# Developing Renewable-based Distributed Energy System in Indonesia

**Session 3: Toward the Low Carbon Energy Sector**

KLH-IGES Workshop on Sustainable Low-Carbon Development in Indonesia and Asia: Dialogues between Policymakers and Scientists on Green Growth

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# Outline

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- Background
- Potential of Renewable Resources
- Existing Regulatory Framework
- Existing Programs
- Growth of Domestic Industry
- Case Studies
- Barriers to realize RE-based Distributed Energy System (Existing programs, financial options)
- Discussion Questions

# Research Scope

## Current Status

- Power generation based on **large-scale, centralized power supply system** with grid, esp in JALAMLI, Sumatra area.
- Includes fossil-fuel based power plants (oil-fired, coal-fired, gas-fired)with transmission/ distribution lines
- centralized grid not fully developed in outer islands
  1) electrification ratio ~64% (2007)
  2) high investment cost for grid infrastructure

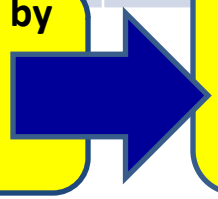
## From LCS Perspective…

- Development of **Renewable Energy-based Distributed Power Supply System** in outer islands as alternative, low-carbon and sustainable development path
- On-site generation system based on full utilization of locally available RE resources = Realization of "locally made, locally consumed"
- **Purpose:**
  - **(1) To explore and assess the potential and barriers to take up renewable resources available across the country**
  - **(2) To identify promoting factors, and policy options for realizing RE-based distributed power generation**
  - **(3) To compare and contrast with other Asian developing countries**

# Features of Centralized and Distributed Power Supply System

| Factors | Fossil Fuel-based Centralized Power Supply | Renewable Energy-based Distributed Power Supply |
|---|---|---|
| Scale of power generation | Large | Small |
| **Lead time for construction (Investment Risk)** | **Long** | **Short** |
| **Distance between demand and supply** | **Long** | **Short** |
| Supply Risk | High (Impact in large area once system damaged) | Low (Impact limited once system damaged) |
| Distribution of resources | Concentrated | Distributed |
| Efficiency of power generation | High | Low (could be high if accompanied by co-generation) |
| Energy Intensity (calorie based) | High | Low |
| Stability of Power Supply (collectivity) | High | Low |
| **Mitigation potential** | **Low** | **High** |
| **Contribution to Energy Security** | **Low** | **High** |
| **Potential of green market creation** | **Low** | **High** |

**☐Large-scale power generation by concentrating fuels (from domestic, abroad)**
**☐Demand-driven**



**☐Smaller-scale power supply (regional level) by utilizing widely distributed RE resources = local perspective is essential**
**☐Supply-driven**

# To realize RE-based Distributed Power Supply System…

Presence of **Renewable Energy Resources** across country

- Assessment of commercially available potential for each source

Presence of **Policy Framework (regulatory, institutional)** to support such development

- RE promotion policies
- Fiscal incentives
- Open market

Assessment of **Power Demand** across country (esp. outer island)

Presence and/or opportunity for acquiring **Technologies** to realize such system

- Local capacity of technology (Growth of domestic industries)

**Human resources** (social workers, practitioners) to implement such system

- Readiness of local community, empowerment
- Presence of programs/projects
- Placement and O&M of system

# Overview of Indonesia: Potential of Renewable Resources

| Type of Energy | Potential | Installed Capacity |
|---|---|---|
| Hydro | 75.27GW | 4,200MW |
| Geothermal | 27GW | 850MW |
| **Mini/Microhydro** | **500MW** | **84MW** |
| **Biomass** | **49.81GW** | **445MW** |
| **Solar Energy** | **4.8 kWh/m2/day** | **8MW** |
| **Wind** | **9.29 GW (3-6m/sec)** | **0.6MW** |

