MINISTRY OF ENERGY AND MINERAL RESOURCES OF THE REPUBLIC OF INDONESIA

DIRECTORATE GENERAL OF NEW, RENEWABLE ENERGY AND ENERGY CONSERVATION





INDONESIA BIOMASS TO ELECTRICITY DEVELOPMENT

Biomass Conversion Technology for Combined Heat and Power

Delivered By:

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Directorate of Bioenergy

Regional Workshop on Overcoming Critical Bottlenecks to Accelerate Renewable Energy Deployment in ASEAN+6 Countries

Bangkok, Thailand, 14-15 June 2016

OUTLINE

I. NATIONAL ENERGY POLICY

II. POLICY FOR BIOENERGY POWER PLANT

III. BIOMASS AND BIOGAS POWER PLANT

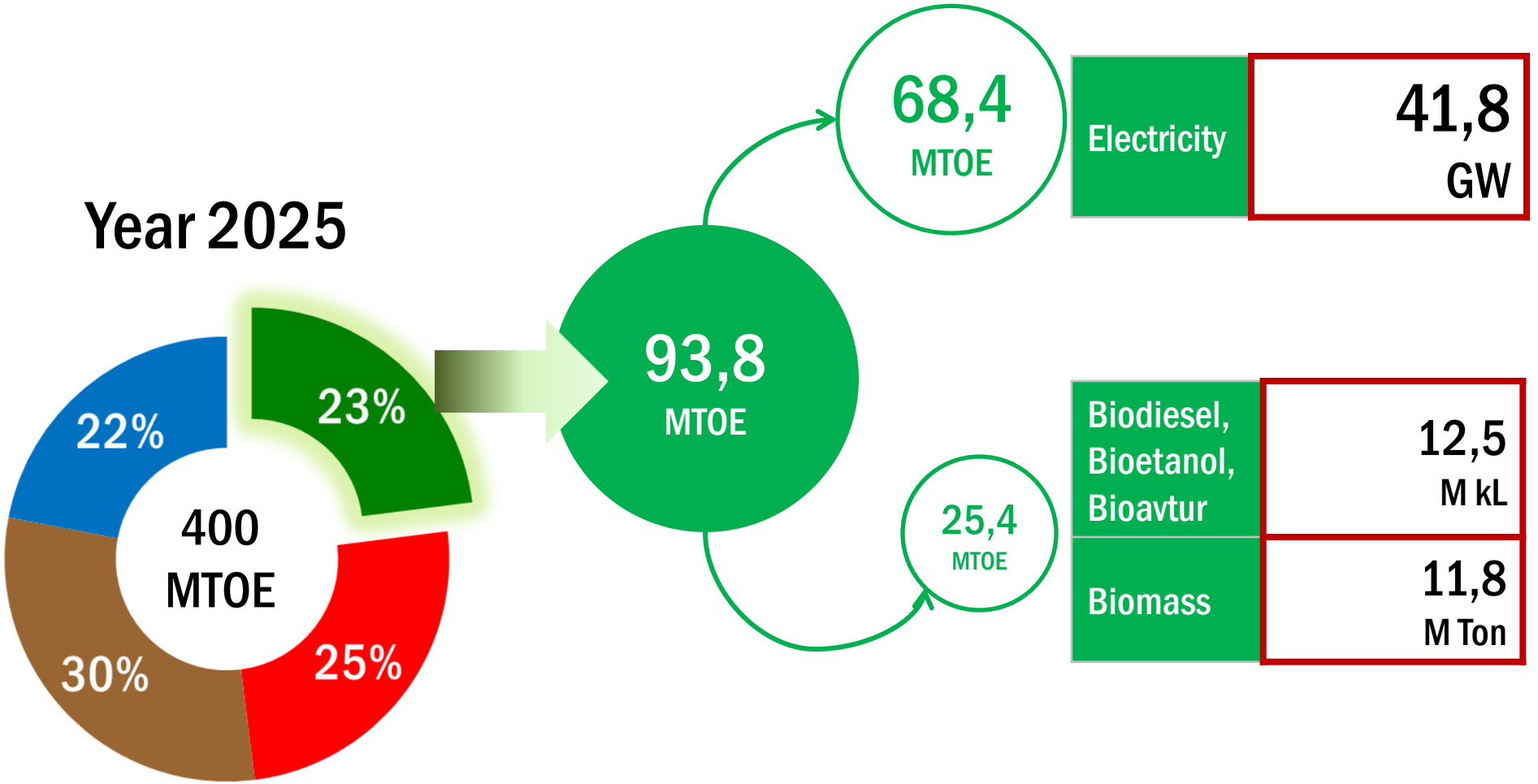
IV. MUNICIPAL SOLID WASTE POWER PLANT

V. CHALLENGES AND MOVE FORWARD

I. NATIONAL ENERGY POLICY

NRE Supply refer to National Energy Policy

NRE Supply 2025



NREEC Development Policy

1. **Improve the installed capacity of power generation /energy production;**
   Energy growth around 8% per year; require any additional capacity to meet energy demand; through geothermal and hydro.
2. **Improve the access to modern energy for isolated area from PLN's grid, particuarly the remote areas and small island;**
   On going program: electricity/rural energy with microhydro, solar, biomass, biogas.
3. **Reduce Fuel/electricity subsidies (energy) Diesel → Solar, Microhydro, Biomass, Biodiesel;**
   Diesel substitution with renewable energy could reduce subsidies.
4. **Reduce greenhouse gas emissions;**
   Efficiency improvement and utilization of new and renewable energy will minimize greenhouse gas emissions.
5. **Energy saving**
   Saving 1 kWh is cheaper and easier than generate 1 kWh.

