Wind Energy Turbine Project-13

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Overview

- Project Description
- Background & Benchmarking
- Customer and Engineering Requirements
- Schedule & Budget

Description of the Project

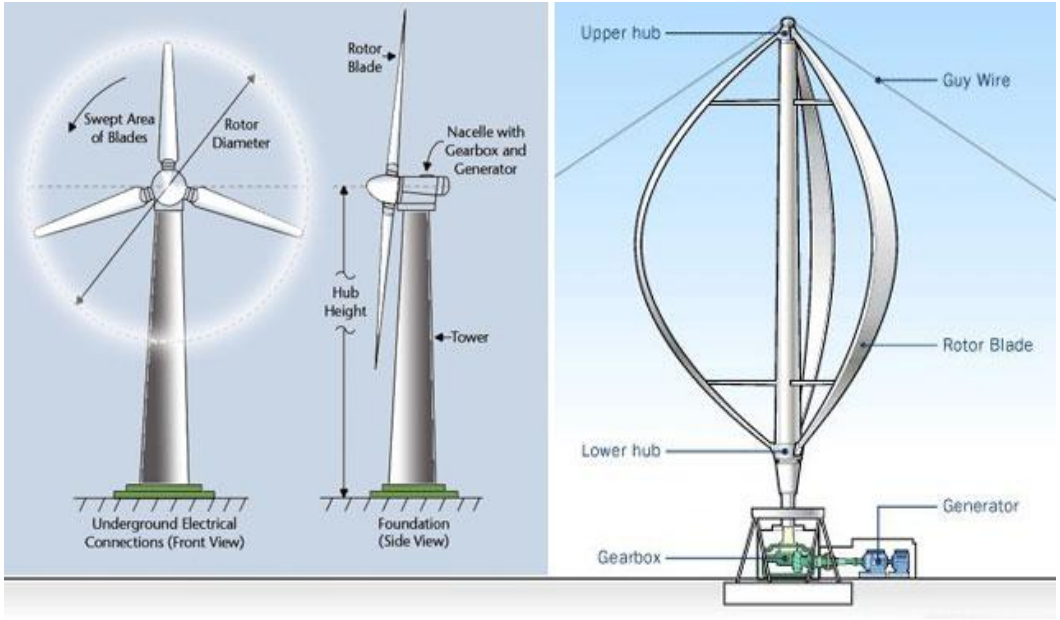
- Open ended wind energy
- How wind energy turbine can produce electricity
- Advantages/Disadvantages
- Project client: Instructor Willy

Background

- Two types of Wind Energy Designs:

  1. Horizontal

  2. Vertical



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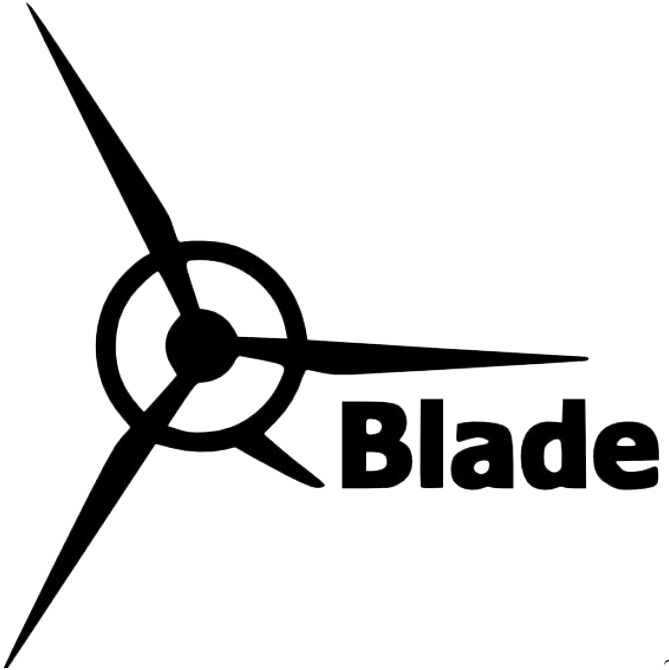
2 / 6 / 18

Background

- Q-Blade Wind Turbine Design and Software [1]
- Create specifications for proper manipulation for modification in blade design.