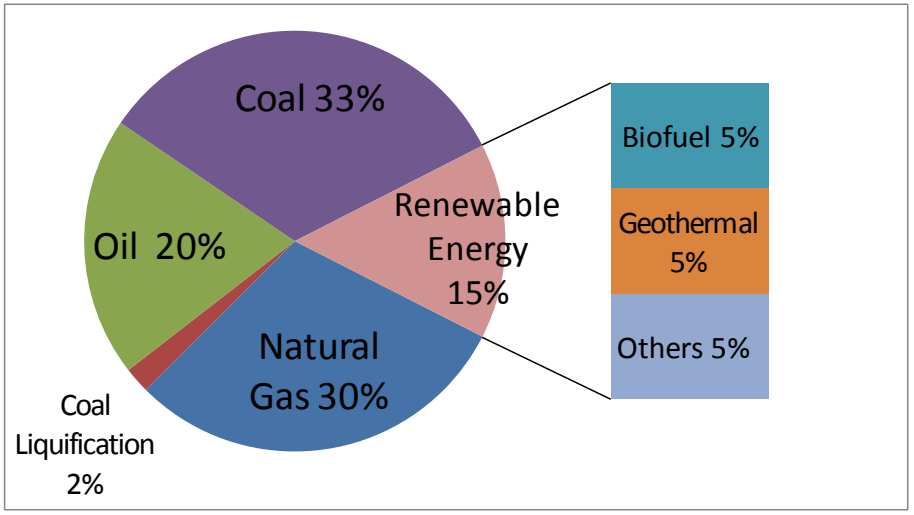
Source:DGEEU

- Potentials are high and widely available across the country, but not fully utilized nor installed
- Priority setting = which resource could serve as base load supply?

## How to combine different sources of RE sources (from stand-alone to hybrid)?

| Photovoltaic | Wind | Micro-hydro | Biogas | Biofuel |
|---|---|---|---|---|
| Low energy intensity<br>Suitable for on-site generation, or grid connection<br>Daytime generation only<br>Battery is costly | Low energy intensity<br>Suitable for on-site generation, or grid connection<br>Constant generation | Relatively high energy intensity,<br>Constant generation with seasonal fluctuation | Resources widely available<br>Relatively high portability<br>Could utilize existing infrastructure for natural gas<br>Requires collection and segregation | Widely available<br>High portability (liquid) |

# Existing Regulatory Framework (Highlights)

| Regulations | Date of Issuance | Highlights |
|---|---|---|
| **Presidential Regulation on National Energy Policy No.5/2006** | Jan 2006 | ☐2025 Energy Mix Target = 15% target with RE-based power   |
| **Law of Energy No.30/2007** | Aug 2007 | ☐ Central & local government's responsibility to enhance provision of new and renewable energy<br>☐ Provision of facilities and/or fiscal incentives to business entities and individuals intending to provide energy from new and renewable energy resources<br>☐For this purpose, Government Regulation on New and Renewable Energy is currently under development. |
| **Ministerial Regulation No.32/2009** | Mar 2009 (MEMR) | ☐Mandating PLN to purchase renewable based power (<10MW)<br>☐Standard purchase price is to be set by PLN |
| **Ministerial Regulation No.24/2010** | Jan 2010 (MOF) | ☐Incentives: i.e. income tax deduction, exemption of VAT for purchase of RE-related goods |

**Do these regulations provide sufficient support and incentives to promote RE-development?**

# Existing Programs to facilitate Distributed Energy System in Indonesia

## Energy Self Sufficient Village Program (DME)

- to improve welfare of local community through RE provision as an entry point. Launched in Feb 2007.
- **Objective**: to improve rural economic productivity
- To be certified as DME, the village has to have 60% of power supplied by RE
- Funding through APBN
- Institutional set up for operating and maintenance
- Provision of productive end use equipment to improve the load factor

