RE Deployment Strategies to Lower Generation Cost in Isolated Grids

PT PLN (Persero) – New and Renewable Energy Division

Renewable Energy Opportunities for Remote Indonesian
Mulia Hotel, Jakarta, October 1\textsuperscript{st}, 2014
AGENDA

1. INTRODUCTION: PLN POSITION IN ELECTRICITY BUSINESS
2. ELECTRICITY STATUS (ELECTRIFICATION RATIO, RE PENETRATION AND GRIDS)
3. RE OPPORTUNITIES FOR ISOLATED GRIDS
4. CHALLENGES
5. STRATEGIES
6. SUMMARY
INTRODUCTION: PLN AS STATE OWNED WITH THE SUBSIDIARIES

- Ministry of State Owned Enterprises (MSOE)
- Ministry of Energy and Mineral Resources (MEMR)
- Ministry of Finance (MoF)
- National Development Planning Agency (BAPPENAS)

PT PLN (Persero) 100% Owned by GoI

Oversight

- PT Indonesia Power
  - Electricity Generation
- PT Pembangkitan Jawa Bali
  - Electricity Generation
- PT PLN Batam
  - Regional Fully Integrated Electric Utility
- PT PLN Tarakan
  - Regional Fully Integrated Electric Utility
- PT Indonesia Comnets Plus
  - Telecommunications for the Electricity Sector
- Majapahit Holding B.V.
  - Financial Institution
- PT PLN Geothermal
  - Geothermal Energy Generation
- PT Prima Layanan Nasional Enjiniring Engineering and Construction Services
- PT PLN Batubara
  - Coal Supplier for PLN
- PT Pelayaran Bahtera Adhiguna
  - Shipping Activities
- PT Haleyora Power

Note: Excludes Joint Ventures.
INTRODUCTION: PLN POSITION IN ELECTRICITY BUSINESS

PLN is the wholly state-owned power utility company, the largest and the only fully-integrated power utility company in Indonesia.

PLN Business Segments:

- Controls over 85% of installed generating capacity Indonesia’s
- Main purchaser of electricity from Independent Power Producers (IPPs)
- Sole provider of power transmission in Indonesia
- Sole distributor of electricity to end customers in Indonesia
- Serving more than 50 million customers

(1) PLN is also the provider of electricity of last resort, in that if PLN is not supplying a particular area and there are no regional-owned companies, private enterprises or cooperatives that elect to supply electricity in that area, the Government is obligated to instruct SOEs (which includes PLN) to supply electricity to the area.
Electrification Ratio Target Realization

<table>
<thead>
<tr>
<th></th>
<th>Target</th>
<th>Realization</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLN</td>
<td>71.2%</td>
<td>73.1%</td>
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<tr>
<td>(PLN+ Non PLN)</td>
<td>73.7%</td>
<td>75.9%</td>
</tr>
</tbody>
</table>

ELECTRICITY STATUS: ELECTRIFICATION RATIO (2012)
- Large interconnection grids: Java-Bali System and Sumatra Grid System with 500 kV T/L
- Interconnection sub system grid: Kalimantan and Sulawesi Grid System with 150 kV T/L
- The rest are small system and isolated system and mostly is small islands with 70 kV T/L or 20 kV D/L
- Most grid system are under development
Power Plant Capacity: Renewable Power plant is 14%.

Generation (2013): Share of renewable energy is 9% only.

Almost all from hydro and geothermal, the other renewables share is less than 1%.
• Archipelago countries with a high electricity national demand growth, especially eastern part, and thousands islands without access electricity.

• A high potential of varies energy resources (hydro, geothermal, biomass, solar, sea and wind) but has not been optimally taped mainly for electricity.

• Generated power in the remote areas mostly by diesel power plant, means expensive and susceptible fuel supply.

• Trend of cost reduction and efficiency improvement on RE technologies.

• Policy and target decision to increase the role of renewable energy.

• Incentives from the government through FIT for small RE plant.
ELECTRICITY DEMAND PROJECTION (2013-2022)

Average annual growth by 8.4%

--- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ---
Demand (TWh) | 189 | 208 | 227 | 246 | 266 | 286 | 308 | 332 | 358 | 387
Elektrification ratio (%) | 79.6 | 82.6 | 85.9 | 88.9 | 91.9 | 93.7 | 95.3 | 96.8 | 97.4 | 97.8
# The Challenges and Stakeholders (1/2)

<table>
<thead>
<tr>
<th>Government and Regulation</th>
<th>Key Stakeholder: Ministries (MEMR, forestry, MoF) government agencies, local government</th>
</tr>
</thead>
<tbody>
<tr>
<td>- To create a harmonic coordination among government institution for permits, land acquisition, land use, national productivity, integrated planning, etc.</td>
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<td>- To provide strong, applicable and synchronous policies and regulation.</td>
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<td>- To reduce the number, complexity and duration process of permits</td>
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</tbody>
</table>

