Long-term Wind Measurement in Philippines

Quantum Leap in Wind

Philippines Wind Energy Stakeholders Meeting

Asian Development Bank

October 11, 2012

Agenda

- QLW goals
- Wind Roadmap
- Philippine Wind Industry Assessment Study
- Long-term wind measurement
- Met-tower size
- Criteria for site selection
- Local institution to take over the wind measurement project

ADB Quantum Leap in Wind (QLW) in Asia and the Pacific

Objectives:

1. **Access to clean and affordable energy**
   - Reach more than 5 million people
   - Target 1 GW wind in Asia (excluding PRC and India) in 5 years
   - 2 million tons per year reduction in CO2
2. **Promote and build capacity for wind and other renewable energy**
   - Expanding to Asia Pacific market will encourage competition and technological innovation

QLW - **MONGOLIA, PHILIPPINES**, SRI LANKA, VIETNAM

DURATION: 3 Years, 2012-2014, Components

1. **Wind Energy Development Roadmaps (200K)**
   - country-level roadmaps in partnership with stakeholders
2. **Wind Resource Assessment (900K)**
   - ground-based wind measurements for long term reference
3. **Knowledge Management and Capacity Building (500K)**
   - in-country, regional and international workshops to share lessons and good cases of wind development, including technical courses
4. **Pre-feasibility Studies and Economic Analysis (200K)**
   - study of key issues to help remove barriers to project development
5. **Business/financial models and contracts (200K)**
   - development of agreed “standard” business/financial models for assessing bankability of wind projects.

Wind Energy Roadmap

- Considers national policy targets and all electricity-generation resources
- Public and private sector stakeholders cooperate and collaborate
  - Spearheaded by lead government ministry
  - Consultative process to ensure sustainability
- Continuing process
  - Implement & update

Key Roadmap Objectives

- Identify issues and barriers
  - Policy
  - Resource assessment & development
  - Technical & technological
  - Infrastructure
  - Financing
  - Social acceptability
- Develop an action plan

in line with national policy

  - Targets
  - Timeline

National Renewable Energy Program (NREP) – Wind Sub-program

- **Targets:**
  - **1,048 MW by 2015**
  - **2,345 MW by 2030**

- **Technology**
  - Resource Assessment
  - Wind database
  - Smart Grid Demo
- **Commercial**
  - Local manufacturing
- **Promotions**
  - Linkages with academe
  - Public awareness

- **Policy**
  - True cost of conventional energy
  - Land use bill
- **Area-Based Energy Component**
  - Decentralized, community based approach

