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Interconnecting Distributed Renewable Energy Generation Plants to PLN's Distribution System

Presented at

“Renewable Energy Opportunities for Remote Indonesian Grids”

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OUTLINE

- Background
- Objectives, Purpose and Applicability of Guidelines
- Applicable Regulations, Standards, and Codes
- Connection Application, Review, and Approval Procedure
- Connection Technical Standards, Testing, and Commissioning



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Risks Associated with Developing and Operating REGP (before Guidelines)

- Location of distributed REGPs (e.g., hydro, biogas) is far from existing distribution lines requires high interconnection costs
- Distribution line capacity limits availability for REGP output or requires redundant lines to connect to substation
- Impact of multiple REGPs connected to same circuit not assessed.
- Power Purchase Agreement (PPA) signed without determining true cost of interconnection or limitations in sales to PLN.
- PLN Regional Offices (ROs) do not use common approach when negotiating interconnection in PPA.
- Availability of REGPs limited by voltage fluctuations on long 20 kV feeder lines.



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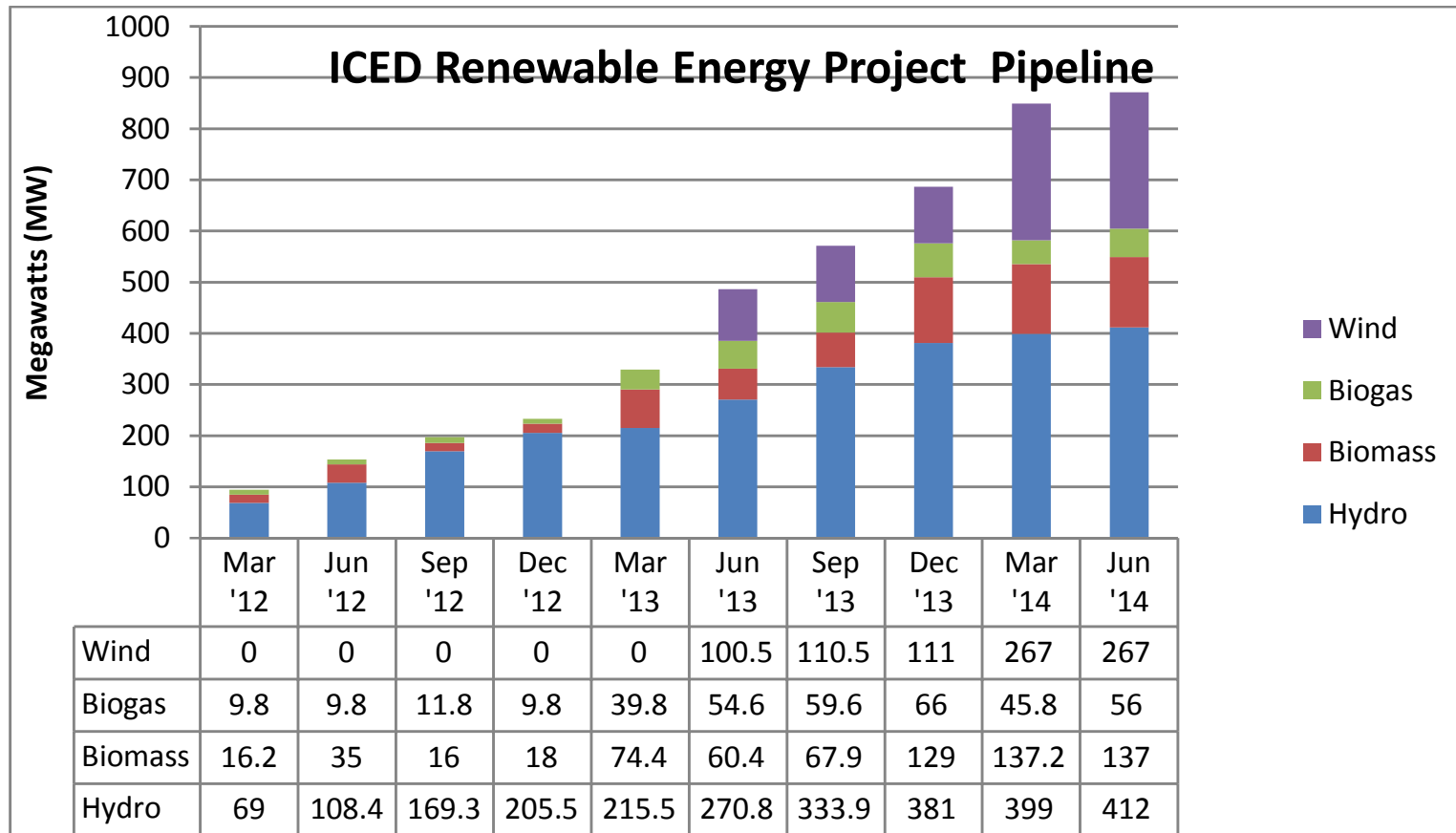


