

# **Overview of Renewable Energy in Indonesia**

## **Andhika Prastawa**



**47<sup>th</sup> Expert Group Meeting on New and Renewable Energy  
Technology**

**10 October 2015**

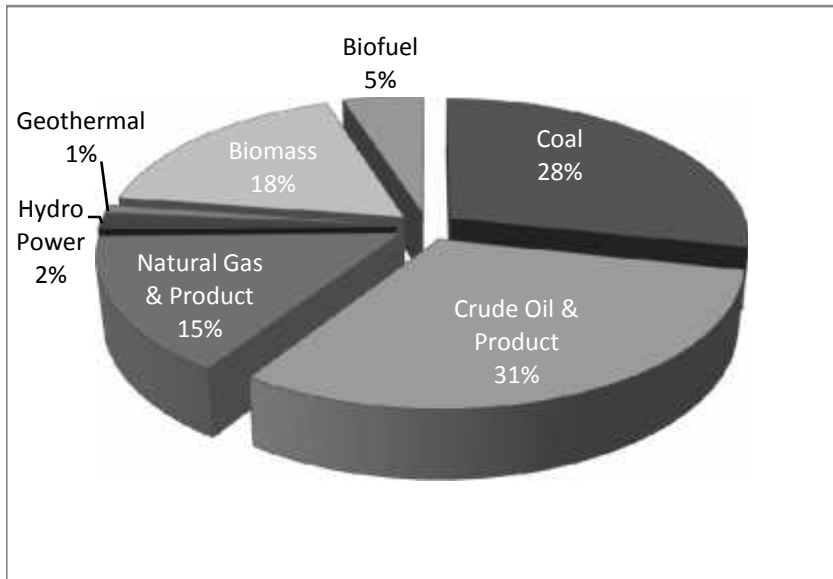
# Outline

- ❑ National Energy Balance of Indonesia in 2014
  - ❑ Current State of the Energy Supply
  - ❑ Energy consumption
  - ❑ Projection up to 2025
- ❑ Renewable Energy Policy Framework
  - ❑ Fuel
  - ❑ Electricity
- ❑ Conclusions



# **NATIONAL ENERGY BALANCE OF INDONESIA IN 2014**

# Current National Energy Supply



**TOTAL PRIMARY ENERGY SUPPLY : 1.75 MBOE**

ENERGY MIX	PRIMARY ENERGY (MILLION BOE)
Oil	584
Coal	288
Gas	236
NRE	67
Biomass	88

- As a large middle-income country with a growing economy, a critical component of Indonesia's future strength will be its ability to harness and manage sustainable sources of energy
- Growth of Indonesia's Economy is 5-6% annually and growth of population is 1.2% annually, energy elasticity: 1.65 → Growth of Energy Demand is 7% annually
  - High dependency on fossil energy and the reserve decreases (about 92% in the national energy mix when biomass is excluded)
  - The development of new and renewable energy resources are not optimal



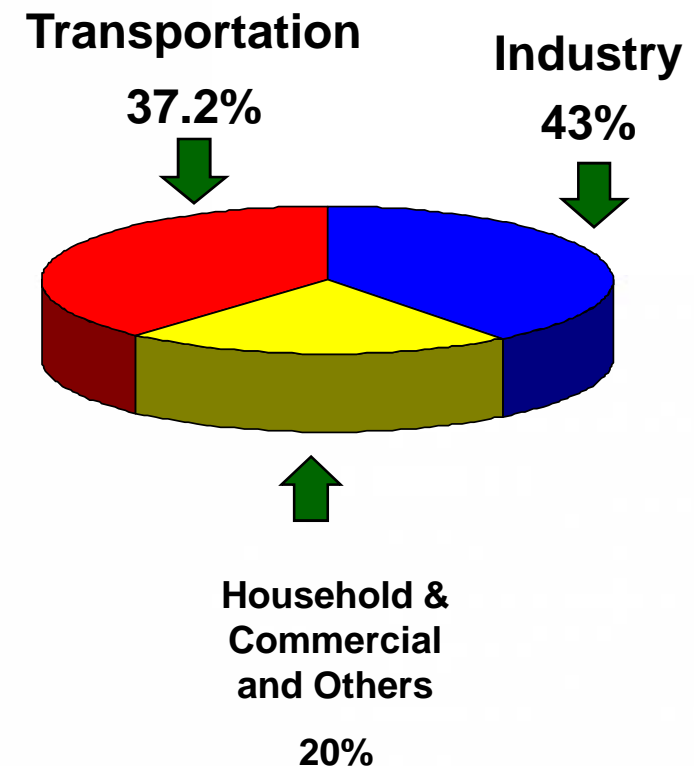
## Energy Balance Table 2014 in Thousand BOE

		Hydro	Geothermal	Biomass	Coal	Brikette	Natural Gas	Crude Oil	Fuel	Biofuel	LPG	Other Petroleum	Electricity	LNG	Total
<sup>1</sup>	Primary Energy Supply	38,139	16,192	310,162	497,805	-	421,205	315,634	197,515	88,843	31,646	22,245	6	149,830	1,745,071
	a. Production	38,139	16,192	310,162	1,924,006	-	482,749	287,902	-	88,843	-	-	-	-	3,147,993
	b. Import	-	-	-	10,662	-	-	121,993	195,181	-	30,723	7,009	6	-	365,573
	c. Export	-	-	-	1,604,286	-	61,543	109,933	4,101	-	-	29,254	-	149,830	1,958,948
	d. Stock Change	-	-	-	167,423	-	-	15,672	6,435	-	923	-	-	-	191,391
<sup>2</sup>	Energy Transformation	38,139	16,192	126	277,166	58	275,878	309,445	110,599	-	20,296	89,943	140,104	171,909	384,037
	a. Refinery	-	-	-	-	-	3,771	309,445	159,362	-	4,667	89,943	-	-	59,245
	b. Gas Processing	-	-	-	-	-	181,169	-	-	-	15,629	-	-	171,909	6,370
	c. Coal Processing Plant	-	-	-	69	58	-	-	-	-	-	-	-	-	10
	d. Power Plant	38,139	16,192	126	277,097	-	90,939	-	48,764	-	-	-	140,104	-	331,152
	- State Own Utility(PLN)	28,108	6,450	-	187,341	-	80,854	-	48,726	-	-	-	107,458	-	244,022
	- Independent Power Producer Non-PLN)	10,031	9,742	126	89,756	-	10,084	-	38	-	-	-	32,647	-	87,130
<sup>3</sup>	Own Use and Loss	-	-	-	-	-	43,220	6,189	565	177	-	-	18,297	22,079	90,528
	a. During Transformation	-	-	-	-	-	3,771	6,189	-	-	-	-	5,164	-	15,124
	b. Energy Use Own Use	-	-	-	-	-	39,450	-	-	-	-	-	-	-	39,450
	c. Transmission & Distribution	-	-	-	-	-	-	-	565	177	-	-	13,132	22,079	39,954
<sup>4</sup>	Final Energy Supply	-	-	310,036	220,639	58	102,107	-	307,549	88,666	51,942	67,697	121,813	-	1,270,506
<sup>5</sup>	Statistic Discrepancy	-	-	-	-	-	22,360	-	-	-	-	-	70	-	22,290
<sup>6</sup>	Final Energy Consumption	-	-	310,036	220,639	58	124,467	-	307,549	88,666	51,942	67,697	121,743	-	1,292,796
	a. Industry	-	-	45,188	220,639	58	93,551	-	32,994	-	753	-	40,402	-	433,585
	b. Transportation	-	-	-	-	-	207	-	245,235	88,666	-	-	95	-	334,203
	c. Household	-	-	263,495	-	-	114	-	4,929	-	49,810	-	51,545	-	369,893
	d. Commercial	-	-	1,353	-	-	1,447	-	4,232	-	1,379	-	29,701	-	38,113
	e. Other Sector	-	-	-	-	-	-	-	20,157	-	-	-	-	-	20,157
<sup>7</sup>	Non Energy Use	-	-	-	-	-	29,148	-	-	-	-	67,697	-	-	96,845

## Final Energy Consumption 2014

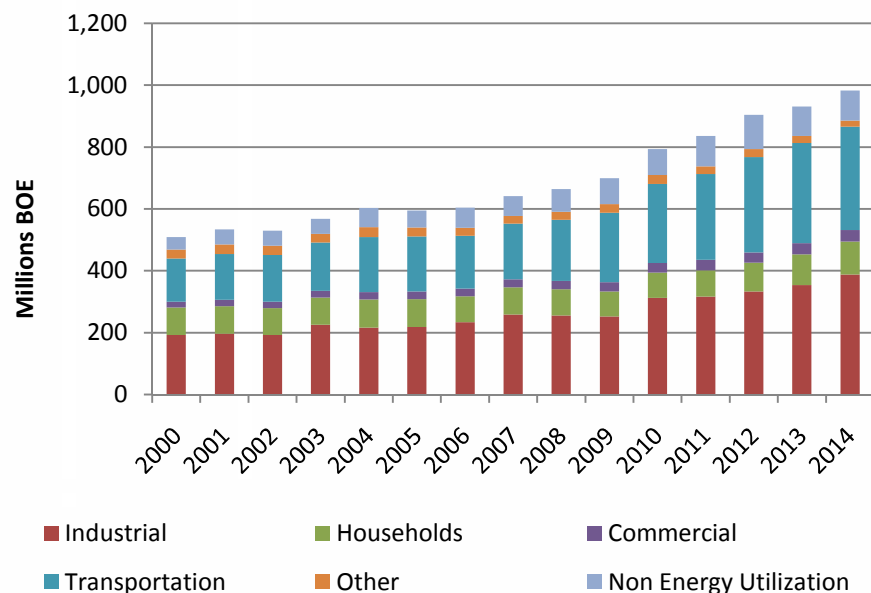
(Industry and Transport Sectors are equally the largest final energy consumers)

Sector	Final Commercial Energy Consumption (Million BOE)
Industry	388
Transportation	334
Household	106
Commercial	37
Others	20
Non Energy Utilization	97
Total	983



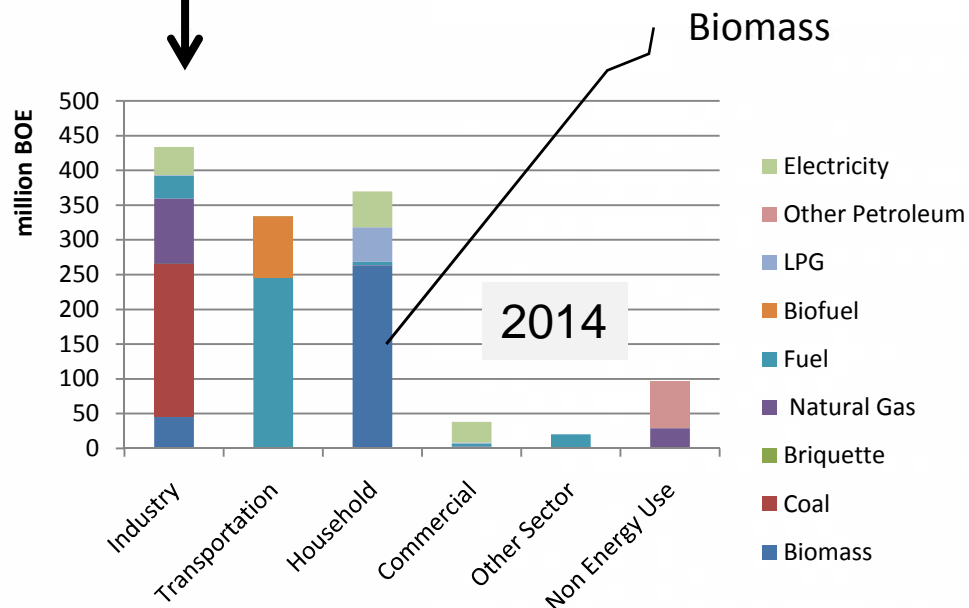
*\*Biomass is excluded*  
Source: Statistic DGEEU 2015

# Consumption



Demand growth accelerates, despite various effort to curb it

- Industry has the most variety of energy options
- Large share of household energy is still met by conventional biomass.
- Transportation is still heavily oil dependent



# Where did our Liquid Fossil Fuels Go? Transportation

Figure 4.6 Liquid fuels balance

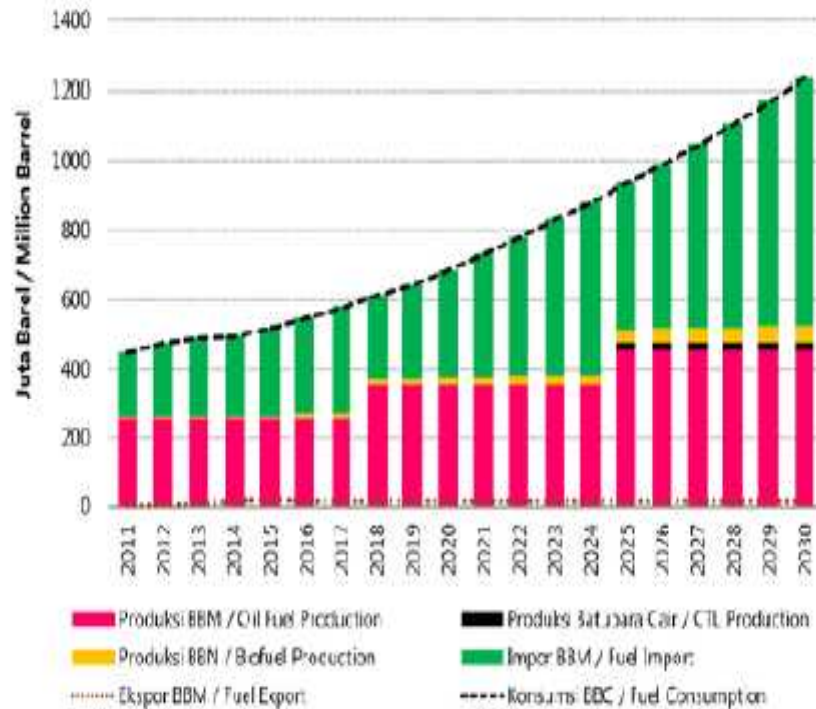
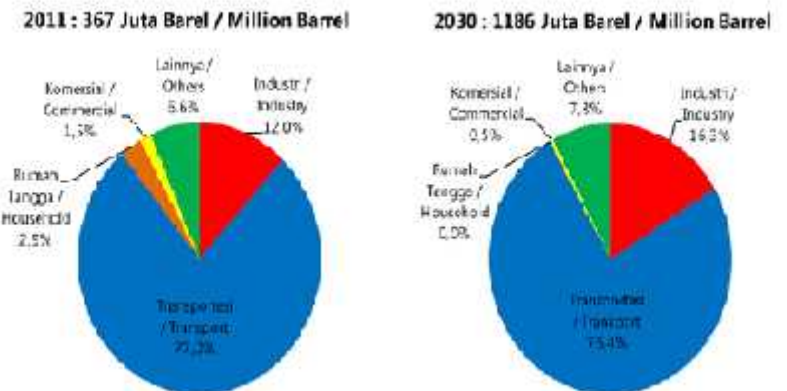


