Current Status of Bioenergy Development in Indonesia

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Presented at Regional Forum on Bioenergy Sector Development: Challenges, Opportunities, and the Way Forward (23-25 January 2008, Bangkok, Thailand)

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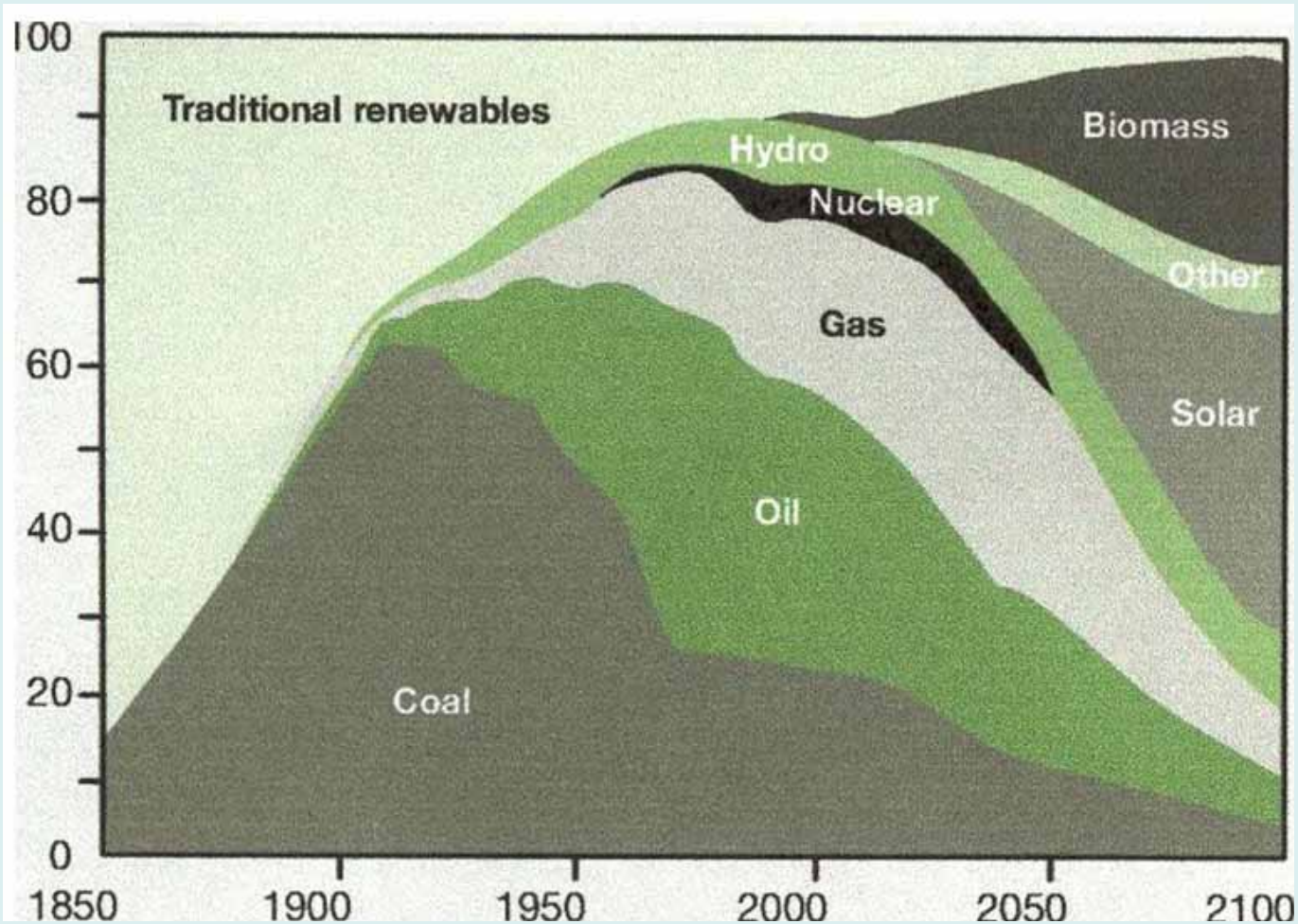
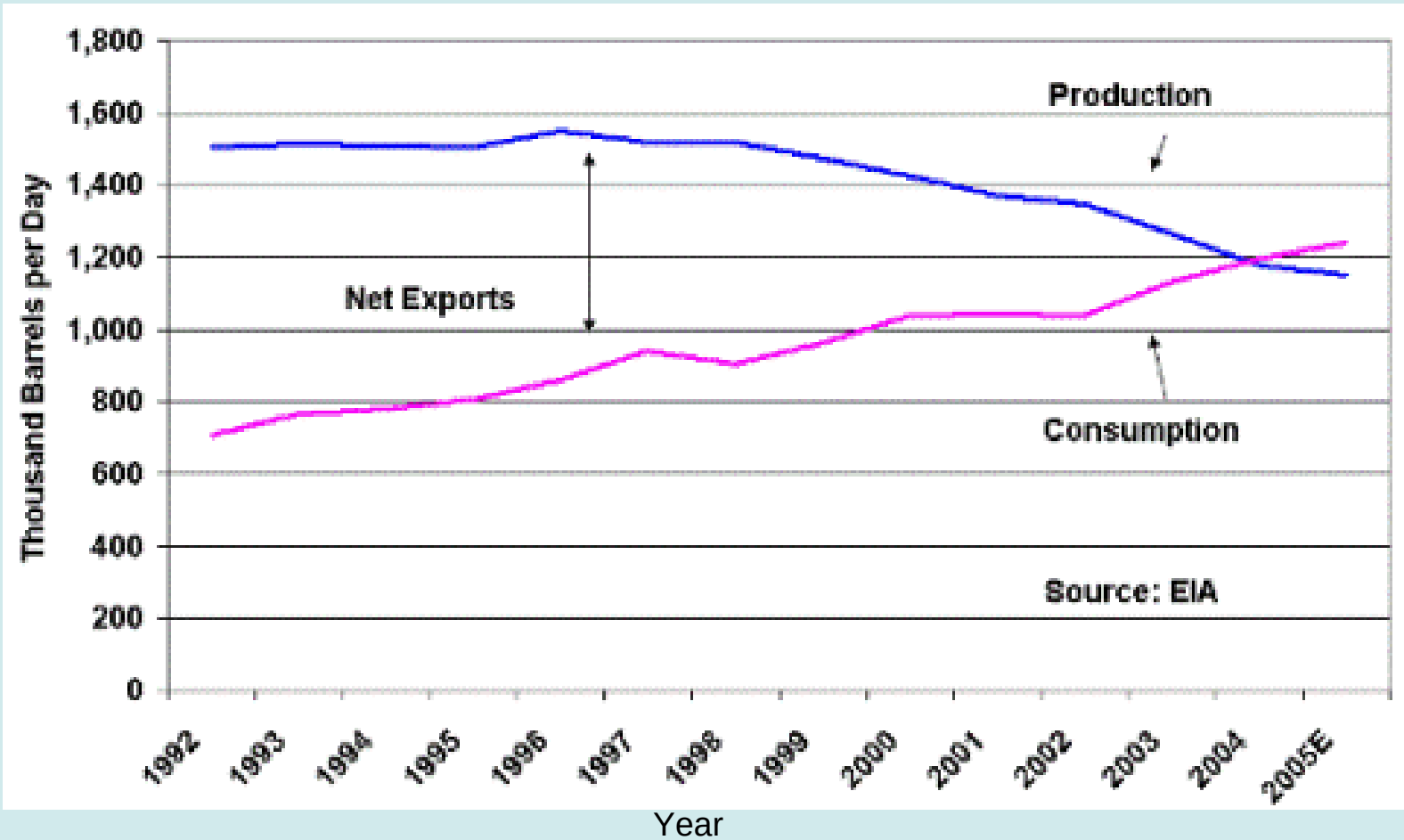
I. Introduction



