EECE 326 Fundamentals of Energy Systems Lab

Labs 10 & 11. Renewable Energy Micro-Power System Design

using

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Design for an Actual System

☐ Work on your own project (or one of the examples)

☐ Lab Objectives:

- ☐ Site Identification → Mission or Goal

- ☐ Load study → Should match with the site and the goal → Must be able to justify and realistic

- ☐ Find the Solar Radiation, and give Sensitivity values

- ☐ Find the Wind Speed, and give sensitivity values

- ☐ Include Realistic Carbon Penalty, if possible

- ☐ **Find the components/devices locally (or Amazon.com) available (Important)**
  - ☐ **Correct Size – Price is very important**
  - ☐ **Physical Size must be considered against the project site**

- ☐ Calculate and Check the Optimization results

- ☐ Sensitivity Analysis - Optional

- **Wind Turbine**
  - Furhlander 30
    - Size: 30 kW
    - Lifetime: 20 years
    - Quantity: 10:   [0, 5, 10]
    - Capital Cost: $7,800 [for 1 unit]
    - Replacement Cost: 10% of the Capital Cost
    - O&M Cost/Year: 5% of the Capital cost

- **PV Module**
  - Size: 200kW: [0,100,200,300] kW
  - Derating Factor: 90%
  - Lifetime: 20 years
  - Capital Cost: $5000/kW
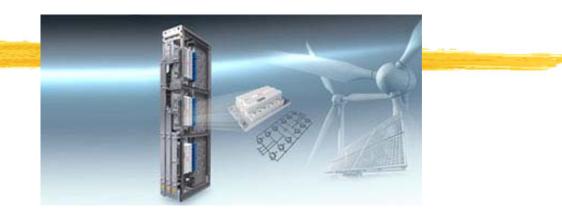 - Replacement Cost: 10% of Capital Cost
  - O&M: 1% of Capital Cost

Suggested Component Data – Converter

- Converter
    - Size: 200kW: [0, 100, 200, 300]kW
    - Lifetime: 20 years
    - Efficiency: 90%
    - Capital Cost: $1000/kW
    - Replacement Cost: 30% of Capital Cost
    - O&M Cost/Year: 10% of Capital Cost
- Rechargeable Battery
    - 1KWh
    - 10, 20, 30 of them

The last piece – Load information

- Example 1:
  - Green Campus Feasibility Study for Howard University
  - Entire Campus or a building (Engineering or Blackburn etc) or an area (such as Quadrangle's lighting)
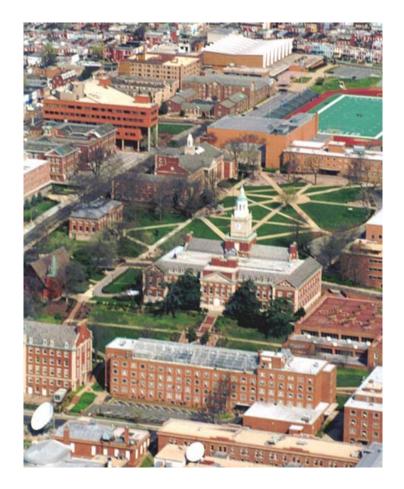 - Need load study for hourly kW demand

- Example 2:
  - Solar/Wind pump for a remote village in Mongolia
  - Pump load study – Water Flow need investigation
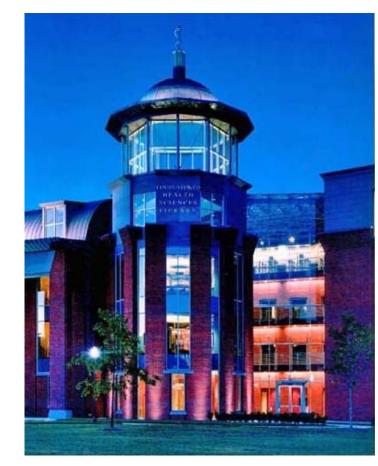 - 24/7 operation or operation when electric energy is available

- Example 3
  - Lighting the 14th St Bridge Street lights
  - Number of street lights
  - kW of each light
  - Hours of lighting

Example 1 – Green Campus

☐ Green Campus Feasibility Study for Howard University

☐ <u>Entire Campus</u> or <u>a building</u> (Engineering or Blackburn etc) or <u>an area</u> (such as Quadrangle's lighting)

Example 2 - Solar/Wind Pump

□ Site Information

   □ Location : Bayannuur, Bulgan, Mongolia (Lat : 47.83. Long : 104.44)

   □ Population: 1000

   □ Elevation : 850[m]

   □ Wind Speed : 10~12[m/s]

   □ Temperature : -42~30[℃]

□ Approach

   □ Supplying power to a pump from Solar and Wind energy sources and providing drinking water to the village folks.

Example 3 – Lighting 14th Bridge by Renewable Energy

☐ 100% Renewable Sourced Night Flood Lighting System for the 14th Street Bridge

Report and Homer Code Submission

- ☐ 0. Everyone should have one's own application
- ☐ 1. Report File
    - ☐ Mission/Purpose, System Site, Location,
    - ☐ Solar/Wind resources in the site
    - ☐ Load info and profile
    - ☐ Optimum result → Comments
    - ☐ Appendix: Homer produced report (tables and graphs)
  - ☐ Put all into 1 MS Word file
  - ☐ File name: Lab10&11_Lastname.docx (or .pdf)

- ☐ 2. Homer Code File
  - ☐ Filename: Lab10&11_lastname.homer
- ☐ **3. Submission due: Check Class Web page**