**DME**

**Biofuel-based**
- Jatropha curcas
- Coconut
- Palm
- Cassava
- sugar cane

**Non-biofuel based**
- microhydro
- wind
- photovoltaic
- Biogas
- biomass

## Rural Electrification Program

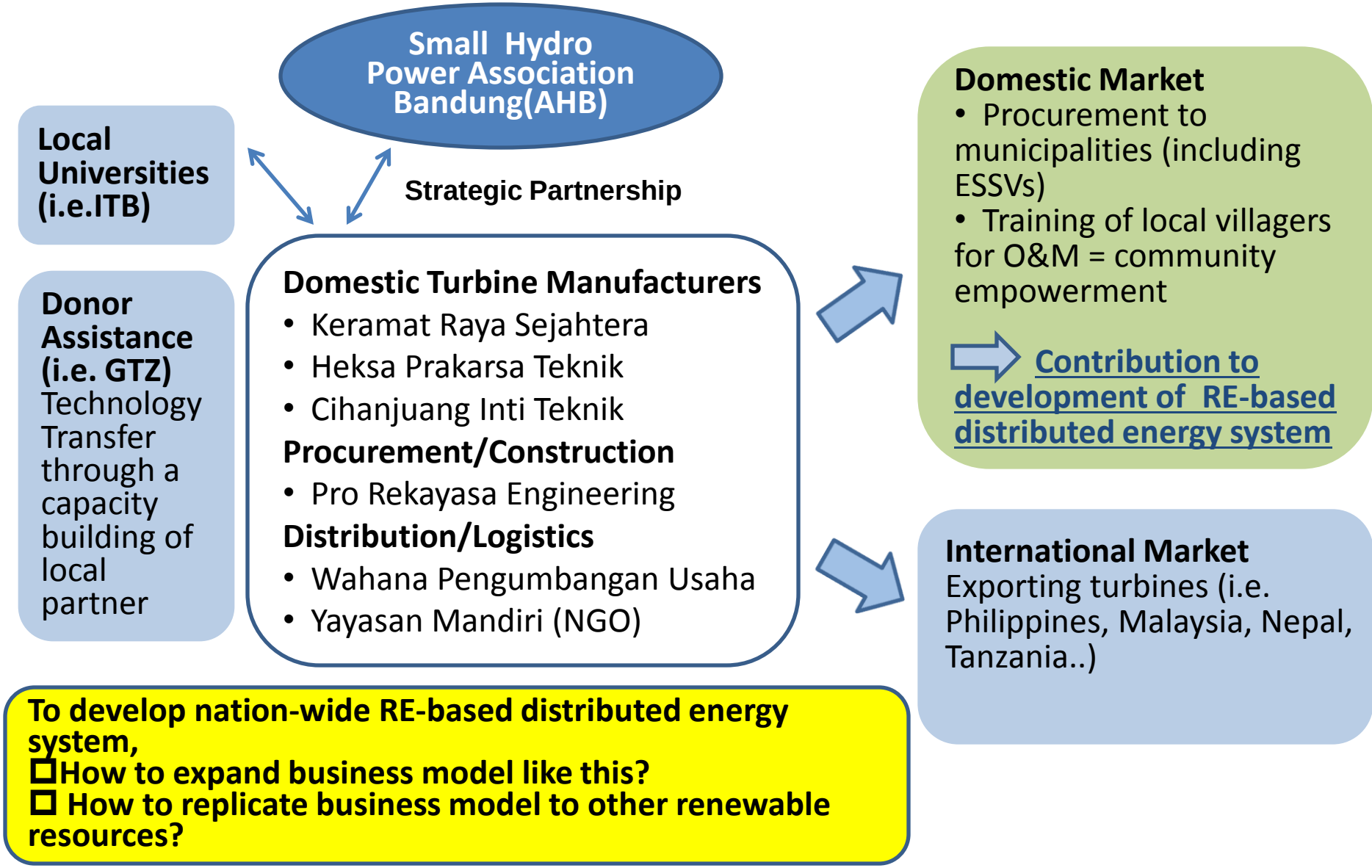
- **Objective**: rural electrification
- Aiming for 95% Electrification Ratio by 2025
- Replacing diesel power plant construction by RE-based power generation (microhyro, wind, photovoltaic) = 50% of total program budget is allocated for RE-based power development

**Rural Electrification**

**Grid extension (on-grid)**

**Renewable energy implementation for remote areas (off-grid)**

# Growth of Domestic Industry
# Preliminary Evidence in Microhydro Power Industry in Bandung



# Case Study 1：RE-based Distributed Power Development


| Tangsi Jaya Village, Bandung, East Jawa | | |
|---|---|---|
| Category | DME | |
| Mode of financing | Public Financing(West Java Local Government) | |
| Operation Hours | Night time operation (to be shifted to 24hrs operation) | |
| Output | 20kW | |
| Max Discharge | 400L / sec | |
| Effective Head | 8 m | |
| # Household supplied | 80 households | |
| Usage of Power | **Local consumption** | |
| Monthly electricity fee by contract | 1A | Rp 15,000 |
| | 2A | Rp 25,000 |
| Monthly electricity fee (PLN, grid) | fixed | Rp 35,000 |
| Misc | Income accounting/management by Co-op | |

