

Chapter 3

Distributed Energy System in Indonesia

Introduction

Indonesia experienced a high energy growth of about 5% in the last couple of years due to industrialisation and population growth. This growth varies in different regions, but provinces outside Java – Sumatera, Kalimantan, and Sulawesi – are experiencing higher growth. These regions have diverse energy sources in terms of quality and quantity for both fossil and renewable types of primary energy.

In 2016, total installed capacity in Indonesia was 59,656 MW, 41% of which was powered by state-owned company PT PLN, and the remainder by independent power producers (IPPs) (13,781 MW); PPU (2,434 MW); and IO non-oil (2,392 MW). Electrification ratio is 92% and consumption is 956 kWh/capita. Indonesia has set a target of 2,500 kWh/capita by 2025 (RUEN); 2,764 kWh/capita (RUKN); and 3,347 kWh by 2034 (RUKN). Almost all installed capacity is on grid, whether in large or smaller system; however, some small portion of scale off-grid renewable energy is also included in the calculation.

Given the nature of Indonesia's geography, distributed on- and off-grid electricity system is promoted through a series of policies, including the development of small-scale renewable energy, especially micro hydro and solar photovoltaic (PV). The private sector can develop its own integrated generation and distribution activities in remote areas using renewable energy, which may or may not be subsidised.

Methodology

Questionnaires

- Using questionnaires (Chapter 1), the type of distributed energy system (DES) is categorised based on energy sources: geothermal, hydro/micro hydro, solar PV, biomass, coal, diesel, and gas. The data fields are current/existing capacity and required capacity to meet off-grid/mini grid future demand by 2025.

Estimation method of future DES capacity

- Terminology and categorisation of DES is based on the definition by the Economic Research Institute for ASEAN and East Asia (ERIA).
- DES is any type of power plant with an installed capacity of less than 100 MW either on grid or off grid. It is a decentralised power system producing electric power that is consumed locally at or near the point of use.
- Off-grid DES is a stand-alone generation without national grid connection. Off-grid DES includes stand-alone micro-grid and off-grid generators.
- This study considers the installed capacity of DES by type of fuel, as follows:
 - Solar PV, small hydro of installed capacity 0–50 MW;
 - Coal, gas, geothermal, solar thermal, electric, waste incineration plants, and biomass-fuelled thermal power plants, of installed capacity less than 100 MW.
- Current data about DES condition comes from the Ministry of Energy and Mineral Resources (MEMR) and PLN. The data is processed based on the regional distribution and type of power plant. The projection of future DES capacity comes from several long-term planning documents including the Electricity Power Supply Business Plan (RUPTL) prepared by state-owned company PLN approved by the MEMR, RUEN (prepared by the government and approved by the National Energy Council), and RUKN (prepared and published by the MEMR).
- Estimation of DES (total on grid and off grid)
Estimation is based on the definition of DES
 - Solar PV, small hydro of installed capacity 0–50 MW;
 - Coal, gas, geothermal, solar thermal electric, waste incineration plants, and biomass-fuelled thermal power plants, of installed capacity less than 100 MW
- Estimation of DES (total on grid and off grid) using RUPTL, RUEN, and RUKN.

Current Situation of Distributed Energy System

Current installed capacity by type of energy source

Geothermal

- Geothermal resources

Geothermal resources in Indonesia are estimated at 29,000 MW. However, the development of this capacity is far from optimum with only around 5% of total resources. In 2016, Total installed capacity of geothermal power plant was 1,643.50 MW or up by 14% compared to 2015. Most of the power plants are in Java. Based on the National Energy General Plan (MEMR, 2017), the capacity of geothermal power plant is targeted to reach 7,241 MW equivalent, around 16% of the total 23% renewable energy target in 2025. Table 3.1 shows the potential of geothermal resources.

Table 3.1. Geothermal Sources in Indonesia

No	Province	Resources			Reserves			
		Speculative	Hypothetical	Total	Possible	Probable	Proven	Total
1	West Java	1225	934	2159	1687	543	1535	3765
2	North Sumatera	300	134	434	1996		320	2316
3	Lampung	600	643	1243	1319		20	1339
4	South Sumatera	273	645	918	964			964
5	Central Java	130	387	517	949	115	280	1344
6	West Sumatera	532	269	801	1035			1035
7	NTT	226	403	629	748		15	763
8	East Java	105	257	362	1012			1012
9	Bengkulu	357	223	580	780			780
10	Aceh	640	340	980	332			332
11	Jambi	348	74	422	566	15	40	621
12	North Sulawesi	55	73	128	540	150	78	768
13	North Maluku	190	7	197	580			580
14	Central Sulawesi	349	36	385	368			368
15	Maluku	370	84	454	220			220
16	Banten	100	161	261	365			365
17	West Sulawesi	316	53	369	162			162
18	South Sulawesi	172	120	292	163			163
19	Bali	70	22	92	262			262
20	Southeast Sulawesi	200	25	225	98			98
21	Gorontalo	129	11	140	110			110
22	NTB	0	6	6	169			169
23	Bangka Belitung	100	6	106	0			0
24	West Papua	75	0	75	0			0
25	West Kalimantan	65	0	65	0			0

26	South Kalimantan	50	0	50	0			0
27	North Kalimantan	20	30	50	0			0
28	Riau	41	0	41	0			0
29	East Kalimantan	18	0	18	0			0
30	Yogyakarta	0	0	0	10			10
Total		7056	4943	11999	14435	823	2288	17546

NTB = West Nusa Tenggara (Indonesian: Nusa Tenggara Barat – NTB), NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur – NTT).

Source: Statistics of New Renewable Energy and Energy Conservation, 2016.

Table 3.2 and Figure 3.1 show the location of current geothermal power plants.

Figure 3.1. Regional Distribution of Geothermal Power Plants



Source: Statistics of New Renewable Energy and Energy Conservation (2016).

- Current/existing capacity

Most geothermal power plants comprise several units, with an installed capacity of 5–100 MW, so many of them can be classified as DES (Table 3.3).

Indonesia has huge potential for hydropower generation. Besides promotinwg large hydropower, the government also encourages the private sector to develop mini and micro-hydro power plants. Small-scale micro-hydro power plant uses run-off river and can fulfil the demand of remote communities. The total potential of large, mini-, and micro-hydro power plants is about 75,000 MW, but only 6.4% produces electricity. Table 3.4 shows the potential for hydropower development across the country.

Table 3.2. Existing Geothermal Power Plants in Indonesia

Province	Region System	Capacity (MW)													
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016			
West Java	G. Salak	375	375	375	375	375	377	377	377	377	377	377	377	377	376.8
West Java	Darajat	145	255	255	255	255	270	270	270	270	270	270	270	270	270
West Java	W. Windu	110	110	110	227	227	227	227	227	227	227	227	227	227	227
West Java	Kamojang	140	140	200	200	200	200	200	200	200	200	200	200	235	235
North Sulawesi	Lahendong	20	40	40	60	60	80	80	80	80	80	80	80	80	120
Central Java	Dieng	60	60	60	60	60	60	60	60	60	60	60	60	60	60
North Sumatera	Sibayak	2	2	12	12	12	12	12	12	12	12	12	12	12	12
NTT	Ulumbu	0	0	0	0	0	0	0	0	0	0	5	10	10	10
NTT	Mataloko	0	0	0	0	0	0	0	0	0	0	2.5	2.5	2.5	2.5
West Java	Patuha	0	0	0	0	0	0	0	0	0	0	0	55	55	55
North Sumatera	Sarulla	0	0	0	0	0	0	0	0	0	0	0	0	0	110
Lampung	Ulubelu	0	0	0	0	0	0	0	0	0	110	110	110	110	220
Total		852.0	982.0	1052.0	1189.0	1189.0	1226.0	1336.0	1343.5	1403.5	1438.5	1698.3			

Source: Directorate General of New Renewable Energy and Energy Conservation, 2017.

Table 3.3. Geothermal Power Plants with Installed Capacity of Less than 100 MW per Unit

No.	Province	PLTP	Turbine Capacity	Capacity each unit (MW)	Total Capacity (MW)
1	Sibayak – Sinabung North Sumatera	Sibayak	(monobloc	2	12
			1 x 5 MW	5	
			1 X 5 MW	5	
2	Cibeureum – Parabakti, West Java	Salak	1 x 60 MW	60	376.8
			1 x 60 MW	60	
			1 x 60 MW	60	
			1 x 65,6 MW	65,6	
			1 x 65,6 MW	65,6	
			1 x 65,6 MW	65,6	
3	Pangalengan, West Java	Patuha	1 x 55 MW	55	55
			Kamojang	1 x 30 MW	
		1 x 55 MW		55	
		1 X 55 MW		55	
		1 x 60 MW		60	
		1 x 35 MW		35	
		Darajat	1 x 55 MW	55	149
			1 x 94 MW	94	
4	Dataran Tinggi Dieng, Central Java	Dieng	1 x 60 MW	60	60
5	Lahendong – Tompaso, North Sulawesi	Lahendong	1 x 20 MW	20	120
			1 x 20 MW	20	
			1 x 20 MW	20	
			1 x 20 MW	20	
			1 x 20 MW	20	
			1 x 20 MW	20	
6	Waypanas – Lampung	Ulubelu	1 x 55 MW	55	220
			1 x 55 MW	55	
			1 x 55 MW	55	
			1 x 55 MW	55	
			1 x 55 MW	55	
7	Ulumbu - NTT	Ulumbu	1 x 2,5 MW	2,5	10
			1 x 2,5 MW	2,5	
			1 x 2,5 MW	2,5	
			1 x 2,5 MW	2,5	
8	Mataloko - NTT	Mataloko	1 x 2,5 MW	2,5	2,5
Total					1240,3

MW = megawatt, NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur – NTT), PLTP = Indonesia Power, monobloc = type of turbine rotor construction.

Source: Statistics of New Renewable Energy and Energy Conservation, 2016.

Hydropower

- Hydropower resources

Indonesia has huge potential for hydropower generation. Besides promoting large hydropower, the government also encourages the private sector to develop mini and micro-hydro power plants. Small-scale micro-hydro power plant uses run-off river and can fulfil the demand of remote communities. The total potential of large, mini-, and micro-hydro power plants is about 75,000 MW, but only 6.4% produces electricity. Table 3.4 shows the potential for hydropower development across the country.

Table 3.4. Hydropower Source in Indonesia

No.	Province	Potential (MW)
1	Papua	22,371
2	Kalsel, Kalteng, Kaltim	16,844
3	Sulsel, Sultra	6,340
4	Aceh	5,062
5	West Kalimantan	4,737
6	Sulut, Sulteng	3,967
7	North Sumatera	3,808
8	West Sumatera, Riau	3,607
9	Sumsel, Bengkulu, Jambi, Lampung	3,102
10	West Java	2,861
11	Central Java	813
12	Bali, NTB, NTT	624
13	East Java	525
14	Maluku	430
Total		75,091

MW = megawatt, NTB = West Nusa Tenggara (Indonesian: Nusa Tenggara Barat – NTB), NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur – NTT).
Source: National Energy General Plan (RUEN) (2017).

- Current/existing capacity

Table 3.5 illustrates some of the existing hydro power plants with capacity less than 100 MW per unit.

