An Advance Rotor for H-Darrieus Type Vertical Axis Wind Turbine (VAWT)

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BACKGROUND

Considering the wind energy potential, up to 130 GW of electricity can be generated across Pakistan from wind alone. The hills and ridges of northern Punjab along with the ridges and wind corridors near Mardan, KPK and the federal capital Islamabad carry a tremendous potential for wind power production. Installation of large HAWTs would be extremely troublesome due to unreachability and remoteness of these locations.

With an increasing investment in renewable energy technologies across the globe, and a power shortfall faced by Pakistan, indigenous development of small-scale VAWT technology has good potential for country’s economic, environmental and technological progress. The proposed project is a small, yet an important step towards native capacity building in an essential renewable energy technology.

VAWT OVERSIGHT

The aim of this project is to study, design and manufacture an H-Darrieus type VAWT for operation in a low-speed wind corridor, (b) maximize the wind energy yield by controlling the dynamic stall of rotor blades, and finally (c) prototyping of the VAWT rotor followed by comprehensive experimentation and, (d) promote the VAWT technology in Pakistan for on- and off-grid decentralized urban power generation.

The present research aims at maximizing the energy yield from low wind speeds in order to produce 1 kW rated power output for decentralized use. Due to applied nature of the project, practical solutions are to be sought and implemented with an aim to design the turbine rotors compliant with the available wind corridor.

RESEARCH IMPACT

- Presenting NUST as role model in wind energy engineering
- Other campuses and communities may learn from NUST experience
- Training manpower with expertise in wind energy solutions
- Strengthening collaboration with industry and government organizations to promote indigenous research in renewable energy resources and wind power generation
- Entrepreneurship opportunities for young engineers and technologists of Pakistan
- Potential publications and patents

INDUSTRIAL COLLABORATORS

- Aeolos Wind Energy Ltd (UK/China)
- Renewable Resources (Pvt) Ltd (Pakistan)

POTENTIAL STAKEHOLDERS

- Alternate Energy Development Board (AEDB)
- Ministries relating to energy such as W&P, MP&NR, etc.
- National University of Sciences & Technology (NUST)
- Aeolos Wind Energy Ltd (UK/China)
- Renewable Resources (Pvt) Ltd (Pakistan)
- Technology Incubation Center (TIC) NUST
- International development partners e.g. USAID, ADB, etc.

METHODOLOGY

Project Closure

ADVANCE
VAWT ROTOR
DESIGN

Detailed CAD of Advance Rotor (SolidWorks)

Prototype Manufacturing (SolidWorks)

VAWT Field Test Bench Set Up

Performance Comparison and Optimization

CFD Modeling and Simulation (ANSYS)

Measurements and Data Analysis (LabVIEW/MATLAB)

CAD (SolidWorks)

Advance VAWT Rotor (LE Stats)

Baseline VAWT Rotor

Aeolos VAWT Turbine Data

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