Benchmarking

- 12V or 24V transmission
- Residential or Commercial
- Companies with several Designs:

  Primus Wind Turbine

  Tycoon Wind Turbine

  Sunforce 44444 Wind Turbine

Primus Wind Power Turbine [2]

- $1144.70
- 30 KWh/month @13 mph
- 110 mph survival wind speed
- 11.5 ft.^2
- 12 to 24 Volt

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2 / 6 / 18

Sunforce 44444 Wind Turbine [3]

- $608.30
- 12V and 24V
- Multiple blade designs
- Residential and Commercial
- Startup wind speed 4.5 mph

Tycon Power Systems TPW 400 DT [4]

- $ 560.00
- Lightweight
- Glass reinforced nylon blades
- Survival wind speed 112 mph
- Residential and Commercial

Design Requirements [6]

Specifically, competition participants will need to create:

- An effective mechanical, electrical, and aerodynamic wind turbine and load design that is safe and reliable for testing in an on-site wind tunnel.
- A basic static performance analysis (e.g., CP-Lambda Report) of the turbine design that contains the annual energy production over a range of operational parameters.
- A top level electrical design with commercially off the shelf components.
- Results of laboratory and/or field testing of turbine prototypes.
- The turbine must be designed to withstand continuous winds of up to 20 m/s.
- The entire turbine must fit within 45 cm by 45 cm by 45cm cube and cylinder and must be able to fit through the turbine door (61 cm by 122 cm) in one assembly.
- Safety requirements including, but not limited to, proper wiring practices, shielding of hazardous components, and proper heat rejection.
- Teams are expected to choose their own generator and design their own turbine and load system.
- All electrical cables leading from the turbine to the electronic components located outside the tunnel must be in cable form (no individual strands)
- Turbine electrical system ground(s) must be electrically tied to this base plate with a 100 kΩ or lower resistance connection.

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Customer Requirements

Needs No.	Needs	Importance
1	An effective mechanical, electrical, aerodynamic wind turbine	5
2	Turbine can withstand continuous winds at 20m/s	5
3	Durable	5
4	Safe	5
5	An electrical control system	4
6	Load design	5
7	Turbine can fit via a 61cmX122cm door	5
8	Reliable	4
9	Proper wiring	5
10	Software testable	3
11	An electrical ground of ≤100kΩ	3

House of Quality

		Technical Requirements									
Customer Needs	**Customer need rank**	Power density	Operating Voltage	Lift Coefficient	Stability	Product Dimension (Size)	Drag Coefficient	Max Voltage Limit	Load material	Torque capcity	Efficiency
An effective mechanical, electrical, aerodynamic wind turbine	5	5		8	7	7	6			9	9
Turbine can withstand continuous winds at 20m/s	4.5			5	7	8		2			
Turbine can fit via a 61cmX122cm door	4					9					
An electrical control system	2		2								6
An electrical ground of ≤100kΩ	1										5
Proper wiring	1								9		3
Load design	2	7	3		2				9		
Safe	5		5							8	
Reliable	3			4	6				7	7	8
Durable	3.7	6							7		
Software testable	2			1			1				5
Specification Value		[W/m^2]	Volts [V]	Dimensionless	Strength [kPa]	meters [m]	Dimensionless	Volts[V]	[H],[kΩ],[C]	Newton-meter [N-m]	Performance [%]
Technical Difficulty (1-Low, 5-High)		5	3	1	2	1	1	5	4	3	5
Importance Rating		61.2	35	76.5	88.5	107	32	9	73.9	106	99

Whats vs. Hows Legend

Strong Strong Relationship • 9

Medium Relationship o 3

Weak Relationship ◌ 1

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2 / 6 / 18

Budget

- Our Budget for this project is $500.00
- Funding Source: Green Funded
- Estimated Cost:

Manufacturing ($100)

-3D Printing

Materials ($350)

