PYC INDONESIA RENEWABLE ENERGY BOOKLET 2018

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BY: PURNOMO YUSGIANTORO CENTER (PYC)

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PREFACE

Greetings from Purnomo Yusgiantoro Center (PYC),

PYC, as a non-profit organization, devotes to independent, in-depth research that leads to provide policy solutions and/or recommendations in research fields of energy and natural resources at the local, national and global level. As a part of its programs, the PYC research team has published “The Indonesia Renewable Energy Booklet 2018” to provide public information of Indonesia's renewable energy development.

The booklet provides the history of Indonesia's renewable energy policies, the current development, the potential and the challenges of renewable energy in Indonesia. Data are compiled up to the first quarter of 2018 and obtained from various sources, including the Indonesia Ministry of Energy and Mineral Resources, IRENA, and World Bank. To make it easy to read, data are presented attractively in infographics.

We hope that the PYC Indonesia Renewable Energy Booklet 2018 can be beneficial to our readers.

Jakarta, 3 January 2019

Filda Yusgiantoro, ST, MBM, MBA, PhD
Chairperson of the Purnomo Yusgiantoro Center

BACKGROUND FOR THIS BOOKLET

Fossil energy has been the major source of energy in the world since its introduction in the 18th century. The discovery of fossil energy changed the domination of firewood as the main source of energy. The energy shift sparked global industrial revolution which led to an increase of energy consumption and rapid economic growth. The increase of energy consumption created a high demand for the fossil energy which initiated global exploration and exploitation. Although fossil fuel provides an extensive amount source of energy, it also brings huge environmental impact. In the late 20th century, the increasing global awareness of environmental sustainability brought up the issue of fossil fuel's contribution to climate change. This led to numerous international pledges to mitigate climate issues. Renewable energy, then, plays an important substitution role on fossil energy as to a more environmentally friendly source of energy. Indonesia also pledges to participate in the global movement of renewable energy utilization as a part to mitigate climate changes. The utilization of renewable energy in Indonesia already started in 1923 when Plengan hydro power plant was first operated. The government, through its pledge in COP21 Paris, created a plan for renewable energy to make up 23% of Indonesia's energy mix by 2025. Thus, to achieve this renewable energy target, it is important for all stakeholders to have an overview of the current development, the potential and challenges of renewable energy in Indonesia.

HOW THIS BOOKLET IS STRUCTURED

This booklet consists of five chapters:

- Chapter 1 presents the international and Indonesia's regulations on renewable energy.
- Chapter 2 presents the list of government regulations from 2002 to 2018 as well as the governments commitments and programs up to 2025.
- Chapter 3 provides the current development of renewable energy in Indonesia.
- Chapter 4 looks at the potential of renewable energy in Indonesia by provinces and type of resources.
- Chapter 5 gives a brief analysis of the renewable energy development challenges in Indonesia.

HOW THIS BOOKLET WAS PREPARED

This booklet was compiled through literature studies and secondary data collection. Some of the data displayed are processed by the PYC research team.

ACKNOWLEDGEMENTS

This booklet was prepared by the Purnomo Yusgiantoro Center. The booklet benefitted from an internal PYC review, as well as valuable comments and guidances from Prof. Purnomo Yusgiantoro and Dr. Luky A. Yusgiantoro.

The contributed researchers for this booklet are Akhmad Hanan, Massita Ayu Cindy, Rahmantara Trichandi, Diwangkara Bagus, and Anggun Alfina Zakia. We also would like to thank Jusa Junaedi, as the graphic designer of this booklet.

PYC would also like to acknowledge the contributions of a number of parties that have provided invaluable insights and comments on the booklet.

For further information and feedback regarding this booklet, please contact us through research@purnomoyusgiantorocenter.org.

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GLOSSARY

BOE	: Barrel of Equivalent
BPP	: Cost of Power Generation (Biaya Pokok Penyediaan)
CGI	: Chevron Geothermal Indonesia
CGS	: Chevron Geothermal Salak
CO_2	: Carbon Dioxide
GDE	: PT Geo Dipa Energy
GDP	: Gross Domestic Product
GW	: Gigawatt
IPB	: Izin Panas Bumi (Geothermal Permits)
IPP	: Independent Power Producer
KEN	: Kebijakan Energi Nasional (Natioanal Energy Policy)
KWH	: Kilowatt Hour
LTSHE	: Lampu Tenaga Surya Hemat Energi (Solar Power Energy Saving Lamps)
M^2	: Square Meter
MEMR	: Ministry of Energy and Mineral Resources
MMSCFD	: Million Standard Cubic Feet per Day
MoF	: Ministry of Finance
MT	: Million Tones
MTOE	: Million Tonnes of Oil Equivalent
MW	: Megawatt

GLOSSARY

OPEX	: Operating Expenses
PGE	: PT Pertamina Geothermal Energy
PLN	: Perusahaan Listrik Negara (State Owned Electricity Company)
PP	: Power Plant
PV	: Photovoltaic
RE	: Renewable Energy
RUEN	: Rencana Umum Energi Nasional (General Plan on National Energy)
RUED	: Rencana Umum Energi Daerah (Regional Energy Plan)
RUKD	: Rencana Umum Ketenagalistrikan Daerah (General Plan for Regional Electricity)
RUPTL	: Rencana Usaha Penyediaan Tenaga Listrik (Electricity Business Plan)
ROR	: Rate of Return
SE	: Star Energy
SOL	: Sarulla Operation Limited
TCO^2	: Test of Carbon Dioxide
TPES	: Total Primary Energy Supply
USD	: United States Dollar
UU	: Undang – Undang (Republic Indonesia Law)

CHAPTER 1

INTRODUCTION

1.1 INTERNATIONAL REGULATIONS ON RENEWABLE ENERGY

- (7.1) By 2030, ensure universal access to affordable, reliable and modern energy services.
- (7.2) By 2030, increase substantially the share of renewable energy in the global energy mix.
- (7.3) By 2030, double the global rate of improvement in energy efficiency.
- (7.a) By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.
- (7.b) By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing states and landlocked developing countries, in accordance with their respective programs of support.

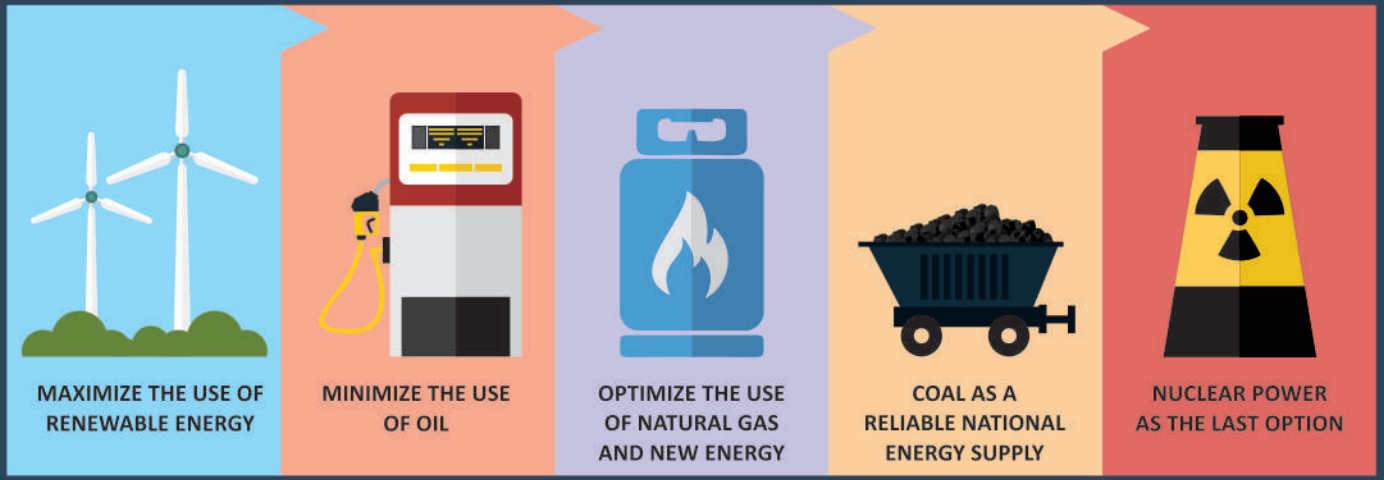
Source: United Nations, 2018

1.2 INDONESIA'S GOVERNMENT REGULATIONS ON RENEWABLE ENERGY

LAW (UU) No. 30/2007
ON ENERGY

- Article 20, (2) The provision of energy by government and/or regional government is prioritized in underdeveloped regions, remote areas, and village regions by using the local energy sources, especially renewable energy.
- Article 21, (2) The utilization of new energy and renewable energy must be increased by the Government and regional government.

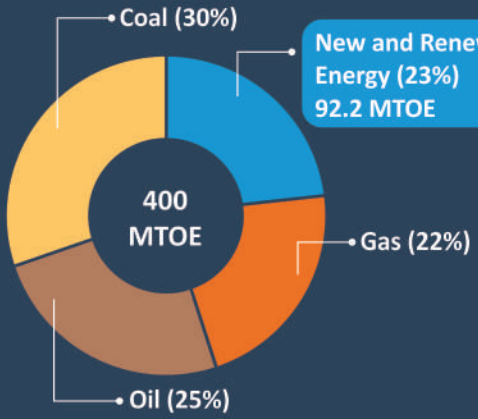
GOVERNMENT REGULATION (PP) NO. 79 / 2014
ON NATIONAL ENERGY POLICY (KEN)



1.2 INDONESIA'S GOVERNMENT REGULATIONS ON RENEWABLE ENERGY

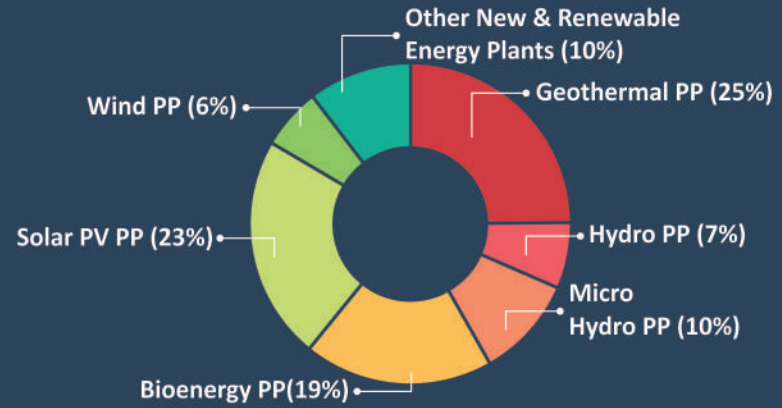
PRESIDENTIAL REGULATION NO. 22/2017
GENERAL PLAN ON NATIONAL ENERGY (RUEN)

2025 New and Renewable Energy Supply Target according to General Planning for National Energy (RUEN)



- National Power Plant Capacity: 135 GW
- RE Power Plant Capacity: 45 GW

(75.05%) 69.2 MTOE → Electricity of New & Renewable Energy 45 GW



(24.95%) 23 MTOE

- **Biofuel** 13.69* Million kilo liter
- **Biomass** 8.4 Million ton
- **Biogas** 489.8 Million m^3
- **CBM** 46 MMSCFD