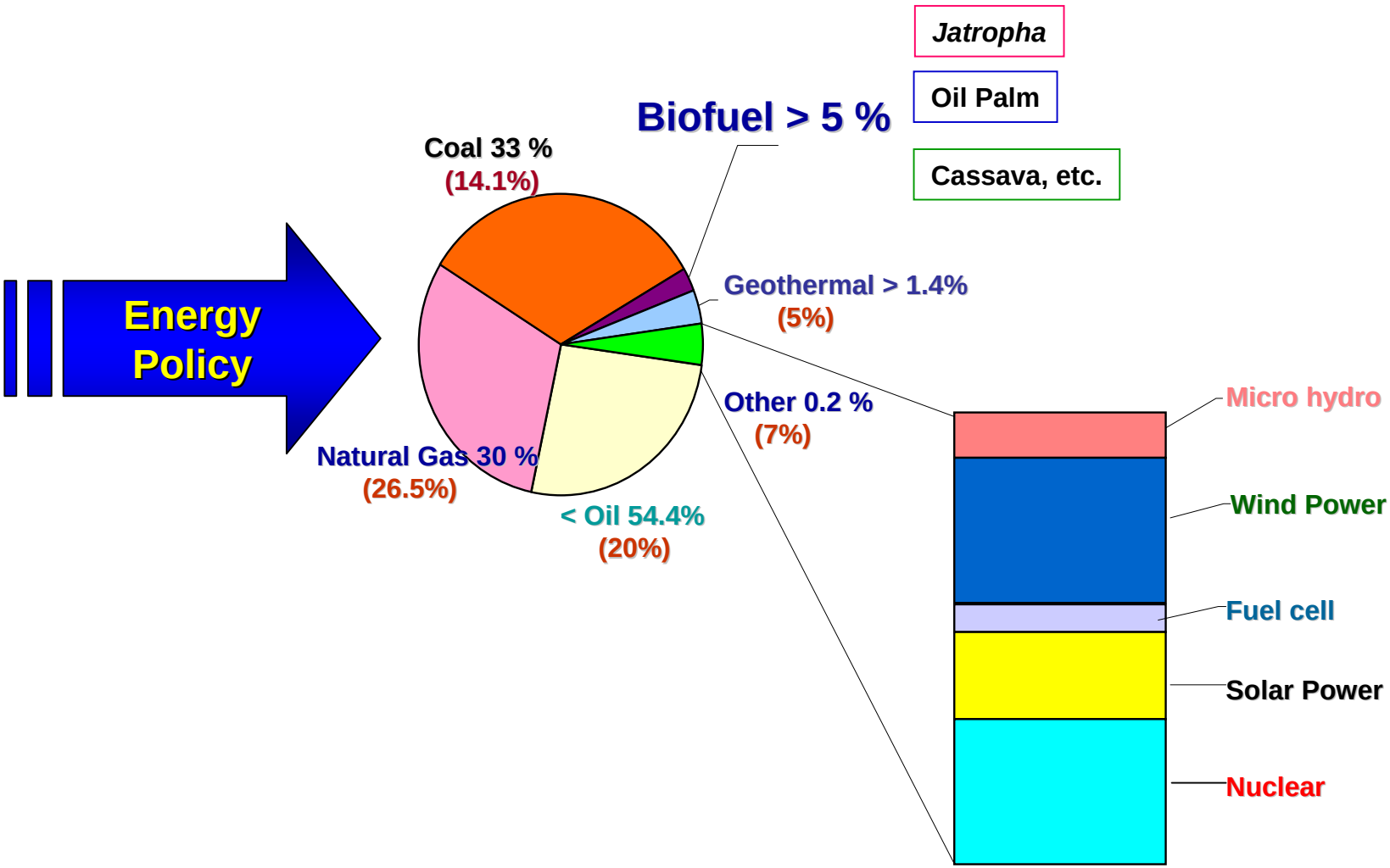
World Energy Council

Indonesia's Oil Production and Consumption 1992 - 2005

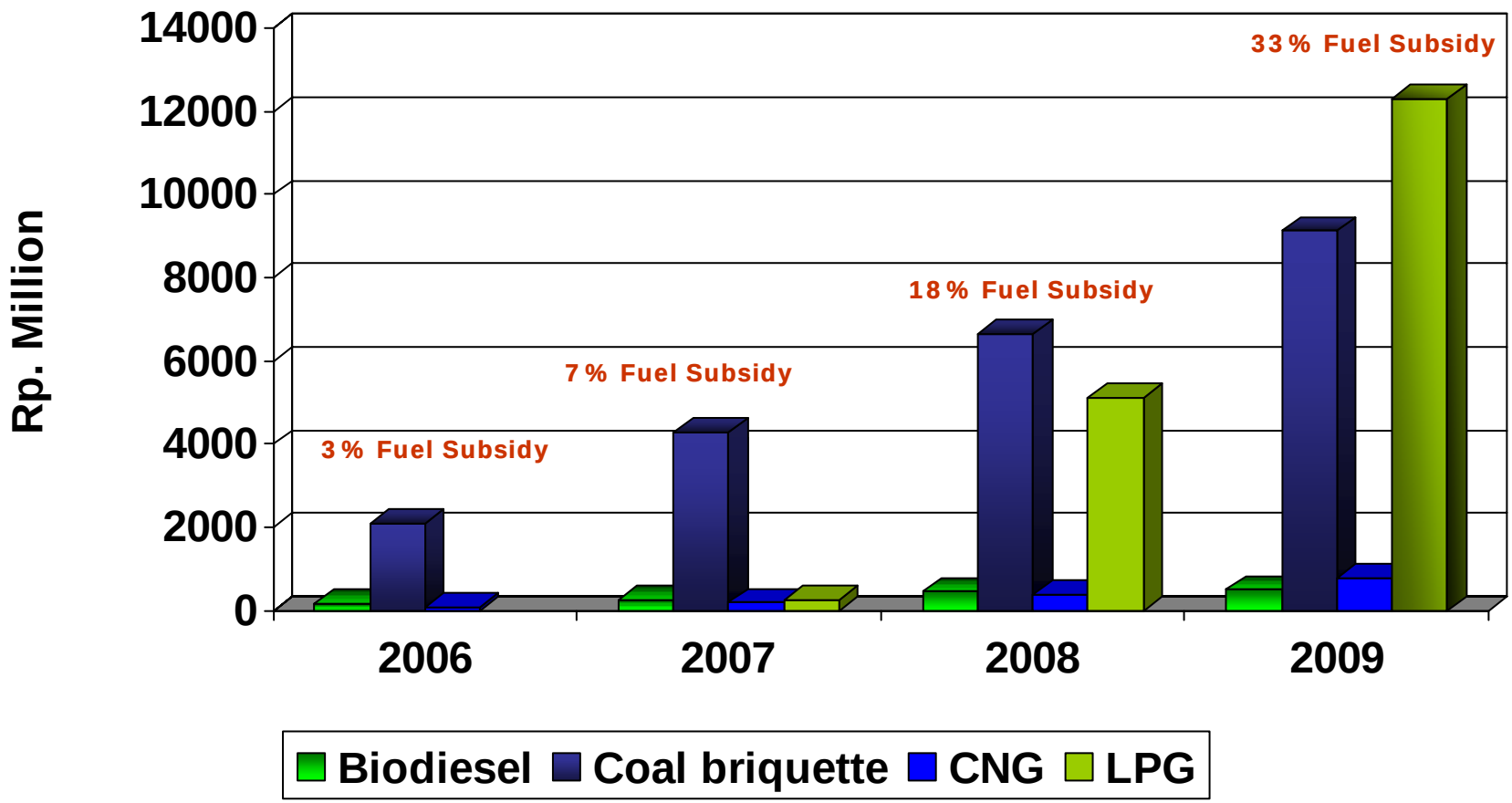


Energy Utilization in the Year 2025

(Presidential Regulation No. 5/2006)



