Indosat Green Power

By : Suharno Budiwibowo

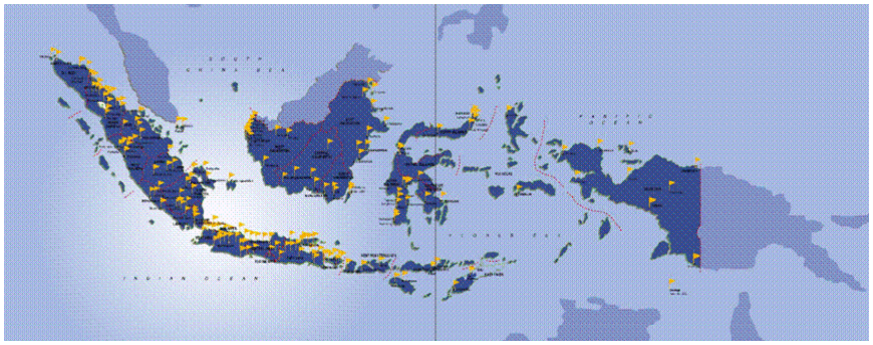
Macau, 19 November 2008

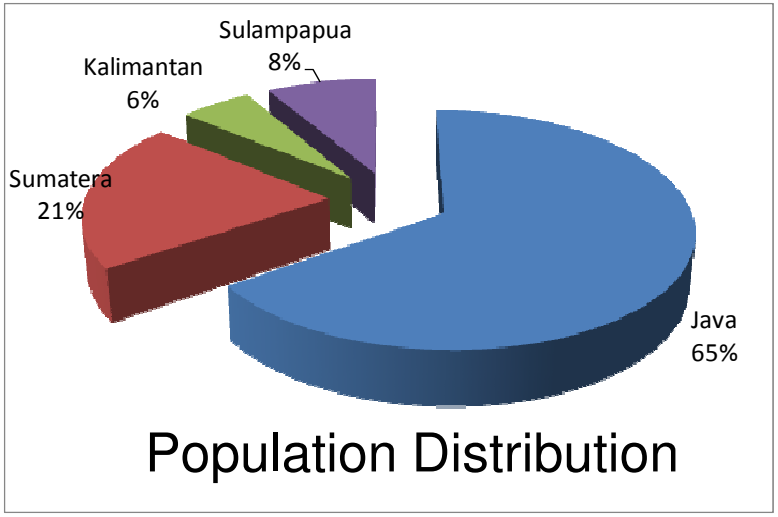


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Indonesia Overview





- 4th of most populated country in the world with 250 million population.
- The largest island country in the world with 1.9 million km^2 wide or nearly 6 times of Japan wide.
- Consists of 17,500 islands, where 3 out of 6 are the biggest islands in the world. Kalimantan (539,460 km^2), Sumatera (473,606 km^2) and Papua (421,981 km^2).

Indosat – Services

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Cellular Business

Matrix – Postpaid for high end with advanced features

Mentari – Prepaid for general users

IM3 – Prepaid for the young & trendy

3G – HSDPA services for wireless broadband

Fixed Data Business

Indosat
- International Leased Circuit
- International Frame Relay/ATM
- VSATs
- Wholesale Internet Access

LINTASARTA
- Domestic Leased Circuit
- Domestic Frame Relay/ATM
- VSATs
- Corporate Solutions

INDOSAT M2
- IP – Virtual Private Network
- Dedicated and Dial Up Internets
- Wi-Fi & Hotspots

Fixed Voice Business

IDD 001 – Premium IDD

FlatCall 0106 – Flat Rate IDD

StarOne – Fixed Wireless Access



GlobalSave – VoIP Service

Indosat – Renewable energy program

1. Mutual cooperation with:
   a. Bandung Institute of Technology → analyzing feasibility of applied renewable energy in Indosat.
   b. A state owned-company (PT LEN) → doing trial PV and WTG with more local contents.
2. Trial Renewable energy:
   a. 100% bio-diesel.
   b. Solar cell (capacity 4800 Wp) and wind turbine generator (2500 W).
3. Trial result was good and fulfilled Indosat requirements.
4. Indosat will use bio-diesel as a part of CSR Program

Overview trial PV & WTG

Configuration:

- PV: 4800 Wp
- WTG: 2500 Wp @ wind 10 m/s + back up by grid-utility
- Battery :1200 AH
- Load : 36KWh/day

Achievement:

- PV can supply up to 22 KWh/day.
- WTG can supply up to 18 KWh/day.
- Backup by grid-utility up to 7 KWh/day.

