

# Applications of Microgrid for Remote Areas in Indonesia

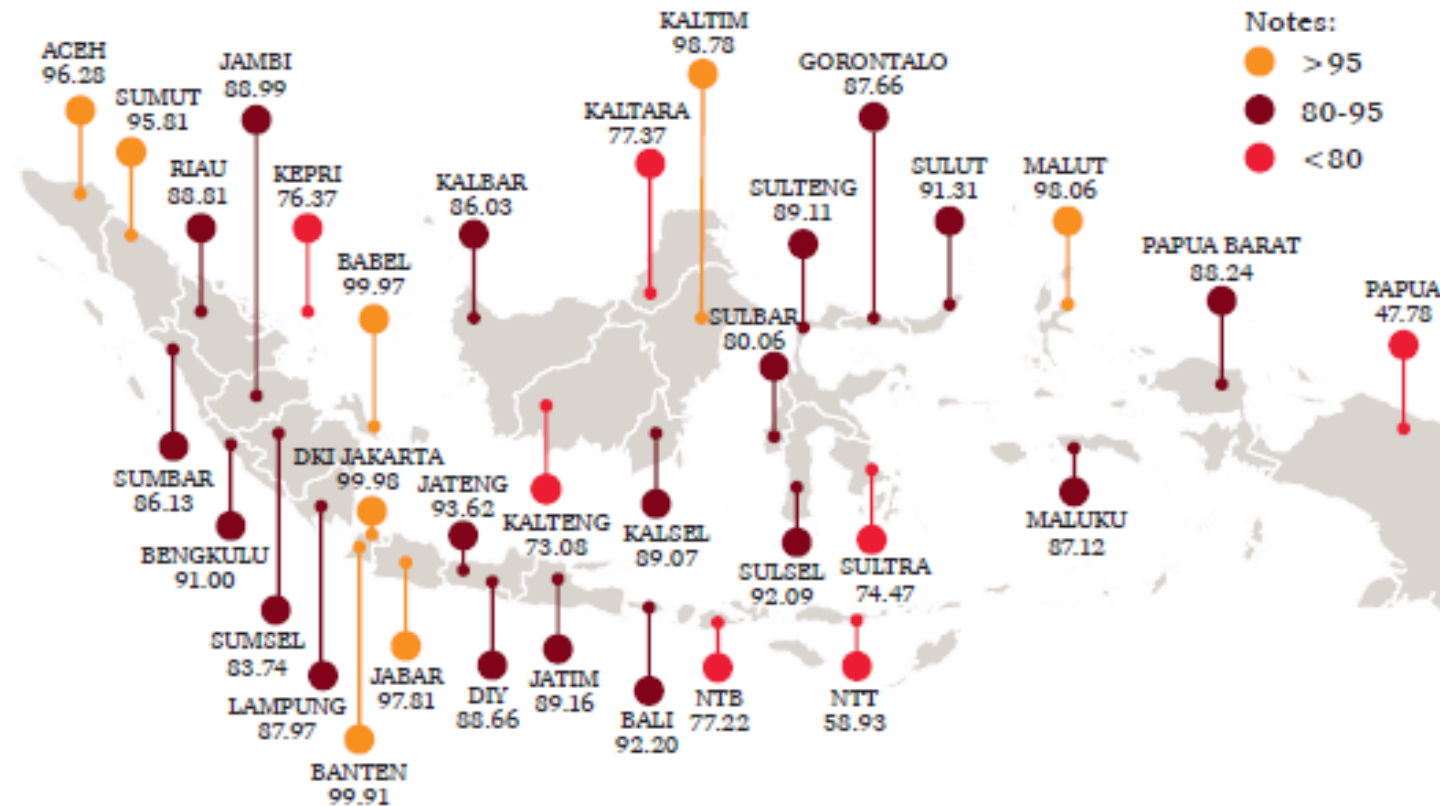
Pekik Argo Dahono

School of Electrical Engineering and Informatics

Institute of Technology Bandung

INDONESIA

# Electrification Ratio



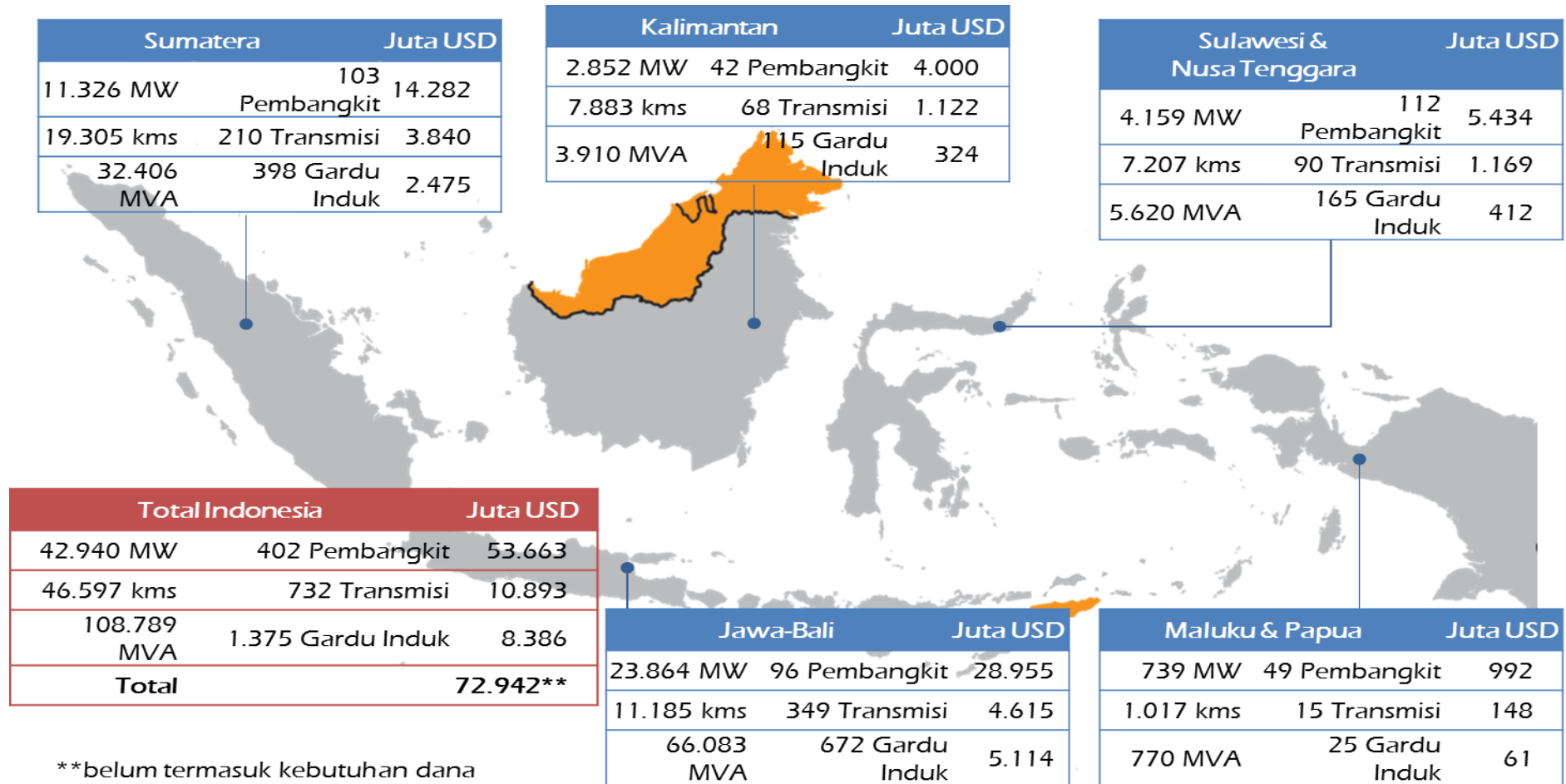
Source: LAKIN DJK 2016, p. 28.