NATIONAL ENERGY MIX ON ELECTRICITY GENERATION

PRIMARY NATIONAL ENERGY MIX (PP 79/2014)

Oil
25% ~ 96 MTOE

Natural Gas
22% ~ 76,75 MTOE

Coal
30% ~ 113,45 MTOE

NRE
23% ~ 84,15 MTOE

2025: 115 GW

Composition of Power Plant Capacity

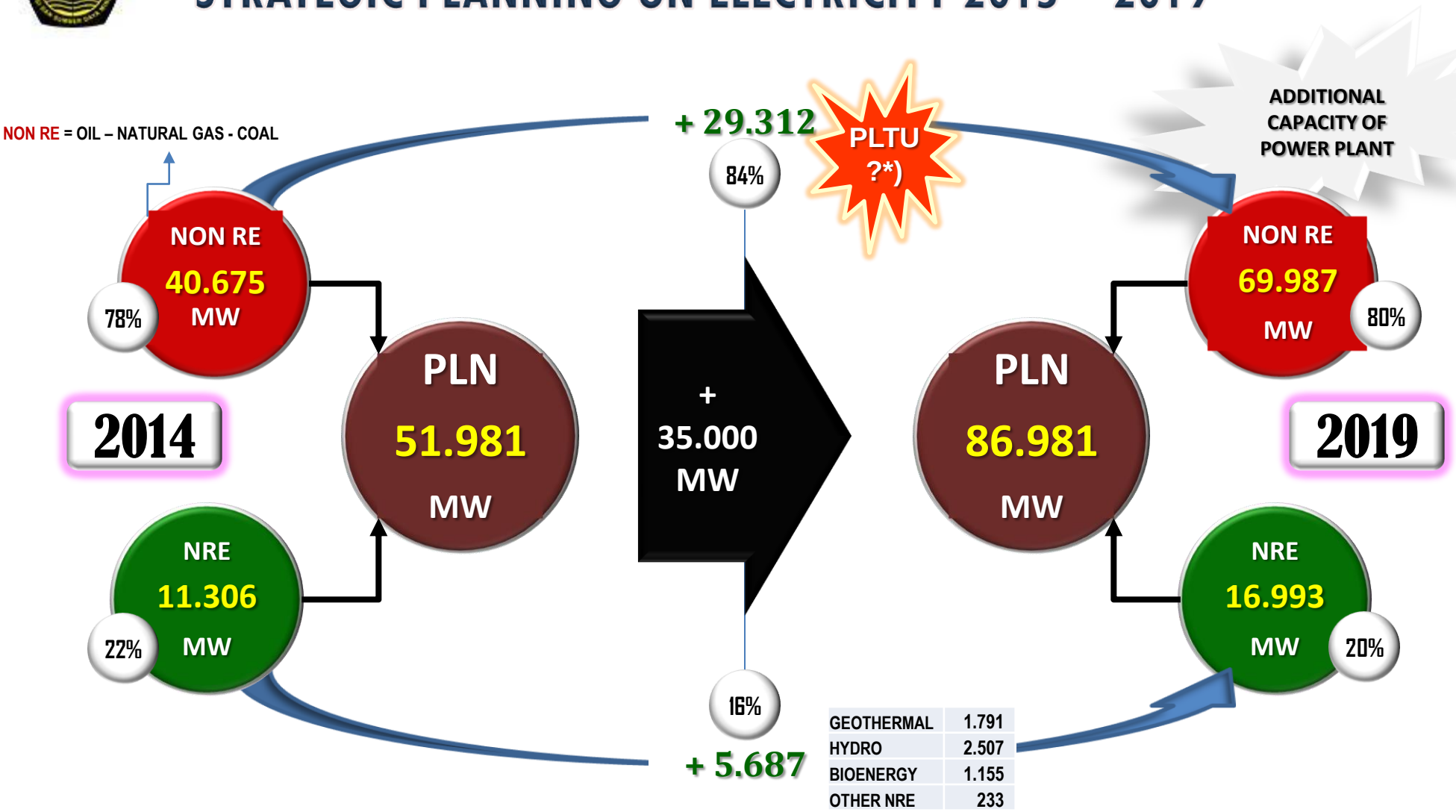
60% Fossil

40% NRE

68,2 GW

46,8 GW

STRATEGIC PLANNING ON ELECTRICITY 2015 – 2019



GEOTHERMAL	1.791
HYDRO	2.507
BIOENERGY	1.155
OTHER NRE	233

ADDITIONAL INVESTMENT: 20 Billion US$ or approximatelu Rp. 260 Triliun
(only for NRE Power Plant).

II. POLICY FOR BIOENERGY POWER PLANT

POLICIES AND REGULATIONS

1. LAW NO. 30 YEAR 2007 concerning on Energy

- Priority supply and use of renewable energy, one of them is bioenergy

2. LAW NO. 18 YEAR 2008 concerning on Waste Management

- Management of MSW to improve people's health, environment quality, and waste as a resource

3. GOVERNMENT REGULATION NO 79 YEAR 2014 concerning on National Energy Policy

- Optimize the utilization of biofuel
- Increase NRE contribution in the total energy mix up to 23% by 2025 and 31% by 2050
- Energy leasticity less that 1 by 2025

4. PRESIDENT REGULATION NO. 18 YEAR 2016 concerning on the Acceleration of the Municipal Solid Waste Development for concerning on the Acceleration of the Municipal Solid Waste Development for DKI Jakarta Province, Tangerang City, Bandung City, Semarang City, Surakarta City, Surabaya City, and Makassar City

Regulate the management and utilization of waste to energy through the development of MSW power plant in 7 cities

5. MEMR REGULATION NO. 44/2015 and NO. 27/2014 concerning on FIT of Biomass, Biogas, and Municipal Solid Waste Poert Plan

- Regulate feed-in tarriff for electricity produced from Biomass, Biogas, and MSW Power Plant