CHAPTER 2

PLAN OF DEVELOPMENT (PoD) ON RENEWABLE ENERGY IN INDONESIA

2.1 INDONESIA'S RENEWABLE ENERGY REGULATIONS UP TO 2018

YEAR	TITLE	LEGAL REFERENCES	STATUS
2018	Rooftop PV Utilization by PT PLN Consumer	MEMR Decree No. 49/2018	In Force
	Electricity Supply Business Plan (RUPTL) 2018 - 2027	MEMR Decree No. 1567 K/21/MEM/2018	In Force
2017	Renewable Energy Purchase	MEMR Regulation No. 50/2017	In Force
		MEMR Regulation No. 12/2017	Ended
2016	Solar Feed-in Tarrif of Indonesia	MEMR Regulation No. 19/2016	In Force
2015	Feed-in-Tariffs for Biomass and Municipal Waste	MEMR Regulation No. 44/2015	In Force
	Accelerated Depreciation in Certain Business Fields and/or Certain Regions of Indonesia	Government Regulation No 18/2015	In Force
2014	Feed-in-Tariffs for Biomass and Municipal Waste	MEMR Regulation No. 27/2014	In Force
	Geothermal Law	Law No. 21/2014	
	National Energy Policy	Government Regulation No. 79/2014	
	Ceiling Price for Geothermal	MEMR Regulation No. 17/2014	

2.1 INDONESIA'S RENEWABLE ENERGY REGULATIONS UP TO 2018

YEAR	TITLE	LEGAL REFERENCES	STATUS
2013	Power Purchase from Solar Photovoltaic Plants	MEMR Regulation No. 17/2013	In Force
	Biofuel Blending	MEMR Regulation No. 25/2013	
2012	Electricity Purchase from Small and Medium Scale Renewable Energy and Excess Power	MEMR Regulation No. 4/2012	In Force
	Geothermal Fund	MoF Regulation No. 3/2012	
	Purchase of Electricity from Geothermal Plants	MEMR Regulation No. 22/2012	
2011	Purchase of Electricity from Geothermal Plants	MEMR Regulation No. 20/2011	Amended
	Tax Exemption on Goods for Geothermal Exploration	MoF Regulation No. 22/PMK.011/2011	Ended
2010	Indonesia Value-Added Tax and Import Duty Exemption For Renewable Energy Property	MoF No. 21/PMK.011/2010	In Force
	Income Tax Reduction for Energy Development Projects	MoF Regulation No. 21/2010	

2.1 INDONESIA'S RENEWABLE ENERGY REGULATIONS UP TO 2018

YEAR	TITLE	LEGAL REFERENCES	STATUS
2010	Geothermal Business Activities	Government Regulation No. 70/2010	In Force
2009	Non-Building Tangible Assets for Tax Depreciation Purposes	MoF No. 96/PMK.03/2009	In Force
	Tariffs for Small and Medium Scale Power Generation using Renewable Energy	MEMR Regulation No. 31/2009	Superseded
	Electricity Law	Law No. 30/2009	In Force
2008	Biofuel Supply, Utilization and Trading	MEMR Regulation No. 32/2008	Superseded
2007	Geothermal Business Activities	Government Regulation No. 59/2007	Amended
	Energy Law	Law No. 30/2007	In Force
	Development Credits for Biofuels and Plantation Revitalisation	MoF Regulation No. 79/2007	
2006	Development Credits for Biofuels and Plantation Revitalisation	MoF Regulation No. 117/2006	Amended
	Provision and Utilization of Biofuel	Presidential Instruction No. 1/2006	In Force
	Medium-Scale Power Generation using Renewable Energy	MEMR Regulation No. 2/2006	

2.1 INDONESIA'S RENEWABLE ENERGY REGULATIONS UP TO 2018

YEAR	TITLE	LEGAL REFERENCES	STATUS
2006	National Team for Biofuel Development and Biofuel Roadmap	Presidential Decree No. 10/2006	In Force
	National Energy Policy	Presidential Regulation No. 5/2006	Superseded
2005	Blueprint of National Energy Management (2005-2025)	MoF Regulation No. 21/2010	In Force
2004	Green Energy Policy	MEMR Decree No. 2/2004	In Force
2003	Geothermal Law	Law No. 27/2003	Superseded
2002	Small Distributed Power Generation Using Renewable Energy	MEMR Regulation No. 1122 K/30/MEM/2002	In Force

2.2 INDONESIA'S GOVERNMENT COMMITMENT & PROGRAMS BY 2025

STRATEGIES & DEVELOPMENT OF RENEWABLE ENERGY

Source: Ministry of Energy & Mineral Resources, 2017

CHAPTER 3

THE CURRENT SITUATION OF RENEWABLE ENERGY IN INDONESIA

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

INDONESIAN ENERGY INDICATORS 2016

POPULATION
261.89 Million

GDP
1.09 Billion
2010 USD

TPES
166.4 MBOE

TPES/Capita
0.64 BOE/capita

TPES GDP
0.15 BOE/000 2010 USD

Final Energy Consumption
1,082.81 MBOE

Energy Cons./Capita
4.13 BOE/capita

CO_2 emission
461.78 MT of CO_2

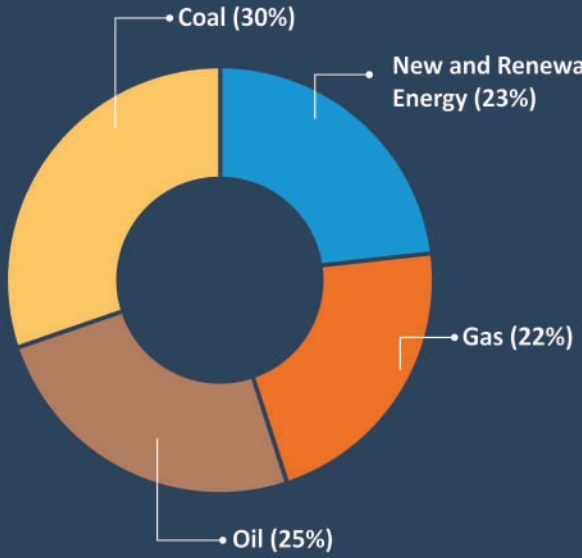
CO_2/TPES
2.77 TCO_2/BOE

CO_2/Capita
1.76 TCO_2/capita

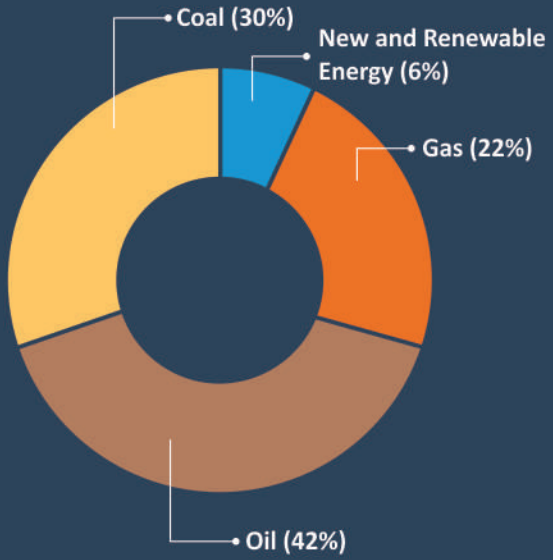
Source: World Bank, 2018; IEA, 2018; Indonesian National Energy Council, 2018

INDONESIA ENERGY MIX 2017

2025 New and Renewable Energy Supply Target according to General Planning for National Energy (RUEN)



2017 National Energy Mix Realization

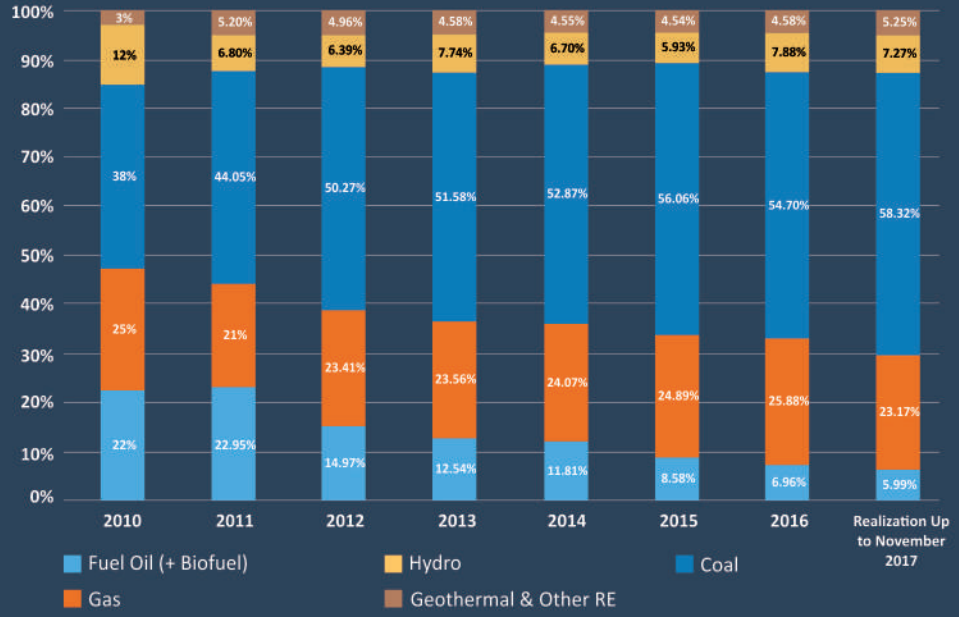


Source: Ministry of Energy & Mineral Resources, 2018

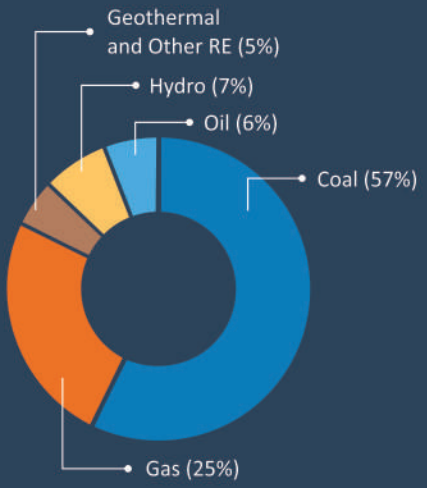
3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

