

Title: Eastern Illinois University's Renewable Energy Center

Authors: Gary Reed

Director of Facilities Planning and Management

Eastern Illinois University

Paul McCann

Treasurer and Director of Business Services

Eastern Illinois University

Contact:

Gary Reed, PE

Eastern Illinois University

600 Lincoln Avenue

Charleston, Illinois 61920

217-581-2199

gdreed@eiu.edu

2011 CACUBO Best Practices Award Program

EIU Renewable Energy Center

Combined Heat and Power Plant Replacement Project

Abstract:

A major project to replace the aging central heating plant is being undertaken. The EIU Renewable Energy Center (REC) plant initiative will address a serious deferred maintenance backlog which has accrued in the campus' mission-critical central steam plant. Vintage equipment which has in some cases served this campus since the mid 1920's, has far-exceeded its useful life. In addition, the accumulation of deferred maintenance on balance-of-plant infrastructure and equipment has increased the likelihood that a catastrophic plant failure could occur at any time. Depending upon the nature of the failure, a total loss of steam production and supply to the campus for an extended period of time could result.

The all-in cost for the REC plant solution is projected to be approximately \$60M. The University has financed this project with Build America Bonds, and will accomplish the work under an energy performance contract (EPC) with Honeywell International, Inc. All costs for the project are guaranteed to be paid back from energy and operational savings in 20 years.

The new facility will be an attractive industrial building with approximately 15,000 gsf housing the boiler, turbine, fuel and ash handling, electrical, water treatment, control room, small maintenance shop and offices. The building will be EIU's first LEED-certified (Leadership in Energy and Environmental Design designated by the US Green Buildings Council) project.

There will be exterior fuel and ash handling, fuel storage, and miscellaneous support infrastructure including electrical high voltage switchyard, transformers, steam distribution tunnels, fuel receiving and access site improvements from Illinois RT 130 to the east. The proposed location is a “greenfield” site on University-owned property at the far southeast corner of campus. The REC will feature biomass-fueled boilers. Although the biomass base will be virgin hardwood chips, the design could utilize various other biomass fuels such as corn stover, miscanthus, switch grass or other agricultural residue as markets drive the availability of these competing fuels, and operational viability is proven. The renewable-fueled components will include one high pressure biomass-fueled boiler rated at approximately 40,000 pounds per hour at 650psi dedicated to cogeneration, and an additional lower pressure biomass-fueled boiler rated at 40,000 pounds per hour to satisfy the peak campus steam heating load. Main steam from the gasifier will drive a backpressure turbine/generator capable of producing electrical power for direct supply to the campus. Turbine exhaust steam will be piped to campus at 150psi to satisfy all campus thermal requirements. In addition, plant internal electrical loads will be partially offset by operations of a 20,000 kilowatt-rated solar photo-voltaic array. The new plant will support research in the green energy fields, and will provide a rich learning lab for EIU’s students in the related technology fields.

Once the new EIU Renewable Energy Center is commissioned, the existing central steam plant building will be re-purposed for other institutional needs.

Introduction of the organization:

Eastern Illinois University's entire campus community benefited from this initiative. EIU is a residential, master's level public university with over 10,000 FTE students. Sitting on 325 acres within the city limits of Charleston, the University represents an obvious cultural, economic and visible presence. A project of this magnitude on campus was not only crucial to campus operations, but also represented a potential impact to the surrounding community. Discussions ensued ranging from decreasing property values, degradation of the air quality and noise issues to concerns for the very safety of residents in residential neighborhoods near the proposed plant site. In response, the University took great care in addressing the concerns of our neighbors by improving the facility's aesthetics, planting vegetative barriers and relocating plant entry points. The changes resulted in a design which is utilitarian but soft to the surroundings and also visibly pleasing. Not only will this combined heat and power project replace an outdated and obsolete coal-fired central plant, but will also represent the university's first LEED certified project.

Statement of the problem:

Currently, the Eastern Illinois University facilities' steam demand is served by a coal-fired central thermal plant located in the core of campus. The plant was built in 1925, is obsolete and is operating under an Illinois EPA interim compliance agreement. The agreement requires EIU to import 'air quality coal' from outside sources, or burn natural gas adding a tremendous cost to the University's continuing operations. Owing to the criticality of the central plant to university operations, a solution for the failing facility quickly became the institution's highest capital priority. Considering the continued difficult economic environment in Illinois, numerous annual capital funding requests submitted by EIU to address the degrading plant's needs could not be fulfilled. As plant reliability continues to degrade, the threat of total plant failure and loss of steam production leading to a forced an institutional shut down loomed.

