INDONESIA SMART GRID

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PLTDG Pesanggaran

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AGENDA

- *ABOUT PLN*
- *ENERGY MIX*
- *ENERGY & POWER DEVELOPMENT*
- *ENERGY CHALLENGE IN INDONESIA*
- *PLN SMART GRID*

About PLN

PLN

One of the largest Indonesia's state-owned company within USD 102,78 Billion assets and revenue USD 18,82 Billion/year

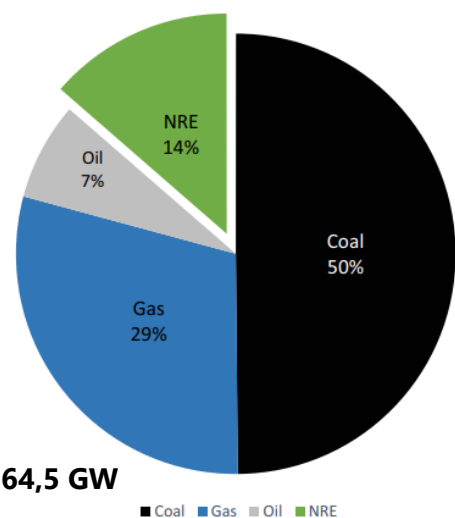**Power Generation** → **Transmission** → **Distribution**

Total capacity 57,8 GW :
- *41,1 GW (71%) PLN*
- *16,7 GW (29%) IPP*

- *53.278 kms transmission line*
- *131.164 MVA power transformers*

- *953.459 kms distribution lines*
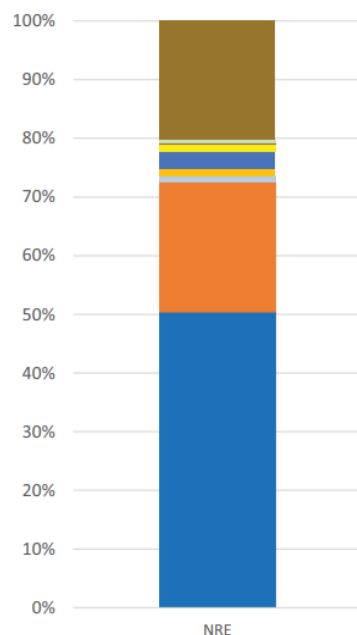- *Over 71,9 million customers (>30 million using pre-paid meter)*
- *Employees 54.225*

PLN Grid

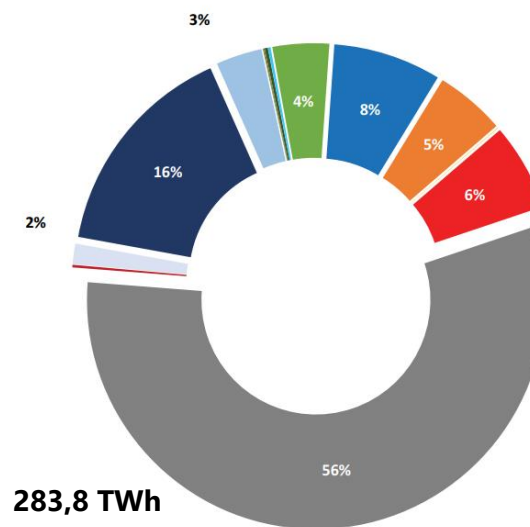*7 high voltages (150,275 &500 kV), 200 medium voltages (20 kV), 900 off grid (400 V)*