- Towers

- Gears

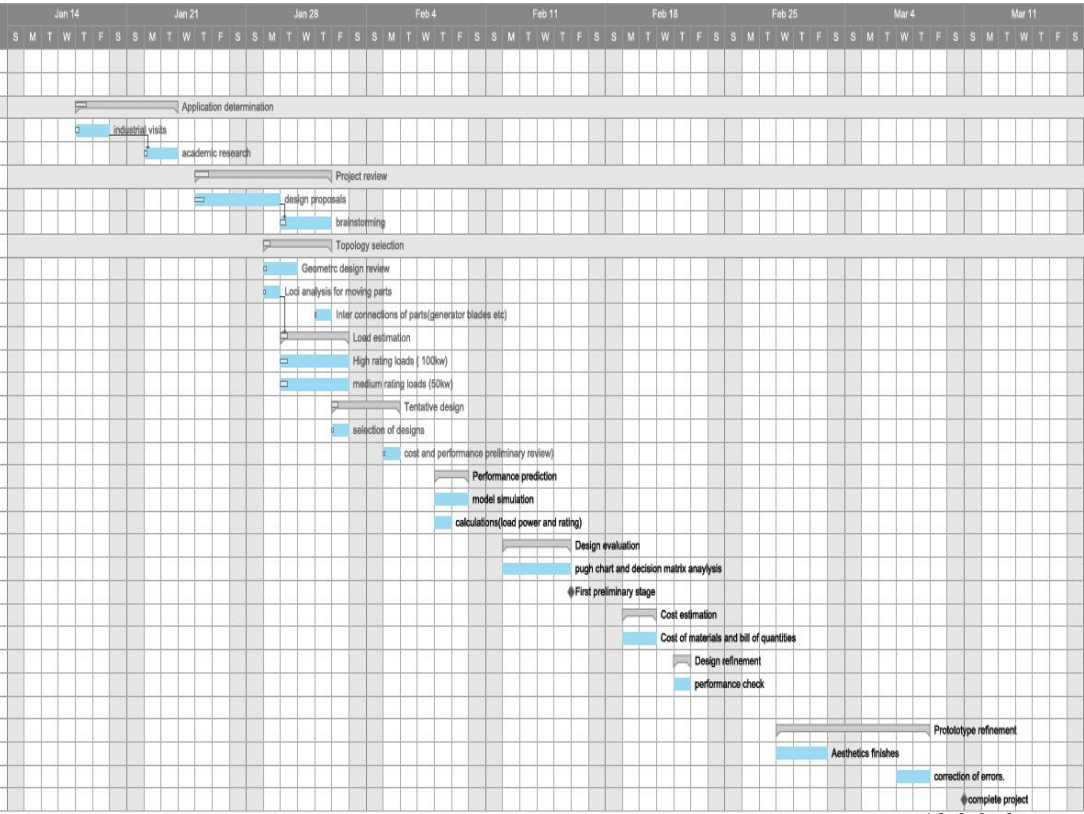
- Shaft

-bearing

Prototyping ($50)

Gantt Chart

p	Task Name	Start Date	End Date	Assigned To	Duration	% Complete	Predecessors	Notes
	Application determination	01/18/18	01/23/18		4d	10%		
	industrial visits	01/18/18	01/19/18	Abdulman	2d	10%		partially complete
	academic research	01/22/18	01/23/18	Mitchele	2d	10%	4	partially complete
	Project review	01/25/18	02/01/18		6d	10%		partially complete
	design proposals	01/25/18	01/29/18	Team mates	3d	10%		partially complete
	brainstorming	01/30/18	02/01/18	Team mates	3d	10%	7	partially complete
	Topology selection	01/29/18	02/01/18		4d	10%		partially complete
	Geometrc design review	01/29/18	01/30/18	Team mates	2d	10%		partially complete
	Loci analysis for moving parts	01/29/18	01/29/18	Ahmad	1d	10%		partially complete
	Inter connections of parts(generator blades etc)	02/01/18	02/01/18	Fahad	1d	10%		partially complete
	Load estimation	01/30/18	02/02/18	Team mates	4d	10%	11	partially complete
	High rating loads (100kw)	01/30/18	02/02/18	Team mates	4d	10%		partially complete
	medium rating loads (50kw)	01/30/18	02/02/18	Team mates	4d	10%		partially complete
	Tentative design	02/02/18	02/05/18	Team mates	2d	10%		partially complete
	selection of designs	02/02/18	02/02/18	Team mates	1d	10%		partially complete
	cost and performance preliminary review)	02/05/18	02/05/18	Abdulman	1d	10%		partially complete
	Performance prediction	02/08/18	02/09/18		2d	0%		
	model simulation	02/08/18	02/09/18	Team mates	2d	0%		
	calculations(load power and rating)	02/08/18	02/08/18	Mitchel	1d	0%		
	Design evaluation	02/12/18	02/16/18		4d	0%		
	pugh chart and decision matrix anaylysis	02/12/18	02/15/18	Team mates	4d	0%		
	First preliminary stage	02/16/18	02/16/18		0	14%		
	Cost estimation	02/19/18	02/20/18		2d	0%		
	Cost of materials and bill of quantities	02/19/18	02/20/18	Ahmad	2d	0%		
	Design refinement	02/22/18	02/22/18		1d	0%		
	performance check	02/22/18	02/22/18	Fahad	1d	0%		
	geometric design review			Abdulman	1d	0%		
	Protototype refinement	02/28/18	03/08/18		7d	0%		
	Aesthetics finishes	02/28/18	03/02/18	Team mates	3d	0%		
	correction of errors.	03/07/18	03/08/18	Abdulman	2d	0%		
	complete project	03/11/18	03/11/18		0	14%		



Abdulrahman

2 / 6 / 18

Conclusion

- The wind turbine project will be a great opportunity to build on what exists to improve or create a new idea.
- It will therefore involve extensive consultation to be able to establish areas in which development can be achieved.
- This is also in line with the global will by nations to conserve the environment using green energy.

References

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5. K. Otto, "QFD ONLINE," Design4X Inc., 2005. [Online]. Available: http://www.kevinotto.com/RSS/templates/QFD Template.xls. [Accessed 28 January 2018].
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THANK YOU

ANY QUESTIONS ?