ISSUES ON GRID INTEGRATION OF SMALL HYDRO IN INDONESIA

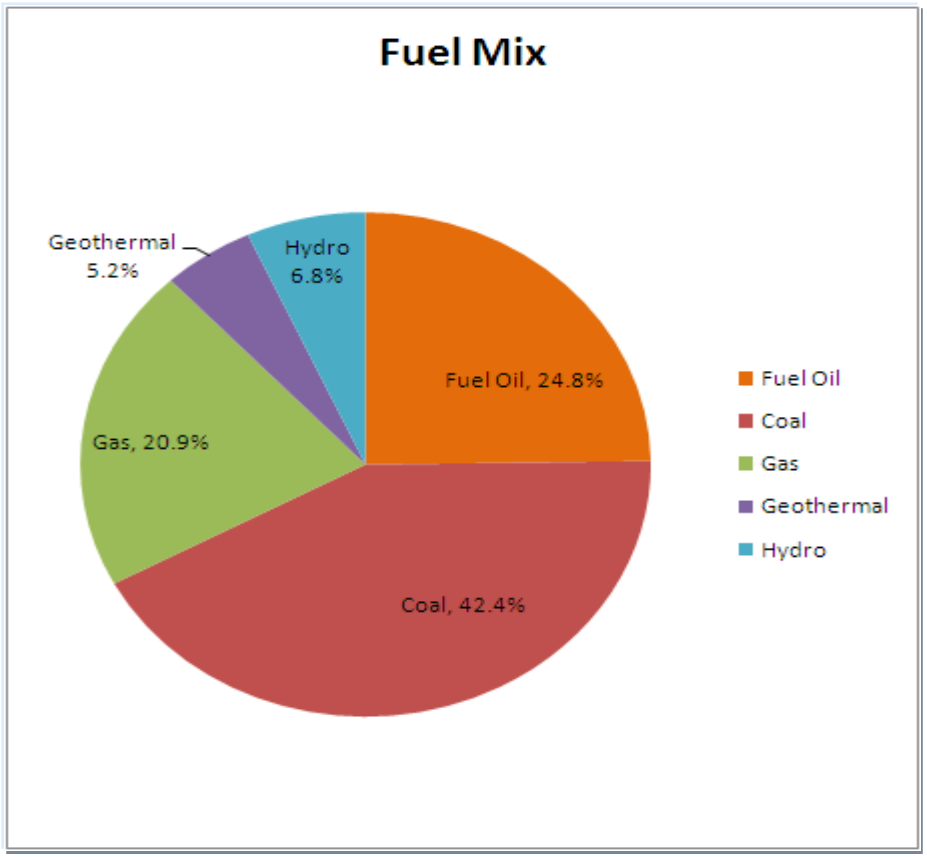
PLN's PERSPECTIVE

System Planning Division
PLN

APEC Workshop on Small Hydro and Renewable Grid Integration
Ha Noi, Viet Nam
April 3-5, 2013

