

Global Advances in Wind Power Research and Development



Sathyajith Mathew



Pune, 22-23 August 2006



Growth rate of the industry - Over 25 per cent
Major contributing factor - Improvements in Technology
Sustaining the growth - Intensify R&D



Physicists
Engineers
Economists
Social scientists
Policy experts



Pune, 22-23 August 2006

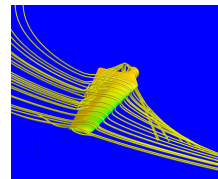
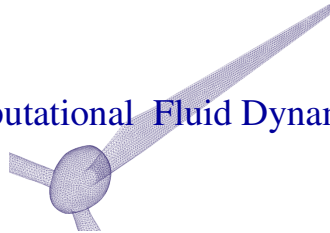
$$E = \int_{V_i}^{V_o} C_P \frac{1}{2} \rho A V^3 f(V) T dV \times R_s \times E_A$$

- Rotor aerodynamics
- Wind resource assessment
- Turbine engineering
- Offshore wind energy
- Grid integration issues and
- Environmental aspects

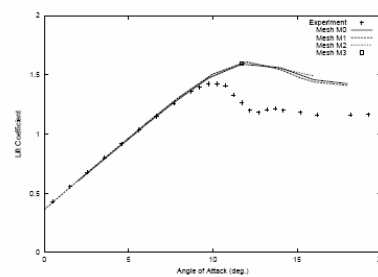
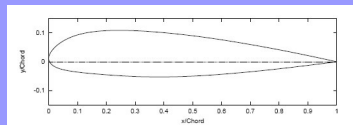
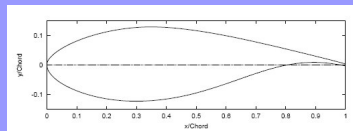


Pune, 22-23 August 2006

Computational Fluid Dynamics

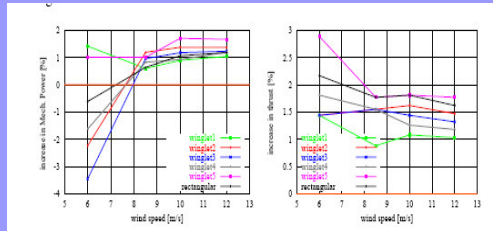
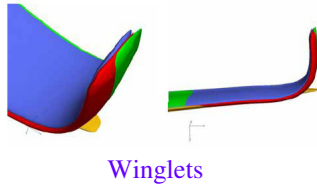


EllipSys3D model



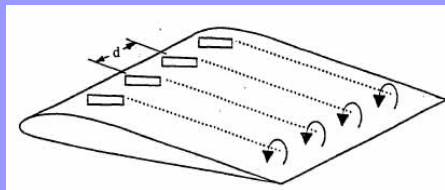
Pune, 22-23 August 2006

Flow manipulators



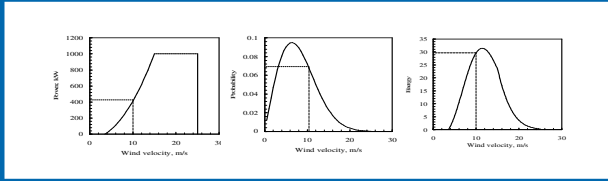
Pune, 22-23 August 2006

Vortex generators



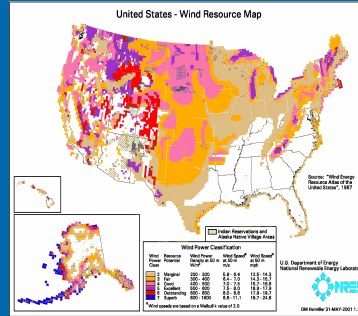
Pune, 22-23 August 2006

WIND RESOURCE ASSESSMENT

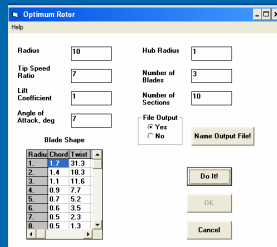


Artificial Neural Network (ANN)