Table 3.5. Hydro Power Plants with Installed Capacity of Less than 100 MW per Unit

No.	Power Plant	Province	Region Power System	Installed capacity (MW)
1	PLTMH	Aceh	Tersebar Aceh	2.62
2	PLTMH	North Sumatera	Tersebar Sumut	7.5
3	PLTA	North Sumatera	Sipan	50
4	PLTA	North Sumatera	Renun	82
5	PLTA	West Sumatera	Maninjau	68
6	PLTA	West Sumatera	Batang Agam	10.5
7	PLTMH	West Sumatera	Tersebar Sumbar	66
8	PLTA	West Java	Ubrug	18
9	PLTA	West Java	Kracak	19
10	PLTA	West Java	Plengan	7
11	PLTA	West Java	Lamajan	20
12	PLTA	West Java	Cikalong	19
13	PLTA	West Java	Bengkok	3
14	PLTA	West Java	Dago	1
15	PLTA	West Java	Parakan	10
16	PLTA	Central Java	Jelok	21
17	PLTA	Central Java	Timo	12
18	PLTA	Central Java	Keteranganenger	8
19	PLTA	Central Java	Gerung	26
20	PLTA	Central Java	Wonogiri	12
21	PLTA	Central Java	Sempor	1
22	PLTA	Central Java	Wadas Lintang	18
23	PLTA	Central Java	Kedung Ombo	23
24	PLTA	Central Java	Lambu	1
25	PLTA	Central Java	Pengkol	1
26	PLTA	Central Java	Selorejo	1
27	PLTA	East Java	Wlingi	54
28	PLTA	East Java	Ledoyo	5
29	PLTA	East Java	Selorejo	5
30	PLTA	East Java	Sengguruh	29
31	PLTA	East Java	Tulung Agung	36
32	PLTA	East Java	Mendalan	23
33	PLTA	East Java	Siman	11
34	PLTA	East Java	Madiun	8
35	PLTA	South Kalimantan	Sistem Barito	30
36	PLTA	North Sulawesi	Sistem Minahasa-Kotamobagu	58.4
37	PLTA/M	Central Sulawesi	Sistem Poso-Tentena	74.8
38	PLTA/M	Central Sulawesi	Luwuk-Tolli	8.4

39	PLTA/M	Central Sulawesi	Ampana-Bunta	3.3
40	PLTA/M	Central Sulawesi	Toli-toli	1.6
41	PLTA/M	Central Sulawesi	Moutong-Kotaraya	2
42	PLTA/M	Central Sulawesi	Kolonedale	3
43	PLTA/M	Central Sulawesi	Bungku	2
44	PLTMH	Gorontalo	Gorontalo	3
45	PLTA	South Sulawesi	Bakaru 1	63
46	PLTA	South Sulawesi	Bakaru 2	63
47	PLTA	South Sulawesi	Bili Bili	20
48	PLTMH	South Sulawesi	Sawitto	1.6
49	PLTMH	South Sulawesi	Balla Mamasa	0.7
50	PLTMH	South Sulawesi	Kalukku Mamuju	1.4
51	PLTMH	South Sulawesi	Bonehau Mamasa	4
52	PLTMH	South Sulawesi	Budong- budong Mamuju	2
53	PLTMH	South Sulawesi	Tangka Manipi Sinjai	10
54	PLTMH	South Sulawesi	Simbuang Luwu	3
55	PLTMH	South Sulawesi	Siteba Palopo	7.5
56	PLTMH	South Sulawesi	Malea Tator	14
57	PLTMH	South Sulawesi	Ranteballa Palopo	2.4
58	PLTMH	South Sulawesi	Bungin Enrekang	3
59	PLTA	South Sulawesi	Poso 1	65
60	PLTA	South Sulawesi	Poso 2	65
61	PLTA	South Sulawesi	Poso 3	65
62	PLTMH	South Sulawesi	Saluanoa Luwu	2
63	PLTA	South Sulawesi	Malili (PT Vale Excess Power)	10.7

MW = megawatt, PLTA = hydropower plant, PLTA/M = mini hydropower plant, PLTMH = micro hydropower plant.
Source: MEMR (2016a).

- Micro-hydro resources

Mini/micro hydro is one of the potential sources to be developed in many parts of the country. Its estimated potential is 19,385 MW (Table 3.6).

Table 3.6. Mini and Micro Hydro Potential in Indonesia

No.	Province	Potential (MW)	No.	Province	Potential (MW)
1	East Kalimantan	3,562	17	Riau	284
2	Central Kalimantan	3,313	18	Maluku	190
3	Aceh	1,538	19	South Kalimantan	158
4	West Sumatera	1,353	20	West Kalimantan	124
5	North Sumatera	1,204	21	Gorontalo	117
6	East Java	1,142	22	North Sulawesi	111
7	Central Java	1,044	23	Bengkulu	108
8	North Kalimantan	943	24	NTT	95
9	South Sulawesi	762	25	Banten	72
10	West Java	647	26	NTB	31
11	Papua	615	27	North Maluku	24
12	South Sumatera	448	28	Bali	15
13	Jambi	447	29	West Sulawesi	7
14	Central Sulawesi	370	30	DI Yogyakarta	5
15	Lampung	352	31	West Papua	3
16	Southeast Sulawesi	301	Total		19,385

MW = megawatt, NTB = West Nusa Tenggara (Indonesian: Nusa Tenggara Barat - NTB), NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur - NTT).
Source: Author.

- Current/existing capacity

Table 3.7 shows the existing micro hydro power plants with capacity less than 100 MW per unit.

Table 3.7. Micro Hydropower Plant with Installed Capacity of Less than 100 MW per Unit

No.	Province	Region System	Installed capacity (MW)
1	Gorontalo	Gorontalo	0.0372
2	West Java	Ciamis	0.0244
3	Central Kalimantan	Gunung Mas	0.3290
4	NTT	Ngada	0.0260
5	NTB	Lombok	0.0300
6	North Sulawesi	Sangihe	0.0141
7	North Sumatera	Samosir	0.0312

8	Central Sulawesi	Lamantoli Morowali	0.0206
9	NTT	Manggarai Timur	0.0800
10	NTT	Rote Tengah	0.0200
11	NTT	Sumba Tengah	0.0120
12	Papua	Pegunungan Bintang	0.0300
13	NTB	Lombok Timur	0.0200
14	NTT	Timor Tengah Selatan	0.0500
15	Papua	Pegunungan Bintang	0.0400
16	Papua	Teluk Bintuni	0.0084
17	Gorontalo	Gorontalo Utara	0.0180
18	South Sumatera	Oku Selatan	0.0230
19	NTT	Timor Tengah Selatan	0.0350
20	West Kalimantan	Kapuas Hulu	0.4000
21	West Papua	Sorong Selatan	0.2850
22	West Sumatera	Pasaman Barat	0.0160
23	Papua	Yalimo	0.0500
24	West Sulawesi	Mamasa	0.1200
25	West Papua	Maybrat	0.2660
26	Lampung	Lampung Barat	0.0800
27	Riau	Kampar	0.0080
28	East Java	Situbondo	0.0150
29	Gorontalo	Bone Bolango	0.0400
30	Gorontalo	Gorontalo Utara	0.0200
31	Papua	Pegunungan Bintang	0.0350
32	Jambi	Sarolangun	0.0180
33	Central Kalimantan	Lamandau	0.0160
34	Southeast Sulawesi	Konawe Utara	0.0160
35	South Sulawesi	Luwu Utara	0.0400
36	West Kalimantan	Landak	0.0500
37	Maluku	Seram Bagian Barat	0.0300
38	West Sumatera	Kep. Mentawai	0.0250
39	West Papua	Manokwari	0.0450
40	NTB	Sumbawa	0.3000
41	Gorontalo	Gorontalo	0.0300
42	South Sumatera	Muara Enim	0.0200
43	Papua	Jayapura	0.0230
44	West Sumatera	Solok	0.0130
45	North Sumatera	Tapanuli Selatan	0.0250
46	Southeast Sulawesi	Buton Utara	0.0120
47	NTT	Manggarai Timur	0.0500

MW = megawatt, NTB = West Nusa Tenggara (Indonesian: Nusa Tenggara Barat – NTB), NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur – NTT).

Source: MEMR (2015).

Solar power

- Solar power resources

The potential of solar power in Indonesia is estimated at 207,888 MW, with West Kalimantan having the largest potential at 20.113 MW (Table 3.8). The development of solar power is still very limited at about 0,08 GWp (80 MWp) consisting of stand-alone solar PV located in remote areas and some on-grid larger capacity up to 5 MW that has been installed in Kupang, East Nusa Tenggara. In 2025, solar power is expected to reach 6,500 MW. Table 3.8 shows the potential of solar power.

Table 3.8. Solar Power Potential in Indonesia

No.	Province	Potential (MW)	No.	Province	Potential (MW)
1	West Kalimantan	20,113	19	North Kalimantan	4,643
2	South Sumatera	17,233	20	Southeast Sulawesi	3,917
3	East Kalimantan	13,479	21	Bengkulu	3,475
4	North Sumatera	11,851	22	North Maluku	3,036
5	East Java	10,335	23	Bangka Belitung	2,810
6	NTB	9,931	24	Banten	2,461
7	West Java	9,099	25	Lampung	2,238
8	Jambi	8,847	26	North Sulawesi	2,113
9	Central Java	8,753	27	Papua	2,035
10	Central Kalimantan	8,459	28	Maluku	2,020
11	Aceh	7,881	29	West Sulawesi	1,677
12	Riau Islands	7,763	30	Bali	1,254
13	South Sulawesi	7,588	31	Gorontalo	1,218
14	NTT	7,272	32	DI Yogyakarta	996
15	West Papua	6,307	33	Riau	753
16	Central Sulawesi	6,187	34	DKI Jakarta	225
17	South Kalimantan	6,031		Total	207,898
18	West Sumatera	5,898			

MW = megawatt, NTB = West Nusa Tenggara (Indonesian: Nusa Tenggara Barat – NTB),

NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur – NTT)

Source: MEMR (2017).

- Current/existing capacity

Table 3.9 shows the existing solar power plants with capacity less than 100 MW per unit.

Table 3.9. Solar Power Plants with Installed Capacity of Less than 100 MW per Unit

No.	Province	Region Power System	Installed capacity (MW)
1	West Sumatera	Kep. Mentawai	0.01
2	West Kalimantan	Kayong Utara	0.01
3	Southeast Sulawesi	Buton Utara	0.01
4	NTT	Belu	0.005
5	NTT	Kupang	0.01
6	NTT	Manggarai Barat	0.01
7	NTT	Rote Ndao	0.005
8	Papua	Nabire	0.01
9	Papua	Tolikara	0.075
10	West Sumatera	Sijunjung	0.015
11	West Sumatera	Solok	0.015
12	West Sumatera	Pasaman	0.015
13	West Sumatera	Pasaman Barat	0.03
14	Riau	Kep. Meranti	0.015
15	Riau	Kep. Meranti	0.015
16	Riau	Rokan Hulu	0.015
17	Riau	Indragiri Hilir	0.015
18	Riau	Kuantan Singingi	0.015
19	Riau	Bengkalis	0.015
20	Jambi	Tanjung Jabung Timur	0.015
21	Jambi	Bungo	0.015
22	Jambi	Sarolangun	0.015
23	Jambi	Batanghari	0.015
24	South Sumatera	Banyuasin	0.03
25	South Sumatera	Banyuasin	0.03
26	South Sumatera	Banyuasin	0.015
27	South Sumatera	Ogan Komering Ilir	0.03
28	Bengkulu	Seluma	0.015
29	Bengkulu	Kaur	0.015
30	Bengkulu	Kaur	0.015
31	Bengkulu	Kaur	0.015
32	Bengkulu	Kaur	0.015
33	Bangka Belitung	Bangka Selatan	0.015
34	Bangka Belitung	Bangka Selatan	0.015
35	Bangka Belitung	Bangka Barat	0.015
36	Bangka Belitung	Belitung Timur	0.015
37	Bangka Belitung	Bangka Barat	0.015
38	DKI Jakarta	Kep. Seribu	0.015
39	Banten	Serang	0.03

40	West Java	Cianjur	0.015
41	West Java	Cianjur	0.015
42	West Java	Cianjur	0.015
43	Central Java	Banyumas	0.015
44	Central Java	Banjarnegara	0.015
45	Central Java	Blora	0.015
46	Yogyakarta	Cirebon	0.015
47	Yogyakarta	Gunung Kidul	0.015
48	East Java	Sumenep	0.015
49	East Java	Jombang	0.015
50	East Java	Bojonegoro	0.015
51	Bali	Bangli	1
52	Bali	Karangasem	1
53	Bali	Karangasem	0.015
54	Bali	Bangli	0.015
55	Bali	Bangli	0.015
56	Bali	Bangli	0.015
57	Bali	Bangli	0.015
58	Bali	Klungkung	0.015
59	NTB	Sumbawa	1
60	NTB	Lombok Timur	0.015
61	NTB	Sumbawa	0.015
62	NTB	Lombok Barat	0.015
63	NTB	Lombok Tengah	0.015
64	NTB	Bima	0.015
65	NTT	Timor Tengah Selatan	0.015
66	NTT	Rote Ndao	0.015
67	NTT	Belu	0.015
68	NTT	Belu	0.015
69	NTT	Belu	0.015
70	West Kalimantan	Ketapang	0.015
71	West Kalimantan	Sanggau	0.015
72	West Kalimantan	Landak	0.015
73	West Kalimantan	Kapuas Hulu	0.015
74	Central Kalimantan	Katingan	0.015
75	Central Kalimantan	Lamandau	0.015
76	Central Kalimantan	Murung Raya	0.015
77	Central Kalimantan	Seruyan	0.015
78	Central Kalimantan	Barito Timur	0.015
79	Central Kalimantan	Barito Utara	0.015