RENEWABLE ENERGY SHARES BY RESOURCES

INDONESIA POWER GENERATION ENERGY MIX 2010 - 2017



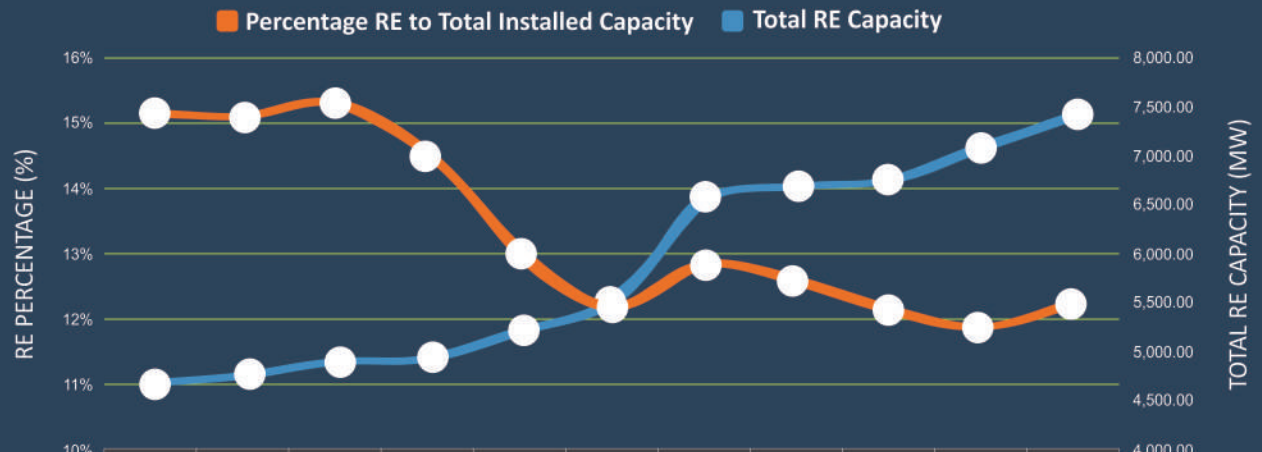
PRIMARY ENERGY SUPPLY MIX IN POWER GENERATION 2017



Source: Ministry of Energy & Mineral Resources, 2018

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

RENEWABLE ENERGY POWER PLANT INSTALLED CAPACITY



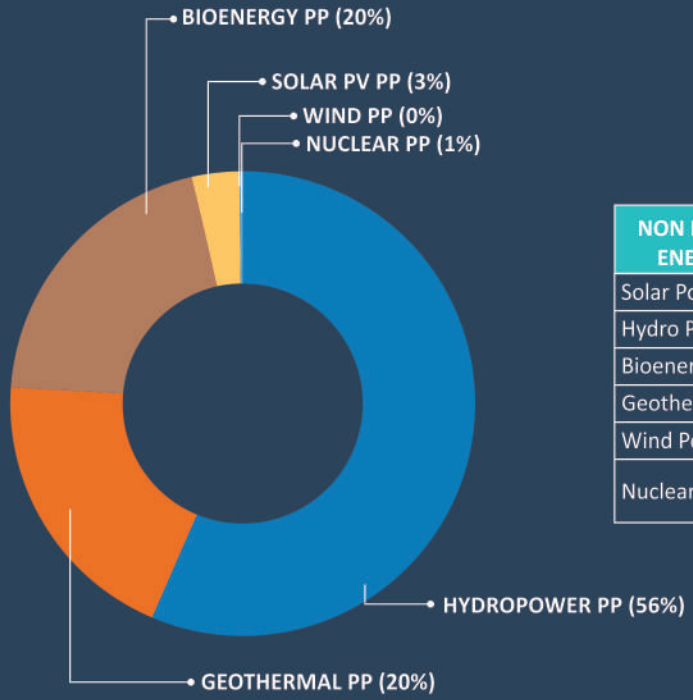
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Percentage RE to Total Installed Capacity	15.15%	15.10%	15.31%	14.49%	13.02%	12.19%	12.84%	12.59%	12.15%	11.87%	12.23%
Total RE Capacity	4674.72	4749.78	4891.73	4923.44	5198.51	5513.43	6544.76	6679.03	6745.33	7079.03	7379.2

- The total of Renewable Energy (RE) power plant capacity increased by 158% in the last 10 years (2007-2017).
- The share of RE to the total installed power plant capacity decreased from 15.15% in 2007 to 12.23% in 2017. Particularly, there was a rapid decrease from 2009 until 2012 because the power plant capacity of fossil fuel increased significantly, especially the amount of coal utilized by the power plant.
- Eventhough the total of RE power plant capacity increased, there was slow progress of RE development. This can be caused by the RE's unattractive economic of scale due to the low fossil fuel price.

Source: Ministry of Energy & Mineral Resources, 2018

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

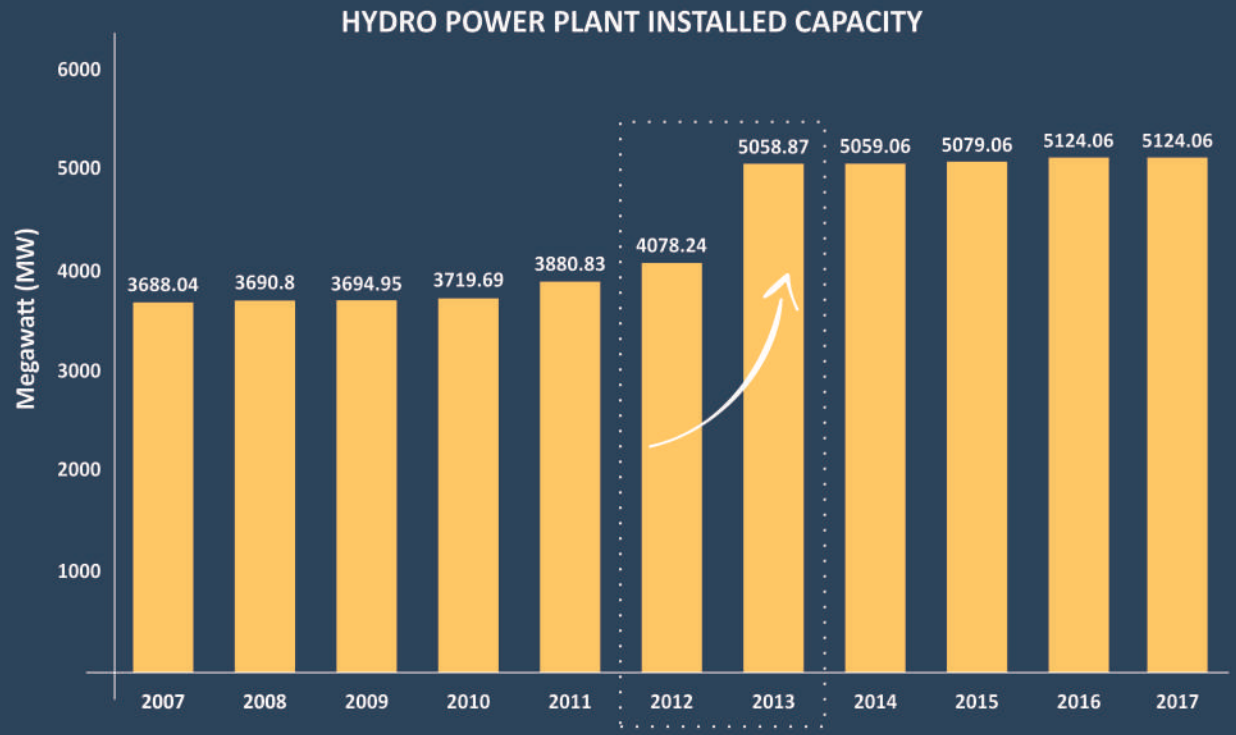
THE PERCENTAGE OF RENEWABLE ENERGY CAPACITY IN INDONESIA 2017



NON FOSSIL ENERGY	RESOURCES	INSTALLED CAPACITY	PERCENTAGE OF UTILIZED RESOURCE
Solar Power	207,898 MW	296.5 MW	0.14%
Hydro Power	75,670 MW	5,124 MW	6.77%
Bioenergy	49,810 MW	1,838 MW	3.69%
Geothermal	27,670 MW	1,808 MW	6.53%
Wind Power	9,290 MW	1.12 MW	0.01%
Nuclear Power	3,000 MW (e.q. 24.112 ton) for 11 years	30 MW	1%

Source: Ministry of Energy & Mineral Resources, 2018

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

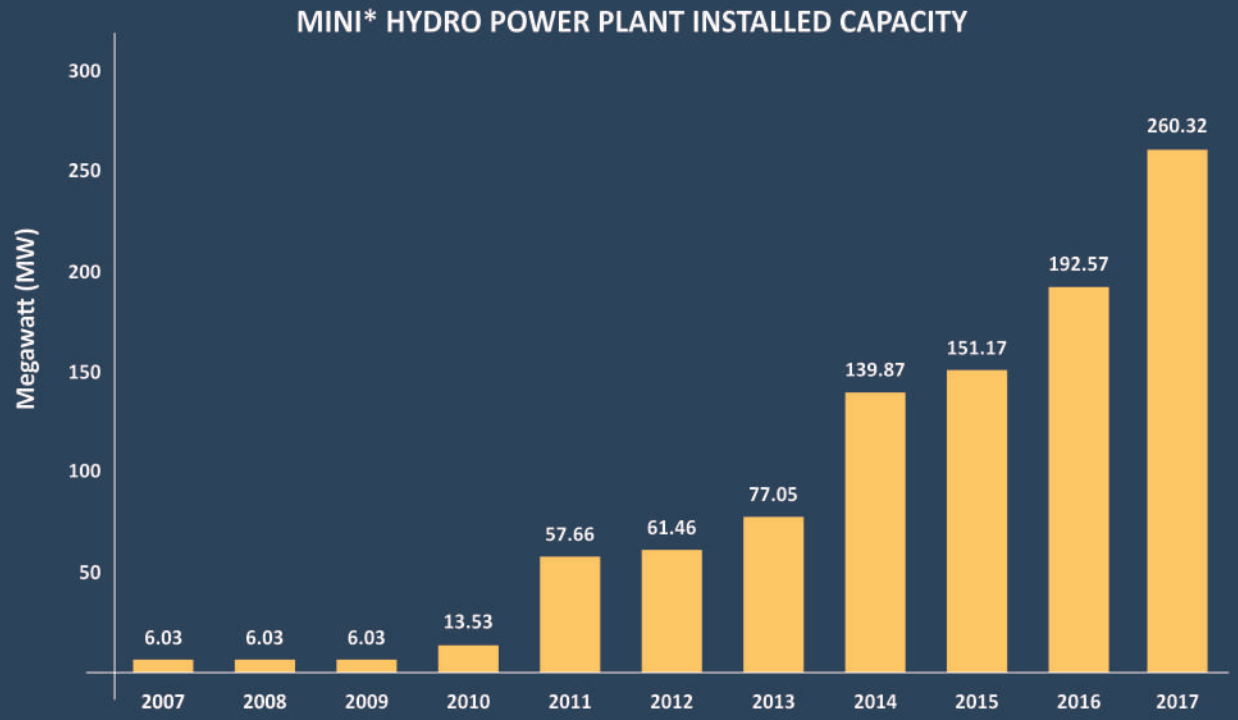


Source: Ministry of Energy & Mineral Resources, 2018

***Capacity ≥ 1 MW**

The significant increase of hydro power plant installed capacity between 2012 and 2013 was a result of new private power plant operations in North Sumatra and South Sulawesi.

