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Wind Energy Activities During the 19th Antarctic Expedition

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Abstract

National Aerospace Laboratories (NAL) have been participating in Indian Antarctic expeditions from the 16th expedition, in connection with wind energy related activities. With the successes of last three expeditions, it was proposed to employ more machines for various scientific and logistic requirements during the 19th expedition. In this report details of work carried out is reported.

Introduction

Wind energy group of NAL had initiated the wind energy activates during the 16th expedition. The main objective of the program was to determine the wind energy potential in Antarctica and to formulate an overall wind energy utilization plan for scientific program. Following are the some of the tasks carried out during our previous expeditions.

During the 16th expedition

1. The Wind monitoring station was installed and commissioned.
2. Wind data colleted at three levels.
3. Further 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 the 17th expedition

1. Small Wind battery chargers were installed at 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 the 18th expedition

1. Installation of new Wind battery charger was carried out.
2. The Wind battery charger installed at Veteheia peak was continued over winter period and its performance was observed.
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.
4. New data retrieval software was installed.

Work done during the 19th expedition

1. Collected the details of old wind machines installed at Maitri and Veteheia peak and check its operation. Studying the wind powered battery charger deployed over the winter months for damage/ performance.
2. Installation of new wind machines and new battery charge control unit.
3. Based on the observation obtained during 18th expedition, the mechanical strength of the Windmill was improved by adding specially designed Viscous damper unit to reduce yaw bearing oscillation.
4. New 12 v, 340-watt wind turbine was installed near "Nanda Devi" hut to charge the batteries and its performance was observed during summer period.
5. Dismantling of wind monitoring system from the 28 m tower.
6. The details of old wind battery charger installed at Maitri and Veteheia peak collected.

Details of Work Carried Out

Based on the observation obtained during 18th expedition, the mechanical strength of the Windmill was improved by adding specially designed viscous damper unit to reduce yaw bearing oscillation.

Viscous damper unit: During high wind, the machine nozzle was oscillating too much this is because of furling mechanism incorporated in the

machine. This frequent oscillation leads to over-vibration in the structure which in turn weakens the structure. The viscous damper unit is a mechanical component, which was specially designed by NAL to smoother the oscillation. It is added near the nozzle of the Wind machine. The grease, which was used in the viscous damper unit, can withstand to the Antarctic environment.

Battery charge control unit: Based on the observation obtained during the 18th expedition, the battery charge control unit needed some modification in the circuit. The control unit, which is used along with machine can charge two battery banks at a time. Once the battery is fully charged the control unit will switch over the output of the Wind machine to Resistive dump load. Thereby the over charging of the battery is controlled. Again, the control unit will switch over from dump load to battery once the battery charge level comes down to certain limit. In this way, the control urn will control charge level of the battery. The control unit provided with an ammeter to show the charging current and two LED bar display to show the charge levels of the individual battery banks.

New wind machine: of 12V, 72 watt was installed at Veteheia peak with new battery charger controller unit. The wind machine was provided with specially designed viscous damper unit for Yaw bearing oscillation. The viscous damper unit reduces the hunting of the machine thereby reducing the bearing loads and vibration of the structure.

Another machine: of same capacity was installed at Maitri Workshop to charge the generator battery and vehicles batteries during summer and