Estimation of Subsidy Thrift



II. Policy and Program of Bioenergy in Indonesia

Policy of Biofuel Development

1. Presidential Regulation No. 5/2006

   Energy National Policy: Biofuel > 5% at 2025

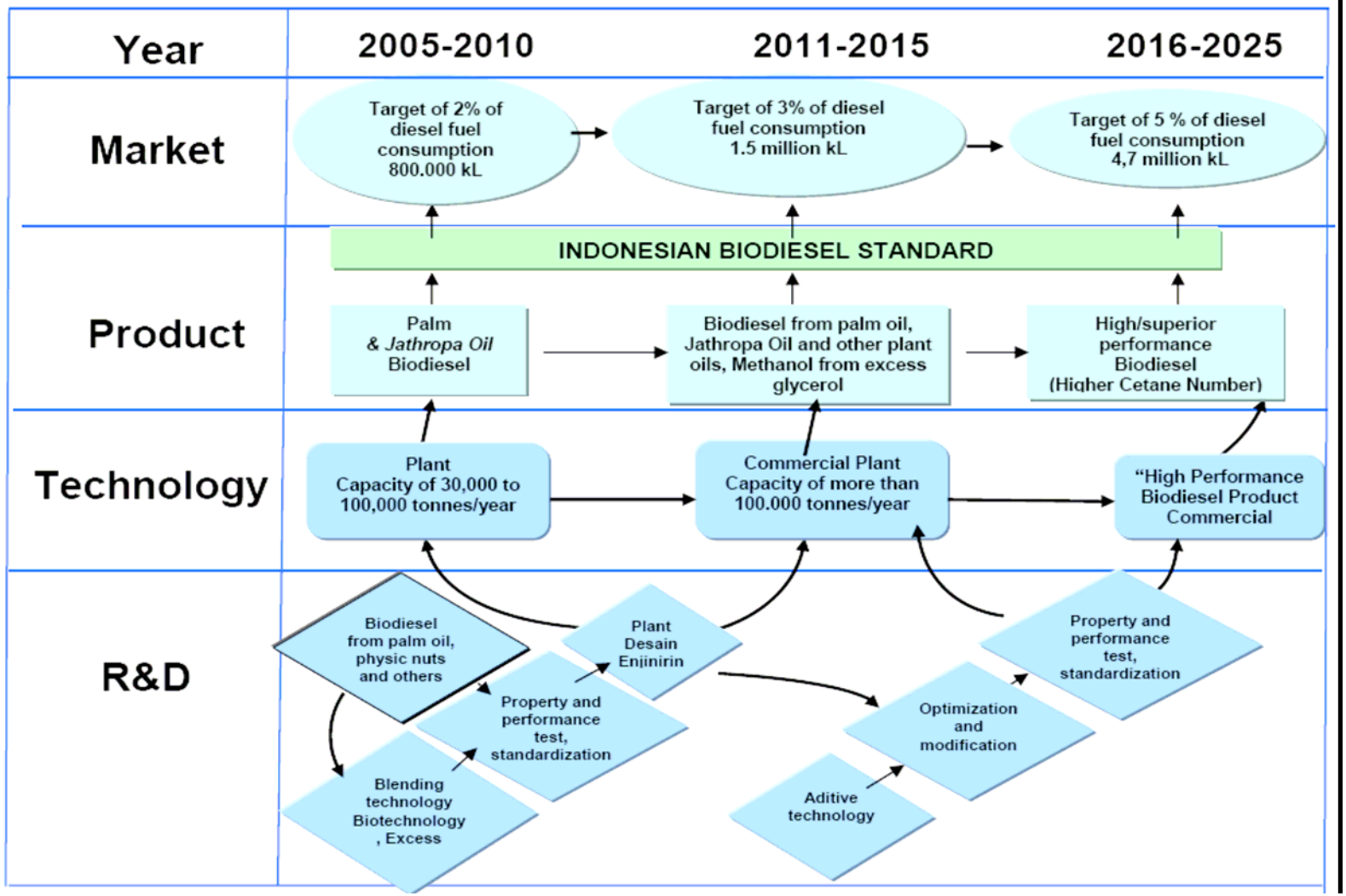
2. Presidential Instruction No. 1/2006

   Acceleration efforts for Biofuel Supply and Utilization