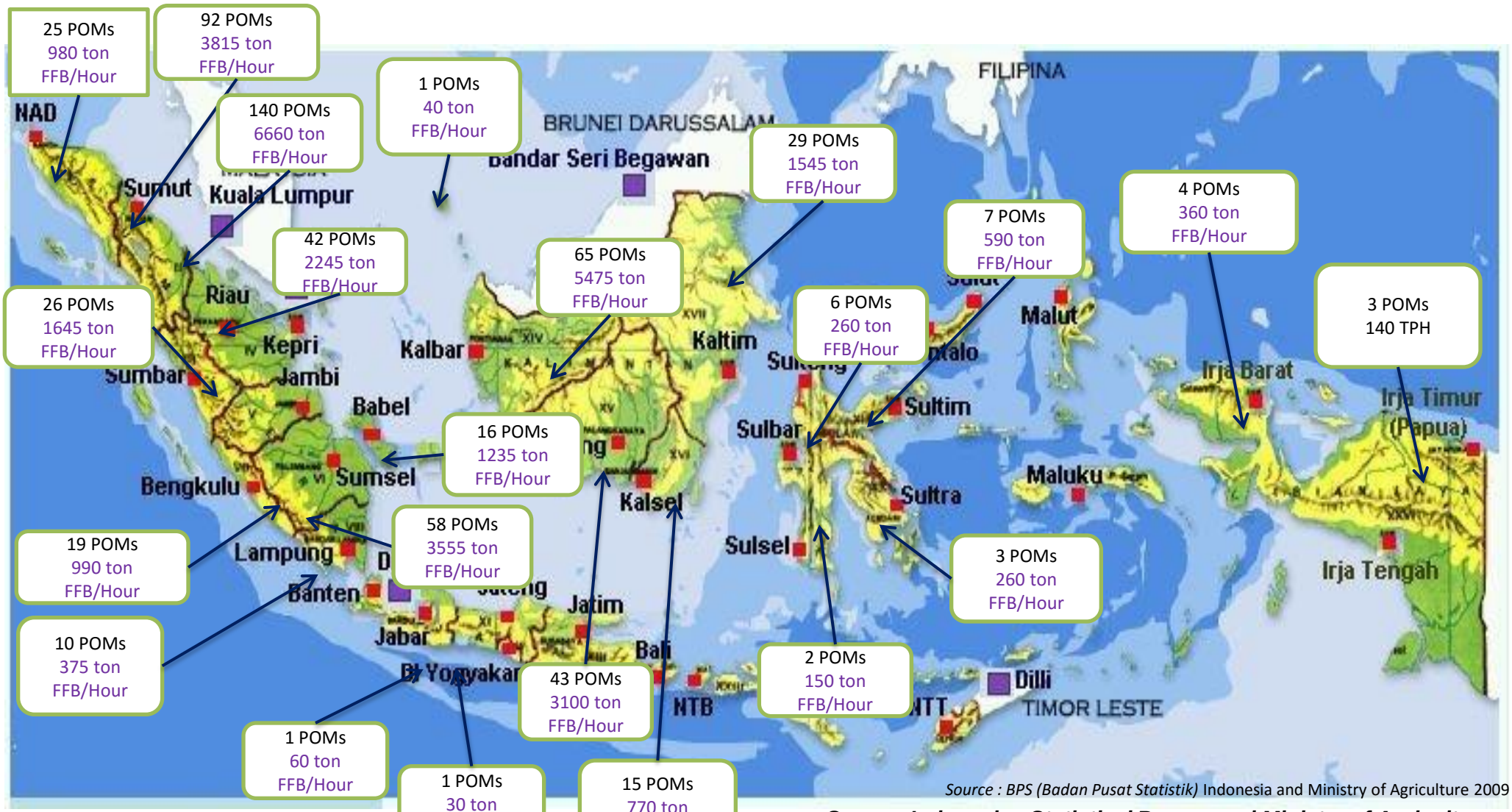
III. BIOMASS AND BIOGAS POWER PLANT

BIOMASS POTENTIAL FOR ELECTRICITY

No	Potential (MWe)	Unit	Sumatera	Kalimantan	Jawa-Bali-Madura	Nusa Tenggara	Sulawesi	Maluku	Papua	Total
1	Palm oil	MWe	8.812	3.384	60	-	323	-	75	12.654
2	Sugar cane	MWe	399	-	854	-	42	-	-	1.295
3	Rubber	MWe	1.918	862	-	-	-	-	-	2.781
4	Coconut	MWe	53	10	37	7	38	19	14	177
5	Rice husk	MWe	2.255	642	5.353	405	1.111	22	20	9.808
6	Corn	MWe	408	30	954	85	251	4	1	1.733
7	Cassava	MWe	110	7	120	18	12	2	1	271
8	Wood	MWe	1.212	44	14	19	21	4	21	1.335
9	Cow dung	MWe	96	16	296	53	65	5	4	535
10	MSW	MWe	326	66	1.527	48	74	11	14	2.066
	Total potential	MWe	15.588	5.062	9.215	636	1.937	67	151	32.654

1) Based on MEMR survey in 2011 – 2012
2) Biofuel resources are palm oil, molasses, cassava, etc

POTENTIAL OF PALM OIL FOR ENERGY



Source : BPS (Badan Pusat Statistik) Indonesia and Ministry of Agriculture 2009

Souce : Indonesian Statistical Beurau and Ministry of Agriculture

POTENTIAL OF PALM OIL FOR ENERGY

Shell

Fiber

Empty Fruit Bunch

Palm Oil Mill Efluent (POME)

Palm Oil
(10% Oil - 90% Biomass)

Palm Oil Mills (POM) → **Electricity Power for Own-Use To fulfil the electricity needs of Palm Oil Mills**

From the POM's production capacity of 30 ton/hour of Fresh Fruit Bunch (FFB), can produce power as much as:

- 3 – 4 MW from Biomass Power Plant (PLTBm)
- 1 MW from Biogas Power Plant (PLTBg) came from POME

From around ±850 units of POM nationally, with the average of FFB production capacity around 30-45 ton/hour, generally it can produce power as much as:

- 3000 MW from Biomass Power Plant (PLTBm)
- 1000 MW from Biogas Power Plant (PLTBg) came from POME

DEVELOPMENT STAGE OF BIOENERGY

EARLY STAGE 1 – 2 YEARS	INTERMEDIATE STAGE 2 – 4 YEARS	FINAL STAGE 3 – 6 YEARS
UTILIZATION OF WASTE	UTILIZATION OF SIDE RESULT	DEVELOPMENT OF DEDICATED BIOENERGY RESOURCES
- Waste that does not have economic value (liquid waste oil palm, agro-industrial, municipal waste) - Technology has been proven - A combination of incentives and mandatory - Developed with the cooperation of government and private approaches - Potential ranges from 2,000 MW	- Currently used as a fertilizer, export commodities or other materials, for example palm shells, empty fruit bunches, rice husks. - Feed-in Tariff that there needs to be revised as a result of the strengthening of the dollar - Settings feedstock - Potential ranges from 10 thousand MW	- Developed in an integrated manner - Potential for development in all regions of the country, including in the islands, remote areas; - Create jobs opportunities - Commercially developed Involving forestry, agriculture and local government