Figure 4.7 Share of Liquid Fuels Utilization per sector



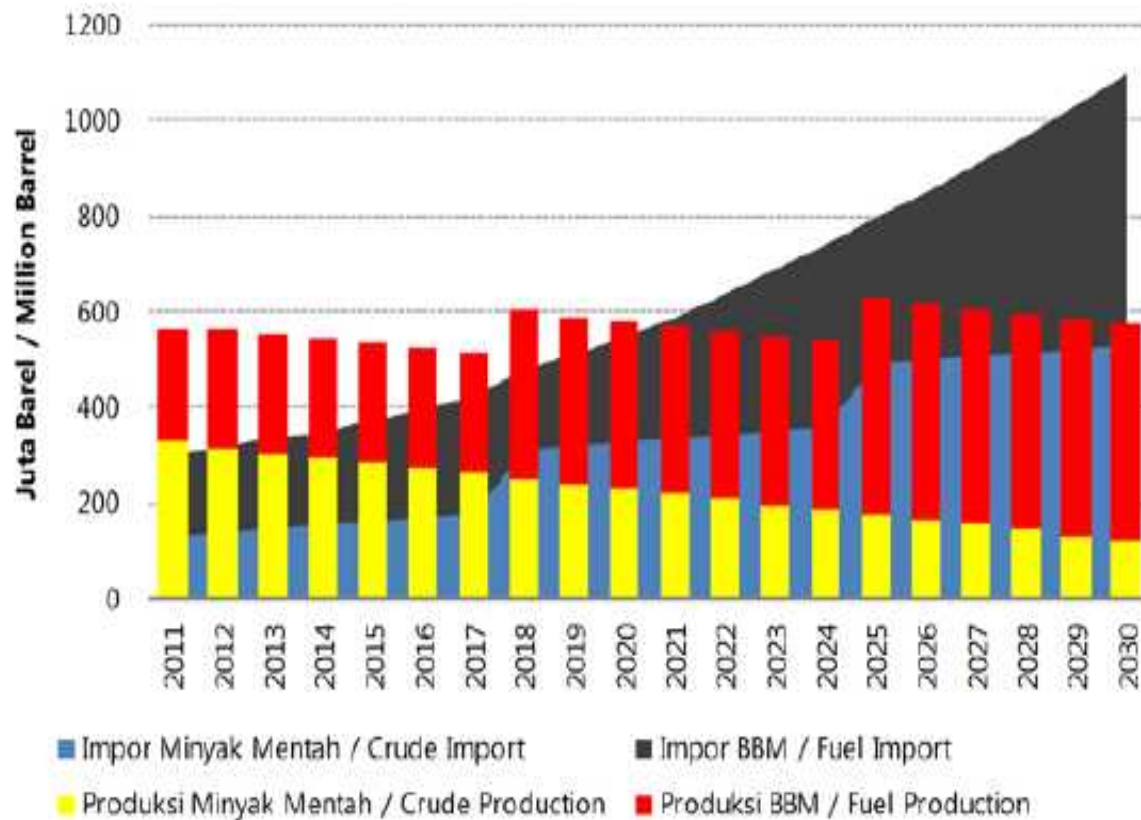
Therefore: Diversified Energy mix in the transportation sector may contribute to :

- the government target of National energy mix
- Reduction of Fuel import
- May have spill over in
  - building more coal fired power plant
  - Use the currently exported gas for domestic use
  - More biofuel



## Projection up to 2025: We are no Longer Oil Export Power house

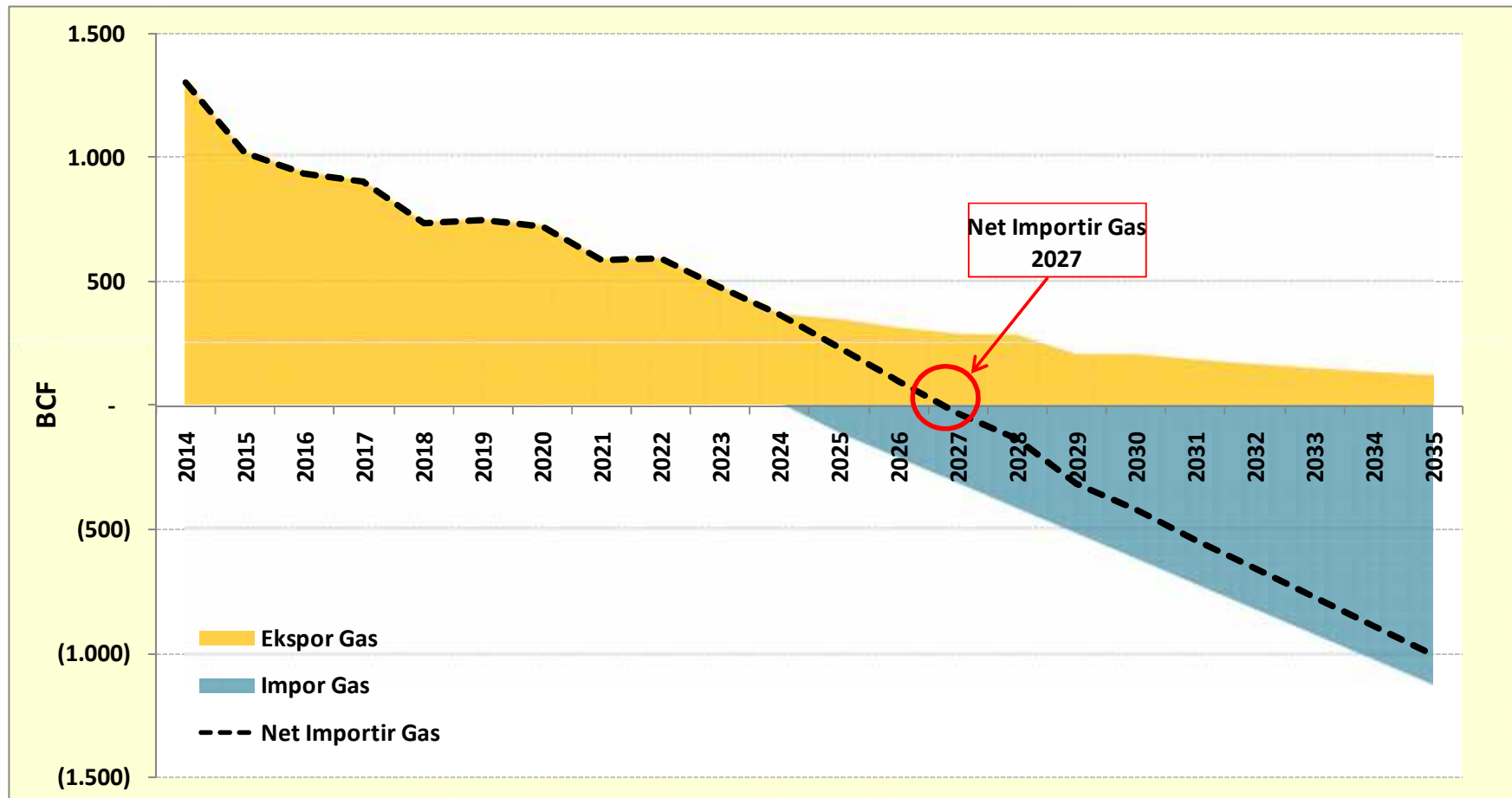
Figure 4.8 Production and import of fuels and crude oil



- Oil production has declined from 329 MBOE in 2011 to 124 MBOE at a rate of - 3% annually.
- Import of 134 MBOE in 2011 is projected to increase to 532 MBOE in 2030 at a rate of 5% per year.
- 70% of the fuel consumption is supplied domestically,