Energy Mix

64,5 GW
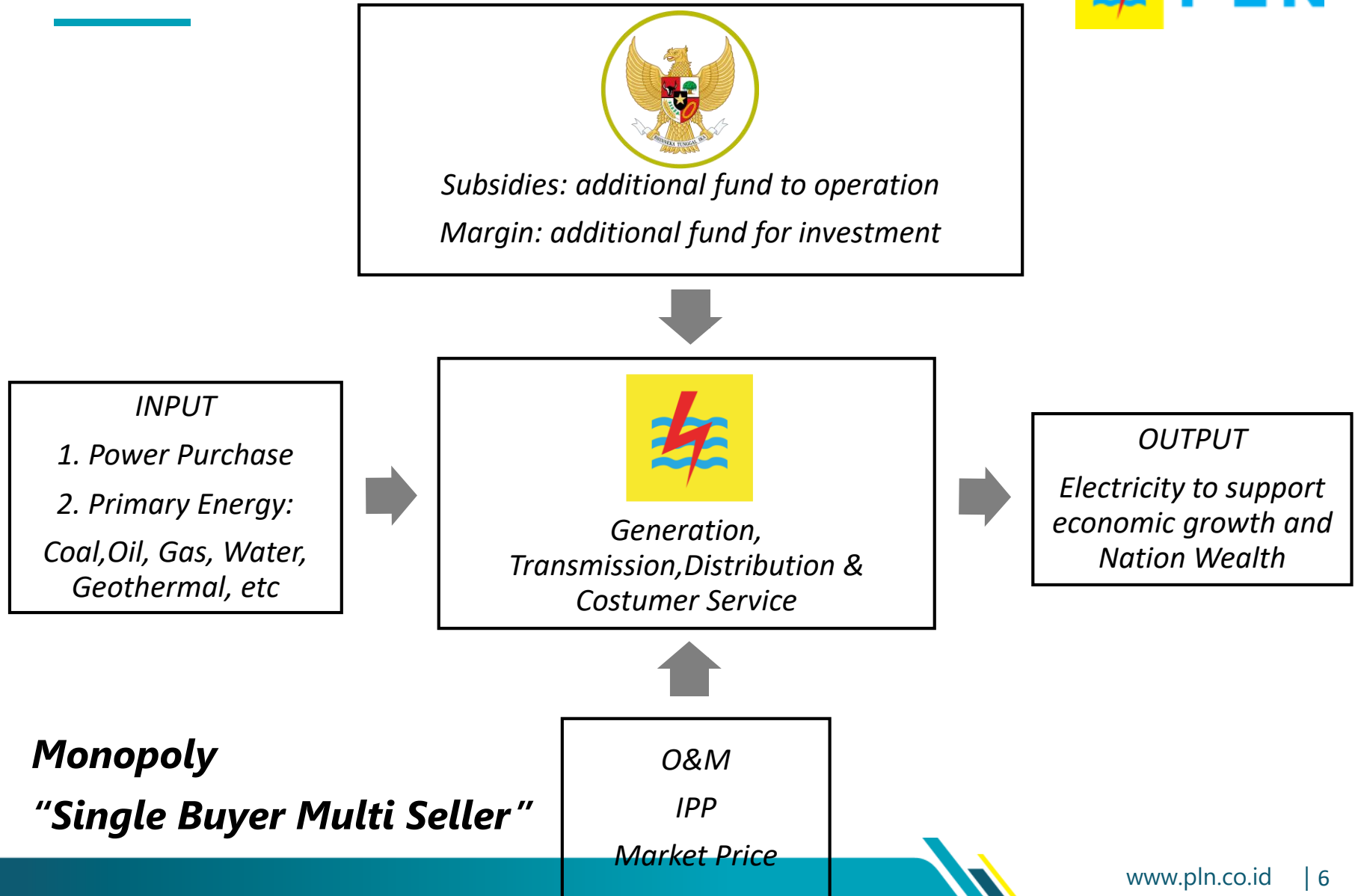
Electricity Generation by Energy Source Year 2018

Legend (stacked bar):
- Hydro PP
- Geothermal PP
- Wind PP
- Micro Hydro PP
- Mini Hydro PP
- Solar PP
- Waste PP
- Biogas PP
- Biomass PP

Pie chart: Coal 50%, Gas 29%, Oil 7%, NRE 14%

283,8 TWh

Electricity Production by Energy Source Year 2018

Legend (donut):
- Hydro PP
- Geothermal PP
- Solar PP
- Diesel PP
- Steam Coal PP
- Steam Oil PP
- Steam Gas PP
- Combined Cycle-Gas PP
- Gas PP
- Gas Engine PP
- Wind PP
- Waste PP
- Biogas PP
- Biomass PP

