PERSATUAN
INSINYUR
INDONESIA








ENERGY DEVELOPMENT IN INDONESIA

"35th CONFERENCE OF THE ASEAN FEDERATION OF ENGINEERING ORGANIZATIONS"

IGN Wiratmaja
Head of Human Development Agency
Ministry of Mineral and Energy Resources

BANGKOK, 16 - 19 NOVEMBER 2017

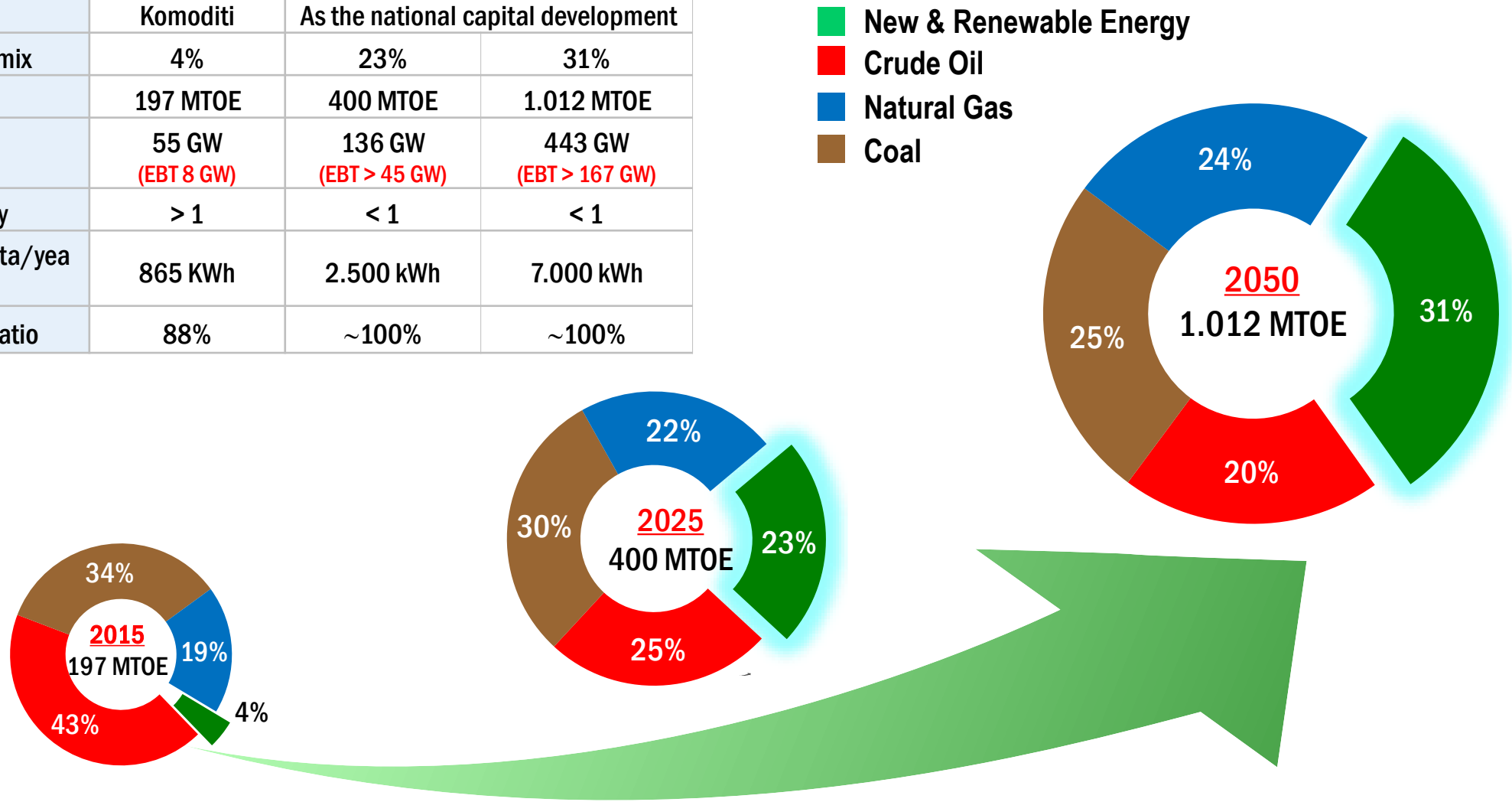
INDONESIA

GDP 2016 : USD 940.9 billion (16th in the world)
Economic Growth 2017: 5.1%
Population: 260 million

NATIONAL ENERGY POLICY

National Energy Policy

	2015	2025	2050
Energy role	Komoditi	As the national capital development	
NRE on energy mix	4%	23%	31%
Energy supply	197 MTOE	400 MTOE	1.012 MTOE
Power plants	55 GW (EBT 8 GW)	136 GW (EBT > 45 GW)	443 GW (EBT > 167 GW)
Energy elasticity	> 1	< 1	< 1
Electricity/capita/year	865 KWh	2.500 kWh	7.000 kWh
Electrification ratio	88%	~100%	~100%