FEED-IN TARIFF
BIOMASS AND BIOGAS POWER PLANT

MEMR Regulation No. 27 Year 2014

No	Energy	Capacity	Electricity Tariff	Note
Medium Voltage				
1.	Biomass	until 10 MW	Rp. 1.150,- / kWh X F	
2.	Biogas	until 10 MW	Rp. 1.050,- / kWh X F	Non Municipal Solid Waste
Low Voltage				
1.	Biomass	until 10 MW	Rp. 1.500,- / kWh X F	
2	Biogas	until 10 MW	Rp. 1.400,- / kWh X F	Non Municipal Solid Waste

F as an incentive factor based on the region where the power plant installed

Jawa Island	F = 1,00	Sumatera Island	F = 1,15
Sulawesi Island	F = 1,25	Kalimantan Island	F = 1,30
Bali, Bangka Belitung, Lombok	F = 1,50	Riau achipelago, Papua and the rest island	F = 1,60

- Applied only for biogas and biomass power plant with capacity up to 10 MW
- Measurable procedure for permitting process
- Incentives for diesel fuel replacement
- Incentives based on region
- Supporting Indonesian Sustainable Palm Oil (ISPO) which based on palm oil for electricity generation
- Short construction period (2 years)
- Being revised to adopt current investment condition of biomass and biogas power plan

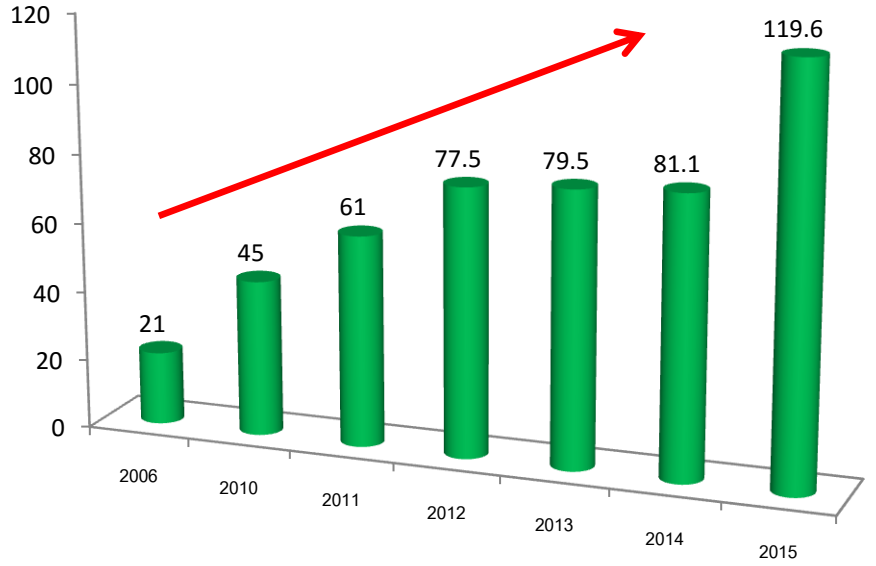
ACHIEVEMENTS OF BIOENERGY POWER PLANT

Installed Capacity Off Grid

Region and Biomass Source	Off-Grid Capacity(MW)
Sumatera	
Palm industry	335
POME	9
Sugar industry	66
Paper Industry	955
Kalimantan	
Palm industry	91
Jawa-Bali	
Palm industry	2
Sugar industry	142
Sampah kota	-
Sulawesi	
Palm industry	11
Sugar industry	11
Papua	
Palm industry	4
Total	1,626

- Current capacity of bioenergy based on-grid power plant in year 2015 is 119.6 MW and based off-grid power plant is 1,626 MW.
- Biomass in Indonesia can be generated electricity to 32 GW

Installed Capacity On Grid (MW)



Installed Capacity of Biomass and Biogas Power Plant until 2015 is **119,6 MW**, consist of:

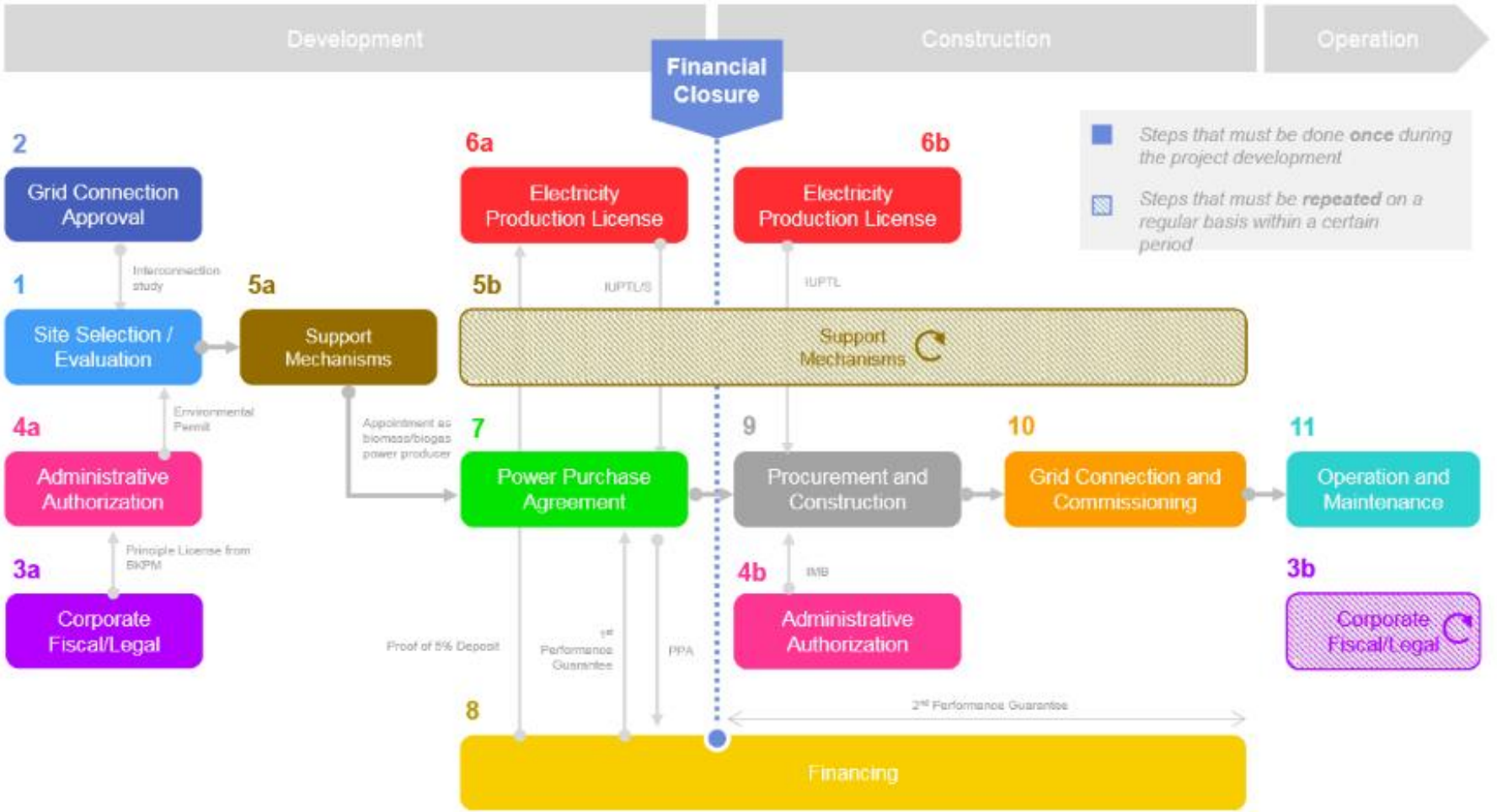
- Solid Palm Oil Waste: 97,4 MW
- Liquid Palm Oil Waste/POME: 4,6 MW
- MSW: 17,6 MW

