



Wind Blade Reliability Considerations

Presented by Gary Kanaby

OBJECTIVES

- **Discuss two major modes of wind blade damage**
- **Prevention and repairs of these problems**
- **Minimize loss of production revenue and repair costs**

LIGHTNING

A Major Cause of Blade Damage

- **Can't stop Lightning**
- **Make sure blade has a lightning protection system**
- **Make sure lightning protections system is working**
- **Make sure drain hole is open**

LIGHTNING SYSTEM TESTING



Digital Low Resistance Ohmmeter

Test each receptor



MINOR LIGHTNING DAMAGE



Protected with Lightning System

MINOR LIGHTNING DAMAGE



Protected with Lightning System

LIGHTNING DAMAGE



Protected with Lightning System

DRAIN HOLE MUST BE OPEN



LIQUID RUNNING OUT OF DRAIN HOLE

MAJOR LIGHTNING DAMAGE



SEVERE DAMAGE



LEADING EDGE EROSION

- **EASILY IDENTIFIED**
- **CAN REDUCE ENERGY CAPTURE BY 5% or MORE**
- **CAN BE REPAIRED WHILE INSPECTING OR PERFORMING REPAIRS**
- **CAN LEAD TO MORE SEVERE DAMAGE**
- **CAN BE PREVENTED WITH LEADING EDGE TAPE or OTHER COATINGS**

LEADING EDGE EROSION



LEADING EDGE EROSION



LEADING EDGE SPLIT LEFT UNREPAIRED



No Lightning Damage Observed

LEADING EDGE TAPE



APPLICATION OF LEADING EDGE TAPE

CRANES: THREE LEVELS OF COST

- 1.SMALL CRANE TO HOIST MAN
BASKET**
- 2.LARGER CRANE TO REMOVE ONE
BLADE**
- 3.VERY LARGE CRANE TO REMOVE
ENTIRE ROTOR**

BLADE INSPECTION OR REPAIRS UPTOWER



Small crane needed to hoist technicians

BLADE/ROTOR REPLACEMENT LARGE CRANE IS REQUIRED



ALTERNATE INSPECTION METHODS

- 400mm Lens on High Resolution Camera
- Rope Access
- Blade Climber
- Site O & M Technicians' Observations

INSPECTION FROM THE GROUND



400MM LENS

DOING NOTHING

- **WAIT FOR SOMETHING TO HAPPEN**
- **UNSCHEDULED REPAIRS**
- **REPAIR COSTS**

LOSS OF REVENUE IN WINDY SEASON

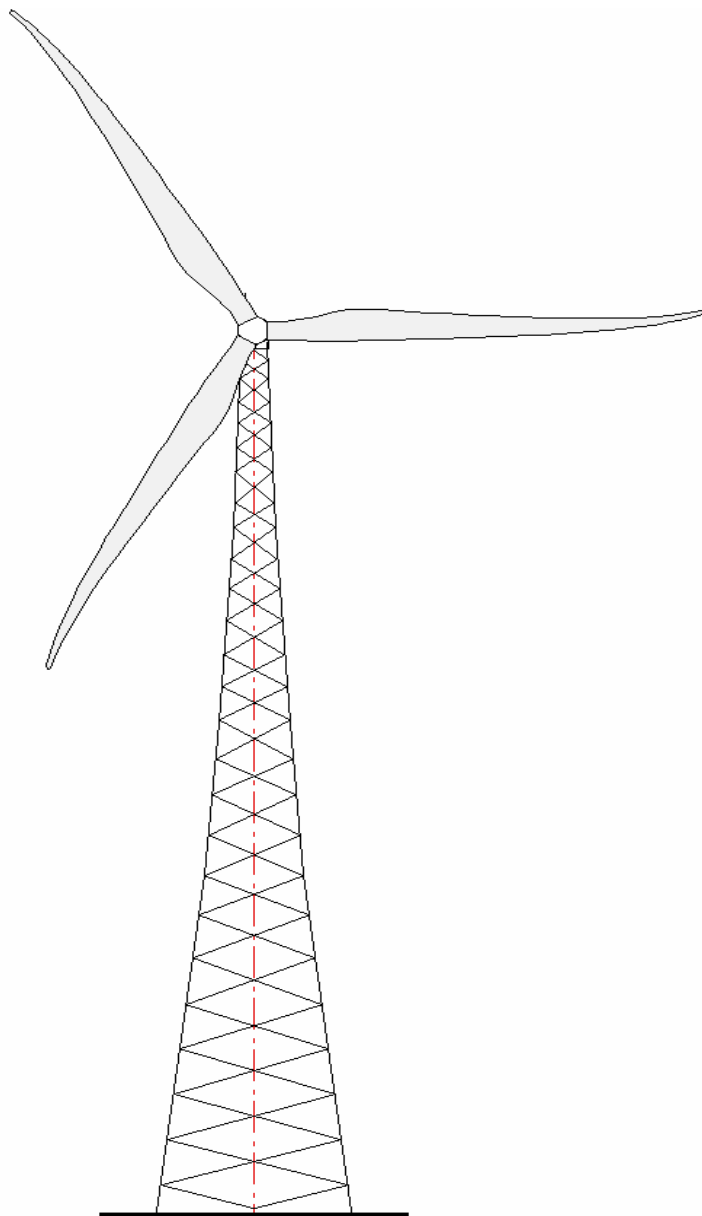
REMOVAL OF BLADE MAY BE NECESSARY

MAY NEED TO BE REPAIRED IN THE SHOP

REPAIRS COSTLY

SCHEDULED MAINTENANCE

- **INSPECTIONS SCHEDULED**
- **REPAIRS UP TOWER SCHEDULED**
- **REPAIRS ARE MINOR**
- **SMALLER CRANES ARE NEEDED**
- **NO LOSS OF REVENUE:**
THE INSPECTIONS AND REPAIRS
ARE SCHEDULED DURING THE
CALM SEASON
- **LEADING EDGES CAN BE REPAIRED**



KNIGHT & CARVER

WIND GROUP

1313 BAY MARINA DRIVE

NATIONAL CITY, CA 91950

Tel: (619)-336-4141

Fax:(619)-474-4811

www.knightandcarver.com