# 35000 MW Program – to respond sectors challenge

- To fulfill growing demand for electricity which is still quite high (8.7% per year) and to promote national economic growth target 7% in 2019.
- To Increase the target of kWh per-capita by 1,293 kWh in 2019.
- To achieve the target of electricity ratio by 97.35% in 2019.

	2015	2019
<b>Installed capacity of Power Plant (GW)</b>	55.5	98.4
<b>economic growth (%)</b>	4.7	7
<b>kWh per-capita (kWh)</b>	910	1.293
<b>of electricity ratio (%)</b>	88.30	97.35

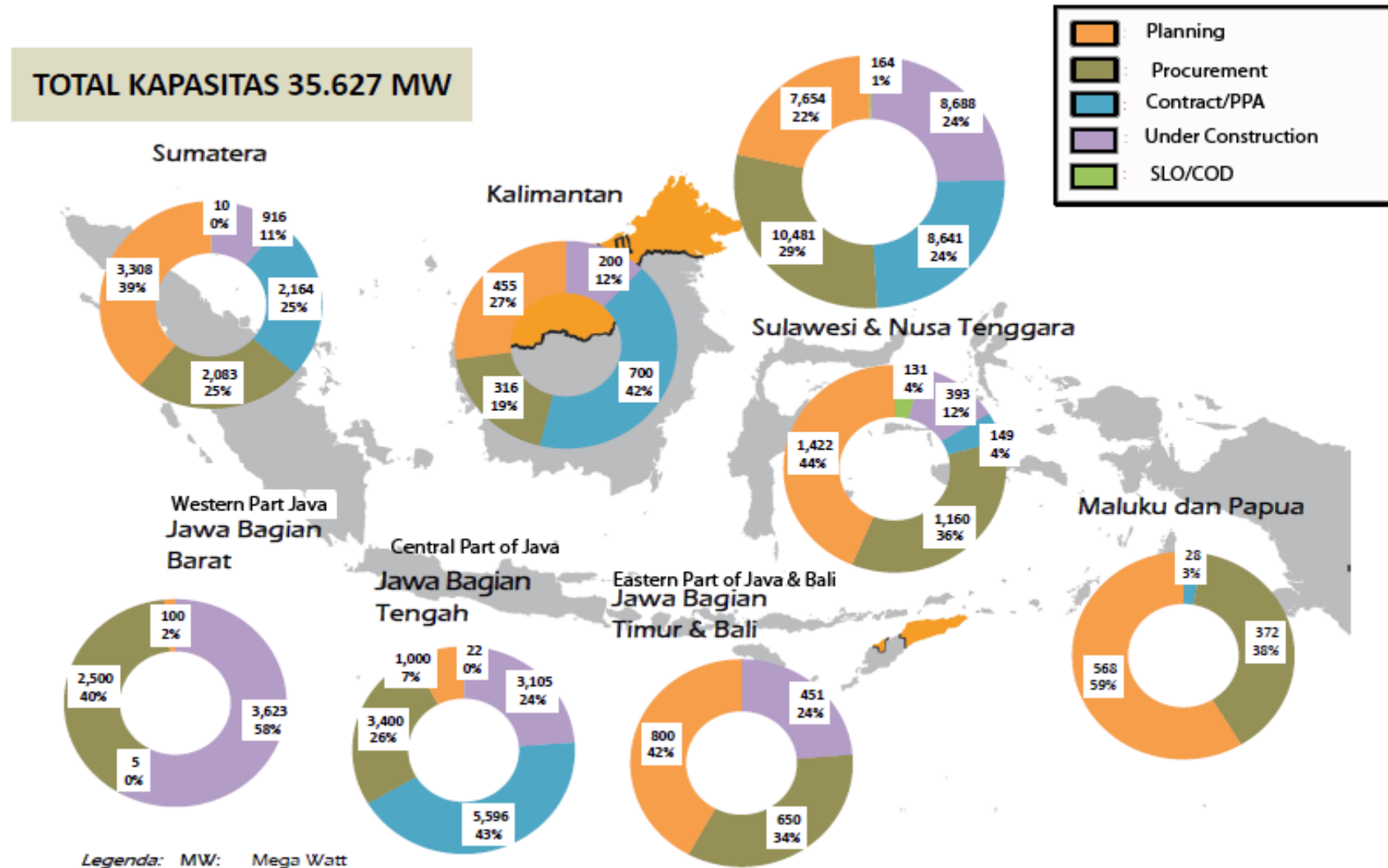
# Distribution of 35000MW Projects



\*\*belum termasuk kebutuhan dana untuk tanah, Interest During Construction (IDC) dan pajak-pajak