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

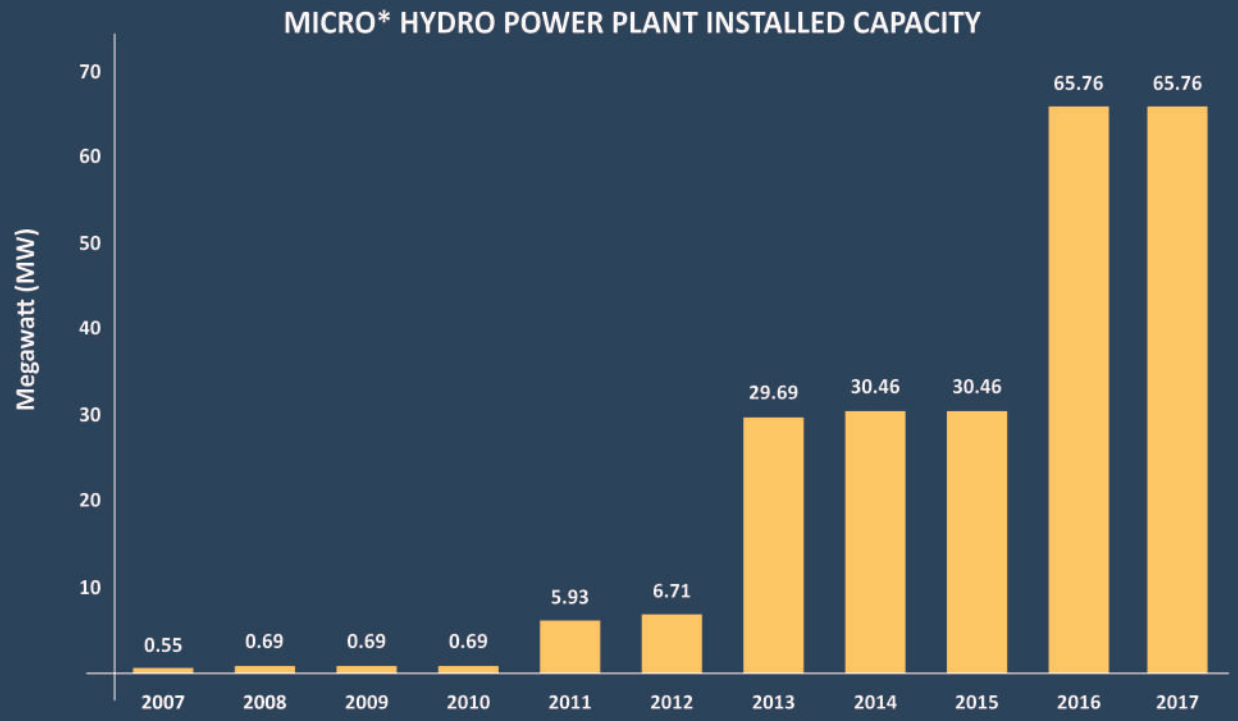


Source: Ministry of Energy & Mineral Resources, 2018

***Capacity between 100 kW - 1 MW**

The significant increase of mini hydro power plant installed capacity in 2011 was the result of the addition of a mini hydro power plant policy on the National Energy Policy (KEN) in 2007.

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

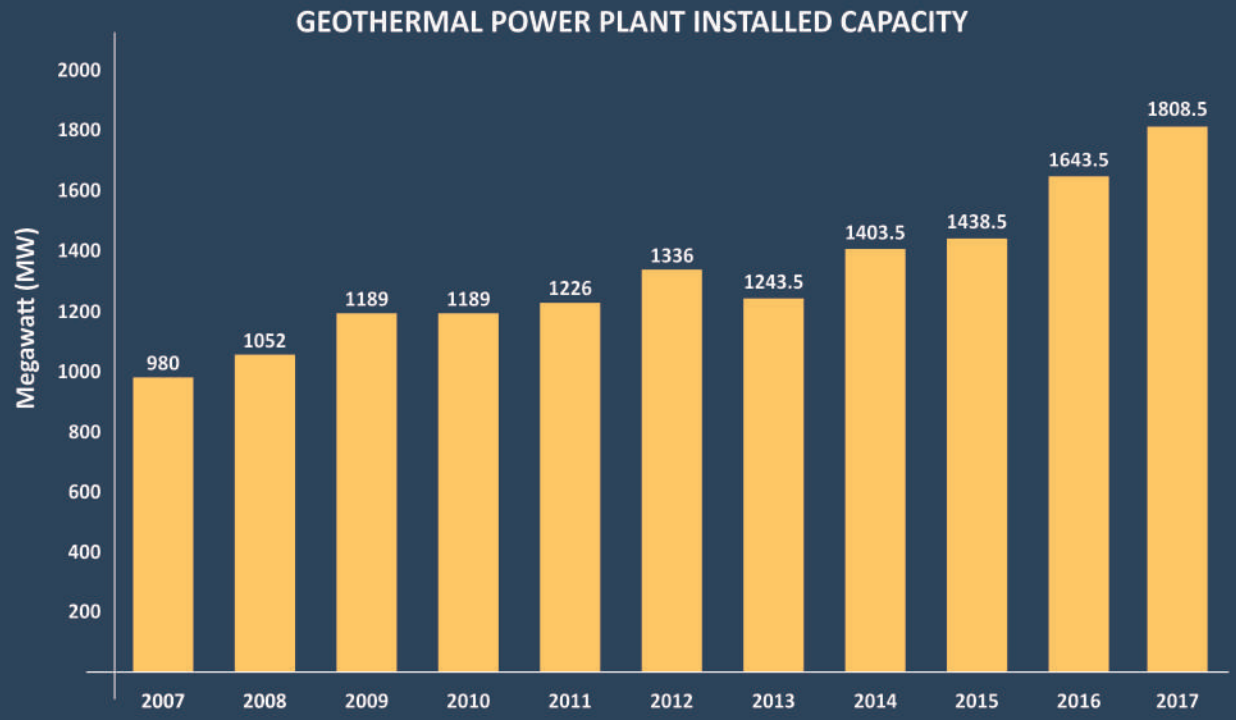


Source: Ministry of Energy & Mineral Resources, 2018

***Capacity between 5 - 100 kW**

The micro hydro power plants are less commercial than mini-hydropower plants, therefore the development of micro power plants are slower than mini hydro power plants.

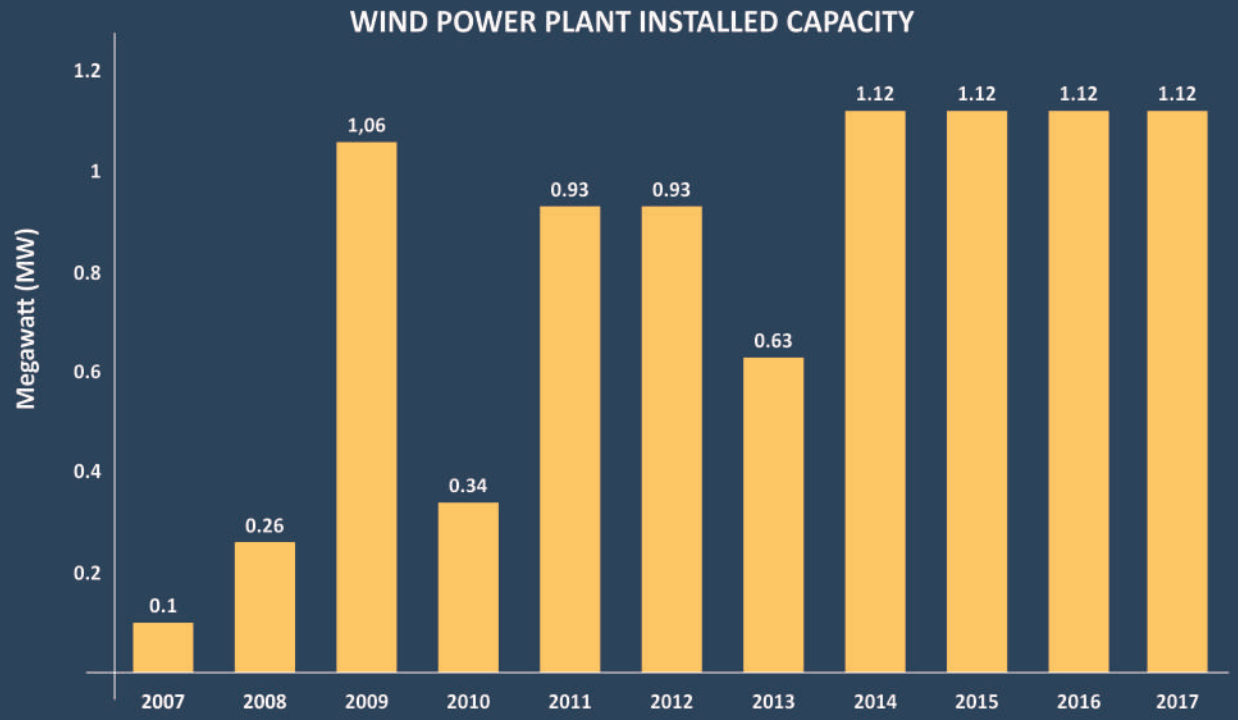
3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY



Source: Ministry of Energy & Mineral Resources, 2018

The increasing trend of geothermal power plant installed capacity was encouraged by the implementation of the Government Regulation No. 70/2010 on Geothermal Business Activities and MEMR Regulation No. 22/2012 on Purchase of Electricity from Geothermal Plants.

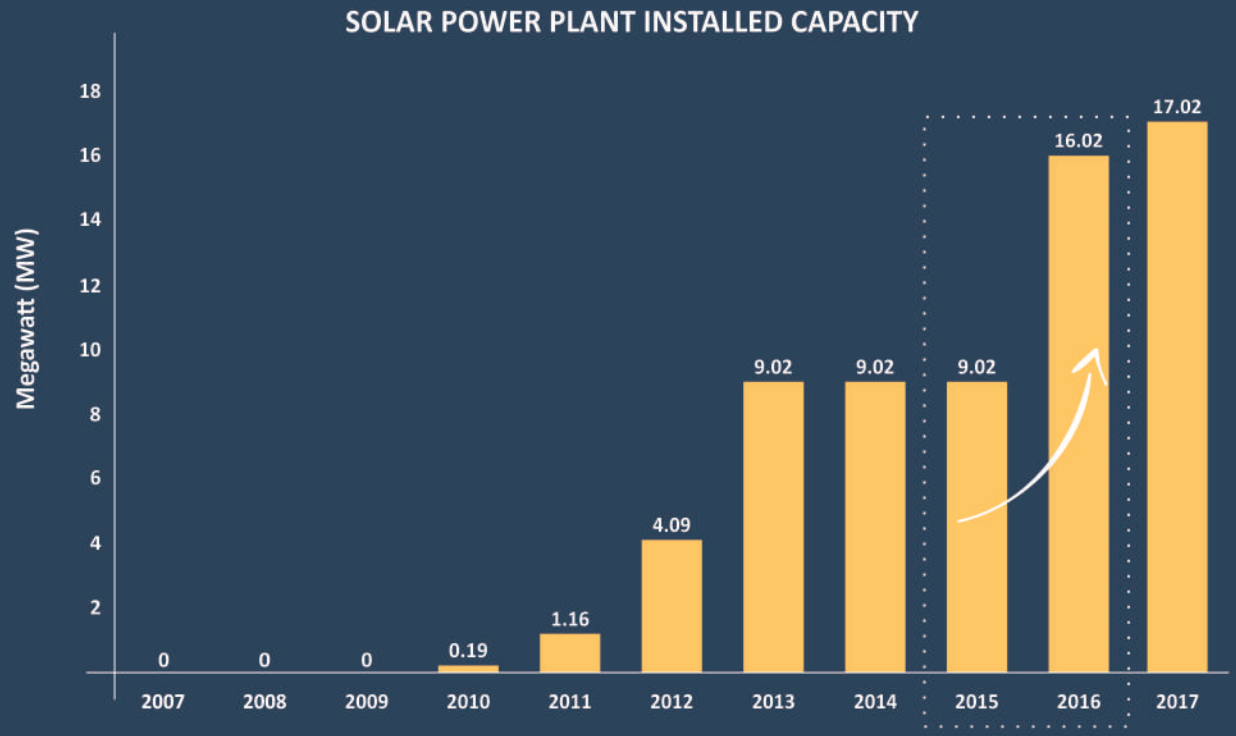
3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY



Source: Ministry of Energy & Mineral Resources, 2018

Until 2017, most of the Indonesia's wind power plants are still under development, such as Jeneponto and Sidrap wind power plant.

