Northeastern Ohio Universities
COLLEGES OF MEDICINE & PHARMACY

Fifteen-Year Plan for Energy Efficiency and Conservation Projects

Presented to the Board of Trustees of the Northeastern Ohio Universities Colleges of Medicine and Pharmacy, December, 2008, in accordance with the 126th Ohio General Assembly Sub House Bill 251 (ORC Sec. 3345.69)

TABLE OF CONTENTS

Introduction

In accordance with the requirements of Sub House Bill 251 (HB251) of the 126th Ohio General Assembly, and in light of the Northeastern Ohio Universities Colleges of Medicine and Pharmacy's (NEOUCOM's) goals of continuous improvement in the areas of energy efficiency and conservation, this document outlines the institution's plans for phasing in energy efficiency and conservation projects over the next fifteen year timeframe. Per statute, the goal of this plan is to reduce building energy consumption by at least 20 percent by the end of the fiscal year ended 2014, as compared to fiscal year 2004, with a secondary goal of a similar reduction of carbon dioxide emission levels.

Guidelines Per Statute

The Energy Efficiency and Conservation Guidelines as incorporated into Ohio Revised Code Section 3345.69 are as follows:

(1) Include a goal to reduce on- and off-campus building energy consumption by at least twenty per cent by 2014, using calendar year 2004 as the benchmark year, while recognizing the diverse nature and different energy demands and uses of such buildings and measures already taken to increase building energy efficiency and conservation;

(2) Prescribe minimum energy efficiency and conservation standards for any new, on- or off-campus capital improvement project with a construction cost of one hundred thousand dollars or more, which standards shall be based on general building type and cost-effectiveness;

(3) Prescribe minimum energy efficiency and conservation standards for the leasing of an off-campus space of at least twenty-thousand square feet;

(4) Incorporate best practices into energy efficiency and conservation standards and plans;

(5) Provide that each board develop its own fifteen-year plan for phasing in energy efficiency and conservation projects;

(6) Provide that project impact assessments include the fiscal effects of energy efficiency and conservation recommendations and plans;

(7) Establish mechanisms for each board to report periodically to the committee on its progress relative to the guidelines.

Guidelines 1 and 5

Historical Energy Efficiency Measures

NEOUCOM has a history of taking proactive and innovative steps toward energy efficiencies. In 1999, the College contracted with Brewer-Garrett to develop a program for facility energy efficiency improvements. The program was implemented through Senate House Bill 7 (HB7), which allowed energy savings dollars to be used to pay for project costs over a period not to exceed ten years.

The HB7 project was in two phases; Phase 1 began with energy savings from lighting. Existing 40 watt T12 fluorescent lamps with magnetic ballasts were replaced with energy efficient 32 watt T8 fluorescent lamps with high efficiency electronic ballasts. Incandescent lamps in exit lights were replaced with LED lamps, lighting controls (occupancy sensors) were installed in strategic areas, and mercury vapor lamps and fixtures were replaced with fluorescent fixtures. Phase 2 replaced an aging steam absorption chiller with an electric centrifugal chiller utilizing a variable frequency drive and waterside economizer. In addition, the College's building automation control system was completely upgraded.

The project was completed in October, 2001. Using November 1999 through October 2000 as the base line year, NEOUCOM has reduced Kilowatt hour (kWh) usage by 17.5%, kilowatts (kW) usage by 18%, and natural gas consumption (mcf) by 22%. The project's success culminated in the College receiving the 2004 Governor's Award for Excellence in Energy Efficiency.

Additional efficiencies were obtained by replacing egg crate lenses in lighting fixtures in the corridors of B, C, D, and E Buildings with clear plastic lenses, allowing for more lumen output with greater light distribution. The foot candle level was increased, allowing disconnection of two lamps per fixture. Energy consumption for corridor lighting in the buildings was reduced by 50%. Replacement of eight 255W mercury vapor fixtures with high efficiency fluorescent fixtures in the Campbell atrium has reduced energy consumption by 1,300 kWh per year.

Two 35 year-old 75 hp chilled water pumps were replaced with National Electrical Manufacturers Association (NEMA) Premium Efficiency motors. Energy consumption is expected to be reduced by 9,873 kWh per year and CO_2 emissions by 6.6 tons per year.

The Fifteen-Year Plan

In order to meet the goal of reducing energy consumption by 20% by 2014, energy usage must be at 76,222 mmBTU/yr given the 2004 baseline energy usage of 95,278 mmBTU. A total reduction of 19,056 mmBTU is required to achieve this goal. NEOUCOM's fifteen year plan includes the three major improvements highlighted below to achieve an overall reduction that will exceed this goal. A reduction in CO_2 emissions by 20% or greater will also be achieved upon implementation of the planned projects.

A. Boiler Plant (Steam Boilers vs. Hot Water Boilers)

NEOUCOM contracted with Energy Instruction Group (EIG), LLC to conduct an energy analysis of the existing boiler plant to determine the energy efficiency value of maintaining the current centralized campus heating system or converting to a decentralized hot water heating system. The study, completed in August 2008, concluded that the existing boiler plant is only 76% efficient because the four boilers are over-sized causing them to operate at the lower end of their efficiency curves. There are also energy losses from steam and condensate return distribution piping.

The study also concluded that decentralizing the heating system and replacing the existing boilers with smaller, localized efficient boiler systems would save approximately 43% of NEOUCOM's annual gas consumption. At current natural gas pricing, this would result in a savings of approximately $196,213 per year. Using a projected conversion cost of $1.8M, the payback period would be less than ten years. Conversion to a distributed hot water heating system is anticipated by the end of FY 2010. Implementation of this initiative will exceed the FY2014 goal of reducing energy consumption by an additional 10%. Refer to Table 1 below.