Donut values: 56%, 16%, 8%, 5%, 6%, 4%, 3%, 2%

Source: HEESI, 2018

Market Structure

Subsidies: additional fund to operation

Margin: additional fund for investment

INPUT

1. Power Purchase

2. Primary Energy:

Coal,Oil, Gas, Water, Geothermal, etc

Generation, Transmission,Distribution & Costumer Service

OUTPUT

Electricity to support economic growth and Nation Wealth

O&M

IPP

Market Price

- **Monopoly**
- **"Single Buyer Multi Seller"**

Electricity Price

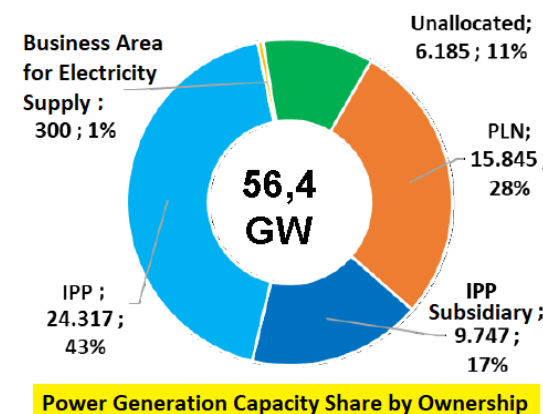| No.	Country	Unit	Residential	Low Voltage	Medium Voltage Commercial	Medium Voltage Industrial	High Voltage Industrial
1	Indonesia	US cents/kWh	11	11	8,36	8,36	7,47
2	Malaysia		9,65	13,11	9,27	8,01	7,49
3	Thailand		12,41	9,09	8,75	7,76	7,76
4	Singapore		19,08	13,79	13,5	12,6	12,25
5	Philippines		18,26	11,86	11,61	11,31	11,25
6	Vietnam		10,34	13,12	12,07	7,62	7,23
							Exchange rate: Rp. 13.342/USD

Sources:

Indonesia: www.esdm.go.id
Malaysia: https://www.tnb.com.my/residential/pricing-tariffs
Thailand: http://www.boi.go.th/index.php?page=utility_costs&language=en
Singapura: https://www.ema.gov.sg/Electricity_Costumers.aspx
Philippines: http://www.meralco.com.ph/consumer-information/rates-archive
Vietnam: http://en.evn.com.vn/c3/gioi-thieu-I/Electricity-price-9-28.aspx