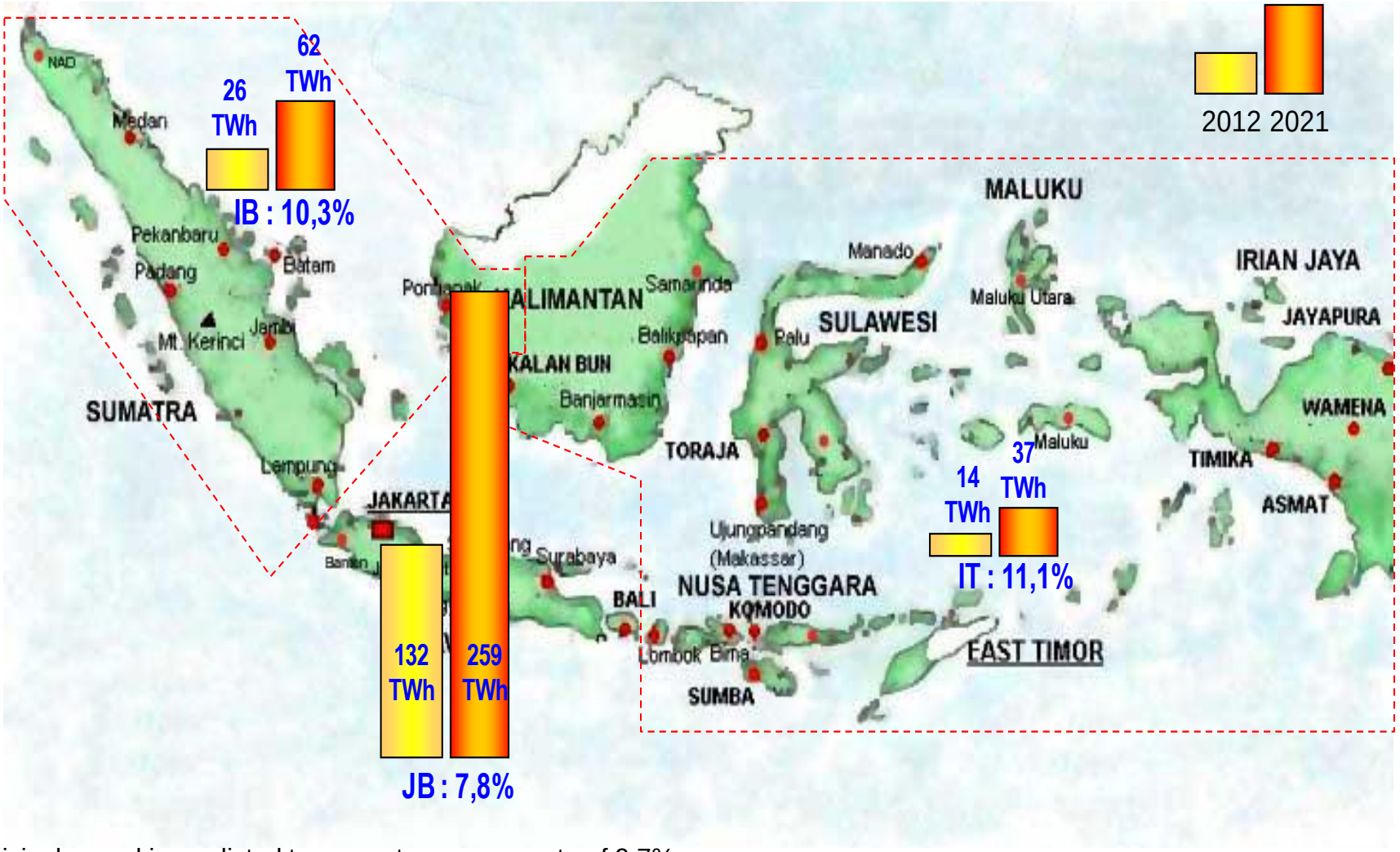
Profile of PLN (Statistic 2011)

No	Description	
1.	Installed Capacity	**29.268 MW** *exclude IPP (5.390 MW)
2.	Peak Load	**26.665 MW**
3.	Energy Production	**184 TWh**
4.	Energy Consumption	**160 TWh**
5.	Number of Customers	**45,9 m**
6.	Transmission Line	**36.720 kmc**
7.	Distribution Line	**679.424 kmc**
8.	Revenue	**21 b USD**
9.	Electrification Ratio	**74%**



RE power plants : Hydro 3.856 MW, Geothermal 780 MW

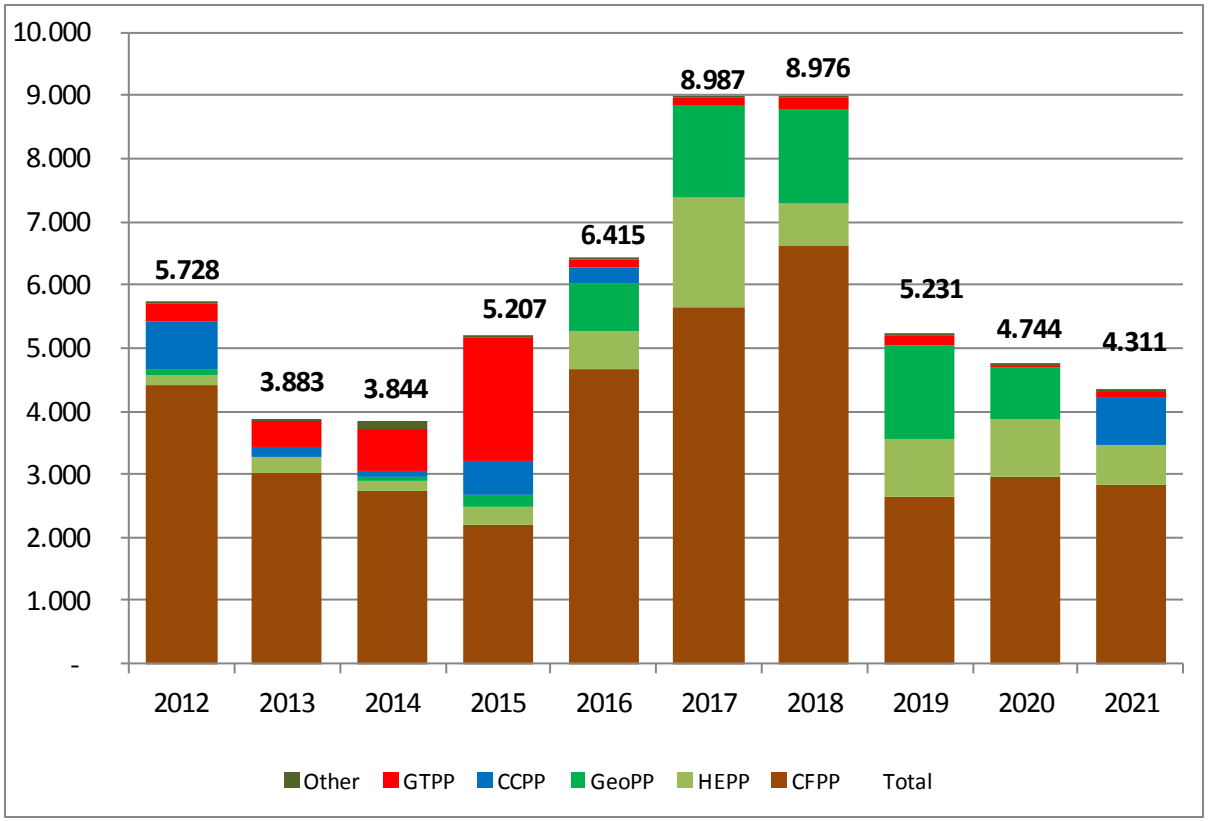
Demand of electricity is expected to grow fast (2012-2021)



