	16	100	83.5
46,9	6	14	90	80
50,08	7	12	80	75
36,6	8	10	70	70
102	9	8	90	75

Least Square Method

$$[A]=([X]^T[[X])^{-1}([X]^T[[X])[B] \quad (3)$$

The answer is=

Coefficient	
$\alpha 1=$	97,31
$\alpha 2=$	69,35
$\alpha 3=$	15,95
$\alpha 4=$	-36,87

Calc.	Data	error
115,333	113,8	-0,01345
49,638	46,9	-0,0583
44,496	50,08	0,1115
39,354	36,6	-0,075
101,982	102	0,000176

Maintain Biomass Fuel Standards and quality

RDF Heating Values

STERN

Combustable Material	MJ/Kg	Moisture %
Wood	17-21	10-30
Straw	19-21	10-40
Waste wood	16-17	10-30
Paper	17-18	5-30
Bark	15-16	10-30
Sludge	15-17	55-70
BrownCoal	15-17	25-60
Stone Coal	29-33	3-5
Polyethylen (PE)	46	low

Wood pellet: dim. 6 – 10 mm ,length 10 – 30 mm. Density: 650 kg/m^3 or 1,5 m^3/ton. Ash content:0,5%. Calorific value :4,7kWh/kg or 19.6MJ./kg.

Result:

Parameter	Unit	Results	Method
Total Moisture	%, ar	11.6	ASTM D. 3302-10
Proximate Analysis :			
- Moisture in Analysis	%, adb	7.0	ASTM D.3173-08
- Ash Content	%, adb	2.7	ASTM D.3174-04
- Volatile Matter	%, adb	38.0	ISO 562-2010
- Fixed Carbon	%, adb	52.3	ASTM D.3172-07
Total Sulfur	%, adb	0.15	ASTM D. 4239-10
Gross Calorific Value	Kcal/kg, adb	4657	ASTM D. 5865-10
Gross Calorific Value	Kcal/kg, ar	4427	ASTM D. 5865-10

