WIND DEVELOPMENT AND EXPERIENCE IN INDONESIA

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Development Objective

Implementation of small, medium and large scales WECS (Wind Energy Conversion Systems) technology for generating electricity in stand alone, hybrid or grid connection modes depend on the wind power availability at an area

Wind Power Classifications and Utilization

Class	Windspeed (m/s)	Power Density (W/m^2)	Capacity (kW)
Small Scale	2.5 – 4.0	< 75	Up to 10
Medium Scale	4.0 – 5.0	75 – 150	10-100
Large Scale	> 5.0	> 150	>100

Measurement and Resource Assessment

- Siting of measurement equipment
- Using accurate and reliable equipment (anemometer, wind direction with data logger and computer access)
- Measurement height up to 50 m or higher
- Minimum 1 year measurement
- Methods of energy estimation : Weibull method and Bin Methods
- Softwares for data processing and evaluation

The stages for implementation

- Wind Measurement and Resource assessment at selected areas
- Annual Energy yield assessment
- Selection of WECS technology
  (for pilot /demo project or electric generating system)
- Economic and environment Analysis
- Recommendation for technology implementation

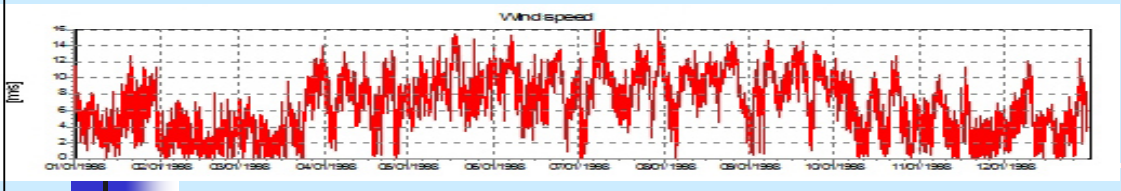
Result of measurement and Resource Assessment

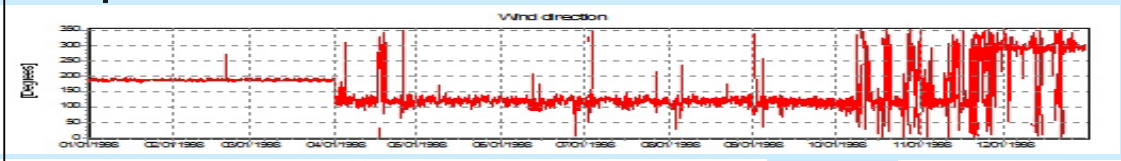
- Wind measurement and site identification (150 Locations by 2008)
- Wind data and statistics : diurnal, average, histogram, distribution, etc
- WPD (Wind Power Density) and estimated energy AkWh (annual kilowatt hour)/m2
- Wind map of several regions of NTT

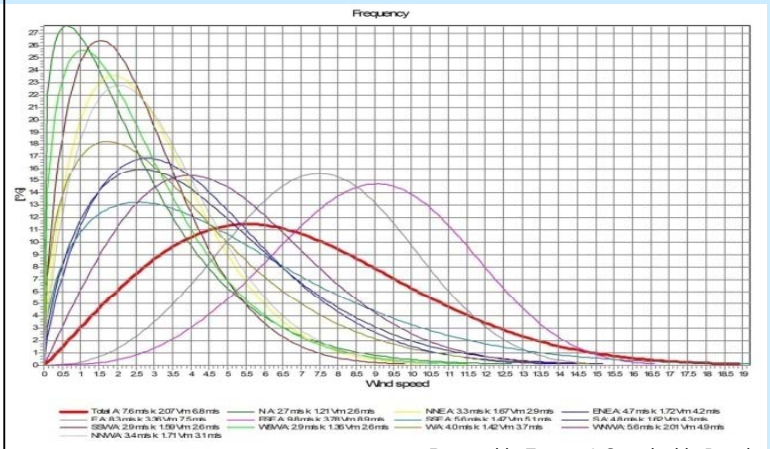
WIND RESOURCES ASSESSMENT

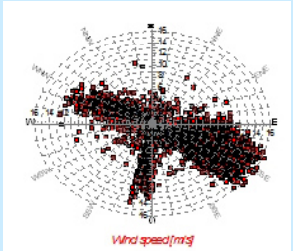
Wind speed and direction measuring points

