OP-9 Clean and Renewable Energy (Examples)

Northern Arizona University has installed a 163 Kwh photovoltaic farm which is the first of a series of renewable energy installations on the campus to include wind and biomass. In addition, Northern Arizona University is working as an investor and consultant with both private and public entities developing large scale renewable energy projects.
A 160-kilowatt photovoltaic system donated by APS provides up to 20 percent of the electricity for the ARD building. This system is maintained and operated by APS so we do not measure the output. Also at ARD, a back-up heating system uses roof - mounted solar thermal panels. Light-harvesting technology adjusts office lighting by reading the brightness of the room. Automated shade controls regulate solar gain to keep building temperatures within a comfortable range.

As mentioned above, EcoLine is the primary fuel source for the on-campus COGEN plant for heating, cooling and electricity. UNH SELLS REC's off our EcoLine landfill gas pipeline into our cogeneration plan - we don't purchase them. Even though UNH now sells RECs, we retain the rights and split the renewable non-electric energy three ways: RECs, heat for campus buildings, and surplus electricity is sold back to the grid. We use the funds generated to finance the EcoLine project and to reinvest in our revolving energy efficiency fund on campus.
While we therefore cannot claim all of the greenhouse emissions reductions from our production and use renewable energy, we are not only lowering our energy use and associated emissions on campus, but we are selling renewable energy and therefore helping our state and region meet stated renewable energy and climate goals.
http://www.sustainableunh.unh.edu/climate_ed/cogen_landfillgas.html
http://www.sustainableunh.unh.edu/climate_ed/recs.html

Cornell placed into service two Solar Titan 130 Combustion Turbines (2@15 MWe)with Rentech dual pressure Heat Recovery Steam Generators in December of 2009. In addition, there are two back pressure steam turbines (8 MWe total) that produce electricity with steam prior to the steam being used for heating purposes on campus. These co-generation systems result in a thermal efficiency of approximately 78% and have allowed the university to discontinue the use of coal. Energy generated with co-generation technology includes electric and steam.

Since mid-2007, the University of California Irvine campus has operated a combustion turbine generating plant at its award-winning central heating and cooling plant, which provides greater than 95 percent of the heating and cooling to the core campus facilities. The cogeneration

facility uses a Solar Turbines Titan combustion turbine with an available steam turbine for additional energy recovery. Emissions are tightly controlled with NOx emissions below 2 ppm by volume. The generating plant provides 81.8% of the electricity used by the campus and the heat recovery steam generator displaces more than 485,000 MMBtu of natural gas that would otherwise have been burned in conventional boilers.

UNH- EcoLine is the primary fuel source for the on-campus COGEN plant. The COGEN plant retains waste heat normally lost during the production of electricity and instead uses this energy to heat buildings, in turn reducing sulfur dioxide and nitrous oxide emissions. The installation of the COGEN plant resulted in an estimated reduction in greenhouse gas emissions of 21% in Academic Year (AY) 2006 compared to AY 2005.

The 140-megawatt Hal C. Weaver Power Plant (.mov*) meets the university's needs 24 hours a day, every day of the year with the following services:

- Electricity—we generate electrical power at 12,000 volts and 4,160 volts for distribution throughout the campus.
- Steam—we generate steam at 425 psi and 710 F for use in the plant, as well as at 160 psi for distribution throughout the campus to provide building heat, heat for hot water, and auxiliary services.
- Compressed Air—we provide air for use in campus buildings and laboratories.
- Demineralized Water—we provide about 8 million gallons of demineralized water to the campus for laboratory use.
- Chilled Water—we distribute about 140,000,000 ton-hours of chilled water through more than 6 miles of chilled water lines to provide air conditioning to the campus. Our peak flow rates are continually rising as campus space is added. In the summer of 2008, our peak load was about 33,000 tons and 60,000 gallons per minute of 39ºF water flowing to meet campus cooling needs. This is equivalent to the air-conditioning needs of 6,600 average houses.

The University of Iowa has operated a combined heat and power plant since 1926. The University of Iowa uses traditional feedstock and biomass to generate steam for cost-effective electricity, cooling and water treatment on campus. In 2003, the UI Power Plant pioneered a unique and innovative source of fuel, oat hulls, through a partnership with Quaker Oats in Cedar Rapids, Iowa. Oat hulls provide an economical, environmentally friendly source of fuel. The hulls are a by-product of the cereal-making process at Quaker. They are trucked to the

Power Plant and co-fired with coal in the circulating fluidized bed (CFB) boiler. The biomass fuel project supports the 2020 Sustainability Vision - Task 2. The task requires the UI to green its energy portfolio and achieve 40% renewable energy by 2020. Replacing coal with biomass is a central strategy. A variety of biomass fuel sources are being investigated including wood chips, micanthus grass, timber stand, and organic industrial byproducts.