Procedure: Step-by-step

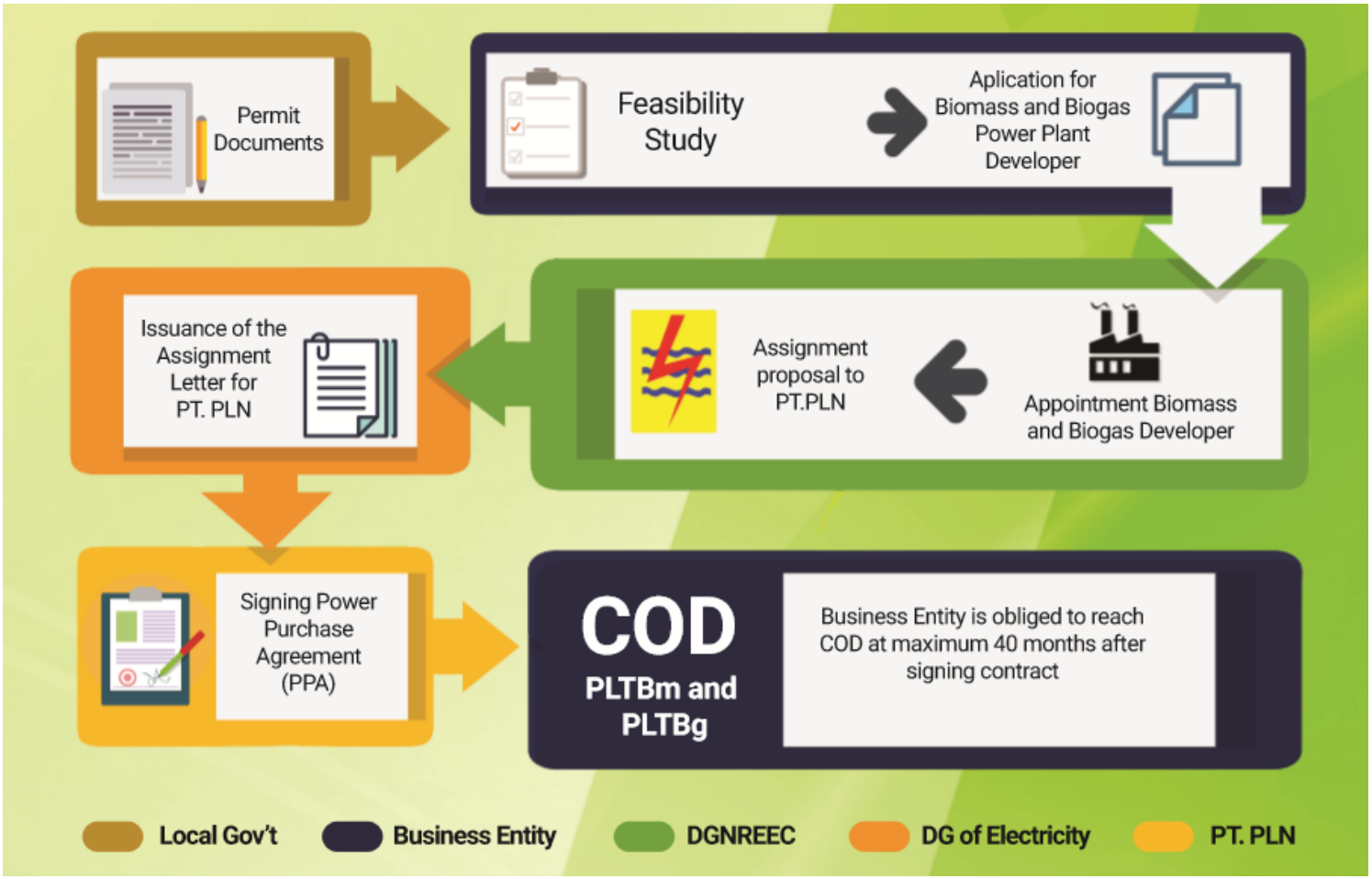
Biomass/biogas Power Plant Development in Indonesia

Gantt Chart | Flow Chart | Description

< Page 2/2



GENERAL MECHANISM FOR BIOMASS AND BIOGAS POWER PLANT PERMIT PROCEDURE



Requirements:

1. Company Profile
2. Permit Document
3. Technical Feasibility Study
4. Interconnection Study
5. Schedule from the construction until COD
6. Guarantee Letter of the availability of land and feedstocks
7. Statement to support Local Contains
8. Commitment to deliver certificates of deposit 5% of the total investment
9. Affidavit on the ability to follow the contents in PPA
10. Statement to commit conciously and responsibly to accept and implement sanctions

EXAMPLE OF BIOENERGY POWER PLANT IMPLEMENTATION

PLTBm PT. Growth Sumatra Industry, Medan

- Unit 1, Excess Power 6 MW, COD DeC 2008
- Unit 2, Excess Power 9 MW, COD Nov 2010

PLTBm PT. Growth Asia, Medan

- Unit 1, Excess Power 10 MW, COD Oct 2011
- Unit 2, Excess Power 10 MW, COD June 2012

PLTBm PT. Rimba Palma Sejahtera Lestari, Jambi

•2x15 MW

EXAMPLE OF BIOENERGY POWER PLANT IMPLEMENTATION

- Palm oil mill effluent, tapioca industry, the industry know, slaughterhouses, large-scale farms
- Buffle Anaerobic Reactor Technology - covered lagoon

Biogas POME Power Plant in Rokan Hulu, RIAU
Biogas : 750 m^3/hour (60% CH_4)
Utilization : 1 MW for 1.050 household

PLT Biogas dari Palm Oil Mill Effluent (POME) di PTPN V, Kebun Tandun, RIAU
Biogas : 850 m^3/hour (60% CH_4)
Utilization : 1 MW own use

PT AUSTINDO NUSANTARA JAYA
1st IPP Biogas POME Power Plant On Grid

IV. MUNICIPAL SOLID WASTE POWER PLANT

WASTE TO ENERGY (WtE) PROGRAM

Why Waste to Energy?

- The waste problem is an environmental issues in terms of producing methane gas (CH4) and carbon dioxide (CO2);
- Increasing population, increases the volume of waste;
- Limited capacity and lifetime of existing Final Disposal Site;
- Municipal solid waste has a potential of biomass energy that can be converted to electricity;
- Can be developed in all regions of the country;
- Contributes to improve the cleanliness and health of the city

- The Potential of Waste to Energy in Indonesia is 2.066 MW while current installed capacity for MSW Power Plant is 17.6 MW
- Still in the construction: 51.56 MW additional capacity

*based on the MEMR Survey in 2013

MEMR REGULATION NO. 44/2015: FEED IN TARIFF (FIT) FOR MSW POWER PLANT

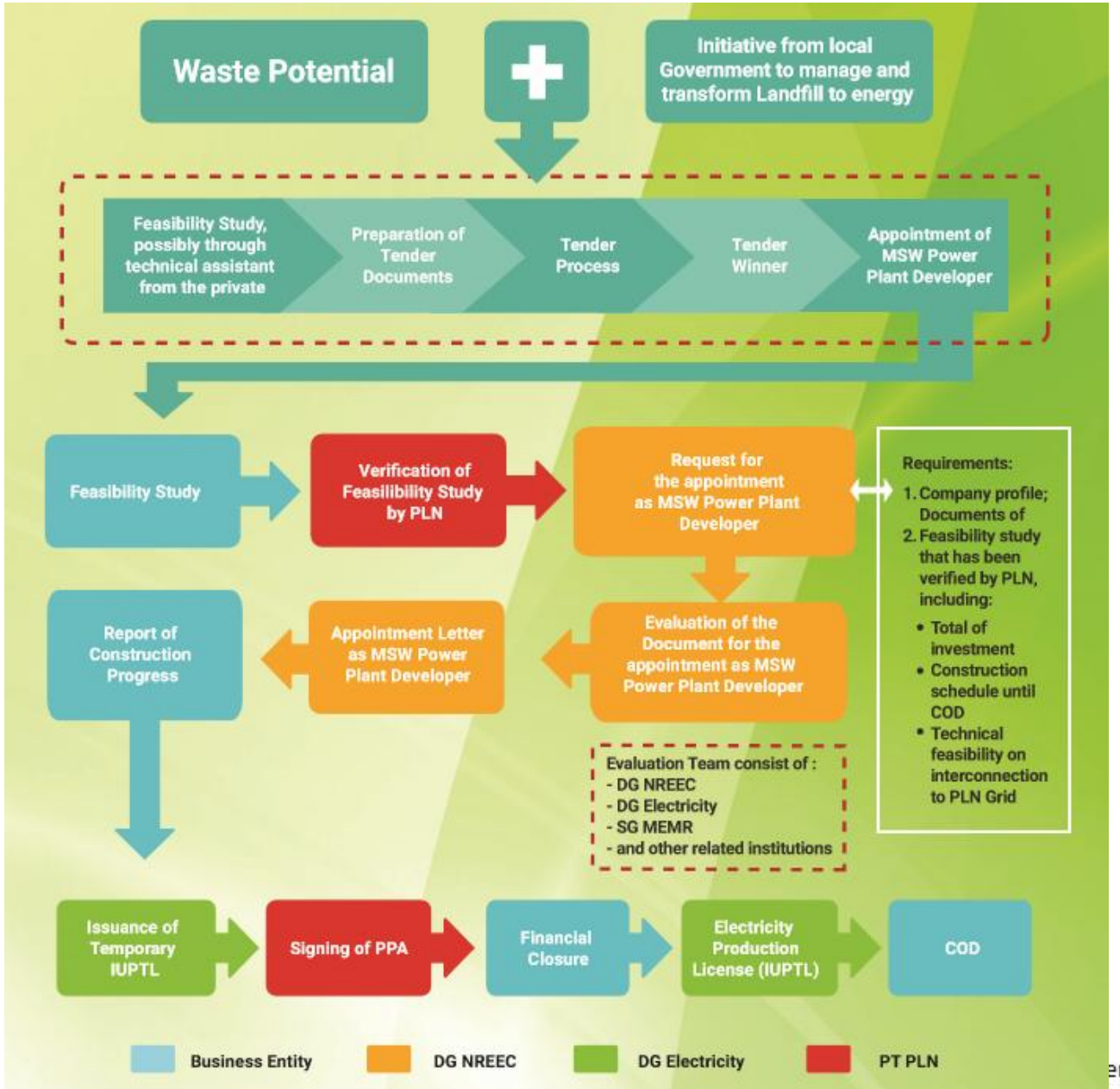
NO	Electricity Voltage	Electricity Tariff (cent USD/kWh)		
		Capacity up to 20 MW	20 MW < Capacity ≤ 50 MW	Capacity > 50 MW
A.	METHANE GAS COLLECTION AND UTILIZATION USING SANITARY LANDFILL TECHNOLOGY, ANAEROBIC DIGESTION, AND ITS KIND			
1.	High Voltage	16,55	-	-
2.	Medium Voltage		-	-
3.	Low Voltage	20,16	-	-
B.	HEAT/THERMAL UTILIZATION USING THERMOCHEMICAL TECHNOLOGY			
1.	High Voltage	18,77	15,95	13,14
2.	Medium Voltage		-	-
3.	Low Voltage	22,43	-	-