Electriciy demand is predicted to grow at a average rate of 9,7% per year.

Source : RUPTL PLN 2012-2021

Need to build 55 GW new power plant to serve the demand growth



Approx New Capacity: 55 GW

Coal : 38 GW

Geothermal: 6.4 GW

Comb. Cycle: 2.5 GW

GT/Gas Eng.: 4 GW

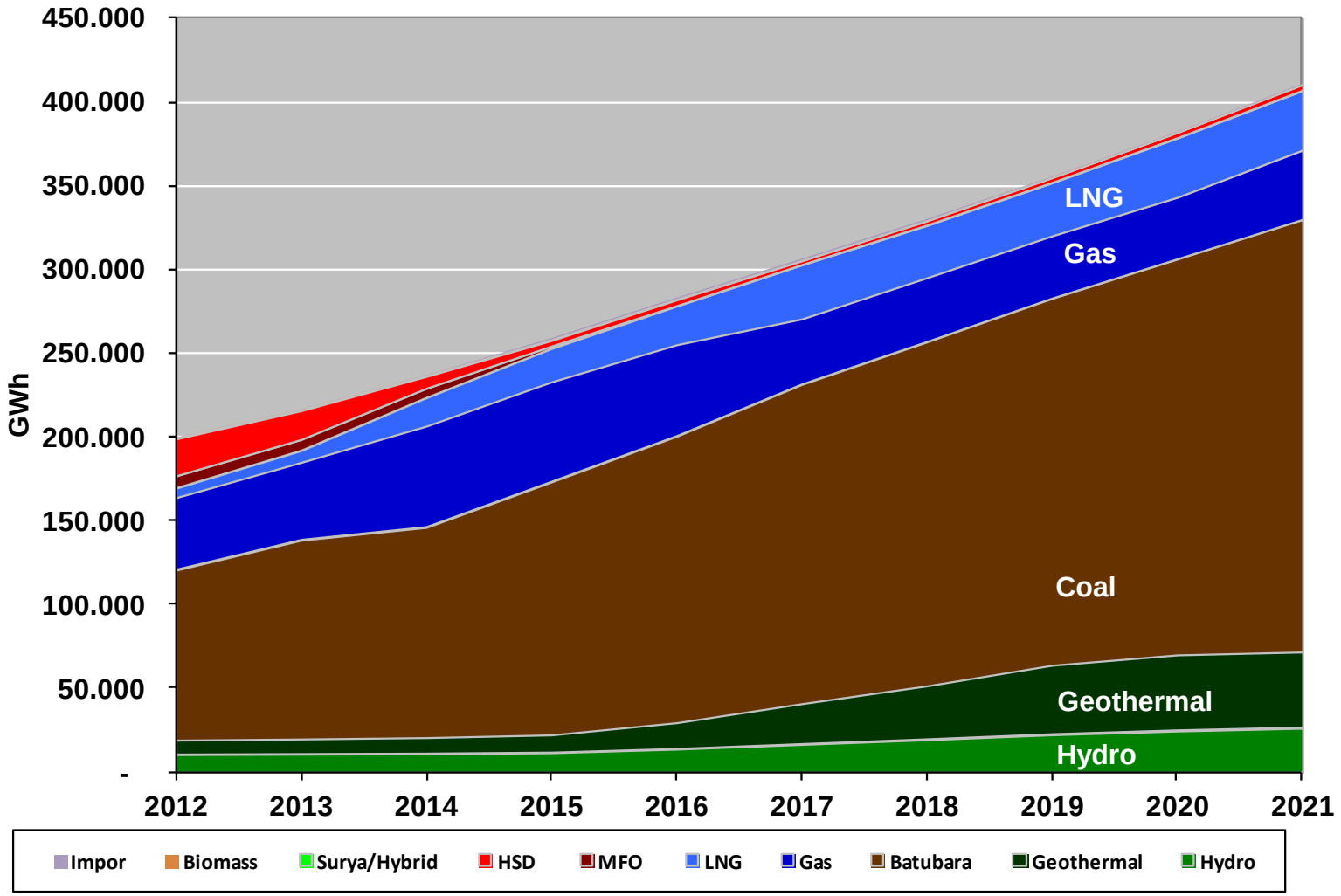
Hydro/Mini Hydro: 5.3 GW

Others: 0.25 GW

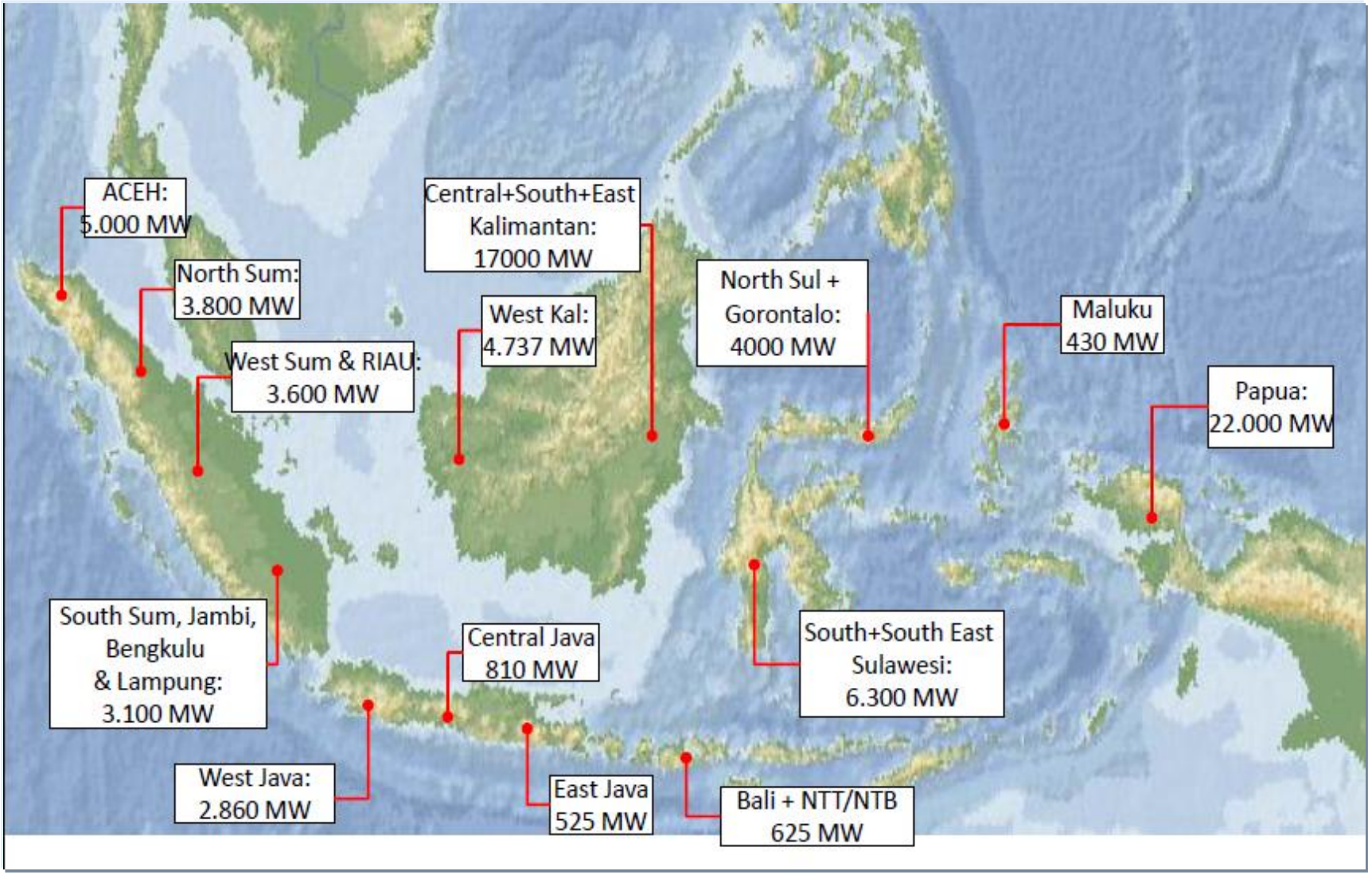
Mini hydro is about 1,500 MW