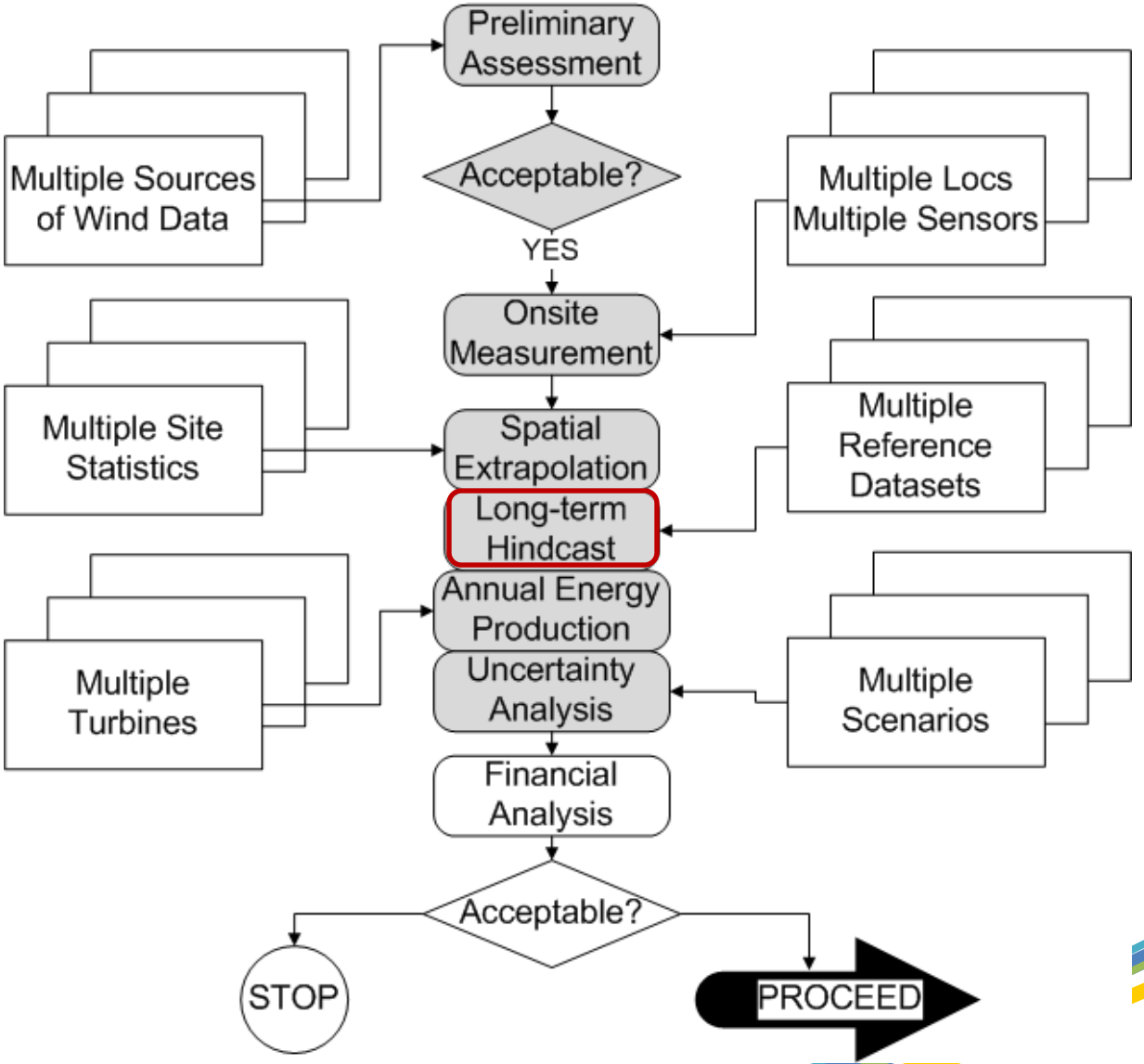
Updating the Wind Roadmap

- Re-assess targets for wind capacity
  - FiT Installation targets, surrendered RESCs, RA
- Review assumptions:
  - Enabling mechanisms still being formulated
- Establish a One-Stop-Action-Center
- Grid study for wind/RE penetration
- National infrastructure in support of RE
- Special window facility
  - Pre-FS to construction
  - System reliability improvement
- Focus on targeting and implementation

Third Party Assessment of the Philippine Wind Industry

- Activity was requested by DOE
- QLW will engage a consultant to:
  - Consult with wind stakeholders
  - Review relevant laws and rules
  - Identify the challenges and barriers
  - Recommend solutions
  - Present result with stakeholders
- Important input to the Philippine Wind Roadmap