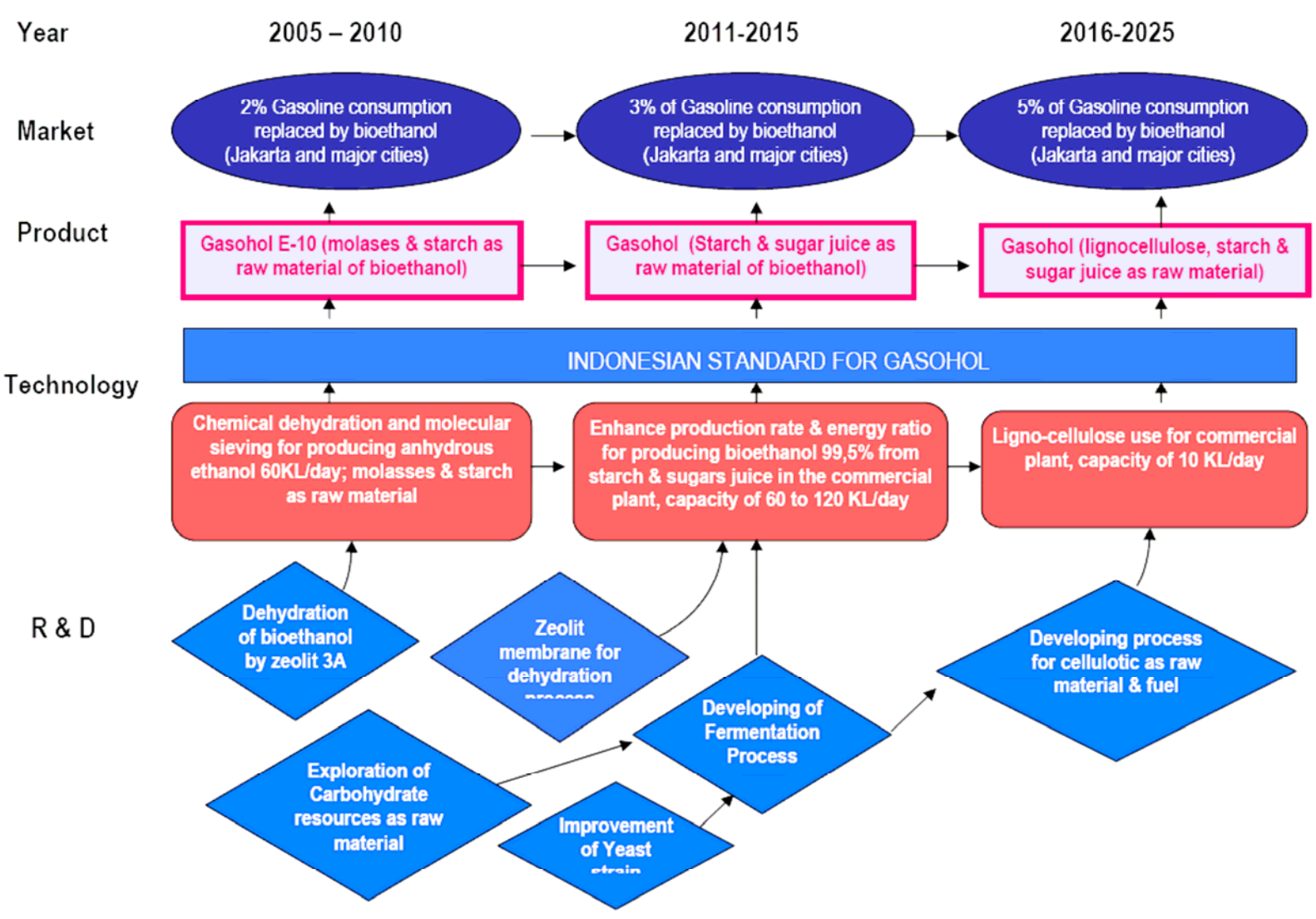
3. Presidential Decree No. 10/2006

   Establishment of National Team for Biofuel Development

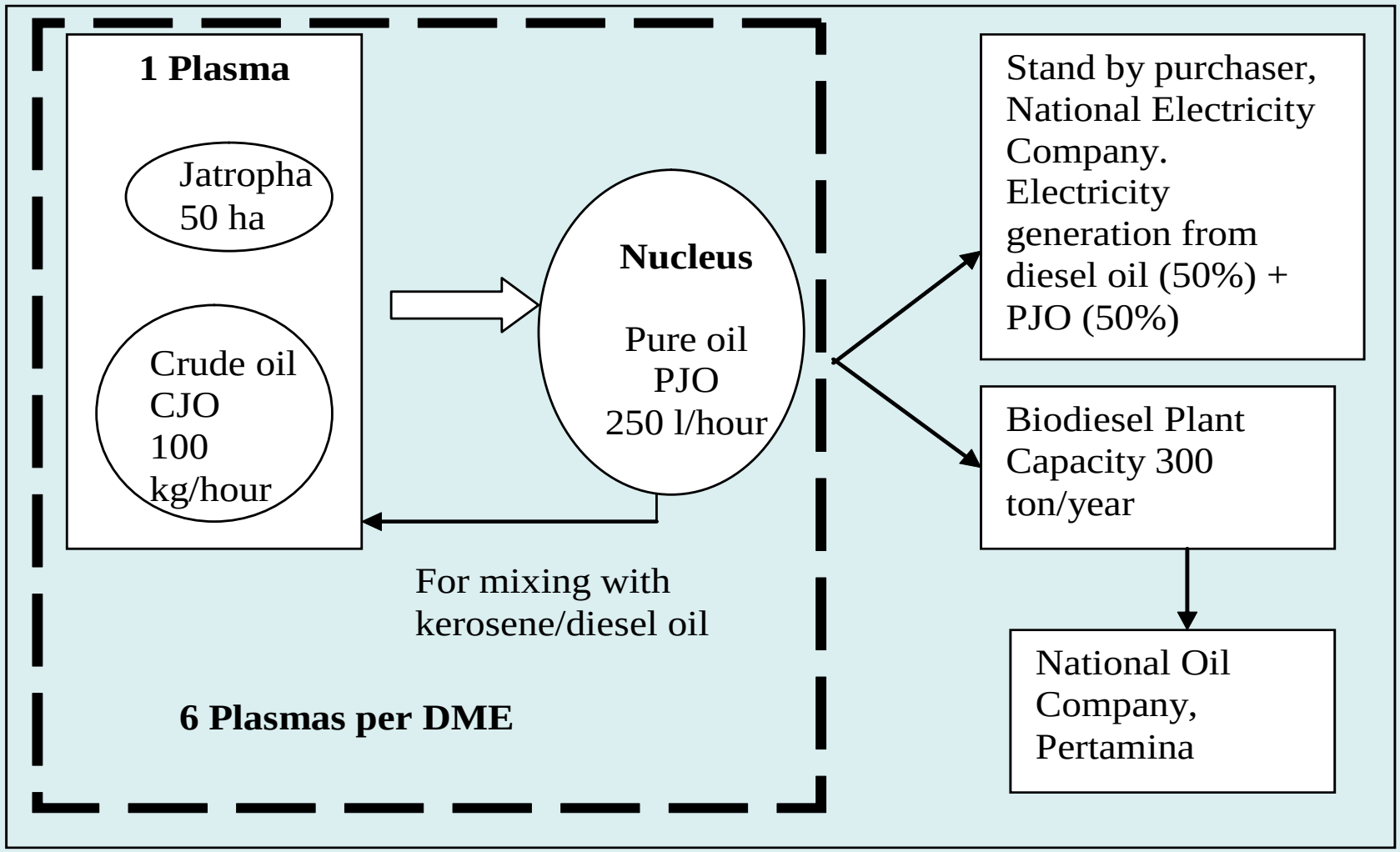
Biodiesel Roadmap



Bioethanol / Gasohol Roadmap



Village Self-Sufficiency Energy Program
(Desa Mandiri Energi/ DME)



Remarks: Crude *Jatropha* Oil (CJO), Pure *Jatropha* Oil (PJO)

