Smart Grid Development in Indonesia

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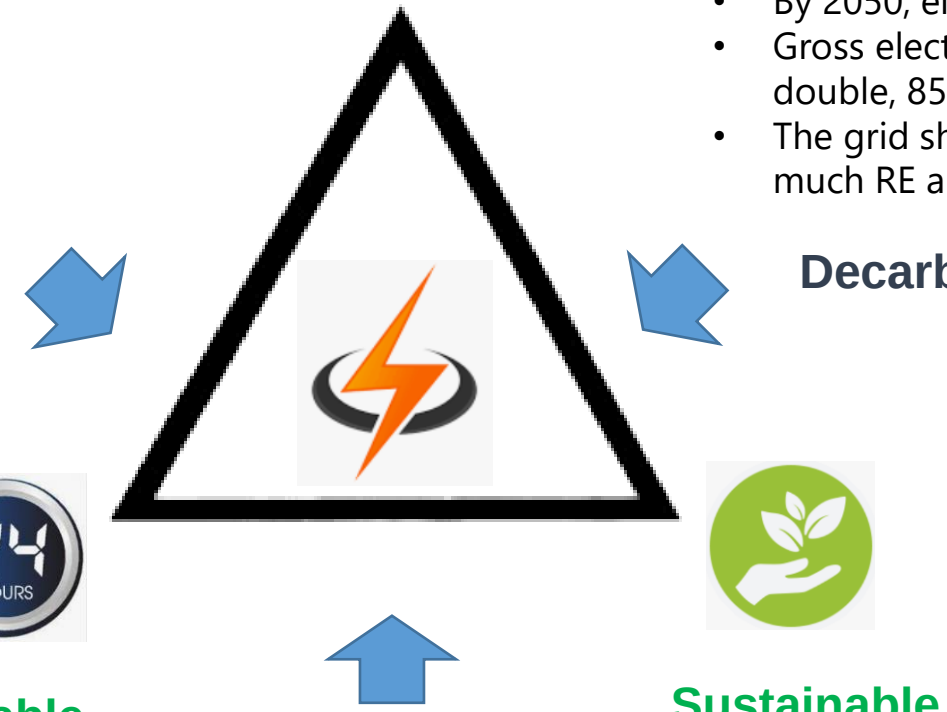
Energy Challenge in Indonesia

- *Losses* Transmission and Distribution is still higher than an average of ASEAN and Global
- LCOE is also relatively high

Affordable

Energy Transition driven by 3D:

- By 2050, electricity become the central energy carrier.
- Gross electricity consumption would more than double, 85% will come from renewable power
- The grid should be "**more flexible**" to integrate with much RE and all energy resources



- Quality of product is still lower than ASEAN's

- Power utility contribute to 33% CO_2 in nation
- Electricity production is still dominated by fossil fuel: 88.67%: Coal 66.55%, Gas 21,99% and Fuel oil 4.23%. Renewable energy mix is 11.23%

Source: World Energy Forum (2019); PLN (2020)

PLN Smart Grid

	Power Plant	Transmission	Distribution	Retail/Customer
Main Benefits	▪ Reduce CO2 emission ▪ Better load curve ▪ Better asset utilization to increase Return On Asset ▪ Reduce number of "peakers"	▪ Reduce transmission congestion impact ▪ Better transmission network ▪ Reduce outages	▪ Reduce number of damage meter ▪ Reduce distribution congestion impact ▪ Faster recovery time ▪ Reduce Outage ▪ Better losses visibility	▪ Reduce meter reading and field servic cost ▪ Revenue assurance ▪ Improve customer satisfaction ▪ Prevent broader impact of equipment outage
Some Main Technologies	Wide Area Monitoring Control	Transmission Enhancement Applications	Distribution Grid Management Advanced Metering Infrastructure (AMI)	
	Information and Communication Technology Infrastructure			
	Energy Storage Technology			
Grid Configuration	High Voltage Grid		Medium Voltage Grid	Low Voltage / Off Grid

Source: IEA (2018); PLN (2020)

Smart Grid - PLN Transformation

GREEN BOOSTER

- PV floating
- Co-firing Biomass
- Smart Micro grid (D3)

LEAN THROUGH DIGITALIZATION

- Digital Procurement
- T&D Digitalization (D1)
- Power plant Digitalization (D1)

INNOVATIVE PRODUCT

- EV charging station (D3)
- Total Power Solution (D2)

CUSTOMER ENGAGEMENT

- PLN Mobile (D2)
- Charge.in for EV customer (D2)
- AMI (D2)

Source: PLN (2020)

