PYC INDONESIA RENEWABLE ENERGY BOOKLET 2019
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BY: PURNOMO YUSGIANTORO CENTER (PYC)
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 publishes “The Indonesia Renewable Energy Booklet 2019” to provide public information of Indonesia's renewable energy development.

This is the second booklet published and provides updated Indonesia’s renewable energy policies and development, while potential and challenges remain the same since last year. Data are compiled up to the fourth quarter of 2019 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 2019 can be beneficial to our readers.

Jakarta, 3 January 2020

Filda Citra Yusgiantoro, ST, MBM, MBA, PhD
Chairperson of the Purnomo Yusgiantoro Center
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 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 began 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.
Chapter 1 presents the international and Indonesia’s regulations on renewable energy. This chapter also provides related regulations on renewable energy from 2003 to 2019.

Chapter 2 illustrates the current development of renewable energy in Indonesia. It covers the updated data on renewable energy installed capacity and production, as well as the renewable energy balance.

Chapter 3 looks at the potential of renewable energy in Indonesia by type of resources and on each province.

Chapter 4 gives insights on the renewable energy development in Indonesia, including the highlights in 2018-2019 and future challenges.

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.
ACKNOWLEDGMENT

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

The contributed researchers for this booklet are Akhmad Hanan, Diwangkara Bagus Nugraha, Haryanto, I Dewa Made Raditya Margenta, Massita Ayu Cindy and Muhammad Razin Abdullah. We’d like to extend our gratitude to Inka B. Yusgiantoro, PhD and Alexander Ery Wibowo, JSD for their guidance. We would also like to thank Dwiki, Felicia, Galih, Nurmasiyidah, Pingkan and Zaenal for their assistance.

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.
TABLE OF CONTENTS

Preface ................................................................................................................................. 1
Background for This Booklet ............................................................................................. 2
How This Booklet is Structured ....................................................................................... 3
How This Booklet was Prepared ..................................................................................... 3
Acknowledgments ............................................................................................................. 4
Table of Contents ............................................................................................................. 5
Glossary .............................................................................................................................. 6

Chapter 1. Renewable Energy Regulations ....................................................................... 9
1.1 International Regulations on Renewable Energy ....................................................... 10
1.2 Indonesia’s Government Regulations on Renewable Energy ....................................... 11

Chapter 2. The Current Situation of Renewable Energy in Indonesia ............................... 19
2.1 Renewable Energy Production and Capacity ............................................................ 20
2.2 Renewable Energy Balance by Type ........................................................................ 40

Chapter 3. The Potential Development of Renewable Energy in Indonesia ...................... 47
3.1 Classification Based on Renewable Energy Types ..................................................... 48
3.2 Classification Based on Geographical Areas ............................................................. 50

Chapter 4. Indonesia’s Renewable Energy Insights .......................................................... 57
4.1 Renewable Energy Highlights in 2018-2019 ............................................................. 58
4.2 Renewable Energy Challenges in the Future ............................................................. 62

Bibliography ....................................................................................................................... 63
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBM</td>
<td>Coal Bed Methane</td>
</tr>
<tr>
<td>BOE</td>
<td>Barrel of Oil Equivalent</td>
</tr>
<tr>
<td>BPP</td>
<td>Biaya Pokok Penyediaan (Cost of Power Generation)</td>
</tr>
<tr>
<td>CGI</td>
<td>Chevron Geothermal Indonesia</td>
</tr>
<tr>
<td>CGS</td>
<td>Chevron Geothermal Salak</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon Dioxide</td>
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<tr>
<td>DGNRECEC</td>
<td>Directorate General of New and Renewable Energy and Energy</td>
</tr>
<tr>
<td>GDE</td>
<td>PT Geo Dipa Energy</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GoI</td>
<td>Government of Indonesia</td>
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<tr>
<td>GW</td>
<td>Gigawatt</td>
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<tr>
<td>HEES Indonesia</td>
<td>Handbook of Energy and Economic Statistics of Indonesia</td>
</tr>
<tr>
<td>IO</td>
<td>Izin Operasi (Operating Licenses)</td>
</tr>
<tr>
<td>IPB</td>
<td>Izin Panas Bumi (Geothermal Permits)</td>
</tr>
<tr>
<td>IPP</td>
<td>Independent Power Producer</td>
</tr>
<tr>
<td>KEN</td>
<td>Kebijakan Energi Nasional (National Energy Policy)</td>
</tr>
<tr>
<td>km</td>
<td>Kilometer</td>
</tr>
<tr>
<td>kW</td>
<td>Kilowatt</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatt Hour</td>
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<tr>
<td>LTSHE</td>
<td>Lampu Tenaga Surya Hemat Energi (Solar Power Energy Saving Lamps)</td>
</tr>
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</table>
GLOSSARY