80	Central Sulawesi	Sigi	0.015
81	Central Sulawesi	Donggala	0.015
82	Central Sulawesi	Toli-toli	0.015
83	Central Sulawesi	Parigi Moutong	0.015
84	Southeast Sulawesi	Kolaka Utara	0.015
85	Southeast Sulawesi	Buton	0.03
86	Southeast Sulawesi	Kolaka	0.03
87	Southeast Sulawesi	Bombana	0.015
88	Southeast Sulawesi	Bau-bau	0.015
89	Gorontalo	Gorontalo	0.015
90	Gorontalo	Bone Bolango	0.015
91	Gorontalo	Pohuwato	0.015
92	Gorontalo	Gorontalo Utara	0.015
93	West Sulawesi	Majene	0.015
94	West Sulawesi	Mamuju Utara	0.015
95	West Sulawesi	Majene	0.015
96	West Sulawesi	Mamuju Utara	0.015
97	West Sulawesi	Mamasa	0.015
98	Maluku	Maluku Barat Daya	0.015
99	Maluku	Maluku Tenggara	0.015
100	Maluku	Maluku Tenggara Barat	0.015
101	Maluku	Maluku Tenggara Barat	0.015
102	Maluku	Maluku Tenggara Barat	0.015
103	Maluku	Maluku Tenggara Barat	0.015
104	Maluku Utara	Halmahera Tengah	0.015
105	Maluku Utara	Kep. Sula	0.015
106	Maluku Utara	Halmahera Timur	0.015
107	Maluku Utara	Halmahera Utara	0.015
108	West Papua	Sorong	0.015
109	West Papua	Kota Sorong	0.015
110	West Papua	Manokwari	0.015
111	West Papua	Kaimana	0.015
112	West Papua	Sorong Selatan	0.015
113	West Papua	Sorong Selatan	0.015
114	West Papua	Sorong Selatan	0.015
115	West Papua	Sorong Selatan	0.015
116	Papua	Keerom	0.015
117	Papua	Keerom	0.015
118	Papua	Keerom	0.015
119	Papua	Yalimo	0.015

120	Papua	Yalimo	0.015
121	Papua	Yalimo	0.015
122	Papua	Peg. Bintang	0.015
123	North Sumatera	Nias Selatan	0.01
124	North Sumatera	Nias Barat	0.005
125	West Sumatera	Kep. Mentawai	0.005
126	South Sumatera	OKU Selatan	0.002
127	Bangka Belitung	Bangka Selatan	0.003
128	Lampung	Mesuji	0.005
129	West Kalimantan	Sekadau	0.023
130	West Kalimantan	Melawi	0.005
131	Central Kalimantan	Gunung Mas	0.005
132	Central Kalimantan	Seruyan	0.005
133	NTT	Alor	0.004
134	NTT	Belu	0.007
135	NTT	Manggarai	0.0075
136	NTT	Sumba Barat	0.006
137	NTT	Sumba Timur	0.005
138	NTT	Timor Tengah Utara	0.015
139	NTT	Manggarai Barat	0.01
140	NTT	Nagekeo	0.005
141	NTT	Sumba Barat Daya	0.005
142	NTT	Sumba Tengah	0.005
143	NTT	Sabu Raijua	0.005
144	Maluku	Kep. Aru	0.005
145	Papua	Paniai	0.05
146	Papua	Yahukimo	0.015
147	Papua	Peg. Bintang	0.015
148	Papua	Yalimo	0.05
149	Papua	Intan Jaya	0.05
150	West Papua	Sorong Selatan	0.01
151	West Papua	Maybrat	0.03
152	West Papua	Tambrauw	0.015
153	Aceh	Singkil	0.015
154	Aceh	Simeulue (2)	0.015
155	Aceh	Simeuleu	0.015
156	Aceh	Simeuleu	0.015
157	Aceh	Singkil	0.015
158	North Sumatera	Tapanuli Utara	0.015
159	North Sumatera	Tapanuli Selatan	0.02

160	North Sumatera	Tapanuli Tengah	0.015
161	North Sumatera	Mandailing Natal	0.02
162	North Sumatera	Nias Selatan	0.015
163	North Sumatera	Nias Utara	0.02
164	West Sumatera	Pasaman	0.015
165	West Sumatera	Sijunjung	0.015
166	Riau	Kep. Meranti	0.02
167	Riau	Indragiri Hilir	0.015
168	Jambi	Tanjung Jabung Barat	0.02
169	Jambi	Tebo	0.015
170	Jambi	Muaro Jambi	0.015
171	Jambi	Batang Hari	0.015
172	South Sumatera	Banyuasin	0.015
173	South Sumatera	Banyuasin	0.015
174	South Sumatera	Banyuasin	0.015
175	Bangka Belitung	Belitung Timur	0.015
176	Bangka Belitung	Bangka Selatan	0.015
177	Bangka Belitung	Bangka Barat	0.015
178	Lampung	Pesawaran	0.025
179	Lampung	Mesuji	0.015
180	Lampung	Mesuji	0.015
181	Lampung	Mesuji	0.015
182	Lampung	Mesuji	0.015
183	Lampung	Tangamus	0.02
184	Lampung	Tangamus	0.02
185	Lampung	Lampung Utara	0.02
186	Kep. Riau	Bintan	0.02
187	Kep. Riau	Bintan	0.015
188	Kep. Riau	Natuna	0.015
189	Kep. Riau	Lingga	0.015
190	Banten	Serang	0.025
191	West Java	Bogor	0.015
192	Central Java	Jepara	0.025
193	Central Java	Tegal	0.02
194	East Java	Ponorogo	0.015
195	East Java	Bangkalan	0.02
196	East Java	Sumenep	0.02
197	Bali	Karangasem	0.015
198	Bali	Karangasem	0.015
199	NTB	Lombok Utara	0.02

200	NTB	Lombok Tengah	0.015
201	NTB	Lombok Barat	0.015
202	NTB	Bima	0.015
203	NTT	Kupang	0.015
204	NTT	Rote Ndao	0.015
205	NTT	Sabu Raijua	0.015
206	West Kalimantan	Landak	0.015
207	West Kalimantan	Ketapang	0.015
208	West Kalimantan	Kapuas Hulu	0.015
209	Central Kalimantan	Kotawaringin Timur	0.025
210	Central Kalimantan	Katingan	0.015
211	South Kalimantan	Hulu Sungai Tengah	0.015
212	South Kalimantan	Tapin	0.025
213	South Kalimantan	Tabalong	0.015
214	South Kalimantan	Tabalong	0.015
215	South Kalimantan	Hulu Sungai Selatan	0.015
216	South Kalimantan	Kotabaru	0.015
217	South Kalimantan	Kotabaru	0.015
218	East Kalimantan	Paser	0.015
219	East Kalimantan	Kutai Barat	0.015
220	East Kalimantan	Kutai Barat	0.015
221	East Kalimantan	Malinau	0.015
222	East Kalimantan	Nunukan	0.015
223	North Sulawesi	Kep. Siau Tagulandang Biaro	0.015
224	North Sulawesi	Kep. Siau Tagulandang Biaro	0.015
225	North Sulawesi	Kep. Sangihe	0.015
226	North Sulawesi	Kep. Sangihe	0.015
227	South Sulawesi	Pangkep	0.015
228	South Sulawesi	-	0.015
229	South Sulawesi	Luwu Timur	0.015
230	South Sulawesi	Pinrang	0.025
231	South Sulawesi	Kep. Selayar	0.015
232	South Sulawesi	Takalar	0.015
233	Southeast Sulawesi	Buton Utara	0.015
234	Southeast Sulawesi	Konawe Utara	0.02
235	Southeast Sulawesi	Wakatobi	0.02
236	Maluku Utara	Halmahera Selatan	0.015
237	Gorontalo	Bone Bolango	0.015
238	Gorontalo	Pohuwato	0.015
239	Gorontalo	Gorontalo Utara	0.015

240	Gorontalo	Gorontalo Utara	0.025
241	West Sulawesi	Polewali Mandar	0.015
242	West Sulawesi	Mamuju	0.015
243	West Sulawesi	Mamuju	0.015
244	West Sulawesi	Mamuju Utara	0.02
245	West Papua	Raja Ampat	0.015
246	West Papua	Tambraw	0.025
247	West Papua	Tambraw	0.015
248	West Papua	Tambraw	0.015
249	West Papua	Tambraw	0.015
250	West Papua	Tambraw	0.025
251	Bangka Belitung	Bangka	1
252	South Sulawesi	Pangkajene Kepulauan	1
253	North Sumatera	Kuantan Singingi	0.1
254	Riau	Nias	0.05
255	Lampung	Lampung Barat	0.075
256	South Sumatera	Banyuasin	0.15
257	East Java	Sumenep	0.05
258	East Kalimantan	Kutai Barat	0.1
259	NTT	Timor Tengah Selatan	0.03
260	NTT	Sumba Tengah	0.05
261	NTB	Sumbawa	0.03
262	West Papua	Kaimana	0.075
263	Papua	Mappi	0.05
264	Papua	Kep. Yapen	0.15
265	Papua	Tolikara	0.05
266	Papua	Tolikara	0.05
267	Papua	Tolikara	0.05
268	Papua	Tolikara	0.05
269	Papua	Mamberamo Raya	0.15
270	Papua	Mamberamo Raya	0.05
271	Papua	Mamberamo Raya	0.075
272	Papua	Mamberamo Raya	0.15
273	Papua	Mamberamo Raya	0.1
274	North Sumatera	Nias	0.005
275	South Sumatera	Musi Rawas	0.04
276	South Sumatera	Ogan Komering Ulu Selatan	0.135
277	East Java	Bangkalan	0.015
278	East Java	Bangkalan	0.0075
279	East Java	Bondowoso	0.03

280	East Java	Sumenep	0.026
281	Central Kalimantan	Gunung Mas	0.018
282	North Sulawesi	Bolaang Mongondow Utara	0.015
283	Gorontalo	Boalemo	0.015
284	Gorontalo	Pohuwato	0.015
285	Gorontalo	Pohuwato	0.007
286	Gorontalo	Gorontalo Utara	0.03
287	South Sulawesi	Sinjai	0.015
288	Southeast Sulawesi	Konawe Selatan	0.015
289	Bali	Bangli	0.0075
290	NTB	Sumbawa	0.015
291	NTB	Sumbawa Barat	0.015
292	NTT	Belu	0.01
293	NTT	Sumba Timur	0.015
294	NTT	Sumba Tengah	0.005
295	Maluku Utara	Pulau Morotai	0.015
296	Papua	Jayawijaya	0.015
297	Papua	Pegunungan Bintang	0.015
298	West Papua	Tambrauw	0.015
299	North Sumatera	Tapanuli Selatan	0.015
300	North Sumatera	Tapanuli Tengah	0.015
301	North Sumatera	Karo	0.02
302	North Sumatera	Tapanuli Selatan	0.02
303	Riau	Rokan Hulu	0.015
304	Riau	Bengkalis	0.02
305	Riau	Siak	0.05
306	Riau	Pelalawan	0.075
307	Jambi	Tanjung Jabung Barat	0.02
308	South Sumatera	Banyuasin	0.015
309	South Sumatera	Ogan Ilir	0.03
310	Lampung	Mesuji	0.015
311	Lampung	Tangamus	0.03
312	Lampung	Pesawaran	0.03
313	Lampung	Tanggamus	0.05
314	Lampung	Tanggamus	0.03
315	Lampung	Tanggamus	0.03
316	Kep. Riau	Natuna	0.03
317	Kep. Riau	Natuna	0.02
318	Kep. Riau	Bintan	0.015
319	Bangka Belitung	Belitung	0.015