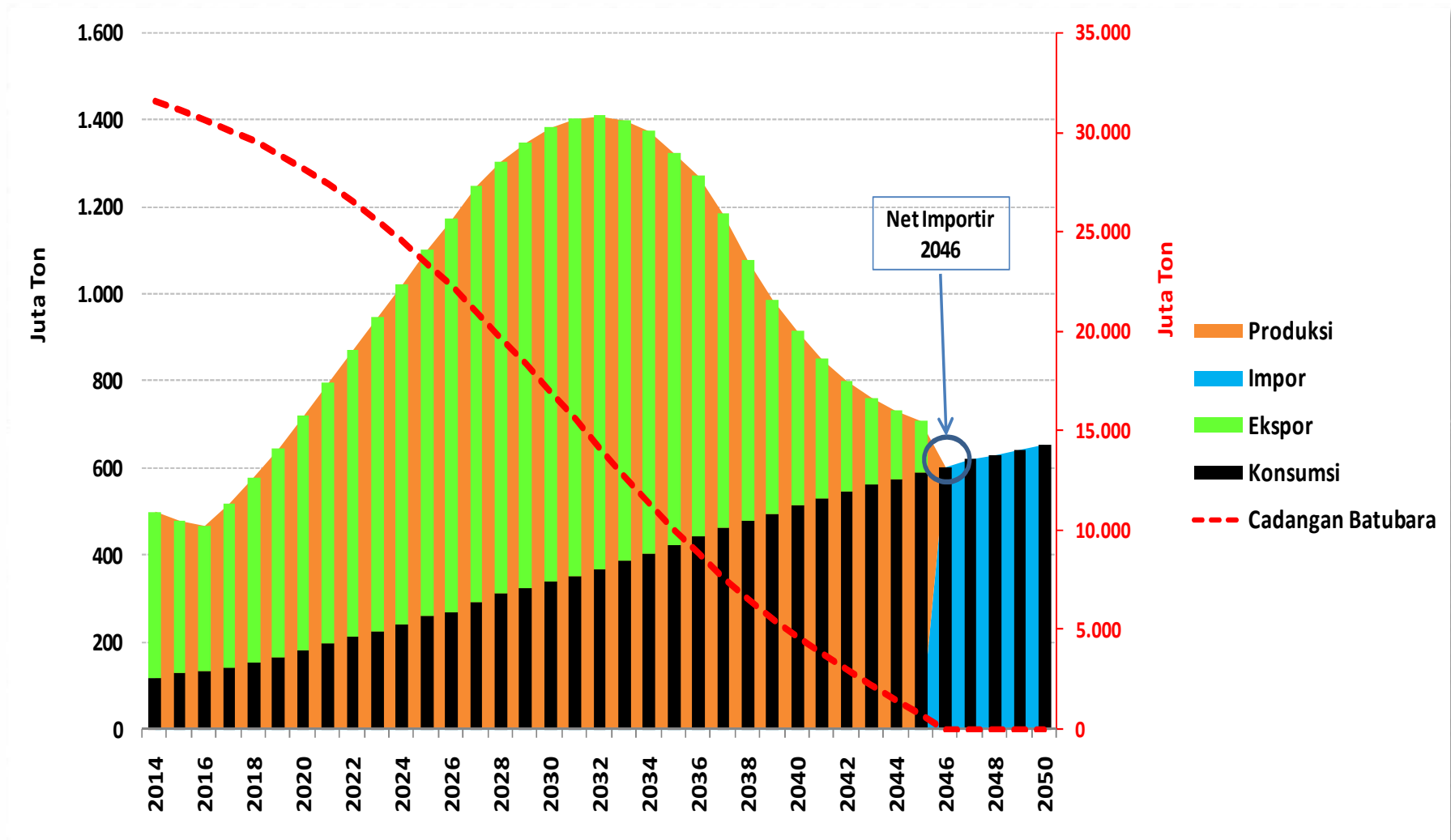
BPPT Energy Outlook, 2014

# Natural Gas Balance



Sumber : OEI 2016

# National Coal Balance



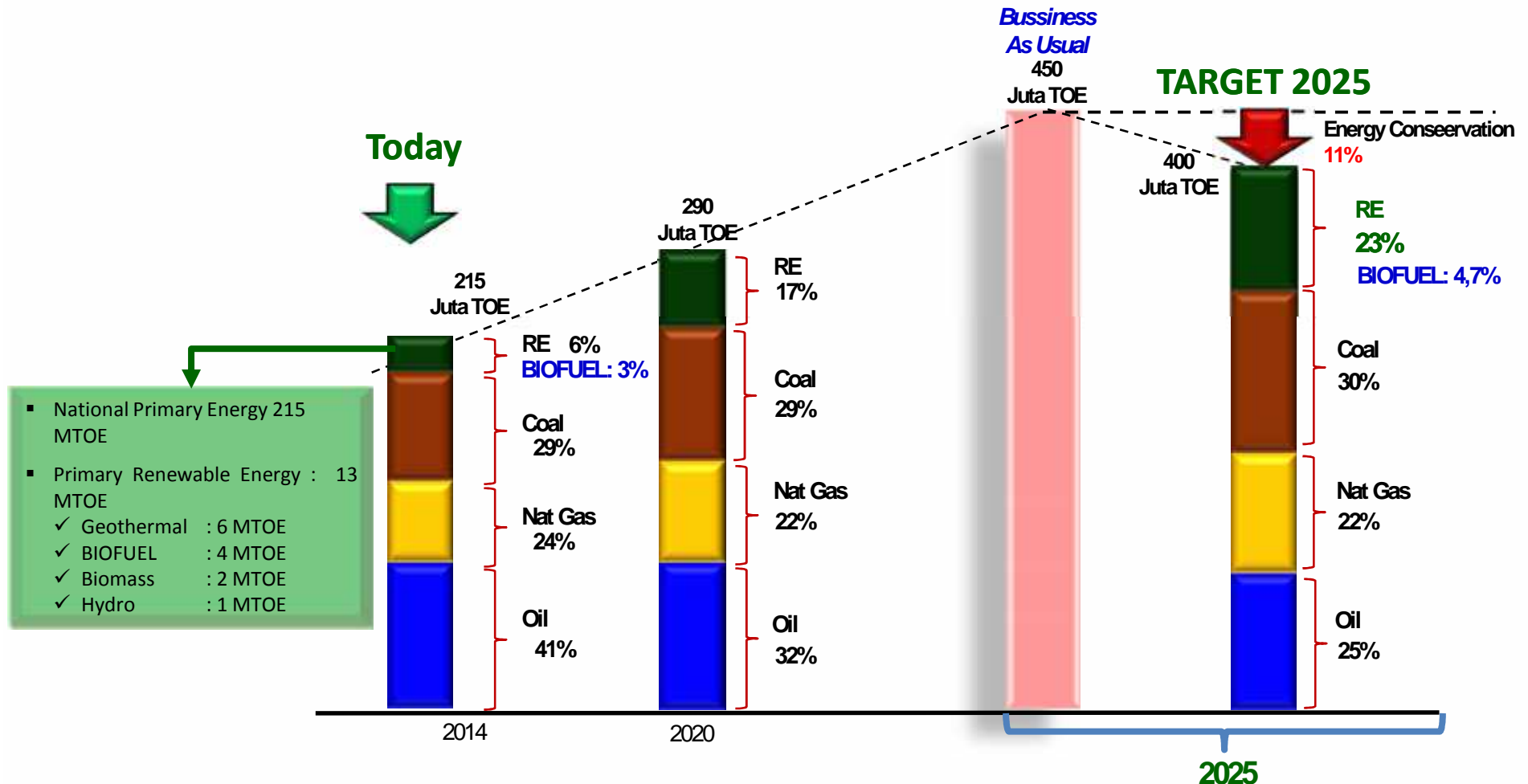
Sumber : OEI 2016



# RENEWABLE ENERGY POLICY FRAMEWORK

# Renewable Energy in the context of National Primary Energy

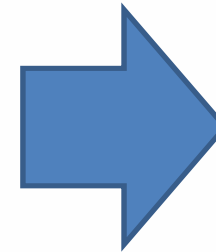
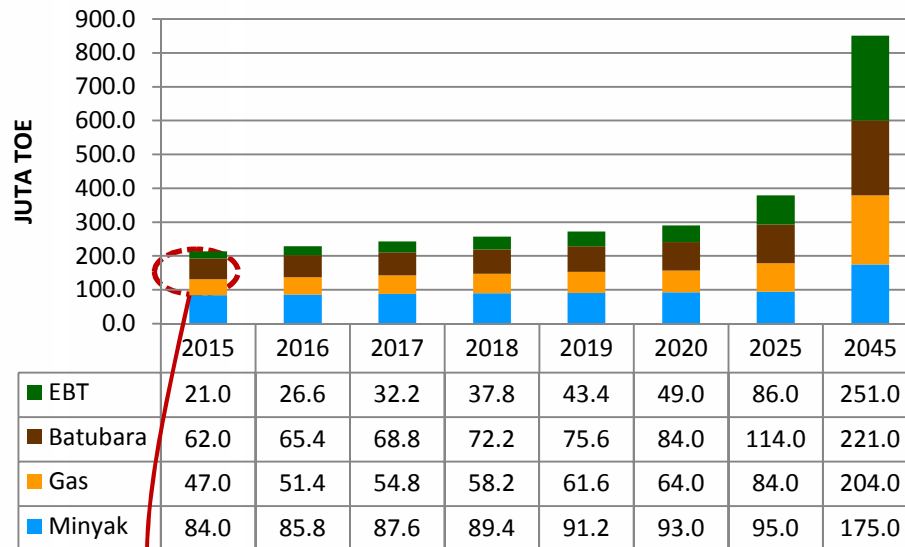
Energy Policy Trajectory  
(PP No. 79/2014 About National Energy Policy)



Source: DGRE-MEMR 2016

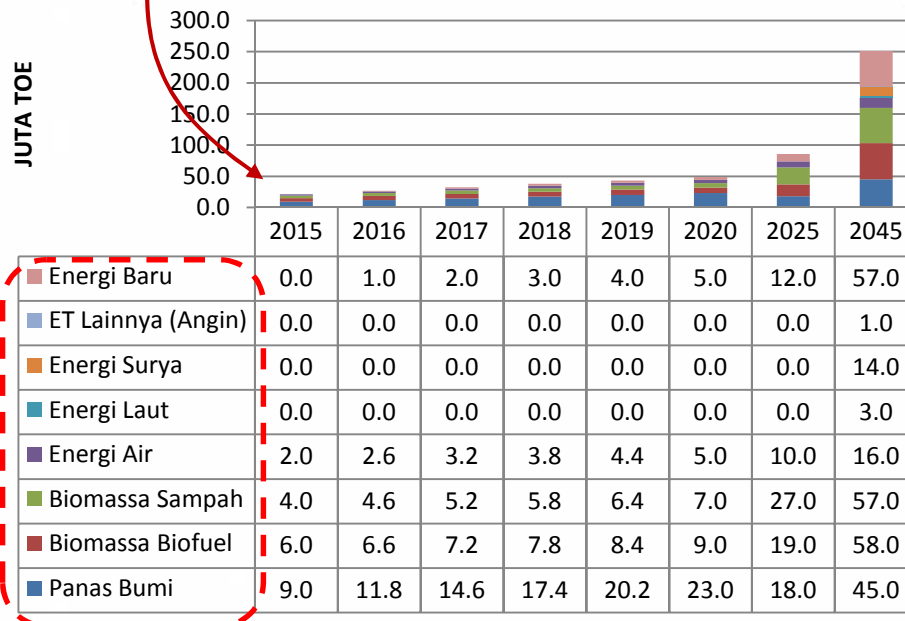


# TARGET AND ROADMAP FOR NRE DEVELOPMENT BASED ON NATIONAL ENERGY POLICY (NEP)



**Renewable Energy  
for Fossil Fuel  
Substitute**

**Renewable Energy for  
Electricity Production**



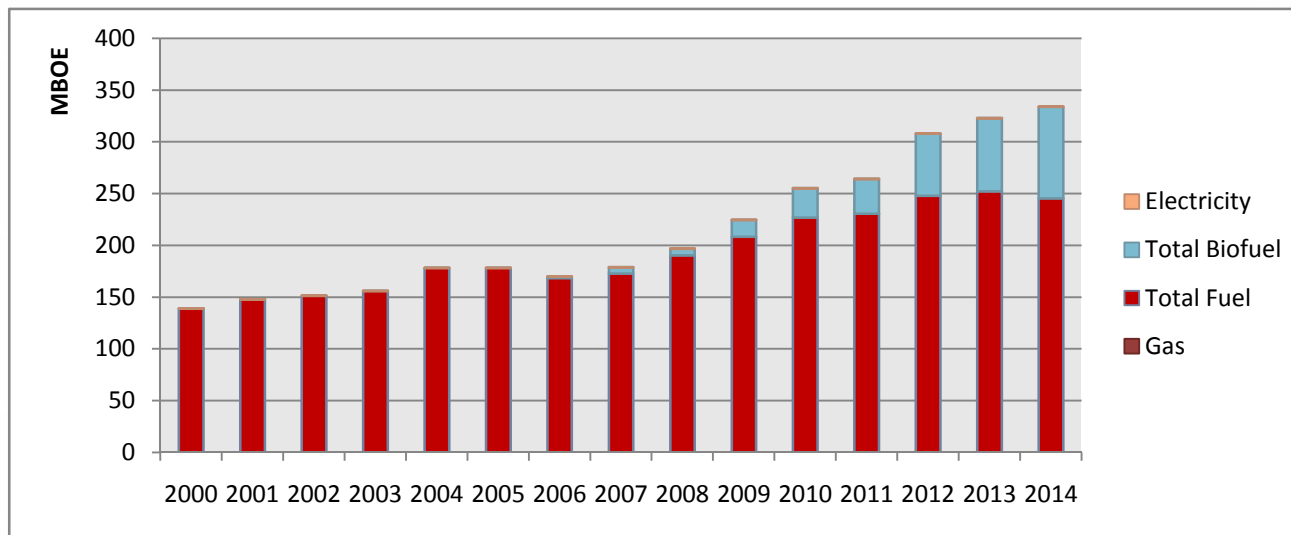
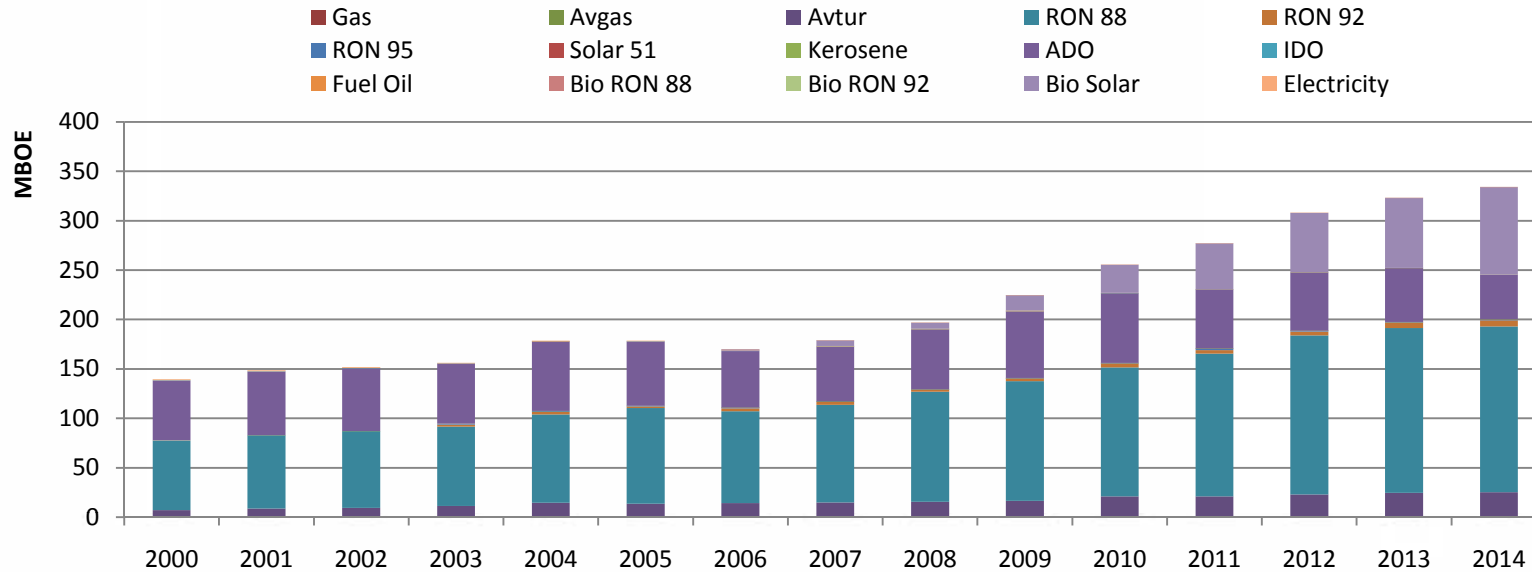
## NRE MIX PROJECTION BASED ON NEP

NRE MIX	2015	2016	2017	2018	2019	2020	2025	2045
Geothermal	43%	46%	48%	50%	51%	52%	24%	18%
Bio. Biofuel	29%	26%	24%	22%	21%	20%	26%	23%
Bio. Waste	19%	18%	17%	17%	16%	16%	36%	23%
Hydro Energy	10%	10%	11%	11%	11%	11%	14%	6%
Ocean Energy	0%	0%	0%	0%	0%	0%	0%	1%
Solar Energy	0%	0%	0%	0%	0%	0%	0%	6%
Other RE (Wind)	0%	0%	0%	0%	0%	0%	0%	0%
NE	0%	4%	7%	9%	10%	11%	16%	23%
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