PRIORITY IN ENERGY DEVELOPMENT: NAWACITA

Energy supply for 35 GW electricity program

System Development for *Biofuel Industry*

Construction of Gas Transmission & Distribution

Development of Gas Network for Household

Building *Storage Unit*

Construction of Oil Refinery

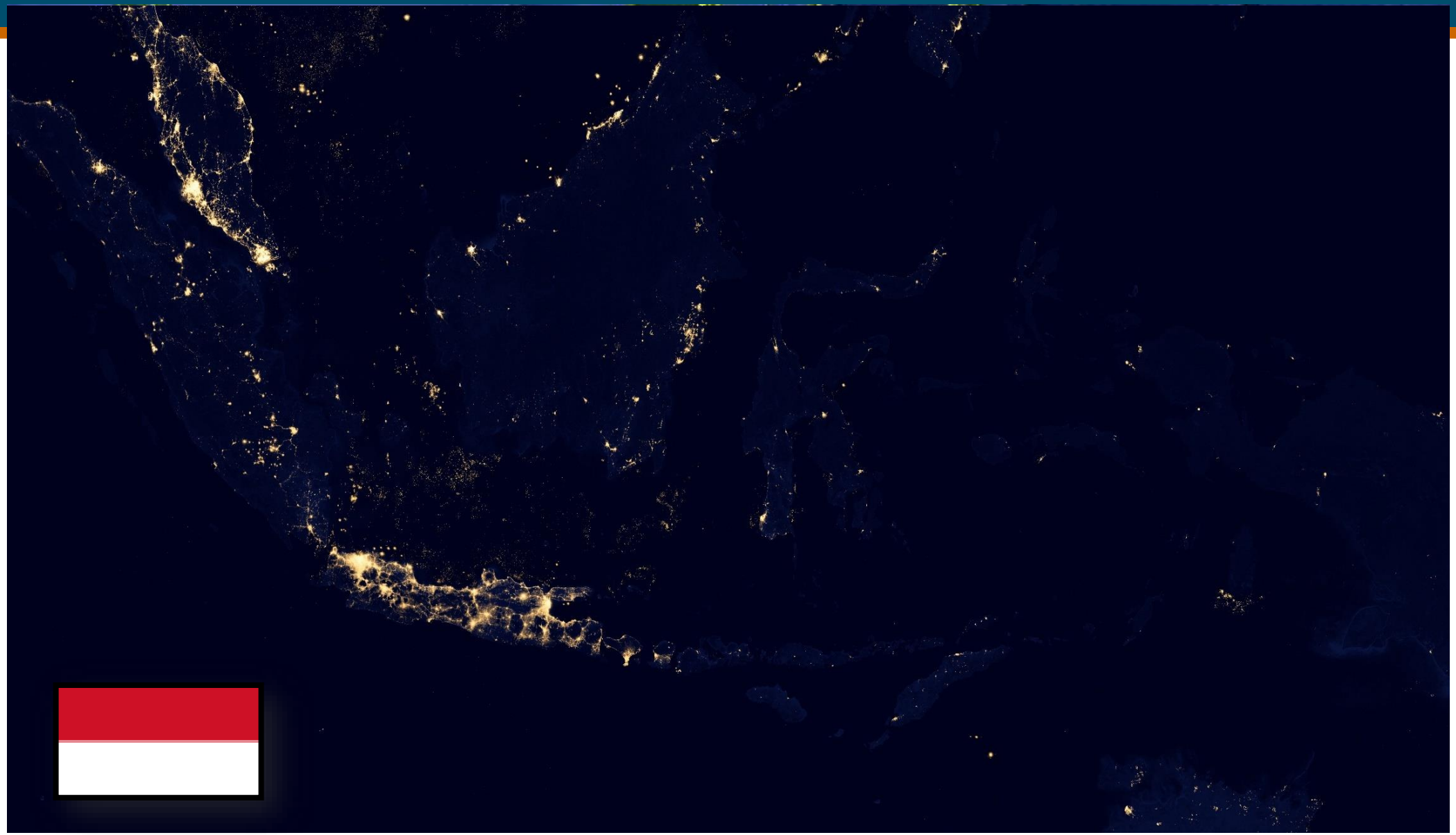
Construction of CNG Refueling Stations

Area Exploration for O&G sector development

Reduce Electricity Consumption

ELECTRICITY SECTOR

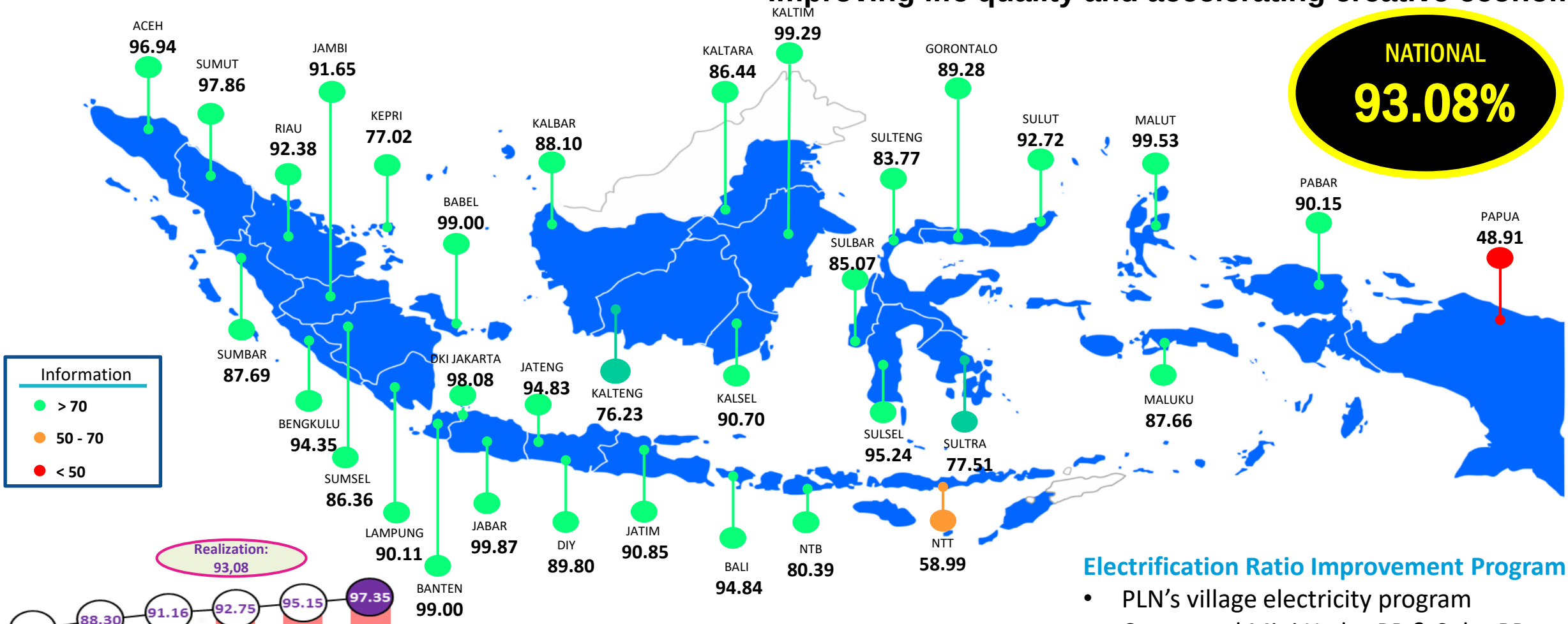
CHALLENGE FOR ENERGY DEVELOPMENT

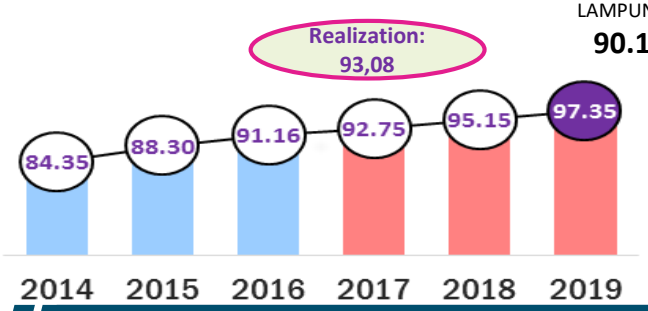


± 5,000 km

ELECTRIFICATION RATIO

Improving life quality and accelerating creative economy

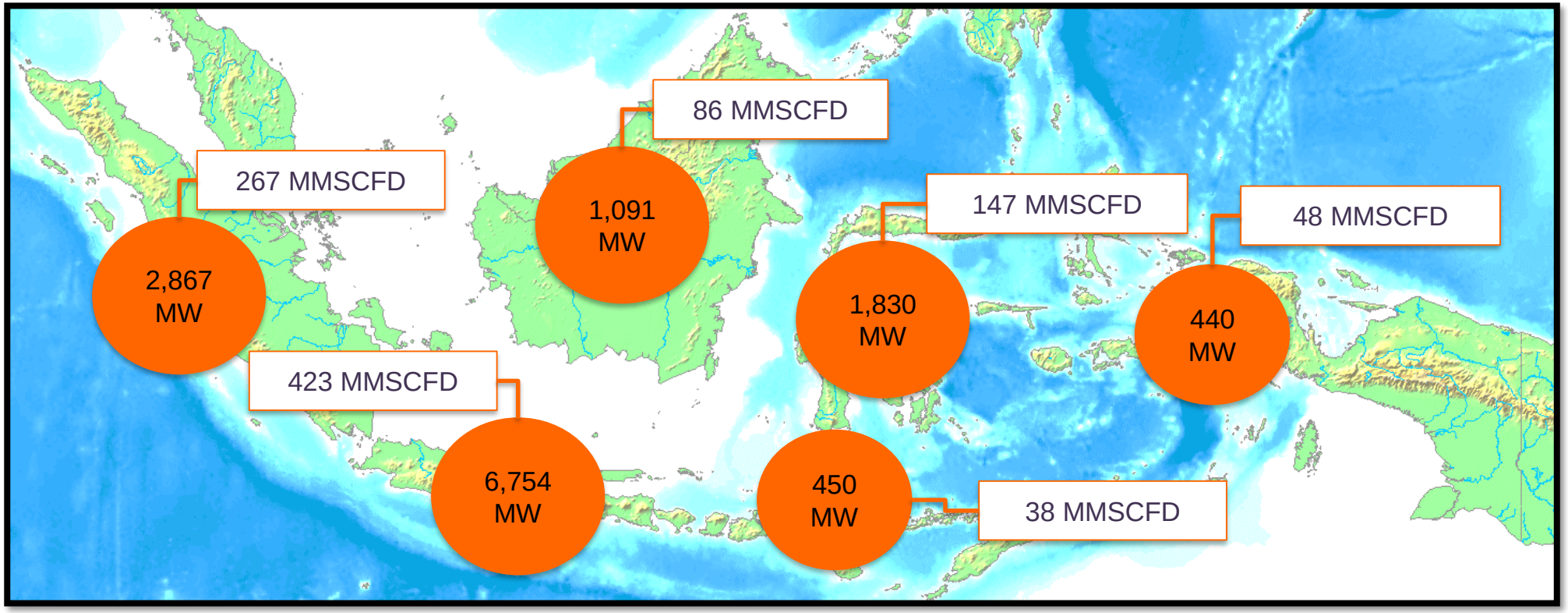




Electrification Ratio Improvement Program

- PLN's village electricity program
- Communal Mini Hydro PP & Solar PP
- Pra-electrification with LTSHE

35,000 MW Electricity Project

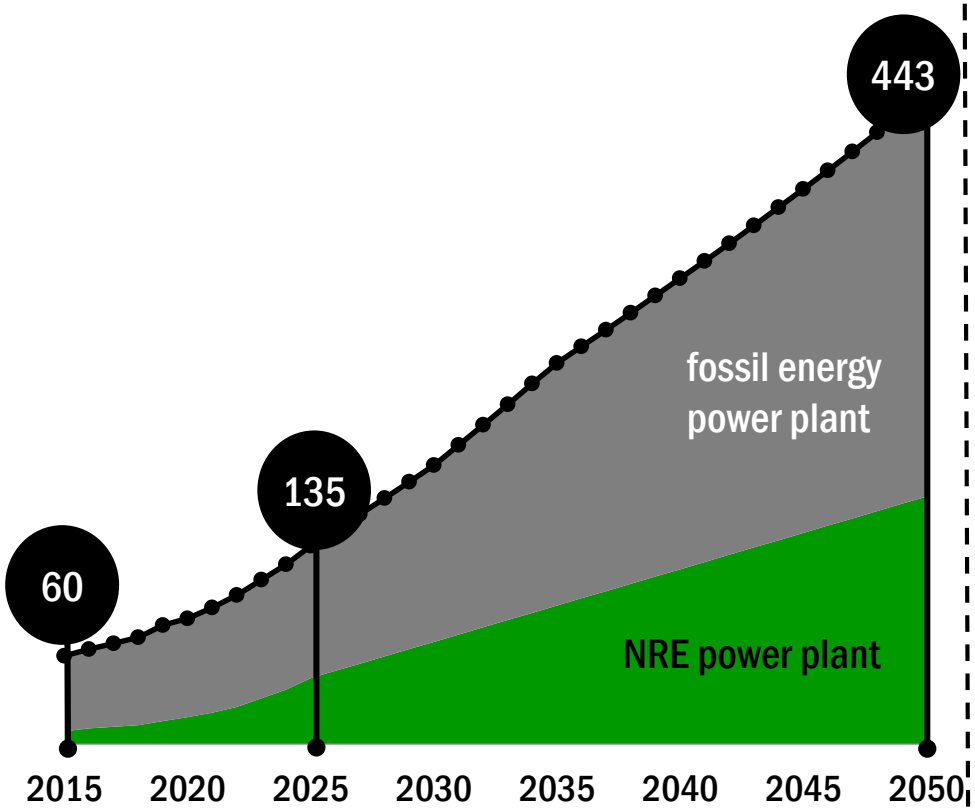


TOTAL GAS NEEDED: 1,100 MMSCFD

TOTAL POWER: 13,432 MW

Development of Power Plants

PLAN



TYPE	2015	2020	2025	2030	2040	2050
NRE	8.6	16.2	45.2	69.7	118.6	167.6
	14.3%	19.4%	33.3%	36.6%	37.4%	37.8%
FOSSIL	51.5	67.3	90.4	120.6	198.6	275.4
	85.7%	80.6%	66.7%	63.4%	62.6%	62.2%
Total	60.1	83.4	135.5	190.2	317.2	443.1

ACTION

1. increase the electrification ratio by nearly 100% in 2020 (Ministry of Energy and Mineral Resources/MEMR)
2. power plant capacity development:
   - 135,4 GW in 2025: 90.4 GW of fossil energy power plants and 45 GW of NRE power plants
   - 444,5 GW in 2050: 275,4 GW of fossil energy power plants and 169 GW of NRE power plants (MEMR)
3. formulating of land use mechanism for energy supply on overlaps land use. (Ministry of Land and Spatial Planning/ MLSP)
4. formulating of regionalization electricity business. (Ministry of State-Owned Enterprises/ MSOE)
5. apply the progressive electricity tariffs. (MEMR)
6. ensures strategic energy infrastructure projects. (Ministry of Finance)
7. develop a prototype of steam power plant ≤ 200 MW using 100% local content, until ready for commercial (Ministry of Research, Technology and Higher Education/MRTHE)
8. mastery of technology nuclear power plant. (MRTHE)
9. strengthen the implementation and utilization of technology and power plant technology components. (MRTHE)
10. Encouraging the establishment of the Engineering Procurement Construction (EPC) for electricity projects with a capacity ≤ 200 MW. (Ministry of Industry/MoI)
11. Facilitating the process of licensing services for the utilization of forest areas (including: leasing, cooperation, utilization of environmental services, or the release of forest area) for energy sector activities. (Ministry of Environment and Forestry/ MEF)
12. formulate policies that prioritize the use of the national production of equipment and services including energy industry. (MoI)