## Business Flow

**RE（PLTMH）**

**Local Consumption**

**Promoting Regional Economic Activities**

Community & Social Development

Domestic Industry

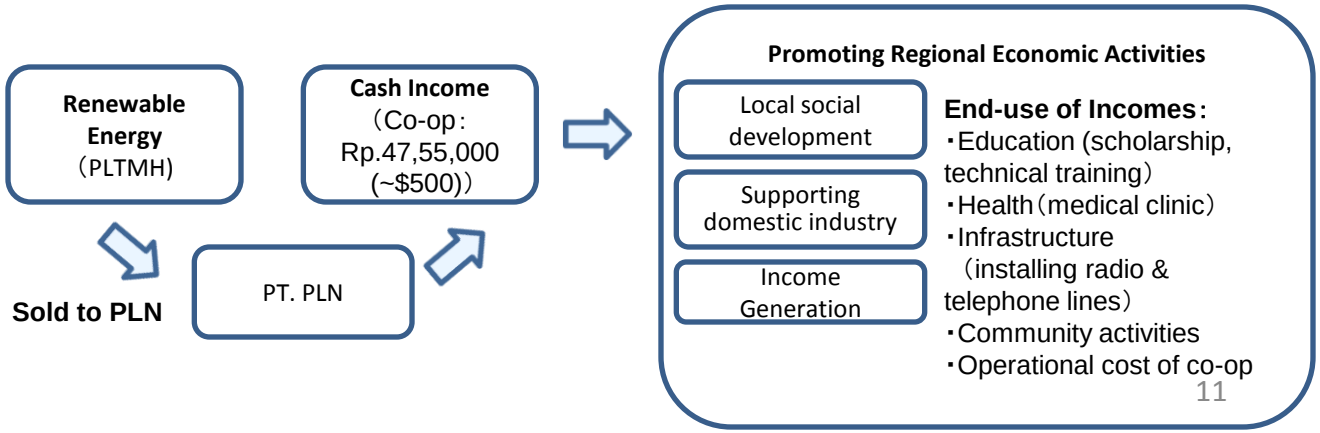
**End-use of Incomes**
**・Processing and commercializing agricultural products (Coffee)**
**・Purchasing machines for regional economic activities**
（Coffee mills, sawing machine）
・Community activities
・Operational cost of co-op

Increase of Income (acquisition of cash income)

# Case Study 2 RE-based Distributed Power Development (Private Finance)

| Cinta Mekar Village, Subang, E.Jawa | |
|---|---|
| Category | Joint Venture ＋NGO |
| Mode of financing | Private financing, external Funds(UNESCAP) |
| Operation hours | 24 hours |
| Output | 40kW |
| Max Discharge | 1100 L/sec |
| Effective Head | 18.6 m |
| # Household | 122 Households |
| Usage of Power Generated | **To be sold to PLN**(432Rp(4.96 cents)/kWh) |
| Misc | Income to Co-op：Rp.47,55,000 (~$500) |

## Business Flow



# Barriers to Realizing Distributed Energy System
# 1) Existing Programs (DMEs)


**Prioritization of Developing RE-resources?**

**Lack of Follow-up Activities**?

- ☐post-assessment of sustainability of projects
- ☐Additional financial/technical support if requested by community

→Development of infrastructure and services must be accompanied by long-term support for operations and maintenance. The "build and leave" model will fail in remote regions.

**Lack of Comprehensive National Database of DMEs**?

- ☐ Development of National database(i.e. size of community, types of devices installed, GHG mitigation potential) for public awareness, and replication of good practices

**Additional Support for Program Expansion/Scale-up**?

- ☐ Hybrid system (i.e. microhydro + photovoltaic)

→ Aim for replicability and scalability

**Local network**

- ☐ Find a partner (university or NGO) to set up shop, logistics, and credibility

# Barriers to Realizing Distributed Energy System
# 2) Financial Options for RE investment

☐ Existing Programs/Projects mostly focus on procurement and installation of devices (i.e. microhydro turbines,) and some capacity building (training ).

☐ Additional financial options to be considered;

**Financial Needs**

- Cost of scale-up (i.e. additional installation needed from stand-alone to hybrid)
- Cost of load stabilization (i.e. batteries)

**Potential fiscal policy options**

- Subsidy (i.e. local government to community)
- Microfinance (role of regional/local banks)

**RE-based power purchase framework by PLN**

- Rooms for improvement ? (i.e. purchase price, contract year)
- Expansion of FIT scheme to RE sources

# Discussion Questions

- Are **RE-based distributed power generation/microgrids** the ideal systems for rural Indonesia? What are the potential advantages and drawbacks of developing such systems from Indonesian perspective?
- Which RE resource should be prioritized for development?
- What kind of additional institutional and regulatory framework is necessary to ensure development of RE-based distributed energy systems? What needs to be improved for existing policy framework?
- What kind of support (domestic, international) are required to increase scalability and replicability of existing programs?
- What kind of additional financing tools/channels do you think might be suitable for promoting and ensuring sustainability of RE-based distributed energy systems in Indonesia?