

Wind Energy Activities During the XXI Indian Scientific Antarctic Expedition

I. Rajashekar, B.S. Ashoka and M.P. Ramesh

Wind Energy Programme, National Aerospace Laboratories
Bangalore -560017

Abstract

National Aerospace Laboratories have been participating in IASE from the XVI expedition in connection with Wind energy related activities. With the successes of last five expeditions it was proposed to employ more machines for various scientific and logistic requirements during this expedition. In this report details of work carried out is reported

Introduction

Wind energy group of National Aerospace Laboratories had initiated the wind energy activities during XVI Indian Antarctic expedition. The main objective of the program was to determine the wind energy potential in Antarctica and to formulate an over all Wind energy utilization plan for Indian Antarctic scientific program.

During XVI expedition

1. The Wind monitoring station was installed and commissioned.
2. Wind data has been collected at three levels.
3. Further a study of terrain features, energy requirement schedules and infrastructure available at Maitri was carried out. .
4. Based on the above studies to pronged strategy to effectively implement a Wind energy program for Indian station at Maitri was initiated.

During XVII expedition

1. The small Wind battery charger was installed two places.

2. Trail pile foundation test was carried out for large Windmills to be installed in future.
3. As a part of routine maintenance servicing of Wind sensors, Solid-state data logger was carried out and the Wind monitoring station was recommissioned.

During XVIII expedition

1. Installation of new Wind battery charger was carried out.
2. The Wind battery charger installed at Vattiah peak was continued over winter period and its performance was observed.
3. As part of routine maintenance servicing of Wind sensors, Solid state data logger was carried out and the Wind monitoring station was recommissioned
4. New data retrieval software was installed.

During XIX expedition

1. Studied the Wind powered battery charger deployed over the winter months for damage/ performance.
2. The specially designed viscous damper unit by NAL is added to the existing Wind battery charger and to the new Wind battery charger to smoothen the nozzle oscillation during high wind.
3. New battery charging control units are added which can charge and two battery banks. In addition it is provided with LED bar display and dump load
4. New 12V, 340Watt machine was installed near Nanda Devi hut and is being used to charge the 630 AH batteries of IIG
5. The Wind monitoring station, which was installed during XVI Expedition was dismantled from the 28mtr mast and the data logging instruments from the Nanda devi hut.

During XX expedition

1. Installation of portable Wind battery charger on the top of the mobile laboratories was carried out to provide power supply to the instruments in the field camps through the battery.
2. Installation of indigenously developed vertical axis windmill was carried out and the performance, survival of the same was studied to the Antarctic condition.

3. Maintenance of existing windmills was carried out.
4. Energy audit of Maitri station was carried out.

The following activities were undertaken during XXI IASE

Assignments During the XXI IASE

1. Installation of indigenously developed improved version Savonious wind battery charger at Vattiah peak to supply power to the Communication Repeater Station.
2. Installation of indigenously developed improved version Savonious wind battery charger at the automotives station workshop.
3. Assess the performance of the Savonious wind battery chargers in the Antarctic environment.

Works Carried Out During the XXI IASE

Based on the observation obtained during the XX expedition the Savonious wind battery charger needed some modification. The Savonious wind battery charger of 150watts capacity and the Wind Energy Group, NAL, had indigenously developed its charge controller unit. Two of these machines were installed during the XX th IASE. According to its performance study it was found that bearings got damaged due to heavy winds during blizzard conditions.

The improved version of Savonious wind battery charger of 150 watts capacity of three machines were taken to deploy at Antarctica during XXI st IASE. The first machine with control unit was installed at Vattiah peak (7 km away from the Main station) to supply continuous power to the communication repeater station, since the batteries are self-discharges very soon due to low temperature in Antarctic conditions.

It was found the improved version of this machine working satisfactorily but due to heavy winds during blizzard time it was noticed that the development of bulging at the middle portion of the both curved blade edges of the rotor. So the machine was dismantled and reinforcement was given at the edges of the rotor by curling the edges of the blade. After this reinforcement again the machine was installed at vattiah peak and it was found working satisfactorily. The same modification were implemented for other two machines



Fig. 1: Savonius Wind battery charger at Vattiah peak

The second machine with its control unit was installed at the station automotive workshop to charge vehicle batteries. The same machine was also used to charge the generator batteries since the main generator of the automotive workshop is used rarely the batteries of the generator gets self drain due to Antarctic condition.

Performance study of Savonius wind battery charger

The third machine with control unit and data logging instruments was installed at the Arravalli hut, near Maitri, to study its performance and assess its suitability to the Antarctic environment. Wind data like average, maximum and minimum wind speeds and the standard deviation were collected for a period of 15 days in 10-minute averages. Machine output data like voltage, current and rotor speed were also collected. These parameters are useful inputs for the further improvement of the design of the machine, particularly, for Antarctica.

Concluding Remarks

- Detailed performance studies of the Savonius wind battery charges have been carried out and possible improvements examined.



Fig. 2: Savonius Wind battery charger near station work shop



Fig. 3: Savonius Wind battery charger near Arravalli hut



Fig. 4: Instrumentation setup to study the Performance

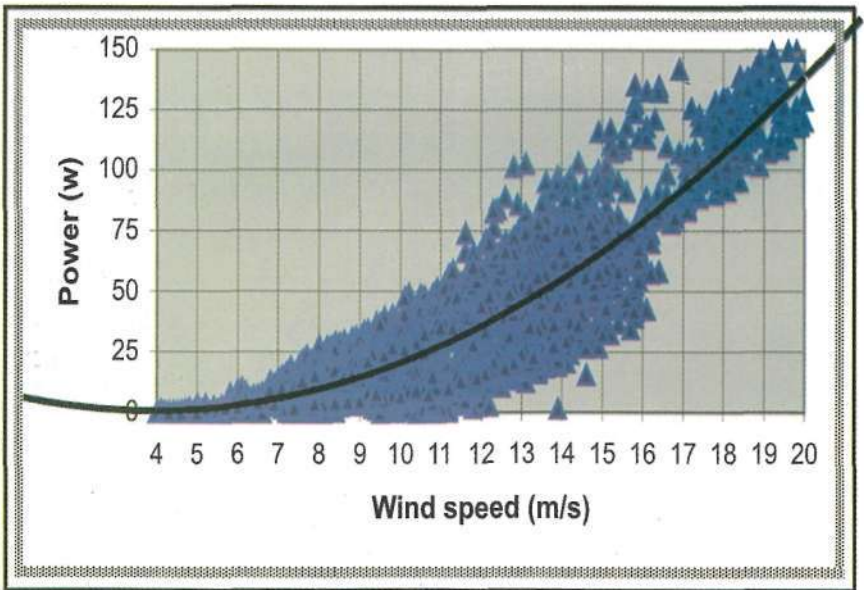


Fig. 5: Performance of Savonius Wind battery charger

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