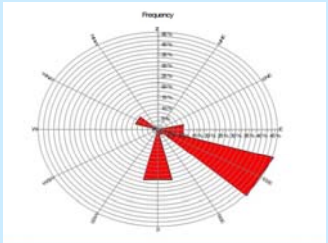
Weibull curves for Windspeed and Direction distributions



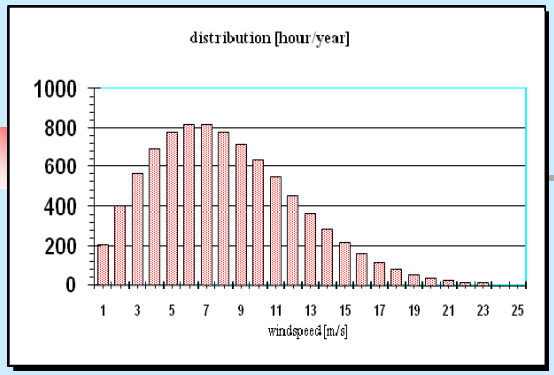


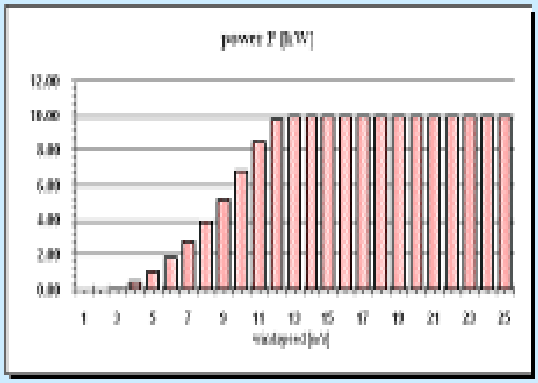




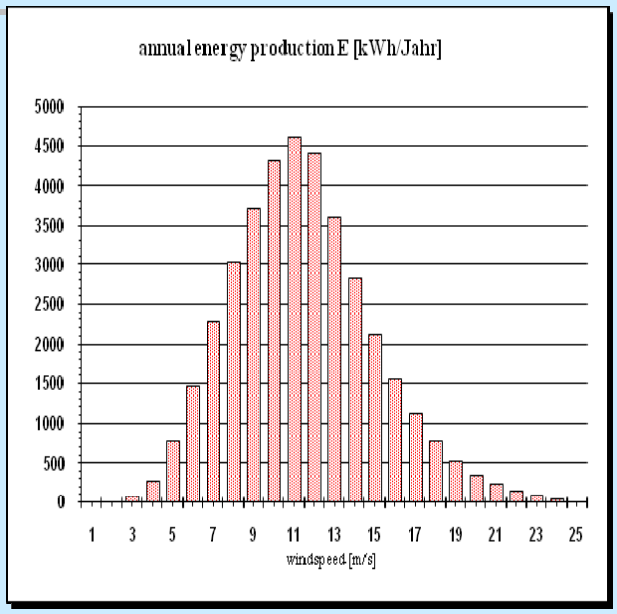


WECS Selection





Annual Energy Production



WECS development and experiences in small WECS ≤ 10 kW

- Type identification : 80W, 100W, 250W, 300W, 500W, 1000W, 1500W, 2500W, 3500W, 4000W, 5kW and 10kW
- Installed at various areas in Indonesia (LAPAN, DJLPE, RISTEK, Local governments, Winrock, private companies, BPPT, etc)
- Prototype development: 250W, 1000W, 2500W, 3500W and 10 KW
- WECS prototypes of mechanical type (multiblade windmill) for water pumping, for 45 liter /mnt, 150 liter/mnt, 249 liter/mnt and 250 liter /mnt
- Local availability and fabrication of certain components :instruments, blades, generator, various towers and electronic material/components