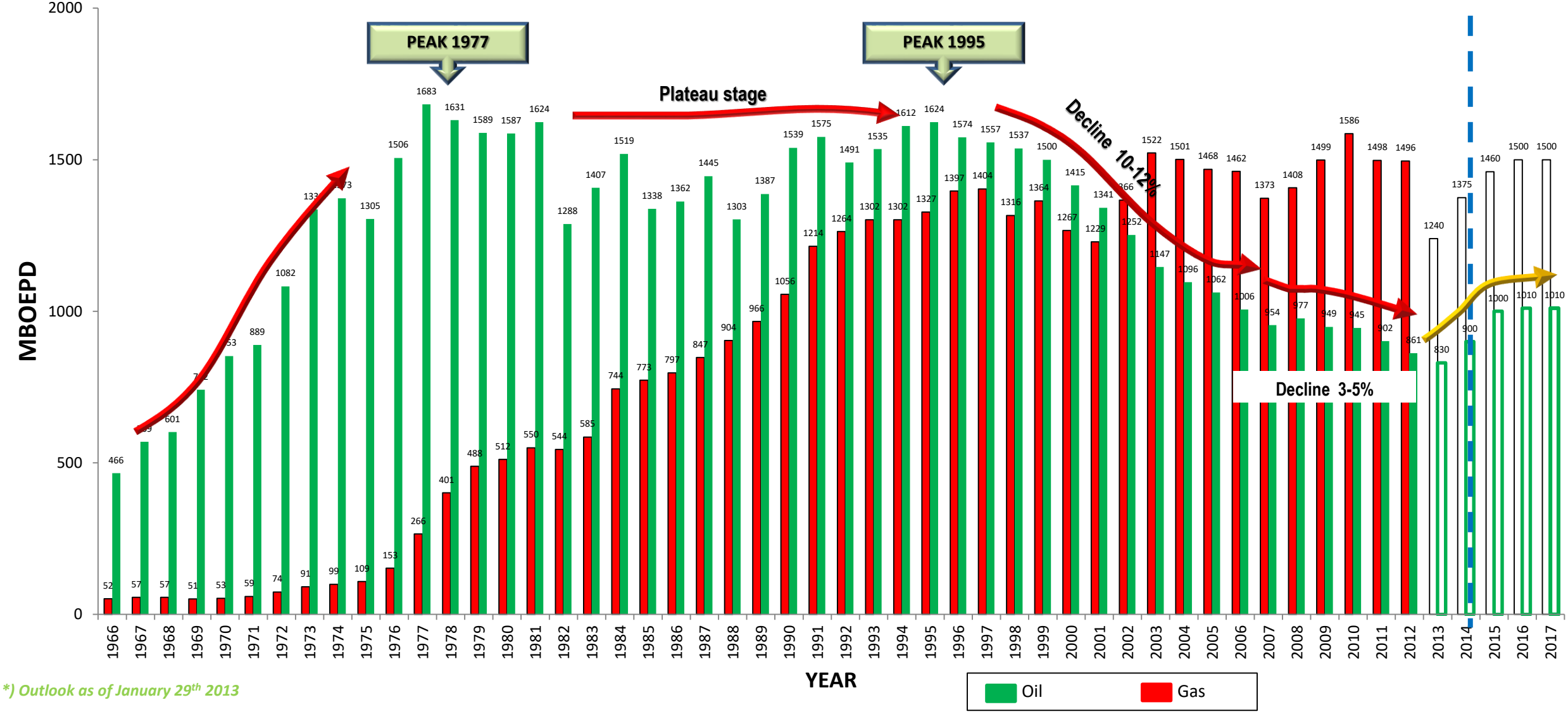
PROMOTING ELECTRIC VEHICLE, JONAN: REDUCE DEPENDENCE TO FOSSIL ENERGY

Minister of energy and mineral resources test electric motorcycle made by Indonesian
"This prototype made by WIKA and ITS Team is well made. I am suggesting, when this motorcyle is mass produced, the price must be competitive to gasoline fueled motorcycles. "

OIL & GAS SECTOR

O&G PRODUCTION PROFILE

- *The development of the oil and gas industry has changed from oil dominance to natural gas*



*) Outlook as of January 29th 2013

INDONESIA: PRODUCER & CONSUMER

2015

CRUDE OIL

Production	830,000 BOPD
Import	770,000 BOPD
Consumption	1.6 Million BOPD
Annual Consumption Growth	3%

LPG

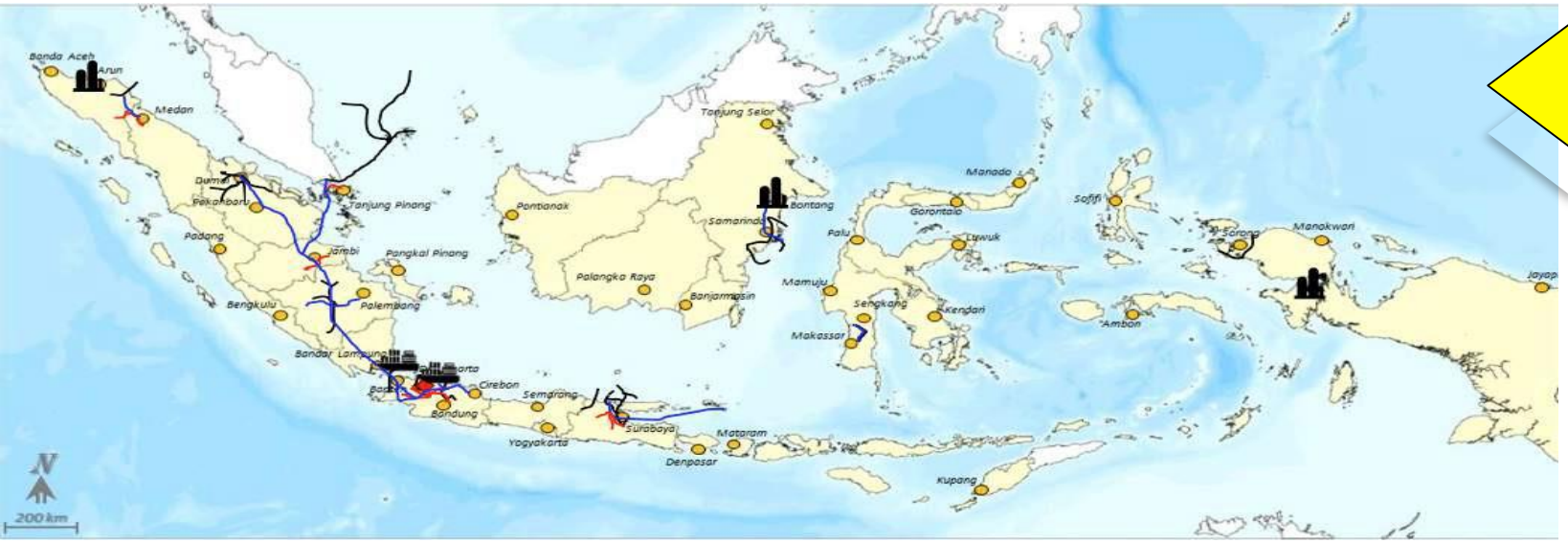
Production	2.27 juta MTon
Import	4.3 juta MTon
Consumption	6.57 Million MTon
Annual Consumption Growth	13%

GAS

Production	8,113 MMSCFD
Export	3,048 MMSCFD
Consumption	3,703 MMSCFD
Annual Consumption Growth	2%

Gas export & consumption as of October 2015

GAS INFRASTRUCTURE, EXISTING & PLAN

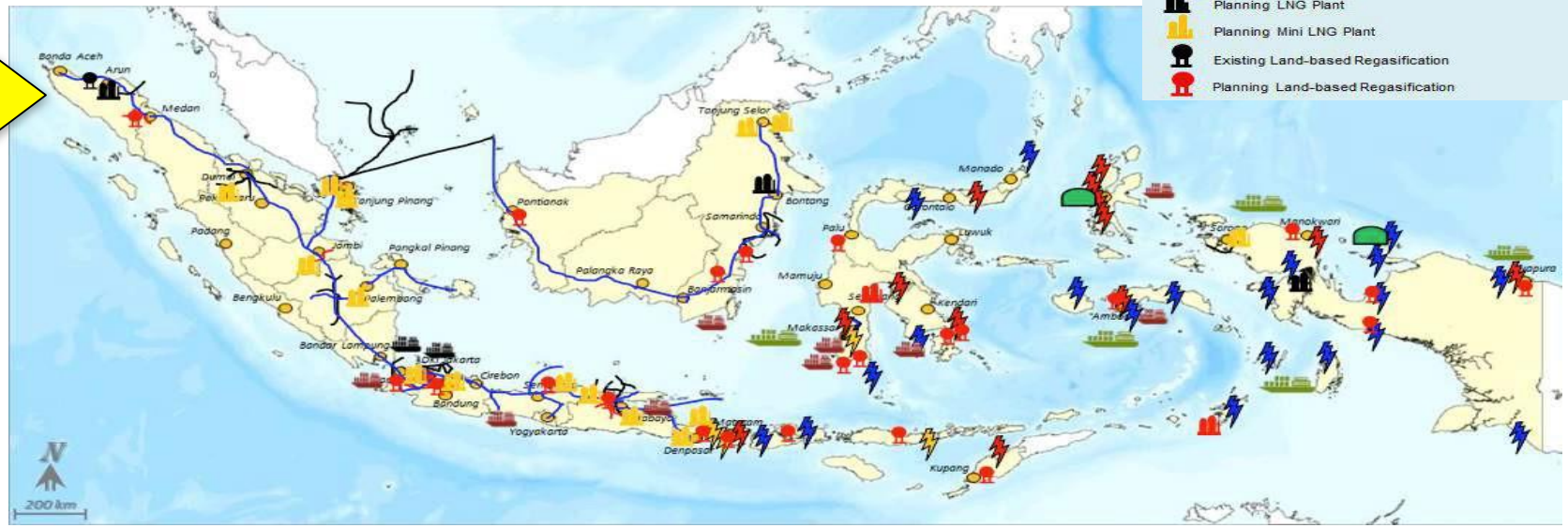


EXISTING

Legend

- Existing Dedicated Upstream Pipeline
- Existing Transmission Pipeline
- Virtual Pipeline from Supply
- Virtual Pipeline to final distribution
- Virtual Pipeline (Plan)
- Primary Hub
- Primary Hub (Plan)
- Plan FSRU
- Existing FSRU
- Mobile Power Plant (MPP) Plan
- Pembangkit Listrik Tenaga Gas - Uap (PLTGU) Plan
- Pembangkit Listrik Tenaga Minyak – Gas (PLTMG) Plan
- Secondary Hub/LNG Storage Tank
- Planning LNG Plant
- Planning Mini LNG Plant
- Existing Land-based Regasification
- Planning Land-based Regasification

ROADMAP OF NEXT 15 YEARS



INVESTMENT DEMAND (Miliar USD)			
Pipa 12	**Liquefaction** 25.6	**SPBG + CNG** 1.93	**TOTAL 48.2**
Regasification 6.1	**Jargas** 2.2	**LPG** 0.4	

REFINERY CONSTRUCTION

May 2015

Pengoperasian Kembali Kilang TPPI Bisa Perkuat Rupiah

Kilang TPPI Bisa Hemat Devisa US$ 2,2 Miliar per Tahun

6 NEWS BISNIS HEALTH SHOWBIZ BOLA TEKNO PHOTO VIDEO OTOMOTIF

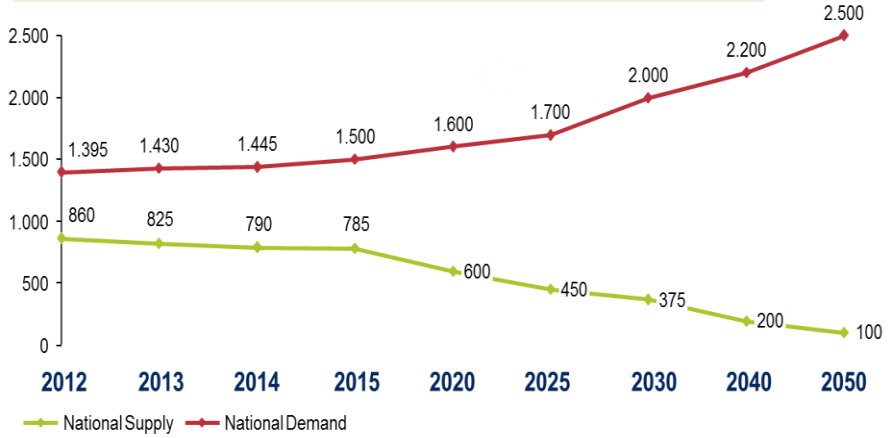
- Presidential Regulation 146/2015: Refinery Development
- Potention from saving
- Plan to build 3 refineries and revitalize 4 refinery until 2025