ENERGY AND POWER DEVELOPMENT

PLN

Additional Generation Capacity

ELECTRICITY GENERATION BY PLANT TYPE

Power Generation Capacity Share by Ownership

Source: Electricity Supply Business Plan 2019-2028
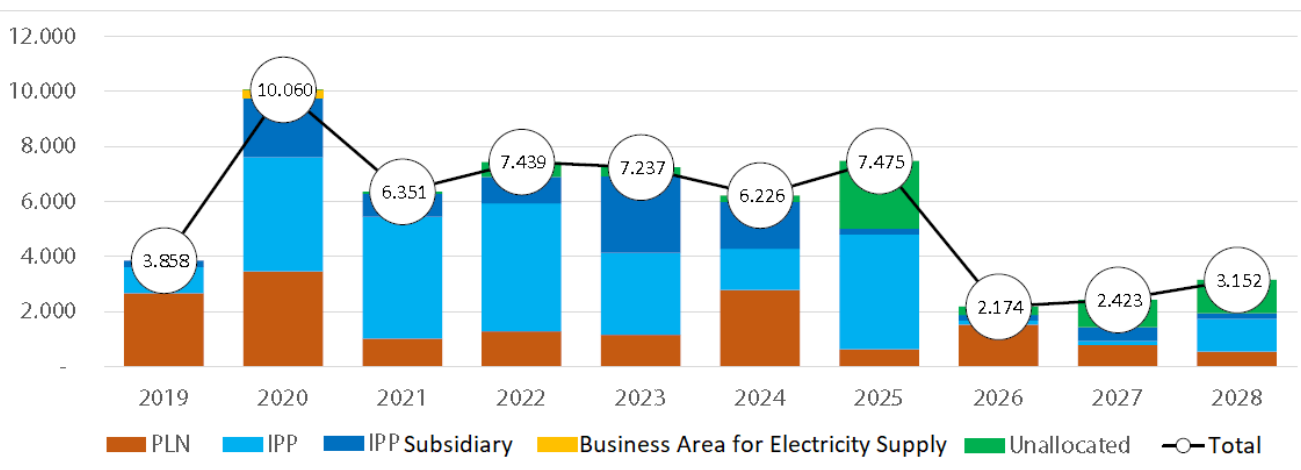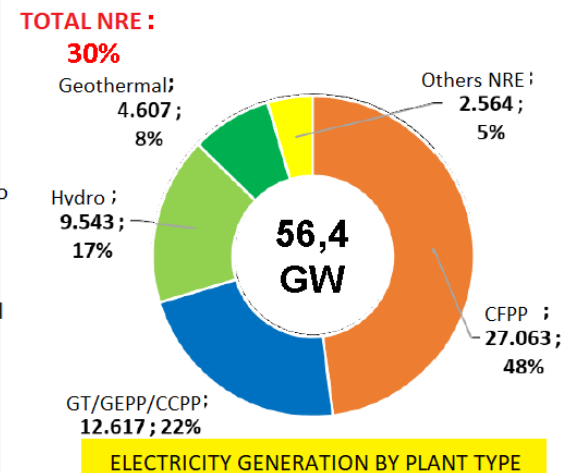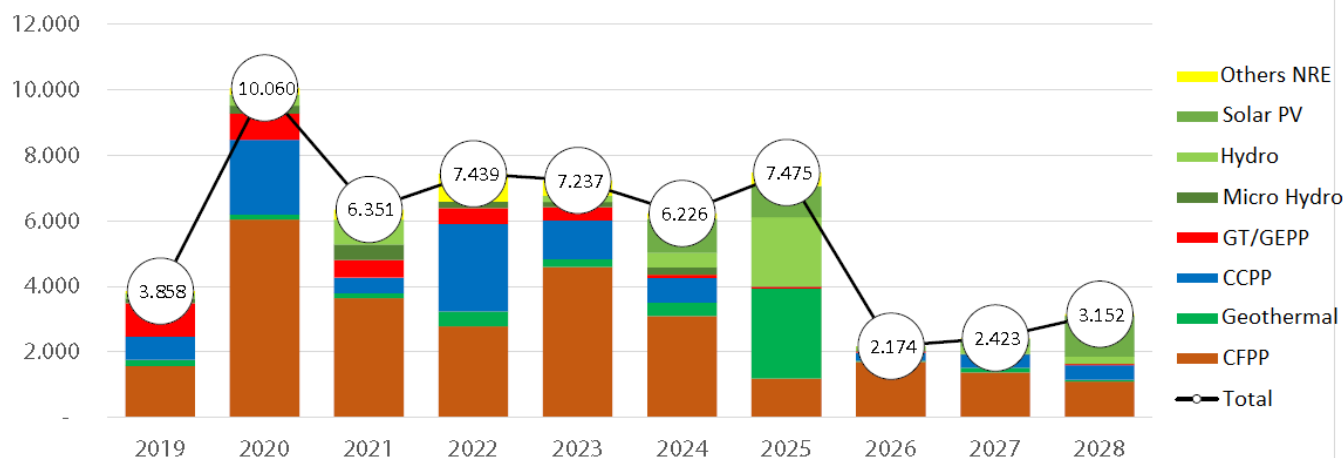
Development Plan for NRE

No.	RE Power Plant	Capacity	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Total
1	Geothermal	MW	190	151	147	455	245	415	2.759	45	145	55	4.607
2	Hydro	MW	154	326	755	-	182	1.484	3.047	129	466	1.467	8.010
3	Mini Hydro	MW	140	238	479	200	168	232	27	20	20	10	1.534
4	Solar	MWp	63	78	219	129	160	4	250	-	2	2	907
5	Wind	MW	-	-	30	360	260	50	150	-	-	5	855
6	Biomass/waste	MW	12	139	60	357	50	103	19	5	15	35	795
7	Ocean	MW	-	-	7	-	-	-	-	-	-	-	7
8	Bio-Fuel	Million litre	520	487	291	167	151	146	154	159	166	175	2.416
Total		**MW**	**559**	**932**	**1.697**	**1.501**	**1.065**	**2.288**	**6.252**	**199**	**648**	**1.574**	**16.715**