Biodiesel Trial Result

By Indosat and Bandung Institute of Technology :

- Trial 100% Biodiesel in BTS Indosat
  Toll Cipularang km 103,5

Introduction (1)

1. Background

- The main goal is to reduce carbon emission.
- The cost of bio-diesel is more effective compare to solar cell & WTG in reducing carbon.
- Using local plantation (jatropha Curcas) by cooperating with local industry and farmer.
- World Wide Fuel Charter (WWFC) → composition of 5% bio-diesel can be used on diesel engine without modification; no change in engine power and less of emission gas (environment friendly).
- Pertamina (Indonesian state own oil company)→ composition of 5% bio-diesel also has been sold in public fuel station.
- Many researches and trials have been done referring to bio-diesel.
- INDOSAT want to use 100% bio-diesel for its BTS operation (maybe the first trial in the world?)

Introduction (2)

2. Goals of Trial

- To see the feasibility of operational aspects
- To evaluate the environment impact as consequent of using bio-diesel and petro-diesel.

3. Obtain information about:

- Bio-diesel VS petro-diesel engine fuel consumption.
- Impact of bio-diesel and petro-diesel emission for environment.
- Deposit on nozzle.
- Lubricant consumption.
- Technical analysis of bio-diesel as genset fuel at the existing BTS site.

Experiment Method & Tools

1. **Experiment Method**

- Based on World-Wide Fuel Charter, standar CEC F-23-A-01.
- Duration:

  Petro-diesel: 7 days

  Bio-diesel: 7 days

2. **Engine Condition**

Perkins Engine Model	**404C-22G1**
Number of Cylinders	4 / In Line
Cubic Capacity: Litres (cu.in)	2.2 (135.2)
Bore/Stroke: (mm)	84/100
Compression ratio:	23.3:1
Aspiration	Natural
Engine Speed: RPM	1500
Gross Engine Power: kW (hp)	18 (24)
BMEP: kPA (psi)	649 (94.2)
Piston Speed: m/sec	5
Total Oil Capacity (Liters)	10.6
Cooling System Cooling	Water Radiator

Experiment Method & Tools

3. Biodiesel Specifications

Petro-diesel Fuel (Pertamina) and Fame 814 (Eterindo Group)

Fuel Properties	Petro Diesel	Fame 814
Fuel Composition	C10-C21 HC	C12-C22 FAME
Gross Heating Value, kcal/lt*	9,018	8,240
Pour Point, ° C	9 max.	16 max.
Flash Point, ° C	66 min.	100 min.
Kin. Visc. (40 ° C), mm^2/s	1.7 –5.5	2.3 –6.0
Water & Sediment, vol.%	0.05 max.	0.05 max.
Sulfur, ppm	5,000 max.	100 max.
Carbon Residue, wt.%	0.1 max.	0.05 max.
Cetane Number	45 min.	51 min.
Methanol Content, wt.%	-	0.2 max.
Free Glycerin, wt.%	-	0.02 max.
Total Glycerin, wt.%	-	0.24 max.
Ester Content, wt.%	-	96.50 min.
Acid Number, mg KOH/g	-	0.8 max.