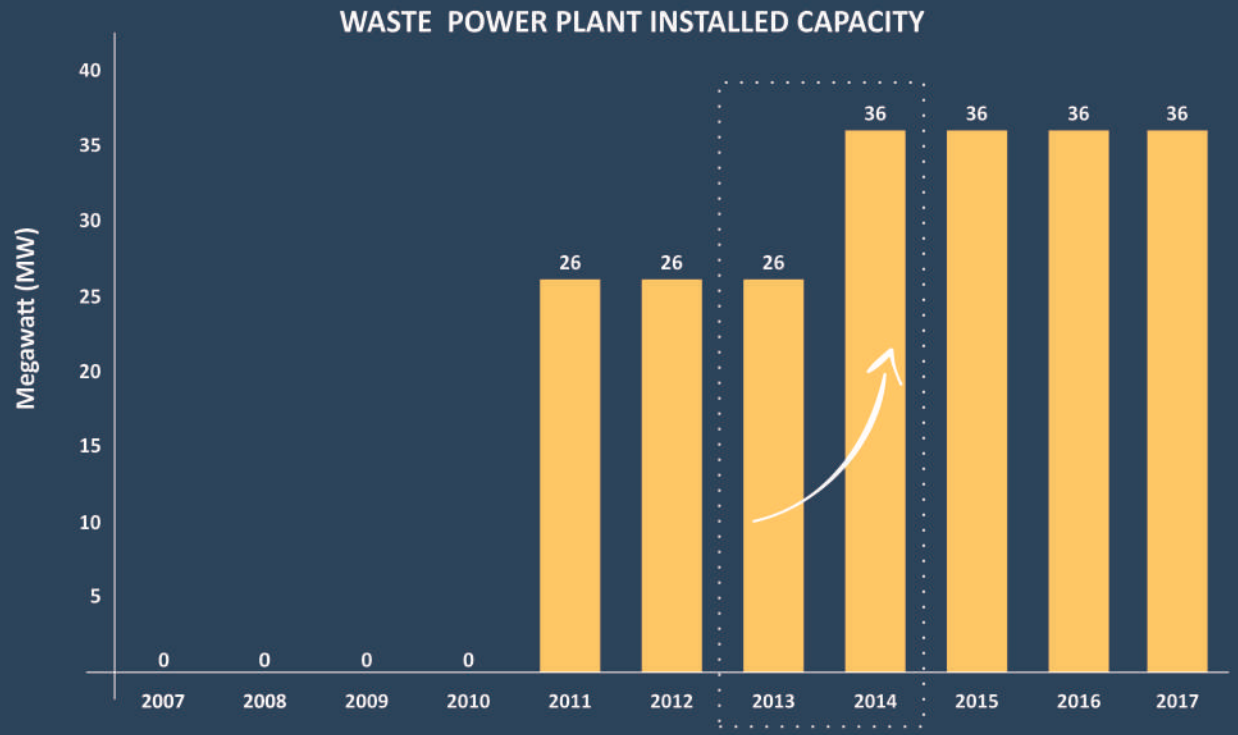
3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY



Source: Ministry of Energy & Mineral Resources, 2018

The significant increase of solar power plant installed capacity between 2015 and 2016 was strengthened by the issuance of MEMR Regulation No. 19/2016 on Solar Feed-in-Tariffs of Indonesia.

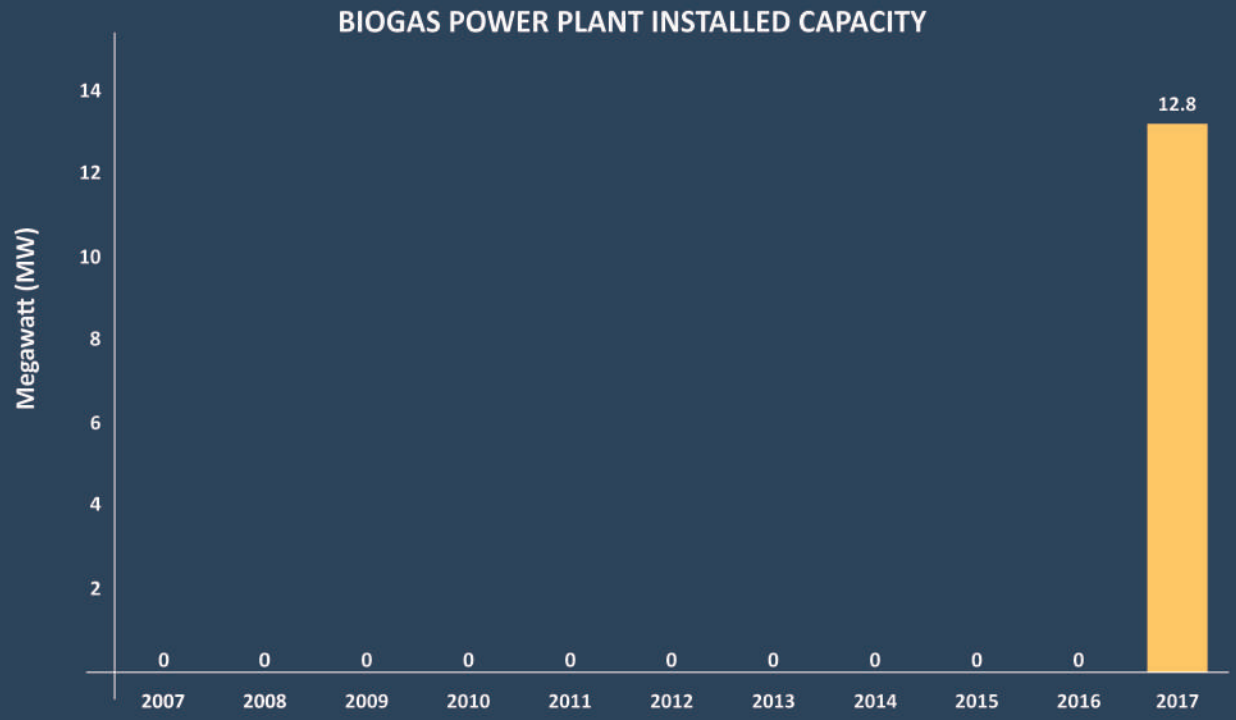
3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY



Source: Ministry of Energy & Mineral Resources, 2018

The significant increase of waste power plant installed capacity between 2013 and 2014 was supported by the enactment of MEMR Regulation No. 27/2014 on Feed-in-Tariffs for Biomass and Municipal Waste.

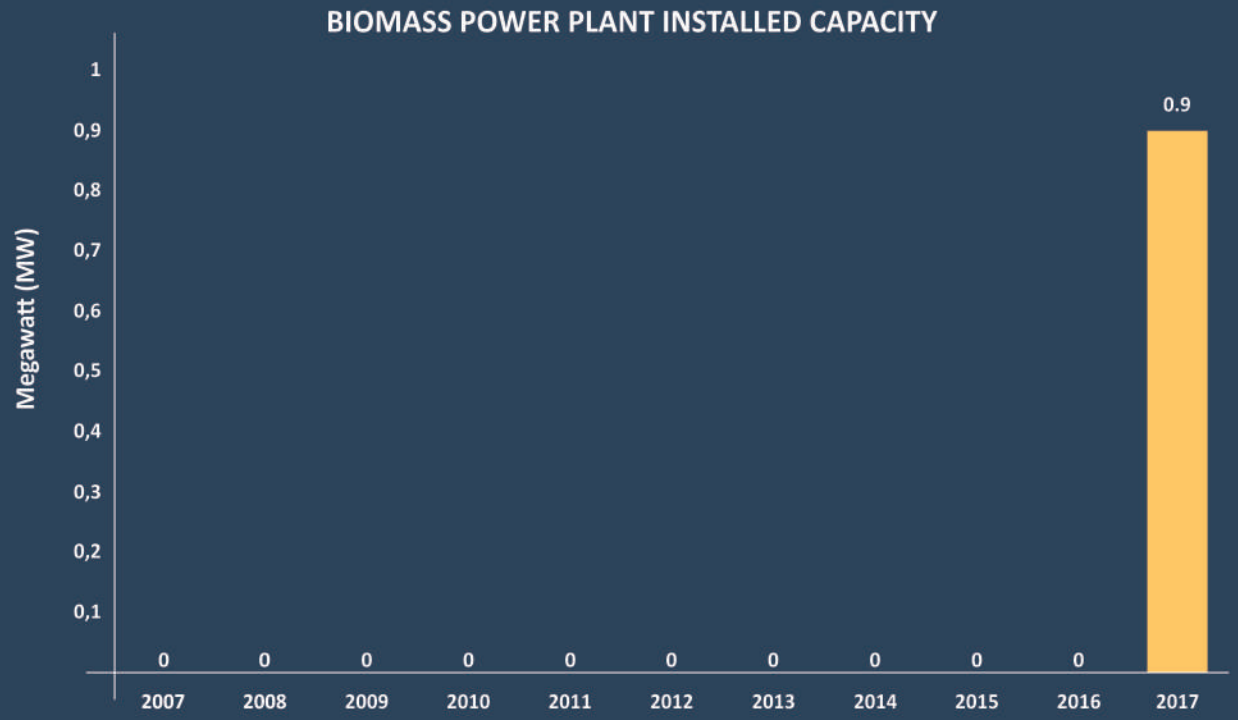
3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY



Source: Ministry of Energy & Mineral Resources, 2018

The first Indonesia's commercial biogas power plant operated using Palm Oil Mill Effluent as a fuel in 2017 in Belitung. Then, followed by other biogas power plant operation in Sumatera region, where it is rich of palm oil.

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

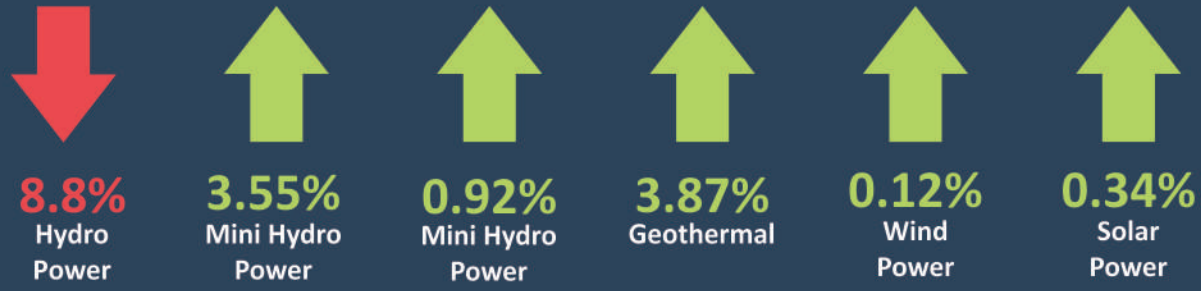


Source: Ministry of Energy & Mineral Resources, 2018

The first utilization of biomass material for a commercial power plant in Indonesia's can be traced back in 2017 by the first operation of a commercial biomass power plant in Kepulauan Riau.