Design/Implementation:

The University completed feasibility studies to define possible plant repair or replacement solutions. A coal-fired solution incorporating current clean coal technologies was desired but was found too costly. Major repairs to the facility were deemed not desirable primarily because doing so would trigger an EPA new source designation due to the major modifications involved. The tight available 'footprint' combined with the unacceptable existing location in the campus core to house continued steam production operation made a new location desirable and recommended. A solution based upon gasification technology using biomass fuel was found to hold the most promise. A plant based upon this solution was determined to be potentially more cost competitive and also much more environmentally friendly. A biomass gasification facility located on a 'greenfield site' at the far southeast corner of the campus was selected as the best-fit for plant replacement.

Project development was based on a guaranteed savings energy performance contract (EPC) basis. This project methodology was enabled under the Public University Energy Conservation Act (ILCS 62-100). This legislation allowed Eastern Illinois University to contract for the plant and pay for it from the utility and operational savings generated from the improvements over a 20 year payback duration. The performance of the project sufficient to provide the on-going savings for payback and guaranteed by the energy services company (ESCO). EIU had been

successful with this type of project having completed three previous EPC initiatives since 1995. Following the required process, an RFP was issued requesting responses from qualified ESCOs. Site visits were arranged and preliminary audits were prepared by the competing ESCOs. A selection committee formed in-house at the university reviewed and short-listed the responses. The short listed firms were asked to present their findings and recommendations to the committee. The committee then scored the firms in rank order. The top firm was contacted and entered into negotiations with the university to perform an investment grade energy audit for the campus. During the audit, numerous potential energy conservation measures (ECMs) were identified. The implementation cost and savings were calculated for each. Then a recommended scope of work and financial pro-forma were developed illustrating the holistic project performance over a 20 year time line. The results concluded that 23 ECMs were viable, including a replacement for the current steam plant based upon biomass gasification. Construction first cost of the project is \$79.5 million. Financially, the savings were guaranteed sufficient to repay the installation cost of the project including debt service. The university decided to engage the project and financing was arranged via sale of COPS. Ground was broken in the fall of 2009 and the plant completion is scheduled for June 2011.

The proposed biomass gasification solution offers an 85% reduction in air emissions and adds in-house electrical generation capability via steam driven and PV applications. Further, it is the vision of EIU that the EIU renewable energy center installation will serve as a superb teaching lab in the related sciences, providing for increased educational opportunities for its students in the field of green energy applications. Through planned university curricula additions based upon the technological aspects of the renewable energy center, the university will be serving to prepare students for opportunities in the emerging green energy markets.

Benefits:

This project was creative in its design scope and also its financing method. The solution was driven from necessity and represents a number of firsts for Eastern Illinois University. The Renewable Energy Center is the largest capital project ever undertaken in the university's history. It also represents the largest purely biomass gasification combined heat and power campus facility in the nation. Its environmentally friendly operation provides for an 85% reduction in air pollutants compared with the currently permitted campus steam plant. The plant will be the first LEED certified building on the EIU campus. Moreover, the REC will be the first ever power plant facility certified by the United States Green Buildings Council. The technological aspects have fueled academic research opportunities in fields of biomass fuels and also agri-business. New collaborative opportunity with outside businesses, agencies and other universities continue to emerge. Academic curricula with the EIU School of Technology are being planned in the fields of biomass energy and sustainable operations. The university has become a leader in green energy solutions. Finally, this project will have been accomplished without dependence on state capital, and more importantly the students were not required to suffer any increase in their tuition or fees.

Retrospect:

Facing the need to replace its central steam plant or suffer the potentially devastating outcome of an institutional shutdown, EIU drew from its successful experience with guaranteed performance contracting to deliver an environmentally friendly, innovative and technologically exciting solution with guaranteed positive results. All this is being accomplished without a state capital project appropriation or the need for an increase in student tuition or fees. Looking back, we believe that we could have started this process earlier, but would have done it the same way.