$m^2$ : Square Meter
$m^3$ : Cubic Meter
MBOE : Million Barrels of Oil Equivalent
MEMR : Ministry of Energy and Mineral Resources
MMSCFD : Million Standard Cubic Feet per Day
MoF : Ministry of Finance
MT : Million Tons
MTOE : Million Tons of Oil Equivalent
MW : Megawatt

NRE : New and Renewable Energy

OPEX : Operating Expenses

PGE : PT Pertamina Geothermal Energy
PLN : Perusahaan Listrik Negara (State Owned Electricity Company)
PLTBg : Pembangkit Listrik Tenaga Biogas (Biogas Power Plant)
PLTBm : Pembangkit Listrik Tenaga Biomassa (Biomass Power Plant)
PLTM : Pembangkit Listrik Tenaga Minihidro (Mini Hydro Power Plant)
PLTMH : Pembangkit Listrik Tenaga Mikrohidro (Micro Hydro Power Plant)
PLTP : Pembangkit Listrik Tenaga Panas Bumi (Geothermal Power Plant)
PLTS : Pembangkit Listrik Tenaga Surya (Solar Power Plant)
PLTSa : Pembangkit Listrik Tenaga Sampah (Waste Power Plant)
POME : Palm Oil Mill Effluent
PP : Power Plant
PPA : Power Purchase Agreement
PV : Photovoltaic
GLOSSARY

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
SE Asia : Southeast Asia
SOL : Sarulla Operation Limited

TCO² : Total of Carbon Dioxide
TPES : Total Primary Energy Supply

USD : United States Dollar
UU : Undang – Undang (Republic Indonesia Law)
(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, 2019
1.2 INDONESIA’S GOVERNMENT REGULATIONS ON RENEWABLE ENERGY

**LAW 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 NO. 79/2014 ON NATIONAL ENERGY POLICY (KEN)**

- **Maximize the use of renewable energy**
- **Minimize the use of oil**
- **Optimize the use of natural gas and new energy**
- **Coal as a reliable national energy supply**
- **Nuclear power as the last option**
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

400 MTOE

- New and Renewable Energy (23%)
- Coal (30%)
- Gas (22%)
- Oil (25%)

(75.05%) 69.2 MTOE

ELECTRICITY SECTOR

- Wind PP (6%)
- Solar PV PP (23%)
- Geothermal PP (25%)
- Hydro PP (7%)
- Micro Hydro PP (10%)
- Bioenergy PP (19%)

Other New & Renewable Energy PP (10%)

(24.95%) 23 MTOE

NON-ELECTRICITY SECTOR

- Biofuel
  13.69 Million kiloliters
- Biomass
  8.4 Million tons
- Biogas
  489.8 Million m³
- CBM
  46 MMSCFD

400 MTOE
## 1.2 Indonesia’s Government Regulations on Renewable Energy

<table>
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<td>MEMR Regulation No. 16/2019</td>
<td>In Force</td>
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<td>Rooftop PV Utilization by PT PLN Consumer</td>
<td>MEMR Regulation No. 13/2019</td>
<td>Amended</td>
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<td>Electric Power Generation Capacity for Own Use Based on Operation Permits</td>
<td>MEMR Regulation No. 12/2019</td>
<td>In Force</td>
</tr>
<tr>
<td></td>
<td>Electricity Supply Business Plan (RUPTL) 2019-2028</td>
<td>MEMR Decree No. 39 K/20/MEM/2019</td>
<td>In Force</td>
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<td>Collection and Disbursement of Oil Palm Estate Fund</td>
<td>Presidential Regulation No. 66/2018</td>
<td>In Force</td>
</tr>
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<td>Acceleration of Waste-to-electrical Energy Installations Based on Environmentally Friendly Technologies</td>
<td>Presidential Regulation No. 35/2018</td>
<td>In Force</td>
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<td>MEMR Regulation No. 53/2018</td>
<td>In Force</td>
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<td>Rooftop PV Utilization by PT PLN Consumer</td>
<td>MEMR Regulation No. 49/2018</td>
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### 1.2 Indonesia’s Government Regulations on Renewable Energy