Role of Long-term Measurement in WRA

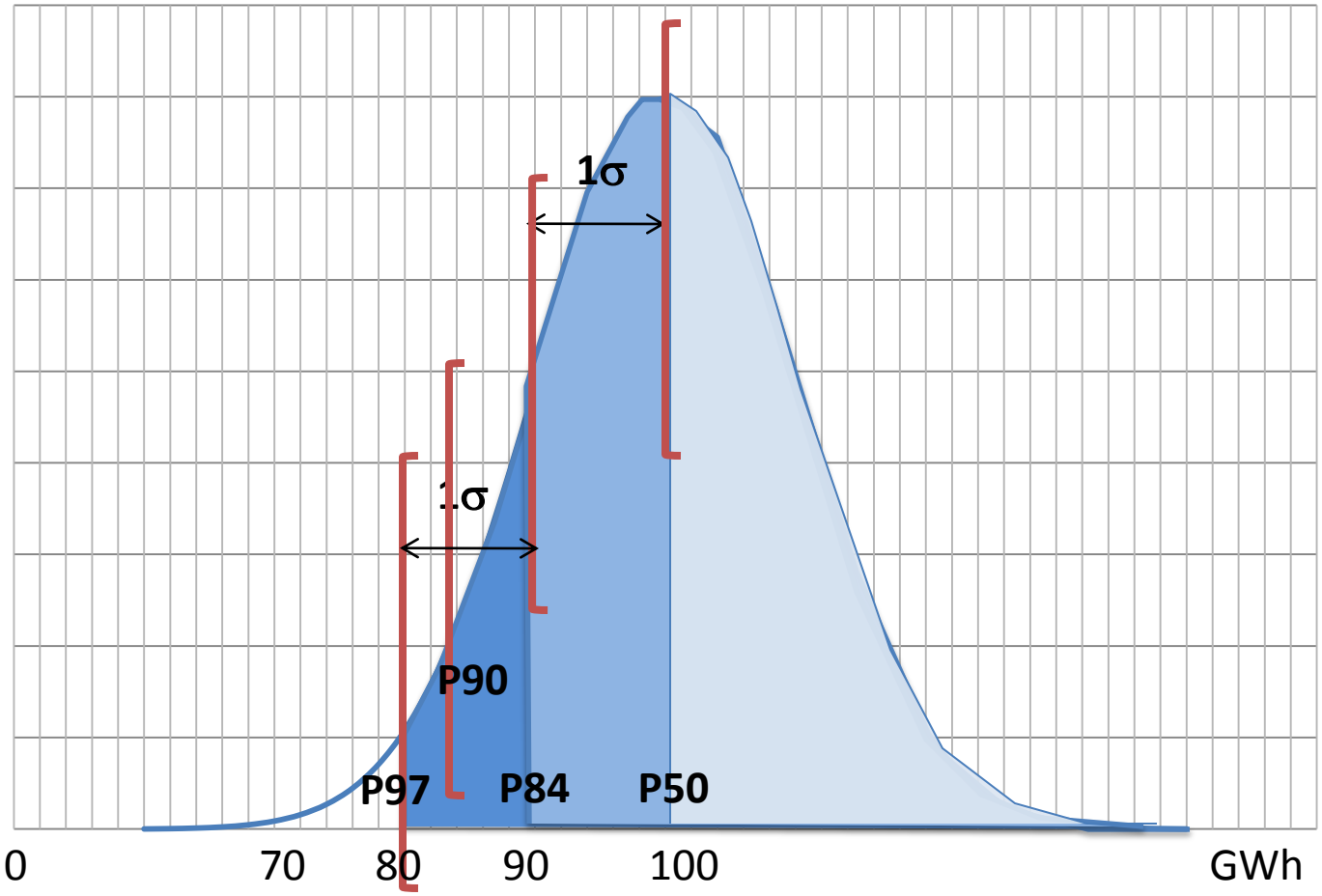


Source: P. Jain, Wind Energy Engineering, 2010

Uncertainty in AEP due to Long-term reference dataset

Component of Uncertainty	Sensitivity Factor	Amount of Uncertainty (%)	Net Uncertainty of AEP Because of Component (%)
Wind speed measurement	1.5	5	7.5
Wind speed spatial extrapolation	1.5	3	4.5
Wind speed long-term correction	1.5	3	4.5
Wind shear, height extrapolation	1.5	2	3
Air density	1	0.3	0.3
Power curve	1	0.6	0.6
Wake losses in wind farm	1	1.7	1.7
Unaccounted for Loss	1	1	1
Total uncertainty of AEP assuming components are uncorrelated is square root of sum of squares			10.5%

Illustration of P50, P84, P90



P84 is an Annual Energy Production number with the following property: There is a 84% likelihood (probability) that energy production will be at least 90GWh.