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<thead>
<tr>
<th>Technical</th>
<th>Key Stakeholder: Government agencies, PLN, developer, academic</th>
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<tbody>
<tr>
<td>- To maintain natural resources</td>
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<td>- To optimise interconnection small RE to the isolated grid</td>
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<tr>
<td>- To have the knowledge and expertise in solar PV technology, biomass technology and wind technology</td>
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<td>- To manage the system stability due to intermittent and high fluctuation of solar PV and wind power</td>
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<td>- To provide a sufficient infrastructure</td>
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<td>- To manage the mismatch between available resource and electricity demand</td>
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</table>
### THE CHALLENGES AND STAKEHOLDERS (2/2)

| Financial | • To obtain tariff, which is a commercially viable for developer and acceptable for the off taker  
• To provide incentive, subsidy including cheap funding  
• To provide an appropriate cost and risk allocation based on available data  
• To prioritize the lower risk and lower cost RE source such as hydro and biomass (solar tends to decrease) | Key stake holder: ministries (MEMR, MoF), government agencies (PIP), lender, banks, PLN |
| Capacity | • To increase the national capacity on both skilled/expertise human resources and institution (consultant, contractor and also IPP developer)  
• To increase the role of national capacity in RE development  
• To increase the participation small and local capacity for appropriate portion of development | Key stake holder: universities, consultant, contractor, manufactures, PLN |
| Social and environmental | • To manage the difference interest between environment sustainability and energy security  
• To provide benefit for local community to increase economic growth and capacity building  
• To manage the local interest to become supporting factor of the development | Key stake holder: ministries (MEMR, MoF), government agencies (PIP), lender, banks |
## RENEWABLES NON GEOTHERMAL AND LARGE HYDRO DEVELOPMENT PLAN
*(Total 2786 MW for the next 10 years)*

<table>
<thead>
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<td>Total</td>
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<td>Total</td>
<td>4815</td>
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</tbody>
</table>

Notes:
- The small scale RE power plants (up to 10 MW) is not necessarily put in the RUPTL
- Solar PV target up to 2015 is 1st Phase of 1000 islands program and PV to be developed by IPP. Plan for following years is indication only.
- Small hydro still dominates but solar PV and biomass are very promising
PLN’s 10 YEARS ELECTRICITY DEVELOPMENT PLAN (RUPTL 2013 – 2022)
(Share of RE will increase from 9 % to 19 % by 2022)

- Total 60 GW additional capacity in the period of (2013 – 2022) consisting of:
  - Coal fired: 38 GW
  - Hydro: 6.5 GW
  - Geothermal: 6.0 GW
  - Combined cycle: 5.0 GW
  - Gas Turbine/Engine: 3.7 GW
  - Other: 0.3 GW

- Coal will be more dominant and geothermal is expected to increase significantly (from 4% to 11%)
## Summary IPP Mini hydro development

**Status: August 2014**

<table>
<thead>
<tr>
<th>Status</th>
<th>IPP</th>
<th>Cumulative</th>
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<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Capacity (kW)</td>
</tr>
<tr>
<td>In operation</td>
<td>47</td>
<td>111,935</td>
</tr>
<tr>
<td>Under construction</td>
<td>45</td>
<td>240,888</td>
</tr>
<tr>
<td>Financing arrangement</td>
<td>43</td>
<td>232,448</td>
</tr>
<tr>
<td>PPA preparation</td>
<td>90</td>
<td>425,316</td>
</tr>
<tr>
<td>Proposal</td>
<td>85</td>
<td>381,340</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>310</strong></td>
<td><strong>1,391,927</strong></td>
</tr>
</tbody>
</table>
SOLAR PV DEVELOPED BY PLN (2012)

**INDONESIA**
- Average Solar Irradiation between 4 – 6 kW/m². Most higher radiation is in Eastern of Indonesia.
- Estimating, the radiation can generate energy about 3.7 kWh/day.

**RIAU&KEPRI**
- Location: TAREMPA, ANAMBAS Island
  - Capacity: 200 kWp
  - Status: Operation
- Location: MORO, KARIMUN Island
  - Capacity: 200 kWp
  - Status: Operation

**EAST KALIMANTAN**
- Location: SEBATIK, SEBATIK Island
  - Capacity: 300 kWp
  - Status: Operation
- Location: BUNYU, BUNYU Island
  - Capacity: 150 kWp
  - Status: Construction
- Location: DERAWAN Island
  - Capacity: 170 kWp + Battery
  - Status: Operation on March 2011

**WEST SUMATERA**
- Location: SIMALEPET, SIPORA Island
  - Capacity: 40 kWp
  - Status: Operation
- Location: TUA PEJAT, SIPORA Island
  - Capacity: 150 kWp
  - Status: Operation