Source : RUPTL PLN 2012-2021

Coal dominates fuel mix, RE role is increasing



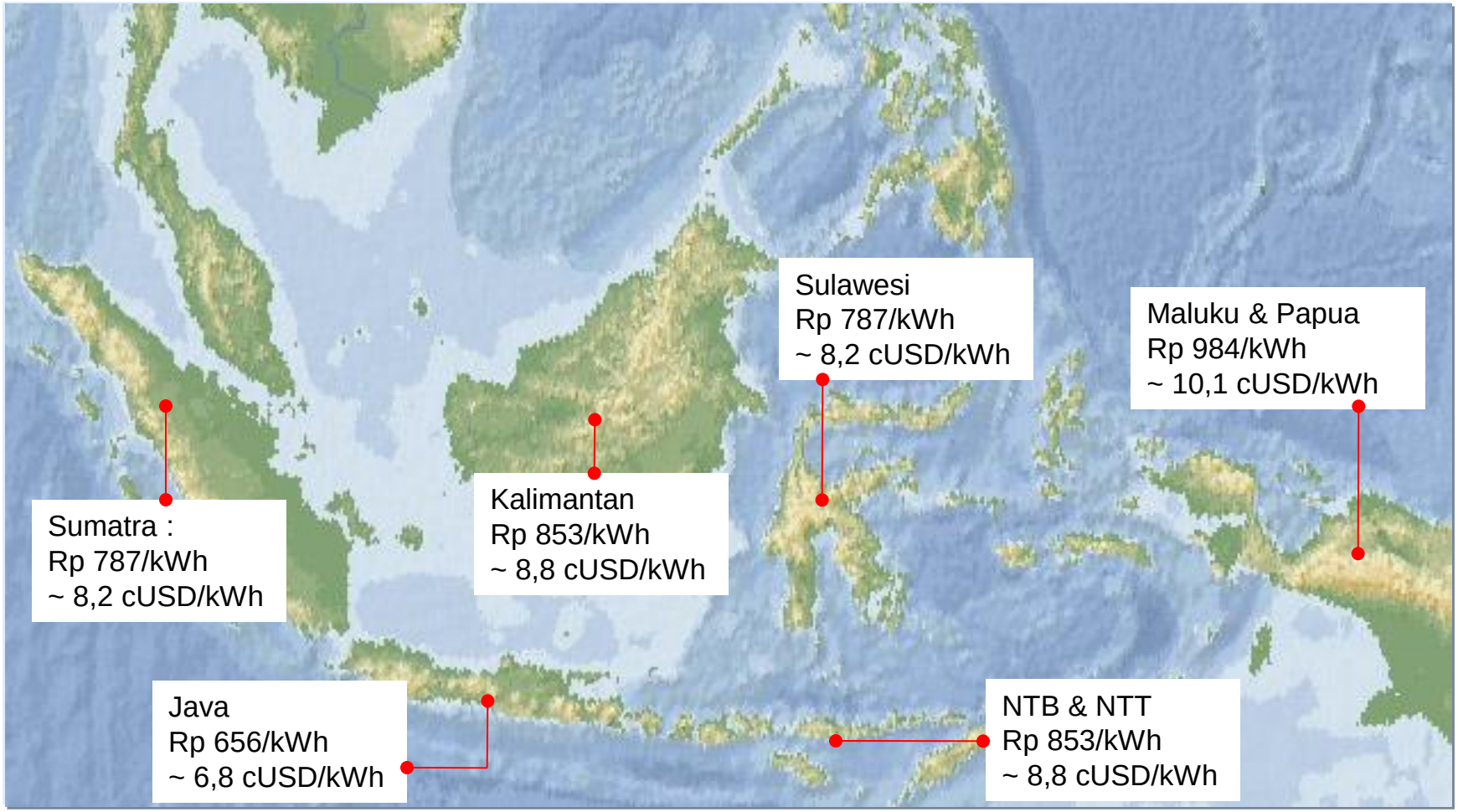
The hydro potential is promising



75 GW hydro potential, after strict screening (environmental & social) is about 26.3 GW 167 location, and further narrow to 12,9 GW 89 location

Source : Hydro Power Potential Study 1983, Hydro Power Inventory Study 1999, Master Plan of Hydro Power Development in Indonesia by Nippon Koei 2011