Result

- Bio-diesel consumption average was 15% higher than petro-diesel. This value was inline with bio-diesel calorie which is lower than petro-diesel.
- HC bio-diesel was 12% lower than petro-diesel.
- Bio-diesel atomization was better than petro-diesel because it consists of oxygen.
- CO (carbon monoxide) bio-diesel was 35% lower than petro-diesel (without loading) and 15% lower (loading).
- Bio-diesel has richer oxygen, and it will be good impact in combustion process.
- Oxygen was supplied from air & bio-diesel itself.
- Bio-diesel oxygen was 2% higher than petro-diesel oxygen
- Opacity bio-diesel on loading was 83% lower than petro-diesel
- Biodiesel nozzle weight was 6% lighter than petro-diesel (because bio-diesel combustion was better than pethro-diesel).
- Oxygen in bio-diesel contributed to make a better combustion. As a result, deposit on bio-diesel nozzle will thinner than petro-diesel.
- Bio-diesel spray was narrow than petro-diesel because bio-diesel viscosity was higher than petro-diesel.
- Higher viscosity gives a good impact to maintenance.

Deposit on Nozzle



Nosel 1,
Solar Sebelum dan setelahUji



Nosel 2,
Solar Sebelum dan setelahUji



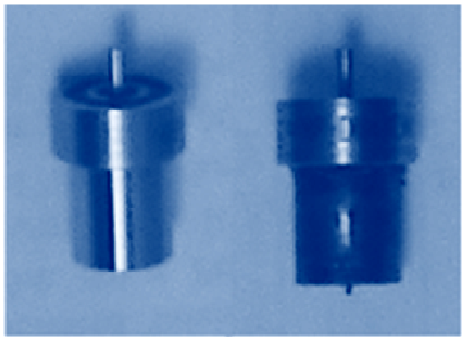
Nosel 4,
Solar Sebelum dan setelahUji



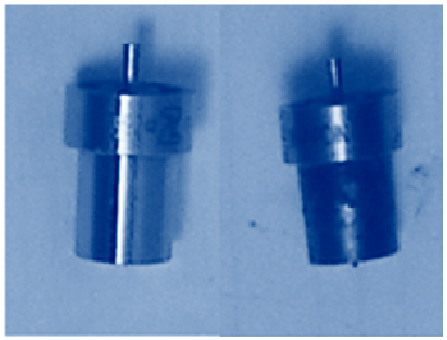
Nosel 4,
Solar Sebelum dan setelahUji

Petro-diesel

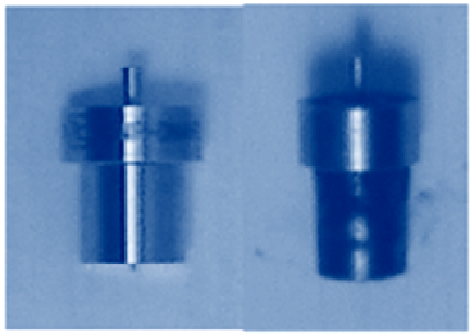
Bio-diesel



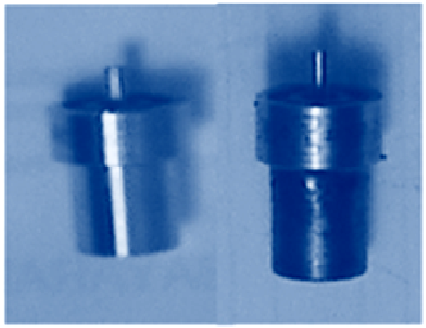
Nosel 1,
Biodiesel Sebelum dan setelah Uji



Nosel 2,
Biodiesel Sebelum dan setelah Uji



Nosel 3,
Biodiesel Sebelum dan setelah Uji



Nosel 4,
Biodiesel Sebelum dan setelah Uji

Conclusion

1. Genset can be operated well without any modifications on its engine, but only replaced rubber hose with synthetic hose.
2. Impact of bio-diesel emission on the environment was lower than petro- diesel:
   - HC was 12 % lower,
   - CO was 15% lower,
   - CO2 was3,5% lower,
   - Opacity was 83% lower,
   - Nuzzle weight was 6% lower.
3. Bio-diesel produces other emission effect, such as:
   - Oxygen (O2) was 2% higher.
   - Bio-diesel consumption was 15% higher because bio-diesel calorie per volume was lower than petro-diesel.
4. Bio-diesel viscosity was higher than petro-diesel; bio-diesel can lubricate well, so lifetime components (e.g. nuzzle and plunger) were getting longer.