320	Bangka Belitung	Bangka Tengah	0.015
321	Central Java	Tegal	0.015
322	Central Java	Jepara	0.075
323	East Java	Pamekasan	0.015
324	East Java	Pamekasan	0.015
325	Bali	Karangasem	0.02
326	NTB	Lombok Timur	0.03
327	NTB	Lombok Utara	0.03
328	NTB	Sumbawa	0.015
329	NTB	Bima	0.05
330	West Kalimantan	Landak	0.02
331	South Kalimantan	Kotabaru	0.02
332	South Kalimantan	Hulu Sungai Tengah	0.015
333	North Kalimantan	Nunukan	0.03
334	East Kalimantan	Kutai Kertanegara	0.03
335	East Kalimantan	Penajam Paser Utara	0.015
336	East Kalimantan	Penajam Paser Utara	0.015
337	East Kalimantan	Penajam Paser Utara	0.015
338	East Kalimantan	Penajam Paser Utara	0.015
339	South Sulawesi	Luwu Utara	0.03
340	South Sulawesi	Luwu Timur	0.015
341	South Sulawesi	Pangkajene Kepulauan	0.02
342	Southeast Sulawesi	Muna	0.015
343	Southeast Sulawesi	Konawe Selatan	0.015
344	Gorontalo	Gorontalo Utara	0.02
345	West Sulawesi	Polewali Mandar	0.015
346	Maluku Utara	Halmahera Timur	0.015
347	Maluku Utara	Halmahera Timur	0.015
348	West Papua	Sorong	0.015
349	West Kalimantan	Bengkayang	0.03
350	West Kalimantan	Sintang	0.02
351	West Kalimantan	Sintang	0.015
352	West Kalimantan	Kapuas Hulu	0.015
353	West Kalimantan	Kapuas Hulu	0.015
354	West Kalimantan	Kapuas Hulu	0.015
355	North Kalimantan	Nunukan	0.03
356	North Kalimantan	Nunukan	0.05
357	North Kalimantan	Nunukan	0.05
358	East Kalimantan	Mahakam Ulu	0.05
359	East Kalimantan	Mahakam Ulu	0.05

360	NTT	Kupang	0.02
361	North Sumatera	Nias Selatan	0.05
362	Kep. Riau	Natuna	0.05
363	Bengkulu	Bengkulu Utara	0.05
364	East Kalimantan	Berau	0.05
365	East Kalimantan	Nunukan	0.05
366	NTT	Alor	0.03
367	Central Sulawesi	Toli-toli	0.03
368	North Sulawesi	Minahasa Utara	0.05
369	North Sulawesi	Kep. Sangihe	0.05
370	North Sulawesi	Kep. Talaud	0.03
371	North Sulawesi	Kep. Sangihe	0.03
372	North Sulawesi	Kep. Talaud	0.05
373	Maluku	Maluku Tenggara Barat	0.1
374	Maluku	Kep. Aru	0.03
375	Maluku	Maluku Barat Daya	0.03
376	Maluku	Maluku Barat Daya	0.03
377	Maluku	Maluku Barat Daya	0.05
378	Maluku	Maluku Barat Daya	0.05
379	Maluku	Maluku Barat Daya	0.03
380	Maluku	Maluku Barat Daya	0.05
381	Maluku	Maluku Tenggara Barat	0.05
382	Papua	Sarmi	0.03
383	Papua	Supiori	0.03
384	Papua	Supiori	0.05
385	Papua	Merauke	0.05
386	Aceh	Simeuleu	0.015
387	North Sumatera	Nias	0.005
388	North Sumatera	Nias	0.008
389	North Sumatera	Nias Selatan	0.02
390	North Sumatera	Nias Barat	0.005
391	North Sumatera	Nias Barat	0.005
392	South Sumatera	Ogan Komering Ulu Selatan	0.005
393	South Sumatera	Ogan Komering Ulu Selatan	0.005
394	South Sumatera	Ogan Komering Ulu Selatan	0.004
395	Yogyakarta	Gunung Kidul	0.015
396	East Java	Bangkalan	0.01
397	East Java	Bondowoso	0.005
398	Central Kalimantan	Katingan	0.02
399	Central Kalimantan	Seruyan	0.005

400	Central Kalimantan	Seruyan	0.01
401	South Sulawesi	Sinjai	0.015
402	Southeast Sulawesi	Kolaka	0.015
403	Southeast Sulawesi	Konawe Selatan	0.015
404	Southeast Sulawesi	Buton Utara	0.008
405	NTB	Dompu	0.015
406	NTB	Sumbawa Barat	0.015
407	NTB	Lombok Utara	0.01
408	NTT	Belu	0.01
409	NTT	Sumba Tengah	0.005
410	Maluku	Maluku Barat Daya	0.023
411	Maluku Utara	Morotai	0.015

MW = megawatt, NTB = West Nusa Tenggara (Indonesian: Nusa Tenggara Barat – NTB), NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur – NTT).

Source: Statistics of New Renewable Energy and Energy Conservation, 2015

Bioenergy

- Bioenergy resources

Indonesia is endowed with various types of bioenergy that can be developed. The potential of biomass or biofuel is equivalent to 32,653 MW (Table 3.10). Indonesia uses around 1,671 MW of bioenergy, or about 5.1% of its potential reserves.

Table 3.10. Bioenergy Sources in Indonesia

No.	Province	Potential (MW)		
		Biomass/Biofuel	Biogas	Total
1	Riau	4,157.4	37.7	4,195.1
2	East Java	2,851.3	569.6	3,420.9
3	North Sumatera	2,796.1	115.5	2,911.6
4	West Java	1,979.8	574.3	2,554.1
5	Central Java	1,884.1	348.4	2,232.5
6	South Sumatera	2,061.4	71.2	2,132.6
7	Jambi	1,821.0	18.9	1,839.9
8	Central Kalimantan	1,486.7	12.2	1,498.9
9	Lampung	1,407.6	84.5	1,492.1
10	West Kalimantan	1,279.3	28.9	1,308.2
11	South Kalimantan	1,266.3	23.6	1,289.9
12	Aceh	1,136.6	37.7	1,174.3
13	East/North Kalimantan	946.6	17.7	964.3

14	South Sulawesi	890.3	69.1	959.4
15	West Sumatera	923.1	34.7	957.8
16	Bengkulu	633.0	11.8	644.8
17	Banten	346.5	118.6	465.1
18	NTB	341.3	52.8	394.1
19	Central Sulawesi	307.4	19.5	326.9
20	NTT	192.5	48.0	240.5
21	DI Yogyakarta	183.1	41.1	224.2
22	Bangka Belitung	217.7	5.4	223.1
23	West Sulawesi	197.8	8.1	205.9
24	Bali	146.9	44.7	191.6
25	North Sulawesi	150.2	13.8	164.0
26	Southeast Sulawesi	132.8	17.7	150.5
27	Gorontalo	119.1	11.5	130.6
28	DKI Jakarta	0.5	126.1	126.6
29	Papua	81.4	15.1	96.5
30	West Papua	50.8	4.1	54.9
31	West Maluku	27.5	7.0	34.5
32	Maluku	23.6	9.0	32.6
33	Riau Islands	11.6	4.3	15.9
Total		30,051.3	2,602.6	32,653.9

* Administratively, DKI Jakarta is divided into four city administrations (City Administration of South Jakarta, East Jakarta, Central Jakarta, West Jakarta, and North Jakarta), and one administrative regency (Thousand Islands or Kepulauan Seribu). MW = megawatt, NTB = West Nusa Tenggara (Indonesian: Nusa Tenggara Barat – NTB), NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur – NTT).

Source: MEMR (2017).

- Current/existing capacity

Table 3.11 shows some of the existing bioenergy power plant – biomass, biogas, and municipal solid waste – with a capacity of less than 100 MW per unit.

Coal

- Coal resources

The total national coal produced in 2015 was 461.6 million tons, of which 79.3% or 365.8 million tons were exported and only 20.7% or 95.8 million tons used domestically, particularly for power plants, making Indonesia the largest coal exporter. Coal sources potential in 2015 was 120.5 billion tons, coal reserves was 32.4 billion tons, and production was 393 million tons.

Table 3.11. Bioenergy Power Plants with Installed Capacity of Less than 100 MW per Unit

No.	Province	Type	Installed capacity (MW)	On/Off grid
1	Riau	Palm waste	5	On grid
2	North Sumatera	Palm waste	9	On grid
3	Bangka	Palm waste	5	On grid
4	Riau	Palm waste	2	On grid
5	Belitung	Palm waste	7	On grid
6	Riau	Palm waste	2	On grid
7	Riau	Palm waste	5	On grid
8	North Sumatera	Palm waste	10	On grid
9	North Sumatera	Palm waste	10	On grid
10	Bekasi	MSW	6	On grid
11	Bali	MSW	2	On grid
12	North Sumatera	Palm waste	10	On grid
13	Bekasi	MSW	4.5	On grid
14	Bekasi	MSW	2	On grid
15	Belitung	POME	1.2	On grid
16	Gorontalo	Tongkol Jagung	0.4	On grid
17	Jambi	Palm waste	10	On grid
18	Sumatera	POME	9	Off grid
19	Sumatera	Sugar cane	66	Off grid
20	Kalimantan	Palm waste	91	Off grid
21	Jawa-Bali	Palm waste	2	Off grid
22	Jawa-Bali	MSW	0	Off grid
23	Sulawesi	Palm waste	11	Off grid
24	Sulawesi	Sugar cane	11	Off grid
25	Papua	Palm waste	4	Off grid

MSW = municipal solid waste, MW = megawatt, POME = palm oil mill effluent.
Source: MEMR (2015).

- Current/existing capacity

Table 3.12 shows coal power plants with installed capacity less than 100 MW.

Other fuels

Table 3.13 shows power plants with installed capacity less than 100 MW that use other fuels.

Table 3.12. Coal Power Plants with Installed Capacity of Less than 100 MW per Unit

No.	Province	Region System	Installed capacity (MW)
1	North Sulawesi	Amurang 1	25
2	North Sulawesi	Amurang 2	25
3	Southeast Sulawesi	Kendari 2	10
4	Riau	Tj Balai Karimun 2	7
5	South Sulawesi	Barru 2	50
6	South Kalimantan	Asam-asam 3	65
7	South Kalimantan	Asam-asam 4	65
8	Bangka Belitung	Bangka 2	30
9	Riau	Tj Balai Karimun 1	7
10	South Sulawesi	Barru 1	50
11	Southeast Sulawesi	Kendari 1	10
12	NTT	Kupang 1	16.5
13	NTT	Kupang 2	16.5
14	Bangka Belitung	Belitung 1	16.5
15	NTT	Ende 1	7
16	Bangka Belitung	Bangka 1	30
17	NTB	Lombok 1	25
18	Central Kalimantan	Pulang Pisau 1	60
19	Bangka Belitung	Belitung 2	16.5
20	NTT	Ende 2	7
21	Kep. Riau	Bukit Carok	14
22	Kep. Riau	Air Raja (Sewa)	30
23	Bangka Belitung	PLTU Suge	16.5
24	Bangka Belitung	PLTU 3 Babel	60
25	South Kalimantan	Sistem Barito (Swasta Excess)	86
26	Central Kalimantan	Sistem Barito (Swasta Excess)	3
27	Central Kalimantan	Sistem Pangkalan Bun (Swasta IPP)	11
28	East Kalimantan	Sistem Berau	27.6
29	North Sulawesi	Sistem Minahasa-Kotamobagu	50
30	Central Sulawesi	Sistem Palu-Parigi	27
31	Gorontalo	Gorontalo	21
32	South Sulawesi	Barru 1	50
33	South Sulawesi	Barru 2	50

IPP = independent power producer, MW = megawatt, PLTU = Indonesia Power.
Source: Ministry of Energy and Mineral Resources (2016).