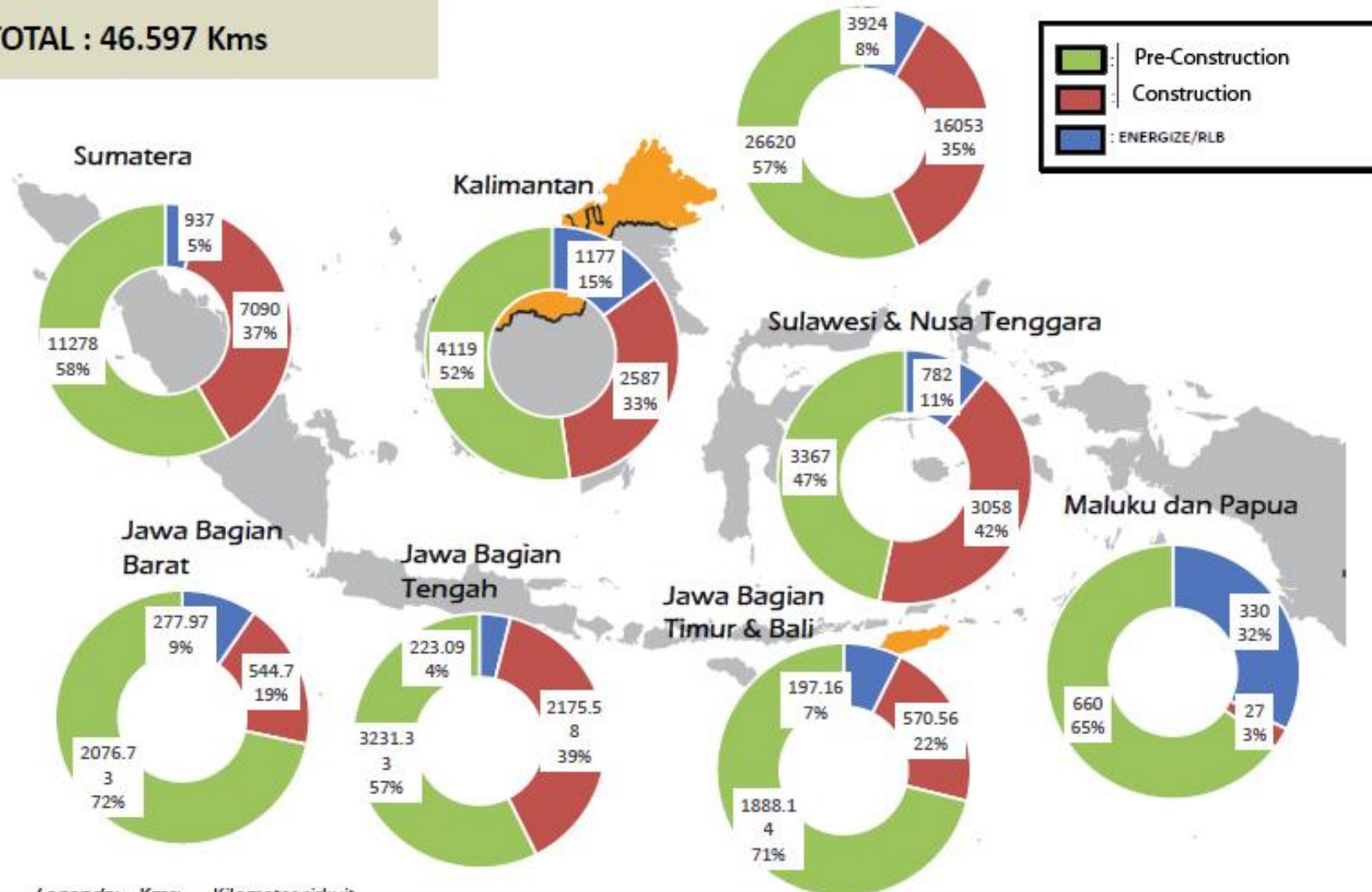
**Legenda:** MW: Megawatt    kms: Kilometer-sirkuit    MVA: Mega-volt ampere