ENERGY CHALLENGE IN INDONESIA

1. **Operational Efficiency**
   - *T&D losses is 8.75% (2017), below ASEAN average 7.24% (2016)*
   - *Limited visibility under the Low-Voltage network*

2. **Service Reliability**
   - *Reserve margins of small systems outside Java-Bali are still under 30%*
   - *The product quality is still relatively low (SAIDI, SAIFI) comparing to ASEAN countries*
   - *Demand Response as an alternative deems more data at the demand side (customer)*

3. **Clean Energy (CO_2 emission)**
   - *Electricity industry contributes to 33% CO_2 emission (RUEN, 2017)*
   - *Indonesia commits to reduce 29% of CO_2 (RUEN, 2017)*

4. **Sustainability**
   - *It is estimated that Oil, gas, and coal will only last up to 12, 33, and 82 years respectively*
   - *RE development is expected to reach 23% in 2025*

PLN SMART GRID OBJECTIVE

1. **Energy Efficiency Solution**
   - *Improve Non-Technical Losses*
   - *Client side demand information integration through two-ways metering infrastructure*

2. **Service Reliability Solution**
   - *Prevent or reduce black-out and minimize feeder outage*
   - *Better accessibility to the network (real time monitoring)*

3. **Better Access & Lower CO2 Emission (Productivity Solution)**
   - *Increase participation of RE, especially the smaller or isolated island*
   - *Combining and integrating RE or Distributed Generation into the grid*
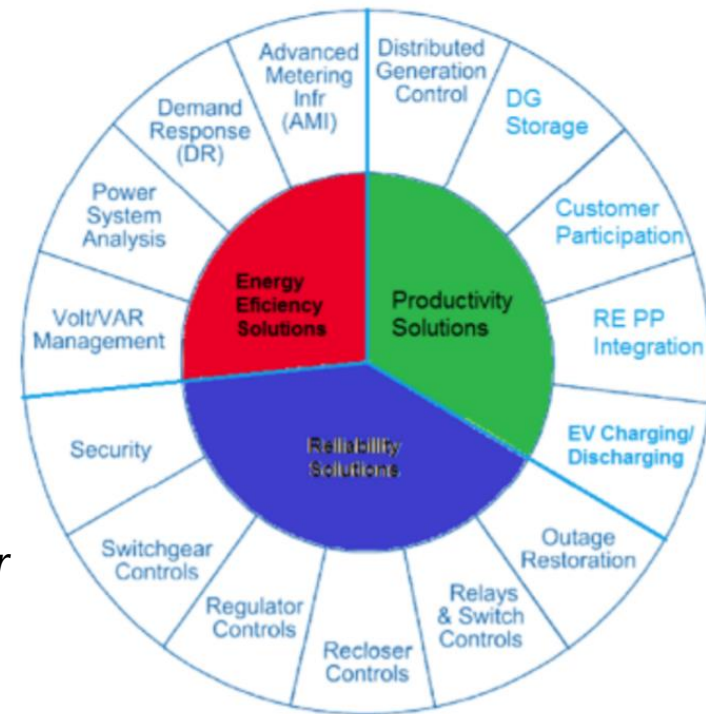
PLN Smart Grid Related Projects

Smart Micro Grid toward "SUMBA Green Island"

A pilot project brought together with Indonesian Agency for the Assessment and Application of technology(BPPT) and Indonesian Directorate-General of RE and Renewable Conservation

Objectives:

- *Demonstrate that RE intermittency could be penetrated more into the grid while maintain its reliability through smart grid.*

- *Reduce the reliance on limited fossil fuels*

Lesson Learned:

ICT allows solar PV feed into the grid gradually and then reduce the diesel load while maintaining the demand.
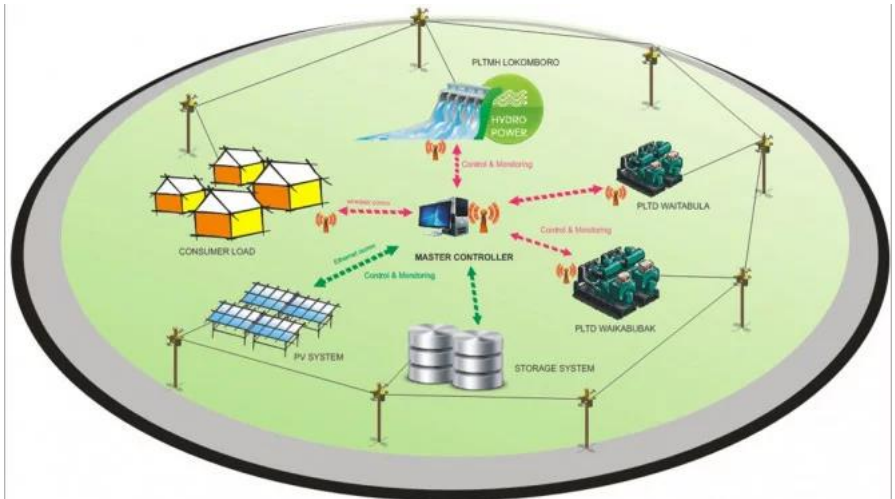
PLN Smart Grid Related Projects

Smart Community in Karawang Industrial Estate

A pilot project brought together with Indonesian Directorate-General of RE and Renewable Conservation and New Energy and Industrial Technology of Japan

Objectives:

Business simulation of Demand Response management through Power Quality and Incentive/Premium tariff
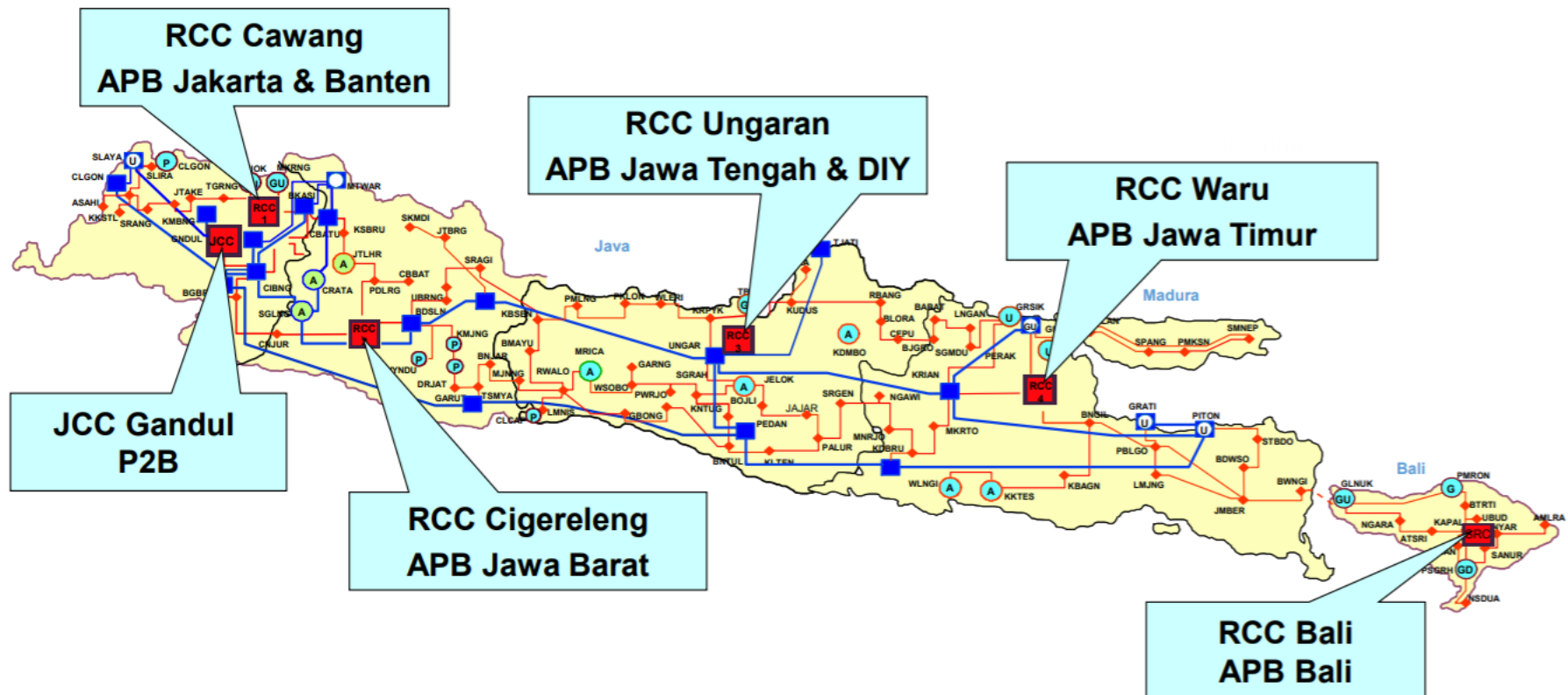
Lesson learned:

ICT combined with appropriate business scheme enables Demand Response Management which may result in better reliability and productivity

PLN Smart Grid Related Projects
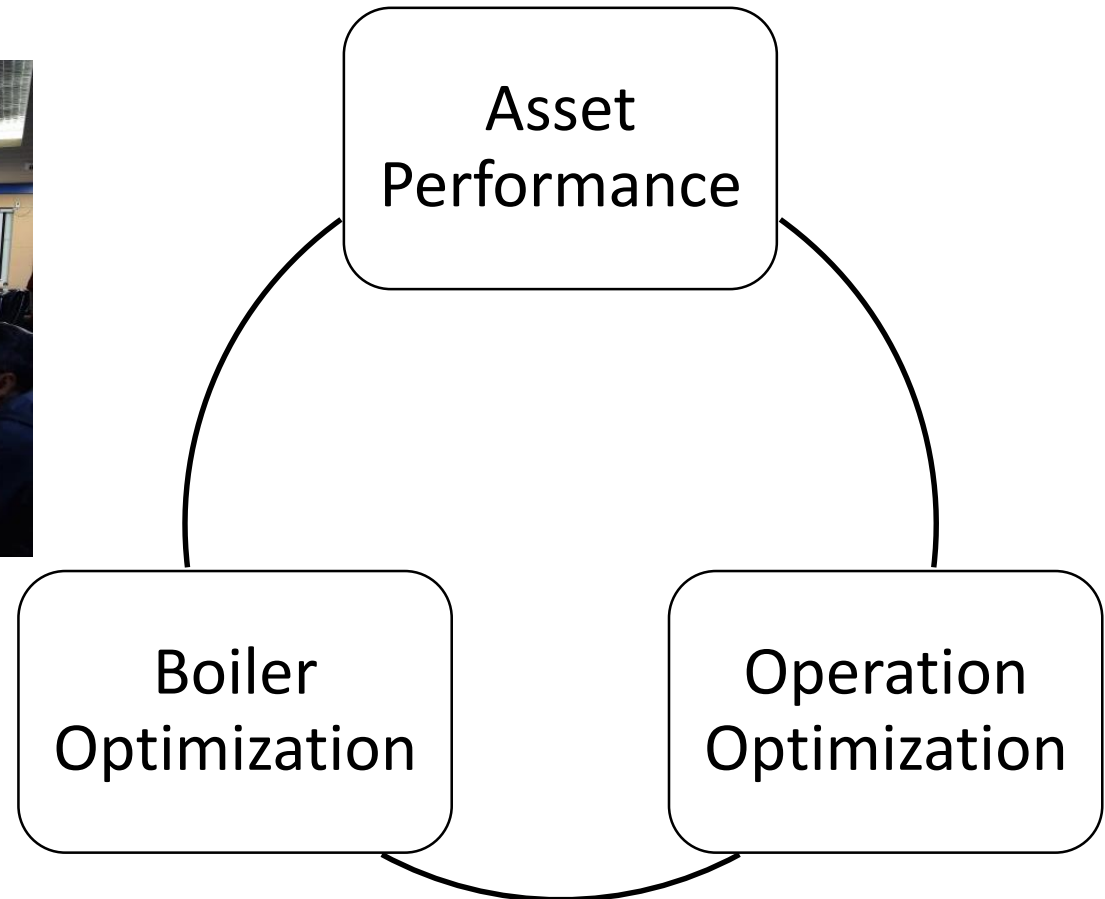
Smart System- JAWA BALI