Table 3.13. Power Plants that Use Other Fuels with Installed Capacity of Less than 100 MW

No.	Fuels	Type of Power Plant	Province	Region Power System	Installed capacity (MW)
1	HSD	PLTD	Aceh	PLTD Tersebar (Sewa)	7
2	HSD	PLTG	Aceh	Mobil Unit	22.11
3	HSD	PLTD	Aceh	Pusat Listrik Lueng Bata	58.17
4	HSD	PLTD	North Sumatera	Titi Kuning	24.85
5	HSD	PLTG	North Sumatera	Glugur	31.71
6	HSD	PLTG	North Sumatera	Paya Pasir	75.55
7	HSD	PLTD	North Sumatera	PT Bima Golden Powerindo (Sewa)	40
8	HSD	PLTD	North Sumatera	PT Prastiwahyu Trimitra Engineering Tamora (Sewa)	45
9	HSD	PLTD	North Sumatera	PT Kurnia Purnama Tama (Sewa)	75
10	HSD	PLTD	North Sumatera	PLTD Tersebar Sumut	1.06
11		PLTD	North Sumatera	PLTD Gunung Sitoli (p.Nias)	33.64
12		PLTD	North Sumatera	PLTD Teluk Dalam (p.Nias)	8.605
13		PLTD	North Sumatera	PLTD Pulau Tello (p. Nias)	0.3
14	HSD	PLTD	West Sumatera	Tersebar Sumbar	1.6
15	HSD	PLTD	West Sumatera	Tersebar Sumbar (Sewa)	1.3
16	HSD	PLTD	Riau	PLTD PT BGP GI BINA (Sewa)	30
17	HSD	PLTD	Riau	PLTD Tersebar WRKR (Sewa)	78
18	HSD	PLTD	Riau	PLTD Tembilahan	23
19	HSD	PLTB	Riau	PLTD Tanjung Batu (Sewa)	5
20	HSD	PLTD	Riau	PLTD Tembilahan (Sewa)	23
21	HSD	PLTD	Kep. Riau	PLTD Tersebar WRKR	87.5
22	HSD	PLTD	Kep. Riau	Kota Lama	23.9
23	HSD	PLTD	Kep. Riau	Air Raja	56.2
24	HSD	PLTD	Kep. Riau	Sukaberenang	42.3
25	HSD	PLTD	Kep. Riau	Bukit Carok	22.2
26	HSD	PLTD	Kep. Riau	Bukit Carok (Sewa)	22.2
27	HSD	PLTGB	Kep. Riau	Air Raja (Sewa)	30
28	HSD	PLTD	Kep. Riau	Sukaberenang (Sewa)	42.3
29	HSD	PLTD	Kep. Riau	Air Raja (Sewa)	56.2
30	HSD	PLTD	Kep. Riau	Kota Lama (Sewa)	23.9
31	HSD	PLTD	Kep. Bangka Belitung	PLTD Tersebar Babel	9.19
32	HSD	PLTD	Kep. Bangka Belitung	PLTD Tersebar Babel (Sewa)	27
33	HSD	PLTD	Kep. Bangka Belitung	PLTD Pilang	27.44

34	HSD	PLTD	Kep. Bangka Belitung	PLTD Merawang	42.3
35	HSD	PLTD	Kep. Bangka Belitung	PLTD Merawang (Sewa)	42.3
36	HSD	PLTD	Kep. Bangka Belitung	PLTD Pilang (Sewa)	27.4
37	HSD	PLTD	Kep. Bangka Belitung	PLTD Air Anyir Sewatama (Sewa)	52
38	HSD	PLTD	West Sumatera	Sikabalu Kep Mentawai	0.1
39	HSD	PLTD	West Sumatera	Sikakap Kep Mentawai	0.4
40	HSD	PLTD	West Sumatera	Sipora Kep Mentawai	0.1
41	HSD	PLTD	West Sumatera	Seay Baru Kep Mentawai	0.1
42	HSD	PLTD	West Sumatera	Saumangayak Kep Mentawai	0.2
43	HSD	PLTD	West Sumatera	Simalakopa Kep Mentawai	0
44	HSD	PLTD	West Sumatera	Simalepet Kep Mentawai	0.2
45	HSD	PLTD	West Sumatera	Tua Pejat Kep Mentawai	1.6
46	HSD	PLTD	West Sumatera	Lakuak Pesisir Selatan	1.9
47	HSD	PLTD	West Sumatera	Balai Selasa Pesisir Selatan	0.6
48	HSD	PLTD	West Sumatera	Indra Pura Pesisir Selatan	1.3
49	HSD	PLTD	West Sumatera	Tapan Pesisir Selatan	0.9
50	HSD	PLTD	West Sumatera	Lunang Pesisir Selatan	2.2
51	HSD	PLTD	Bengkulu	PLTD Tersebar S2JB	20.6
52	HSD	PLTD	Bengkulu	PLTD Tersebar S2JB (Sewa)	9.3
53	HSD	PLTD	Lampung	PLTD Tersebar Lampung	0
54	HSD	PLTD	Lampung	PLTD Tersebar Lampung (Sewa)	0
55	HSD	PLTD	Lampung	Tarahan	23.2
56	HSD	PLTG	Lampung	Tarahan (G)	16.2
57	HSD	PLTD	Lampung	Tarahan (Sewa)	23.2
58	HSD	PLTD	Lampung	PLTD Tersebar Lampung	1.2
59	HSD	PLTD	Lampung	PLTD Tersebar Lampung (Sewa)	0
60	HSD	PLTG	DKI Jakarta	Priok	52
61	BBM	PLTD	Jambi	Pelabuhan Dagang	6.4
62	BBM	PLTD	Jambi	Sungai Lokan	1.2
63	BBM	PLTD	Jambi	Mendahara Tengah	0.4
64	BBM	PLTD	Jambi	Kuala Tungkal	3.5
65	BBM	PLTD	Jambi	Batang Asai	0.8
66	BBM	PLTD	Jambi	Sarolangun	3
67	BBM	PLTG	Central Java	Cilacap	55
68	BBM	PLTG	East Java	Gilitimur	40

69	BBM	PLTG	Bali	Pemaron	98
70	BBM	PLTD	Bali	Pesanggaran	0
71	BBM	PLTD	Bali	Pesanggaran BOO	10
72	BBM	PLTD	Bali	Pesanggaran BOT	51
73	BBM/Hydro	PLTD/M	West Kalimantan	Bengkayang	4
74	BBM	PLTD	West Kalimantan	Ngabang	9
75	BBM/Hydro	PLTD	West Kalimantan	Sanggau	24
76	BBM	PLTD	West Kalimantan	Sekadau	12
77	BBM	PLTD	West Kalimantan	Sintang	22
78	BBM	PLTD	West Kalimantan	Putussibau	7
79	BBM	PLTD	West Kalimantan	Nangapinoh	8
80	BBM	PLTD	West Kalimantan	Ketapang	31
81	BBM	PLTD	West Kalimantan	Sistem Isolated	70
82	BBM	PLTG	South Kalimantan	Sistem Barito	21
83	BBM	PLTD	South Kalimantan	Sistem Barito	87.11
84	BBM	PLTD	South Kalimantan	Sistem Barito (Sewa)	74.5
85	BBM	PLTD	South Kalimantan	Sistem Kotabaru	5.4
86	BBM	PLTD	South Kalimantan	Sistem Kotabaru (Sewa)	10
87	BBM	PLTD	South Kalimantan	Sistem ULD Isolated Tersebar	14.4
88	BBM	PLTD	Central Kalimantan	Sistem Barito	32.4
89	BBM	PLTD	Central Kalimantan	Sistem Barito (Sewa)	41.5
90	BBM	PLTD	Central Kalimantan	Sistem Pangkalan Bun	12.82
91	BBM	PLTD	Central Kalimantan	Sistem Pangkalan Bun (Swasta Sewa)	13.4
92	BBM	PLTD	Central Kalimantan	Sistem Buntok	5.58
93	BBM	PLTD	Central Kalimantan	Sistem Buntok (Sewa)	7
94	BBM	PLTD	Central Kalimantan	Sistem Muara Taweh	3.53
95	BBM	PLTD	Central Kalimantan	Sistem Muara Taweh (Sewa)	7.5
96	BBM	PLTD	Central Kalimantan	Sistem Kuala Pambuang	1.8
97	BBM	PLTD	Central Kalimantan	Sistem Kuala Pambuang (Sewa)	4
98	BBM	PLTD	Central Kalimantan	Sistem Nanga Bulik	2.5
99	BBM	PLTD	Central Kalimantan	Sistem Nanga Bulik (Sewa)	2
100	BBM	PLTD	Central Kalimantan	Sistem Kuala Kurun	2.07
101	BBM	PLTD	Central Kalimantan	Sistem Kuala Kurun (Sewa)	3
102	BBM	PLTD	Central Kalimantan	Sistem Puruk Cahu	1.5
103	BBM	PLTD	Central Kalimantan	Sistem Puruk Cahu (Sewa)	4
104	BBM	PLTD	Central Kalimantan	Sistem Sukamara	1
105	BBM	PLTD	Central Kalimantan	Sistem Sukamara (Sewa)	2

106	BBM	PLTD	Central Kalimantan	Sistem ULD Isolated Tersebar	19.7
107	BBM/Gas	PLTD/MG	East Kalimantan	Sistem Petung	21.2
108	BBM	PLTD	East Kalimantan	Sistem Tanah Grogot	17.2
109	BBM	PLTD	East Kalimantan	Sistem Melak	24.7
110	BBM	PLTD	East Kalimantan	Sistem Sangatta	19.7
111	BBM	PLTD	North Kalimantan	Sistem Bulungan	18.9
112	BBM/Gas	PLTD/MG	North Kalimantan	Sistem Nunukan	24.7
113	BBM	PLTD	North Kalimantan	Sistem Malinau	13.1
114	BBM	PLTD	North Kalimantan	Sistem Tidung Pale	3.4
115	BBM/Gas	PLTD/MG	North Kalimantan	Sistem Bunyu	4
116	BBM/Solar	PLTD/S	North Kalimantan	Sistem Sebatik	5.3
117	BBM	PLTD	North Sulawesi	Tahuna	11.4
118	BBM	PLTD	North Sulawesi	Talau	6.3
119	BBM	PLTD	North Sulawesi	Siau/Ondong	4.9
120	BBM	PLTD	North Sulawesi	Lirung	3.9
121	BBM	PLTD	North Sulawesi	Tagulandang	3.7
122	BBM	PLTD	North Sulawesi	Molibagu	5.2
123	BBM	PLTD	North Sulawesi	Tahuna (isolated tersebar)	3.4
124	BBM	PLTD	North Sulawesi	Manado (isolated tersebar)	4
125	BBM	PLTD	Central Sulawesi	Sistem Palu-Parigi	91
126	BBM	PLTD	Central Sulawesi	Sistem Poso-Tentena	6
127	BBM	PLTD	Central Sulawesi	Luwuk-Tolli	25.2
128	BBM	PLTD	Central Sulawesi	Ampana-Bunta	9.8
129	BBM	PLTD	Central Sulawesi	Toli-toli	14.5
130	BBM	PLTD	Central Sulawesi	Moutong-Kotaraya	12.3
131	BBM	PLTD	Central Sulawesi	Kolonedale	5.9
132	BBM	PLTD	Central Sulawesi	Bungku	7.5
133	BBM	PLTD	Central Sulawesi	Banggai	4.8
134	BBM	PLTD	Central Sulawesi	Leok	11.2
135	BBM	PLTD	Central Sulawesi	Bangkir	4.2
136	BBM	PLTD	Central Sulawesi	Palu (isolated tersebar)	5
137	BBM	PLTD	Central Sulawesi	Luwuk (isolated tersebar)	15.4
138	BBM	PLTD	Central Sulawesi	Toli-toli (isolated tersebar)	3.3
139	BBM	PLTD	Gorontalo	Gorontalo	59.6
140	BBM	PLTG	South Sulawesi	Westcan	14.4
141	BBM	PLTG	South Sulawesi	Altshom 1	21.3