# **Renewable Energy for Fossil Fuel Substitute (biofuel)**

## **RENEWABLE ENERGY POLICY FRAMEWORK**

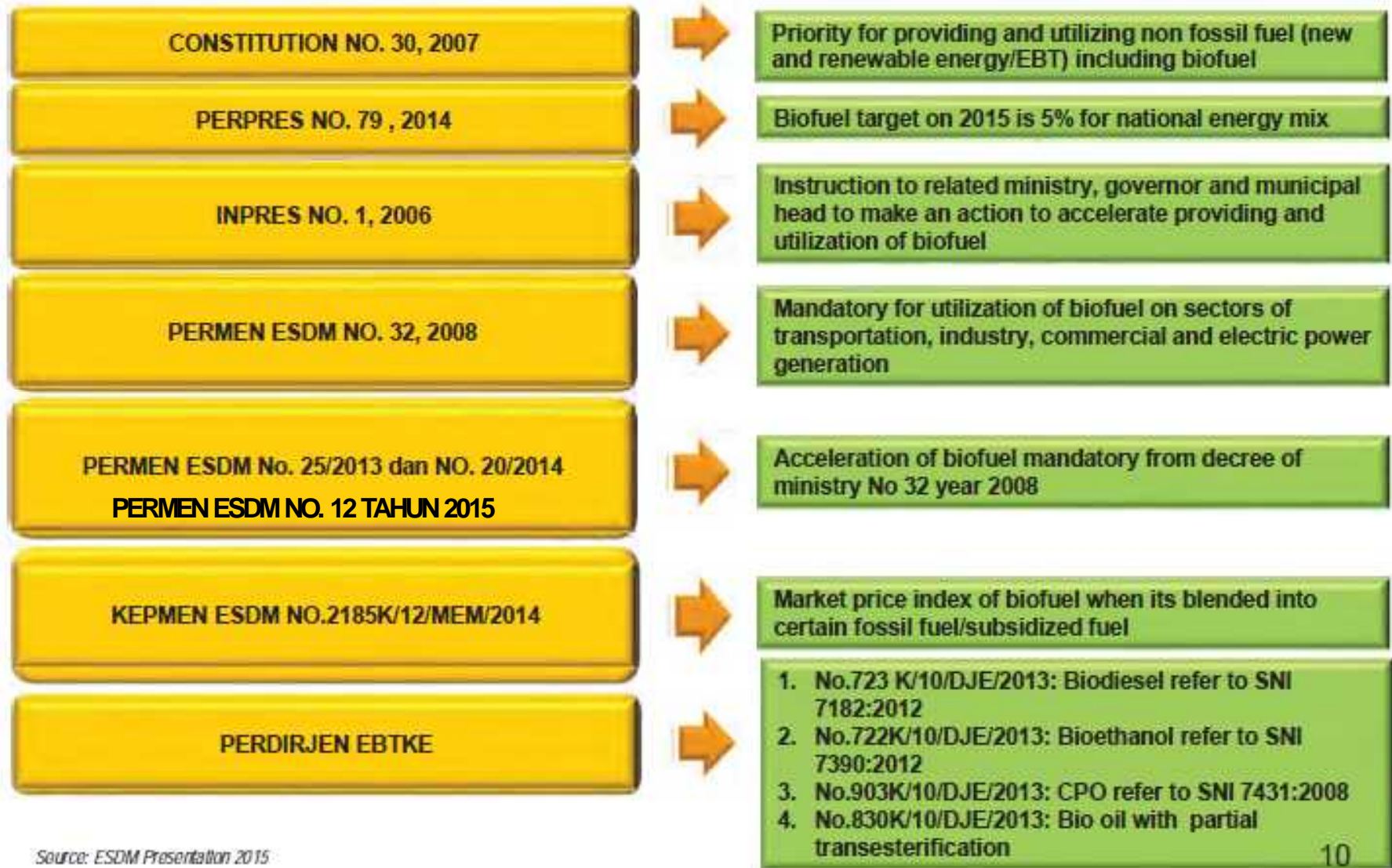
# Composition of Fuel Type within Transport Sector



It is a progress from B5 to B10, thus biofuel only made up to 10%



# BIOFUEL POLICIES



Source: ESDM Presentation 2015

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# BIOFUEL MANDATE

## (MEMR REGULATION No. 12/2015)

### BIODIESEL (Minimum)

Sector	January 2015	January 2016	January 2020	January 2025
Micro-business, Fishery, Agri-business, Transportation, and Public Services (PSO)	15%	20%	30%	30%
Transportation (Non PSO)	15%	20%	30%	30%
Industrial and Commercial	15%	20%	30%	30%

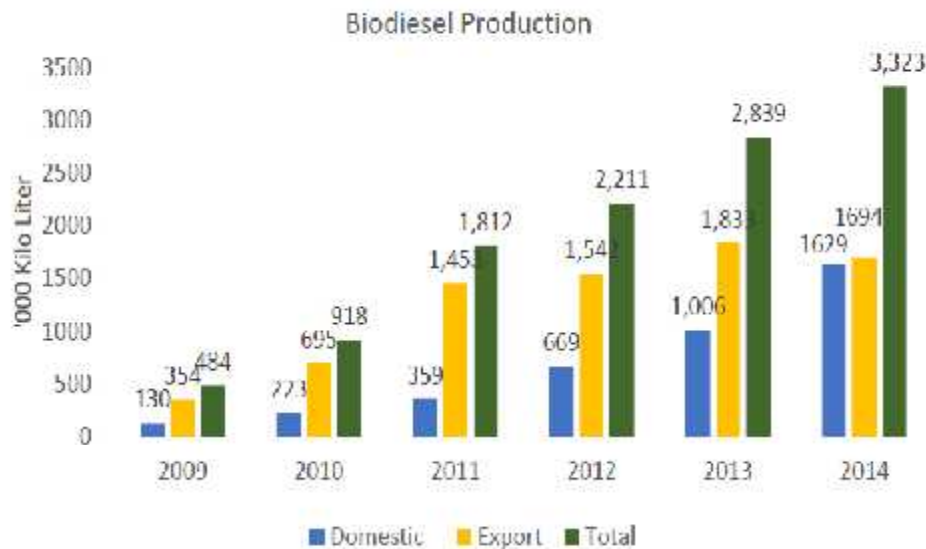
### BIOETHANOL (Minimum)

Sector	January 2015	January 2016	January 2020	January 2025
Micro-business, Fishery, Agri-business, Transportation, and Public Services (PSO)	1%	2%	5%	20%
Transportation (Non PSO)	2%	5%	10%	20%
Industrial and Commercial	2%	5%	10%	20%

### Other Biofuels (Minimum)

Sector	January 2015	January 2016	January 2020	January 2025
Industry and Transportation (Low and Medium Speed Engine)	Industry	10%	20%	20%
	Marine Transport	10%	20%	20%
Air Transport	-	2%	3%	5%
Power Plant	15%	20%	20%	20%

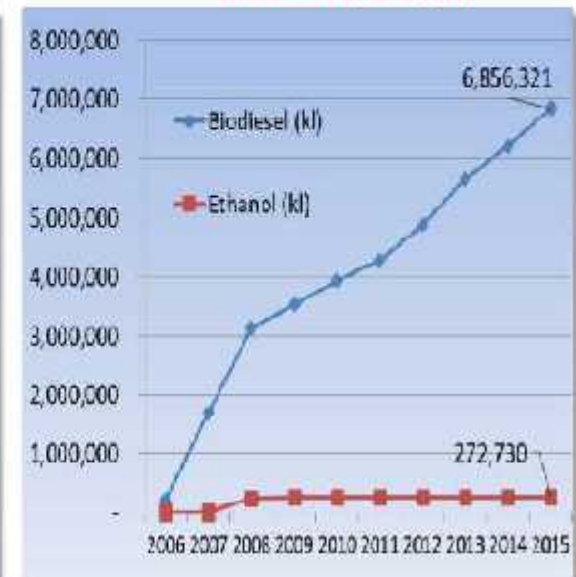
# BIOFUEL IMPLEMENTATION



## Biofuel Industries

- **Biodiesel**
  - 23 Companies
  - Feedstock, Palm Oil
- **Ethanol**
  - 13 Companies
  - Feedstock, Molasses & Cassava

## Installed Capacity (kl)



**Prospect, 2016 Biodiesel Production Capacities, 8 M kl**

SOURCE: APRORI

## PRODUCTION

- Biodiesel industry production capacity was 4,5 million KL/year in 2015 but projected to grow further in 2016
- Bioethanol industry production capacity (*fuel grade*): 270 thousand KL/year

## DISTRIBUTION AND BLENDING

- Implementation of 10% biodiesel (B-10) in diesel fuel and will go up to 20% (B-20) in 2016
- Distributed by fuel distributors including PT. Pertamina.



## **Biodiesel** implementation **B-105** and will increased to **B-20** by 2016 and to **B-25** by 2025

- Currently, Indonesia has implemented biodiesel blending B-15 on transportation and industry sector and B-30 to B-60 on electricity.
  - Recently, new Market Price Index for Biodiesel that blended with subsidized fuel has been launched.
  - Now the Government are preparing preparation stages to implement B-20 on 2016 by conduct an engine testing together with automotive engine manufacturers, automotive and expertise association, university and research institution.
  - Implementation B-25 will be conducted on 2025
- 

## **Bioethanol** implementation: E-5 in 2016

- Bioethanol utilization/blending become a trending issues in many countries. Implementation of bioethanol blending has increased significantly in many countries
- There is no doubt related on technical aspect of bioethanol blending
- Currently, subsidy is no longer imposed on the liquid fuel. Thus Bioethanol blend with gasoline could be feasible financially.
- Market Price Index of Bioetanol that blended with subsidized fuel has been issued

## Domestic Biodiesel Consumption Semester 1 2016

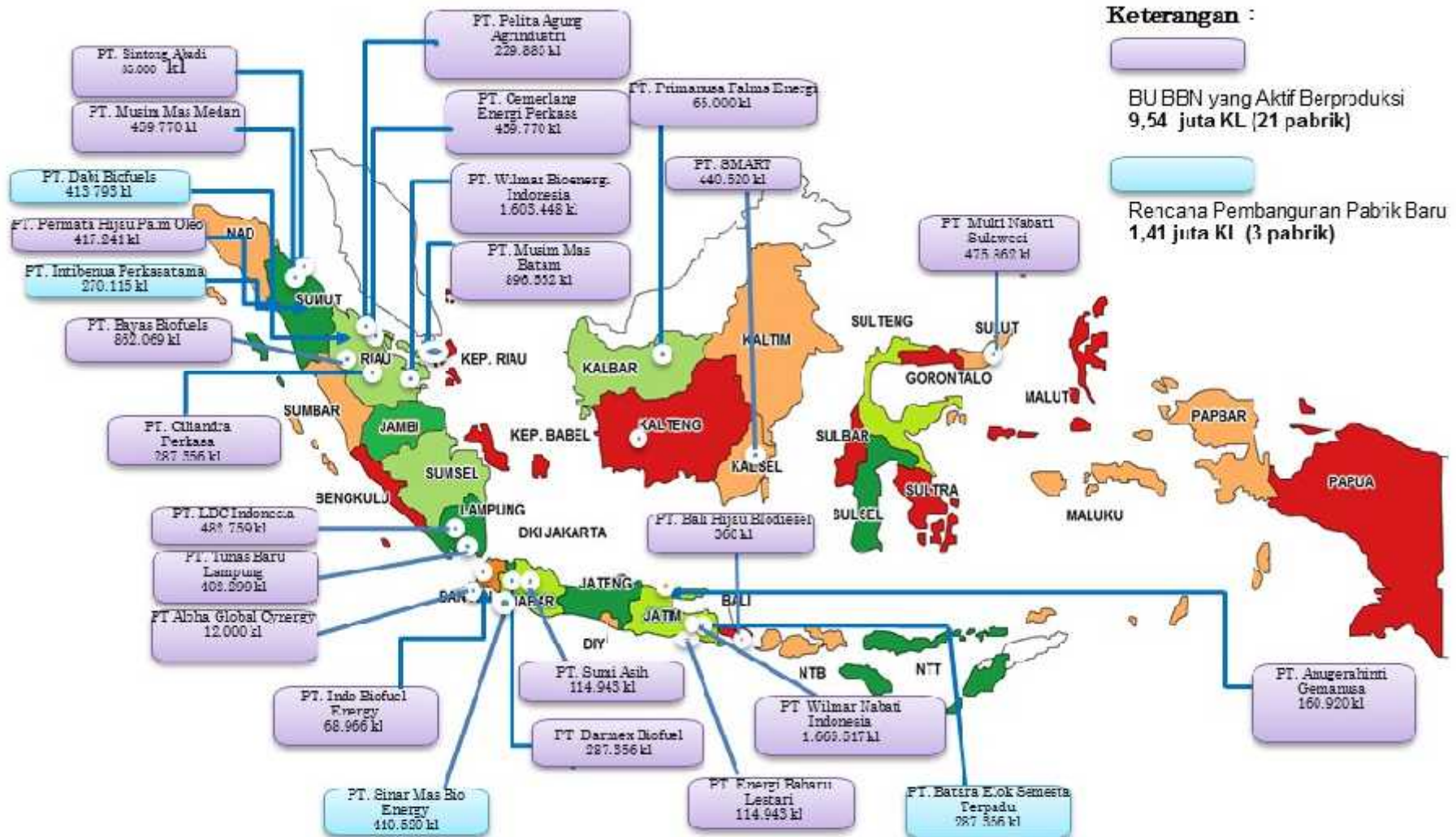
Distribusi Bahan Bakar	PSO (KL)	NON PSO (KL)	Total (KL)	Keterangan
	(1)	(2)	(3)=(1)+(2)	
Penyaluran Solar Januari-Maret	6.500.000	2.000.000	8.500.000	Data Perkiraan
<b>Total Penyaluran Biodiesel</b>	<b>1.235.734</b>	<b>167.287</b>	<b>1.403.021</b>	
<b>Prosentase Capaian Mandatori</b>	<b>19,0%</b>	<b>8,4%</b>	<b>16,5%</b>	

<b>Penghematan Devisa (Triliun Rupiah)</b>	<b>5,85</b>	<b>0,79</b>	<b>6,64</b>
<b>Penurunan Emisi GRK (Juta Ton CO<sub>2</sub>e)</b>	<b>1,85</b>	<b>0,25</b>	<b>2,10</b>