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<td>MEMR Regulation No. 43/2017</td>
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<td>MEMR Regulation No. 12/2017</td>
<td>Superseded</td>
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<tr>
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<td>Mol Regulation No. 5/2017</td>
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<td>Provisions and Procedures for Assessing Local Content Requirement for Solar Power Plant</td>
<td>Mol Regulation No. 4/2017</td>
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### 1.2 INDONESIA’S GOVERNMENT REGULATIONS ON RENEWABLE ENERGY

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<td>MEMR Regulation No. 21/2016</td>
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<td>Presidential Regulation No. 61/2015</td>
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<td>MEMR Regulation No. 44/2015</td>
<td>In Force</td>
</tr>
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<td>MEMR Regulation No. 19/2015</td>
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<td>Law No. 21/2014</td>
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<td>Government Regulation No. 79/2014</td>
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<td>Government Regulation No. 75/2014</td>
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### 1.2 Indonesia’s Government Regulations on Renewable Energy

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### 1.2 Indonesia’s Government Regulations on Renewable Energy

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CHAPTER 2
THE CURRENT SITUATION OF RENEWABLE ENERGY IN INDONESIA
2.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

INDONESIAN ENERGY INDICATORS IN 2019

<table>
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<th>POPULATION</th>
<th>265.02 Million</th>
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<td>GDP</td>
<td>USD 1.15 Trillion</td>
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<tr>
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<td>2010 USD</td>
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Final Energy Consumption
868.58 MBOE
Energy Consumption/Capita
3.28 BOE/capita

CO₂ emission
543 MT of CO₂
CO₂/TPES
0.37 TCO₂/BOE
CO₂/Capita
2.05 TCO₂/capita

TPES
1,466 MBOE
TPES/Capita
5.53 BOE/capita
TPES GDP
0.33 BOE/000 2010 USD

Source: BP Statistical Review of World Energy, BP, 2019; HEES Indonesia, MEMR 2019; World Bank, 2019
2.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

INDONESIA ENERGY MIX 2018

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

- Coal (30%)
- New and Renewable Energy (23%)
- Gas (22%)
- Oil (25%)

2018 National Energy Mix Realization

- Coal (32.97%)
- New and Renewable Energy (8.55%)
- Gas (19.67%)
- Oil (38.81%)

Source: HEES Indonesia, MEMR, 2019; RUEN, MEMR, 2017
2.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

RENEWABLE ENERGY CONTRIBUTION IN POWER GENERATION SECTOR

INDONESIA POWER GENERATION ENERGY MIX 2010 - 2019*

* Data as of first semester of 2019

Source: Energi Berkeadilan Semester-I, MEMR, 2019; HEES Indonesia, MEMR, 2019
2.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

In 2018, there was a significant increase of RE share in the national energy mix from 12.23% in 2017 to 15.06% in 2018. This increase was due to the additional off-grid biomass power plant data which was published by the government in 2018.

The total of Renewable Energy (RE) power plant capacity increased by 32% between 2017-2018.

In 2018, there was a significant increase of RE share in the national energy mix from 12.23% in 2017 to 15.06% in 2018. This increase was due to the additional off-grid biomass power plant data which was published by the government in 2018.

Source: HEES Indonesia, MEMR, 2019
2.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

INDONESIA'S RENEWABLE ENERGY IN NUMBERS 2018

<table>
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<tr>
<th>RENEWABLE ENERGY</th>
<th>TOTAL RESOURCES (MW)</th>
<th>INSTALLED CAPACITY (MW)</th>
<th>PERCENTAGE OF UTILIZED RESOURCE</th>
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<td>Solar Power</td>
<td>207,898</td>
<td>60.20</td>
<td>0.03%</td>
</tr>
<tr>
<td>Hydro Power</td>
<td>75,670</td>
<td>5,742.15</td>
<td>7.59%</td>
</tr>
<tr>
<td>Bioenergy</td>
<td>49,810</td>
<td>1,867.15</td>
<td>3.75%</td>
</tr>
<tr>
<td>Geothermal</td>
<td>25,386</td>
<td>1,948.30</td>
<td>7.67%</td>
</tr>
<tr>
<td>Wind Power</td>
<td>9,290</td>
<td>143.51</td>
<td>1.54%</td>
</tr>
</tbody>
</table>