# Progress of 35.000MW as of December 2016



# Progress for Electricity Transmission

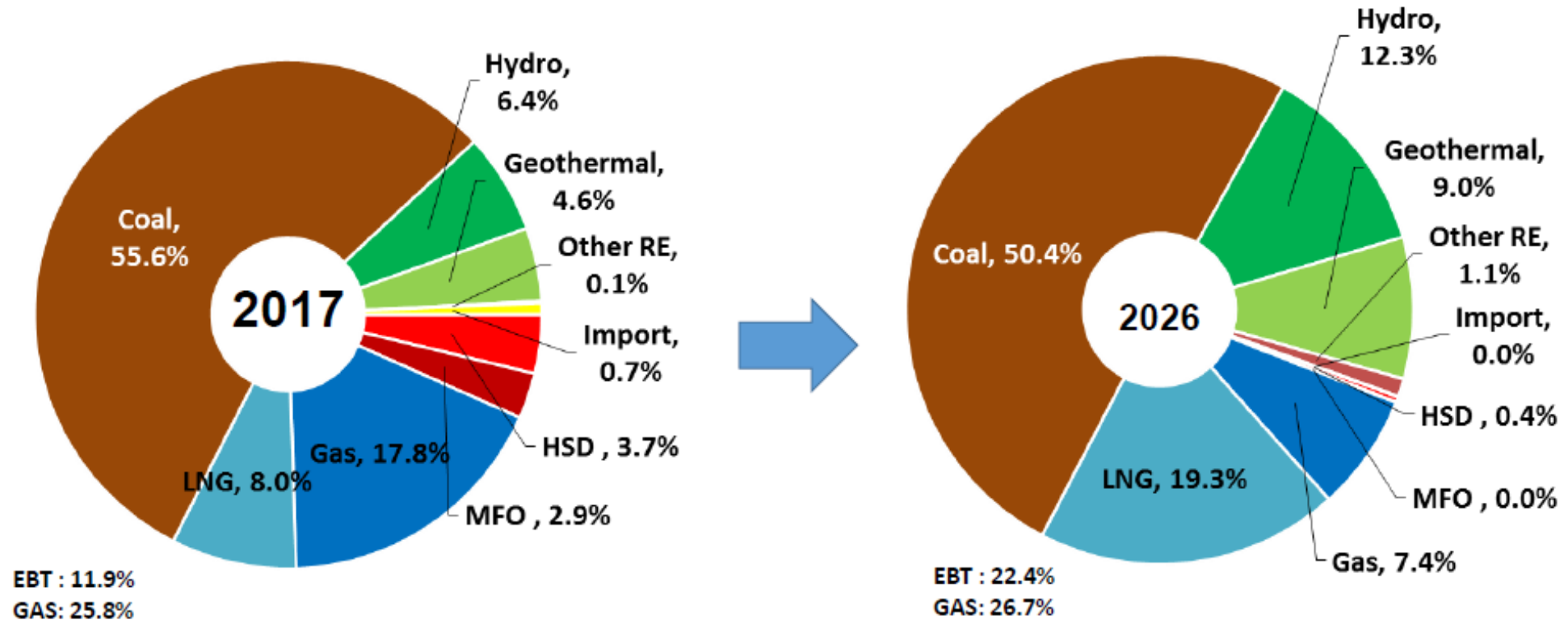
TOTAL : 46.597 Kms



Legenda: Kms: Kilometer sirkuit

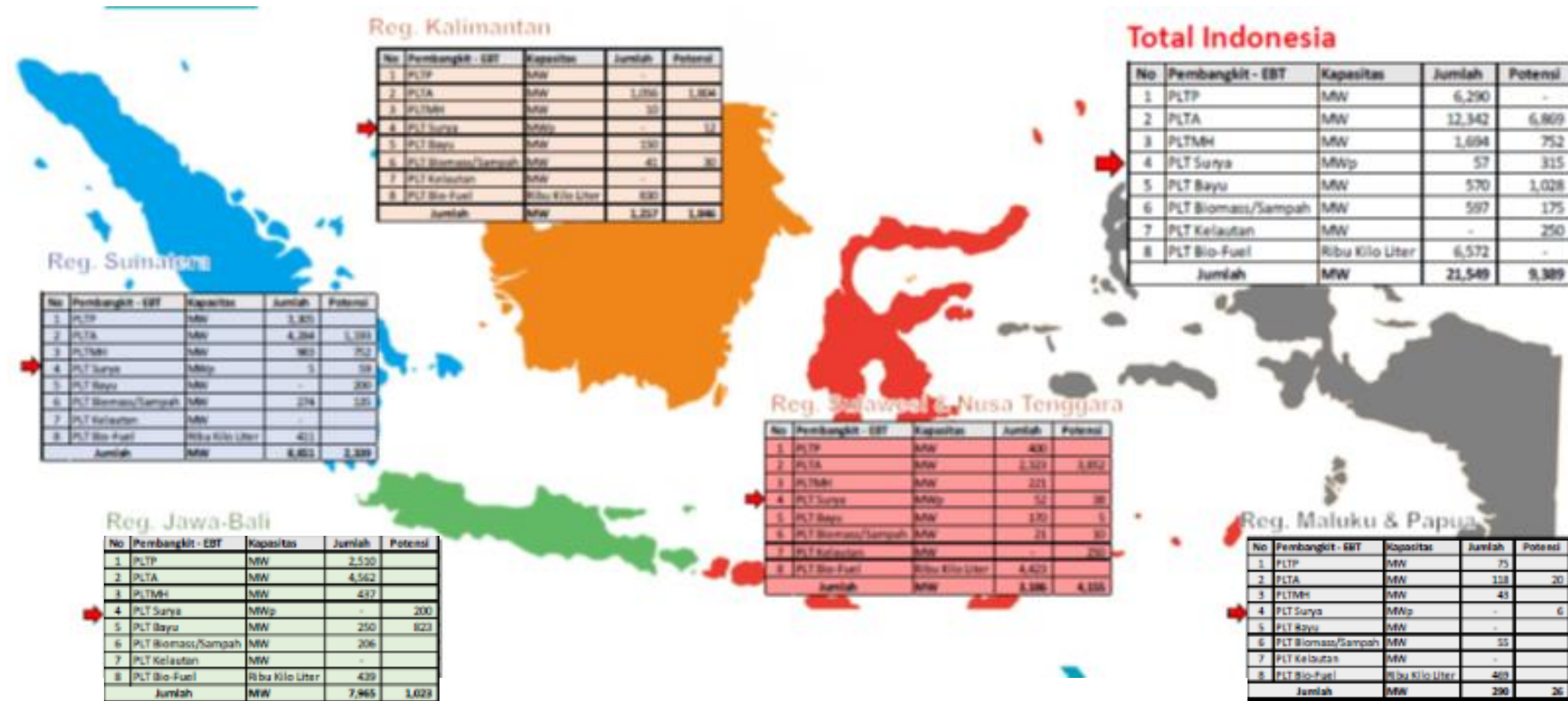
Newcastle 2017

# Energy Mix





# Renewable Energy in 2017-2026 Electricity National Plan





# Existing PV Power Generation (Total 9 MW)

WILAYAH DAN NAMA PLTS		DAYA (kWp)	PROGRESS	KETERANGAN
<b>PT PLN WILAYAH RIAU KEPRI</b>				
1	PLTS TAREMPA ANAMBAS	200	100%	COD 2011 (EX PULAU TERLUAR)
2	PLTS TAREMPA KARIMUN	200	100%	COD 2011 (EX PULAU TERLUAR)
<b>Sub Total</b>		<b>400</b>		
<b>PT PLN WILAYAH SUMBAR</b>				
1	PLTS PULAU TUA PEJAT SIPORA	150	100%	COD 2011 (EX PULAU TERLUAR)
2	PLTS PULAU SIMALEPET SIPORA	40	100%	COD 2011 (EX PULAU TERLUAR)
<b>Sub Total</b>		<b>190</b>		
<b>PT PLN WILAYAH KALIMANTAN BARAT</b>				
1	PLTS PULAU LIMBUNG	60	100%	masih menunggu data
2	PLTS TEMAJUK	80	100%	Ex SKI Unit/sisa SKI 2012.
3	PLTS SIDING	40	100%	Ex SKI Unit/sisa SKI 2012.
<b>Sub Total</b>		<b>180</b>		
<b>PT PLN WILAYAH KALIMANTAN TIMUR</b>				
1	PLTS DERAWAN	170	100%	Mulai Operasi Mar 2011
2	PLTS SEBATIK	340	100%	Mulai Operasi Feb 2012
<b>Sub Total</b>		<b>510</b>		
<b>PT PLN WILAYAH SULAWESI UTARA, TENGAH DAN GORONTALO</b>				
1	PLTS MIANGAS	85	100%	Mulai Operasi Oct 2011
2	PLTS BUNAKEN	355	100%	Mulai Operasi Feb 2011
3	PLTS MARAMPIT	125	100%	Mulai Operasi Jun 2012
4	PLTS MARORE	120	100%	Mulai Operasi Mar 2013
5	PLTS MAKALEHI	260	100%	Mulai Operasi Mar 2013
<b>Sub Total</b>		<b>945</b>		
<b>PT PLN WILAYAH SULAWESI SELATAN DAN SULAWESI TENGGARA</b>				
1	PLTS KARANRANG	200	100%	Mulai Operasi Nov 2012
2	PLTS WAHA TOMIA	75	100%	Mulai Operasi Feb 2012 (masalah pada sistem hybrid)
3	PLTS BALLANG LOMPO	200	100%	Mulai Operasi Nov 2012
4	PLTS TANAKEKE	200	100%	Mulai Operasi Jul 2012
5	PLTS KAPOTA	200	100%	Mulai Operasi Apr 2013
6	PLTS KABAENA	400	100%	Mulai Operasi Jun 2012
7	PLTS KODINGARENG	400	100%	Mulai Operasi Oct 2012
8	PLTS SABUTUNG	150	100%	Mulai Operasi Nov 2012 (gangguan inverter)
9	PLTS SALEMO	150	100%	Mulai Operasi Sep 2012
<b>Sub Total</b>		<b>1,975</b>		