Figure DME Based on *Jatropha curcas*

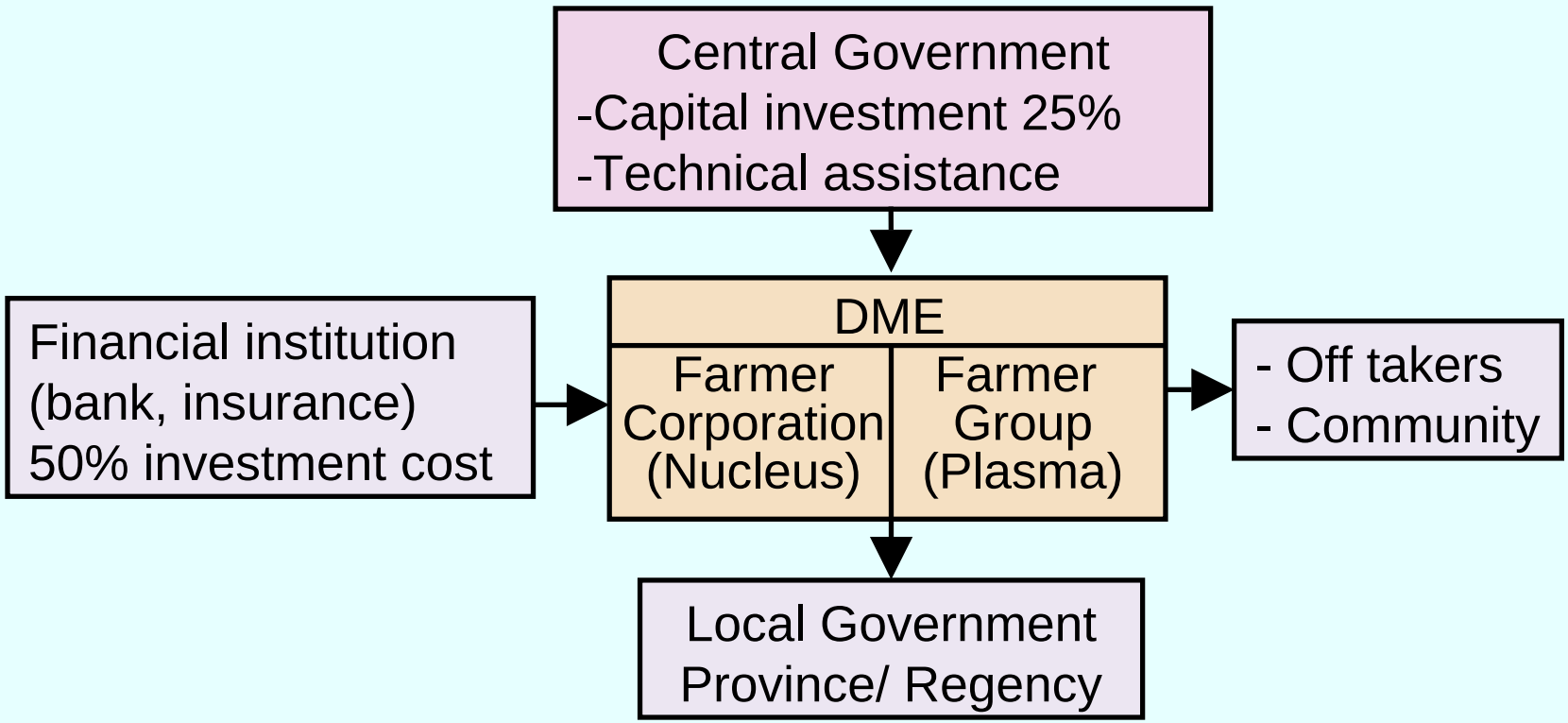


Figure The scheme of DME funding

III. Research and Development

- Biodiesel Plants for diesel oil substitution: oil palm, *jatropha*, coconut
- Bioethanol Plants for gasoline substitution: sugarcane, cassava, sorghum and corn
- Agricultural Waste :estate crop, food crop, agricultural industry waste

Bioethanol for Gasoline Substitution

- Bioethanol for gasoline substitution could be fulfilled from cassava, sorghum and molasses.
- By consideration of land availability and suitability for plantation, cassava will be an important role for ethanol production to substitute gasoline.

Productivity of Various Oil Plants

English	Botanical Name	kg/ha/year
Oil palm	*Elaeis guineensis*	5000
Coconut	*Cocos nucifera*	2260
Avocado	*Persea americana*	2217
Brazil nut	*Bertholletia excelsa*	2010
Macadamia nut	*Macadamia ternif.*	1887
Physic nut	*Jatropha curcas*	1590
Jojoba	*Simmondsia califor.*	1528
Pecan nut	*Carya pecan*	1505
Castor	*Ricinus communis*	1188
Olive	*Olea europea*	1019
Rapeseed	*Brassica napus*	1000
Poppy	*Papaver somniferum*	978

- Cultivation technology
- Improved seed of *jatropha*: for wet, moderate, dry climate
- Machinery for processing and quality improvement

Expeller Machine for *Jatropha* Kernel (ICAERD)

Expeller Machine for *Jatropha* Kernel (BBPT)

Biodiesel Plant

1.5 Tons/day Prototype Biodiesel Plant

8 Tons/day Prototype Biodiesel Plant

Coco Diesel Processing Plant

Coconut Research Center (IAARD-MOA)

Pure Plant Oil (PPO) for replacing the use of kerosene

BBPT Ethanol Plant : 8000 liters/day

Estimation of estate crops waste potency

No	Kind of waste	Area (ha)	Conversion factor (%)	Potency (m^3/ha)	Total Potency (ton/yr)
1	Rubber trunk	3,279,391	3.33*	35	3,279,391
2	Oil palm	6,370,217			11,861,615
	Trunk		5.46*	78	16,277,688
	Shell		5**		593,080
	EFB		20**		2,372,323
	Ditch CPO		15**		1,779,242
3	Coconut	3,803,614			3,096,845
	Trunk		2.0*	80	3,651,469
	Shell		12****		371,621
4	Sugarcane	381,786			2,241,806
	Bagasse		4****		76,357.2
	Molasses		3****		57,267.9
Total					45,658,705

Remarks: * Rate of tree replantation per year, ** percentage from FFB

**** Percentage from the whole fruit, ***** percentage from sugarcane

(Sudradjad, 2004; MOA, 2005)

Harvesting areas, productions and waste potency of some food crop products

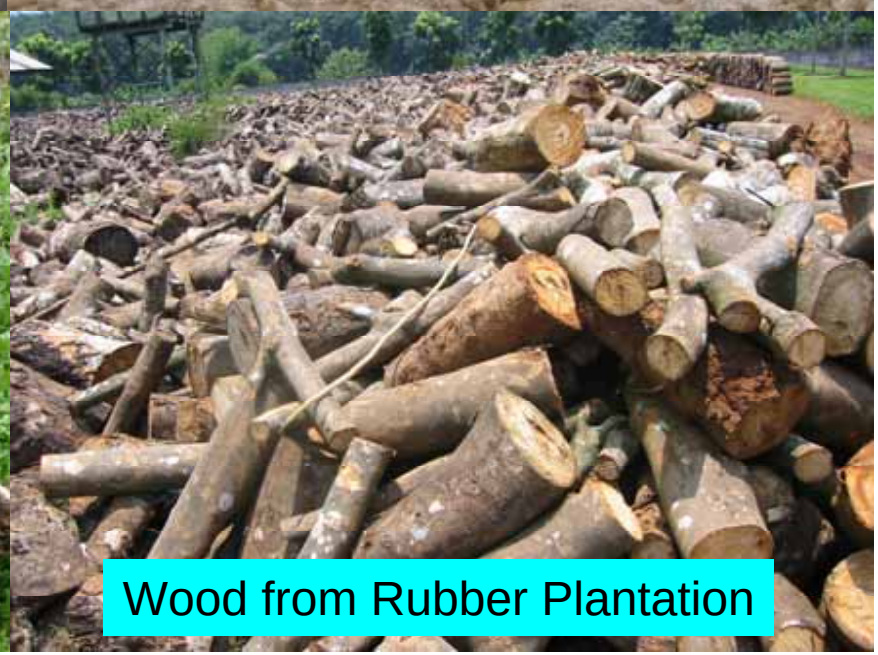
No	Kind of Agricultural Products	Harvesting area (10^3 ha)	Production (10^3 ton)	Yield Rate (quintal/ha)	Conversion Factor (ton/ha)	Potency (10^6 ton)
1	Paddy**	11,786.430	54,454.937	46.20	5.1	60.110
2	Maize	3,345.805	11,609.463	34.70	5.2	17.398
3	Cassava	1,227.459	19,986.640	163.00	6.1	7.487
4	Peanuts	706.753	838.096	11.86	2.0	1.413
5	Soybeans	580.534	747.611	12.88	1.8	1.045
	Total					87.453

Source: (Sudradjad, 2004; MOA, 2006)


Bagasse


Corn Waste


Empty Fruit Bunch (EFB)


Wood from Rubber Plantation

Rice husk furnace
for paddy dryer

Rice husk gasifier
for electric generator (0.5 MW)

1 ton Crude Palm Oil (CPO)
→ 2,5 ton waste water

Sugarcane mill factory
waste water

Waste water from
cassava starch factory

Cattle farm waste
(10 – 20 kg/head)

Cow Milk Shelter

Stove

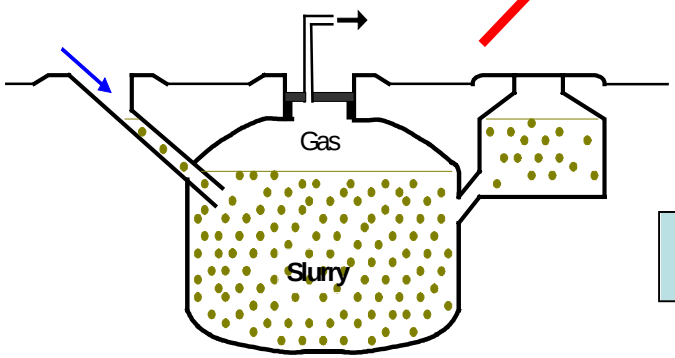
Mantle Lamp

Animal Waste Manure

Filter

Dual Fuel Diesel Engine
(Mechanical/Electrical Power)

