IPRO 303

Wind Power Generation

Problem Statement

http://www.facelift.co.uk/images/piclibrary/hi-rez/Red-Nose-Wind-Turbine-Bronto-Skylift.JPG

The Fall 2008 semester of IPRO 303 investigated and analyzed the economic and technical details of the wind-turbine electricity generation industry. The team will be focusing on the impact of equipment failures that lead to downtime and maintenance associated with the failures. A comparison of current industry practices in dealing with these problems, along with a detailed economic analysis of the true costs involved, will be the major goal. A spread sheet will be developed to provide a scenario based cost analysis of down time.

Objectives

- **Explain faults that are occurring in wind turbines And why**
  - Gain a general understanding of how wind turbines work
  - Identify turbine components and major failures
  - Determine turbine faults
  - Determine most costly and most common reasons for turbine downtime
- **Provide an overview of current maintenance practices and procedures**
  - Provide listings of maintenance procedures available
  - The advantages and disadvantages of current maintenance practices
  - Determine who is responsible for maintenance
- **Technical Business Case**
  - Describe the revenues and cost basis of wind power generation
  - Calculate costs of unplanned down time due to failures

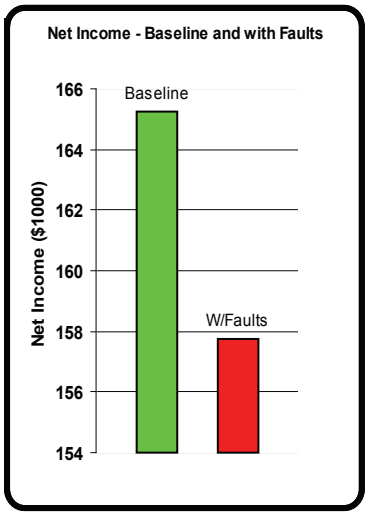
Current Maintenance Practices

The relative scale of large wind turbines poses difficulty in accessing and working on the components. With the exception of some switch gear and power conversion equipment, most the turbine equipment is accessed by climbing the tower. Labor for minor repairs (those associated with sensors, actuators or control components that fail or function intermittently) is generally accounted for by assigning a number of turbines to each technician. The above information is taken directly from: Sandia Report. Wind Turbine Reliability: Understanding and Minimizing Wind Turbine Operation and Maintenance Costs

Results

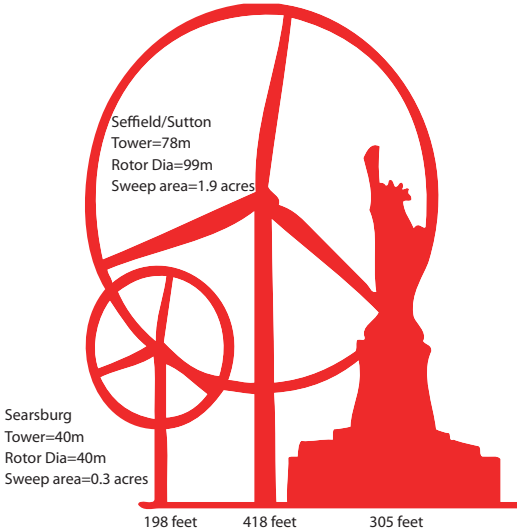
The chart below is from the cost analysis spreadsheet. It shows the total cost of repair and downtime for each failure scenario considered on a yearly basis. Other spread sheets were developed to analyze cost for an entire wind farm and turbine component analysis

Component Faults			
Component	**Cost to Repair ($)**	**Downtime (Hours)**	**#**
Gearbox	448,000	900	0
Generator	325,450	875	0
Rotor	287,400	720	0
Hydraulic System	5,470	72	0
Electrical System	27600	280	0
Control Electronics	2,110	8	3
Total $ | Hours	$6,330	24	0



The graph to the left shows how much the wind farm's net income will be affected by having the selected faults. The baseline income includes the turbine size and how much energy on average is produced a year. It also takes into account typical annual costs not associated with failures.

Cost Impact of Equipment Failure



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