WILAYAH DAN NAMA PLTS		DAYA (kWp)	PROGRESS	KETERANGAN
<b>PT PLN WILAYAH MALUKU &amp; MALUKU UTARA</b>				
1	PLTS BANDA	100	100%	Mulai Operasi Dec 2010
2	PLTS MOROTAI	600	100%	Mulai Operasi Apr 2012
3	PLTS PANJANG	115	100%	Mulai Operasi Mei 2012
4	PLTS KELANG	100	100%	Mulai Operasi Mei 2012
5	PLTS TIGA (NUSA ELA)	75	100%	Mulai Operasi Jul 2012
6	PLTS KISAR	100	100%	Mulai Operasi Jul 2012
7	PLTS TIDOR	100	100%	Mulai Operasi Jul 2012
8	PLTS KEI BESAR	200	100%	Mulai Operasi Nov 2011
9	PLTS KUR	100	100%	Mulai Operasi Nov 2012
10	PLTS MANAWOKA	115	100%	Mulai Operasi Sep 2012
11	PLTS WETAR (ELWAKI)	100	100%	Mulai Operasi Jul 2012
<b>Sub Total</b>		<b>1,705</b>		
<b>PT PLN WILAYAH NUSA TENGGARA BARAT</b>				
1	PLTS GILI TRAWANGAN	200	100%	Mulai Operasi Mar 2011
2	PLTS GILI TRAWANGAN (Ext)	400	100%	Mulai Operasi Mei 2012
3	PLTS GILI AIR	160	100%	Mulai Operasi Mei 2012
4	PLTS GILI MENO	60	100%	Mulai Operasi Mei 2012
<b>Sub Total</b>		<b>820</b>		
<b>PT PLN WILAYAH NUSA TENGGARA TIMUR</b>				
1	PLTS LEMBATA	200	100%	Mulai Operasi Jun 2011
2	PLTS NULE	250	100%	Mulai Operasi 13 Juni 2013
3	PLTS PURA	175	100%	Mulai Operasi 31 Mei 2013
4	PLTS SOLOR BARAT	275	100%	Mulai Operasi Apr 2013
5	PLTS SEMAU	450	100%	Mulai Operasi Sep 13
6	PLTS SALURA	150	100%	Menunggu JTR
7	PLTS RAIJUA	150	100%	Mulai Operasi 13 Mei 2013
<b>Sub Total</b>		<b>1,650</b>		
<b>PT PLN WILAYAH PAPUA DAN PAPUA BARAT</b>				
1	PLTS Saonek (Raja Ampat)	40	100%	Mulai Operasi Apr 2011 (menunggu data)
2	PLTS OKSIBIL	300	100%	Mulai Operasi Apr 2013
4	PLTS KIGAMANI/DOGIAY	300	100%	Mulai Operasi Apr 2013
<b>Sub Total</b>		<b>640</b>		

# Independent PV Power Producers (in Operation)

No	Nama Pembangkit	Nama Perusahaan	Kapasitas (MWp)	Lokasi	Status
1	PLTS Gorontalo	PT Brantas Energi-Adyawinsa KSO	2	Gorontalo	PPA tanggal 19 Agustus 2015, Operasi
2	PLTS Kupang	PT LEN Industri	5	Kupang, Nusa Tenggara Timur	Telah PPA pada 1/9/2015, Operasi
3	PLTS Sumba Timur	PT Buana Multi Techindo	1	Sumba Timur, Nusa Tenggara Timur	Telah PPA
<b>TOTAL = 8 MWp</b>					

# Independent PV Power Producers (Approved)

No	Pembangkit	Lokasi	Kapasitas (MWp)	Pengembang	Status	Rencana COD
1	PLTS Isimu	Isimu, Gorontalo	10	PT Quantum Energy Indonesia	PPA Pada 2 Agustus 2017	2018
2	PLTS Likupang	Likupang, Minahasa	15	PT Infrastruktur Terbarukan Lestari	PPA Pada 2 Agustus 2017	2018
3	PLTS Sengkol	Sengkol, Lombok	5	PT Infrastruktur Terbarukan Cemerlang	PPA Pada 2 Agustus 2017	2018
4	PLTS Selong	Selong, Lombok	5	PT Infrastruktur Terbarukan Buana	PPA Pada 2 Agustus 2017	2018
5	PLTS Kuta	Kuta, Lombok	5	NV Vogt Singapore PTE LTD	PPA Pada 2 Agustus 2017	2018
6	PLTS Pringgabaya	Pringgabaya, Lombok	5	PT Infrastruktur Terbarukan Adhiguna	PPA Pada 2 Agustus 2017	2018
7	PLTS Atambua	Atambua, Nusa Tenggara Timur	1	PT Global Karya Mandiri	Telah PPA	2018
8	PLTS Maumere-Rope-Ende	Maumere-Rope-Ende, Nusa Tenggara Timur	2	PT Indo Solusi Utama	Telah PPA	2018
<b>TOTAL 48 MWp</b>						

In addition, there are tota 5 MWp PV power plants constructed under government budget that will be delivered to local government.