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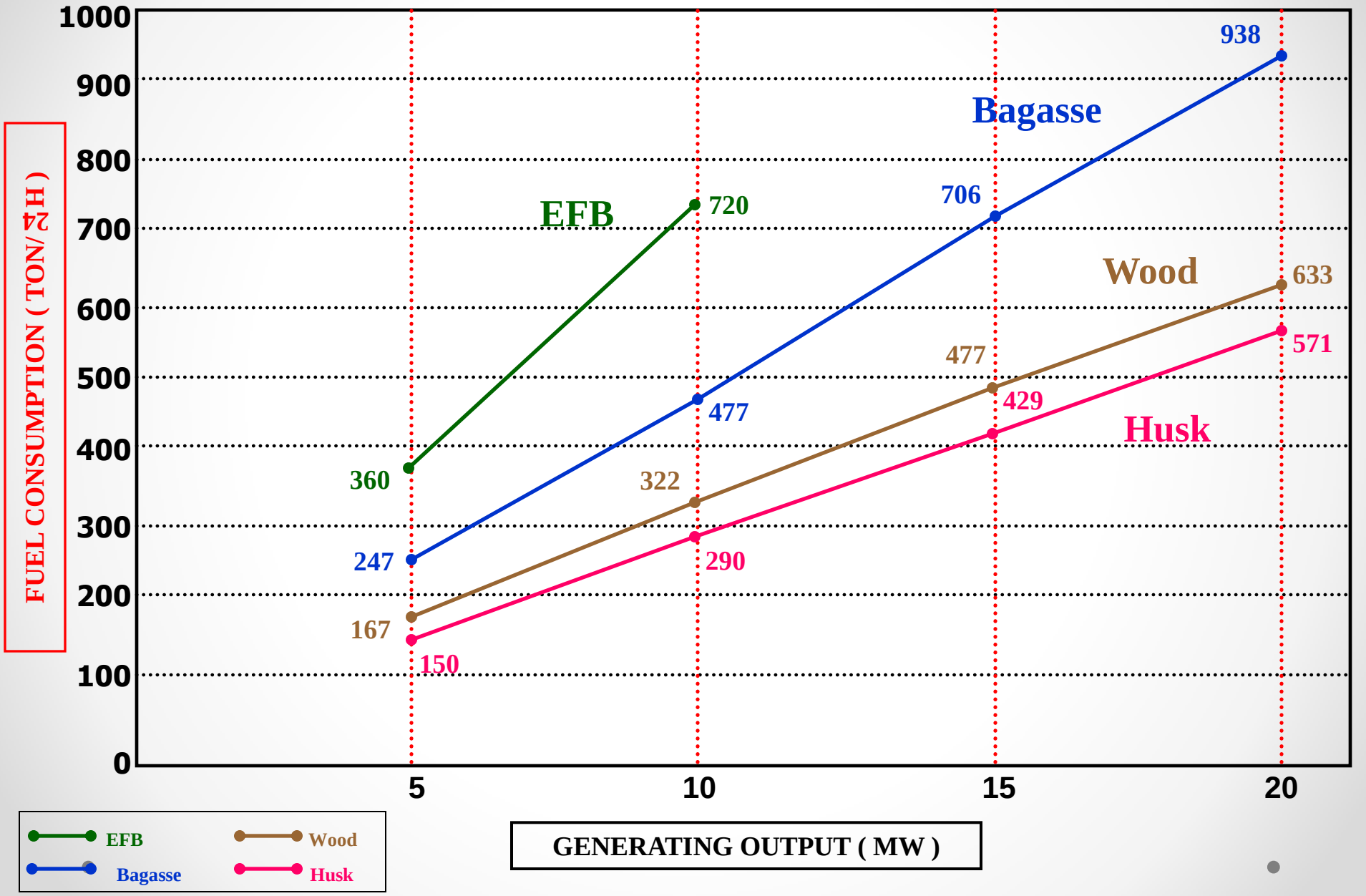
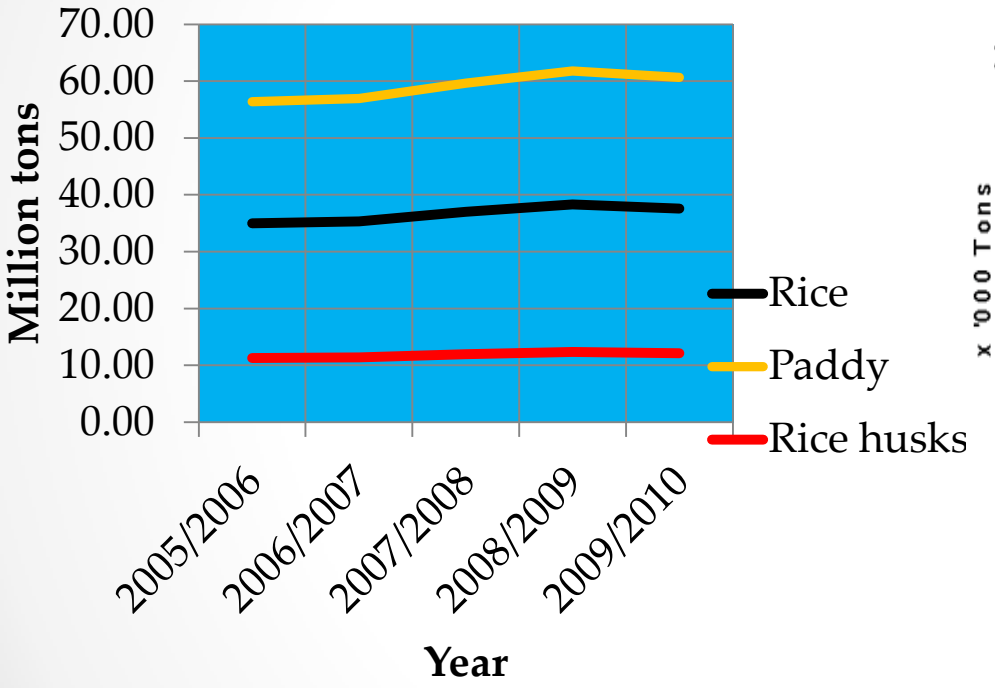
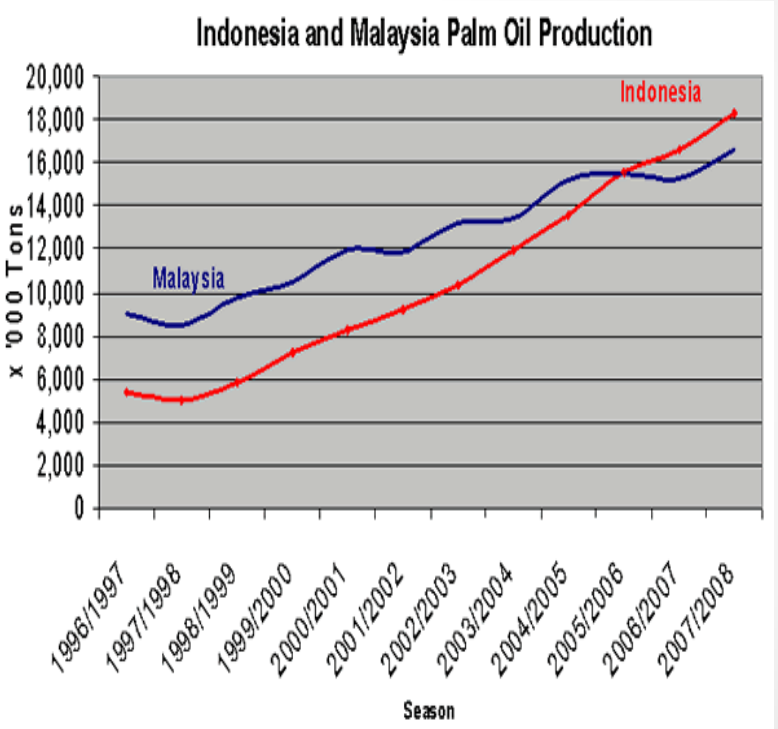
Various Biomass Fuel Consumption using Full Condensing Turbine