Indonesia's Oil Refinery Development

TPPI Refinery Operation Could Strengthen Rupiah Value

2 million barrels of Condensat per month

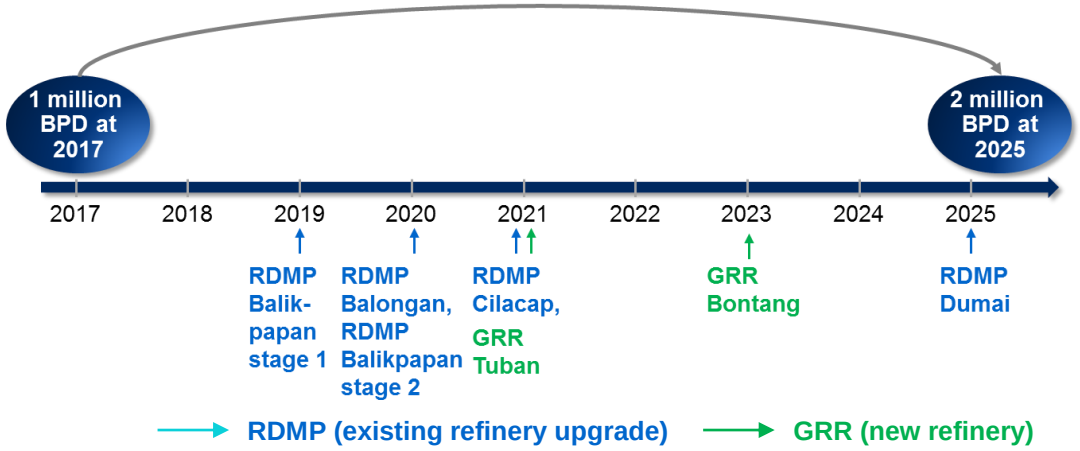
National Fuel Oil Supply Demand



Regulations

- Presidential Regulation 146/2015: Refinery Development
- Ministerial Regulation 25/2016: Privately Funded Oil Refineries

Oil Refinery Development Plan in the Next 10 Years



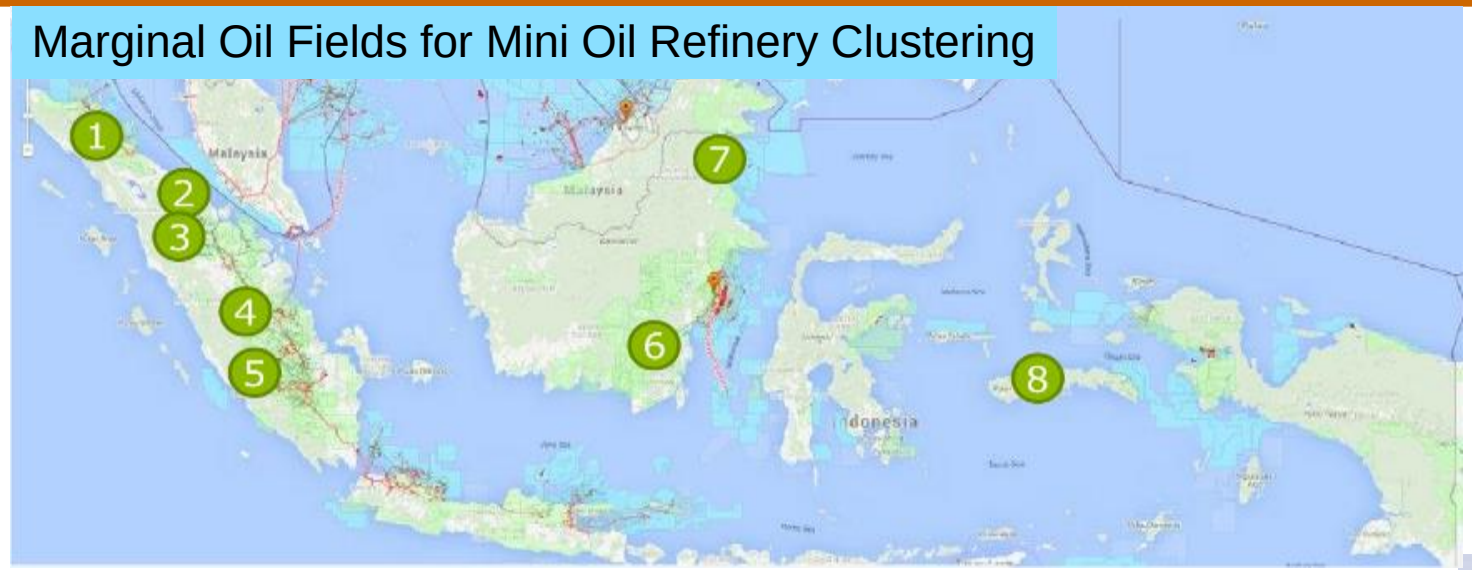
Total CDU capacity mn bpd	1.0	1.1	1.2	1.6	1.9	2.0

Target refinery capacity in 2025: 2 million BPD

No	Refinery Project	Investment (billion US$)
1	GRR Tuban	12 – 15
2	GRR Bontang	11 – 13
3	RDMP Balikpapan	5.2
4	RDMP Balongan	1.2
5	RDMP Cilacap	4.3
6	RDMP Dumai	4.5

Mini Refinery Development

Marginal Oil Fields for Mini Oil Refinery Clustering



Ministerial Regulation 22/2016 on Small Scale Oil Refineries

1. **Cluster I – Sumatera Utara (Rantau dan Pangkalan Susu)**
2. **Cluster II – Selat Panjang Malaka (EMP Malacca Strait dan Petroselat)**
3. **Cluster III – Riau (Tonga, Pendalian, Langgak, West Area, Lindai, Parit Minyak)**
4. **Cluster IV – Jambi (Mengoepeh, Budi, Akatara, Ridho)**
5. **Cluster V – Sumatera Selatan (Tampi dan Sriwijaya Ariodamar)**
6. **Cluster VI – Kalimantan Selatan (Tanjung)**
7. **Cluster VII – Kalimantan Utara (Bunyu, Sembakung, Mamburungan)**
8. **Cluster VIII – Maluku (Oseil dan Bula)**

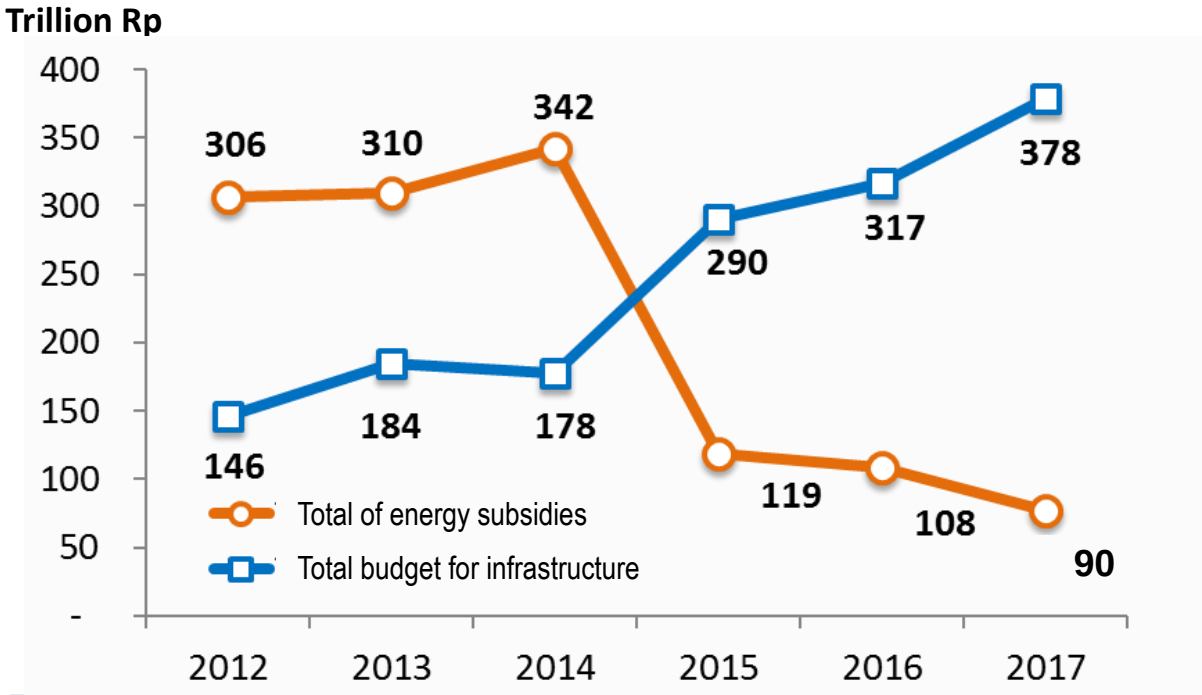
Existing Mini Refinery in East Java (18,000 BPD)

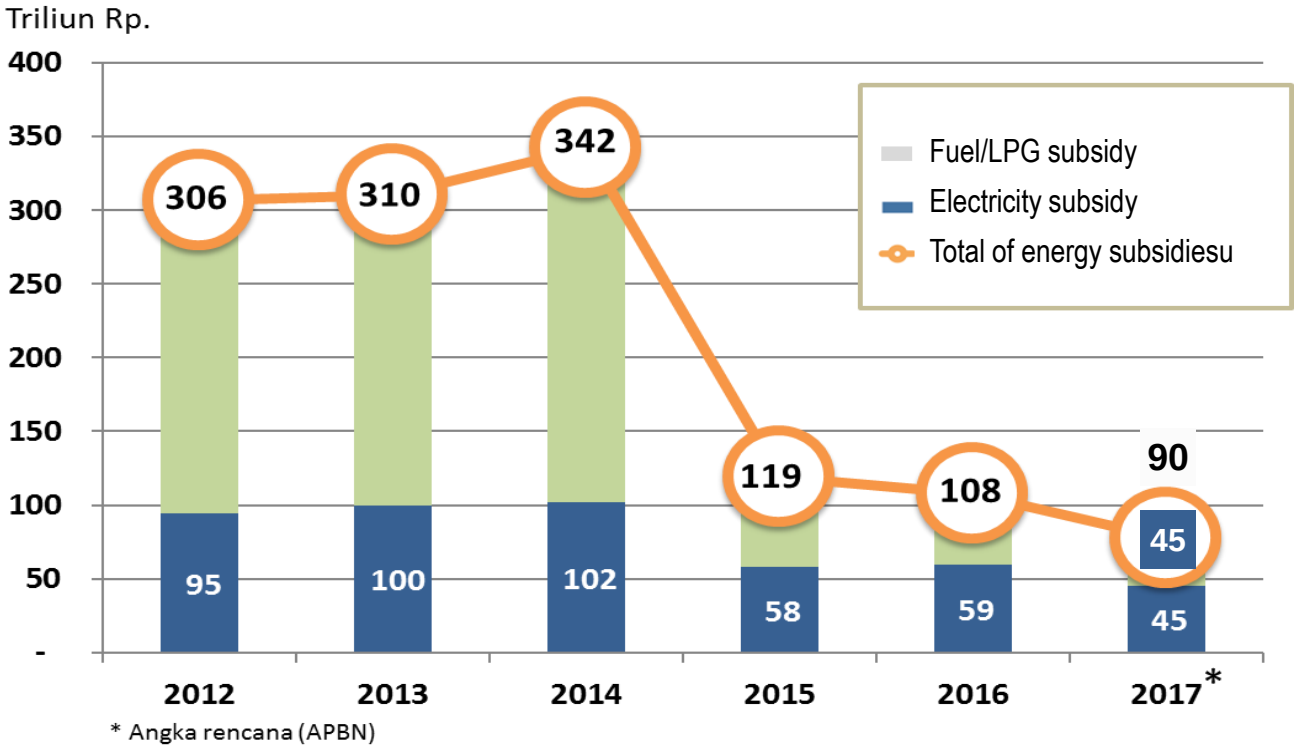
Prod. (bopd)	Cluster							
	I	II	III	IV	V	VI	VII	VIII
2016	3,191	2,731	1,252	1,653	1,152	3,239	7,002	4,113
2022	3,253	4,419	4,079	5,728	2,801	878	2,653	197