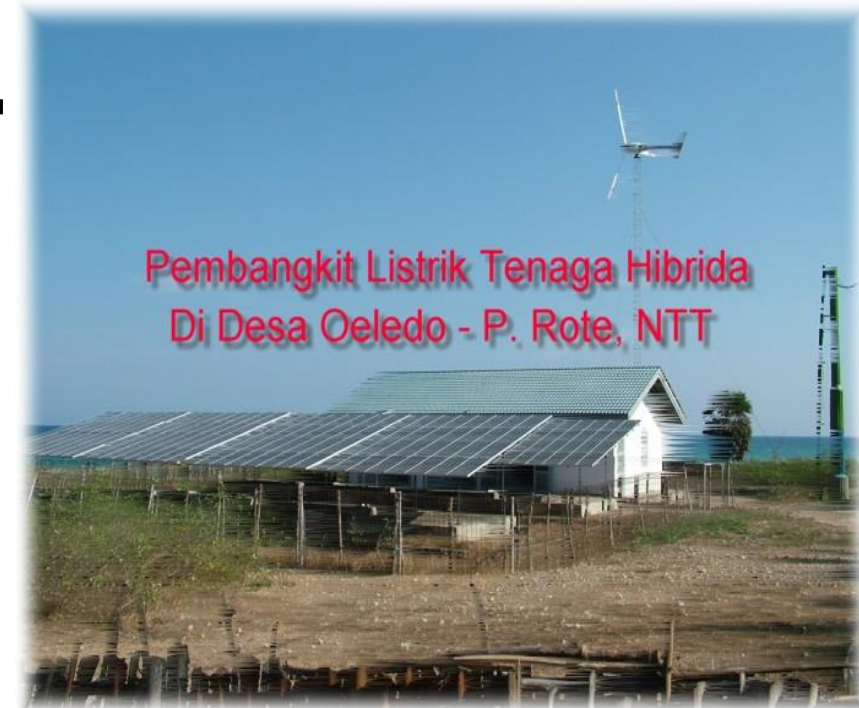
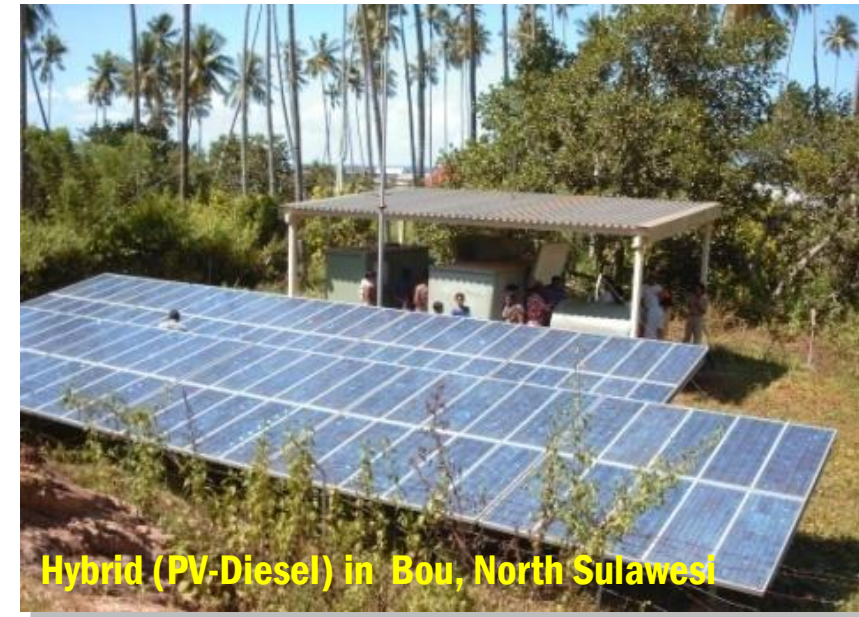
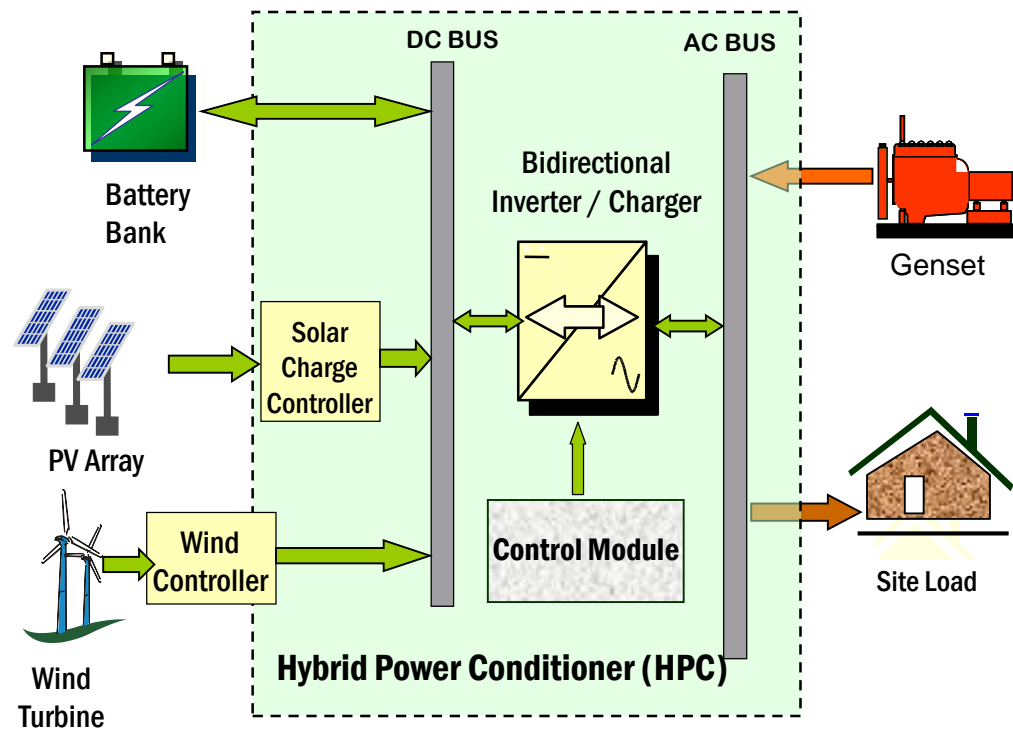
# New PV Power Generation Systems in New 2017-2027 Electricity National Plan (Draft)

No	Usulan PLTS	Kapasitas (MW)	Lokasi
1	PLTS Kuota Sumatera	156,58	Tersebar Sumatera
2	PLTS Kuota Jawa Bali Nusa Tenggara	180,99	Tersebar Jawa Bali NT
3	PLTS Kuota Kalimantan	19,61	Kalimantan Tersebar
4	PLTS Kuota Sulawesi	42,5	Sulawesi Tersebar
5	PLTS Kuota Maluku Papua	12,06	Maluku Papua Tersebar
6	PLTS Jalan Tol Sumatera	500	Jalan Tol Trans Sumatera
7	PLTS Bali 1	100	Negara, Bali
8	PLTS Bali 2	100	Amlapura, Bali
9	PLTS Bali 3	100	Kubu, Bali
10	PLTS Floating Cirata	200	Cirata, Jawa Barat
11	PLTS Bekasi	200	Muara Tawar, Jawa Barat
12	PLTS Worldbank	500	Tersebar Jawa Bali
TOTAL		2.111,74	

