Collegiate Wind Competition 2016

DEPLOYMENT TEAM

TEAM MEMBERS:
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Project Description

- Design a small-scale wind turbine with a feasible business plan to enter the selected market
  - Small scale wind includes turbines 1-100 kW of rated generation

This Semester's Work

Market Research

- Existing small wind market research
- Decided on telecommunication energization market
- Identification of design requirements for desired market

Design Work

- Blade design and analysis
- Financial analysis of basic turbine design
- Research of generator types available
- Identification of generator type and requirements

Design Description

- Rotor: Converts wind's kinetic energy to mechanical energy
- Main shaft: Transmits the mechanical energy from one point to another
- Magnets & coils (generator): Converts mechanical energy into electrical energy
- Tail vane: Directs the turbine into the on coming wind
- Safety Devices: This includes passive stall & tail deflection springs

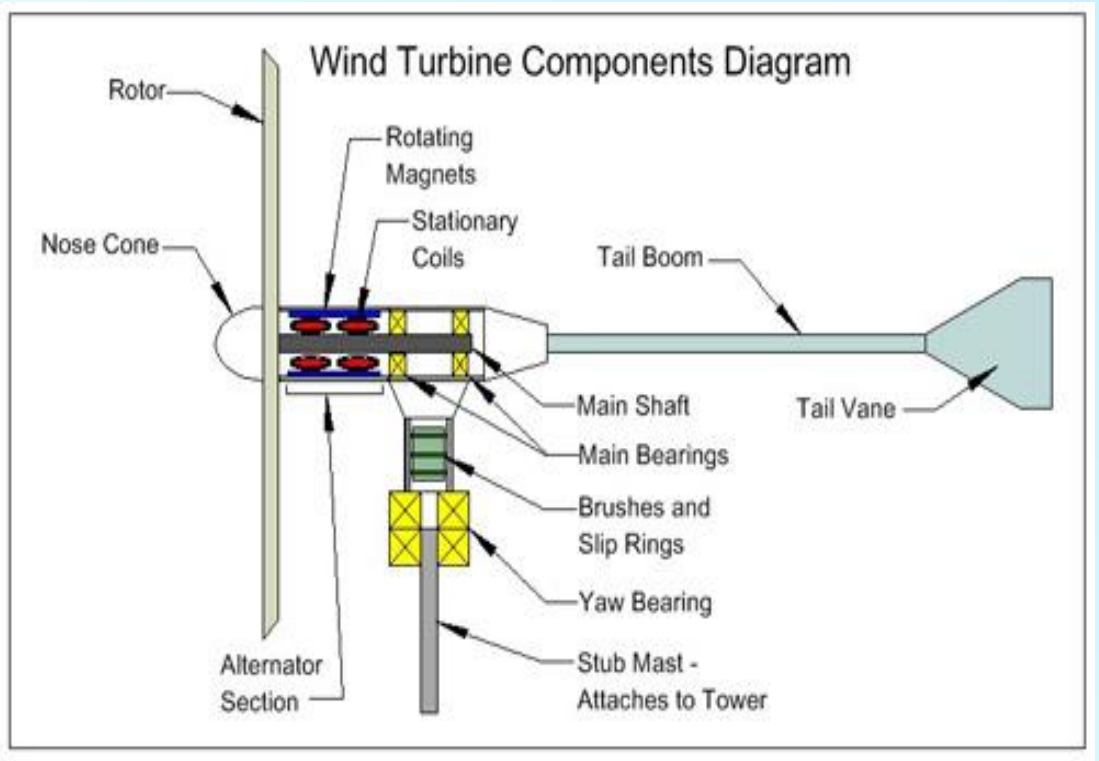


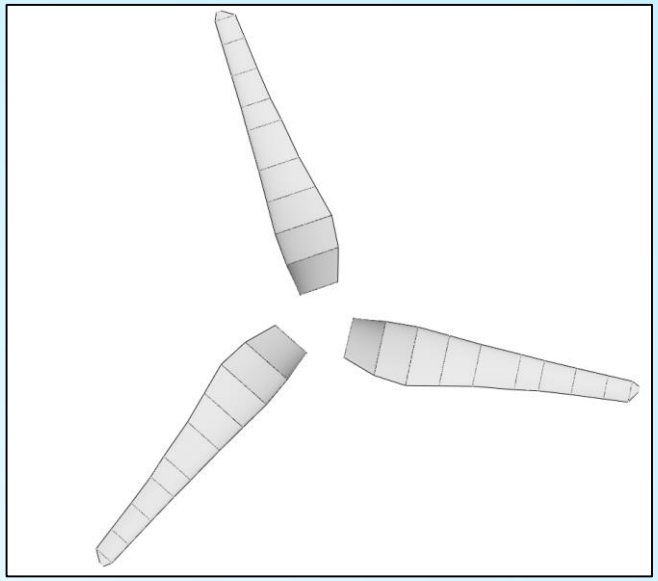
Figure 1: Horizontal wind turbine components [1]