Recommendation

1. Optimize load of genset suit based on its specification. Thereby positive effect of bio-diesel on engine will be more significant and efficient.

2. Bio-diesel is an alternative solution to substitute petro-diesel, and also it could reduce emission.

Picture


SOLAR
BIO DIESEL
2008/05/27


BIO DIESEL


emisi
mcb
STARGAS
OTC
2008/05/27 09:57


2008/05/27 09:50



Picture




indosat
BTS Girisari
Berenergi Alternati
Solar Cell - Wind Turbine
indosat cinta Indonesia





Thank You



indosat

Back Up

CO2 Reduction Methods

No	Method	CO2 (kgCO2/year/$)	Remarks
1	Planting	70	• After 10 years • Additional income from planting • Land cost is excluded
		3	• If land cost is $10,000/ha
2	PV	1	It is assumed that the PV is lasting upto 20 years
		0.75	If battery cost is included
3	Wind	1.5	It is assumed that the wind system is lasting up to 20 years
		1.1	If battery cost is included
4	Energy savings	1 - 10	e.g shelterless system Depending on the existing conditions
5	Biofuels	1.6	It is assumed that the energy production cost by diesel is 50 c/kWh.

Source: ITB (Bandung Institute of Technology) Study

Bio-diesel is environment friendly

- Renewable energy !.
- Lower emission green house gas CO_2 ,because come from plantation that during its life absorb CO_2 .
- Fuel that contains oxygen !.

  Combustion biodiesel give better emission (e.g. CO, NOx, HC, Particel) is lower.(Local Emission)
- Not contain sulfur, so emission SOx = 0.(Regional Emission)
- Biodiesel has better lubrication comparing with petro diesel, so the oil lubricant more longer life & and also for the machine.
- Biodegradable

The Potential of Bio Fuel in Indonesia

Tropical (equator) area:

- Bio diversity no 2 in the world
- Full 1 year long agriculture

More than 16,000 islands the longest sea shore in the world for sea (aquatic) agriculture. (Biodiesel from Micro Algae [ref:NREL/TP-580-24190])

Fatty-oil producing plants of Indonesia (1)

Name (Ind)	Latin name	Source	Oil, %-w dry	E / NE
Jarak kaliki	*Ricinus communis*	Seed	45 – 50	NE
Jarak pagar	*Jatropha curcas*	Kernel	40 – 60	NE
Kacang tanah	*Arachis hypogea*	Kernel	35 – 55	E
Kapok/randu	*Ceiba pentandra*	Kernel	24 – 40	NE
Karet	*Hevea brasiliensis*	Kernel	40 – 50	NE
Kecipir	*Psophocarpus tetrag.*	Seed	15 – 20	E
Kelapa	*Cocos nucifera*	Kernel	60 – 70	E
Kelor	*Moringa oleifera*	Seed	30 – 49	E
Kemiri	*Aleurites moluccana*	Kernel	57 – 69	NE
Kusambi	*Sleichera trijuga*	Kernel	55 – 70	NE
Nimba	*Azadirachta indica*	Kernel	40 – 50	NE
Saga utan	*Adenanthera pavonina*	Kernel	14 – 28	E
Sawit	*Elais guineensis*	Pulp + Kernel	45-70 + 46-54	E

Fatty-oil producing plants of Indonesia (2)

Name (Ind)	Latin name	Source	Oil, %-w dry	E / NE
Akar kepayang	*Hodgsonia macrocarpa*	Seed	≈ 65	E
Alpukat	*Persea gratissima*	Fr. Pulp	40 – 80	E
Cokelat	*Theobroma cacao*	Seed	54 – 58	E
Gatep pait	*Samadera indica*	Seed	≈ 35	NE
Kepoh	*Sterculia foetida*	Kernel	45 – 55	NE
Ketiau	*Madhuca mottleyana*	Kernel	50 – 57	E
Nyamplung	*Callophyllum inophyllum*	Kernel	40 – 73	NE
Randu alas/agung	*Bombax malabaricum*	Seed	18 – 26	NE
Seminai	*Madhuca utilis*	Kernel	50 – 57	E
Siur (-siur)	*Xanthophyllum lanceatum*	Seed	35 – 40	E
Tengkawang tungkul	*Shorea stenoptera*	Kernel	45 – 70	E
Tengk. terindak	*Isoptera borneensis*	Kernel	45 – 70	E
Wijen	*Sesamum orientale*	Seed	45 – 55	E