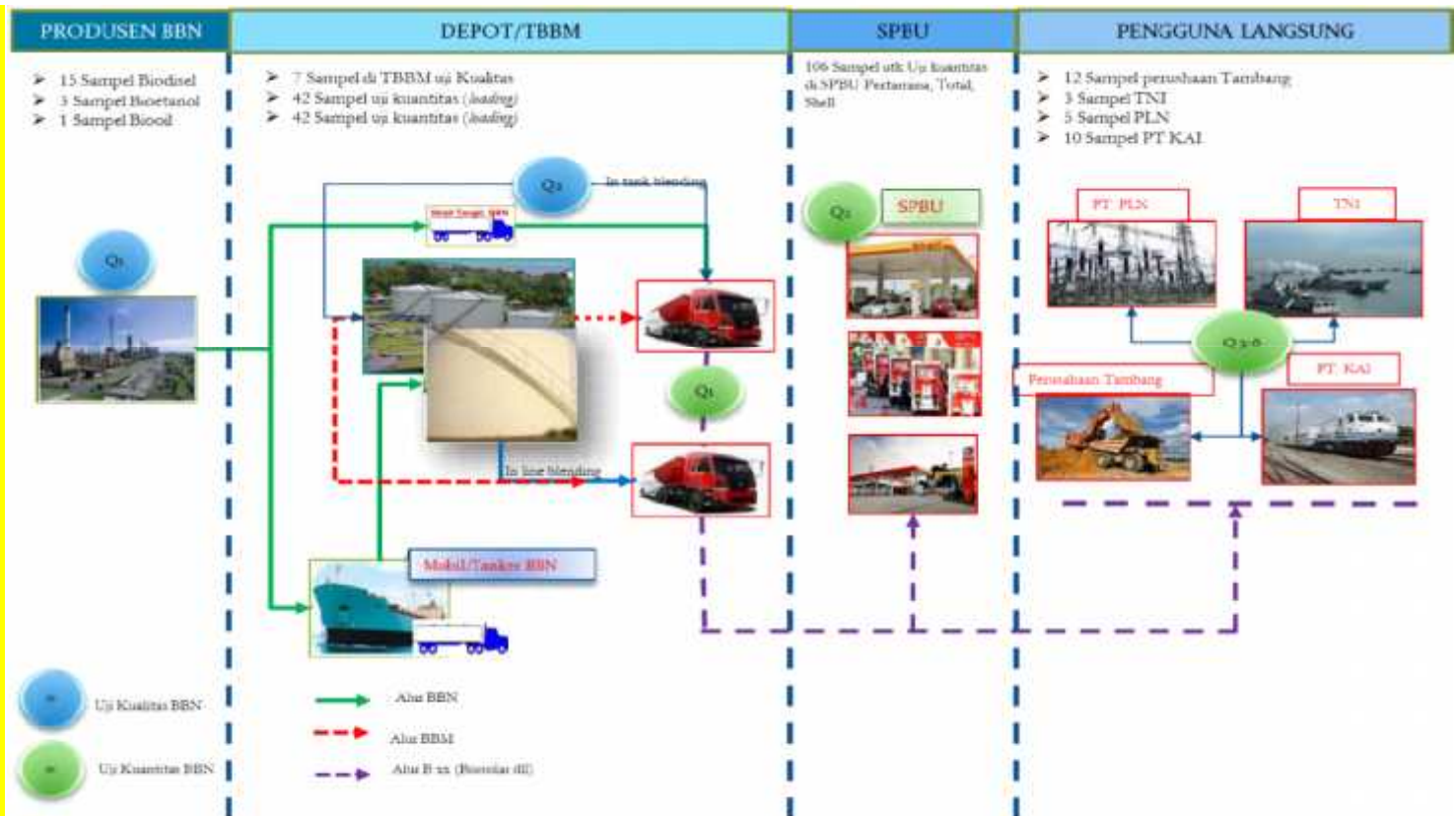


# Capacity of Biodiesel Supply in 2016



# Monitoring and Evaluation of Biofuel Quality

Monitoring biofuel has been carried out regularly to ensure the quality meet the standard specified in the Keputusan Dirjen EBTKE No. 100 K/10/DJE/2016. Monitoring was conducted in the retail pumps, Depot and direct consumers



## Mandatory for Ethanol

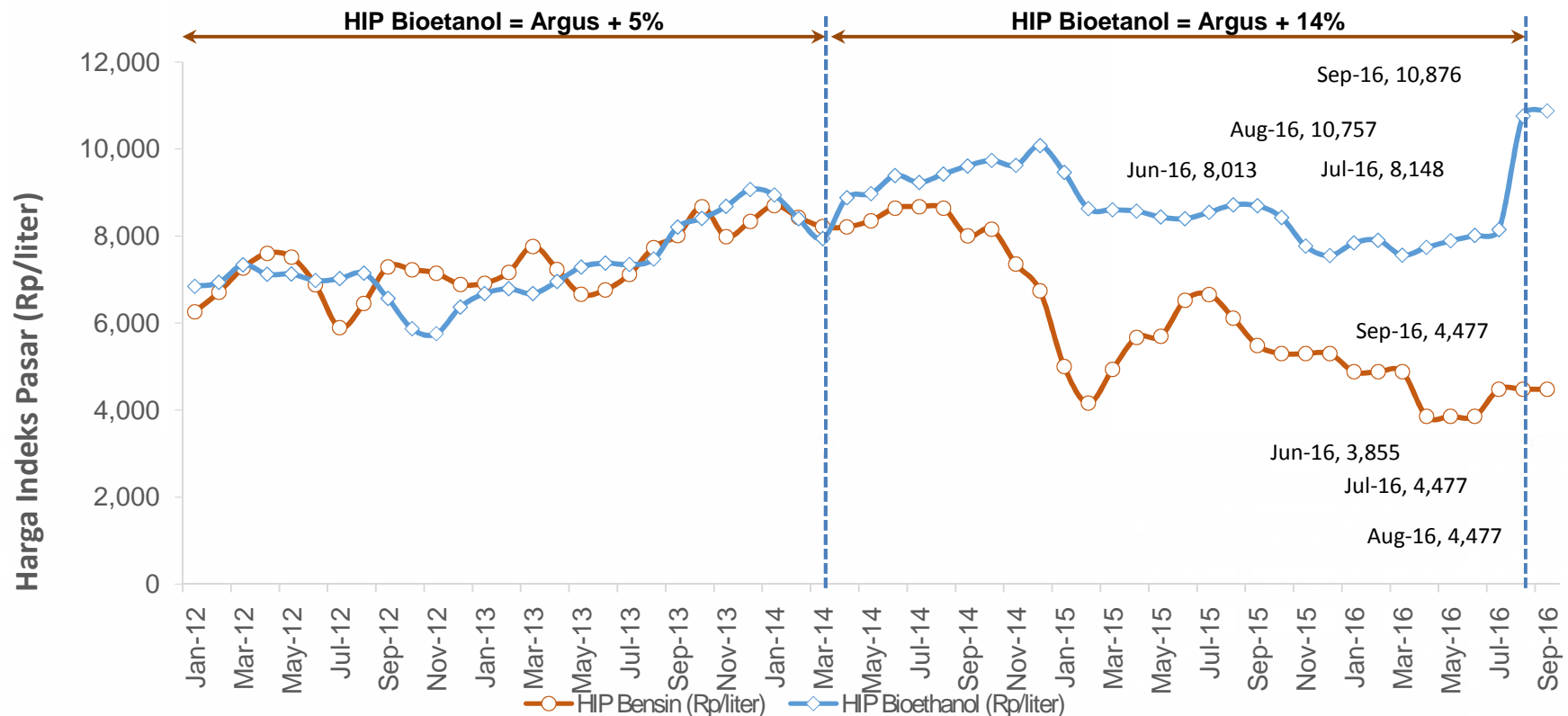
- 1) Pertamina has implemented bioethanol mandate since 2006, but was stopped in 2009 due to higher price of ethanol relative to gasoline/
- 2) DG Renewable Energy, Ministry of Energy has been working on renewing the ethanol mandate for gasoline with Octane Value of 90 in several cities (Surabaya, Jakarta, Bandung).
- 3) As price difference between ethanol and gasoline is larger, the government is considering to subsidize the ethanol for 2017 budget.
- 4) To ensure such an incentive works, several items are being carried out:
  - To ensure adequate supply of *Fuel Grade Ethanol* (Bioetanol). Currently there are only 2 companies that produces the fueal with a total capacity of 40 thousand KL
  - Infrastructure for storage, blending and distribution







## Ethanol Price relative to gasoline



### Notes

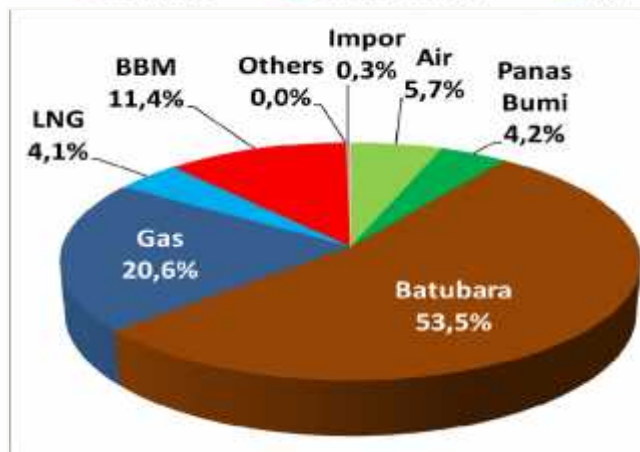
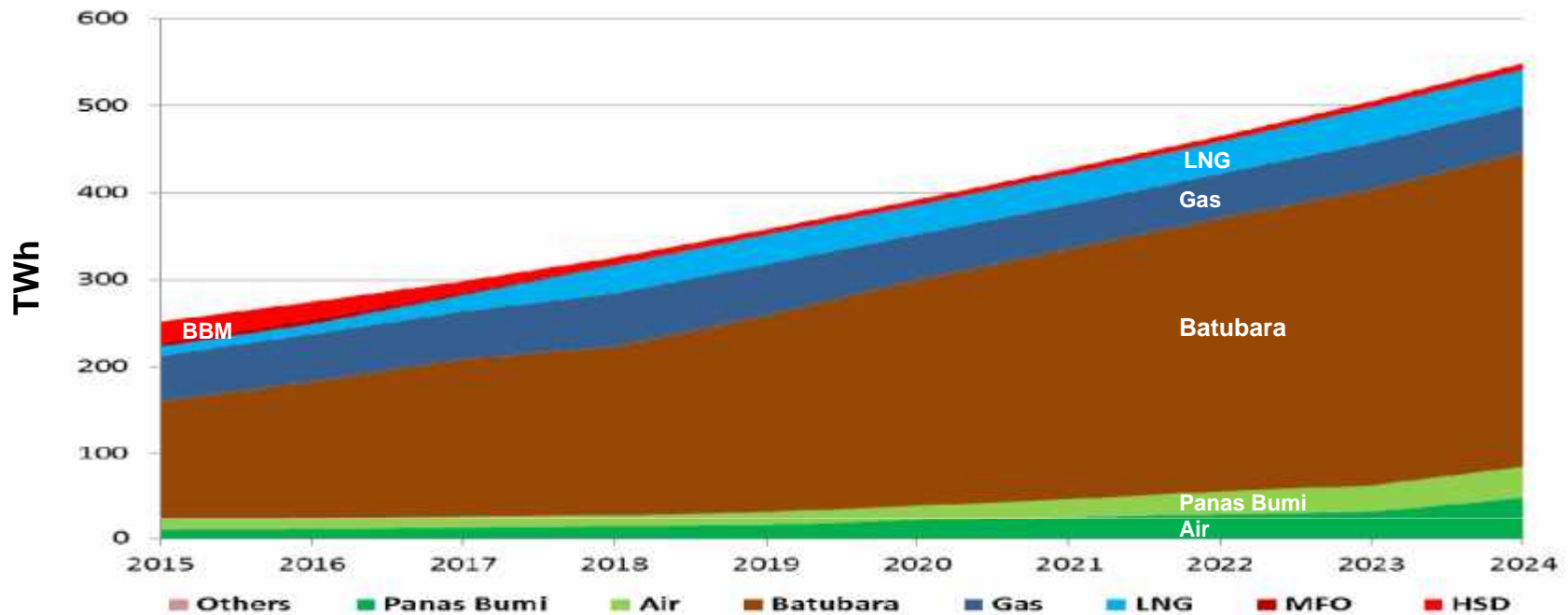
1. Since August 2016, The government has revise the formula for ethanol index price (HIP) based on the local price of molasses

$$\text{HIP Ethanol} = (4,125 \text{ Kg molasses/liter etanol} \times \text{price of molasses}) + 0,25 \text{ USD/liter}$$

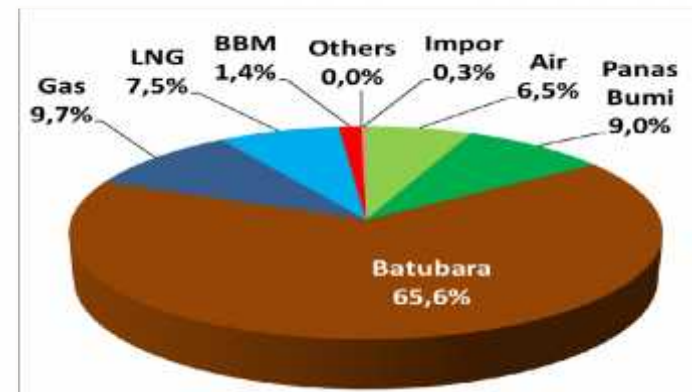
# **Renewable Energy for Electricity Production**