Source: HEES Indonesia, MEMR, 2019
2.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

HYDRO POWER PLANT INSTALLED CAPACITY

(Capacity ≥ 1 MW)

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>3,690.8</td>
</tr>
<tr>
<td>2009</td>
<td>3,694.95</td>
</tr>
<tr>
<td>2010</td>
<td>3,719.69</td>
</tr>
<tr>
<td>2011</td>
<td>3,880.83</td>
</tr>
<tr>
<td>2012</td>
<td>4,078.24</td>
</tr>
<tr>
<td>2013</td>
<td>5,058.87</td>
</tr>
<tr>
<td>2014</td>
<td>5,059.06</td>
</tr>
<tr>
<td>2015</td>
<td>5,079.06</td>
</tr>
<tr>
<td>2016</td>
<td>5,124.06</td>
</tr>
<tr>
<td>2017</td>
<td>5,124.06</td>
</tr>
<tr>
<td>2018</td>
<td>5,369.59</td>
</tr>
</tbody>
</table>

Source: HEES Indonesia, MEMR, 2019

The significant increase of hydro power plant installed capacity between 2012 and 2013 was the result of new private power plant operations in North Sumatra and South Sulawesi.
The significant increase of mini hydro power plant installed capacity in 2011 was the result of additional mini hydro power plant policy on the National Energy Policy (KEN) in 2007.

Source: HEES Indonesia, MEMR, 2019
In 2018, the remarkable growth of micro hydro was supported by the significant additional capacity in Sumatera, such as in Silangkitang Tambiski, North Sumatera (53 kW).
Since the implementation of Government Regulation No. 70/2010 and MEMR Regulation No. 22/2012, there was an increasing trend of geothermal power plant installed capacity. The 2018 additional capacity came from PLTP Sarulla (110 MW) and PLTP Karaha (30 MW).
In 2018, the first large-scale wind power plants were inaugurated in Sidrap and Jeneponto, South Sulawesi. PLTB Sidrap is the biggest wind power plant in Southeast Asia.

Source: HEES Indonesia, MEMR, 2019
The significant increase of solar power in 2018 mostly came from the additional off-grid solar power capacity, including the LTSHE program from the government. Moreover, the issuance of MEMR Regulation No. 19/2016 on solar feed-in-tariff in Indonesia supported the development of solar power since 2016.

Source: HEES Indonesia, MEMR, 2019
The increase of waste power plant installed capacity from 2013 to 2014 was the response to the enactment of MEMR regulation No. 27/2014. However, the trend dropped in 2018 due to the MEMR Regulation No. 50/2017, which stipulates the waste power plant electricity price at a maximum of 100% of regional electricity supply cost (BPP). The government then anticipated it by imposing Presidential Regulation No. 35/2018.

Source: HEES Indonesia, MEMR, 2019
The first Indonesia’s commercial biogas power plant operated using Palm Oil Mill Effluent (POME) as the fuel was installed in Jangkang, East Belitung in 2017. Then, followed by other biogas power plants operation in Sumatera region, where it has abundant supply of palm oil.

Source: HEES Indonesia, MEMR, 2019
The first utilization of biomass material for a commercial power plant in Indonesia can be traced back in 2017 by the first operation of a commercial biomass power plant in Kepulauan Riau. In 2018, the significant increase was caused by additional off grid data by MEMR and new biomass power plants installation such as in Siantan, West Kalimantan (15 MW).

Source: HEES Indonesia, MEMR, 2019
Hybrid power plant is a combination of different technologies to produce power from various sources. In 2018, 1.23 MW hybrid power plants which integrate three power generation systems (microhydro-genset-solar PV & battery) were installed in 3 villages in Kabupaten Berau, Kalimantan Timur.