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

THE PROGRESS OF RE SHARES DURING 2007-2017

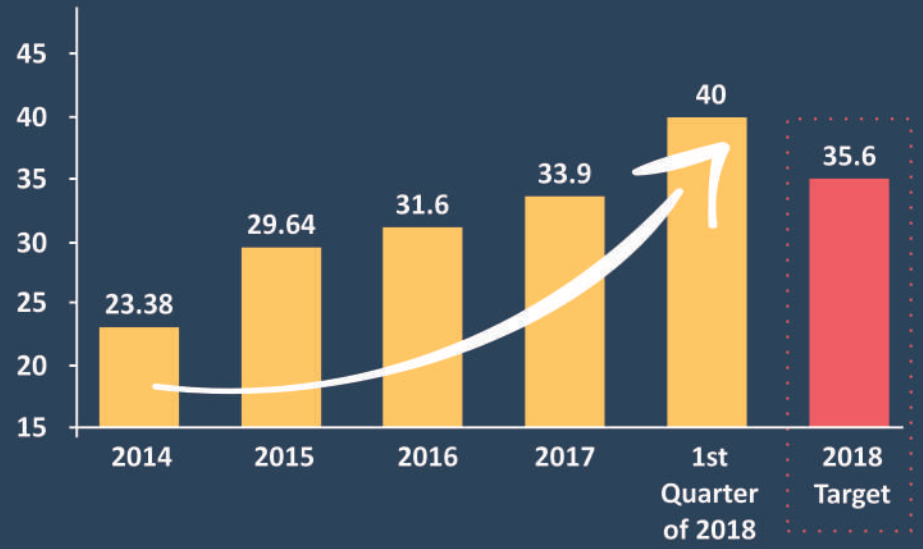


- Although hydro power capacity increased, its share decreased by 8.8% in the last 10 years. This is due to the hydro power plant construction tariff which includes high social and environmental costs.
- The increase of mini and micro hydro power share was driven by its suitability for Indonesia's geographic condition with its numerous rivers. Their development were also preferable and affordable options for off-grid electrification.
- The highest growth of RE share came from the geothermal power plant. This was the result of government's priority on the development of geothermal projects.
- The low growth of solar and wind power share was due to the relatively high cost of solar and wind power which hampered their development, especially for a large scale system.

Source: Ministry of Energy & Mineral Resources, 2018

ACHIEVEMENTS AND TARGETS FOR RENEWABLE ENERGY UP TO THE FIRST QUARTER OF 2018 (MW)

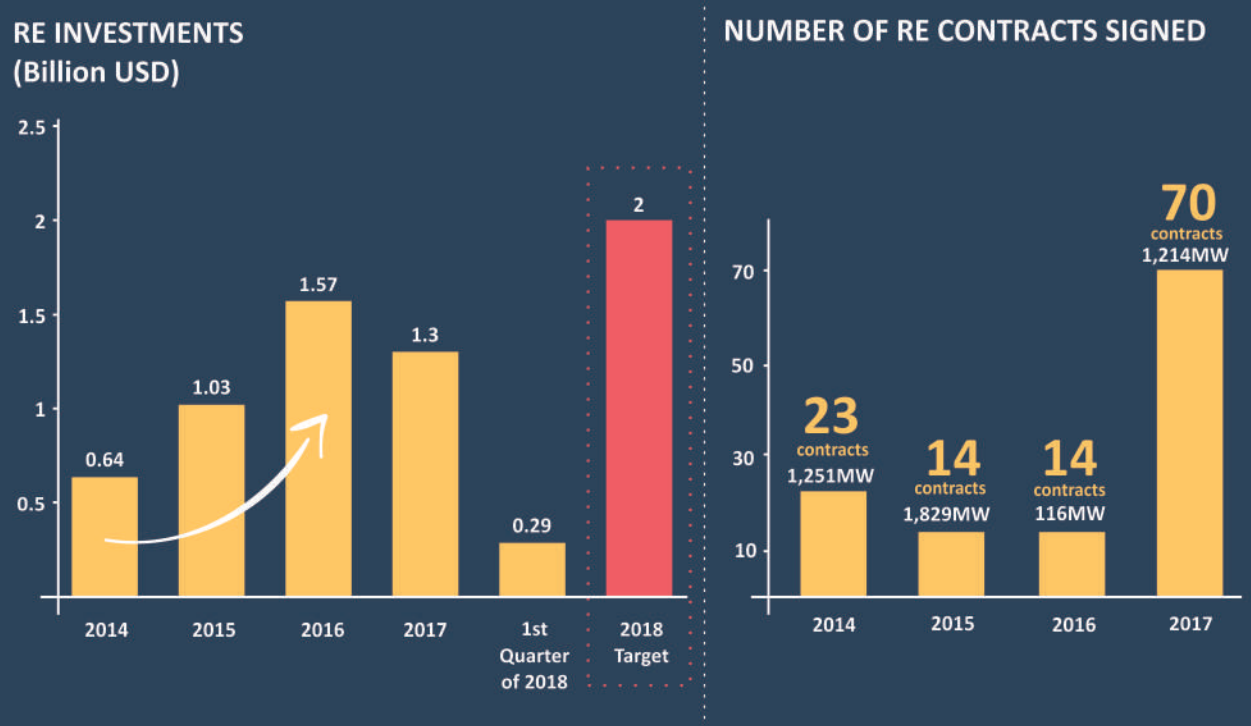
CO_2 EMISSION REDUCTION
(Million ton CO_2)



Source: Ministry of Energy & Mineral Resources, 2018

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

ACHIEVEMENTS AND TARGETS FOR RENEWABLE ENERGY UP TO THE FIRST QUARTER OF 2018 (MW)



Source: Ministry of Energy & Mineral Resources, 2018

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

GEOTHERMAL POWER PLANT CAPACITY (2017)

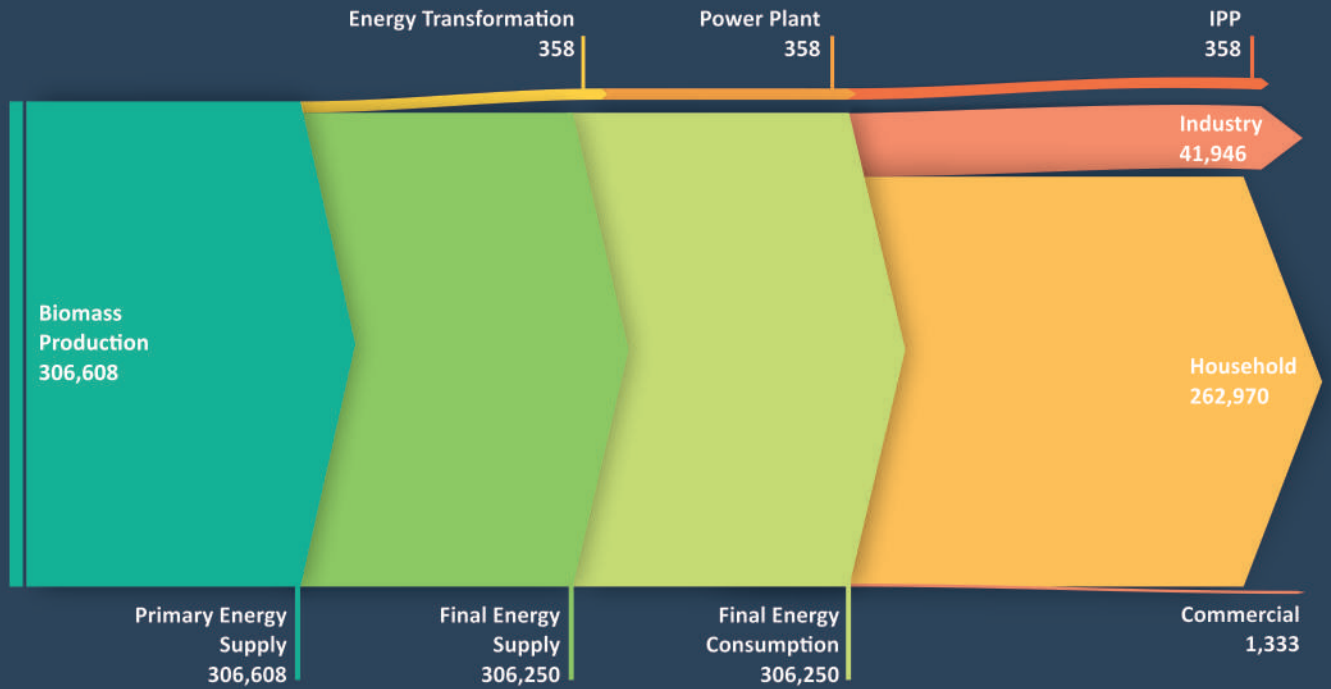
ABBREVIATIONS

IPB	: Izin Panas Bumi (Geothermal Permits)
PGE	: PT Pertamina Geothermal Energy
CGI	: Chevron Geothermal Indonesia
CGS	: Chevron Geothermal Salak
SE	: Star Energy
GDE	: PT Geo Dipa Energy
SOL	: Sarulla Operation Limited

Source: Ministry of Energy & Mineral Resources, 2018

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

BIOMASS SANKEY DIAGRAM* 2017 (THOUSAND BOE)

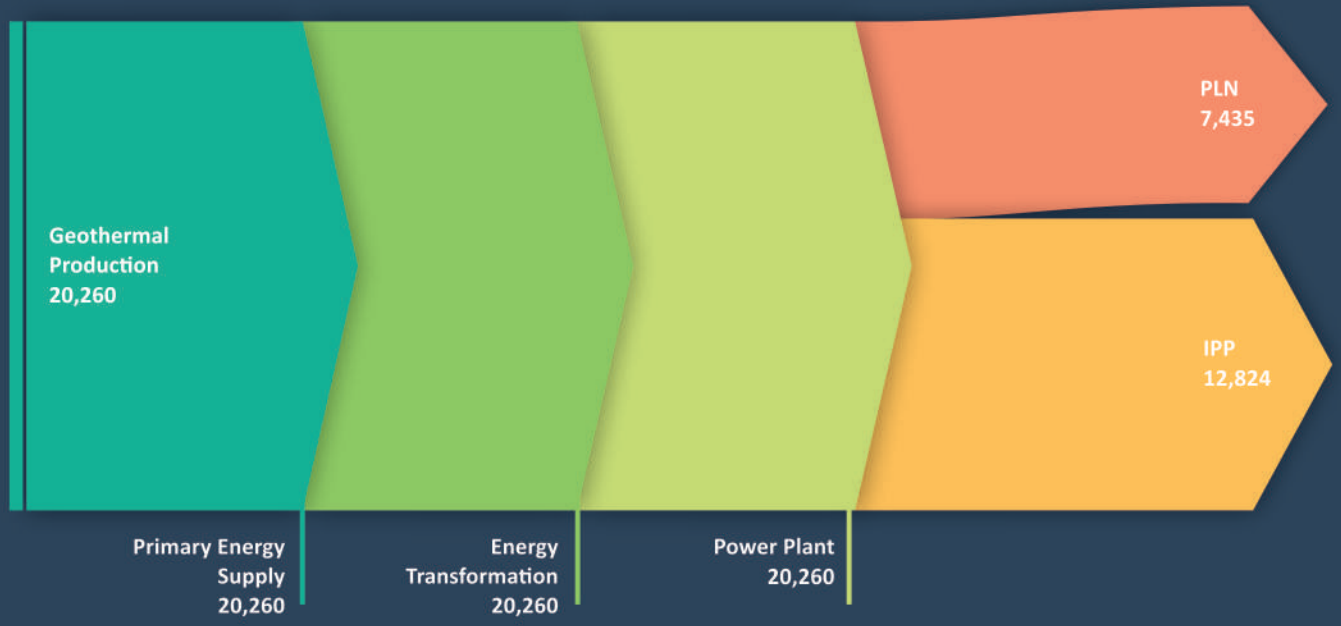


*Sankey Diagram represents the flows of energy and their quantities in each process from the primary energy supply to the final consumption.