MEMR REGULATION NO. 44/2015: KEY POINTS

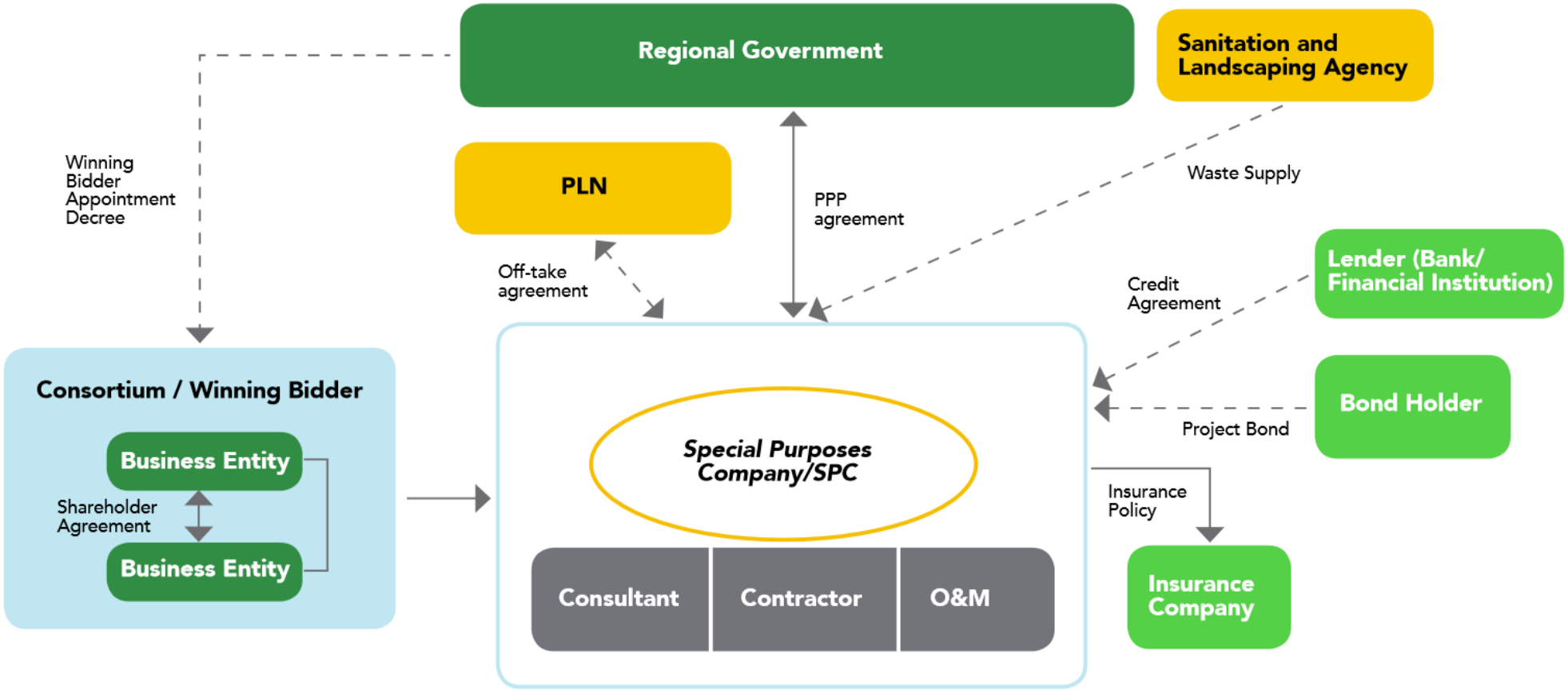
1. Minister of Energy and Mineral Resources assigns PLN to purchase the electricity from MSW Power Plant managed by Business Entities (of which has signed a cooperation contract with Local Government or Municipal solid waste management)
2. The Minister's assignment is direct to PLN to purchase the electricity
3. The Feed In Tariff is inclusive:
   a. The entire procurement cost of the interconnection grid from MSW Power Plant grid to grid of PLN
   b. The price is set forth in the PPA without any negotiation or escalation
   c. Effective at the time MSW Power Plant is declared to have reached its COD as scheduled in PPA
4. Payment transaction for purchasing the electricity from MSW Power Plant between PLN and the business entity shall be made in rupiah denomination using the exchange rate at Jakarta Interbank Spot Dollar Rate (JISDOR) at the time as agreed in PPA
5. PPA is valid for 20 (twenty) years since COD with the possibility for extension

BUSINESS SCHEME OF MSW POWER PLANT:

By Business entities that sign the contract with Local Government



Typical Contractual Framework For A WtE Project Under A PPP Scheme in Indonesia



WTE PPP PROJECT BENOWO SURABAYA

1. Sanitary Landfill
2. Waste Water Treatment
3. Support Facility
4. Landfill Gas Collection
5. Landfill Power Plant
6. Gasification Power Plant
7. Tipping Road
8. Waste Reconditioning Facility

V. CHALLENGES AND MOVE FORWARD

CHALLENGES

Financing and Investment

High initial investment costs and the Bank is less interested in providing funding related to new fields such as renewable energy,