- Training the model
- Verification of the model



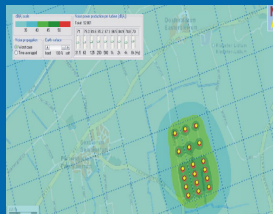
Pune, 22-23 August 2006



Mini Codes



RETScreen



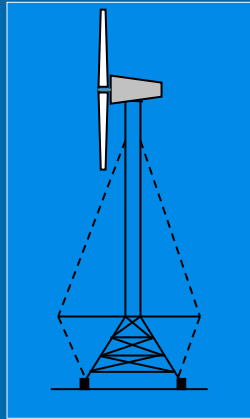
FluxFarm



WERA



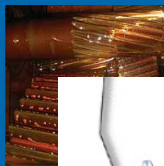
Pune, 22-23 August 2006



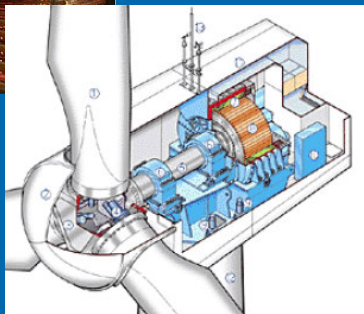
Hybrid Towers



Pune, 22-23 August 2006



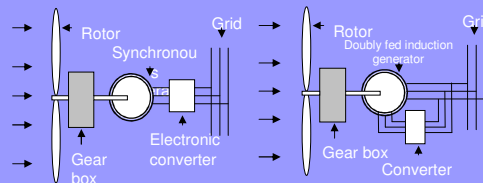
Direct Drive Turbines



Synchronous
Permanent-magnet

Variable Speed Drives

Challenge:
Optimal
Control Schemes



Pune, 22-23 August 2006

OFFSHORE WIND ENERGY



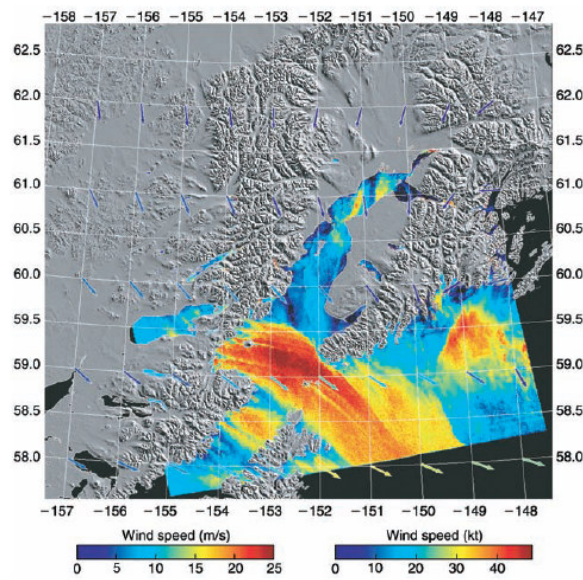
Offshore resource

Understanding offshore conditions

Tailoring turbines for offshore

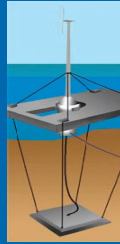
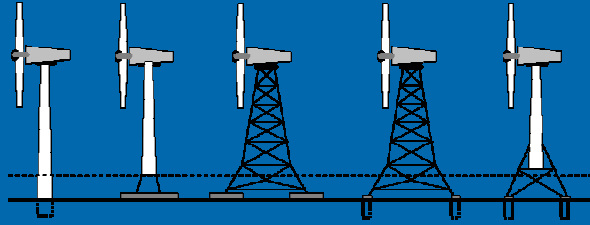


Pune, 22-23 August 2006



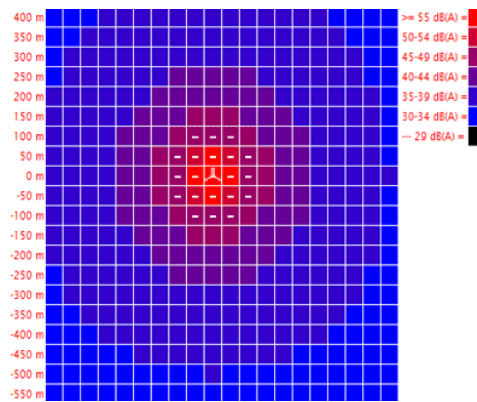
Pune, 22-23 August 2006

Offshore Foundations



Pune, 22-23 August 2006

ENVIRONMENTAL ASPECTS

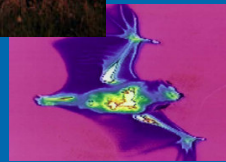
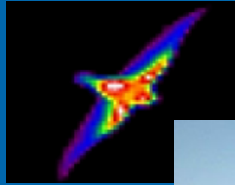


Sound propagation modeling



Pune, 22-23 August 2006

Avian Mortality



Pune, 22-23 August 2006

Visual Impact

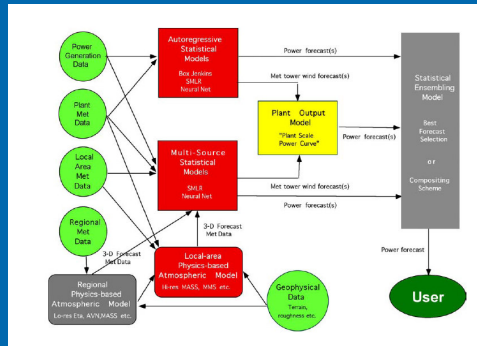


Pune, 22-23 August 2006

GRID INTEGRATION

Wind Energy penetration exceeds 20 per cent – major issue

Long term forecast
Short term forecast
Next hour forecast



Pune, 22-23 August 2006



It is due to the Research and Development initiative, at various parts of the world, that wind energy is a technically feasible and economically viable and environmentally acceptable energy alternative today

To sustain the growth of wind industry today, R&D should further be intensified



Pune, 22-23 August 2006