Source: Ministry of Energy & Mineral Resources, 2018

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

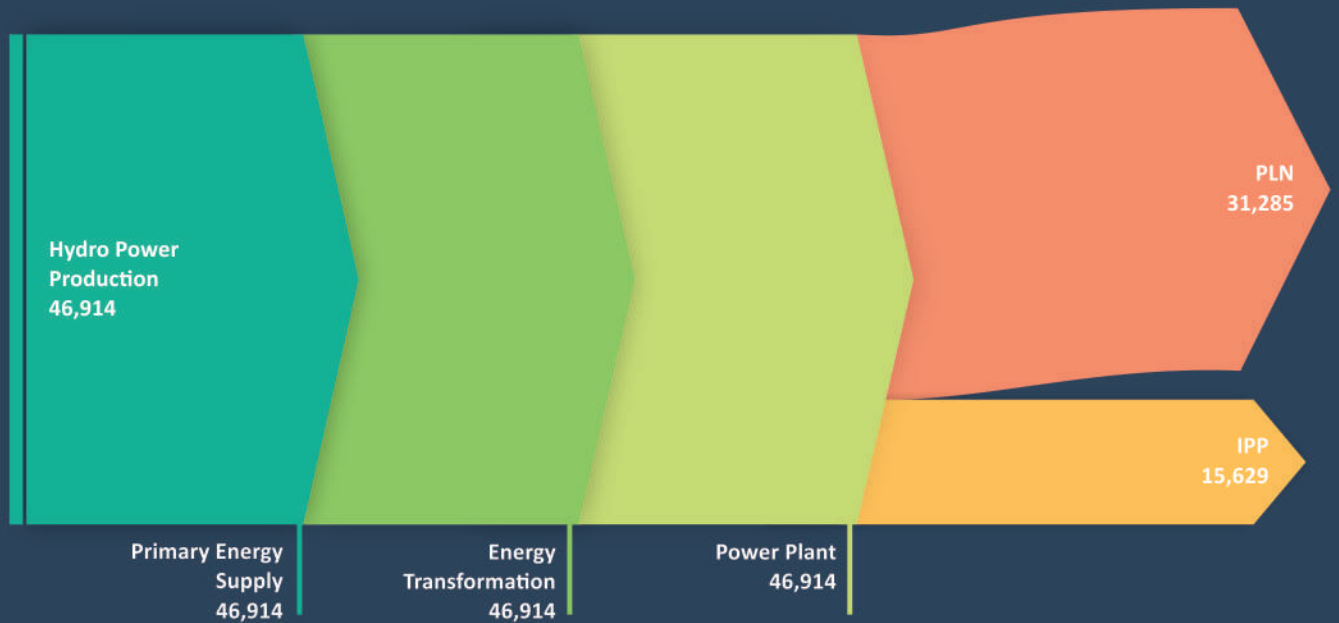
GEOTHERMAL SANKEY DIAGRAM 2017 (THOUSAND BOE)



Source: Ministry of Energy & Mineral Resources, 2018

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

HYDRO POWER SANKEY DIAGRAM 2017 (THOUSAND BOE)



Source: Ministry of Energy & Mineral Resources, 2018

LOCATION AND QUANTITY OF INSTALLED FREE SOLAR POWER ENERGY SAVING LAMPS "LAMPU TENAGA SURYA HEMAT ENERGI (LTSHE)" IN 2017

Source: Ministry of Energy & Mineral Resources, 2018

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

LOCATION AND QUANTITY OF INSTALLED FREE SOLAR POWER ENERGY SAVING LAMPS "LAMPU TENAGA SURYA HEMAT ENERGI (LTSHE)" IN 2018

15 PROVINCES

167,064 HOUSEHOLDS | **1,260** VILLAGES

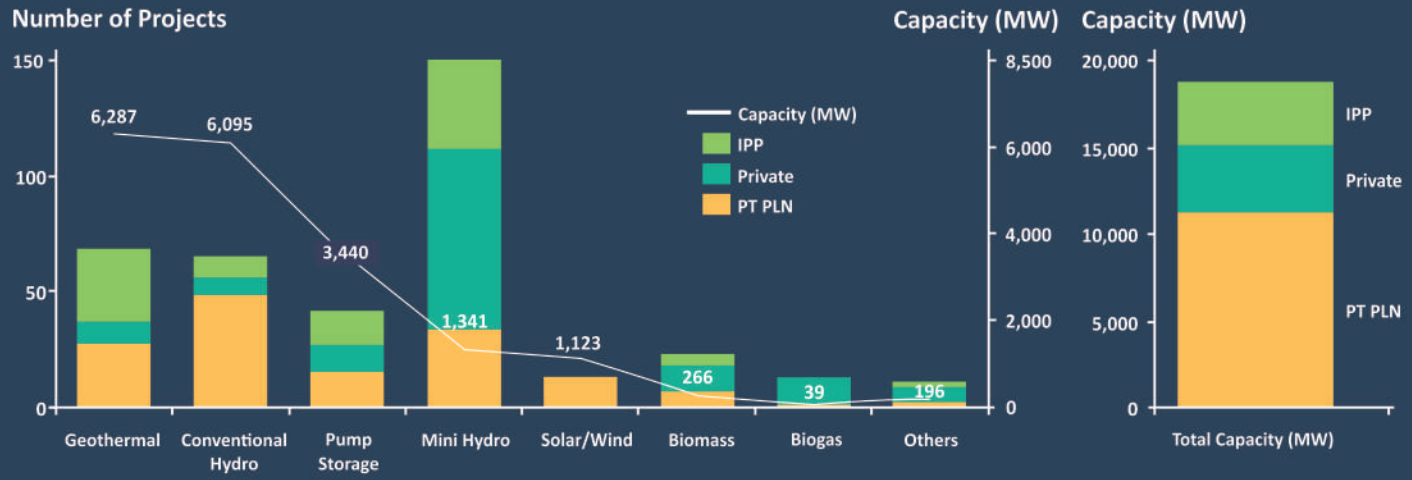
ILLUMINATED IN 2018

14 AUCTION PROJECTS

Source: Ministry of Energy & Mineral Resources, 2018

3.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

TOTAL RENEWABLE ENERGY PROJECTS UP TO 2018



TYPES OF RENEWABLE ENERGY

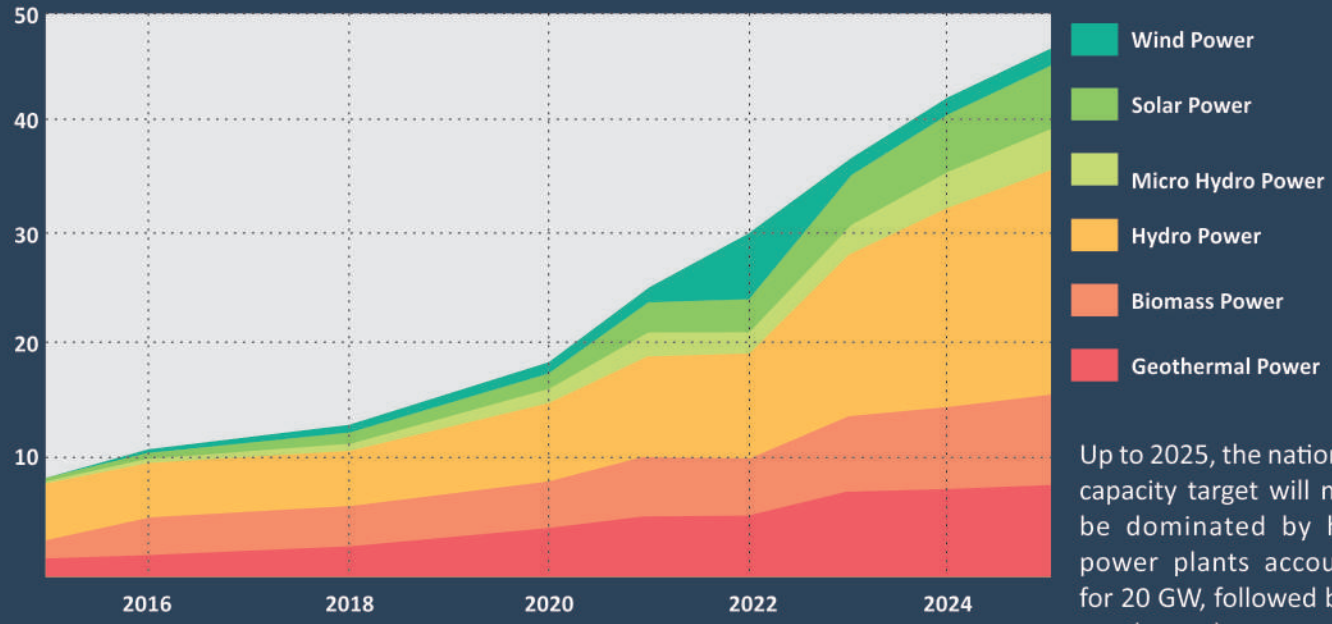
Source: The Boston Consulting Group, 2018

CHAPTER 4

THE POTENTIAL DEVELOPMENT OF RENEWABLE ENERGY IN INDONESIA

4.1 CLASSIFICATION BASED ON THE RENEWABLE ENERGY TYPES

RENEWABLE ENERGY POWER PLANT CAPACITY TARGET (MW) FROM 2015 TO 2025

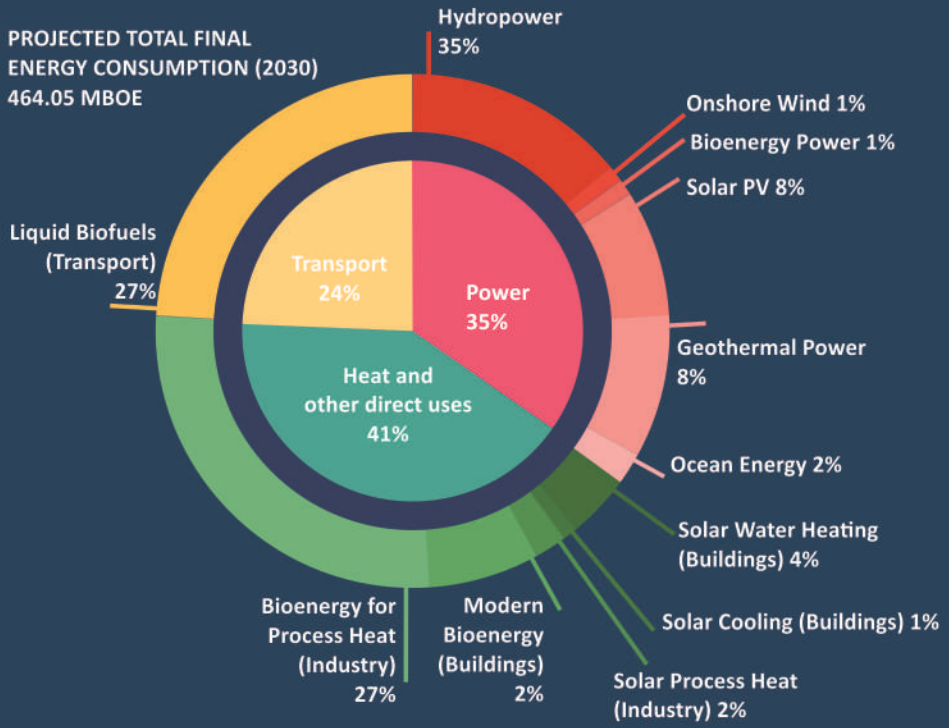


Up to 2025, the national RE capacity target will mostly be dominated by hydro power plants accounting for 20 GW, followed by the geothermal power plants and the biomass power plants.