FIT encourages RE, especially Small Hydro



MEMR Ministerial Decree No. 04/2012 FIT Small Hydro < 10 MW

1 USD = Rp 9,700

More Small Hydro and Other RE is planned

NO	PEMBANGKIT EBT	SATUAN	TAHUN										TOTAL
			2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
1	PLTMH	MW	40	99	113	112	101	185	188	201	189	260	1488
2	PLT SURYA	MWp*)	6	84	125	150	100	75	75	80	80	80	855
3	PLT BAYU	MW	0	10	50	50	15	15	20	20	25	25	230
4	PLT BIOMASS	MW	22	40	90	35	40	40	45	45	50	40	447
5	PLT KELAUTAN	MW	0	2	0	0	5	5	5	5	5	27	54
6	PLT BIO-FUEL	MW**)	10	15	15	14	8	7	7	8	9	8	101
7	PLT GAS-BATUBARA	MW	32	81	43	22	7	22	14	6	10	10	247
TOTAL		**MW**	**110**	**331**	**436**	**383**	**276**	**349**	**354**	**365**	**368**	**450**	**3.422**

Up to 1,500 MW mini hydro for the next 10 years

Source : RUPTL PLN 2012-2021

Progress for small hydro until now [1]

SUMMARY OF MHPP DEVELOPMENT BY IPP

Maret 2013

Region	IPP		Cumulative	
	Number	Installed Capacity (kW)	Number	Installed Capacity (kW)
West Indonesia	90	570,315		
Operation	7	21,095	7	21,095
Construction	13	100,858	20	121,953
Financing	25	161,120	45	283,073
PPA Process	14	85,668	59	368,741
Proposal	31	201,574	90	570,315
East Indonesia	55	193,920		
Operation	13	37,640	13	37,640
Construction	10	31,700	23	69,340
Financing	13	48,700	36	118,040
PPA Process	9	39,780	45	157,820
Proposal	10	36,100	55	193,920
Java-Bali	94	302,383		
Operation	9	2,530	9	2,530
Construction	13	28,180	22	30,710
Financing	15	70,790	37	101,500
PPA Process	30	93,684	67	195,184
Proposal	27	107,199	94	302,383
Total Indonesia	**239**	**1,066,618**		
Total Operation	**29**	**61,265**	**29**	**61,265**
Total Construction	**36**	**160,738**	**65**	**222,003**
Total Financing	**53**	**280,610**	**118**	**502,613**
Total PPA Process	**53**	**219,132**	**171**	**721,745**
Total Proposal	**68**	**344,873**	**239**	**1,066,618**