142	BBM	PLTG	South Sulawesi	Altshom 2	20.1
143	BBM	PLTG	South Sulawesi	GE 1	33.4
144	BBM	PLTG	South Sulawesi	GE 2	33.4
145	BBM	PLTD	South Sulawesi	Mitsubishi 1	12.6
146	BBM	PLTD	South Sulawesi	Mitsubishi 2	12.6
147	BBM	PLTD	South Sulawesi	SWD 1	12.4
148	BBM	PLTD	South Sulawesi	SWD 2	12.4
149	BBM	PLTD	South Sulawesi	Suppa	62.2
150	BBM	PLTD	South Sulawesi	Tallasa (Sewa)	80
151	BBM	PLTD	South Sulawesi	Tallo Lama (Sewa)	20
152	BBM	PLTD	South Sulawesi	Sewatama Masamba (Sewa)	5
153	BBM	PLTD	South Sulawesi	Selayar	8.8
154	BBM	PLTD	Southeast Sulawesi	Lambuya	16.5
155	BBM/Hydro	PLTD/M	Southeast Sulawesi	Kolaka	25.1
156	BBM	PLTD	Southeast Sulawesi	Raha	11.8
157	BBM/Hydro	PLTD/M	Southeast Sulawesi	Bau-Bau	47.4
158	BBM	PLTD	Southeast Sulawesi	Wangi-Wangi	5.9
159	BBM/Hydro	PLTD/M	Southeast Sulawesi	Lasusua	10.1
160	BBM	PLTD	Southeast Sulawesi	Bombana	7.6
161	BBM	PLTD	Southeast Sulawesi	Ereke	3.4
162	BBM	PLTD	West Sulawesi	Pasang Kayu	8.41
163	BBM	PLTD	Maluku	Hative Kecil	21.5
164	BBM	PLTD	Maluku	Hative Kecil (Sewa)	20
165	BBM	PLTD	Maluku	Poka	20.8
166	BBM	PLTD	Maluku	Poka (Sewa)	26
167	BBM	PLTD	Maluku	Masohi	4.7
168	BBM	PLTD	Maluku	Masohi (Sewa)	6
169	BBM	PLTD	Maluku	Waipia	0.4
170	BBM	PLTD	Maluku	Liang	0
171	BBM	PLTD	Maluku	Liang (Sewa)	1
172	BBM	PLTD	Maluku	Kairatu	1.3
173	BBM	PLTD	Maluku	Kairatu (Sewa)	4
174	BBM	PLTD	Maluku	Piru	1.5
175	BBM	PLTD	Maluku	Piru (Sewa)	2
176	BBM	PLTD	Maluku	Namlea	4.6
177	BBM	PLTD	Maluku	Namlea (Sewa)	5
178	BBM	PLTD	Maluku	Mako	1.3
179	BBM	PLTD	Maluku	Mako (Sewa)	2

180	BBM	PLTD	Maluku	Saparua	3.2
181	BBM	PLTD	Maluku	Langgur	9.8
182	BBM	PLTD	Maluku	Sistem Tual (Sewa)	4
183	BBM	PLTD	Maluku	Saumlaki	7
184	BBM	PLTD	Maluku	Sistem Saumlaki (Sewa)	1.5
185	BBM	PLTD	Maluku	Dobo	2.5
186	BBM	PLTD	Maluku	Sistem Dobo (Sewa)	1.5
187	BBM	PLTD	Maluku Utara	Kayu Merah	11.6
188	BBM	PLTD	Maluku Utara	Kayu Merah (Sewa)	14
189	BBM	PLTD	Maluku Utara	Soa Siu	4.9
190	BBM	PLTD	Maluku Utara	Soa Siu (Sewa)	10
191	BBM	PLTD	Maluku Utara	Tobelo	6.8
192	BBM	PLTD	Maluku Utara	Tobelo (Sewa)	4
193	BBM	PLTD	Maluku Utara	Malifut	3.2
194	BBM	PLTD	Maluku Utara	Jailolo-Sidangoli	4.6
195	BBM	PLTD	Maluku Utara	Jailolo (Sewa)	3
196	BBM	PLTD	Maluku Utara	Sofifi	3
197	BBM	PLTD	Maluku Utara	Sofifi (Sewa)	3.2
198	BBM	PLTD	Maluku Utara	Payahe	0.4
199	BBM	PLTD	Maluku Utara	Bacan	3.2
200	BBM	PLTD	Maluku Utara	Sistem Bacan (Sewa)	3
201	BBM	PLTD	Maluku Utara	Sanana	2.4
202	BBM	PLTD	Maluku Utara	Sistem Sanana (Sewa)	4
203	BBM	PLTD	Maluku Utara	Daruba	7.3
204	BBM	PLTD	Papua	Genyem	14.7
205	BBM	PLTD/M	Papua	Wamena	7.3
206	BBM	PLTD	Papua	Timika	28.8
207	BBM	PLTD	Papua	Biak	21
208	BBM	PLTD	Papua	Serui	8.4
209	BBM	PLTD	Papua	Merauke	17.7
210	BBM	PLTD	Papua	Nabire	34.5
211	BBM/Solar	PLTD/S	Papua	Lisdes tersebar	13.9
212	BBM/Gas	PLTD/G	West Papua	Sorong	52.8
213	BBM/Hydro	PLTD/M	West Papua	Fak Fak	9.4
214	BBM	PLTD	West Papua	Teminabuan	3.2
215	BBM	PLTD	West Papua	Kaimana	8.7

216	BBM	PLTD	West Papua	Manokwari	31.5
217	BBM	PLTD	West Papua	Bintuni	12.2
218	BBM/Solar	PLTD/S	West Papua	Lisdes tersebar	11.9
219	BBM/Hydro	PLTD/M	NTB	Sumbawa	49.61
220	BBM	PLTD	NTB	Bima	50.72
221	BBM	PLTD	NTB	Sebotok	0.12
222	BBM	PLTD	NTB	Labuhan Haji	0.1
223	BBM	PLTD	NTB	Lebin	0.37
224	BBM	PLTD	NTB	Bugis Medang	0.21
225	BBM	PLTD	NTB	Klawis	0.13
226	BBM	PLTD	NTB	Lunyuk	1.88
227	BBM	PLTD	NTB	Lantung	0.47
228	BBM	PLTD	NTB	Bajo Pulau	0.22
229	BBM	PLTD	NTB	Nggelu	0.07
230	BBM	PLTD	NTB	Pekat	0.62
231	BBM	PLTD	NTT	Sistem Seba, Oesao	2.2
232	BBM	PLTD	NTT	Sistem Soe	7
233	BBM	PLTD	NTT	Sistem Kefamananu	7.1
234	BBM	PLTD	NTT	Sistem Atambua	14.1
235	BBM	PLTD	NTT	Sistem Betun	4.1
236	BBM	PLTD	NTT	Sistem Kalabahi	6.1
237	BBM	PLTD	NTT	Sistem Rote Ndao	4.9
238	BBM/Coal/ Hydro	PLTD/U/M	NTT	Sistem Ende	18.4
239	BBM	PLTD	NTT	Sistem Wolowaru	2.2
240	BBM	PLTD	NTT	Sistem Aesesa	3.2
241	BBM/Solar/ Hydro	PLTD/S/MH	NTT	Sistem Bajawa	12.7
242	BBM/Solar/ Hydro	PLTD/S/MH	NTT	Sistem Ruteng	20.7
243	BBM	PLTD	NTT	Sistem Labuhan Bajo	6.5
244	BBM	PLTD	NTT	Sistem Maumere	14.7
245	BBM	PLTD	NTT	Sistem Larantuka	6.7
246	BBM	PLTD	NTT	Sistem Adonara	5.1
247	BBM/Solar	PLTD/S	NTT	Sistem Lembata	5.5
248	BBM	PLTD	NTT	Sistem Waingapu	8.2
249	BBM/Solar/ Hydro	PLTD/S/MH	NTT	Sistem Waikabubak- Waitabula	10.4
250	BBM/Solar	PLTD/S	NTT	Gab isolated area Kupang	8.7

251	BBM	PLTD	NTT	Gab isolated area FBB	8.8
252	BBM/Solar	PLTD/S	NTT	Gab isolated area FBT	4.6
253	BBM/Hydro	PLTD/MH	NTT	Gab isolated area Sumba	0.8
254	MFO	PLTD	South Sumatera	PT Asta Kramasan Energi (Sewa)	65
255	IDO	PLTD	Jambi	PLTD Tersebar S2JB	0.9
256	IDO	PLTD	South Sumatera	Sungai Juaro	25

BBM = fuel and oil, HSD = high-speed diesel, MFO = marine fuel oil, NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur – NTT), PLTD = Pembangkit Listrik Tenaga Diesel, PLTG = Pembangkit Listrik Tenaga Gas. Source: MEMR (2016a).

Merits of DES

DES is a good option to fulfil electricity demand of regions consisting of many islands like Indonesia. It has several advantages such as cost competitiveness and its role in optimising local content.

Economy of DES by industrial zone, island, and/or off grid

DES projects, such as micro hydro or solar, when installed in remote areas, will ease the logistics issue of supplying fuel to remote locations. This can result in a more competitive cost of production when compared to diesel power plants. DES installed in a grid-connected system, such as geothermal and hydro, will help reduce distribution losses.

A case study of a micro-hydro power plant in a remote area in East Java shows that the net present value (NPV) of the total production of 101,478 MWh per year, with a 7% interest rate, is 4,2 billion rupiah with payback period of 8 years and return on investment (ROI) of 2.07%.

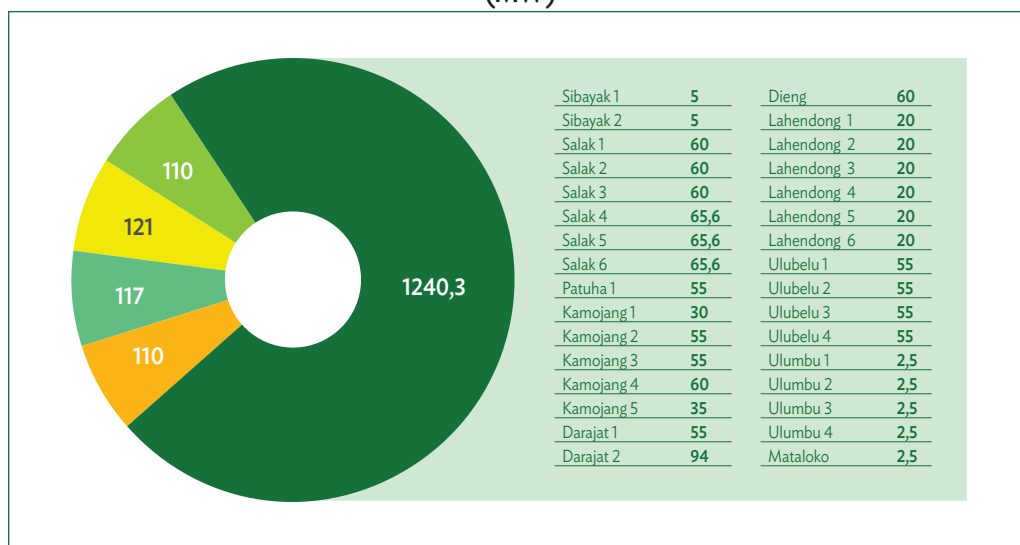
Another study on solar PV in Nias island in North Sumatera evaluated the saving that can be obtained using solar PV when compared to diesel power plants. The size of solar panel of 200Wp (200 watt peak), with total 9,800 panel (1.27 m² each), electricity production is 2.81 GWh/year. With the solar PV's lifetime of 25 years, interest rate of 7.5% per year, the cost of production is 2,475 rupiah/kWh. The study shows that savings from the use of diesel power plants would be about 759 kilolitre/year.

Energy security brought by DES

- Geothermal power plant

In 2016, the total capacity of geothermal power plants was 1,698.3 MW. This included that of DES geothermal power plants, which is about 1,240.3 MW (73.03% of overall capacity) (Figure 3.2).