Roadmap Smart Grid

	2021-2025	2026 →
Purposes	**Reliability, efficiency, customer experience and grid productivity**	**Resiliency, customer engagement, sustainability and self healing**
Main Initiatives	**Power plant Digitalization** for improving efficiency **Sub-Station Automation and Digitalization** selectively for improving power quality **Distribution Grid Management** for improving reliability and faster respond **EV Charging Station and *e-mobility*** for EV ecosystem development **Smart Micro Grid** for increasing RE penetration and decreasing LCOE at some isolated areas **AMI implementation** by clustering approach	**Upgrading SCADA to *Wide Area Monitoring, Protection and Controlling System (WAMPAC)*** for improving the system resiliency **Interconnecting Distributed Energy Resources** to the grid **Integrating Energy Storage** for VRE penetration and system stability **Implementing Dynamic Line Rating** for improving the system resiliency and self healing capability **Demand response** for customer engagement to increase the system efficiency

Source: PLN (2020)

Initiative 1: Power plant Digitalization

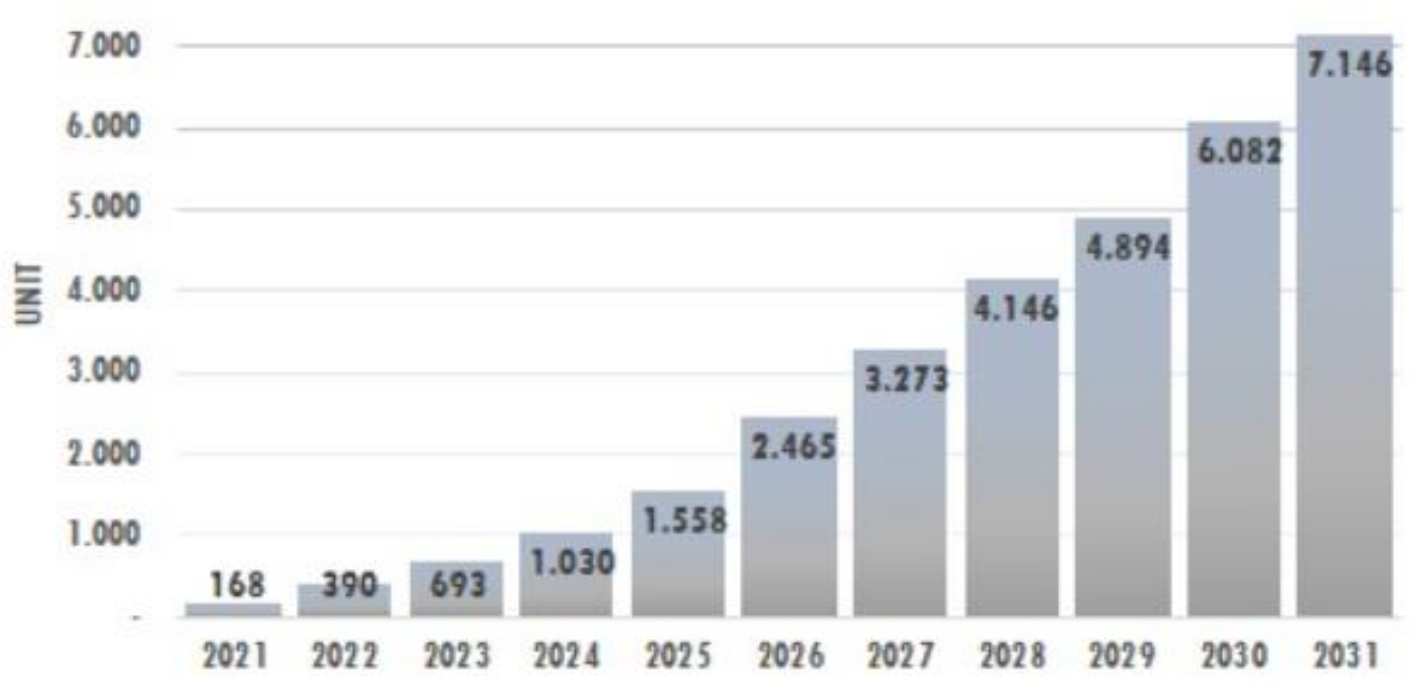
Program	Sub-Program	2021	2022	2023	2024	2025
Roll out Advanced Analytics	Plant Heat Balance Monitoring dashboard	16	16	10	10	10
	Performance Index & Forecast dashboard	16	16	13	13	13
	Combustion Optimization Monitoring dashboard	9	9	7	7	7
	Plant Heat Balance & Combustion Optimization	10	10	7	7	7
Digital Control Room	-	18	17	1	1	1
Digitized O&M Procedure	-	18	17	7	7	7
Productivity through IoT/Automation	-	13	12	7	7	7
Predictive / Proactive Maintenance	-	13	10	7	7	7

Source: PLN (2020)

Initiative 4: EVCS and e-Mobility

Planning of EVCS Development (PLN : Partnership = 40 % : 60 %)

PLN Mandiri	67	156	277	412	623	986	1309	1658	1958	2433	2858
PLN Partnership	101	234	416	618	935	1479	1964	2487	2936	3649	4288



Assumption :