Pilot or Demo Projects

- Wind Village Pilot Project at Jepara,31 units of 250W,1000W and 2500W (LAPAN);1992-2002
- East Lombok 7 x 1000W (LAPAN); 1992 – 2002;
- Parangkusumo, Samas Bantul, Karimunjawa, Sumenep Madura, etc (LAPAN)
- Hybrid System of 4 x 10 kW, PV, genset and battery storage at Rote Island (2007), Ristek
- 1,5 kW and 10 kW WECS for battery charging, household electrifications and water pumping at various locations in NTT (Winrock),1998
- Installations at various areas (privates);etc

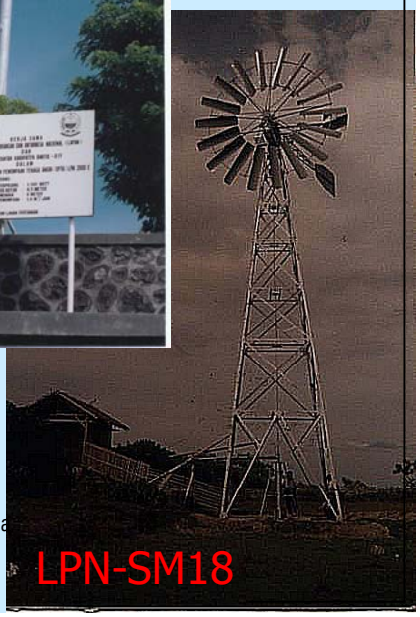
R & D Products

Mechanical WECS for Pumpings

LPN-SM12


LPN-3500E


LPN-SM4-1G


LPN-SM18

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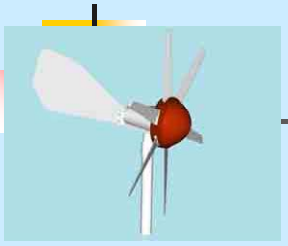
R &D Small scale installations