Biogas



Digester

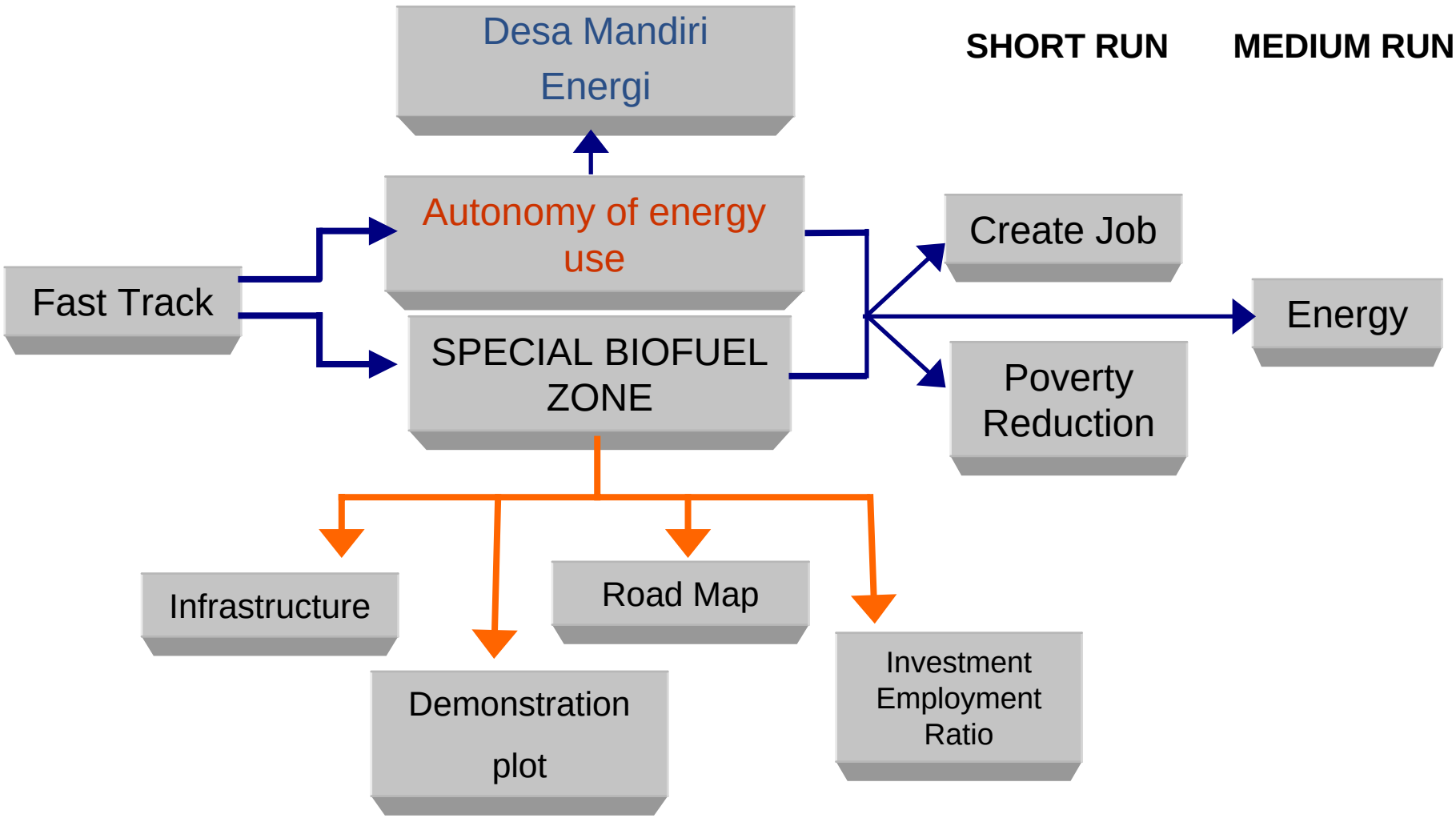
Pond

Purification

Biogas Bottling

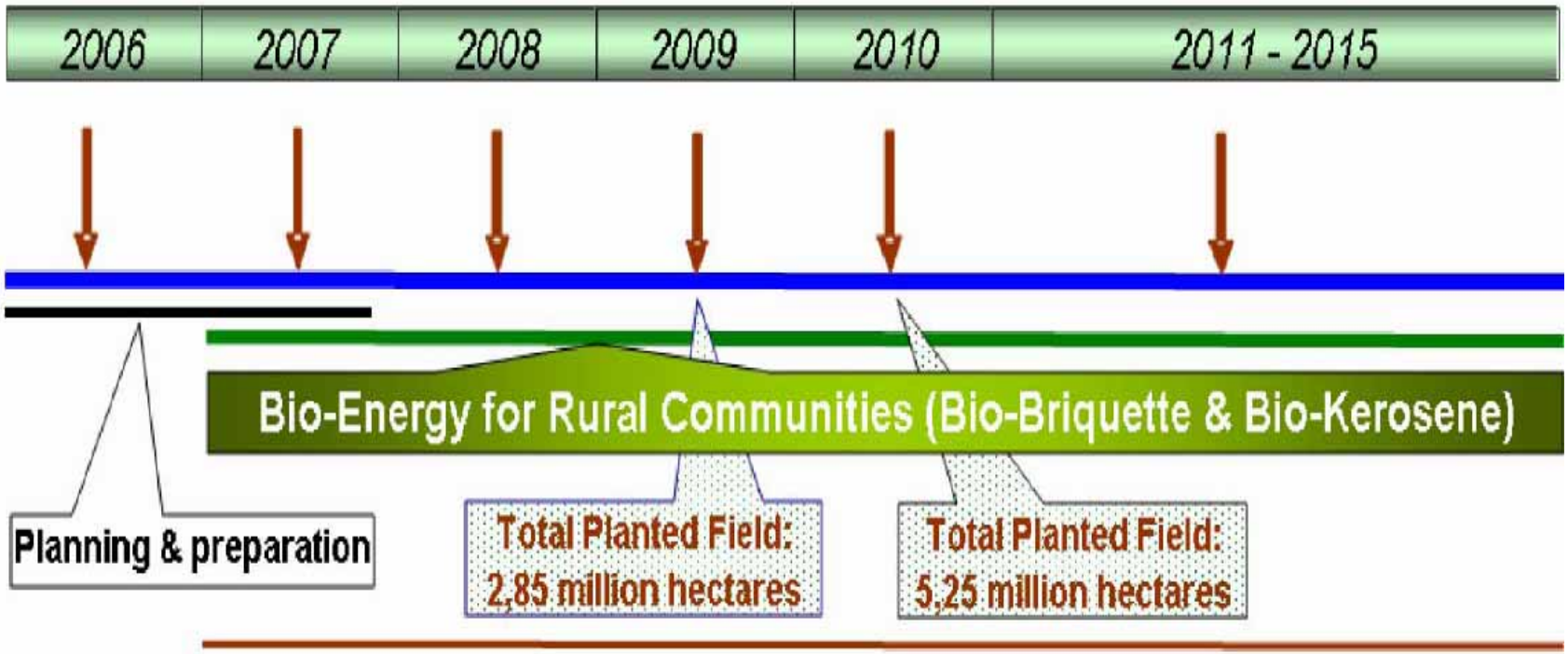
Liquid fertilizer/
Compost

IV. Challenge and Opportunity of Bioenergy Development in Indonesia



Fast Track for Biofuel Development

Strategies to Supply Biofuel : Oil-Palm, *Jatropha*, Cassava



Gov of Indonesia (GoI) Bio-Fuel Incentives:

Research: GoI develops Superior Varieties of Jatropha Curcas - Cassava - Sugarcane

Infrastructure: GoI develops infrastructure support US$ 1.1 bio/year

Investment: Tax Allowance etc; Seed Capital for BioFuel Fund US$ 220 mil

Incentives to Farmers: GoI subsidies interest rate US$ 110 mil/year

Projection of Diesel Oil Demand and Feedstock Accomplishment of Biodiesel, 2006-2010

Activity	Unit	2006	2007	2008	2009	2010
1. Diesel Oil Demand	thousand KL	12.438	13.184	13.975	14.814	15.703
2. Supply of Biodiesel						
a. Blue Print of Energy	thousand KL	50	100	300	500	720
b. Supply from Agricultural Sector	thousand KL	62	132	419	741	785
- Oil Palm	thousand KL	62	125	349	593	471
-*Jatropha*	thousand KL	0	7	70	148	314
3. Planting Area						
a. Oil Palm (*dedicated area*)	thousand Ha	18	36	100	169	135
b. *Jatropha*	thousand Ha	40	341	345	360	375

Projection of Gasoline Demand and Feedstock Accomplishment of Bioethanol, 2006-2010

Activity	Unit	2006	2007	2008	2009	2010
1. Gasoline Demand	thousand KL	17,170	18,370	19,660	21,000	22,510
2.Supply of Bioethanol						
a. Blue Print of Energy	thousand KL	172	735	1,376	2,100	2,251
b. Supply from Agricultural Sector	thousand KL	720	1,205	1,741	2,341	2,476
- Cassava	thousand KL	138	588	1,100	1,680	1,800
- Sorghum	thousand KL	172	184	197	210	225
- Molasses	thousand KL	410	433	444	451	451
3. Planting Area						
a. Cassava	thousand Ha	38	161	300	459	491
b. Sorghum	thousand Ha	86	92	98	105	113
c. Sugarcane	thousand Ha	369	380	392	398	402

Oil Palm

Planting Area	:	$5.5 \cdot 10^6$ hectares
CPO Production	:	$15.4 \cdot 10^6$ tons
Domestic Consumption	:	$3.5 \cdot 10^6$ tons
Export	:	$8 – 10 \cdot 10^6$ tons

1 Ha of oil palm could produce 3.9 kilo liters of biodiesel

Oil Palm Plantation

53.7 % : Private Company
34.2 % : Farmer
12.1 % : National Company

Palm oil for diesel oil substitution is sufficient, but it is needed consideration for utilization of edible oil and export.

Land Suitability Map for Oil Palm in Indonesia

Jatropha curcas

- 1 Ha of jatropha plantation yield of 4-5 tons kernel with 0.8-1.0 ton with oil content 20-30%, it could be obtained 0.8-1.0 ton of crude *jatropha* oil (CJO)

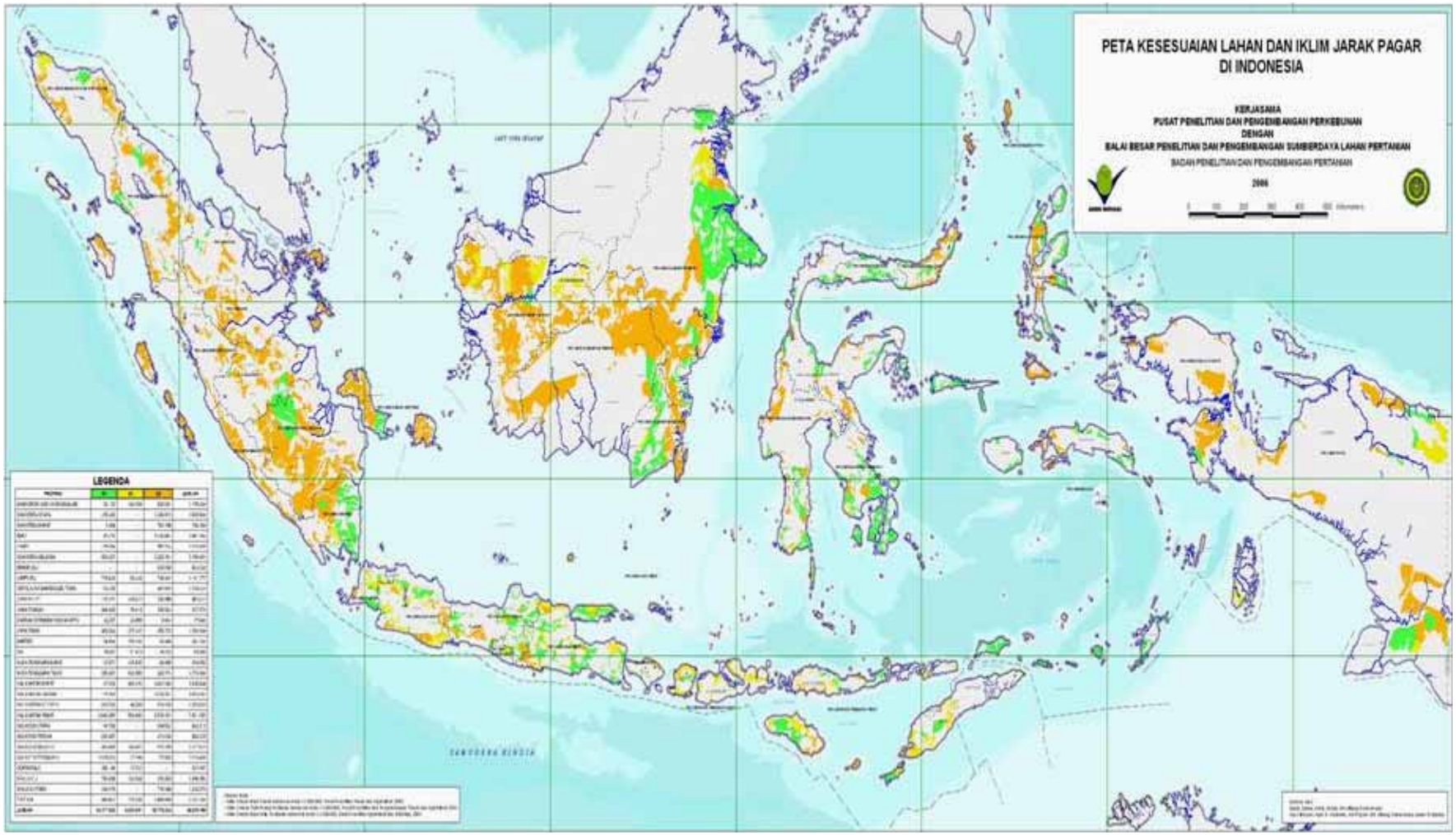
- Planting area that suitable for *jatropha* development, are consist of 3 categories

  S1 = Most Suitable $(14.2 \cdot 10^6$ ha)

  S2 = Suitable $(5.5 \cdot 10^6$ ha)

  S3 = Less Suitable $(29.7 \cdot 10^6$ ha)