ENERGY SUBSIDIES

"Implementing equitable and targeted energy subsidies

- Decreasing energy subsidy by 66% (Rp.491 Trillion) within last 2 years (2015-2016)
- Diverting energy subsidies for more equitable development, such as for: education, health, and infrastructure





The amount of subsidies are decreasing, subsidies are allocated for productive matters such as infrastructure financing

On Going & Upcoming Upstream Oil & Gas Projects

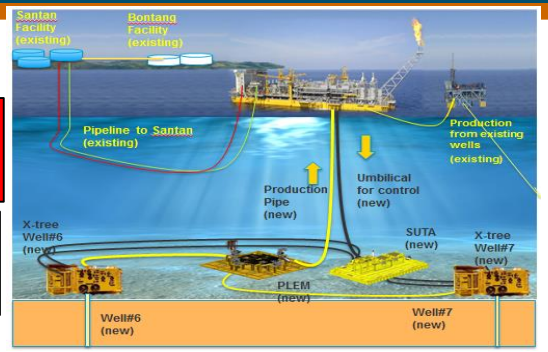
BLOCK A ACEH

Gas Reserves: 563 bscf
Investment: US$ 1.3 Billion
Production: Q4 2017

Production (Q1 2021):
25000 bopd
Gas Reserves: 46 TCF
CO2 Content: 72%

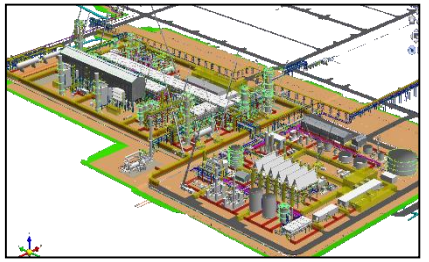
ANDE ANDE LUMUT

EAST NATUNA



IDD BANGKA

Gas Reserves 100.41 bscf
Investment: US $ 8 Billion
Production: 110 MMSCFD
(already onstream)



TANGGUH TRAIN 3

Gas reserves 5.7 TCF
Train 3 Investment: US $ 8 Billion
Production (Q2 2020): 700 MMSCFD

WASAMBO

Production (Q1 2017): 70 MMSCFD
Investment: US $ 55.2 million

Gas Reserves: 2.27 TCF
Investment: US$ 4.1 Billion
Production (Q3 2017): 450 MMSCFD

JANGKRIK COMPLEX PROJECT

JAMBARAN TIUNG BIRU

Gas reserves: 97 bscf
CO_2 Content: 34%
Investment US $ 2.2 Billion
Production (Q4 2019): 330 MMSCFD

MADURA

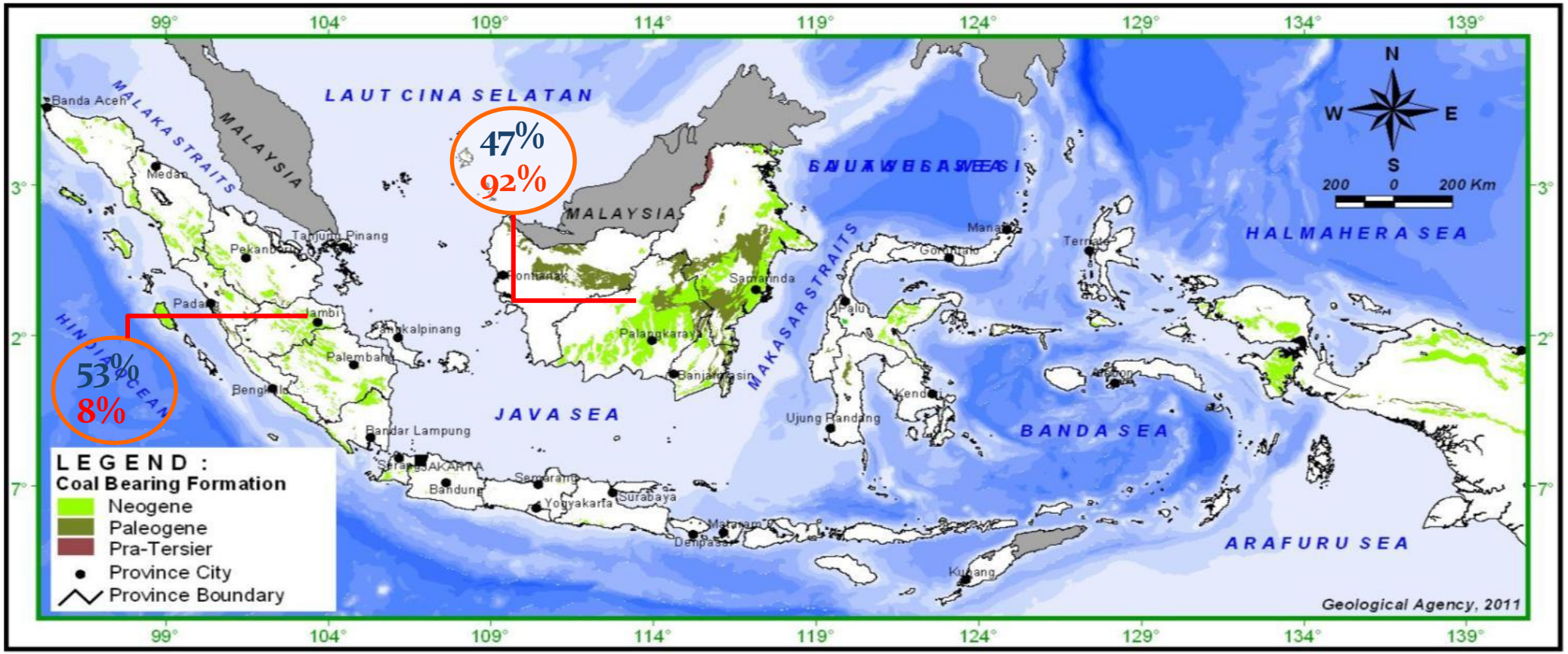
Production (Q1 2017): 110 MMSCFD
Investment: US $ 642 million

MASELA

Gas Reserves: 10.73 TCF
Investment: US $ 15-16 Billion

COAL SECTOR

ENERGY RESOURCES
COAL BEARING FORMATION IN INDONESIA



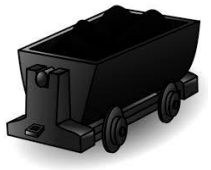
Note:

53% Potential Resources
8% Production

Total coal resources :161 Billion tonne; Coal reserves :28 Billion tonne	CBM assosiated with coal (Depth >300 m)

Optimalization of Coal Utilization

issue



The largest coal exporter in the world

Target

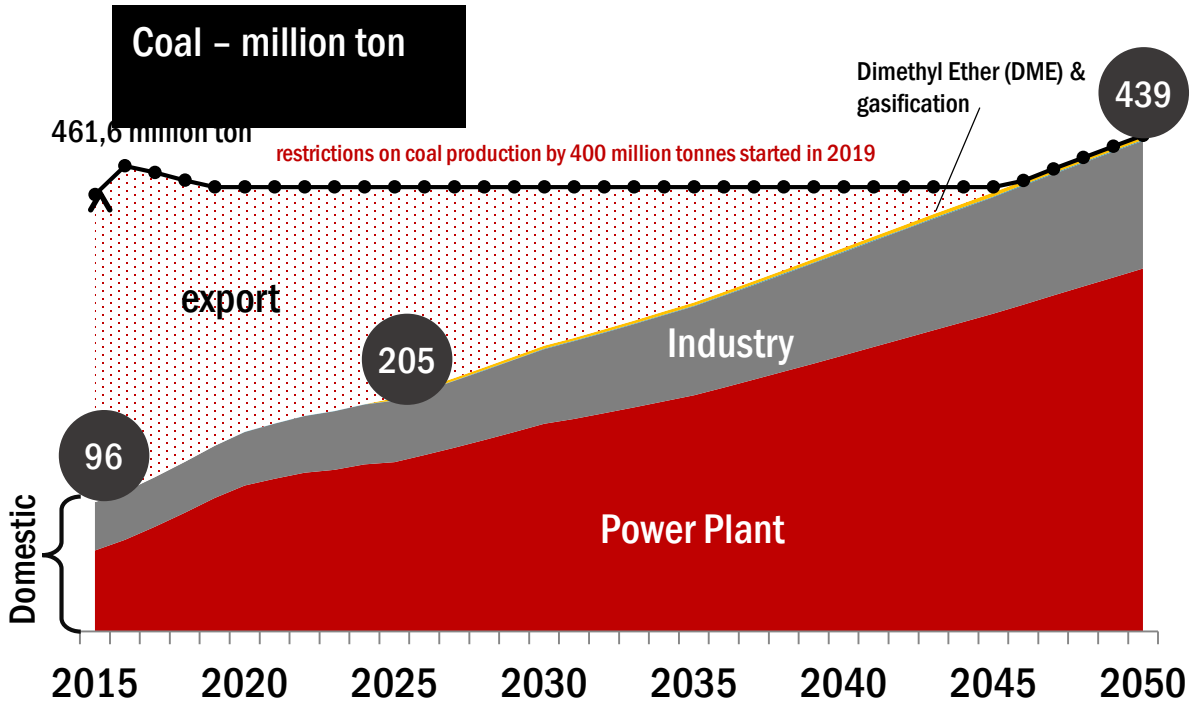
 # Domestic coal utilization increases

 # Production conrol

1	Control coal production to max. of. 400 million tonne starting in 2019 (2018 production: 406 million tonne)
2	Increase exploration of coal resources and reserves
3	Increased use of coal as a mainstay of national energy supply (DMO 2018: 131 Million Tonne)
4	Development of coal liquefaction, hydrogen liquefaction, coal gasification (target 2018 : commercialization)
5	Require the use of environmentally friendly Coal Technology (CCT: clean coal technology) and high efficiency (USC : Ultra Super Critical) technology in stages
6	Post-mining land reclamation (2018 : 6,900 Ha)
7	Provide input in the preparation of the master plan of integrated coal port development plan

Coal as the Reliable national Energy Supply

PLAN



Program		2015	2016	2017	2018	2019	2020	2025	2030	2040	2050
Export		365,8	288,1	274,8	251,6	232,9	220,4	194,8	147,3	59,9	0
Domestic	PP	63,2	82,4	94,2	106,8	120,0	131,1	152,3	186,7	248,5	326,6
	Industry	15,8	43,5	44,5	45,6	47,0	48,4	55,2	67,4	92,9	114,8
	DME	-	-	-	-	-	-	2,1	2,5	3,2	4,0
	Gasification	0,0	0,0	0,0	0,0	0,1	0,2	0,4	0,5	0,7	0,9
Total Production		461,6	414,0	413,0	403,0	400,0	400,0	400,0	400,0	400,0	438,7