80W,1000W,2500W

Battery Charging at Fisherman Boat



Control system → Storage batteries → mps 'etc

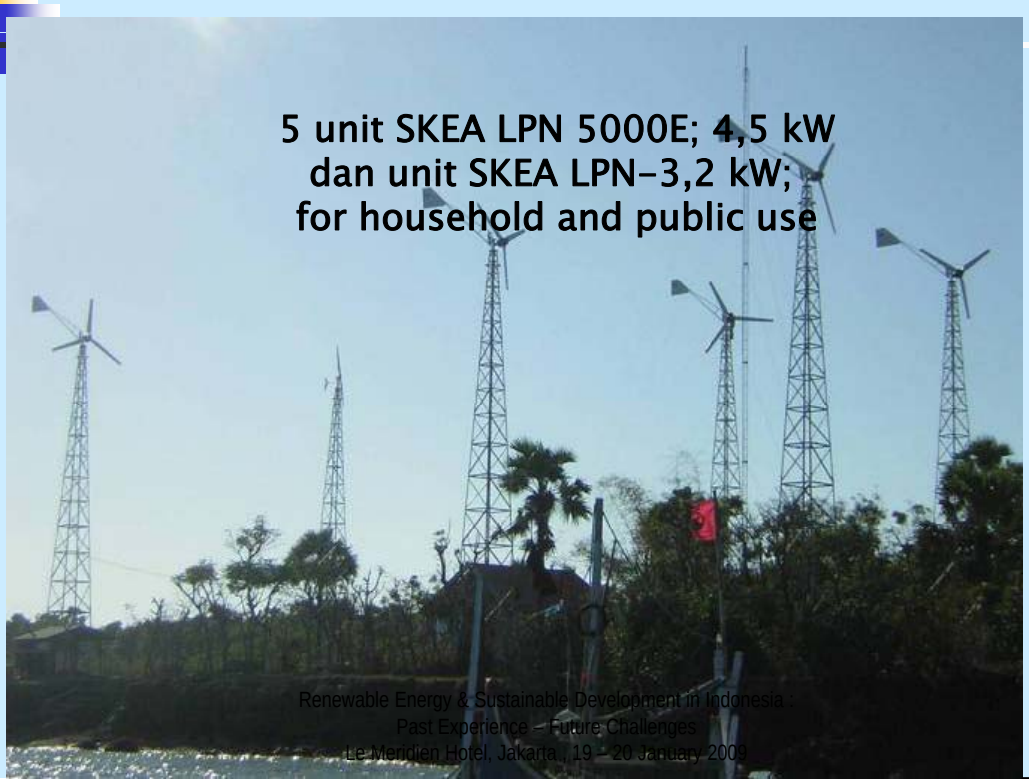
NILA 80

Spesifikasi :

Daya : 50 -80 W
Sudu : 6 bh
Diameter : 20"
Bahan sudu: fiberglass
Generator : magnet permanen
Tegangan : 12 V
Putaran : 800 RPM

Giliyang Sumenep, Madura (2006)

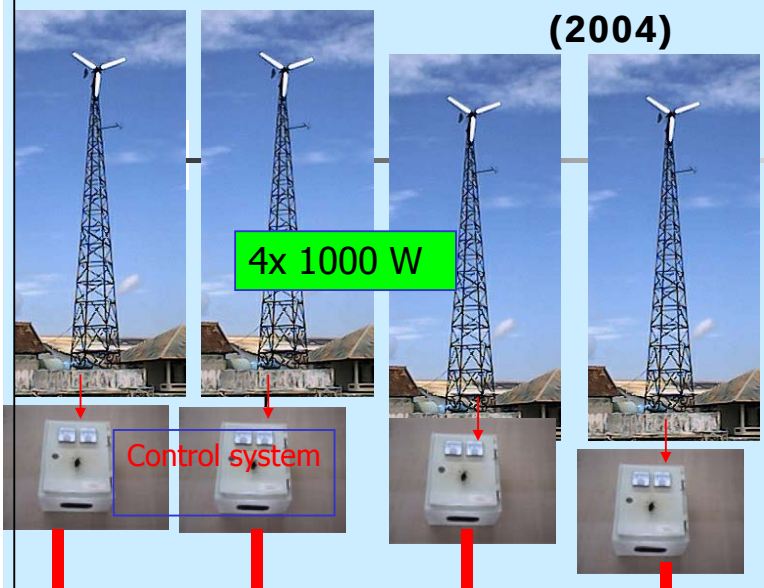
LAPAN



Pulau Karya in Pulau Seribu

(2004)

LAPAN



Of Grid Application

Applications :
- Lighting
- Computer
- Water Pumping

Hybrid Systems

Wind turbines 4 x 10 kW,PV 36 kWp and Genset, 125 kW; Nembrala Rote Ndao,NTT (2007)

Windturbine 2.5 kW and PV 4.8 kWp for BTS at Girisari, Bali (2008)

Observation for Small system :

- Most of the wind turbines are technically function with regular maintenances .For this task, spare -parts must be availability
- Maintenance jobs are particularly more problems at the remote areas due to the lack of technical persons and spare-parts delivery

The future for small WECS Development

- Existing industrial support for local fabrication of WECS components : Pindad, PTDI, Korindo, LEN etc
- Available materials, components and technology support : electric material including power cables, panels and instruments, electric/electric components, etc
- Tools and equipment for shipment, erection, installation and testing

Medium scale WECS (10kW – 100kW)

- Intended applications : hybrid with diesel generating units
- Prototype Development for generator of 30 kW and 50 kW WECS
- Existing installations :
  - 3 x 85kW and 6x80kW in Nusa Penida Bali (PLN) hybrid with diesel gensets, PV and
  - Some 80kW WECS at several areas (DJLPE)