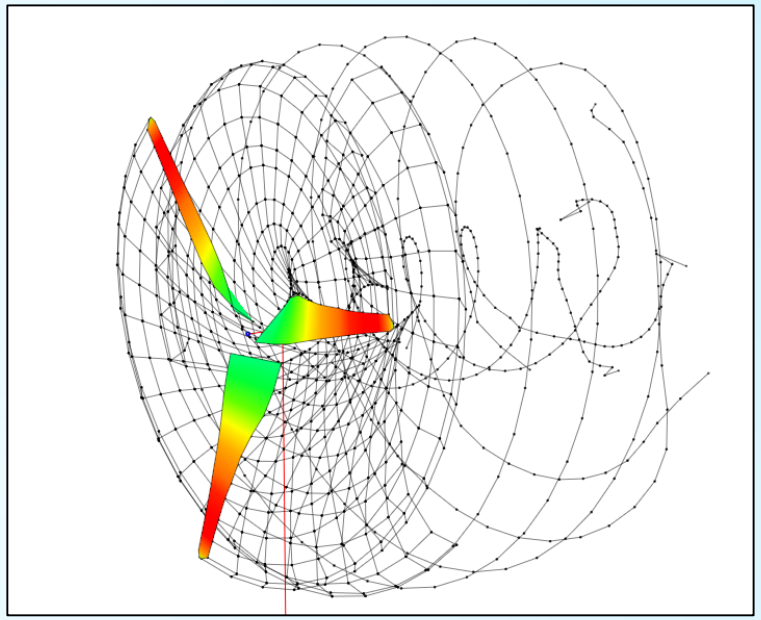
Design Requirements

- Horizontal axis wind turbine design (more efficient than vertical axis)
- Least amount of components possible (simplified design)
- Rated power of at least 3 kW @ 11 m/s wind speed
- Lightweight design (less than 150 lbs)
- Little or no maintenance involved (limit to 1 service a year)
- Rotor diameter of 4m or less

Prototype

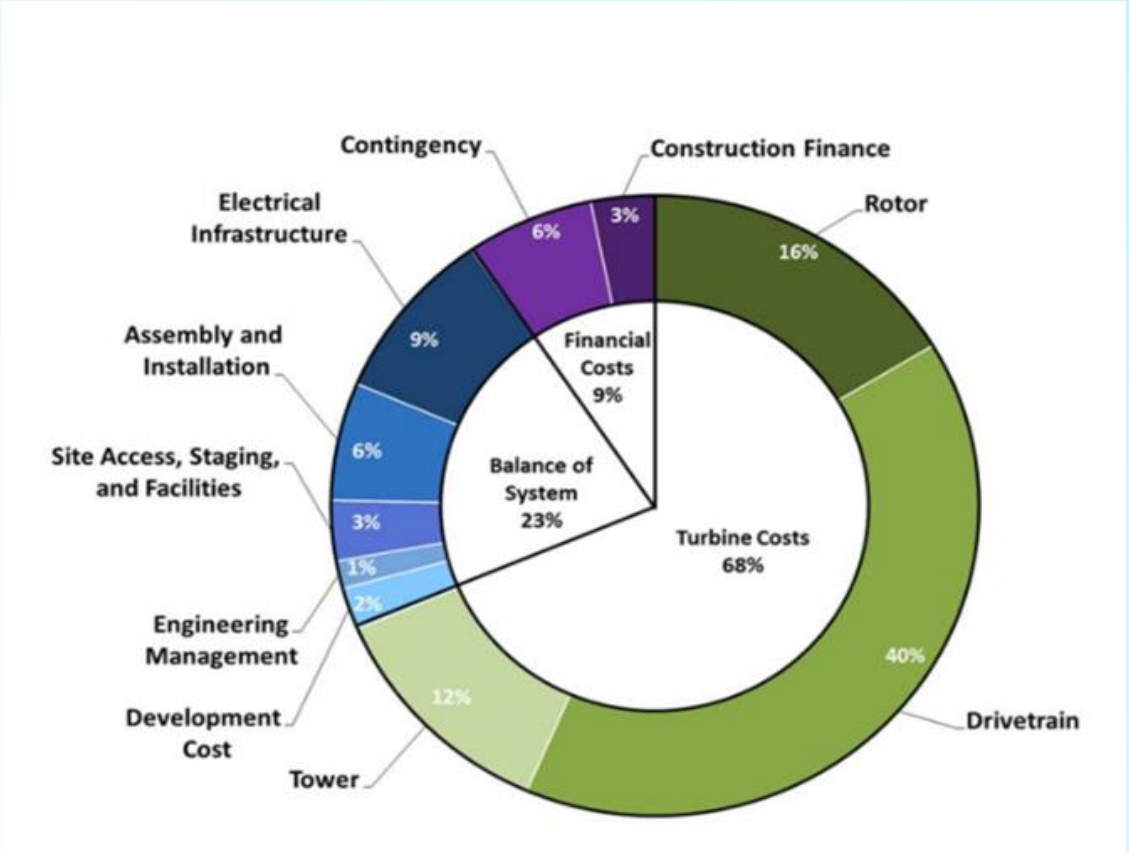
- Software packages used
  - Matlab
  - Qblade
- Theories used
  - Blade element momentum
  - Betz's optimum rotor design with wake rotation
- Coefficient of power and power outputs
  - Coefficient of power: .47 @ tip speed ratio 5
  - Power: 3.6 Kw @ 11 m/s





Budget

- Nothing spent to date
  - $4,097 per kW in India
  - India costs 61% of what it would be in US
  - 3.6kW turbine: total cost - $14,749.20
  - Cost of possible turbine prototyping - TBD



Schedule

#	Task	Date
1	Students meet with industry expert for generator design and selection discussion	Dec. 16, 2015
2	Preliminary Department of Energy (DOE) Document due	Dec. 17, 2015
3	-Individual research turbine structural components (ie tower, etc.) -Begin work on CAD models and array of simulations of components	Dec. 20, 2015 – Jan. 19, 2016
4	-Blade design & generator compatibilities identified -Create full array of CAD, FEA, and other models/simulations	Feb. 1, 2016
5	-Iterate design and business plan as needed -Finalize CAD and create manufacturing drawings	Feb. 2, 2016 – Mar. 1, 2016
6	-Physical prototype created -Work towards DOE presentations and final report	Apr. 10, 2016
7	-DOE final document and presentations due	Apr. 25, 2016
8	- Collegiate Wind Competition begins in New Orleans, LA at AWEA National Conference	May. 19, 2016

References

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