ACTION

1. Controlling the maximum coal production of 400 million tons starting in 2019 with the priority of domestic needs and stop exports in the domestic demand of 400 million tonnes. (MEMR)
2. Reducing the share of coal exports gradually and stop coal exports by the year 2046. (MEMR)
3. Developing coal gasification industry. (MoI)
4. Increasing the capacity of basic chemical industry based on oil and gas and coal to increase value-added and import substitution. (MoI)
5. Formulating a master plan for port development plan integrated coal. (Ministry of Transportation/ MoT)
6. Improving the utilization of coal to the industrial sector with a target of 55.2 million tonnes in 2025. (MoI)

RENEWABLE ENERGY

Renewable Energy Potention – Future (which is still neglected)

Hydro, Mini Hydro, Micro Hydro.
75 GW

5.02 GW (7%)

Solar
532.6 GWp

0.08 GWp (0,01%)

Geothermal
29.5 GW

1.44 GW (5%)

Wind
113.5 GW

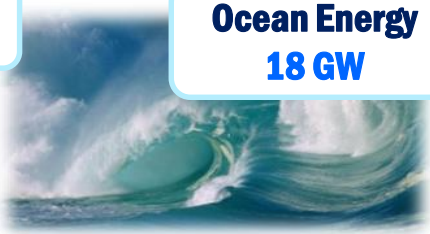
6.5 MW (0,01%)

Bioenergy
32.6 GW

Biofuel
200 ,000 Bph

1.74 GW (5,3%)

Ocean Energy
18 GW



0.3 MW (0.002%)

Fossil Fuel

Proven resources:
- Oil : 3.6 miliar barel
- Natural Gas : 100.3 TSCF

Production:
- Oil : 288 Juta barel
- Natural Gas : 2.97 TSCF

Extimated to be depleted in:
- Oil : 13 tahun
- Natural gas : 34 tahun

801.2 GW | **8,66 GW** | **1%**

Utilization of NRE not yet optimal

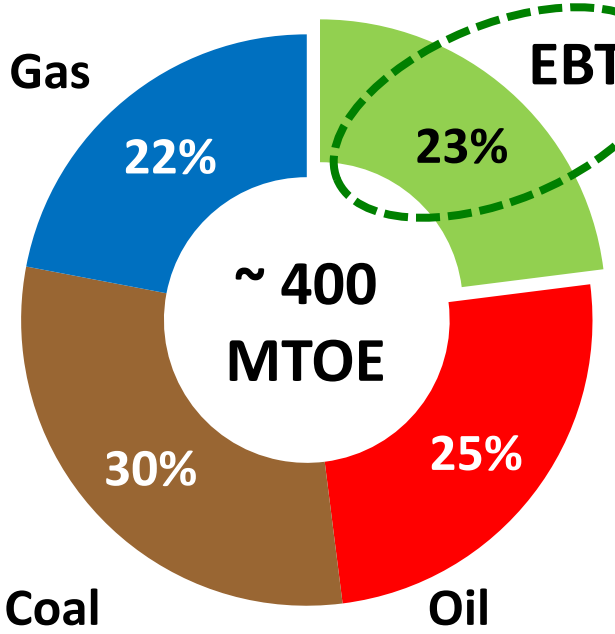
Current installed power plant capacity **55,528 MW**

Power plant development plan **35,000 MW** New project
+7,500 MW On going project

26

Target of Primary Energy Supply NRE Year 2025

Based on RUEN



93.4 MTOE

69 MTOE

24.5 MTOE

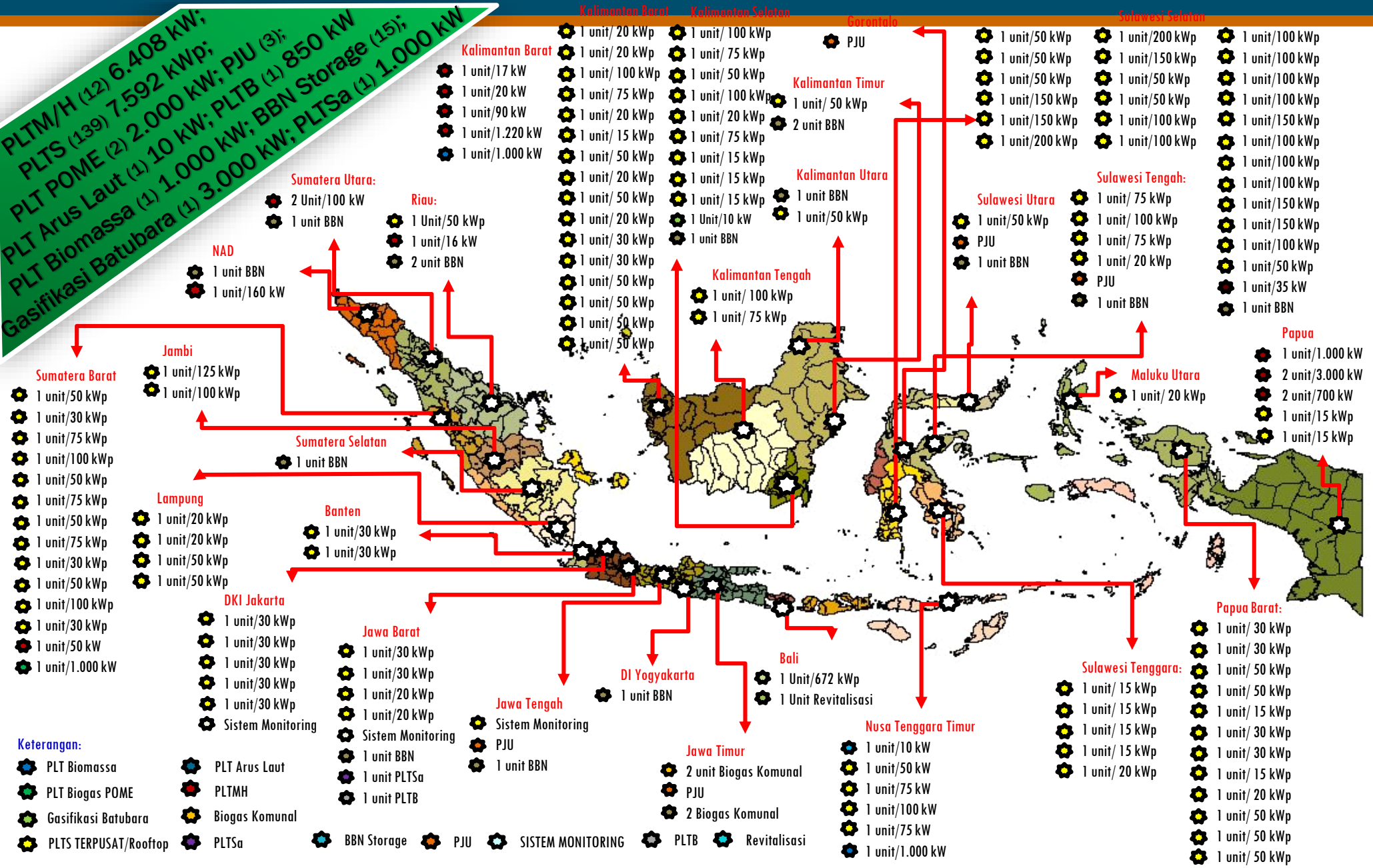
NRE Electricity	45 GW

Biofuel	15.6 *) million KL
Biomass	8.3 million tonne
Biogas	489.8 jmillion m3
CBM	46.0 Mmscfd

*) excluding biofuel for power generation of 0.7 million kL by 2025

Proposed Infrastructure Development TA. 2017

PLTM/H (12) 6.408 kW;
PLTS (139) 7.592 kWp;
PLT POME (2) 2.000 kW; PJU (3);
PLT Arus Laut (1) 10 kW; PLTB (1) 850 kW
PLT Biomassa (1) 1.000 kW; BBN Storage (15);
Gasifikasi Batubara (1) 3.000 kW; PLTSa (1) 1.000 kW



GEOTHERMAL ENERGY IN INDONESIA

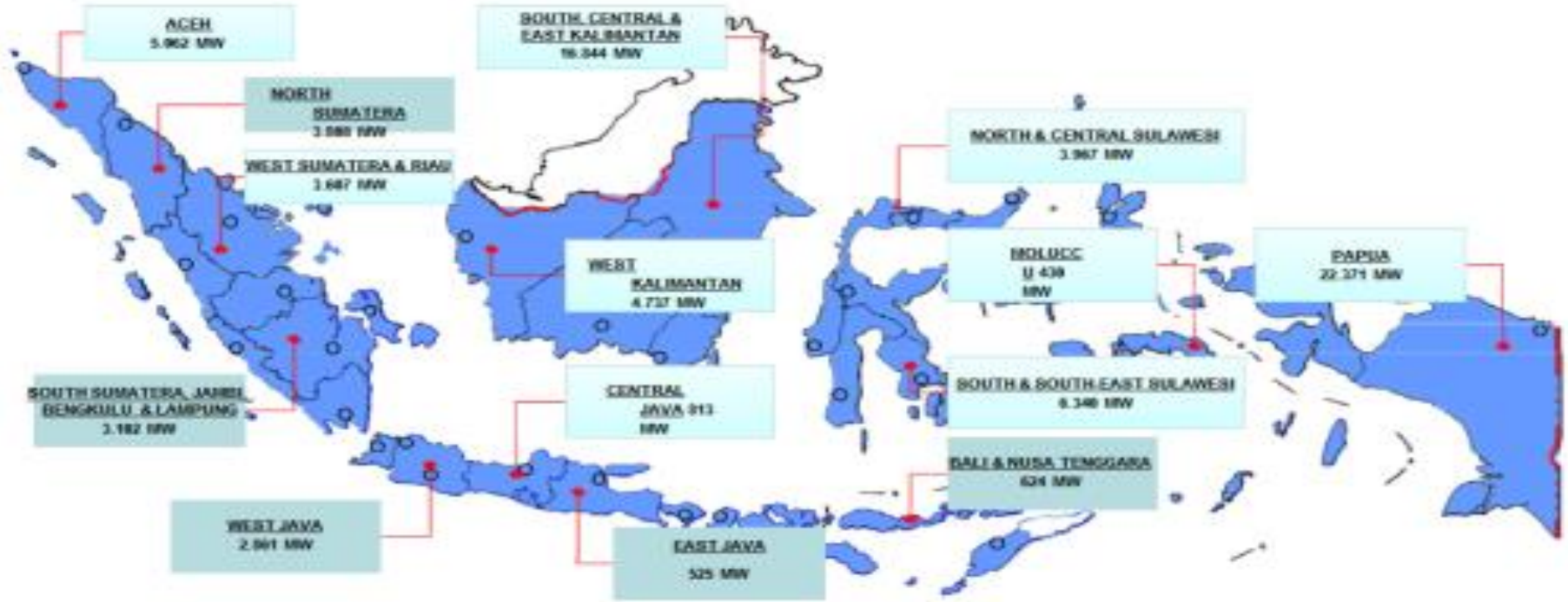
• Geothermal Potential Map

- Ready for Exploration or on Bidding Stage – 2590MW
- Exploration Stage – 985MW
- Ready for Exploitation – 940MW
- Construction Stage – 117.5MW
- Production Stage - 1201MW

(Source: Perusahaan Listrik Negara [PT PLN (Persero)]

- Indonesia has an estimated geothermal energy potential of 29GW across more than 285 locations – equivalent to about 40% of world's total geothermal reserves
- The government is using only 4-5% of its geothermal capacity
- In August 2014, Indonesia's House of Representatives passed the Geothermal Law No. 21/2014 separating geothermal from other mining activities and thus paving the way for geothermal exploration in the country.
- The Geothermal Fund Facility (GFF) provides support to mitigate risks and provide information regarding the relatively high upfront costs for geothermal development, as the government efforts to make the investment in geothermal energy more attractive.