Assuming: Average AEP=100GWh, uncertainty is 10%

Value of Long-term Data

- Allows developers to:
  - Compute accurate energy production over the entire life of project (20 years)
  - Reduce duration of measurement from say 3 years to one year
- Allows financiers to decrease uncertainty, thereby increase the valuation of wind project
  - Allows bankers to increase % of loan, because DSCR is higher
  - Allows equity investors to increase ROE

Properties of Long-term Data

- For long-term data to be useful
  - High quality data with no “holes”, with high quality instruments, with redundant measurements
  - Correlation with concurrently measured wind data must be high
  - Duration of long-term data must be longer, and measurement must be continuous

Met-tower Height for Long-term Measurement

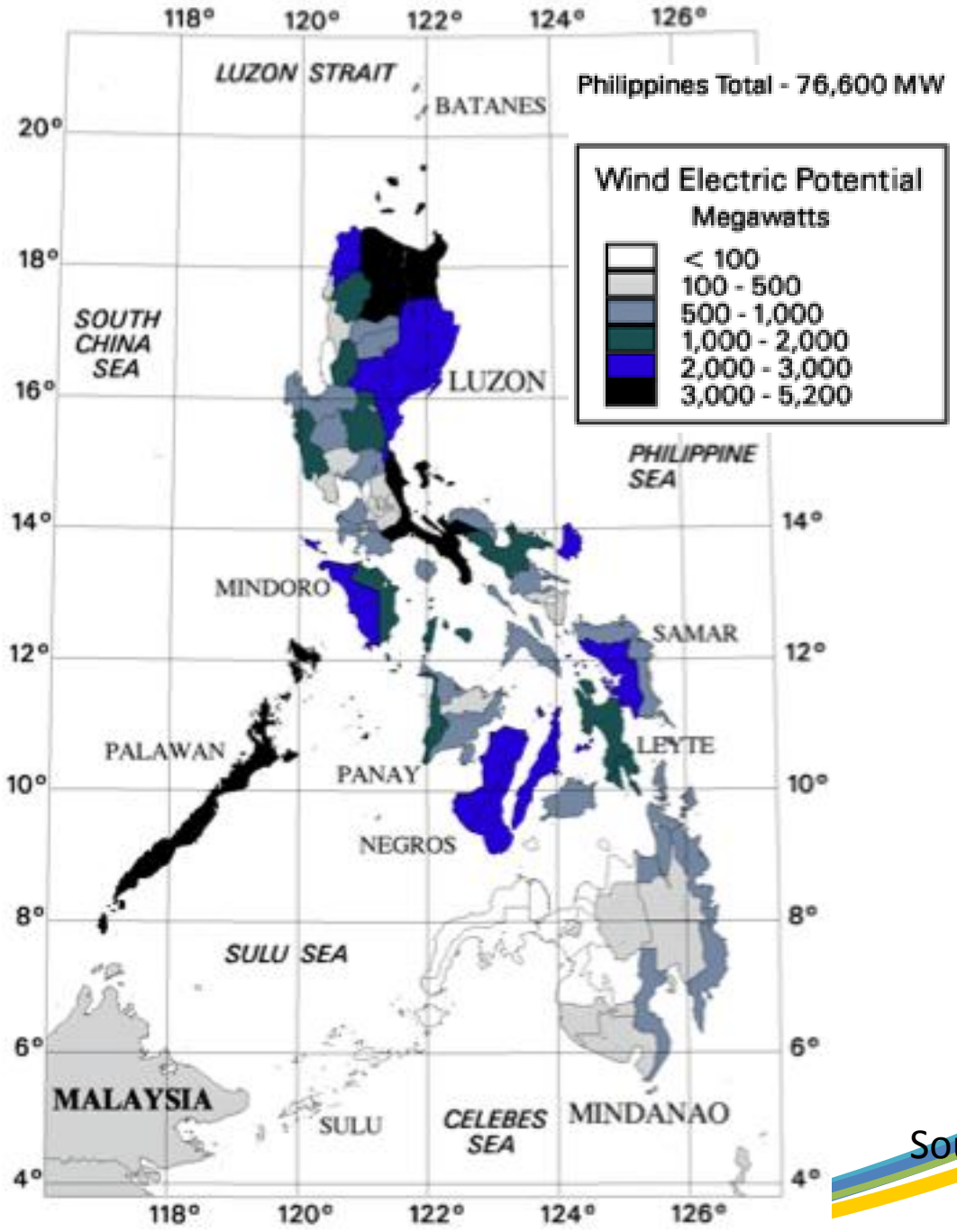
- Evaluated 40m, 60m, 80m and 100m
- Settled on 60m, reasons:
  - Tower cost of 100m is 3 times the cost of 60m
  - Can deploy larger number of 60m met-masts
  - Correlation between 60m and 100m data is very high
  - Shear is much more local , so if shear modeling is a big issue, then onsite measurement should use higher met-tower