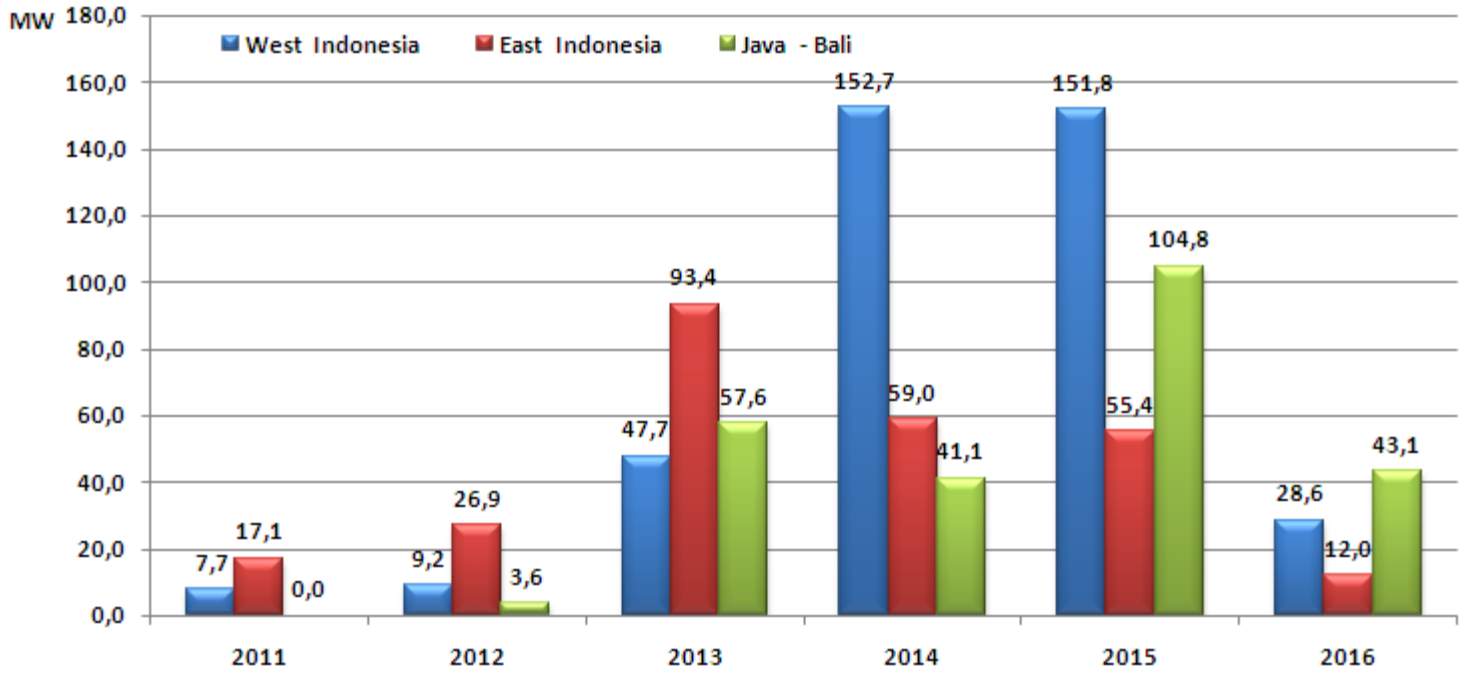
PPA signed to date 502 MW

Progress for small hydro until now [2]

SUMMARY OF MHPP DEVELOPMENT BY PLN
Maret 2013

Region	PLN		Cumulative	
	Number	Installed Capacity (kW)	Number	Installed Capacity (kW)
West Indonesia	39	26,570		
Operation	34	15,582	34	15,582
Construction	0	-	34	15,582
Procurement	0	-	34	15,582
Study	5	10,988	39	26,570
East Indonesia	75	117,185		
Operation	43	52,330	43	52,330
Construction	3	5,500	46	57,830
Procurement	17	37,700	63	95,530
Study	12	21,655	75	117,185
Java-Bali	36	72,768		
Operation	36	72,768	36	72,768
Construction	0	-	36	72,768
Procurement	0	-	36	72,768