## **RENEWABLE ENERGY POLICY FRAMEWORK**

## FUEL MIX PROJECTION



Year 2015  
Energy Production 253 TWh



Year 2024  
Energy Production 550 TWh

Source :  
RUPTL 2015-  
2024

# ROADMAP of SMALL SCALE RE DEVELOPMENT

## Small RE Development Program (MW)

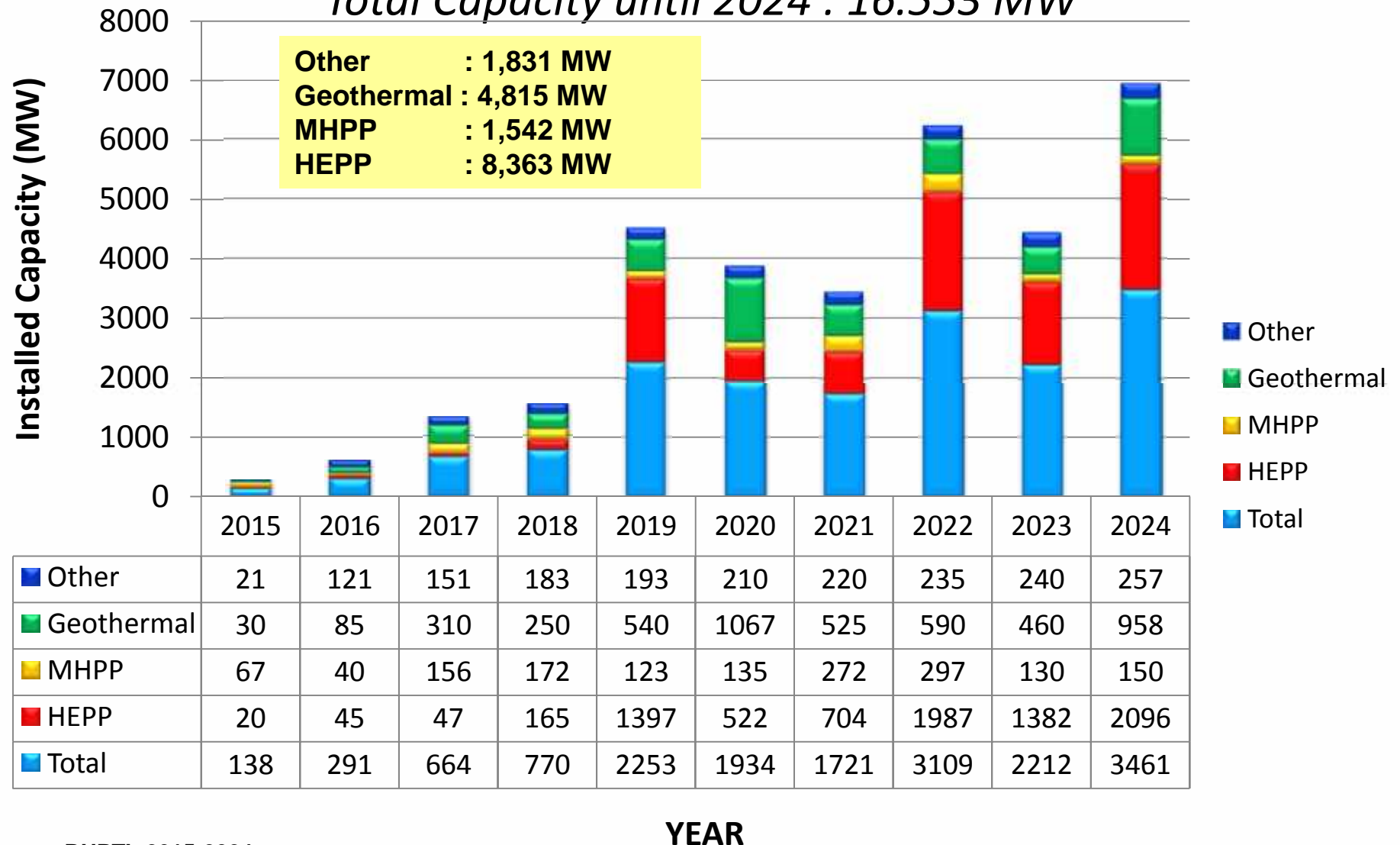
No	Pembangkit - EBT	Kapasitas	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Jumlah
1	PLTM/H	MW	67	40	156	172	123	135	272	297	130	150	1.542
2	PLT Surya	MWp	6	20	25	30	35	35	35	40	45	50	321
3	PLT Bayu	MW	-	40	40	40	40	40	50	50	50	50	400
4	PLT Biomass	MW	15	30	40	50	50	50	50	50	50	50	435
5	PLT Kelautan	MW	-	1	1	3	3	5	5	5	5	10	38
6	SPD CPO	MW	-	30	30	40	40	45	45	50	50	55	385
7	PTMTD-LCS	MW	-	-	15	20	25	35	35	40	40	40	250
8	PLT Bio-Fuel	Ribu kL	350	500	550	550	600	600	650	700	750	800	6.050
<b>JUMLAH</b>		<b>MW</b>	<b>88</b>	<b>161</b>	<b>307</b>	<b>355</b>	<b>316</b>	<b>345</b>	<b>492</b>	<b>532</b>	<b>370</b>	<b>405</b>	<b>2.986</b>

Source : RUPTL 2015-2024 page 45



## ROADMAP of RENEWABLE ENERGY DEVELOPMENT

*Total Capacity until 2024 : 16.553 MW*



Source : RUPTL 2015-2024

# Photo Voltaic

It is undeniably suited to the geographical condition of Indonesia, it has been going on for more than two decades, but its share is still insignificant.

## **Minister of Energy and Mineral Resources Regulation No 17/2013**

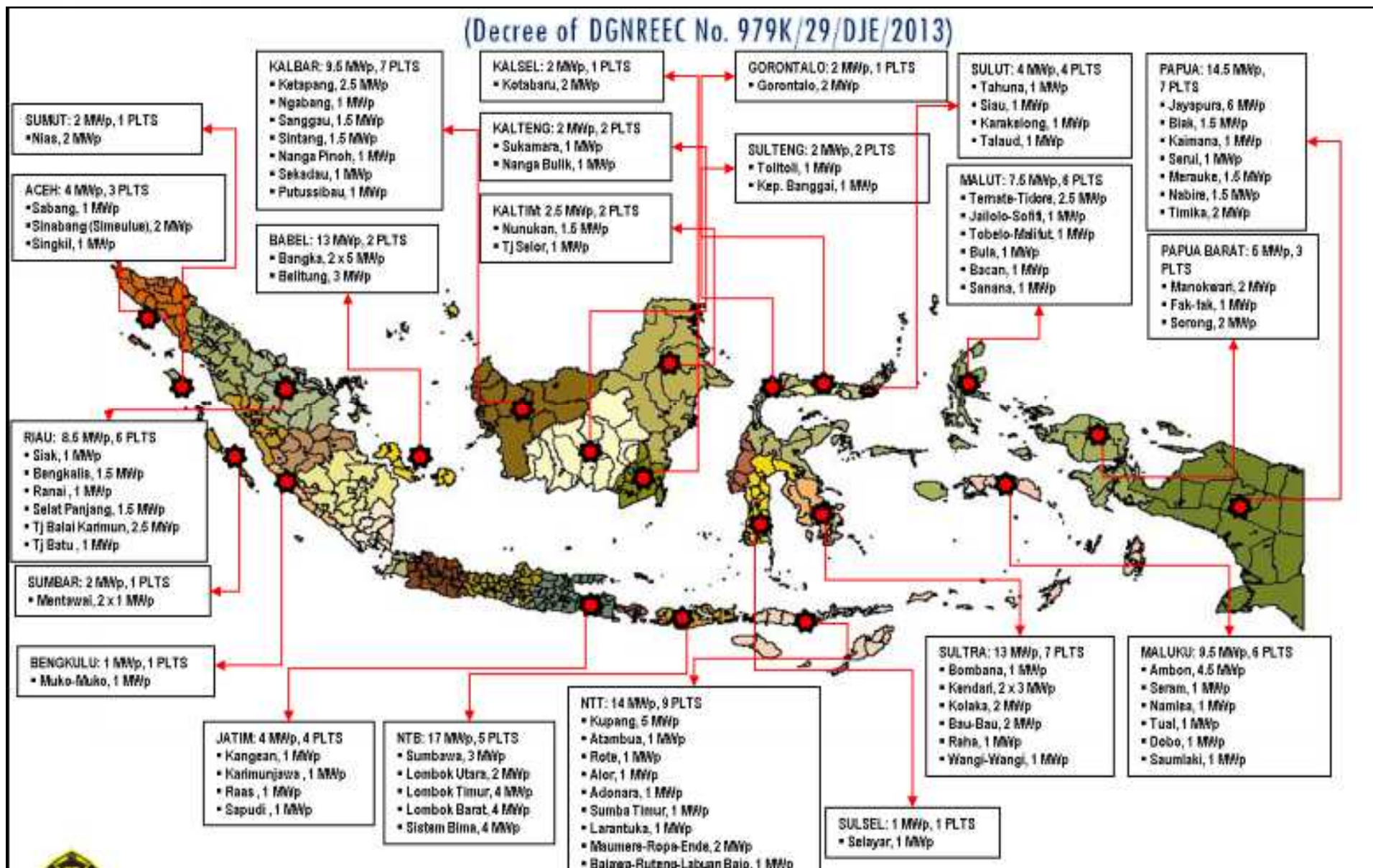
- The tariff will be based on ceiling price of 25 cent USD/kWh (using modules with local content < 40%, i.e. Considered as imported modules) and 30 cent USD/kWh (using modules with local content = 40%)
- The application for the ceiling price will be done through bidding process using online system based on certain quota per annum
- Director General of NREEC has set 80 locations with total capacity 140 MWp
- The Result of First Bidding 6 locations with total capacity 13 MWp

## **PV Rooftop Regulation:**

- Net Metering has been mandated by PLN in Regulation 0733.K/DIR/2013 (December 2013), which obliges PLN to 'credit' energy produced by solar to a customer's account.
- FIT for PV Rooftop is under final drafting.
- The target of PV Rooftop FiT is for residential, business and industry customers
- Through 2016 budget, the Government will construct 2941 kWp PV Rooftop for 30 government buildings and 4 airports



# PV Quota Allocation



# Geothermal

It is also undeniably suited to the geographical condition of Indonesia, it has been going on for more than two decades, but its share is stagnant

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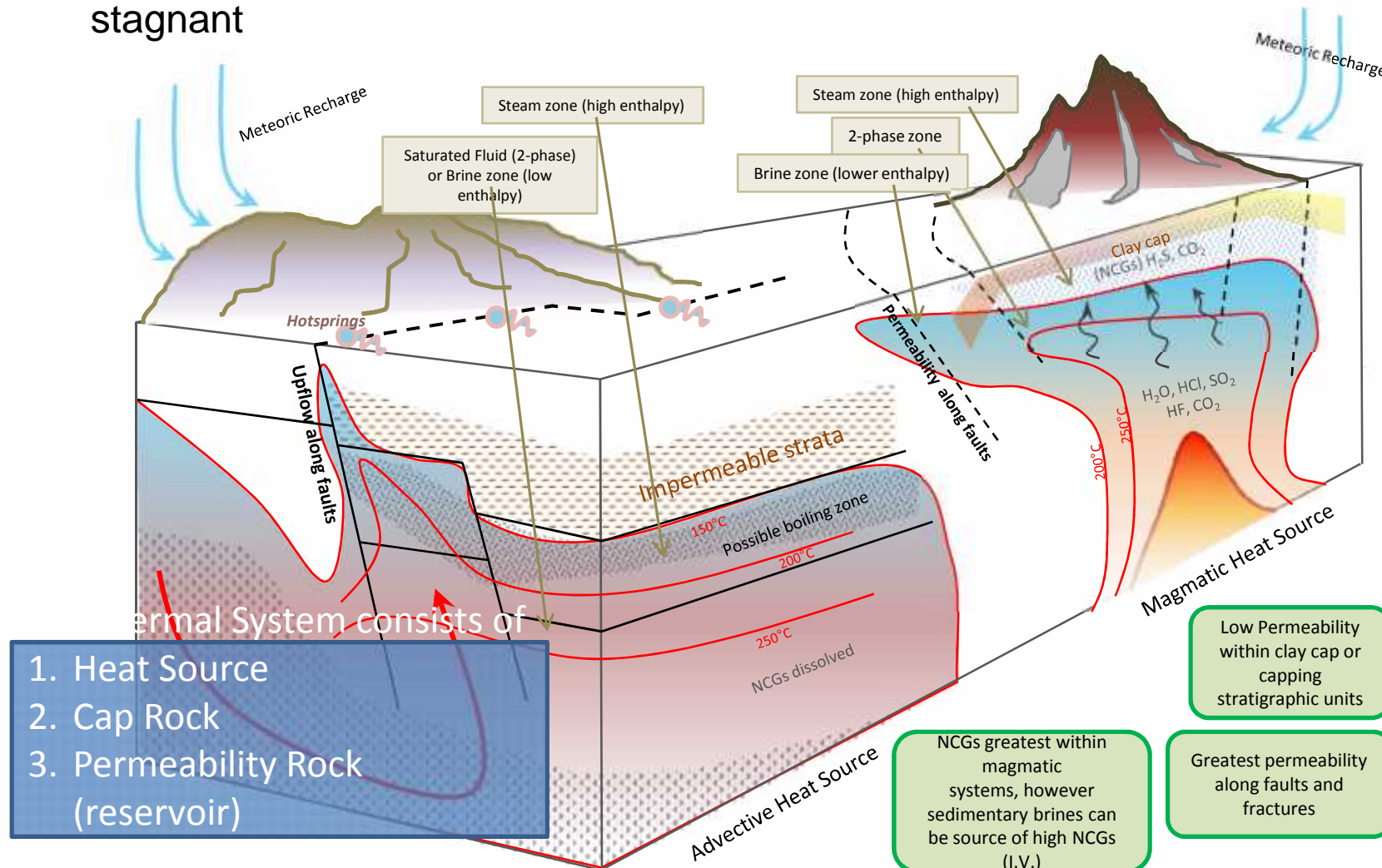
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# Indonesian Geothermal Resources

It is also undeniably suited to the geographical condition of Indonesia, it has been going on for more than two decades, but percentage wise, its share is stagnant



# Indonesia Geothermal Prospects



No	Island	Number of Locations	Potential Energy (Mwe)					Total	Installed Capacity
			Resources		Reserves				
			Speculative	Hypothetic	Possible	Probable	Proven		
1	Sumatera	93	3.182	2.469	6.625	239	380	12.895	122
2	Jawa	73	1.560	1.739	4.023	658	1.815	9.795	1.224
3	Bali	6	70	22	262	-	-	354	0
4	Nusa Tenggara	27	342,5	409	787	-	15	1.553,5	12,5
5	Kalimantan	14	162,5	-	-	-	-	162,5	0
6	Sulawesi	76	1.239	343	1.419	150	78	3.229	80
7	Maluku	32	532	89	767	-	-	1.388	0
8	Papua	3	75	-	-	-	-	75	0
Total		324	7.163	5.071	13.883	1.047	2.288	29.452	1.438,5
			12.234		17.218				
			29.452						