Criteria for Selecting Sites for Wind Measurement

- Must benefit multiple projects; cannot be tied to a single project
  - Clusters of existing wind service contracts
- It must cover an area with high wind energy potential
  - Wind potential
  - Existing data (start with what DOE has and summary data that developers will be willing to provide)
- Close to consumption center
  - Dedicated market/off taker
  - Availability of cellular phone signal
- Close to grid, roads
  - Availability/proximity of current and future transmission access
  - Accessibility of site (i.e. public land; not forest land or in water bodies)
- Security of the site

Existing Measurement Data

- Important for QLW to get locations of past and current measurements
  - QLW wants to use the most updated wind resource information to choose sites
- Request: Share aggregate measurement wind data with QLW
- QLW does not have locations of DOE or private measurements
  - Have locations of project sites that have received pre-development license


Philippines Total - 76,600 MW
Wind Electric Potential
Megawatts
< 100
100 - 500
500 - 1,000
1,000 - 2,000
2,000 - 3,000
3,000 - 5,200
LUZON STRAIT
BATANES
SOUTH CHINA SEA
LUZON
PHILIPPINE SEA
MINDORO
SAMAR
PALAWAN
PANAY
LEYTE
NEGROS
SULU SEA
MALAYSIA
SULU
CELEBES SEA
MINDANAO
118°
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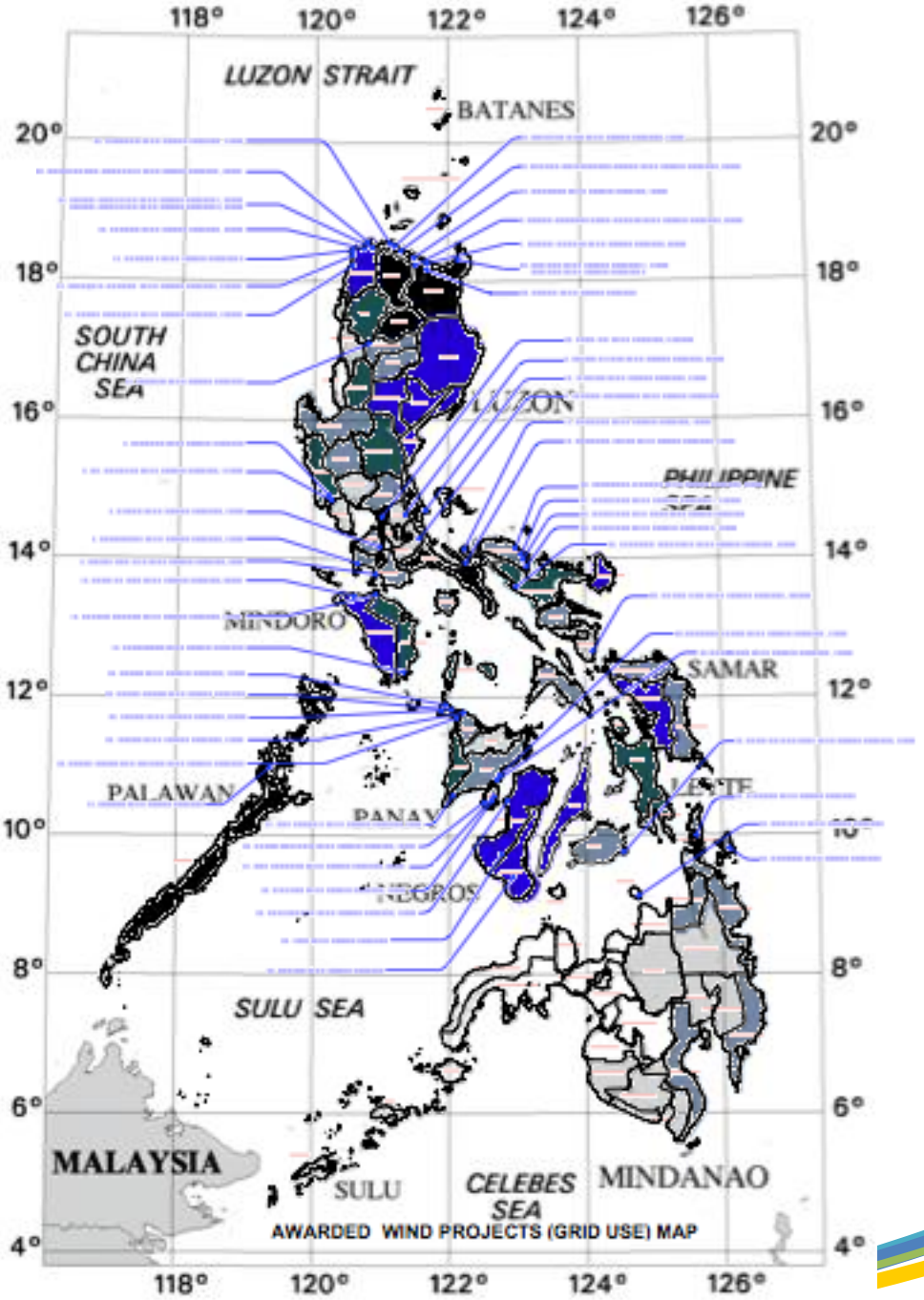
Source: NREL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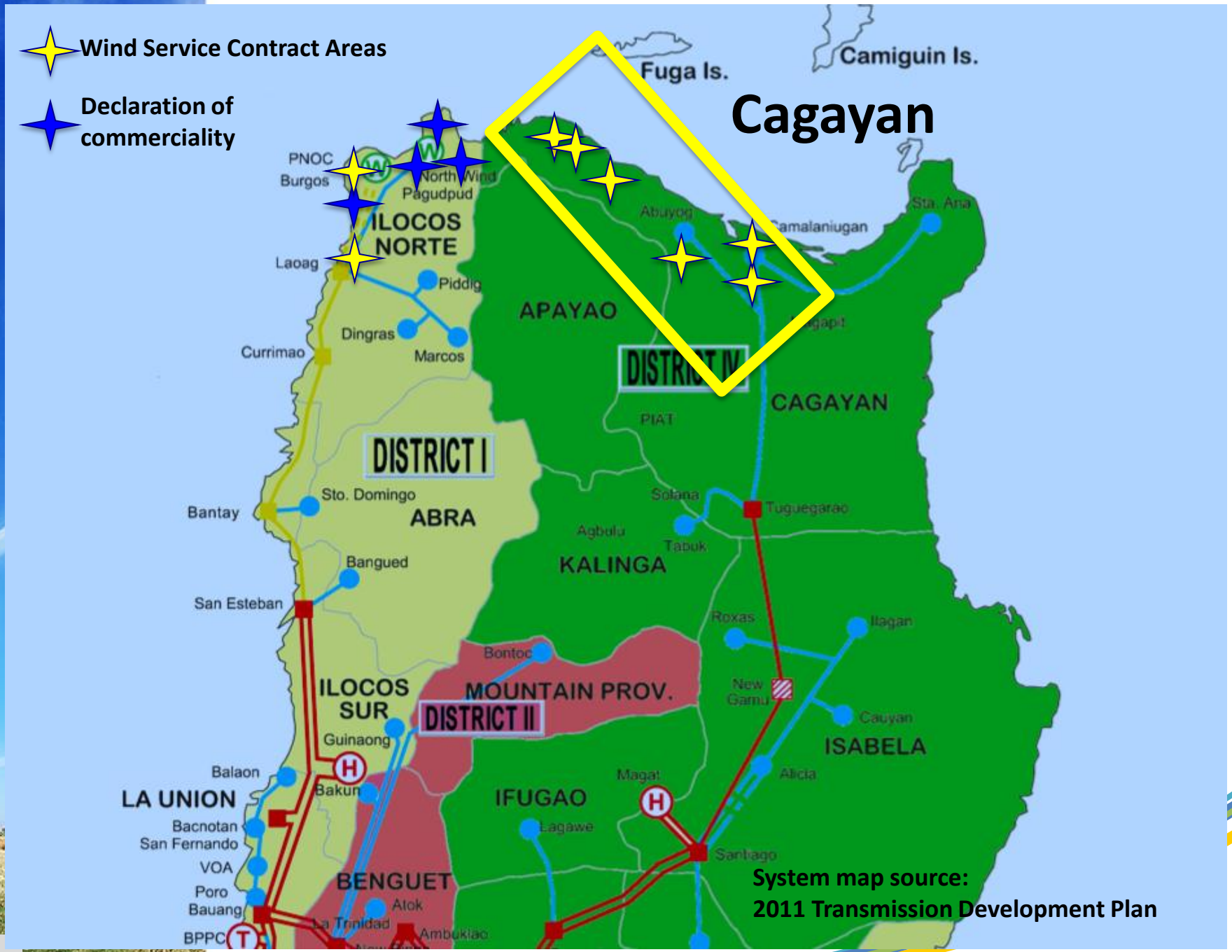
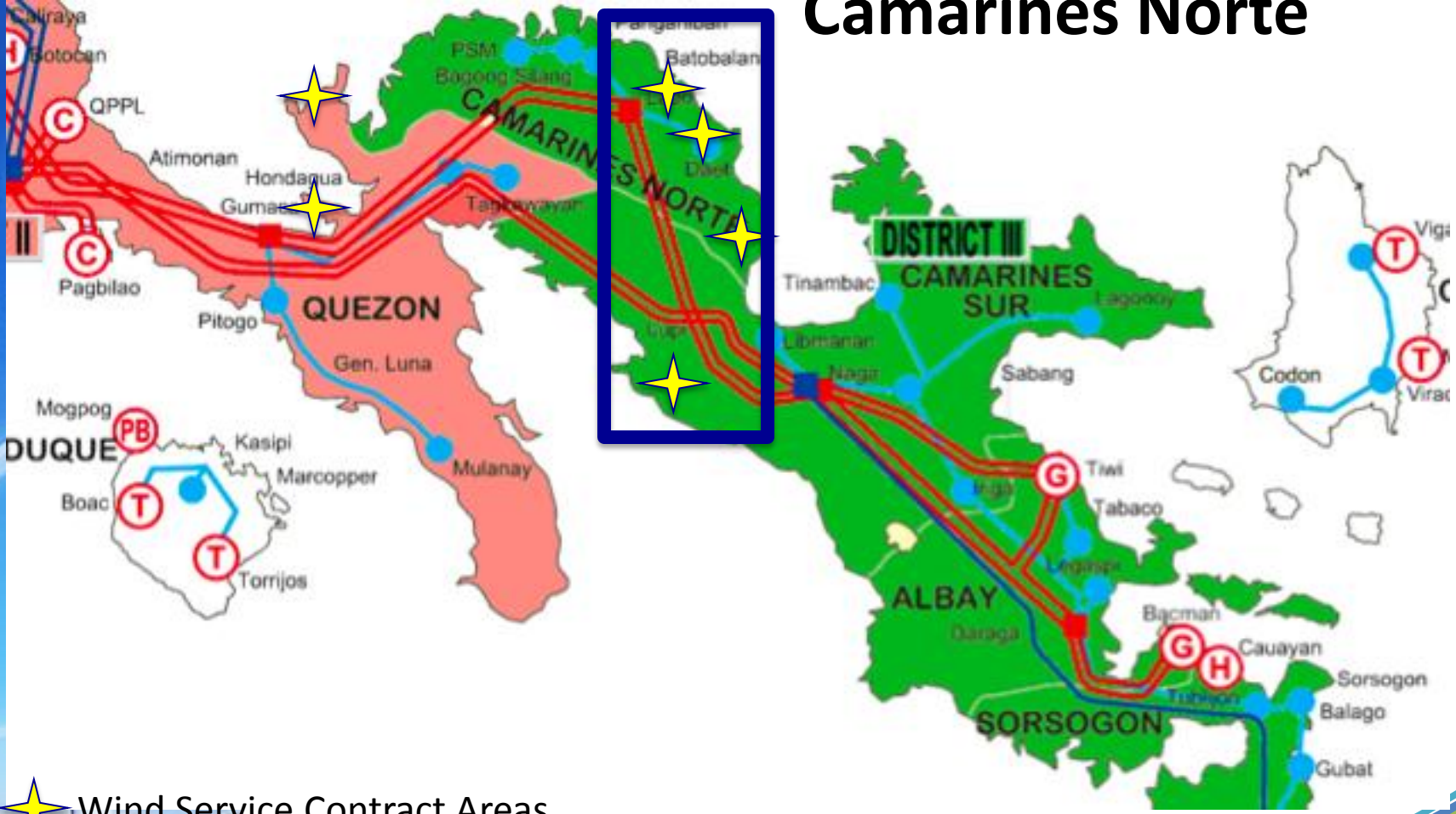
MINDORO
SAMAR
PALAWAN
PANAY
NEGROS
SULU SEA
MALAYSIA
SULU
CELEBES SEA
MINDANAO
AWARDED WIND PROJECTS (GRID USE) MAP

