

CHAPTER 9

WIND ENERGY GENERATION

ACTIVITY 1: Create a Hypothetical Wind Energy Project

Activity Objective: Develop a hypothetical wind energy project either on or off-shore to include a list of all materials needed, site plan, estimated cost of the project, and the projected the energy output and grid parity.

Definition: Wind energy like solar energy is used to generate electricity and promising renewable energy because its energy source is the WIND, which is all around us. Electricity is created through the use of airflow through wind turbines and the two types of wind turbines used: HAWT (horizontal axis wind turbines) and the Gorlov-type wind turbine. Wind power is generating electricity using air flow through wind turbines, which are mechanically power generators driven by a large propeller blade

A wind turbine is designed to extract energy from the wind. It is simply an AC generator driven by a propeller that is driven by wind passing over it instead of a steam turbine driven by steam generated from the burning of fossil fuel or a turbine driven by falling water as in hydroelectric systems. A wind turbine installation consists of the necessary systems needed to capture the wind's energy, point the turbine into the wind, convert mechanical rotation into electrical power, using other systems to start, stop, and control the turbine.

The modern wind turbine is a complex and integrated system. Structural elements comprise the majority of the weight and cost. All parts of the structure must be inexpensive, lightweight, durable, and manufactural, under variable loading and environmental conditions. Turbine systems that have fewer failures, require less maintenance, are lighter and last longer will lead to reducing the cost of wind energy. The modern turbine major components could cost from the total percentage: tower 22%, blades 18%, gearbox 14%, and generator 8%.

Utility-scale wind turbine generators have minimum temperature operating limits which apply in areas that experience temperatures below $-20\text{ }^{\circ}\text{C}$. Wind turbines must be protected from ice accumulation. Some manufacturers offer low-temperature packages at a few percent extra cost, which include internal heaters, different lubricants, and different alloys for structural elements. If the low-temperature interval is combined with a low-wind condition, the wind turbine will require an external supply of power, equivalent to a few percent of its rated power, for internal heating. You would need to factor in the effects of wind turbine operation in cold climates.

REVIEW VIDEOS:

How do Wind Turbines Work: https://www.youtube.com/watch?v=qSWm_nprfqE

How Wind Turbines Generate Electricity: https://www.youtube.com/watch?v=0Kx3qj_oRCc

Gorlov-Type Vertical Axis Wind Turbine: https://www.youtube.com/watch?v=CjLKX_bs_r0

Materials: Chapter 9, paper, computer, printer. Internet Access

Procedure:

1. Work as partners or small teams
2. Review the above videos and Chapter 9 information from www.sus101.com
3. Research the Internet for wind mill projects and review Chapter 9 for what is necessary to build a wind mill project
4. Create your wind project to include the following components or systems and include the
5. cost of each system in the below table, you can use additional paper as needed:

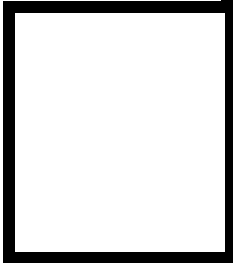
SYSTEM	TEAM PLANS	COST
Wind Turbine Foundation		
Connection to Electric Grid		
Tower		
Yaw Control		
Generator		
Anemometer		
Braking System		

Rotor Blades & Number		
Blade Pitch Control		
Energy Credit Discounts		Minus
TOTAL Project COST		
Estimated ENERGY OUTPUT		
Estimated Energy Consumed by this test case		



RUBRIC

4 World-Class Learner	3 Proficient Learner	2 Developing Learner	1 Emergent Learner
Learner at this level has gone beyond mastery of knowledge, skills, & attitudes described in project. World-class learner consistently exhibits high-quality performance.	Learner at this level has had opportunities to apply knowledge, skills, & attitudes of component of project. Proficient learner has mastered essential attributes, thus proving mastery.	Learner at this level has been exposed to & had opportunity to apply knowledge, skills, & attitudes of project. Developing learner may have only a few essential attributes to master before mastery.	Learner at this level may or may not have been exposed to knowledge, skills, & attitudes required by academic standards of the project.



- 1= Emergent Learner
- 2 = Developing Learner
- 3 = Proficient Learner
- 4 = World-Class Learner