## Geothermal Potential



29,4 GW  
Badan Geologi,  
March 2015

## Geothermal Working Area



69 GWAS  
• Existing 19 GWAS  
• New: 50 GWAS

## Installed Capacity



1438,5 MW  
11 PLTP s in 9 GWAS



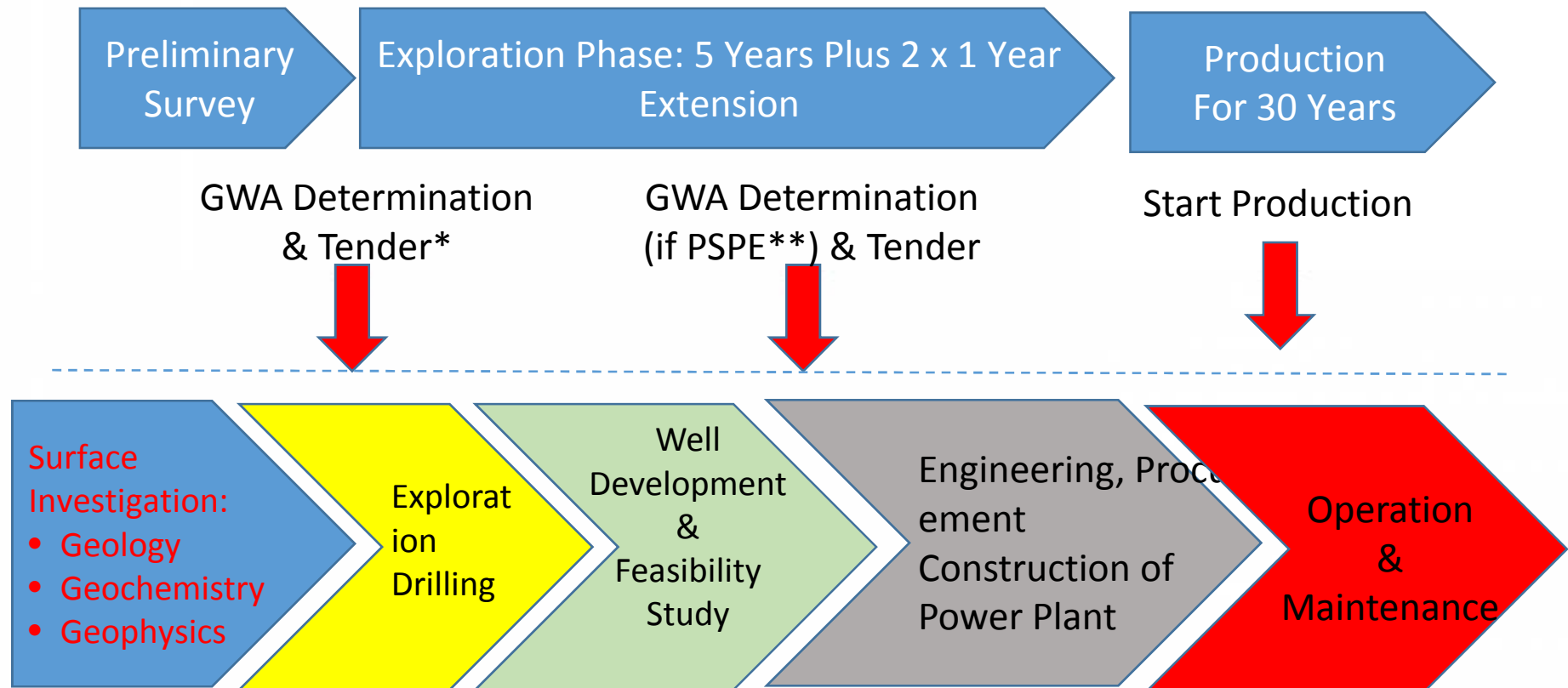
9,964 GWh  
Total Prod  
(Des 2015)



# Geothermal Development Stages

For Indirect Purpose

## Law No 21/2014: “Geothermal”



\*Tender winner will be awarded by Geothermal License (IPB)

\*\*PSPE: Preliminary Survey Plus Exploration which will be assigned into business entity



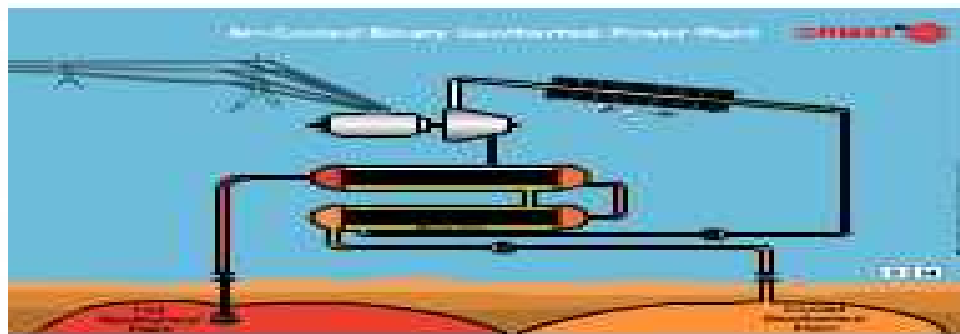
# Indonesian Geothermal Resource Challenges

- Most of Potential Geothermal Resources are Low/Medium Enthalpy which are classified as liquid dominated system or 2 phases system (mixed of steam & liquid).
- Not all wells are created equal
  - Field development may result in any combination of high-gas, high-enthalpy, low-gas, low-enthalpy wells, varying percentage of steam vs. brine and chemical composition
  - Well production will change over time
  - Reservoir Depletion

## Proposed Binary Cycle

### Usage:

- Ideal for Low Temperature resources
- Able to optimize unused separated brine in existing power plant

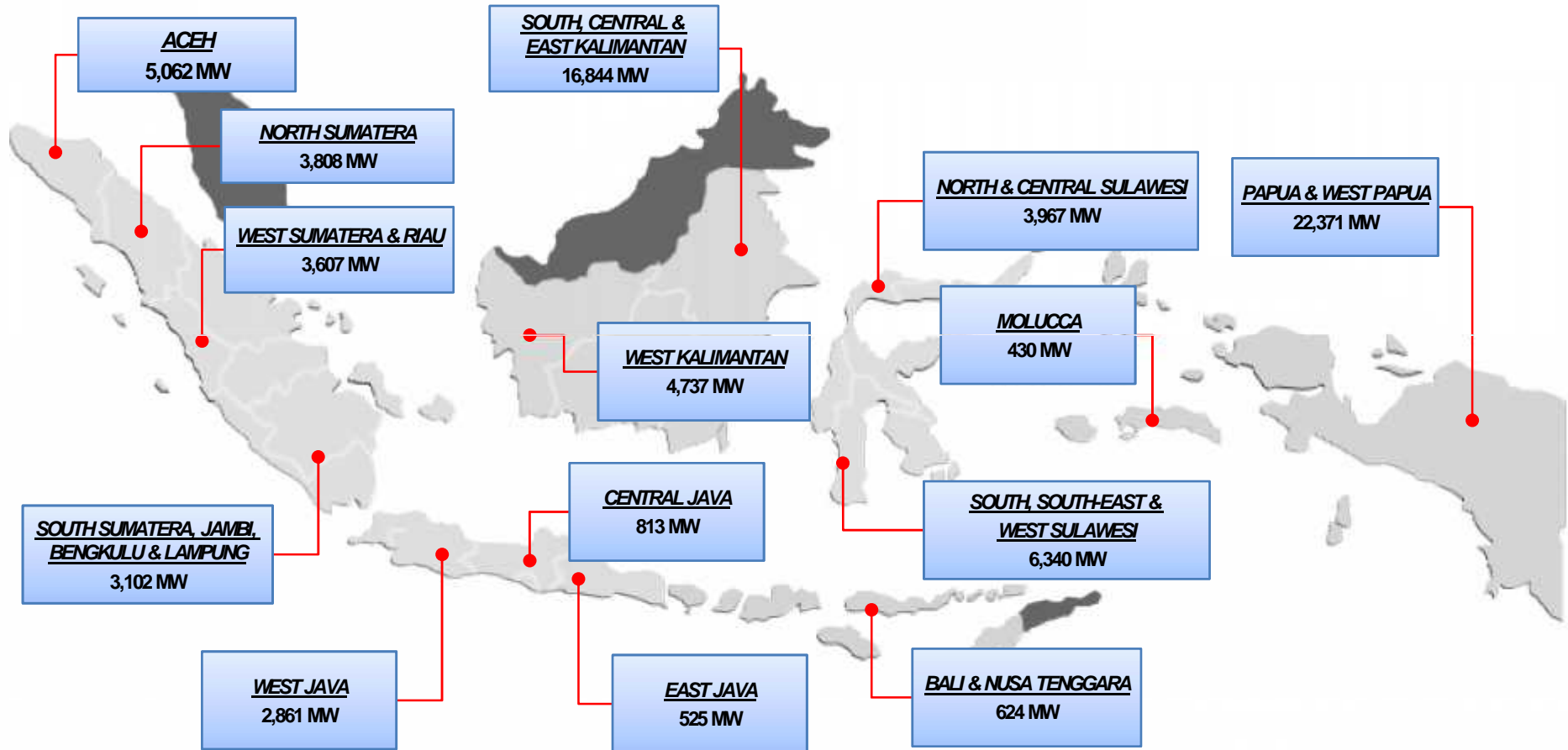


### Benefit:

Ability to utilize low temperature geothermal fluid for actual electricity generation  
Does not require to flash the brine, but use it in its liquid state;  
Maintains the volume of brine fluid after usage;  
Does not increase silica concentration in the fluid and thus, minimizes silica scaling potential