Background

- Indonesian 2009 “National Action Plan to Reduce Greenhouse Gas Emissions”
- Electricity Law No. 30 of 2009 (and implementing regulations) promotes development of small and medium (no larger than 10 MW) renewable energy generation plants (REGP) as IPPs.
- PLN is required to connect and purchase power from qualified REGPs at government-set feed-in tariffs.
- PLN and REGPs experiencing difficulties with feeding REGP power into medium voltage (20 kV) distribution system.
- PLN issues “Guidelines for Connecting Renewable Energy Generation Plants to PLN’s Distribution System” in July 2014.



Growth in REGP market





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Distribution of REGP Projects (under development)



RENEWABLE ENERGY PROJECT DISTRIBUTION IN NORTH SUMATERA



Legend

- Existing Substation

RE PROJECT TYPE

- BIOGAS
- BIOMAS
- HYDRO
- 20 KV line

COOPERATION
PT. PLN SUMATERA UTARA - ICED



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Objectives of the Guidelines

- To ensure connection and parallel operation of REGPs do not adversely affect the safety, reliability and power quality of PLN's power system.
- To facilitate implementation of the Government regulations on development of renewable energy generation:
 - MEMR Regulations No. 31 (2009) - power purchase from small and medium scale renewable energy plants),
 - MEMR Regulation No. 4 (2012) – Feed in Tariff (FIT) for biomass, biogas, landfill gas and waste to energy.
 - MEMR Regulation 17 (2013) – Ceiling price and bidding for solar photovoltaic power plants,
 - MEMR Regulation 19/ESDM/2013 – Public-Private-Partnership and FIT for municipal waste-based power plants), and
 - MEMR Regulation 4/ESDM/2014 – FIT for small hydropower plants.: 8

* - MEMR - Ministry of Energy and Mineral Resources



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Purposes of the Guidelines

- Provide streamlined procedures for:
 - REGP developers to prepare REGP connection applications, and carry out necessary connection studies;
 - PLN to review, and approve connection applications and studies, and seek ESDM's initial approval for proceeding with the process for direct procurement of REGP power.
- Provide REGP developers with clear guidance in performing connection studies and technical requirements for consideration early in the REGP project planning and development stages.
- Provide useful reference connection technical information to REGP engineering firms, equipment manufacturers, suppliers and accredited testing and certification agencies.
- Standardize the approach and methodology used by PLN ROs.



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Applicability

- Applicable to all new REGPs no larger than 10 MW in capacity to be connected to PLN's distribution system at 20 kV or lower voltage level.
- Also applicable to major refurbishment/modification of existing REGPs already connected to PLN's distribution system.



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Applicable Regulations, Standards and Codes

- ❑ Connection technical requirements built upon:
 - Regulation 4/ESDM/2009: Indonesian Electric Distribution Code,
 - Relevant Indonesian National Standards of Indonesia, and the Standards of PLN, and
 - Suitable international best practices for renewable energy generation connection, including the Institute of Electric and Electronics engineers (IEEE), the International Electro-technical Commission (IEC), the Underwriters Laboratories, Inc. (UL), and California Model Electric Rule 21 for Generating Facility interconnection.