PLN Smart Grid Related Projects

Power Generation → Predictive Analytics

PJB Remote Engineering, Monitoring, Diagnostic and Optimization Centre (REMDOC)

Asset Performance

Operation Optimization

Boiler Optimization

Source: PJB REMDOC, 2018

AMI (advanced Metering Infrastructure)

PLN

AMI (advanced Metering Infrastructure)

Several small scale projects of Two-Ways System fully or partially funded by third parties.
Pilot Projects:
1. *Two-ways communication using SMS for BTS and Adv. Billboard (2014 – 2017)*
2. *Two ways for 1000 meters in Bali island using Low Power Wide Area Network (2016)*
3. *Business Simulation for data/multimedia service and smart home using cellular network (3G/4G) in BSD Serpong*
4. *Two ways for small community in Nusa Lembongan island in Bali using BPLC technology (2018)*
5. *Two ways for 1344 meters in Batam island using BPLC technology (2018)*
6. *Two ways for 308 meters in Cengkareng are using BPLC technology (2018)*

Objectives:
1. *Performance measurement of Communication technologies for two-ways system*
2. *Proof of Concept of Two-ways features such as hourly data reads, wireless top-up for prepaid etc.*

Lesson learned :
1. *No silver bullet in communication technology for the whole Indonesia, depends heavily on the geographical condition and technology readiness*
2. *A segmented and clustered approach may easier to implement and measure compare to one that is dispersed.*

PLN Smart Grid On-going Projects

1. Deployment of AMI for one millions customers in Jakarta - "first stage"

2. Four Smart micro grid projects funded by ADB:
   - Selayar : PV 1.3 MWp + Battery 800 kW + Existing Diesel
   - Tahuna : PV 1.3 MWp + Battery 800 kW + Existing Diesel
   - Medang : PV 350 kWp + Battery 1200 kW + 150 kW Diesel
   - Semau : PV 450 kWp + Battery 450 kW + 1600 kW Diesel

3. Implementation ADS (Advanced Distribution System) for Sumba Timur and NTT micro-grid system PV + Diesel (US AIDS)

4. Digital Substations: 1) Sepatan I : 4 Line Bay, 1 Bus Couple, 3 Trafo Bay and 20 kV cubicle 2) Teluk Naga II : 2 Line Bay, 1 Bus Couple, 2 Trafo Bay and 20 kV cubicle

5. Predictive Analytic on Power Generation:
   - Remote Engineering, Monitoring, Diagnostic & Optimization Centre (REMDOC) phase 2 in PJB
   - REOC (Reliability Efficiency Optimization Center) in Indonesia Power

PLN Smart Grid On-going Projects

6. *PLN Smart Grid maturity level assessment using Carnegie Mellon's SGMM (join with India Smart Grid Forum and Universitas Indonesia)*

7. *Block Chain pilot project – phase 1 (PLN Research Institute join with Chaintope, Japan)*

8. *Smart Grid and Power System Study funded by Economic Ministry of France (join with Think Smart Grid France): 1) Defence scheme of Sulawesi system 2) Mandalika Smart micro grid*

What's Collaboration PLN Needs?

1. **Smart Grid Study:**
   - *Renewable energy grid integration*
   - *Grid defense scheme and stability system*
   - *DC House for rural electrification*
   - *Wide Area Monitoring Control*
   - *Distributed energy resources etc.*

2. **"Pilot Project" for Smart Grid:**
   - *Hybrid Energy Management System → Smart Micro Grid*
   - *BESS (Battery Energy Storage System) application*
   - *e-Mobility (Electric Vehicle platform)*
   - *Distribution Automation*
   - *Digitalization of Sub-station etc.*

3. **"Capacity building" for Smart Grid**

THANK YOU

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