Study	0	-	36	72,768
Total Indonesia	**150**	**216,523**		
Total Operation	**113**	**140,680**	**113**	**140,680**
Total Construction	**3**	**5,500**	**116**	**146,180**
Total Procurement	**17**	**37,700**	**133**	**183,880**
Total Study	**17**	**32,643**	**150**	**216,523**

5 years Programme



COD / Capacity (MW)

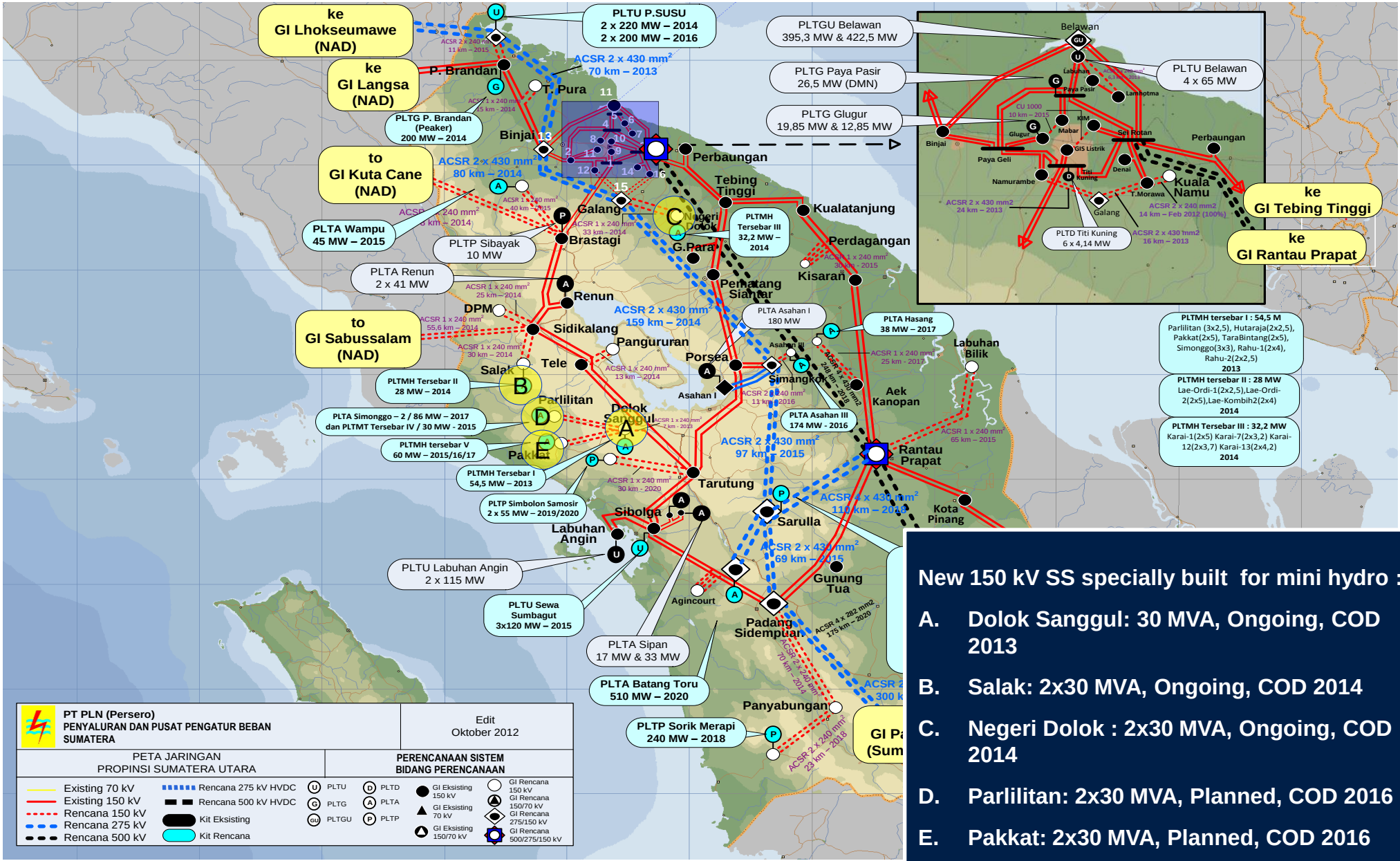
REGION	2011	2012	2013	2014	2015	2016	GRAND TOTAL
West Indonesia	7.7	9.2	47.7	152.7	151.8	28.6	**397.6**
East Indonesia	17.1	26.9	93.4	59.0	55.4	12.0	**263.8**
Java - Bali	0	3.6	57.6	41.1	104.8	43.1	**250.2**
GRAND TOTAL	**24.8**	**39.7**	**198.7**	**252.8**	**312.0**	**83.7**	**911.6**