Observation for Larger WECS

- Some wind turbines do not perform according to the given specifications. Main reason is the siting or design of operating system due to the lack of wind data and less technical assessment or FS
- Local governments have the important roles for wind applications; more supports are expected in order to accelerate the achievement
- More private companies and industry had indicated their interests in marketing and local fabrications, however, they need the stimulus for better contributions

Large WECS (≥ 100kW)

- To be used for interconnection into grids
- Recommended sizes : 300kW – 750 kW
- Some FS had been performed for site selection and utilization (LAPAN, Litbang PT PLN Persero,Windguard,Soluziana,RISO)
- Wind measurement for large WECS applications: Windguard Germany, Soluziona & Nipsa Spain, RISO Denmark, Binatek, etc
- Identified areas for large applications (East Nusa Tenggara, South Sulawesi, Central Java, etc)
- No utilization yet for large system (even for demonstration or pilot project)

The challenge for the future of wind energy

- For significant contribution as electricity generating systems according to BPEN/Road Map up to 2025),large system with grid interconnection have to be started
- Producing of national wind map with accurate and reliable wind data base.This has to be done nationally
- The implementation has to be started with the available WECS products (300kW, 500kW, 750 kW or MW sizes depend on the site conditions)
- To support the investors willingness for WECS implementation in Indonesia
- Industrial support for local fabrications ; i.e large WECS tower fabrication at Cilegon Banten, fabrication of generators (PINDAD) , Rotor blades (PTDI) and control subsystems(PT LEN) have to be stimulated with proper facility for production, testing and validation for accurate and reliable products as well as for reducing cost and market development

330 KW WECS,

rotor diameter : 33 m

Tower : 50 m

Number of blade : 3 blades,

total weight : >10 tons

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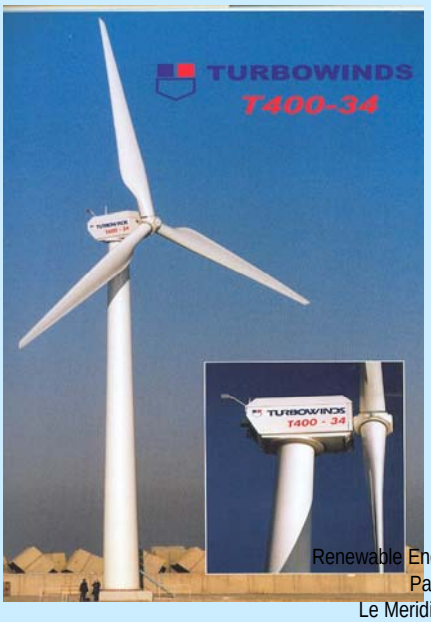
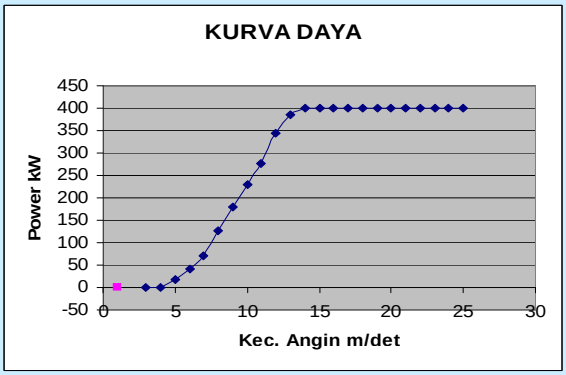
400 kW WECS