Eucafuel Co. Ltd.



Rice and rice husks and Palm oil production in Indonesia



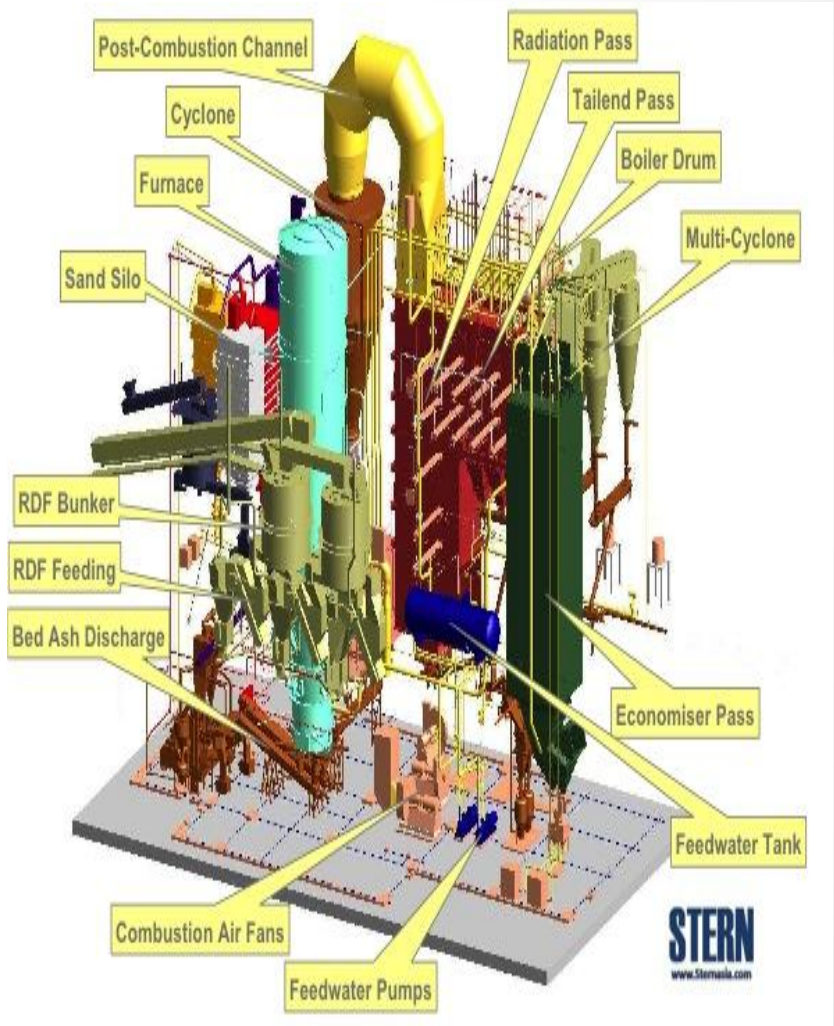


Daily news, July 2012

Rice husks supply chain

Potentials of Rice husks and palm oil fruits shells

Fluidized bed gasifiers as CHP



Thank you