Follow up action: Implementation of interest rate subsidy and Project Guarantee, Capacity Building on Banking Sector on Technical Aspect of RE Project

Raw Materials

Guarantee availability of raw materials, mostly derived from waste and bioenergy crops

Follow up action: Forest for Energy Program

Infrastructure

The Importance of infrastructure development, such as the construction of a distribution network to Biomass Power Plants and Biogas Power Plants

Follow up action: Network infrastructure development by government as part of the rural electrification program

Beyond Bioenergy from Palm (Move Forward)

1. The revision is being finalized for ***feed-in tariff*** of biogas and biomass-based power generation.
2. Being prepared the regulation on the liability of palm oil liquid waste utilization for electric energy (in the form of joint regulation , MEMR, MOEF and MOA).
3. Being examined the establishment of institutions that will handle the purchase of electricity from renewable energy generation, including the payment of the difference in the cost of electricity production EBT with the PLN' s Production Cost
4. Being examined/structured business models developing power plants based on CPO.
5. Being developed a program for Sustainable Energy Farm in Central Kalimantan as a pilot development dedicated feedstock to bioenergy.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Kementerian Energi dan Sumber Daya Mineral
2016
Directorate of Bioenergy
Directorate General of New Renewable Energy and Energy Conservation
Ministry of Energy and Mineral Resources
2016

german cooperation

Implemented by: giz

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Handbook

POME-to-Biogas

Project Development in Indonesia

Second Edition

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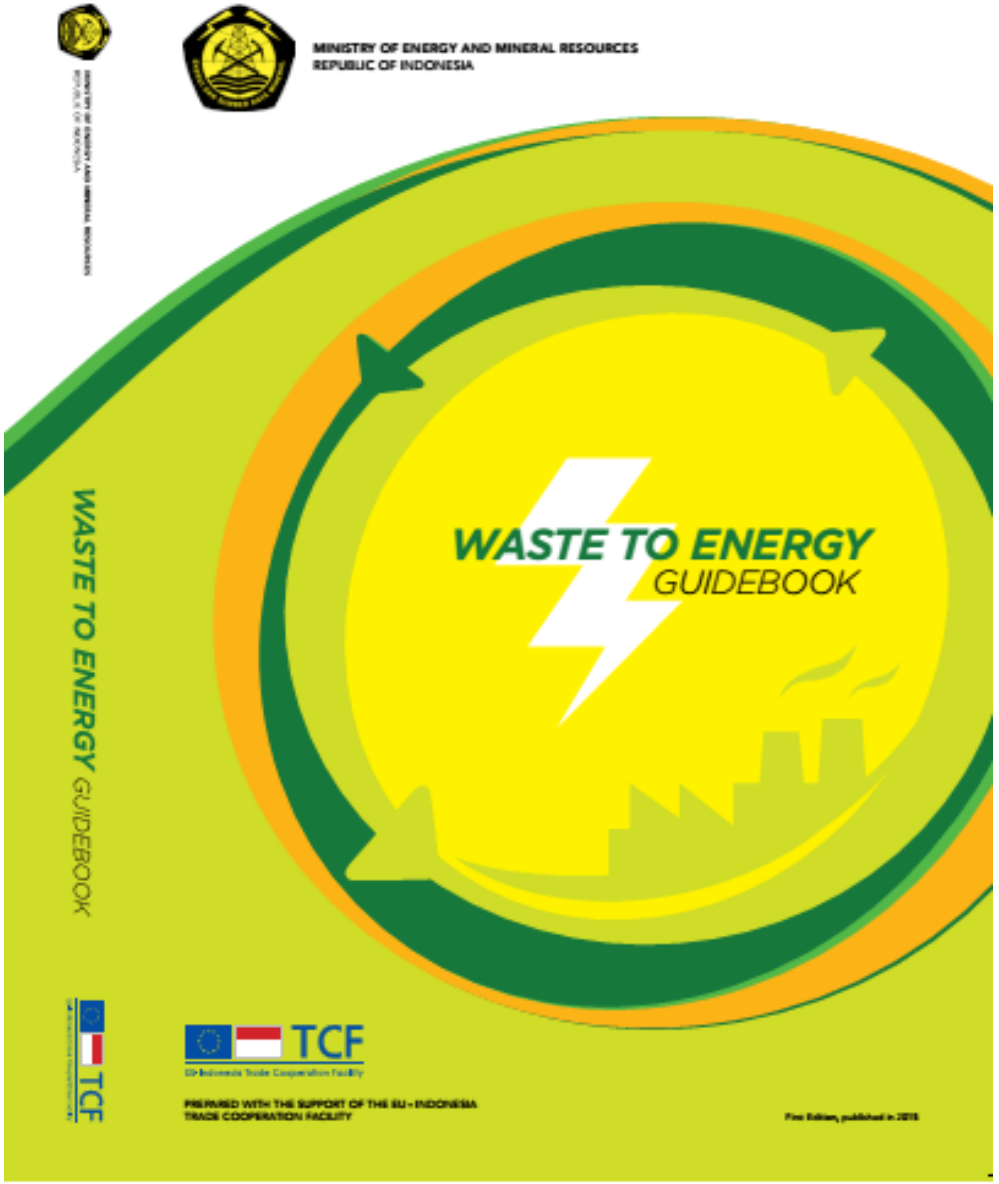
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Roadmap for Sustainable Finance in Indonesia

2015-2019

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PENETAPAN PENGEMBANG PLT BIOENERGI

No	Jenis PLT	Jumlah Pengembang	Total Kapasitas (MW)	Total Investasi (IDR Milyar)
1.	PLT Biomassa	19	168,63	3731,45
2.	PLT Biogas	22	38,1	921,96
3.	PLT Sampah	6	34,66	1706,61
	TOTAL	**47**	**241,19**	**6360**

Setelah Permen ESDM No.27 Tahun 2014 dan Permen ESDM No.19 Tahun 2013 ditetapkan, telah terdapat 47 pengembang yang mengajukan Penetapan sebagai pengembang PLTBg, PLTBm dan PLTSa,

PLTBm telah mendapat penetapan: 14 pengembang
PLTBg telah mendapat penetapan: 5 pengembang
PLTSa telah mendapat penetapan: 1 pengembang