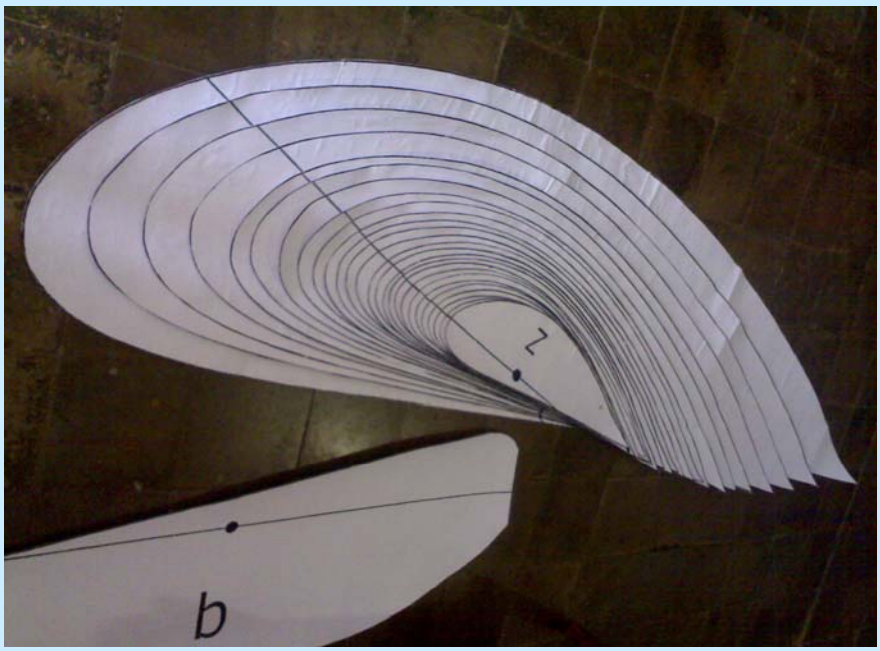




600 kW WECS

The model of 300 kW rotor blades with 30m rotor diameter

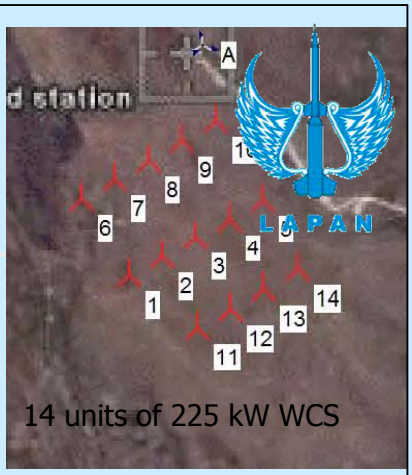
Airfoils from blade roots to tip (r/R =0.1 to 1.0)



Fabrication of Large WECS Tower

Siting of 3 WECS types for producing 3,0 MW power at a location in NTT

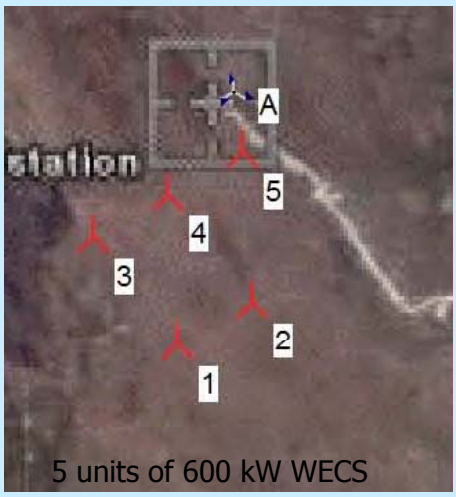
3,0 MW D4/49



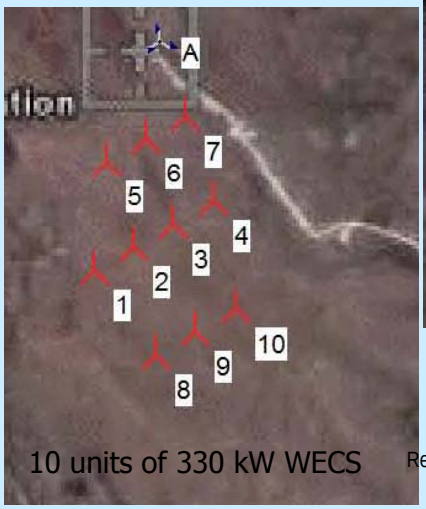
14 units of 225 kW WCS

3,15 MW V-29

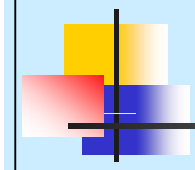
3,3 MW E-33



5 units of 600 kW WECS



10 units of 330 kW WECS



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