HYDROPOWER ENERGY IN INDONESIA

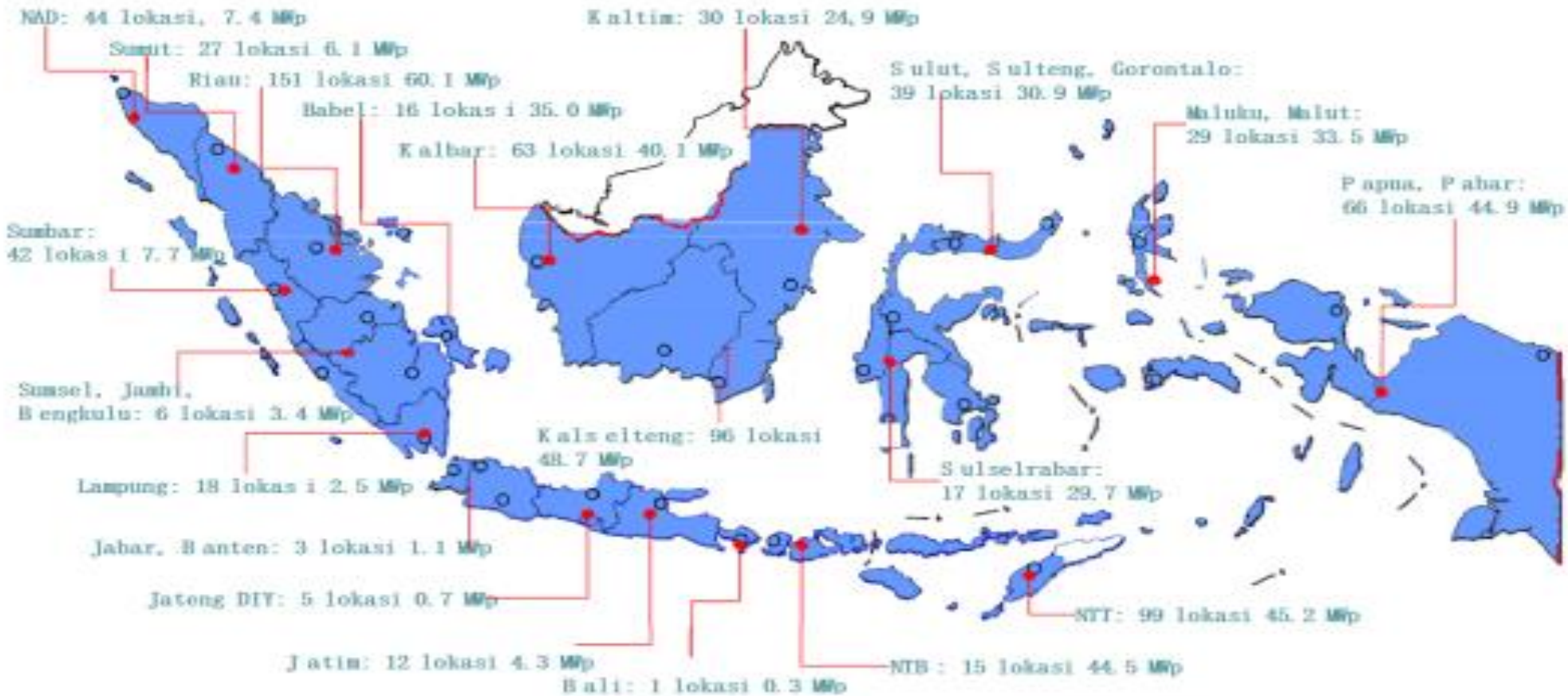


(Source: Indonesia Investment Coordinating Board (BKPM)

- Indonesia has an estimation of 75,670MW of hydropower potential and an addition of 770MW of mini- or micro-hydropower for development. 95% of the hydropower potential is not utilized.
- A 2007 grant from the United Nations Development Program allowed Indonesia to create an Integrated Microhydro Development Program to accelerate hydropower development. The program focused on removing investment barriers and fostering technical capacity.
- To meet electricity demand, a total of 5.7GW new additional hydropower plant has been planned for the next 10 years and 20% expected to be developed by IPP.

SOLAR ENERGY IN INDONESIA

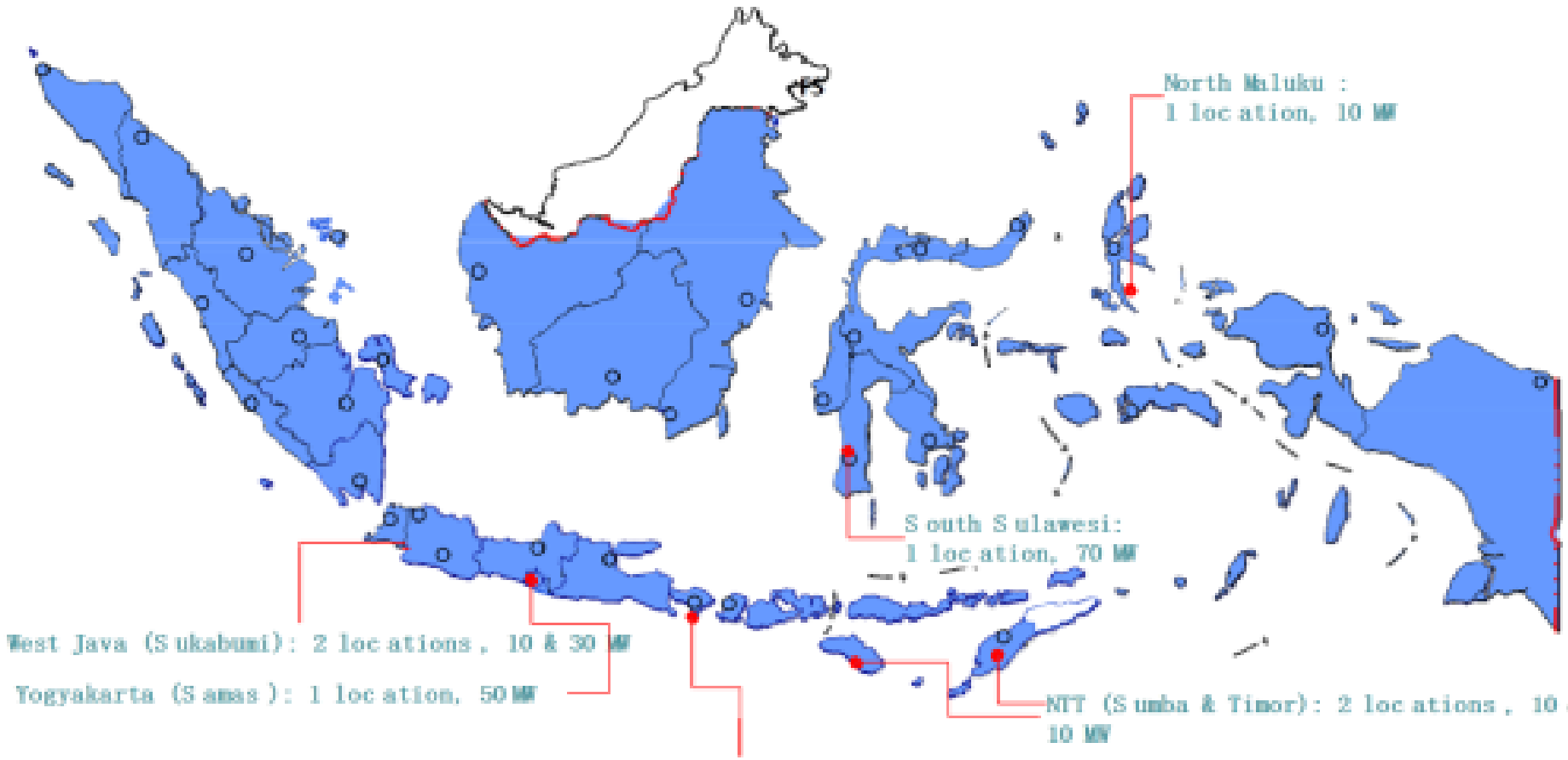
- Indonesia offers significant solar power resources with 4.8kWh/m2 per day, but has yet to develop strong market
- Current installed capacity is mostly solar home systems and utility-scale solar photovoltaic (PV) plants.
- The feed-in Tariff (FiT) for solar energy is at US$0.25/kWh.
- The GoI shown desire to attract foreign solar cell manufacturers to Indonesia to create jobs for local Indonesians and also drive interest in solar power writ large that could lead to export opportunities



(Source: Perusahaan Listrik Negara [PT PLN (Persero)]

WIND ENERGY IN INDONESIA

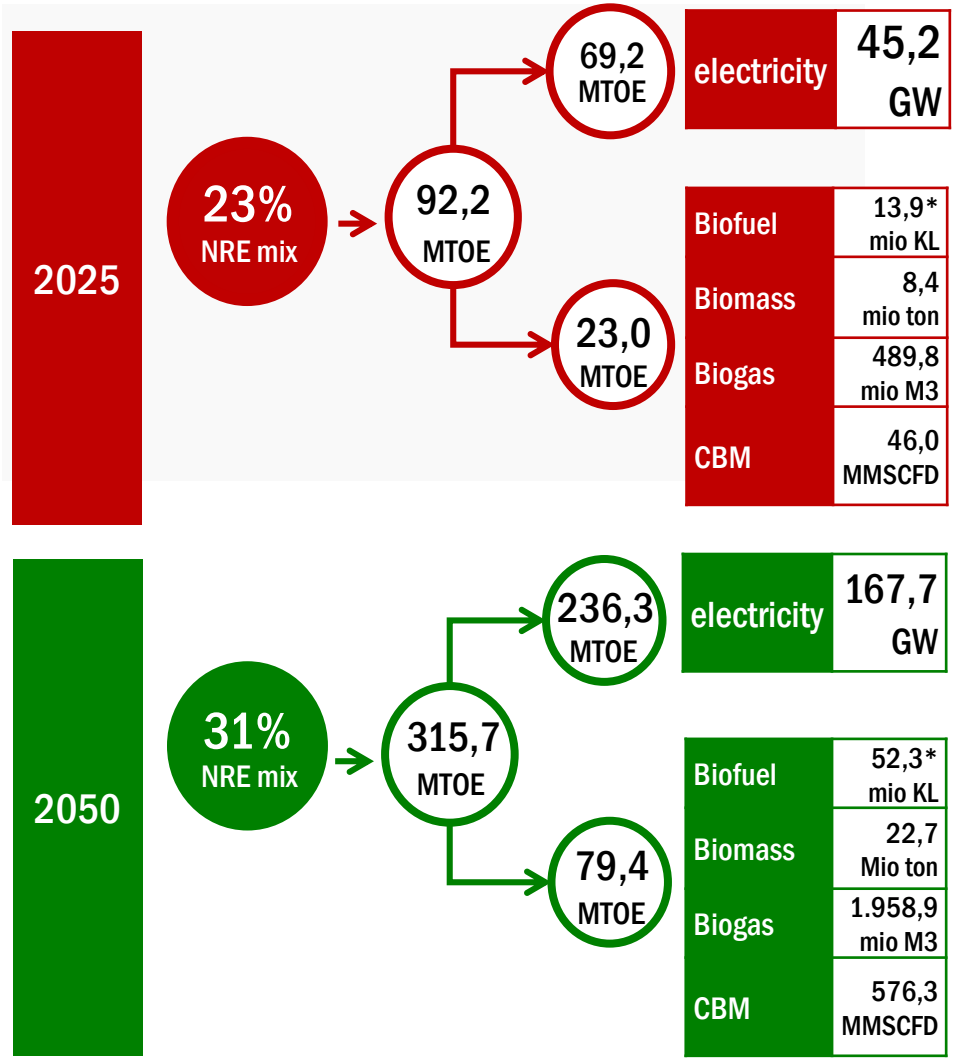
- Wind energy development program in Indonesia up to 2020 are 200MW which are currently still under procurement.
- Offshore wind is providing more investment opportunities due to Indonesia's lengthy coastlines and consistent ocean breezes.
- The GoI will be tabling the final draft of the Feed-in Tariffs (FiT) for wind energy.