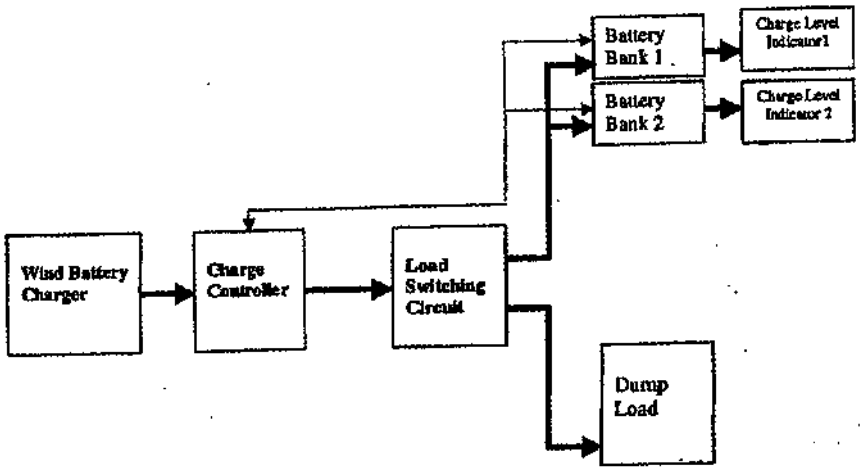

Fig. 1: Block diagram of battery charge control unit

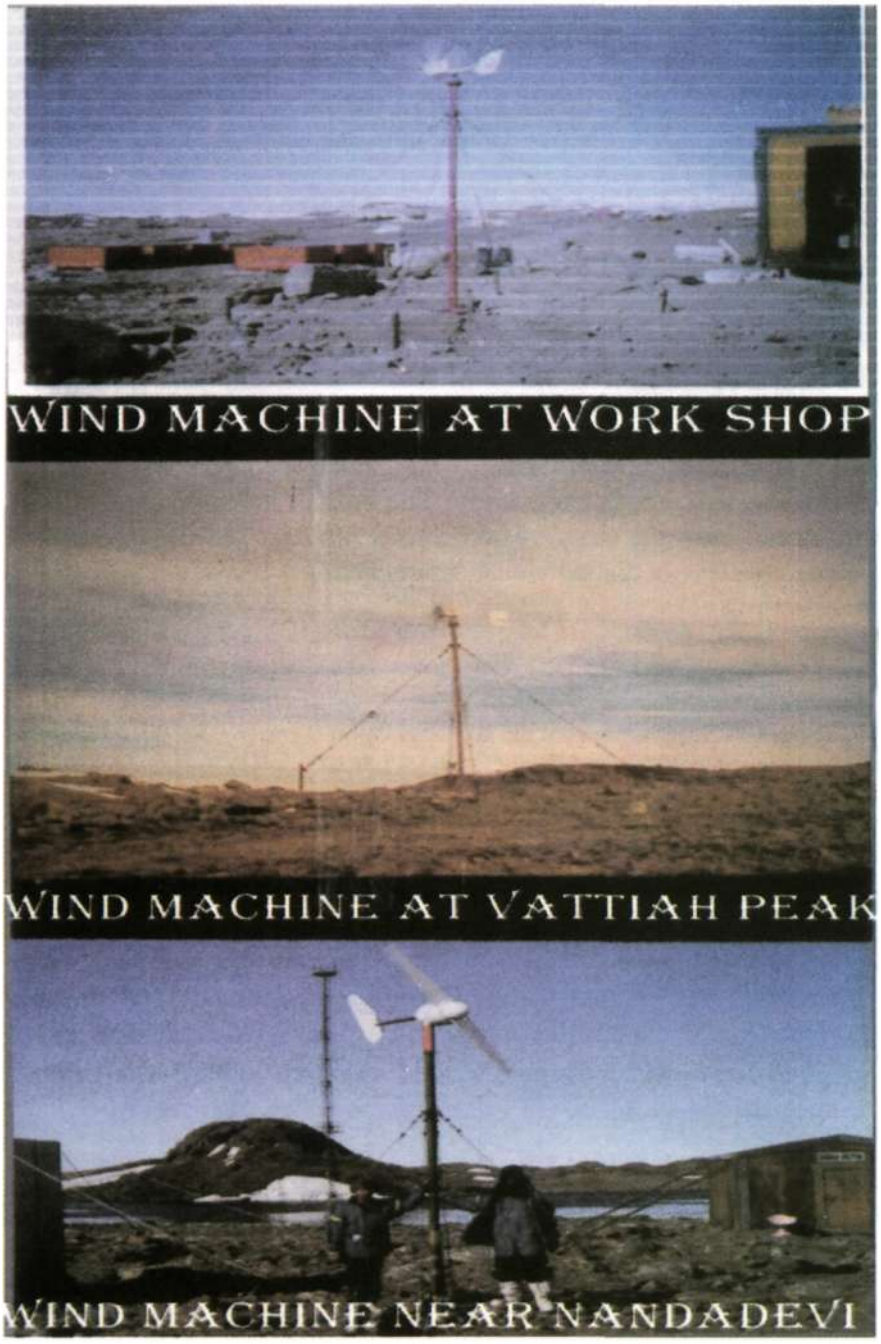
WIND MACHINE AT WORK SHOP
WIND MACHINE AT VATTIAH PEAK
WIND MACHINE NEAR NANDADEVI

Fig. 2

winter. This machine also provided with viscous damper unit, charge control unit.

The **tower:** for the 12V, 340-Watt machine was too big for air-lifting from ship to Maitri station. Therefore, it was cut into two pieces and transported. After reaching Maitri, these were joined again securely by welding.

A bigger machine: was installed near Nanda Devi hut and is being used to charge the 630 AH batteries of IIG. This machine is an auto-cutoff model. During transportation, the electronic components were damaged and the machine could not run automatically. The board was repaired using components procured from South Africa. End users were trained on operation and maintenance of the machine. The operation and maintenance of machine was instructed to the end users.

Wind Monitoring Activities

Wind monitoring station, which was installed during 16th expedition, was used to collect wind data regularly and it was analyzed at NAL to get a clear picture of wind environment at Maitri. The data during 18th winter period was collected by the NGRI Scientist. During the 19th expedition the data collected by the NGRI scientist was processed and sent to the NAL for further processing. This activity continued during the summer period. All the Sensors are dismantled from the 28 m mast.

Conclusion

In this Expedition the performance of 340W, Wind Machine was observed. The Viscous damper unit added to the existing machine was working satisfactorily. The performance of new control unit added to the wind machine was observed. Based on the results obtain in this expedition, planning would be done to install larger wind machines at Maitri for space heating and other electrical applications. In future expeditions, NAL would propose to carry out such projects.