**EAST KALIMANTAN**
- Location: TOMIA Island
  - Capacity: 75 kWp
  - Status: Operation on May 2011

**EAST KALIMANTAN**
- Location: SEBATIK, SEBATIK Island
  - Capacity: 300 kWp
  - Status: Operation
- Location: BUNYU, BUNYU Island
  - Capacity: 150 kWp
  - Status: Construction
- Location: DERAWAN Island
  - Capacity: 170 kWp + Battery
  - Status: Operation on March 2011

**WEST SUMATERA**
- Location: SIMALEPET, SIPORA Island
  - Capacity: 40 kWp
  - Status: Operation
- Location: TUA PEJAT, SIPORA Island
  - Capacity: 150 kWp
  - Status: Operation

**WEST NUSA TENGGARA**
- Location: GILI TRAWANGAN
  - Capacity: 200 kWp
  - Status: Operation on Feb 2011
- Location: TOMIA Island
  - Capacity: 75 kWp
  - Status: Operation on May 2011

**NORTH MALUKU**
- Location: MOROTAI Island
  - Capacity: 600 kWp
  - Status: Operation on April 2012

**NORTH SULAWESI**
- Location: MIANGAS Island
  - Capacity: 30 kWp
  - Status: Operation on Oct 2011
- Location: MARAMPIT Island
  - Capacity: 50 kWp
  - Status: Final Construction
- Location: BUNAKEN Island
  - Capacity: 335 kWp + Battery
  - Status: Operation on Feb. 2011
- Location: MARAMPIT Island
  - Capacity: 50 kWp
  - Status: Final Construction
- Location: MIANGAS Island
  - Capacity: 30 kWp
  - Status: Operation on Oct 2011

**NORTH SULAWESI**
- Location: BUNAKEN Island
  - Capacity: 335 kWp + Battery
  - Status: Operation on Feb. 2011
- Location: BUNAKEN Island
  - Capacity: 335 kWp + Battery
  - Status: Operation on Feb. 2011
- Location: BANDA Naira
  - Capacity: 100 kWp
  - Status: Operation on Dec. 2010

**PAPUA**
- Location: SAONEK, RAJA AMPAT Islands
  - Capacity: 40 kWp
  - Status: Operation on Dec. 2010

**EAST NUSATENGGARA**
- Location: LEMBATA
  - Capacity: 200 kWp
  - Status: Operation on Sept 2011
Tourism islands - 6 locations - 0.92 MWp

Outer islands - 8 locations - 1.34 MWp

100 islands stage I - 36 locations -- 7 MWp
100 islands stage II - 78 locations -- 13 MWp
1000 islands -- 672 locations -- 119 MWp
IPP > 1 MWp -- 114 locations -- 140 MWp

Outer islands (861 locations; 379 MWp)

94 locations; 19.5 MWp (Hybrid scheme) financing preparation
SOLAR PV DEVELOPMENT PROGRAM – 1000 ISLANDS

Roof Top PV is projected for households consumption

( RUPTL 2013 – 2022 ) : 634 MW
An abundant potential of Biomass using palm oil shell, bagasse, rice husk, municipal waste and wood chips (Biomass potential resources 32000 MW with 445 MW under preliminary construction).

Private participation will be encouraged, either as an IPP or Excess Power to PLN grid. (Existing Biomass Power Plant 61 MW all IPPs).

PLN Pilot Plants of small scale Biomass (cap. 500 kw up to 1 MW) using wood chip on progress as an option to replace diesel fuel oil and reduce the fuel oil.

The utilization of industrial forest for energy forest (estimated 2 to 3 mill. Ha) will replace about 3.000 MW of diesel fuel oil.

Bio-fuel (biodiesel, olein and CPO) program for converting High Speed Diesel Oil (HSD) projected about 0.5 to 1 million KL.
BIOMASS POWER PLANT PROJECTS

Contact us : PT PLN (Persero), Jl. Trunojoyo Blok M I/135, Jakarta 12160  Phone : 62-21-7261875 Fac : 62-21-7221330
Indonesia’s wind power potential is not much because of average wind velocity is low (< 5 m/s).

Wind Power Development Program up to 2020: 200 MW, in study and procurement stage.
PLN committed to support the National Policies in accelerating the utilization RE as one solution to meet the high growth of electricity.

The small and distributed RE, with another alternative the use of biofuel, has reduced significantly the use of highly cost of fossil fuel oil of diesel generation.

The hybrid of solar PV and biomass power plan is promising solution following the minihydro especially for electricity in small and remotes island and other isolated grid system.

The policy for proportionally allocation for RE as PLN Project and IPP’s project (Great opportunity for private to make a PPA with PLN in IPP Schemes). Small RE generation is generally addressed to be developed by IPP.

To encourage the IPP and also promote RE development, the pricing policies has been based on economical price with also considering incentives and subsidy.

Bankable PPA standard considering lender concern has been implemented and also supported by a guidelines to increase the penetration of small and distributed generation into distribution grid.

Synergy among stakeholders is key factors to provide supportive climate for RE development.
Terima kasih - Thank You)