Figure 3.2. Geothermal Power Plants (MW)



Source: Ministry of Energy and Mineral Resources, 2016

Reduction of CO₂ emissions through DES

The use of renewable energy will reduce the dependence on fossil fuels and, hence, reduce greenhouse gas (GHG) emission. Based on Indonesia Energy Outlook 2016, if the target on renewable energy and energy intensity could be achieved, reduced emission in 2030 would be 402 million tons of CO₂, thus meeting the government target. In the case of geothermal where the share of geothermal capacity less than 100 MW (categorised as DES) is dominant, the contribution from DES will also be substantial in reducing GHG emission.

The method of calculating CO₂ emission reduction is referred to as the Greenhouse Gas Equivalencies, which uses the emission factor of 7.03×10^{-4} metric tons CO₂/kWh (US EPA, 2016).

Cost-benefit analysis between on grid and off grid

The following section compares the cost of providing electricity to remote, mountainous, and island areas (using average national grid cost) and that of off grid (system cost).

Case Study: Sumba Island

Based on Ministerial Decree No 3051 K/30/MEM/2015 on Sumba Island, an iconic ‘Island of Renewables’, the Government of Indonesia, in collaboration with local governments, non-governmental organisations, Hivos in Indonesia, and international donors such as the Asian Development Bank and the Norwegian Embassy, established a programme aimed ‘to create access to alternative renewable energy which will enable gender-balanced economic well-being to all’. The programme’s report in Least-Cost Electrification Plan for the Iconic Island states on the levelised cost of electricity (LCOE) based on a base scenario of 10–20 MW storage hydro and pumped storage scenario of 10 MW Storage Hydro is shown in Table 3.14.

Table 3.14. LCOE Comparison on the Sumba Iconic Island

Base Scenario – 20 MW Storage Hydro	Base Scenario – 10 MW Storage Hydro	Pumped Storage Scenario – 10 MW Storage Hydro	Diesel Only
Solar power 10 MW Wind power 10 MW, Micro-hydro PP 4.5 MW, Hydro (storage) 20 MW, Biomass 10 MW, Diesel 49.3 MW	Solar power 10 MW, Wind power 10 MW, Micro-hydro PP 4.5 MW, Hydro (storage) 20 MW, Biomass 10 MW, Diesel 49.3 MW	Solar power 30 MW, Wind power 20 MW, Micro-hydro PP 4.5 MW, Hydro (storage) 10 MW, Pumped storage 18 MW, Biomass 10 MW, Diesel 49.3 MW	
LCOE: Total generating systems on busbars, including current generators but excluding network costs			
US\$0.357/kWh	US\$0.279/kWh	US\$0.276/kWh	US\$0.450/kWh

LCOE = levelised cost of electricity, kWh = kilowatt-hour, MW = megawatt, PP = power plant.
Source: The Government of Indonesia and ADB (2014).

Case study

Based on the characteristics of power plant locations, such as island, remote, and mountainous areas and economic zones, three provinces were selected for the case study: Sumatera Barat (West Sumatera), Jambi, and Kepulauan Riau (Riau Island). West Sumatera has some projects on solar PV, biogas, micro hydro, and geothermal with capacities in line with DES classification. The same is the case for Jambi and Riau islands. Table 3.15 details the current situation and required additional capacities to meet demand.

Table 3.15. Case Study of DES Power Plants in Some Provinces

Model case(s) of introduction of DES (off-grid energy system)		
(1) Site Name	West Sumatera Province	
Applications	Current/existing capacity	Required capacity to meet off-grid/mini grid future demand (2025)
	MW	MW
Solar PV		
Wind		
Biomass/biogas		10.0
Micro hydro	66.0	300.2
Geothermal		205.0
Diesel generator	2.9	
Thermal power (coal, slurry, fuel oil, others)		
CHP (incl. heat recovery facility)		
Other generators		
(2) Site Name	Jambi Province	
Applications	Current/existing capacity	Required capacity to meet off-grid/mini grid future demand (2025)
	MW	MW
Solar PV		
Wind		
Biomass/biogas		25.0
Micro hydro		20.7
Geothermal		110.0
Diesel generator		
Thermal power (coal, slurry, fuel oil, others)		
CHP (incl. heat recovery facility)		
Other generators (gas)	1,186.8	205.0
(3) Site Name	Kepulauan Riau (Special Economic Zone)	
Applications	Current/existing capacity	Required capacity to meet off-grid/mini grid future demand (2025)
	MW	MW
Solar PV		
Wind		

Biomass/biogas	4.8	1.0
Micro hydro		
Geothermal		
Diesel generator	406.7	
Thermal power (coal, slurry, fuel oil, others)	44.0	47.0
CHP (incl. heat recovery facility)		
Other generators (gas)		220.0

CHP = combined heat and power, MW = megawatt, PV = photovoltaic.
Source: MEMR (2016a).

Current policy

Indonesia issued Presidential Decree No. 22 of 2017 on National Energy General Plan (RUEN), which details the country's National Energy Policy. It presents the existing energy condition, target, and measures to achieve the targets: (i) energy consumption per capita to increase to 1.4 toe/capita in 2025 from its current level of 0.4 toe/capita; (ii) on energy mix, 23% renewable energy and reduced share of oil to less than 25% by 2025; and (iii) 2,500 kWh/capita of electricity consumption by 2025 from its current level of below 1,000 kWh/capita.

The government also issued several policies to accelerate the development of energy infrastructure, including lighting remote areas with small-scale renewable energy, which match the criteria of DES.

a. Ministerial Regulation No. 38 of 2016 on Acceleration of Electrification on Less Developed Villages, Remote and Boundary Areas and Small Island Through Small-Scale Electricity Supply

This regulation allows the private sector (non-PLN) to generate electricity and build transmission lines with less than 50 MW capacities using renewable energy. The governor proposes the business area to the minister and offers the area to non-PLN entities (local state-owned and private companies and cooperatives). The proposed area can be classified as either subsidy or non-subsidy based.

b. Ministerial Regulation No. 11 of 2017 on the Utilisation of Gas for Power Plant
This regulation allows the use of wellhead power plants to make the price more competitive. The use of wellhead gas for power plants can be a direct offer or general tender.

c. Ministerial Regulation No. 50 of 2017 on the Utilisation of Renewable Energy Sources for Electricity Supply

This regulation allows PT PLN (Persero) as buyer and the private sector as seller to negotiate the electricity price from renewable energy sources, the mechanism of buying electricity using direct elections, and the build-own-operate-transfer scheme.

Future Development of DES

Based on Government Regulation 79 of 2014 on National Energy Policy, by 2025, renewable energy shall be at least 23% (92.3 Mtoe), oil at most 25%, and gas at least 23% of national energy mix. According to the DES definition, DES is flexible for island, mountainous, and remote areas and economic zones. DES also supports the use of renewable energy resources (geothermal, solar PV, micro hydro, and biomass) to meet future energy demand.

Future installed capacity by type of energy sources

Geothermal

Table 3.16 shows the future development of geothermal.

Hydropower

In 2025, the target for large-scale hydropower is 17,986 MW while for mini/micro-hydro, around 3,000 MW. Tables 3.17 and 3.18 show the future development plan of hydropower and mini/micro hydro based on the National Energy General Plan.

Solar power

Table 3.19 shows the projection of solar power development.

Bioenergy

Table 3.20 shows the projection of bioenergy development until 2025.

Table 3.16. Existing Geothermal Power Plants in Indonesia

No.	Province	Annual Total Installed Capacity (MW)											
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
1	West Java	1,164.0	1,194.0	1,194.0	1,194.0	1,269.0	1,449.0	1,569.0	1,767.0	1,767.0	1,767.0	1,917.0	1,972.0
2	Lampung	110.0	165.0	220.0	220.0	220.0	220.0	220.0	275.0	275.0	495.0	605.0	825.0
3	North Sumatra	12.0	122.0	232.0	342.0	347.0	507.0	587.0	587.0	587.0	640.0	710.0	710.0
4	Central Java	60.0	60.0	70.0	70.0	80.0	140.0	200.0	420.0	420.0	640.0	710.0	710.0
5	East Java						55.0	165.0	165.0	165.0	220.0	440.0	520.0
6	Bengkulu				55.0	110.0	140.0	140.0	255.0	255.0	255.0	340.0	505.0
7	South Sumatra			55.0	110.0	110.0	201.0	201.0	256.0	256.0	371.0	371.0	505.0
8	West Sumatra				80.0	80.0	80.0	80.0	100.0	100.0	100.0	300.0	300.0
9	North Sulawesi	80.0	100.0	125.0	130.0	150.0	150.0	170.0	170.0	170.0	170.0	210.0	250.0
10	Aceh					10.0	10.0	10.0	65.0	65.0	65.0	120.0	230.0
11	Jambi					55.0	60.0	115.0	115.0	115.0	145.0	145.0	200.0
12	Banten								110.0	110.0	110.0	150.0	150.0
13	NTT	12.5	12.5	12.5	12.5	42.5	77.5	82.5	92.5	92.5	102.5	102.5	117.5
14	North Maluku								20.0	20.0	20.0	55.0	70.0
15	Central Sulawesi												60.0
16	NTB											20.0	40.0
17	Southeast Sulawesi												20.0
18	Gorontalo											20.0	20.0
19	Maluku					20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
20	Bali												10.0
21	Central Kalimantan												
Total Installed Capacity		1,438.5	1,653.5	1,908.5	2,133.5	2,493.5	3,109.5	3,559.5	4,417.5	4,417.5	5,067.5	6,242.5	7,241.5
Total Additional per year		215.0	255.0	225.0	360.0	616.0	450.0	858.0	650.0	1175.0	1175.0	999.0	

MW = megawatt, NTB = West Nusa Tenggara (Indonesian: Nusa Tenggara Barat - NTB), NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur - NTT).
Source: MEMR (2017).

Table 3.18. Projection of Mini/Micro Hydro Development (2015–2025)

No.	Province	Annual Total Installed Capacity (MW)										
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
1	North Sumatera	23.9	40.8	48.9	93.9	150.8	160.8	170.8	236.3	236.3	289.8	352.0
2	Central Kalimantan	0.5	0.5	0.5	28.9	28.9	59.5	93.3	122.3	164.8	199.5	243.9
3	West Java	18.3	23.3	48.3	91.3	113.8	132.1	167.6	178.1	195.3	219.7	237.4
4	East Kalimantan	0.7	0.8	0.8	13.4	13.4	32.7	71.5	97.8	144.9	173.9	173.9
5	NTT	4.1	5.2	5.6	23.6	25.2	46.7	66.4	85.7	111.0	134.9	163.5
6	West Sumatera	18.8	20.1	37.8	37.8	77.8	91.2	91.2	111.8	117.8	142.5	142.5
7	Aceh	1.1	1.1	1.1	9.3	11.5	21.8	44.6	81.7	88.5	107.7	132.4
8	Papua	3.5	3.7	8.4	13.6	27.4	28.5	46.5	61.4	84.0	101.5	124.5
9	South Sulawesi	39.1	39.4	48.6	68.9	97.3	107.3	107.3	109.0	109.0	122.3	122.3
10	Central Java	4.7	8.3	9.2	9.2	16.2	25.3	25.3	39.0	47.8	91.9	119.0
11	West Sulawesi	5.0	5.1	5.1	13.3	13.3	27.3	43.2	56.7	76.6	92.6	113.4
12	Bengkulu	0.7	0.7	0.7	0.7	0.7	0.7	7.4	13.4	29.4	34.4	95.4
13	Central Sulawesi	42.3	42.3	43.5	43.5	74.6	74.6	74.6	76.0	76.0	90.0	90.0
14	Southeast Sulawesi	2.9	2.9	7.7	7.7	12.7	14.0	29.4	40.1	58.8	70.7	88.0
15	Jambi	0.3	0.3	0.3	4.4	4.4	11.4	27.4	37.9	57.3	68.7	86.0
16	Maluku	-	-	-	3.3	37.1	42.1	42.1	42.1	50.7	60.7	76.2
17	NTB	13.2	13.3	13.3	14.6	32.0	32.0	32.0	32.3	49.0	58.7	73.6
18	North Maluku	-	-	-	3.2	3.2	8.7	22.5	31.2	47.8	57.2	71.8
19	East Java	1.7	1.7	1.7	1.7	1.7	4.5	4.5	8.9	37.1	49.2	63.0