(Source: Perusahaan Listrik Negara [PT PLN (Persero)]

NEW & RENEWABLE ENERGY TARGETS

PLAN



ACTION

1. Build NRE power plants:

Types of Power Plant (MW)	2025	2050
Geothermal	7.239	17.546
Hydro & Micro hydro	20.960	45.379
Bioenergy	5.532	26.123
Solar	6.379	45.000
Wind	1.807	28.607
Other NRE	3.128	6.383

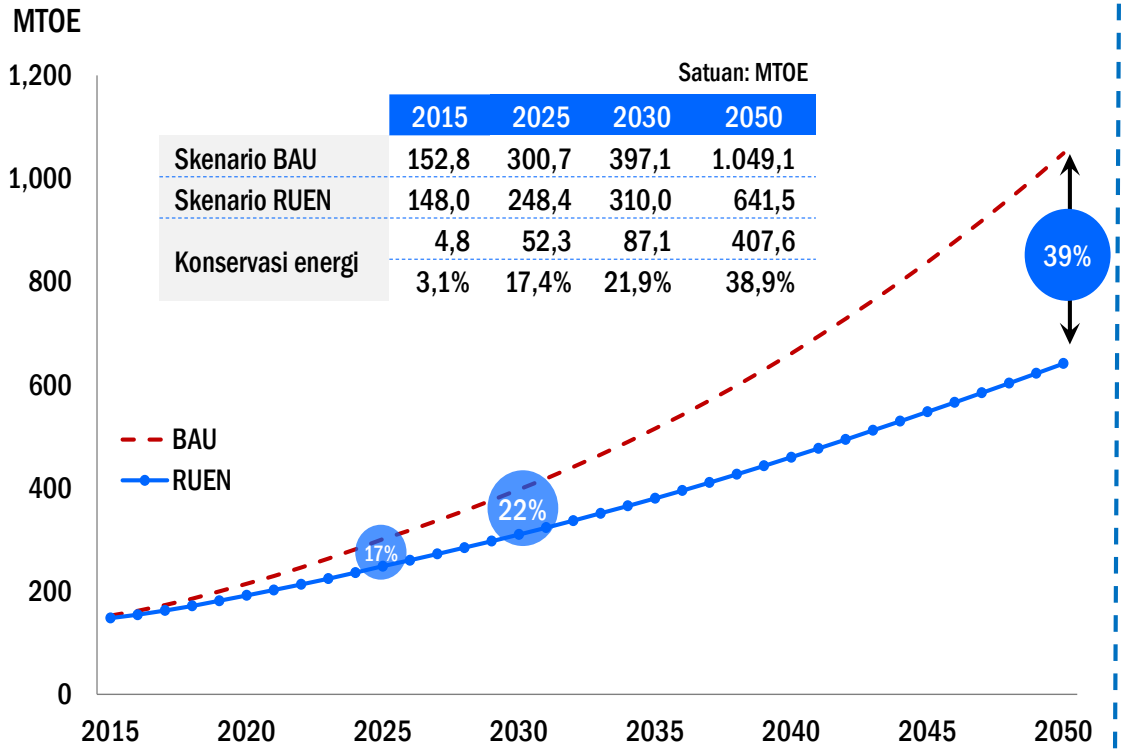
(MEMR)

2. Establish a specialized business entity for NRE. (MSOE)
3. Allocating subsidies feed-in tariff of renewable energy plants. (MEMR)
4. Provide an area of 4 million hectares gradually to fulfill the needs of biofuel raw materials to produce 16.4 million kiloliters of biofuel.(MLSP)
5. Develop a roadmap of priority plant species and prepare a biofuel feedstock crop seeds while maintaining food security. (Ministry of Agliculture)
6. fulfill biofuel production target of at least 15.6 million kl in 2025 and 54.2 million kl in 2050. (MEMR)
7. Develop roadmap biogas development and fulfill the production target of 47.4 MMSCFD in 2025. (MEMR)
8. Assignment of State Owned Enterprises / Public Service Agency to develop geothermal power plants. (MEMR)
9. Assignment of specific State Owned Enterprises to produce and purchase biofuels. (MEMR)
10. Strengthen research and development and application of energy industry systems and components primarily for the use of NRE (MRTHE)
11. Facilitation of the location of geothermal and water energy resources in the area of conservation forest and protected forest (MEF)
12. Developing guidelines to encourage potential energy subsidies from local government (Ministry of Home Affairs/ MoHA)

ENERGY EFFICIENCY and CONSERVATION

PLAN

Comparison of economic growth on energy consumption



Satuan: MTOE

	2015	2025	2030	2050
Skenario BAU	152,8	300,7	397,1	1.049,1
Skenario RUEN	148,0	248,4	310,0	641,5
Konservasi energi	4,8	52,3	87,1	407,6
	3,1%	17,4%	21,9%	38,9%

ACTION

1. Restructuring the industry machinery, publishing green industry standard and giving incentives for industrial facilities that implement energy efficiency. (MoI)
2. Accelerating the development of mass transport and increased use of gas and electricity. (MoT)
3. Rejuvenating public transport to improve the efficiency of energy use. (MoT)
4. Implementing *Minimum Energy Performance Standard* (MEPS) dan labeling on energy utilizing equipment. (MEMR)
5. Developing *Energy Service Company* (ESCO) policy for the implementation of energy efficiency projects. (MEMR)
6. Accelerating the substitution of fuel with the gas transport sector and the development of electric trains. (MoT)

National Energy Policy targets :

- Energy elasticity less than 1 (one) in 2025
- Reduction in final energy intensity of 1% (one) percent per year up to 2025

NUCLEAR POWER DEVELOPMENT

PLAN **ACTION**

"Formulating the implementation roadmap of a nuclear power as a *last choice* in the priority of national energy development."

2016 - 2050

nuclear as the *last choice* in the National Energy Policy, translated in RUEN as the following steps:

- Develop roadmap implementation of nuclear power as a last choice in the national energy development priorities;
- Multi-criteria analysis of the implementation of the NPP;
- Pre-feasibility study NPP;
- Build a power reactor as a laboratory research;
- Encourage international cooperation to enhance technology capability.

CHALLENGES AND OPPORTUNITIES FOR ASEAN COUNTRIES

LNG hub

Electricity highway system

R&D in NRE

R&D in O&G

(upstream & downstream)

R&D in clean coal energy

Capacity building

THANK YOU

OPPORTUNITY AND CHALLENGES OF RENEWABLE ENERGY DEVELOPMENT

Opportunity

1. There are still lot of region having no fully electricity facilities until 2015, there are 2.519 from total 12.659 village still remain having no fully electricity facilities
2. Gap Potential of RE Development from 2015 until 2025
3. Indonesian already committed on *Paris Agreement*
4. Trend of global sustainable development energy is use a clean energy and RE
5. Abundant potential of RE resources ,spread in all Indonesian territorry
6. As a prime mover of green energy.

Why private sector partnership involvement is required?

1. Government has a limited budget to achieved the RE target according to the National Energy Policy Regulation and the GHG emission reduction target

2. Government request support from private sectors both international and national company to join together with Government to develop RE projects target as is it already mandate on National Energy Policy.

Investment Opportunity Refer to the National Long Term Planning (RPJMN 2014-2019) in Power Generation Section

Presidential Regulation No. 39 /2014 , issuing the list of open bussines with refer to International procedures standard , terms and conditions;

I.Power Plant

1. Mini Hydro Plant < 1MW : 100 % Domestic share holder
2. Mini Hydro Small scale (1-10 MW) : Foreign shareholder up to 49 %
3. Hydro Power > 10 MW : Maximum 95 % for Foreign Share

II.Transmission

1. Transmission Line Project : Max 95 % Foreign Share
2. Distribution of Power : Max 95 % of Foreign share

III. Services Company

1. Consultant for Power Installation : Max 95 %
2. Geothermal Drilling Sevices : Max 90 %
3. O&M in Geothermal: Max 90 %
4. Construction Services : Maximum 65 %

Opportunity for Industrial Services and Manufacturing Investment in RE Business

I. Solar Power/Energy • PV/Solar Modul • Inverter • Solar charge Controller • Battery system	**III. Wind Turbine Power Generation** • Blade and rotor • Civil work and Tower • Inverter • Controller • Battery System
II. Hydro Power Plant • Civil works Component (Dam, Water channel, penstock etc) • Hydro Turbine • Generator • Controller	**IV. General Administration & Services** • Planning & Project Management • Operation & Maintenance • Inspection • Construction • EPC

Key challenges in RE development in Indonesia

I. Economic feasibility on RE investment :

- Tariff and incentives
- Technology, construction and operational costs
- Financing costs
- Grid connection facilities

II. Regulation issues:

- Frequently regulation changes
- Permits, land acquisition, Social, etc.

III. Human resources issues:

- Lack of HR qualified for all activity in RE engineering development (FS, DED, construction stages, operation stages)
- Lack of Education, training and certification for HR
- Less of interest qualified HR willing to work in remote area, border area, small island, where it is most of RE projects located

Challenges of RE Development in Indonesia

- Political will to intensify RE utilisation
- Competitiveness of RE Energy Price
- Continuing to reduce subsidy for Fossil Fuel
- Shortage of competent Human Resources
- The Absences of Technology , R&D support
- Commitment of RE incentives
- Integrated Energy Planning
- The Lack of information and Publicity on Indonesian RE potency and benefit
- Regulation and Permits
- Enviromental and social issues
- Required big capital and the effort to encourage the Domestic Bank Participation
- Some of RE Resources are located in Forrest Protection and conservation area
- Potential Development the domestic Power industry including the State Owned Enterprises (SOE) participation.