Source: HEES Indonesia, MEMR, 2019
Biodiesel utilization started to grow significantly after the government issued Presidential Regulation No. 66/2018 on "Collection and Utilization of the Palm Oil Plantation Fund" and MEMR Regulation No. 41/2018 on "Provision and Utilization of Biodiesel in the Financing Framework of the Indonesian Oil Palm Estate Fund". Through B20 program, the government successfully increased biodiesel consumption in Q4 of 2018.
Biodiesel industry is usually located close to the palm oil industry, since it is the main feedstock for biodiesel production. According to Ministry of Agriculture, there are about 14.23 million Ha of palm oil plantations, in which 19% of them are in Riau.
2.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

**GEOTHERMAL POWER PLANT CAPACITY (2018)**

- **Sibayak (12 MW)**
  - Owner: PGE
  - Steam Area Operator: PGE
  - PLTP Operator: PT Dizamatra Powerindo

- **Sarulla (330 MW)**
  - Owner: PGE-SOL
  - Steam Area Operator: SOL
  - PLTP Operator: SOL

- **Ulubelu (220 MW)**
  - Owner: PGE
  - Steam Area Operator: PGE
  - PLTP Operator: PT PLN

- **Kamojang (235 MW)**
  - Owner: PGE
  - Steam Area Operator: PGE
  - PLTP Operator:  PLN & PGE

- **Dieng (60 MW)**
  - Owner: GDE
  - Steam Area Operator: GDE
  - PLTP Operator: GDE

- **Lahendong (120 MW)**
  - Owner: PGE
  - Steam Area Operator: PGE
  - PLTP Operator: PLN & PGE

- **Ulumbu (10 MW)**
  - Owner: PT PLN
  - Steam Area Operator: PT PLN
  - PLTP Operator: PT PLN

- **Mataloko (2.5 MW)**
  - Owner: PT PLN
  - Steam Area Operator: PT PLN
  - PLTP Operator: PT PLN

- **Patuha (55 MW)**
  - Owner: GDE
  - Steam Area Operator: GDE
  - PLTP Operator: GDE

- **Wayang Windu (227 MW)**
  - Owner: PGE
  - Steam Area Operator: SE
  - PLTP Operator: SEGWWL

- **Salak (376.8 MW)**
  - Owner: PGE
  - Steam Area Operator: CGS; PLTP Operator: PLN & SEGS;

- **Karaha (30 MW)**
  - Owner: PGE
  - Steam Area Operator: PGE
  - PLTP Operator: PGE

- **Darajat (270 MW)**
  - Owner: PGE
  - Steam Area Operator: CGI
  - PLTP Operator: PLN & SEGD II

- **Total Installed Capacity: 1,948.3 MW**

**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 Dipo Energy
- SOL: Sarulla Operation Ltd
- PLN: Perusahaan Listrik Negara
- SEGS: Star Energy Geothermal Salak Ltd
- SEGD II: Star Energy Geothermal Darajat II Ltd
- SEGWWL: Star Energy Geothermal Wayang Windu Ltd

Source: HEES Indonesia, MEMR, 2019
LOCATION AND QUANTITY OF INSTALLED FREE SOLAR POWER ENERGY SAVING LAMPS “LAMPU TENAGA SURYA HEMAT ENERGI (LTSHE)” IN 2019

<table>
<thead>
<tr>
<th>Province</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORTH SUMATERA</td>
<td>2,740</td>
</tr>
<tr>
<td>WEST SUMATERA</td>
<td>2,178</td>
</tr>
<tr>
<td>BENGKULU</td>
<td>3,038</td>
</tr>
<tr>
<td>LAMPUNG</td>
<td>4,272</td>
</tr>
<tr>
<td>JAMBI</td>
<td>4,606</td>
</tr>
<tr>
<td>WEST KALIMANTAN</td>
<td>4,492</td>
</tr>
<tr>
<td>NORTH KALIMANTAN</td>
<td>4,553</td>
</tr>
<tr>
<td>CENTRAL KALIMANTAN</td>
<td>5,413</td>
</tr>
<tr>
<td>SOUTH KALIMANTAN</td>
<td>3,136</td>
</tr>
<tr>
<td>EAST KALIMANTAN</td>
<td>3,618</td>
</tr>
<tr>
<td>WEST SULAWESI</td>
<td>4,278</td>
</tr>
<tr>
<td>SOUTHEAST SULAWESI</td>
<td>4,618</td>
</tr>
<tr>
<td>SOUTHWEST SULAWESI</td>
<td>3,363</td>
</tr>
<tr>
<td>SOUTH SULAWESI</td>
<td>3,363</td>
</tr>
<tr>
<td>NORTH SULAWESI</td>
<td>4,618</td>
</tr>
<tr>
<td>MALUKU</td>
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<tr>
<td>EAST JAVA</td>
<td>1,367</td>
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<td>NTB</td>
<td>1,907</td>
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<tr>
<td>NTT</td>
<td>1,907</td>
</tr>
<tr>
<td>WEST PAPUA</td>
<td>3,842</td>
</tr>
<tr>
<td>NORTH MALUKU</td>
<td>6,100</td>
</tr>
<tr>
<td>WEST PAPUA</td>
<td>3,842</td>
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<td>NORTH PAPUA</td>
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<td>EAST JAVA</td>
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<tr>
<td>NTB</td>
<td>1,907</td>
</tr>
<tr>
<td>NTT</td>
<td>1,907</td>
</tr>
</tbody>
</table>