Source: Ministry of Energy & Mineral Resources, 2017

4.1 CLASSIFICATION BASED ON THE RENEWABLE ENERGY TYPES

BREAKDOWN OF RENEWABLE ENERGY IN TOTAL FINAL ENERGY CONSUMPTION (2030)



- Bioenergy will dominate the RE usage in the transport, heat and other direct uses.
- While hydro, geothermal and solar energy dominate the RE usage in the power sector.

Source: IRENA, 2017

4.2 CLASSIFICATION BASED ON THE GEOGRAPHICAL AREAS

GEOTHERMAL POTENTIAL RESOURCES (MW)

The highest geothermal resources are spread along the volcanic track in Sunda Trench which lies from the western of Sumatra to the southern of Java and continue to the southern of East Nusa Tenggara. In the northern part, the meeting between Eurasia plate, Pacific Plate, and Philippines Plate produces the volcanically active zone which provides a high geothermal potential. The geothermal power plant has been developed in West Java, Central Java, Nusa Tenggara, West Sumatera, and Lampung while other potentials in different areas are yet to be developed.

Source: Ministry of Energy & Mineral Resources, 2018

4.2 CLASSIFICATION BASED ON THE GEOGRAPHICAL AREAS

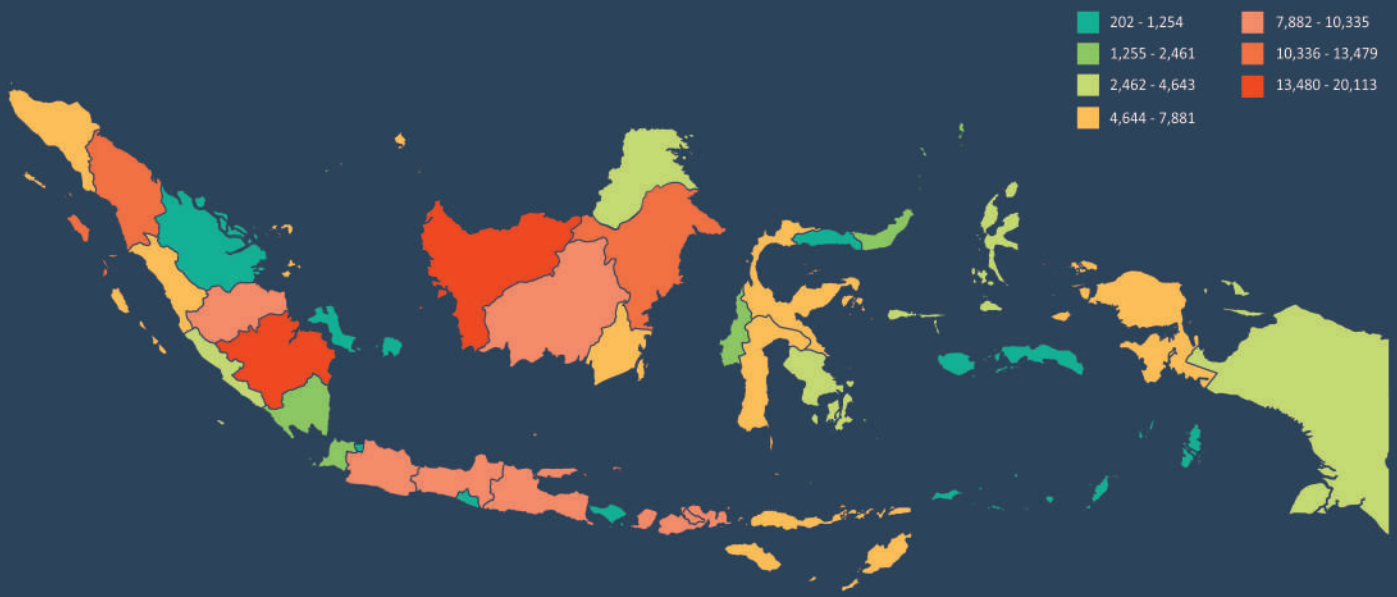
PLTM AND PLTMh POTENTIAL RESOURCES (MW)

Islands of Sumatera, Java, Kalimantan, Sulawesi and Papua have a significant potential of both mini and micro hydro power resources. Mini and micro hydro power plants have been commonly used in dispersed remote areas, especially for off-grid electrification.

Source: Ministry of Energy & Mineral Resources, 2018

4.2 CLASSIFICATION BASED ON THE GEOGRAPHICAL AREAS

PLTS POTENTIAL RESOURCES (MW)



Indonesia is located in the equator zone where solar intensity is high. Thus, the solar potential is distributed in almost all provinces. Small scale solar power has been operated dispersedly in some areas of Indonesia from Sumatera to Papua but its potential has not been fully exploited.

Source: Ministry of Energy & Mineral Resources, 2018

4.2 CLASSIFICATION BASED ON THE GEOGRAPHICAL AREAS

PLTB POTENTIAL RESOURCES (MW)

The highest wind power potential in Indonesia is spreaded from Java to Nusa Tenggara, continued to Maluku, Papua and some part of Sulawesi. The first and largest (75 MW) commercial wind power plant has been operating in South Sulawesi, respectively since 2018. The potential in other regions are yet to be developed optimally.

Source: Ministry of Energy & Mineral Resources, 2018

4.2 CLASSIFICATION BASED ON THE GEOGRAPHICAL AREAS

OCEAN ENERGY POTENTIAL RESOURCES (MW)

The potential of ocean energy is mostly located in the Nusa Tenggara area, West Papua Province and Lampung Province. Currently, no ocean-powered power plant exists in Indonesia.

Source: Ministry of Energy & Mineral Resources, 2018

4.2 CLASSIFICATION BASED ON THE GEOGRAPHICAL AREAS

PLTBg POTENTIAL RESOURCES (MW)

The biogas potential is related to the amount of the raw materials availability, such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. Thus, the highest potential of biogas should be located in the high population area. As of now, biogas for electricity generation has been utilized in some palm fruit industries in Sumatera.

Source: Ministry of Energy & Mineral Resources, 2018

4.2 CLASSIFICATION BASED ON THE GEOGRAPHICAL AREAS

WASTE TO ENERGY POTENTIAL RESOURCES (MW)

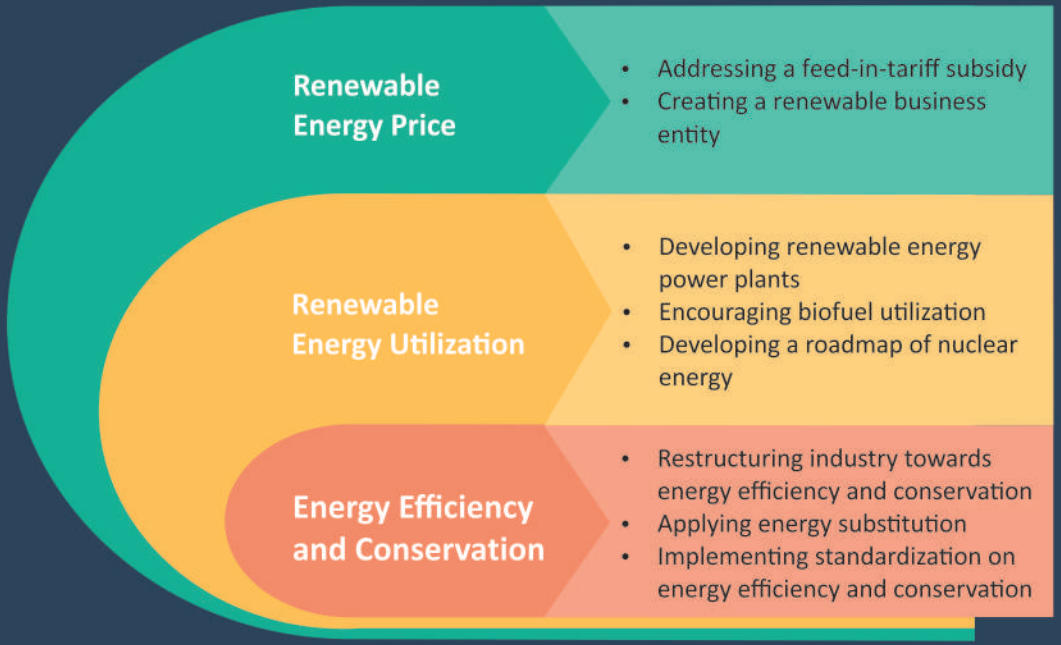
The waste-to-energy resource is related to the amount of waste. Thus, the highest potential of waste-to-energy is often located in the highly dense population area. Currently, the waste-to-energy power plant remains in small scale and in some urban areas, such as PLTSa Gede Bage in Bandung and in Solo.

Source: Ministry of Energy & Mineral Resources, 2018

CHAPTER 5

CONCLUSION

5.1 CURRENT ISSUES IN RENEWABLE ENERGY SECTOR



Source: Indonesian National Energy Council, 2018

LACK OF SUBSTANTIAL AND INTEGRATED ACTION FROM RELATED STAKEHOLDERS IN FULFILLING RENEWABLE ENERGY TARGET

Availability	Indigenous characteristic of RE resource makes it difficult to be exploited and distributed to certain demand location;
Accessibility	Limited accessibility of renewable energy, in comparison with fossil energy;
Affordability	Uncompetitive cost of some renewable energy, compared to other alternatives, especially subsidized fossil energy; Cost of energy does not account the environmental cost;
Acceptability	Some RE development face disapproval from local society and environmentalist, for example geothermal and hydro power;
Sustainability	Inadequate research and policy in assessing sustainable environment, social and economic impact of RE.

5.3 RECOMMENDATIONS

Carbon Tax Implementation

Currently, the economical scale of renewable energy power plant can not compete with cheap fossil fueled power plant, such as coal power plant. However, with the introduction of carbon tax, the fossil fueled power plant will require to pay a significant amount of tax to compensate the high carbon emission produced by the power plant. On the other hand, renewable energy power plants produce relatively to none carbon emission. With the implementation of carbon tax, the OPEX of fossil fueled power plants will increase and make renewable energy power plants to be more competitive economically.

Adjustment to the Feed-in-Tariff System

The current feed-in-tariff system is based on the local electricity supply cost (Biaya Pokok Penyediaan, BPP). The reference tariff of BPP is considered to be unattractive by the investors as it returns a relatively low Rate of Return (RoR). In order to attract more investors, reviews and adjustments of the reference tariff are required.

Accelerate the Drafting of RUED-P and RUKD

The national energy policies in Indonesia, currently, are still limited to KEN and RUEN. These policies are designed to serve as guidelines for national energy management. However, further guidelines are needed in the provincial levels. RUED-P and RUKD will provide a more detailed planning on the regional energy management to support the realization of RUEN.

5.3 RECOMMENDATIONS

Improve the Collaboration among Industry, Government and Academic Institution (The Triple Helix Concept)

Triple helix is the concept where the industry collaborates with the government and academic institution to improve the research and development sector. Encouraging triple helix concept not only would improve the quality of human resources and technology but also lead to a more affordable renewable energy price.

Maintaining the Consistency of Policy

Renewable energy development requires significant amount of investment which cannot be fully imposed to the government's balance. Therefore, external investments are crucial in the development of renewable energy in Indonesia. An attractive climate for renewable energy investment can be realized by maintaining the consistency of renewable energy policy.

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