# **HYDROPOWER POTENTIAL in INDONESIA**

*(Hydropower Potential Study 1983: 75,000 MW)*



Source : Sembayang, N 2015



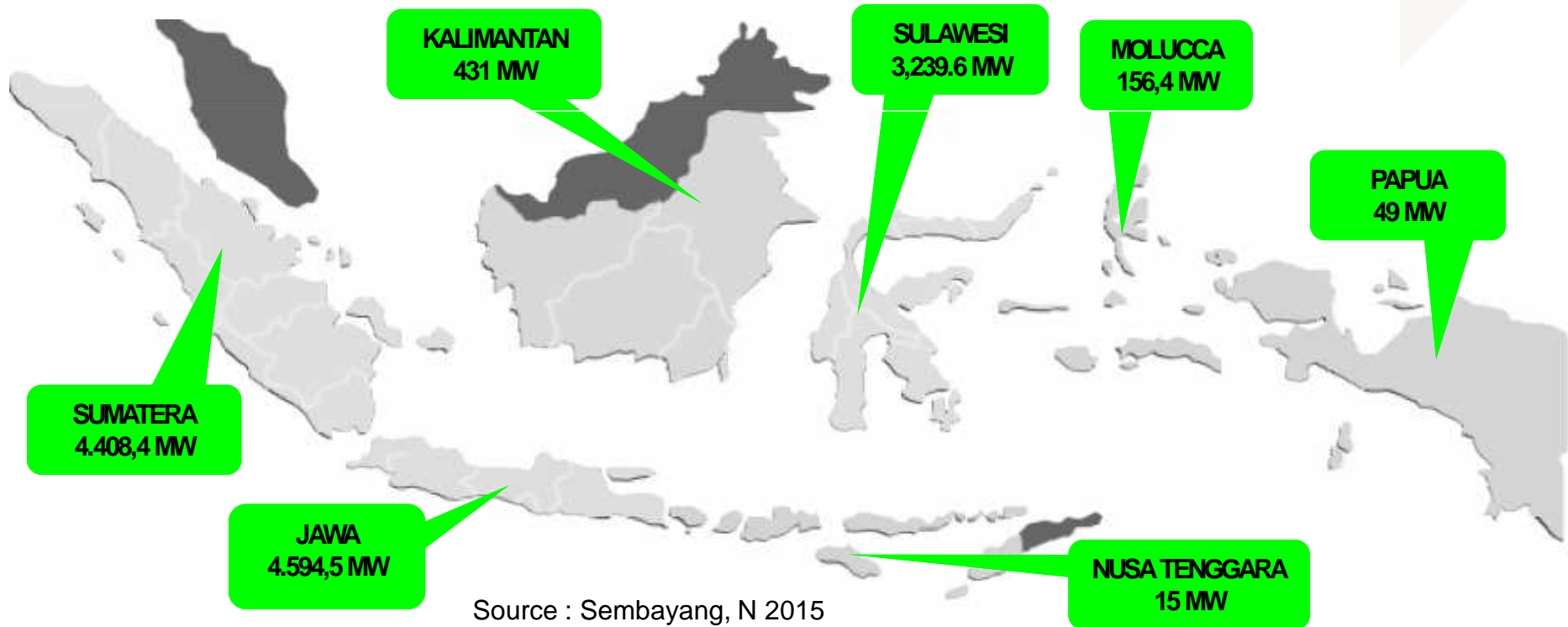
# **HYDROPOWER DEVELOPMENT PLAN**

*(6,300 MW up to Year 2021 and 12,900 MW up to Year 2027)*

**Hydro Power Potential Study  
(1983) : 75.000 MW –  
1,249 Location**

**Review Hydro Power Potential  
Study (1999) 3<sup>rd</sup> Screening :  
21.480 MW -167 Location**

**Hydropower Master Plan Study  
( 2011 ) : 12.894 MW –  
89 Location**

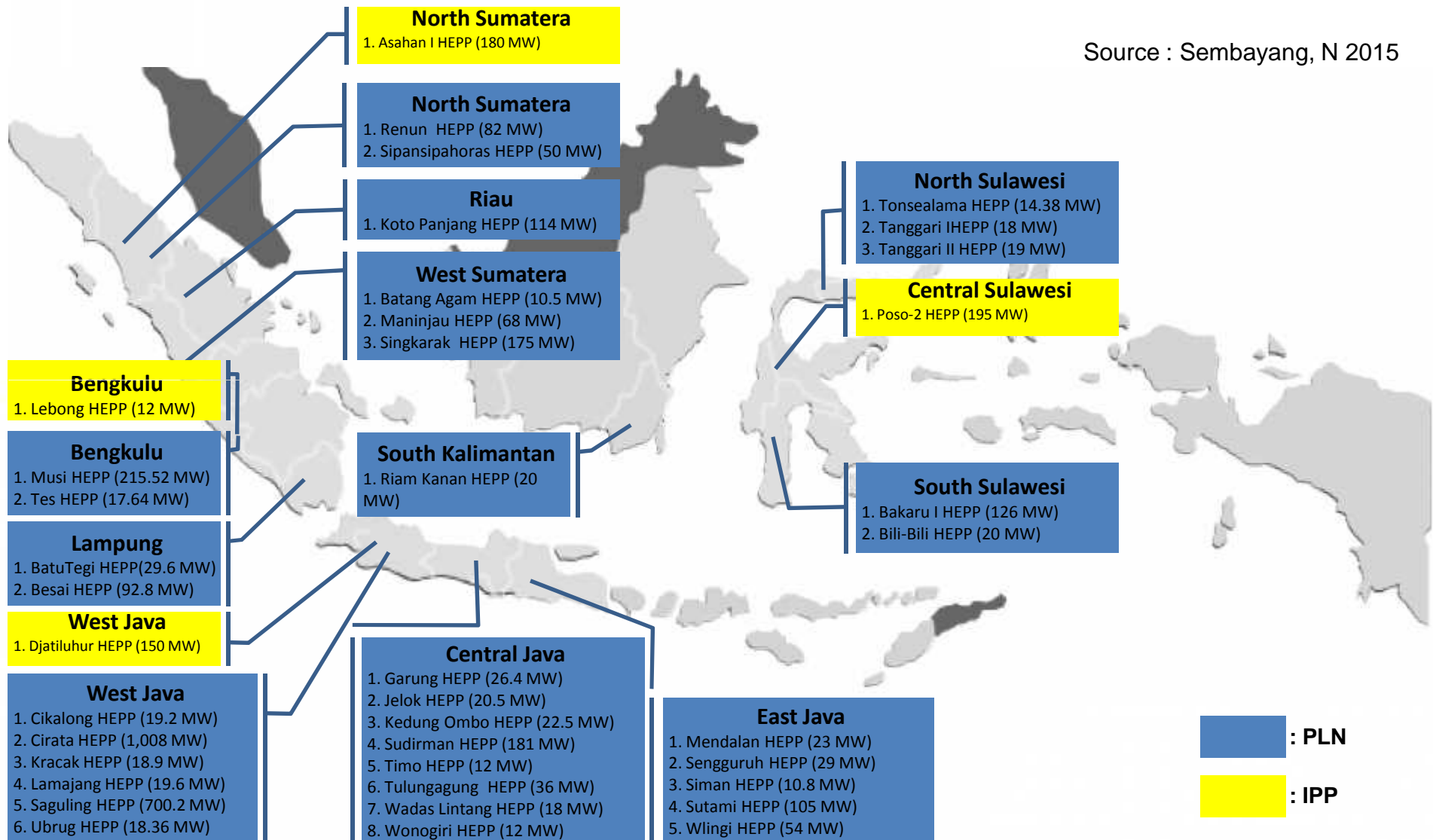




# **LARGE HYDROELECTRIC POWER PLANT in OPERATION**

**(PLN: 3,407 MW & IPP: 537 MW, Total: 3,944 MW)**

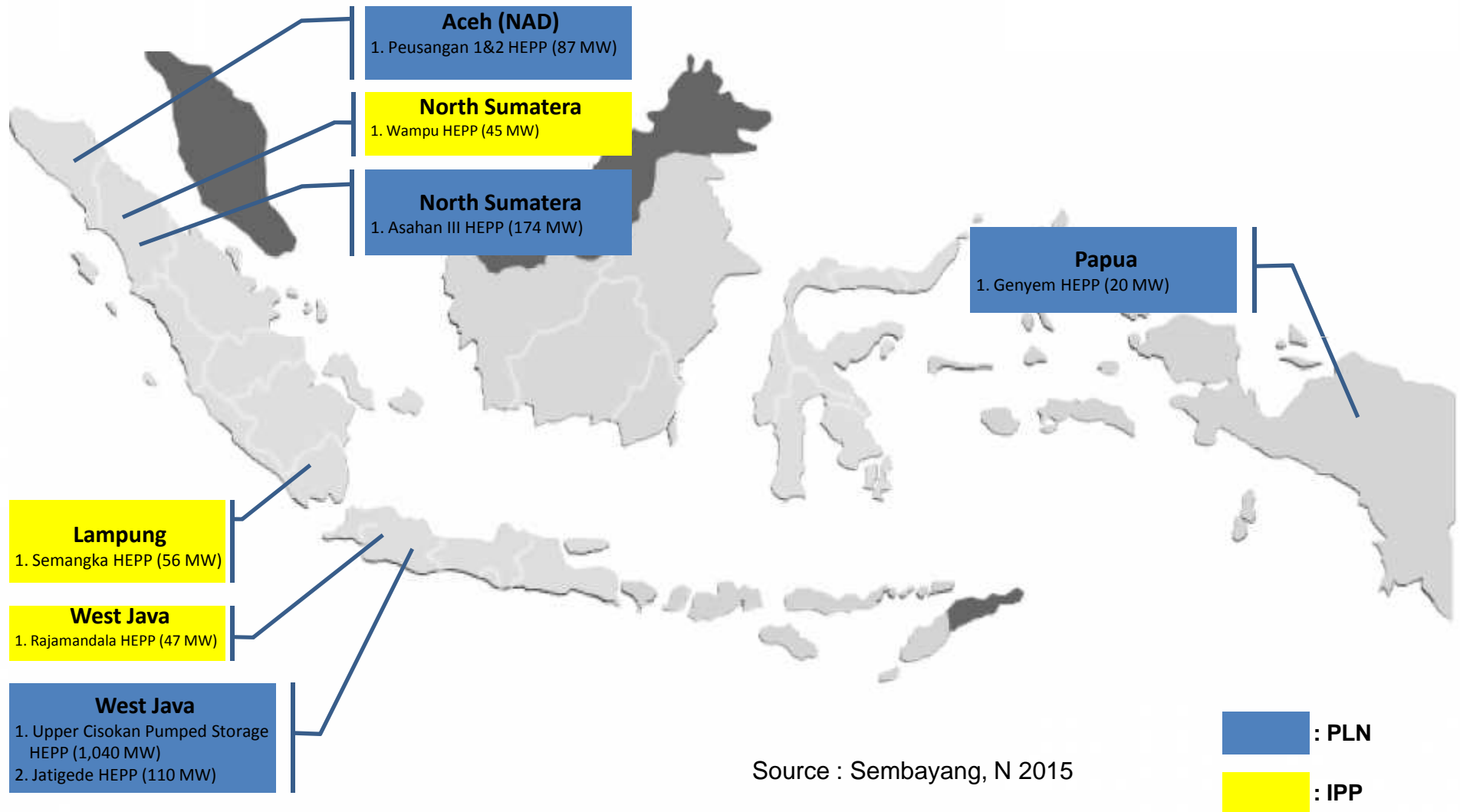
Source : Sembayang, N 2015





# **LARGE HYDROELECTRIC POWER PLANT under CONSTRUCTION**

*(PLN: 3,407 MW & IPP: 537 MW, Total: 3,944 MW)*



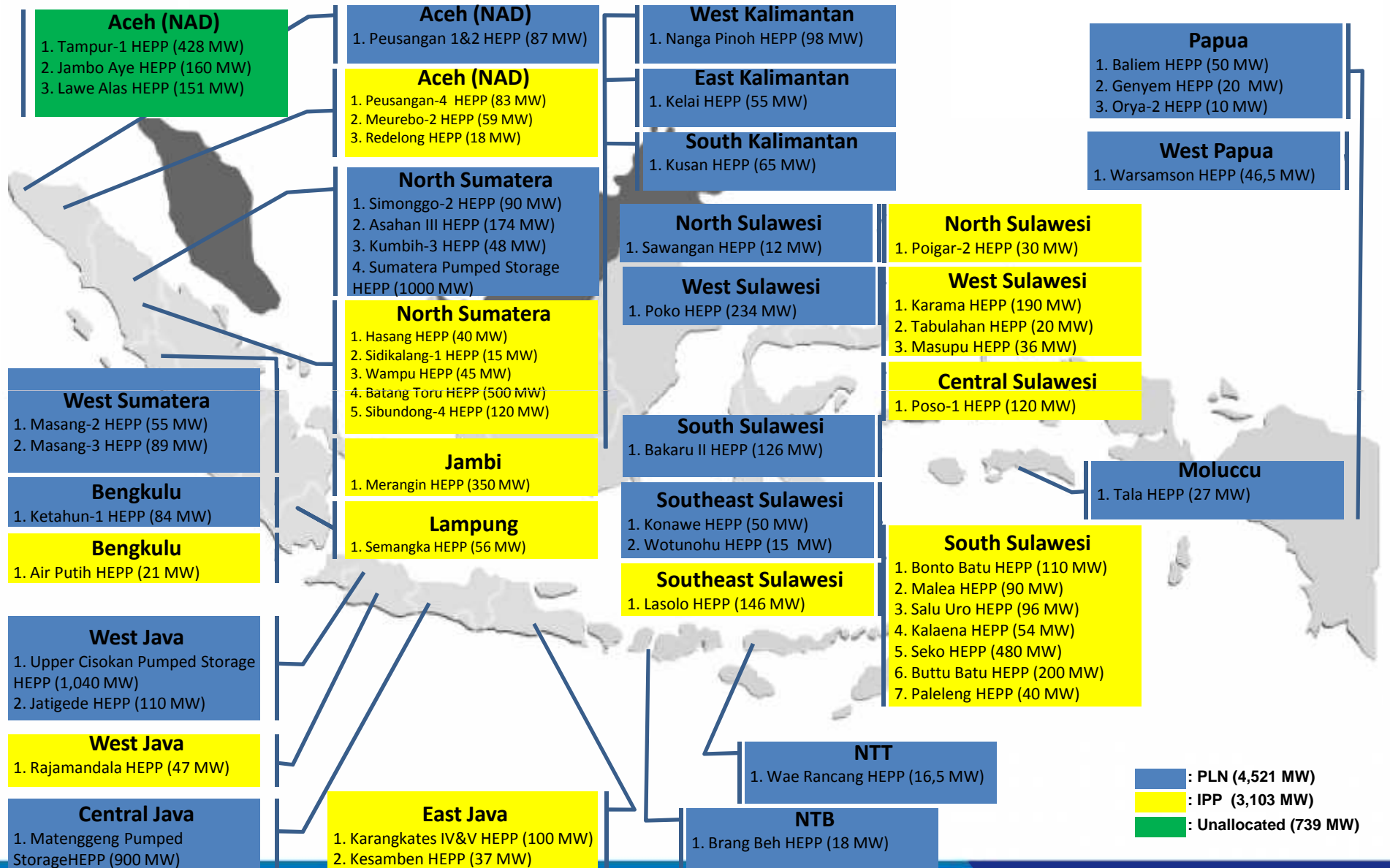




# LARGE HYDROELECTRIC POWER PLANT DEVELOPMENT

up to 2024 (Total: 8,363 MW)

Source : Sembayang, N 2015





# ***OPPORTUNITIES AND CHALLENGES ON HEPP DEVELOPMENT***

## **OPPORTUNITIES**

- Electricity Demand is continually high
- Resources is largely available.
- Technology is proven commercially
- Full support from the government policy and PLN.
- It is Renewable and meet our COP 21 commitment.

## **CHALLENGES**

- Mismatch between availability of HEPP resources and the electricity demand
- Regulatory barriers as it involves many stakeholders that could potentially inhibit each other.
- Relatively high development cost
- High risk due to the natural condition and location
- Limited availability of competent institution and human resources
- Managing environmental sustainability and energy security with conservation area

## Other RE Technologies

### Wind Power :

- A total of 2 MW wind power generator installed in various application usage, mostly in remote areas and small islands as prototyping and research purposes
- The largest is 100 kW located in Selayar island – South Sulawesi, and several 80 kW WTGs are located in Nusa Penida – Bali and North Sulawesi
- Some interest to develop 300 MW on several locations, both in Java (Sambas -Bantul, Sukabumi, Lebak) and outside Java ( Jeneponto and Sidrap – South Sulawesi)

**Micro Hydro:** It has been technologically mature but limited to remote areas

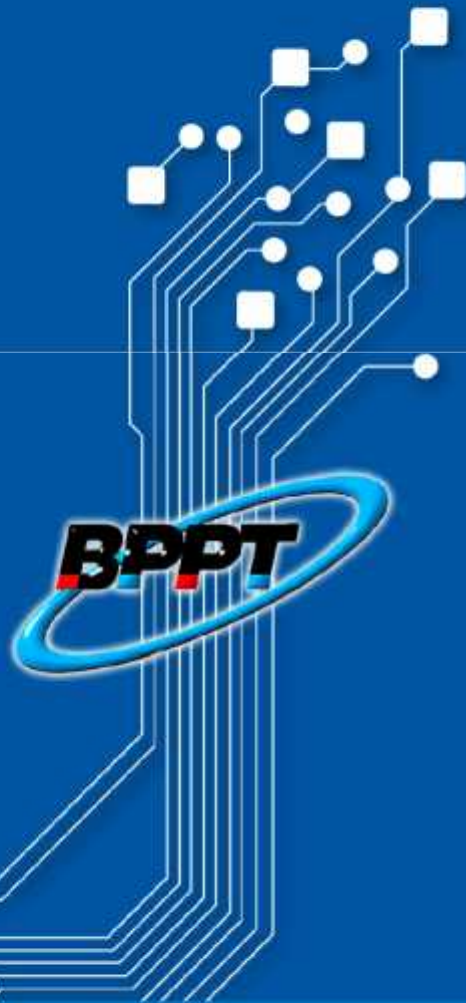
**Ocean Energy :** It is in the development stage,



# CONCLUSIONS

# Conclusions

- Indonesia has committed to developing Renewable Energy as part of the country energy systems
- Government regulations PP No. 79/2014 about National Energy Policy has set up a target of 23% of Indonesian energy mix in 2025
- However, realities range from financial issues, supporting regulations, land availability, technical problems, inadequate infrastructures such electricity grids, distributions, blending are the barriers to bring these technologies to the market
- So far biodiesel, PV, Hydro and Geothermal are RE technologies that successfully penetrated the market, but need to be done.



... in harmony we progress ...

Thank You