But connecting to the Grid is not always easy, many issues arise

Issue 1. Expanding the Grid to reach them

- Connection issues due to remote location
  - Too remote : islanding operation for local load and doesn't connect to PLN's grid, forming micro grids
  - Connecting to 150/20 kV substation
  - Connecting to nearest 20 kV distribution network
  - In some cases, PLN needs to build section of 150 kV T/L and 150/20 kV substation, revising on-going transmission expansion plan
- Economic issues : location will greatly affect project viability

In some areas, PLN needs to build 150 kV Substation and extend T/L, revising the on-going power development plan



New 150 kV SS specially built for mini hydro :

A. **Dolok Sanggul: 30 MVA, Ongoing, COD 2013**

B. **Salak: 2x30 MVA, Ongoing, COD 2014**

C. **Negeri Dolok : 2x30 MVA, Ongoing, COD 2014**

D. **Parlilitan: 2x30 MVA, Planned, COD 2016**

E. **Pakkat: 2x30 MVA, Planned, COD 2016**

Issue 2. Site overlapping between PLN and developers

- No single authoritative agency :
  - Principal permit, location permit, environment assesment issued by local governments
  - Approval to proceed to PPA and operation-worthy certificate is given by central government c.q Ministry of Energy and Mineral Resources
  - Pre-qualification, direct appointment process and PPA is processed by PLN, FIT is used for PPA periods 2x15 years
- Need coordinated approach/one gate processing centre.
- New proposals need to consult with the prevailing power development plan (RUPTL 2012-2021)

Issue 3. Operational aspect of small hydro integration

- Distribution code : MEMR Ministerial Decree No 4/2009
- Need to ensure that the distribution system working properly after small hydro connected, as distribution system is mostly designed, operated and protected with a single voltage source on each distribution feeder, and the connection alter this existing operation pattern.
- Conditions to be maintained in the system are:
  - voltage regulation;
  - thermal ratings of equipment being not exceeded;
  - fault ratings of switchgear and cables being not exceeded;
  - fault current contribution;
  - Power quality, voltage disturbance affected in terms of step changes, flicker and harmonics being kept to a minimum and within accepted limits;
  - reverse power flow
  - protection coordination, fault clearance
  - etc

Concluding Notes

- There are other issues : metering point, coordination of outage schedule, automation/SCADA/telecom, SOP, etc
- Mini hydro improve fuel mix, reduce losses, improve voltage profile on distribution network
- FIT generates positive response from IPP developer
- Developers and PLN needs to work out on several issues such as site overlapping or connection issues
- PLN needs to adjust its network expansion plan to accommodate small hydro

Example of small hydro

Plumbungan 1.6 MW, Central Java, commissioned 2008

Siteki 1.2 MW, Central Java, commissioned 2008

Thank You...

Further Contact :

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