Land Suitability Map for *Jatropha curcas* in Indonesia



Sugarcane

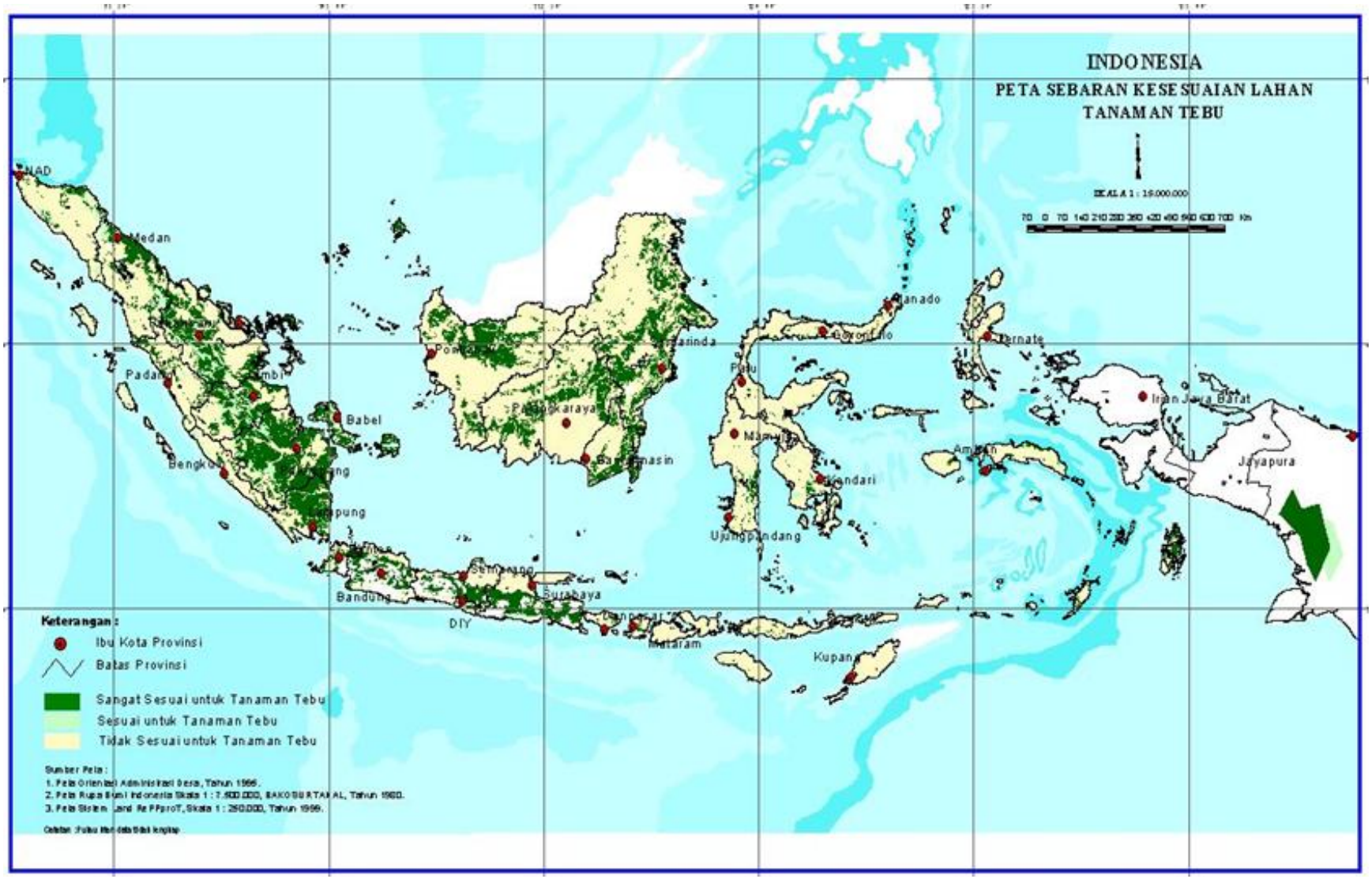
- PRODUCTION
  - PLANTING AREA 382 thousand ha
  - PRODUCTION 31,140 thousand ton
  - SUGAR PRODUCTION 2,244 thousand ton
  - Molasses 1,186 thousand ton
- CONSUMPTION
  - Sugar 2,500 thousand ton
  - Industry 1,000 thousand ton

  Total 3,500 thousand ton
  - Molasses

    Ethanol 40 % of total production of molasses

    MSG, etc 60 % of total production of molasses

Land Suitability Map for Sugarcane in Indonesia



Cassava and Sorghum

INDICATOR	COMMODITY	
	Cassava	Sorghum
1. Status		
• Harvesting Area (million ha)	1.208	0.113
• Productivity (ton/ha)	15.90	0.850
• Production (million ton)	19.232	0.096
2. Growth (1996 – 2005)		
• Harvesting Area (%/year)	-0.65	-
• Productivity (%/year)	1.70	-
• Production (%/year)	4.37	-

Cassava and Sorghum Utilization

Utilization	Commodity	
	Cassava	Sorghum
• Food (%)	64	25
• Animal Feed (%)	2	70
• Industry (%)	34	5

The facts indicated that it is needed an effort to increase production for bioethanol feedstock from cassava and sorghum without affect to animal feed and food production.

Potential sources of bioethanol feedstock

	Yield	Ethanol (l/Ha/year)
-Corn	1– 6 Ton/Ha/year	400 – 2500
-Cassava	10 – 50 Ton/Ha/year	2 000– 7 000
-Sugarcane	40 – 120 Ton/Ha/year	3 000 – 8 500
-Sweet potato	10 – 40 Ton/Ha/year	1 200 – 5 000
-Sorghum	3 – 12 Ton/Ha/year	1 500 – 5 000
-Sweet sorghum	20 – 60 Ton/Ha/year	2 000 – 6 000
-*Arrenga pinnata*	0.6 – 1.2 million liter/ha/year	40 000 liter/ha/year
-Molasses	2000 liter/ha/year	500 liter/ha/year

Target Bio Fuel Development until 2010

Parameter	Unit	Oil Palm	*Jatropha*	Sugarcane	Cassava	Total
Indirect Labor	person	750 000	500 000	1 500 000	750 000	3 500 000
Income/person (Sugarcane@0.5ha; Oil palm @2ha; Jatropha@3ha)	Rp/yr/person	20 000 000	13 500 000	9 140 625	12 000 000	54 640 625
Bioethanol or biodiesel	Ton oil	6 000 000	2 250 000	3 750 000	4 615 385	16 615 385
Production	Ton	30 000 000	7 500 000	60 000 000	30 000 000	127 500 000
Industry	unit	167	22 727	125	288	23 307
Planting Area	hectare	1 500 000	1 500 000	750 000	1 500 000	5 250 000
Indirect Labor	person	1 167	68 182	6 250	11 538	87 137
Seed	Ton	202 500 000	3 750 000	6 000 000	12 000 000	224 250 000
Investment on farm	Million Rp	45 000 000	4 500 000	11 250 000	5 250 000	66 000 000
Investment off farm	Million Rp	10 000 000	2 272 727	43 750 000	43 269 231	99 291 958

V. Conclusion

1. Bioenergy development should consider to several aspects such as socioeconomic, food security and environment. Establishment of national and international regulatory frameworks are important for sustainable development.

2. Village self-sufficiency energy program *(Desa Mandiri Energi or DME)* is a program of special region for biofuel development to open job opportunity and eliminate poverty at isolated or remote villages by empowering the society to fulfill their energy need.

3. The stages of bioenergy development from research to be ready commercialized have been done. Acceleration program is important for the construction of new bioenergy plants and plantation as a key driver in the continuity of raw material.

4. By several government regulations regarding fuel blending regulation and conversion of kerosene to LPG, opportunity to market bioenergy has been widely opened as the current government fully supports bioenergy development.


Thank You