PROBLEM DEFINITION

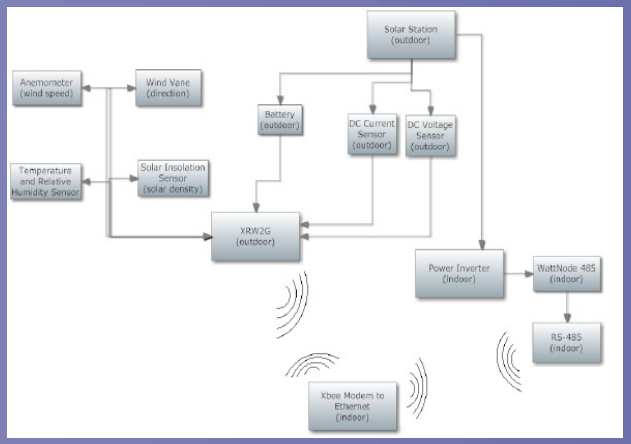
- The current 1.5 kW wind-solar hybrid power station at UNI campus is not sufficient.
- Growing number of students.
- Increasing interest on wind-solar projects.
- Increasing demands for advanced laboratory activities on renewable energy systems.
- Emerging requirements of a larger testbed with grid inter-tie and smart grid feature.
- Fossil fuels dependency has been an issue for UNI's power demand.

PV panel frame installation, July 2010

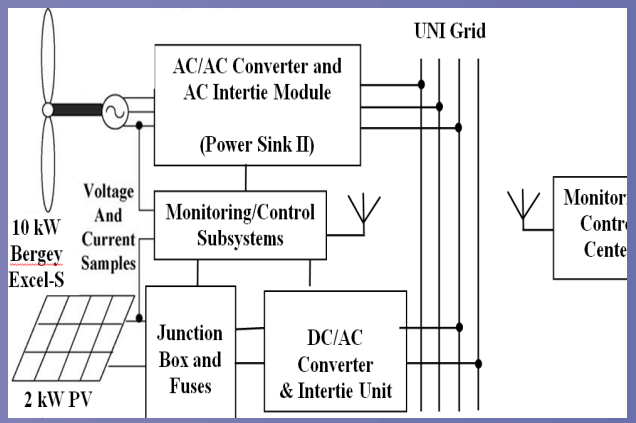
PV panels are installed by students, July 2010

PROJECT DESIGN

- Construction of 12 kW wind-solar power system synchronized with the UNI power grid:
  - 10 kW Bergey Excel-S with Power Sink II utility inter-tie module (208 V AC, 60 Hz) installed at 100-ft long steel tower.
  - 2 kW PV solar panels of 24 VDC.
  - Junction box, circuit breakers, fuses, inverters, grid-tie modules are connected directly to the UNI grid.
  - LabView NI FPGA data acquisition module.
- Wireless sensor networks (WSNs) for dynamic monitoring.
- AC/DC interaction between conventional and renewable energy systems since this system is grid connected.



PV Station Wireless Monitoring Functional Block Diagram



Proposed 12 kW wind-solar power system at UNI

OUTCOMES

A) Power and Economy outcomes:

- The proposed project will save an estimated annual total energy of 11 MWh
- Economy savings are estimated according to Cedar Falls Utility rate charge

  •11 MWh x $0.1/kWh ≈ $1100 per year

B) Environmental outcomes:

- The proposed project will help in reducing CO_2 emissions at a rate of 1.416 pounds per kWh:

  •11 MWh x 1.416 pounds/kWh =15,576 pounds CO_2 emissions saved at UNI campus

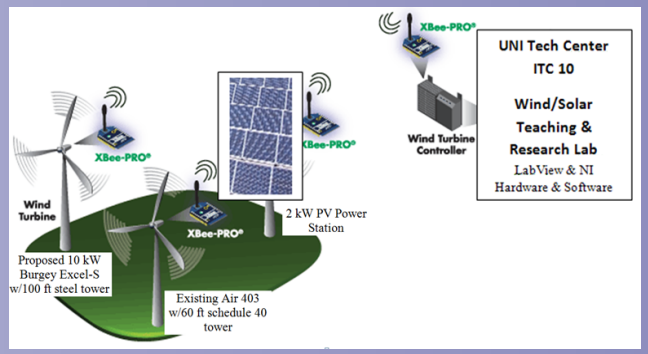
C) Educational Outcomes and Community Outreach:

- Providing a hands-on and a remote laboratory application through a dynamic website.
- Generating several lab activities in solar-wind technology that will be used in educational and research purposes.
- Promoting wind and solar energy for middle and high school students.
- Promoting Science Technology Engineering Mathematics (STEM) Education at UNI

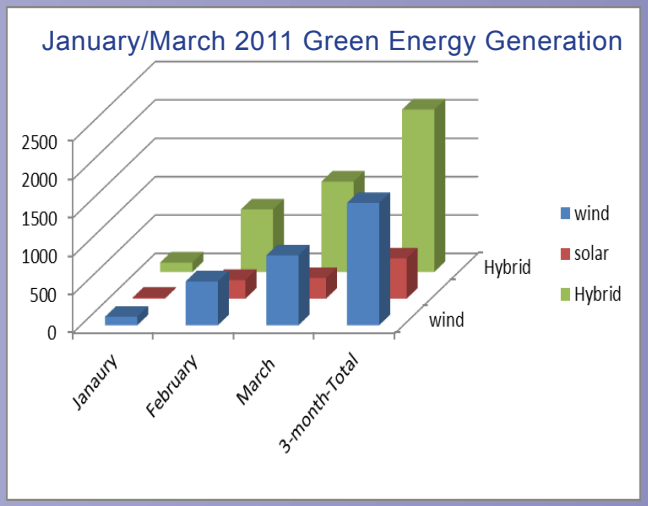
Blade installation to hub

Blade installations

The proposed power and wireless data acquisition scheme

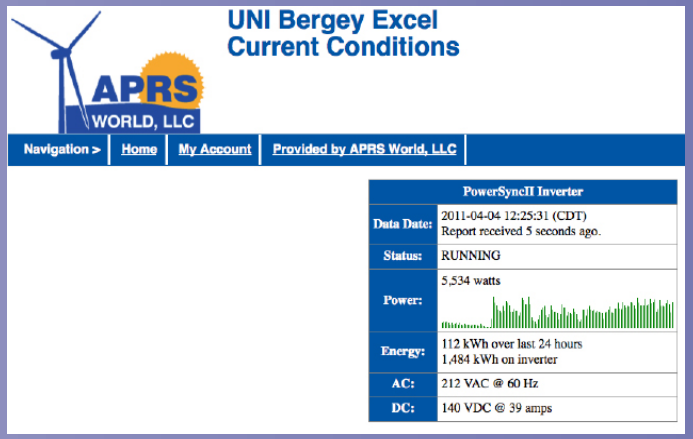


January/March 2011 Green Energy Generation



As of March 30th, 2118 kWh of green energy has been generated, which is approximately 1,298 kg of CO2 emissions saved at the UNI campus, if the same amount of energy would be produced from a coal fired power plant

Real-time data available online for the UNI Wind Solar Power System



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University of Northern Iowa

electrical engineering TECHNOLOGY

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For more information or would like a tour please contact Dr. Reg Pecen at pecen@uni.edu

Brochure designed by Alex McLeland, UNI Graphic Technologies Student, Spring 2011

Design and Implementation of a 12 kW Wind-Solar Distributed Power and Instrumentation System as an Educational Testbed

Electrical Engineering Technology

Dr. Reg Pecen, Dr. Jeff Nie, Steve Burdette, Jeff Rose, Tim Earles

Students: Justin Chu, Hameed Madwar, Sultan Altamimi, Paul Johnson, Aaron Spiess, Mackenzie Russett, Alex McLeland

OBJECTIVES

- Design and build a 12 kW solar-wind hybrid power station to enhance UNI's sustainability efforts.
- Integrate wireless sensor and LabView based monitoring instrumentation systems.
- Generate renewable energy for a smart grid based green house for educational and research demonstration on smart grid and energy efficiency issues.
- Provide a teaching and research facility on renewable energy areas for Electrical Engineering Technology (EET) and Manufacturing Technology students.
- To promote wind/solar hybrid power systems for farmers and residential customers.
- To enhance Science Technology Engineering and hMathematics (STEM) efforts at UNI.

Installation and Final Project