20	Gorontalo	4.0	4.1	4.1	4.1	6.1	6.1	16.4	24.1	40.6	48.2	61.7
21	Banten	0.1	4.3	15.3	15.3	16.8	21.8	34.8	43.3	43.3	58.3	58.3
22	Lampung	0.6	0.6	0.6	0.6	0.6	0.6	10.1	31.8	35.1	41.2	54.4
23	South Sumatera	1.3	1.3	1.3	2.7	2.7	2.7	20.2	30.2	30.2	36.2	52.4
24	West Kalimantan	0.9	0.9	1.0	2.3	17.5	17.5	17.5	17.5	29.7	34.7	46.2
25	Riau	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2.4	20.5	22.9	33.8
26	North Kalimantan	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	14.4	14.4	28.4
27	North Sulawesi	8.2	8.2	8.2	8.7	16.4	16.4	19.7	19.7	19.7	26.1	26.1
28	South Kalimantan	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	15.1	16.3	25.8
29	Bali	-	-	-	1.4	1.4	1.4	1.4	7.3	7.3	23.5	23.5
30	West Papua	1.0	1.0	1.0	2.0	11.0	11.0	11.0	11.0	11.1	11.5	19.8
31	Yogyakarta	0.2	0.2	0.2	0.2	0.2	0.8	0.8	0.8	0.8	0.8	0.8
Total Installed Capacity		197.4	230.5	313.6	520.0	815.1	999.9	1,299.9	1,650.0	2,049.9	2,500.0	3,000.0
Total Additional per year		-	33.1	83.2	206.3	295.1	184.9	300.0	350.0	400.0	450.0	500.0

- = Missing data, MW = megawatt, NTB = West Nusa Tenggara (Indonesian: Nusa Tenggara Barat – NTB), NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur – NTT).
Source: MEMR (2017).

Table 3.19. Projection of Solar Power Development (2015–2025)

No.	Province	Annual Total Installed Capacity (MW)										
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
1	NTT	4.2	14.2	15.0	15.0	20.3	40.5	96.8	159.6	238.0	320.7	414.9
2	West Kalimantan	1.3	1.3	1.6	15.1	24.3	43.8	88.3	140.9	209.2	282.4	366.4
3	Gorontalo	0.7	4.7	9.7	9.7	19.7	19.7	35.7	65.4	128.8	218.6	343.3
4	South Sumatera	1.1	1.1	1.1	12.8	20.0	35.8	71.7	114.1	169.3	228.5	296.6
5	NTB	4.7	4.9	25.2	90.2	90.2	90.2	90.2	112.3	167.2	225.4	292.0
6	West Sulawesi	0.5	0.5	0.5	2.4	9.8	23.3	60.5	100.7	150.4	202.6	261.8
7	Jambi	1.0	1.0	3.0	7.1	13.6	27.1	60.7	98.6	146.7	197.9	256.3
8	East Kalimantan	1.6	1.9	2.0	8.4	15.3	27.7	56.1	89.3	132.5	178.9	232.1
9	North Sumatera	16.0	17.7	57.7	57.7	57.7	57.7	57.7	86.2	128.0	176.2	224.1
10	Central Sulawesi	1.4	1.4	11.4	11.4	31.4	31.4	52.7	86.2	128.4	173.1	224.1
11	Central Kalimantan	0.8	1.1	1.1	6.7	13.4	23.7	52.5	85.0	126.5	170.6	221.1
12	Papua	7.8	8.2	19.4	19.4	39.4	39.4	50.7	84.2	125.7	169.3	218.8
13	Southeast Sulawesi	1.9	2.4	9.6	9.6	10.5	21.6	49.7	81.9	122.1	164.6	212.9
14	Aceh	0.8	0.8	2.8	6.2	12.7	22.5	50.2	81.3	121.0	163.2	211.4
15	North Maluku	4.5	4.6	9.6	9.6	9.7	18.9	47.3	78.3	116.8	157.3	203.5
16	Central Java	0.4	0.4	0.4	6.7	12.3	22.1	44.6	71.7	106.6	143.8	186.4
17	East Java	0.5	0.6	3.4	7.7	13.2	23.1	44.9	71.7	106.4	143.6	186.4
18	South Sulawesi	3.9	7.0	8.1	8.1	11.5	21.2	43.8	70.8	105.2	142.0	184.0
19	Maluku	5.0	5.3	10.3	15.3	15.3	17.6	41.9	69.6	103.8	139.9	180.8
20	West Papua	1.8	4.1	4.1	5.0	15.0	19.0	39.8	64.6	96.1	129.5	167.8
21	West Java	0.3	0.3	0.4	6.8	11.5	20.2	39.3	62.7	93.1	125.6	163.0
22	South Kalimantan	1.9	3.9	3.9	4.8	9.7	18.1	38.0	61.5	91.5	123.5	160.0
23	Bengkulu	0.6	0.7	0.7	3.1	8.2	16.5	37.3	61.2	91.3	123.0	159.2

24	West Sumatera	1.7	2.0	2.9	4.6	9.3	17.2	35.9	58.1	86.4	116.6	151.0
25	Lampung	1.3	1.6	1.6	2.1	6.5	13.5	31.3	51.6	77.0	103.8	134.3
26	Riau Islands	1.1	1.1	1.1	5.8	9.5	16.5	31.5	50.2	74.4	100.5	130.4
27	North Sulawesi	3.8	3.8	3.8	3.8	5.6	11.5	26.5	43.7	65.1	87.8	113.6
28	Bangka Belitung	1.6	1.6	3.6	3.6	5.9	11.7	25.9	42.4	63.2	85.2	110.3
29	Bali	4.4	7.5	8.2	8.2	8.2	108.2	108.2	108.2	108.2	108.2	108.2
30	North Kalimantan	0.4	0.6	0.6	3.6	6.6	12.0	24.3	39.1	58.1	78.5	101.7
31	Banten	0.2	0.2	0.3	2.1	5.1	10.0	22.2	36.3	54.0	72.9	94.3
32	Riau	0.9	1.0	1.0	1.0	4.1	9.0	21.8	36.2	54.1	72.8	94.2
33	DI Yogyakarta	0.1	0.1	0.1	1.1	3.7	8.0	18.9	31.3	46.8	63.0	81.5
34	Jakarta	0.2	0.2	0.3	0.3	0.7	1.4	3.2	5.3	7.9	10.7	13.8
Total Installed Capacity		78.4	107.8	224.5	375	550	900	1600	2500	3700	5000	6500
Total Additional per year		-	29.3	116.6	150.5	175.0	350.0	700.0	900.0	1200.0	1300.0	1500.0

- = missing data, DI = Special Region of Yogyakarta, MW = megawatt, NTB = West Nusa Tenggara (Indonesian: Nusa Tenggara Barat – NTB), NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur – NTT) .
Source: MEMR (2017).

Table 3.20. Projection of Bioenergy Development (2015–2025)

No.	Province	Annual Total Installed Capacity (MW)												
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025		
1	Riau	179.4	183.4	193.4	195.4	195.4	195.4	195.4	195.4	195.4	195.4	260.9	306.8	359.0
2	NTT	38.8	39.8	43.8	81.0	110.5	136.9	161.4	190.2	224.0	263.3	308.1		
3	East Java	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	145.4	204.7	240.9	281.9
4	North Sumatera	126.0	174.5	174.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	192.2	226.1	264.5
5	Jambi	88.4	104.4	104.4	104.4	104.4	108.9	132.2	157.1	185.5	218.1	255.2		
6	West Sulawesi	30.0	30.0	31.0	41.2	75.3	100.7	120.3	142.3	167.9	197.3	230.9		
7	Central Java	98.5	98.5	98.5	98.5	98.5	98.5	111.3	134.5	159.6	187.8	219.8		
8	South Sumatera	94.6	98.6	101.1	101.1	101.1	101.1	110.0	132.7	157.4	185.2	216.7		
9	West Java	109.3	121.8	121.8	121.8	121.8	121.8	121.8	131.7	157.0	184.9	216.4		
10	Central Kalimantan	71.7	72.7	72.7	82.7	82.7	84.2	105.0	125.8	148.9	175.1	204.9		
11	Lampung	70.6	70.6	70.6	70.6	70.6	79.5	100.2	120.4	142.6	167.7	196.3		
12	West Kalimantan	63.9	63.9	85.9	105.9	105.9	105.9	105.9	117.6	139.2	163.8	191.7		
13	Aceh	58.2	71.2	81.0	82.5	82.5	82.5	92.2	110.9	131.3	154.4	180.8		
14	West Papua	10.2	10.2	10.2	10.8	49.8	75.5	92.0	109.5	129.3	152.0	177.9		
15	NTB	31.1	31.1	32.1	32.1	46.5	74.6	91.6	109.3	129.2	151.9	177.8		
16	South Kalimantan	60.4	66.8	66.8	66.8	66.8	66.8	81.9	99.6	118.4	139.4	163.1		
17	Southeast Sulawesi	20.8	20.8	20.8	20.8	38.0	65.5	81.1	97.0	114.7	134.9	157.9		
18	Central Sulawesi	26.5	26.5	26.5	26.5	33.6	63.1	78.9	94.6	112.0	131.8	154.2		
19	North Maluku	16.2	16.2	16.2	16.2	35.7	62.6	77.8	93.0	110.1	129.4	151.5		
20	Bengkulu	36.8	42.8	42.8	42.8	42.8	58.2	74.8	90.4	107.3	126.2	147.7		
21	South Sulawesi	47.3	47.3	57.3	57.3	57.3	57.3	72.5	88.5	105.2	123.8	144.9		
22	Maluku	15.2	15.2	21.2	21.2	30.5	58.1	72.8	87.4	103.5	121.7	142.4		
23	Gorontalo	17.8	23.8	23.8	29.8	29.8	53.6	68.3	82.3	97.6	114.8	134.3		

24	West Sumatera	46.1	46.1	47.1	47.1	47.1	47.6	66.2	81.6	97.4	114.7	134.2
25	East Kalimantan	45.2	46.2	58.3	67.8	67.8	67.8	67.8	67.8	67.8	76.7	89.8
26	North Sulawesi	14.5	14.5	14.5	14.5	14.5	28.9	43.2	54.2	64.9	76.5	89.6
27	Banten	24.8	24.8	24.8	24.8	24.8	24.8	41.2	53.2	64.1	75.7	88.6
28	Papua	21.2	21.2	21.2	31.2	31.2	31.2	41.8	52.4	62.8	74.1	86.7
29	Bangka Belitung	15.9	25.7	25.7	65.7	65.7	65.7	65.7	65.7	65.7	70.7	82.7
30	DI Yogyakarta	15.4	15.4	15.4	15.4	15.4	20.2	35.7	46.3	56.0	66.1	77.3
31	North Kalimantan	-	-	-	-	-	9.0	29.8	42.1	51.8	61.4	71.8
32	Bali	11.7	12.1	12.1	12.1	12.1	12.1	19.2	29.7	37.3	44.3	51.8
33	Riau Islands	13.0	14.0	14.0	14.0	14.0	14.0	14.0	16.2	22.1	26.6	31.1
34	DKI Jakarta	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	11.8	15.8	18.4
Total Installed Capacity		1671	1801.7	1881	2030	2200	2500	2900	3400	4000	4700	5500
Total Additional per year		-	130.6	79.4	149.0	170.0	300.0	400.0	500.0	600.0	700.0	800.0

* Administratively, DKI Jakarta is divided into four city administrations (City Administration of South Jakarta, East Jakarta, Central Jakarta, West Jakarta, and North Jakarta) and one Administrative Regency (Thousand Islands or Kepulauan Seribu).

- = missing data , DI = Special Region of Yogyakarta, MW = megawatt, NTB = West Nusa Tenggara (Indonesian: Nusa Tenggara Barat – NTB), NTT = East Nusa Tenggara (Indonesian: Nusa Tenggara Timur – NTT).

Source: MEMR (2017).