Source: Energi Berkeadilan TW-III, MEMR, 2019
2.1 RENEWABLE ENERGY PRODUCTION AND CAPACITY

NUMBER OF RE CONTRACTS SIGNED

<table>
<thead>
<tr>
<th>Year</th>
<th>Contracts</th>
<th>Capacity (MW)</th>
</tr>
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<tbody>
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<td>2014</td>
<td>23</td>
<td>1,251</td>
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<tr>
<td>2015</td>
<td>14</td>
<td>1,829</td>
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<tr>
<td>2016</td>
<td>14</td>
<td>1,214</td>
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<tr>
<td>2017</td>
<td>70</td>
<td>362</td>
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<tr>
<td>2018</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Q3 2019</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: Energi Berkeadilan TW-III, MEMR, 2019
2.2 RENEWABLE ENERGY BALANCE BY TYPE

GEOTHERMAL SANKEY DIAGRAM* 2018 (THOUSAND BOE)

Source: HEES Indonesia, MEMR, 2019

*Sankey Diagram represents the flows of energy and their quantities in each process from the primary energy supply to the final consumption.
2.2 RENEWABLE ENERGY BALANCE BY TYPE

HYDRO POWER SANKEY DIAGRAM 2018 (THOUSAND BOE)

Source: HEES Indonesia, MEMR, 2019
2.2 RENEWABLE ENERGY BALANCE BY TYPE

SOLAR & SOLAR PV SANKEY DIAGRAM 2018 (THOUSAND BOE)

Source: HEES Indonesia, MEMR, 2019
2.2 RENEWABLE ENERGY BALANCE BY TYPE

Source: HEES Indonesia, MEMR, 2019
2.2 RENEWABLE ENERGY BALANCE BY TYPE

BIOGAS SANKEY DIAGRAM 2018 (THOUSAND BOE)

Source: HEES Indonesia, MEMR, 2019
2.2 RENEWABLE ENERGY BALANCE BY TYPE

WIND POWER SANKEY DIAGRAM 2018 (THOUSAND BOE)

Wind Production 466
Primary Energy Supply 466
Energy Transformation 466
Power Plant 466
IPP 461
Off-Grid 5

Source: HEES Indonesia, MEMR, 2019
CHAPTER 3

THE POTENTIAL DEVELOPMENT OF RENEWABLE ENERGY IN INDONESIA
Up to 2028, the additional RE capacity projection will mostly be dominated by hydro power plants accounting for 8 GW, followed by geothermal power plants and mini hydro power plants.

Source: RUPTL, PT PLN (Persero), 2019
• 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.
The highest geothermal resources are spread along the volcanic track in Sunda Trench, that lies from the western of Sumatra to the southern of Java and continue to the southern part of East Nusa Tenggara. In the northern part, the meeting point between Eurasia plate, Pacific Plate and Philippines Plate produces the volcanically active zone which provides a high geothermal potential. The geothermal power plants have 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: Statistik EBTKE, DGNRECC, 2016
Islands of Sumatera, Java, Kalimantan, Sulawesi and Papua have significant potential of both mini and micro hydro power resources. Mini and micro hydro power plants have been commonly used in remote areas, especially for off-grid electrification.

Source: Statistik EBTKE, DGNREEC, 2016
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: Statistik EBTKE, DGNREEC, 2016
The highest wind power potential in Indonesia is widely distributed from Java to Nusa Tenggara, continued to Maluku, Papua and some parts of Sulawesi. The first and largest (75 MW) commercial wind power plant has been operating in South Sulawesi since 2018. The potential in other regions are yet to be developed.

