Design and Simulation of Micro-Power System of Renewables

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6. Modeling using HOMER: Team Project and Summary

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Course Contents and Schedule

- Day 5: January 25, 2013
  - ☒ Team Project
    - Hybrid Renewable System Design
  - ☒ Team Presentation
  - ☒ Summary and Conclusions

Team Design Project

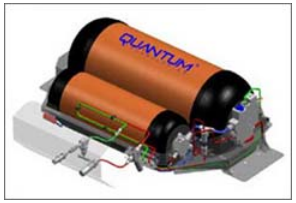
- Design a Hybrid Energy System (Grid may be connected)
- Site: **Work (School or Company or store) – team's consensus**
- **Mission/Goal:** Energy reduction, peak shaving, or zero-energy system
- Objective: **Find the optimum system** with sensitivity analysis
- Components: Grid (optional), Converter, Wind Turbine, PV panel, Fuel Cells, Electrolyzer, and Hydrogen Tank
- Project Lifetime: 20 years
- Fixed Cost: $10,000
- Load Study – as realistic and true as possible
- Load Profile →
  - You may have to use your **own load profile** obtained from your work
- You need to provide resource data on your work location
  - Solar Radiation {provide also sensitivity}
  - Wind Speed {sensitivity}

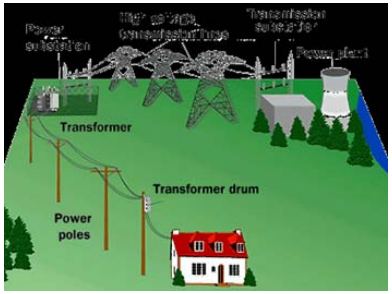
Team Project - Brief

- Analysis of a Hybrid Energy System (Grid may be connected)
- Site: **Your (School or Company or resort or …)**
- Objective: Find the optimum system with sensitivity analysis
- Components Considered: Grid, Converter, Wind Turbine, PV panel, Fuel Cells, Electrolyzer, and Hydrogen Tank
- Project Lifetime: 20 years
- Fixed Cost: $10,000
- Load Profile
- Resource data on your work location
  - Solar Radiation {provide also sensitivity}
  - Wind Speed {sensitivity}

Suggested Component Data – Wind and PV

- Wind Turbine
  - Size: 30 kW
  - Quantity: 10: [0, 5, 10]
- PV Module
  - Size: 200kW: [0,100,200,300] kW
  - Derating Factor: 90%
- Electrolyzer
  - Size: 100kW: [0, 50, 100] kW
  - Lifetime: 20 years
- Fuel Cell
  - Size: 200kW: [0, 100, 200, 300] kW
- Hydrogen Tank
  - Size: 2000 kg: [0, 1000, 2000, 3000]kg
- Converter
  - Size: 200kW: [0, 100, 200, 300]kW
- Grid (Optional)
  - Single rate
  - Price ($/kWh): $0.15 :
  - Sellback ($/kWh): $0.15
  - Demand: $0
  - **Purchase Capacity: 300kW**
  - Sellback Capacity: 200kW





Analysis Points and Team Presentation

- Analysis Points:
  - Site Identification → Mission or Goal
  - Load study → Should match with the site and the goal
  - Find the Solar Radiation, and give Sensitivity values
  - Find the Wind Speed, and give sensitivity values
  - Calculate and Check the Optimization results
  - Check the Sensitivity Results
  - Find the optimum results
  - Find the components/devices locally available (Important)
  - Prepare Slides for team presentation (Tomorrow morning)
    - System Site, Location, etc (+ Real components and vendor info)
  - Also run the HOMER in the presentation

Teams and Goals

- Neo-Power (2)
  - Kwang Hyun Ahn
  - Hyun Jun Lee
  - Island
  - Zero-Energy

- Green Campus (2)
  - Hyun Wook Kim
  - Yong Taek Oh
  - Energy cost impact to the renewable source penetration to university campuses
  - Cost of Energy

Teams and Goals

- Renewable sourced pump system (2)
  - Jae Bum Park
  - Jung Woon Ahn
  - Supply drinking water to a Mongol village

- Yonhwa Island (3)
  - Su Hyun Lee
  - Suk Muk Hong
  - Il Dong Kim
  - Zero-energy energy self-sustainability (Energy Independence)

Team Presentation

- 1 Neo-Power (Kwang Hyun Ahn and Hyun Jun Lee)
- 2 Green Campus (Hyun Wook Kim and Yong Taek Oh)
- 3 Renewable Pump System (Jae Bum Park and Jung Woon Ahn)
- 4 Yonhwa Island (Su Hyun Lee, Suk Muk Hong, and Il Dong Kim)

Summary

- Energy Sources
- Smart Grid and Micro Grid
- Renewable Sources and Characteristics
- Wind Energy Details
  - Wind Speed
  - Wind Turbine
- Solar Energy Details
  - Insolation
  - Power Conversion
- Resource Data: SWERA
- HOMER
- Stand-Alone Renewable System
- Grid-Connect Renewable System

Summary

- Simulation Software – HOMER (Hybrid Optimization Model for Electric Renewables)
- HOMER components
- HOMER optimization by NPC
- Input Requirements
- Optimization Results
- Sensitivity Analysis
- Example Cases: Stand-Alone and Grid-Connected
- Team Project

Survey

- 1. My understanding in Smart Grid and Micro Grid is:
  - Very satisfactory ( ); Satisfactory ( ); neutral ( ); unsatisfactory ( ); very unsatisfactory ( )
- 2. My learning gain in renewable energy sources and their characteristics is:
  - Very satisfactory ( ); Satisfactory ( ); neutral ( ); unsatisfactory ( ); very unsatisfactory ( )
- 3. My learning gain in micro-power system design is:
  - Very satisfactory ( ); Satisfactory ( ); neutral ( ); unsatisfactory ( ); very unsatisfactory ( )
- 4. My learning gain in HOMER simulation is:
  - Very satisfactory ( ); Satisfactory ( ); neutral ( ); unsatisfactory ( ); very unsatisfactory ( )
- 5. After the course, my skill in designing a renewable energy system is:
  - Much improved ( ); Improved ( ); I am not sure ( ); Very little improved ( ); Not improved at all ( )

Thank You !

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