Fatty-oil producing plants of Indonesia (3)

Name (Ind)	Latin name	Source	Oil, %-w dry	E / NE
Bidaro	*Ximenia americana*	Kernel	49 – 61	NE
Bintaro	*Cerbera manghas/odollam*	Seed	43 – 64	NE
Bulangan	*Gmelina asiatica*	Seed	?	NE
Cerakin/Kroton	*Croton tiglium*	Kernel	50 – 60	NE
Kampis	*Hernandia peltata*	Seed	?	NE
Kemiri cina	*Aleurites trisperma*	Kernel	?	NE
Labu merah	*Cucurbita moschata*	Seed	35 – 38	E
Mayang batu	*Madhuca cuneata*	Kernel	45 – 55	E
Nagasari (gede)	*Mesua ferrea*	Seed	35 – 50	NE
Pepaya	*Carica papaya*	Seed	20 – 25	E
Pulasan	*Nephelium mutabile*	Kernel	62 – 72	E
Rambutan	*Nephelium lappaceum*	Kernel	37 – 43	E
Sirsak	*Annona muricata*	Kernel	20 – 30	NE

Fatty-oil producing plants of Indonesia (4)

Name (Ind)	Latin name	Source	Oil, %-w dry	E / NE
Srikaya	*Annona squamosa*	Seed	15 – 20	NE
Kenaf	*Hibiscus cannabinus*	Seed	18 – 20	NE
Kopi arab (Okra)	*Hibiscus esculentus*	Seed	16 – 22	NE
Rosela	*Hibiscus sabdariffa*	Seed	≈ 17	NE
Kayu manis	*Cinnamomum burmanni*	Seed	≈ 30	E
Padi	*Oryza sativa*	Bran	≈ 20	E
Jagung	*Zea Mays*	Germ	≈ 33	E
Tangkalak	*Litsea sebifera*	Seed	≈ 35	E
?	*Taractogenos kurzii*	Kernel	48 – 55	NE
Kursani	*Vernonia anthelmintica*	Seed	≈ 19	NE

E ≡ Edible fat/oil, NE ≡ Non-Edible fat/oil.

Only several of these tens of plant species (e.g. : palm, coconut, peanut) have been utilized as commercial sources of fatty-oils !.

Biodiesel = bahan bakar mesin diesel yang berupa ester metil/etil asam-asam lemak

Cara pembuatan paling umum : metanolisis/etanolisis lemak atau minyak-lemak :

Lemak/ minyak-lemak + *Metanol (Etanol)* —Katalis, 25 - 80 °C→ *Ester metil/etil asam-asam lemak* (biodiesel) + *Gliserin*

⇧

Minyak sawit
Minyak kelapa
Minyak inti-sawit
Minyak kacang-suuk
Lemak ternak
Minyak jarak pagar
Minyak nyamplung
Minyak kelor
Minyak kesambi
Minyak saga utan/pohon
Minyak nimba
Lemak rambutan
Minyak kapok/randu
Minyak randu alas
dll.

Khazanah kekayaan hayati Nusantara

Metanol dan etanol dapat dibuat dari gas bumi maupun biomassa..

Teknologi produksi mudah dikembangkan dan dikuasai tenaga-tenaga dalam negeri.

Gliserin merupakan produk samping yang berpermintaan pasar besar.
(Di masa depan dapat juga dikonversi/difermentasi menjadi etanol)

CSR Biodiesel

- Give donation press machine of Jatropha Curcas to local farmer in Sumbawa island.
- Give support to local industry of Bio-diesel, with long term contract for supplying bio-diesel to Indosat.
- Indosat will use biodiesel from local industry in this area for 33 sites with volume 6000-7000 liter per month.
- The farmer will be supported by Indosat, because Jatropha curcas can grow better in this area.

References

Biodiesel :

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