# Various Supports and Barriers to the Use of Microgrids

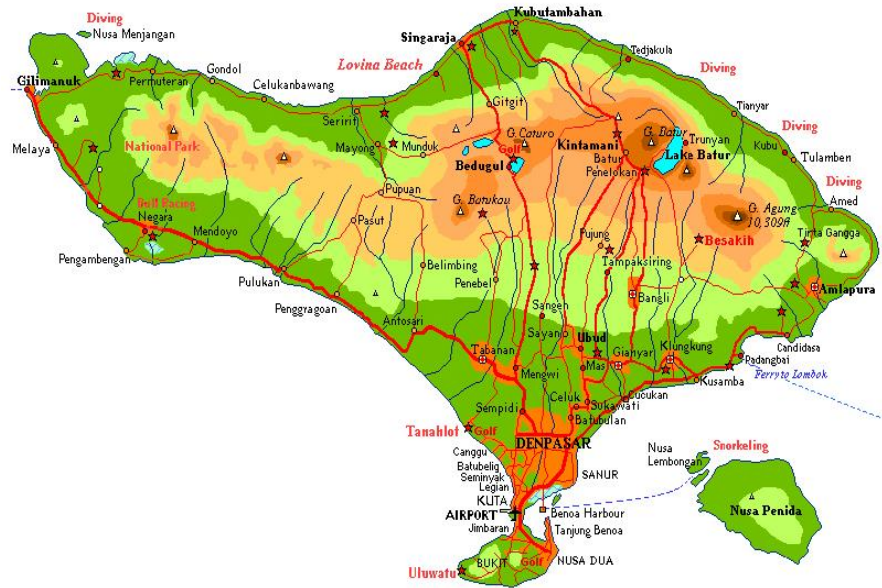
- Ministry of Energy Regulation No 50/2017
- Inviting private sectors to develop microgrids (mini PLN), for remote areas and islands
- PV rooftop and solar home system projects according to the regulation of PLN, No 0733/2013.
- Inviting private sectors to develop a hybrid system for remote areas and islands through BtoB scheme.