Proposed Location of Met-Towers for Long-Term Measurement


Wind Service Contract Areas
Declaration of commerciality
Cagayan
Fuga Is.
Camiguin Is.
PNOC
Burgos
North Wind
Pagudpud
ILOCOS NORTE
Laoag
Piddig
Dingras
Marcos
Currimao
APAYAO
Abuyod
Sta. Ana
DISTRICT IV
CAGAYAN
PIAT
DISTRICT I
Sto. Domingo
Bantay
ABRA
Bangued
San Esteban
Solana
Tuguegarao
Agbolu
Tabuk
KALINGA
Roxas
Ilagan
Bontoc
ILOCOS SUR
MOUNTAIN PROV.
DISTRICT II
Guinaong
New Gamu
Cauyan
ISABELA
Balaon
Bakun
Magat
Alicia
LA UNION
IFUGAO
Bacnotan
San Fernando
Lagawe
Santiago
VOA
BENGUET
Poro
Bauang
Atok
La Trinidad
Ambuklao
BPPC
System map source:
2011 Transmission Development Plan

Camarines Norte



Wind Service Contract Areas

System map source:
2011 Transmission Development Plan

Aklan

System map source:
2011 Transmission Development Plan

Conditions Associated with Wind Data

- Data will be public, there may be a nominal fee to get raw data
- After the QLW project, want a local agency to:
  - Own the met-tower
  - Maintain the met-tower
  - Own the data
  - Manage the data
  - Become the repository of knowledge
  - Manage detailed wind resource modeling
  - Updating wind resource maps

Options for Institution to Own Long-term Measurement Campaign

- Research center at university, with faculty and graduate student participation
  - Asian Institute of Management
  - Ateneo – Manila Observatory
  - University of Asia and the Pacific
  - University of the Philippines
- Government
  - DOE
  - PAGASA
- Private sector
  - NGO
  - WEDAP

Characteristics of Successful Institution

- Sufficient budget for long-term (after QLW):
  - Maintaining met-tower:
    - Replacing faulty sensors, datalogger, etc.
    - Maintaining spares
    - Tightening guy wires
    - Replacing guys wires and booms when necessary
    - Doing necessary repairs after an extreme weather event
  - Operations :
    - Cost of communications
    - Cost of personnel, vehicles
  - Data management
    - Software, training, personnel
  - Wind resource assessment
    - Software, training, personnel
- Independent RE agency:
  - Work in partnership with DOE
  - Mandate to promote wind energy
  - Repository of data, best practices, training and research

Open Discussions

- Measurement locations
- Institution for managing long-term wind data
- Implementation Issues

Invitation to Policy Brownbag

- Why does wind energy development policy fail? What are lessons to learn from countries with successful wind energy policies?
  - Audience: Policy makers and government officials
  - Presented by Pramod Jain
  - Oct 12, 2012 at 10AM at ADB Room 4653

Thank you !

Contact details for more information

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