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Future Updates of the Guidelines

- The Guidelines are available for download on PLN's website.
- The Guidelines shall be reviewed and updated regularly in the future to reflect:
 - Advancement in renewable energy generation technologies,
 - Increasing penetration of REGPs, especially the intermittent power generation of wind and solar power, and
 - Changes in power sector structure or regulatory framework.



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REGP Connection Application, Review and Approval Process

- ❑ REGP developers are required to submit a complete connection application (using the standard connection application form) to PLN regional office (RO).
- ❑ Smaller REGP projects can opt for a ***Fast-Track Connection Review*** process. Eligible projects are:
 - No larger than 2 MW in total REGP capacity for connection to 20 kV distribution system in Java-Bali region,
 - No larger than 200 kW for connection to 20 kV distribution system outside Java-Bali region,
 - No larger than 30 kW in capacity for connection to 400 V distribution feeder.



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REGP Connection Application, Review and Approval Process (cont.)

- ❑ The ***Fast-Track Review*** involves several screening criteria for checking whether there are potential adverse impacts on the distribution system:
 - Feeder's thermal loading capacity limit,
 - REGPs' short circuit contribution ratio limit,
 - REGP connection line configuration requirement, and
 - Others.



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REGP Connection Application, Review and Approval Process (cont.)

- REGP projects not eligible for a Fast-Track Review will typically require: (i) a connection feasibility study, (ii) a distribution system impact study, and (iii) a connection facilities study.
- Developers are responsible for carrying out the required studies and then submit the study results to PLN RO for review and approval.
- The Guidelines provide detailed scopes for interconnection studies.
- Developers are advised to meet with PLN RO to confirm the scopes of the studies before performing the studies.



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REGP Connection Application, Review and Approval Process (cont.)

- PLN will approve the most economic REGP connection option (i.e., the Point of Connection (POC) that would result in least total connection costs, including the costs of connection facilities, any distribution system improvements/upgrades triggered by the proposed REGP connection).

- Cost responsibilities: Developer responsible for the connection facilities on the developer's side of the POC; PLN responsible for any required distribution system improvements/upgrades, and connection facilities on the PLN's side of the POC.



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The Connection Technical Requirements

- ❑ Key Components:
 - General requirements applicable to all types of REGPs
 - Protective function requirements
 - Prevention of system interference function requirements
 - Generation technology-specific requirements
 - Synchronous generator
 - Induction generator
 - Inverter-based REGP
 - Additional requirements for variable REGPs
 - Wind power plant
 - Solar photovoltaic (PV) power plant
 - Metering and communication requirements



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Studies Required under PLN Guidelines

- ❑ **Connection Feasibility Study** is a preliminary evaluation of potential adverse impacts on PLN's distribution system that would result from connection of the proposed REGP. The developer has the option of skipping the Connection Feasibility Study of proceeding directly to a Connection System Impact Study.
- ❑ **Connection Distribution System Impact Study** is to further examine and detail the potential adverse distribution system impacts and their mitigating measures identified in the Connection Feasibility Study carried out previously by the developer.
- ❑ **Connection Facilities Study** is to provide design and detailed cost and schedule estimates for the required connection facilities and distribution system modifications and REGP facility modifications to be in compliance with the connection technical standards.



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Benefits to Studies Required Under PLN

Helps to identify upfront any location and/or generator specific characteristics of the Renewable Energy Generating Project (REGP) that could lead to any of the following:

- Save money on feasibility studies and detailed engineering design for a project that cannot be economically connected to PLN's grid
- Allow the REGP to benefit from a reduced timeline, including priority over multiple projects proposed to connect to the same feeder
- Result in large differences in estimates between expected and actual interconnection costs
- Serve as reference in evaluating alternatives and negotiating cost sharing with PLN regarding interconnection costs



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