## Hybrid (PV-Wind-Diesel) Power Plant

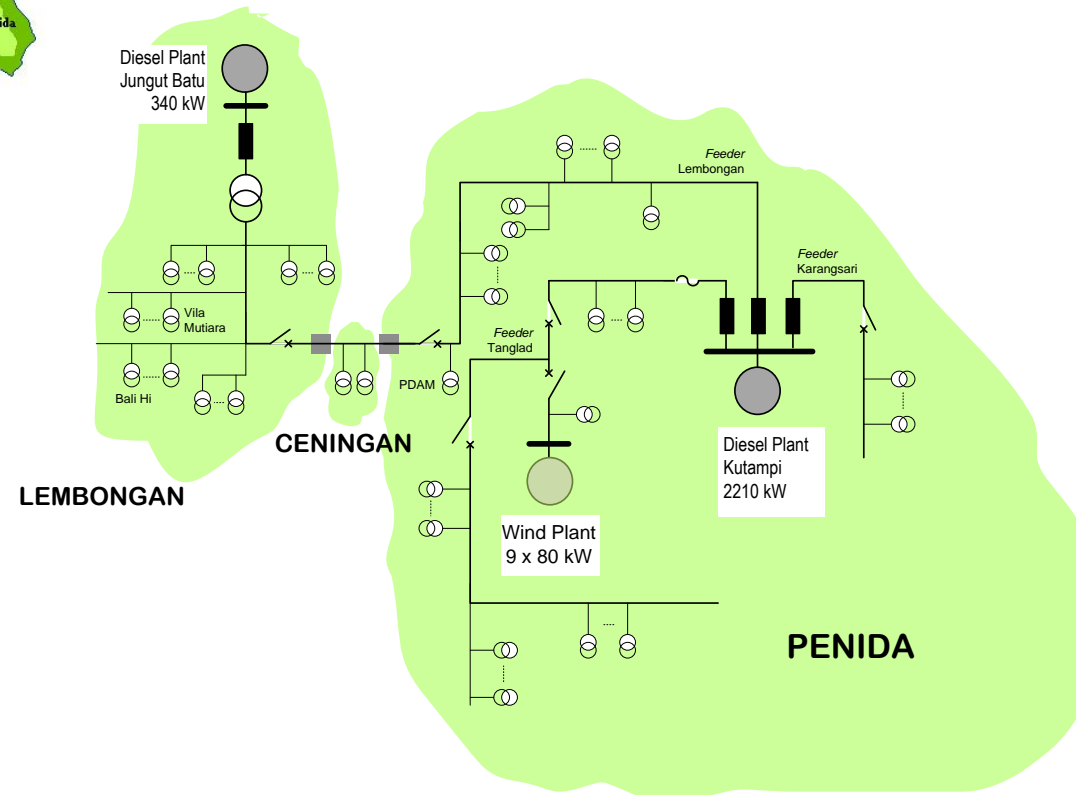




# Wind-Solar-Diesel Nusa Penida Microgrid

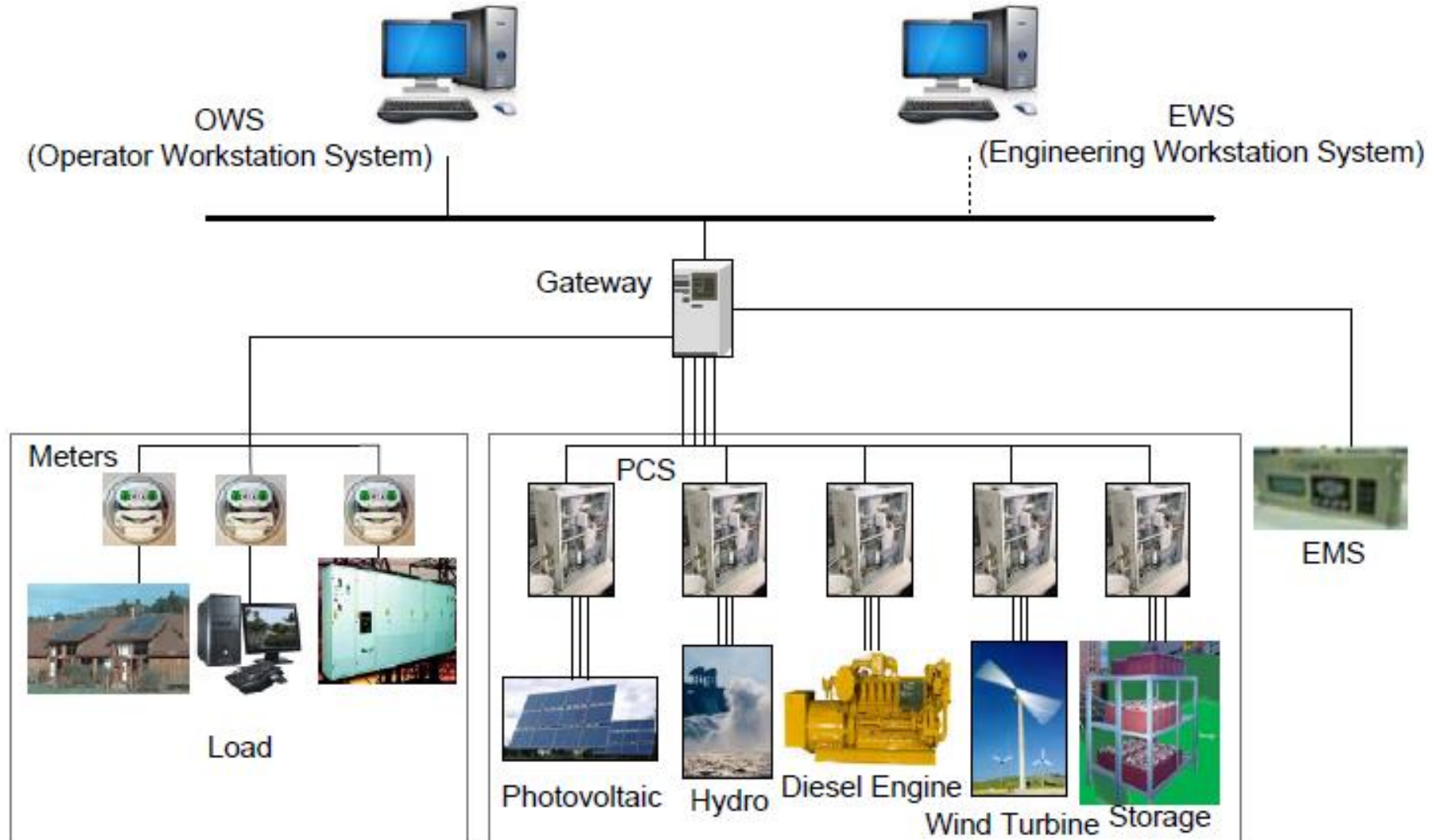


Nusa Penida has been declared  
as self-sufficient energy island

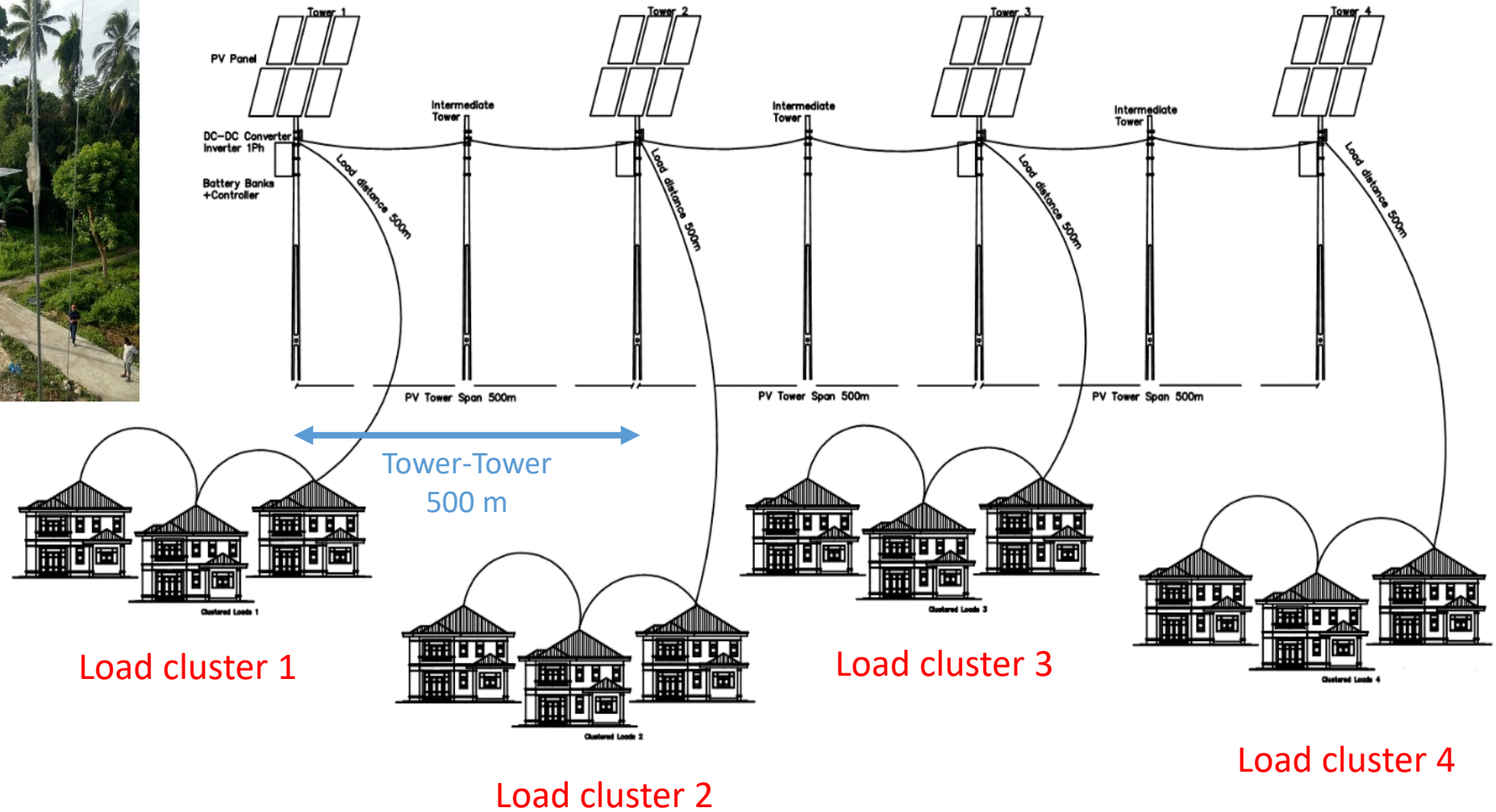




# Pilot Plant – Sumba Smart Microgrid For Renewable Energy Integration



# Microgrid for Remote Areas





# Centralized PV Offgrids





# Centralized PV offgrid



# Barriers to the Use of Microgrids and Renewable Energy

- Lack of human resources
- Lack of capabilities of local people to pay electrical bill
- Poor coordination between central and local governments
- Vandalism

# Thank You