Source: Statistik EBTKE, DGNREEC, 2016
West Nusa Tenggara, East Nusa Tenggara, Riau Islands, Lampung and West Papua Province are the locations with a promising ocean energy potential. Currently, there are no ocean energy power plant exists in Indonesia.

Source: Statistik EBTKE, DGNREEC, 2016
The biogas potential is related to the availability and sustainability of raw materials, such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. Thus, the highest potential of biogas power plant is located in the area with high population. As of now, biogas for electricity generation has been utilized in several palm oil mills in Sumatera.

Source: Statistik EBTKE, DGNREEC, 2016
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 high densely-populated area. Currently, the waste to energy power plant remains in small scale and located in several urban areas, such as PLTSa Benowo in Surabaya.

Source: Statistik EBTKE, DGNREEC, 2016
CHAPTER 4

INDONESIA’S RENEWABLE ENERGY INSIGHTS
Indonesia's energy supply increased from 1,334 MBOE to 1,466 MBOE, marking a growth of 9.84%, from 2017 to 2018, respectively. Meanwhile, the final energy consumption grew at a higher rate at 11.27% during the same year, from 780 to 868 MBOE. The emission raised by 5.2%, from 516 MT to 543 MT CO$_2$e.

The renewable energy (RE) target in the energy mix remains the same, with 23% of the total energy mix in 2025, according to General Plan of National Energy (RUEN). In 2018, RE contribution grew slightly to 8.55%, compared to around 6% in 2017. This data indicates that a lot of work needs to be done to reach the 23% in the next five years.
New regulations were enacted in 2018 and 2019, including a solar rooftop regulation and waste power plant electricity purchasing scheme. The solar rooftop regulation allows PLN's customers, both household and industrial customers, to install solar rooftop PV. The MEMR regulation No. 49/2018 covers the required license, installation requirements and excess power purchasing scheme. The excess power purchase is capped by 65% of the total monthly excess power. The MEMR regulation No. 13/2019 removes the requirement to obtain operating license (IO) for solar rooftop with capacity under 500 kV. Meanwhile, the MEMR regulation No. 16/2019 amends the MEMR regulation No. 49/2018. The new regulation removes the emergency charge and cut the capacity charge from 40 hours to 5 hours for industrial customers.

The new regulation on waste power plant, Presidential Regulation No. 35/2018, sets the electricity price for PLN at USD 13.35 cent/kWh and a bit adjustment for PLTSa with a capacity more than 20 MW. It also states the fundings for waste power plant development, requirements for electricity purchase by PLN and the required permits. Besides, the regulation arranges a coordination team to accelerate waste power plant development, to coordinate, to supervise and to provide assistance for the smooth development of waste power plant.
In the electricity sector, the RE's contribution has stagnated around 12% for the last four years (2016-2019) in the generation mix. On the contrary, the portion of coal in the mix increased from 54.7% to 61.85% from 2016 to 2019. Total power plant installed capacity increased from 60.8 GW to 62.3 GW, from 2017 to 2018. Meanwhile, RE power plant installed capacity grew from 7.3 GW to 9.8 GW in the same year, accounting for 30% increase from 2017 to 2018.

A notable additional capacity of 1,6 GW was found in the off grid biomass power plant, according to the Handbook of Energy and Economic Statistics 2019 published by the Ministry of Energy and Mineral Resource. The increase of biomass power plant was pushed by the installation in the agriculture industry, such as palm oil industry. The growth of RE power plant capacity was also supported by the newly operated wind power plants in Jeneponto & Sidrap with a total capacity of 142 MW.
Meanwhile, the government also developed a 20% blended biodiesel (B20) in order to reduce fossil fuel imports. In September 2018, the government ordered all diesel fuel providers through MEMR Regulation No. 41/2018, to blend their diesel with 20% biofuel.

Recently, the government also tried to increase the composition of biofuel by 10% (B30) and successfully implemented it in a 50,000 km road test. Moreover, Pertamina has also conducted the first biorefinery testing in Indonesia, through the co-processing method at Balikpapan, Dumai and Plaju refineries.

The government also imposed a supporting regulation on palm oil funding through Presidential Regulation No. 66/2018. The funding is used to cover the difference between the market price index of diesel fuel types and the biodiesel market price index, calculated for at least every 3 months.
4.2 RENEWABLE ENERGY CHALLENGES IN THE FUTURE

**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 developments 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.
BIBLIOGRAPHY


RUPTL PT PLN (Persero) 2019-2028.