1. The estimated of EVCS investment based on some EVCS has been built by PLN.
2. Ratio for each type of EV Charging based on the following table:

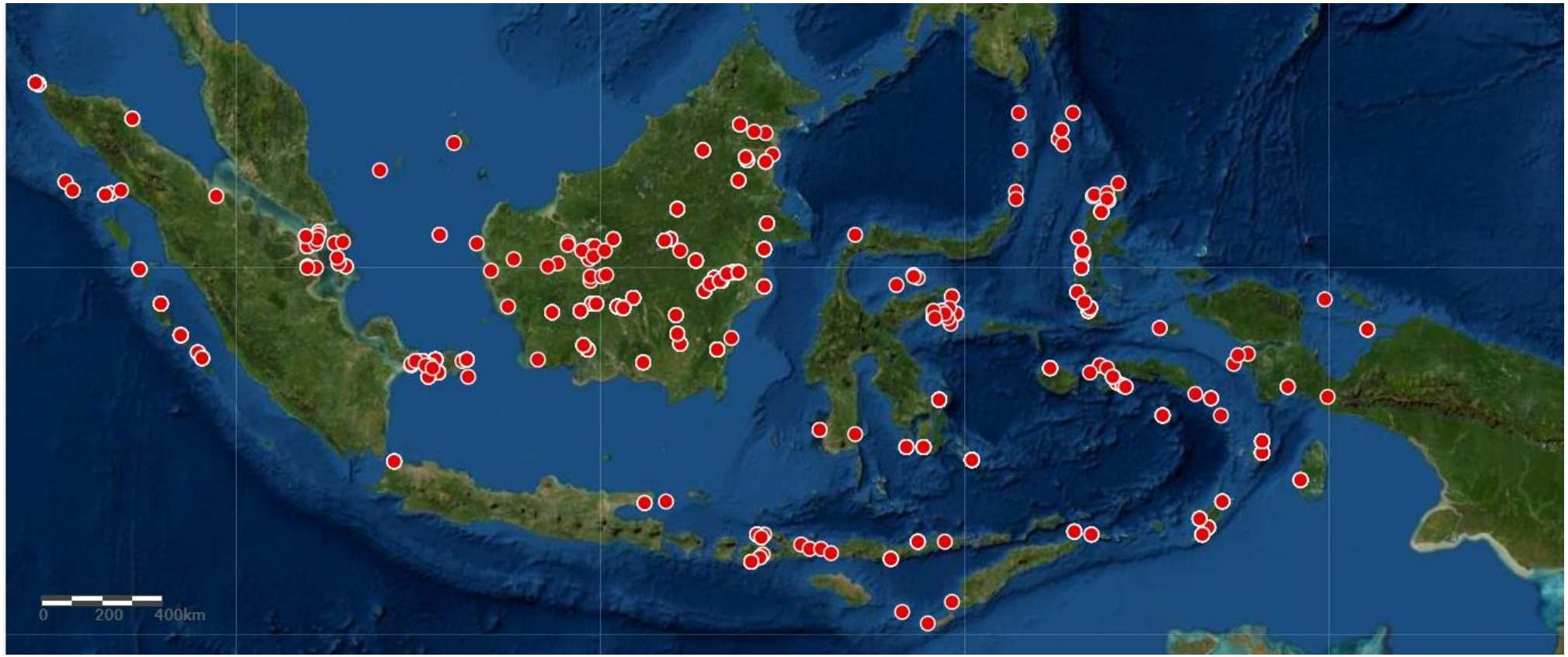
Tipe	Ratio
Fast Charging	20%
Medium Charging	50%
Slow Charging	30%

3. The total estimated investment for EVCS development until 2031 is about ~ IDR 4,35 T (US$ 281 M)

Source: PLN (2020)

Initiative 5: Smart Micro Grid

	2021	2022	2023
Replacing Diesel to Renewable Energy (PV + Battery) - MW	225	500	1.300



Conclusion

1. The development of a smart grid in Indonesia is to answer the challenges of electricity supply (***efficiency / losses, reliability, resiliencyy*** and ***sustainability***) as well as to support the energy transition process (***De-carbonization, Digitalization*** and ***Decentralization***).

2. In line with the ***PLN Transformation*** program, some of the transformation initiatives are related to the development of a smart grid in Indonesia, including: ***Power plant Digitalization***, ***e-mobility***, ***Digitalization of T&D***, ***Micro grids (De-dieselization)***, ***PLN Mobile*** and others.

3. At the ***short term***, the road map implementation of the smart grid in Indonesia focuses on ***reliability, efficiency, customer experience*** and ***grid productivity*** with an estimated CAPEX of IDR 10-25 T (US$ 645 M – 1,6 B). While the ***long term*** focuses on ***resiliency, customer engagement, sustainability*** and ***self-healing*** with an estimated CAPEX of IDR 30-50 T (US$ 1,9 – 3,2 B).

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THANK YOU