Table 1

2004 Base Line Year		**2014 Goal: 20% Reduction in Energy Consumption**		**2010 Projected Energy Consumption**			
mmBTU (Electric/Gas)	**CO_2 In Tons**	**mmBTU (Electric/Gas)**	**CO_2 In Tons**	**mmBTU (Electric/Gas)**	**% of Change**	**CO_2 In Tons**	**% of Change**
95,278	**10,435**	**76,222**	**8,348**	**66,346**	**30%**	**8,310**	**20%[1]**
Estimated project cost to implement: $1,800,000 **Estimated yearly savings: $196,213** **Simple payback period: 9.2 years**				**[1] Meets FY2014 goal of reducing CO_2 gas emissions by 20%.**			

B. Chiller Plant

Gardiner-Trane was contracted to conduct an energy analysis to determine the capacity of the chilled water plant (two chillers and a cooling tower). They examined whether 1) adequate capacity exists to allow for future expansion, 2) the existing cooling tower system is performing as designed, and 3) an opportunity exists to enhance efficiency and/or performance.

The report concluded that the chilled water plant is well maintained and will continue to serve the College efficiently and dependably for many years with 100% redundancy to existing loads. The cooling tower is surrounded on all four sides by high walls, which restricts the free flow of air and causes the unit to re-use or re-circulate the air around it. The re-circulating air will absorb more moisture evaporating from the cooling tower media resulting in higher wet bulb temperatures. These temperatures could degrade tower performance by 10-15% depending upon ambient conditions. Elevating the cooling tower will improve/ensure cooling tower performance. At current electrical rates, this would result in a savings of approximately $4,994 per year. Using a projected construction cost of $58,000, the payback period would be less than twelve years. Elevation of the cooling tower is anticipated to be completed by the end of FY 2011. Refer to Table 2 below.

Table 2

2004 Base Line Year for the cooling tower		**2011 Projected Energy Consumption**			
mmBTU (Electric)	**CO_2 In Tons**	**mmBTU (Electric)**	**% of Change**	**CO_2 In Tons**	**% of Change**
2,319	**455**	**2,177**	**.06**	**428**	**.06**
Estimated project cost to implement: $58,000 **Estimated yearly savings: $4,994** **Simple payback period: 11.6 years**					

C. F Building Fume Hoods

Analysis of the performance of our laboratories in F building to verify safety compliance and potential energy savings optimization through a laboratory re-commissioning currently being completed by Ingenuity IEQ (Indoor Environmental Qualify for Life), Inc. The company will provide a detailed review of the operation of

the existing laboratory airflow control system including fume hoods, auxiliary exhaust devices, general exhaust and supply air flows. Airflows and room pressurization will be evaluated under a combination of scenarios with fume hoods both open and closed under heating and cooling conditions. Past studies and experience typically show a 15-20% saving in energy following a successful re-commissioning. Preliminary discussions indicate that air into the lab spaces can be reduced on an average of 5,200 cfm per year. The cost to produce one cfm per year is approximately $5. The re-commissioning project (controls software, new sensors and air valves) is estimated to cost $180,000 with a projected yearly energy savings of $26,000. The payback period for this project is less than seven years. Ingenuity IEQ's report is being finalized and is expected to be presented to NEOUCOM in mid-December 2008.

D. Summary of Fifteen Year Plan Project Costs and Payback

Table 3

Project	Cost	Yearly Savings	Payback
A. Boiler Plant (Steam Boilers vs. Hot Water Boilers)	**$1,800,000**	**$196,217**	**9.2 years**
B. Chiller Plant	**$58,000**	**$4,994**	**11.6 years**
C. F Building Fume Hoods	**$180,000**	**$26,000**	**6.9 years**

Guidelines 2 and 3

Minimum Standards for New Construction

The College will seek to reduce future energy costs in new facility construction and renovation projects whenever possible. Energy standards for heating, ventilating, and air conditioning will comply with the latest versions of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standard 90.1, "Energy Efficient Design of New Buildings Except Low Rise Residential," and ASHRAE Standard 62, "Ventilation for Acceptable Indoor Air Quality." However, in accordance with HB 251, ASHRAE Standard 90.1 shall be exceeded by 10% for new construction and 7.5% for renovations after July 1, 2008; and after July 1, 2010, ASHRAE Standard 90.1 shall be exceeded by 20% for new construction and 15% for renovations. Although the College does not currently have plans to lease off-campus space greater than 20,000 square feet, should

the need for leasing such a space arise, energy efficiencies and standards would be put into place.

Building Commissioning

All new building construction will go through a commissioning process. *ASHRAE Guideline 0, The Commissioning Process*, defines commissioning as "a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria". Commissioning is therefore an "umbrella" process for all the planning, delivery, verification, and management of risks to critical functions performed in, or by, facilities. Commissioning uncovers deficiencies in design or installation using peer review and field verification. Commissioning also accomplishes higher energy efficiency, environmental health, and occupant safety and improves indoor air quality. Commissioning is a quality assurance-based process that delivers preventive and predictive maintenance plans, tailored operating manuals, and training procedures. Essentially, the commissioning process formalizes review and integration of all project expectations during planning, design, construction, and occupancy phases by inspection and functional performance testing, and oversight of operator training and record documentation.

Guideline 4

Best Practices

NEOUCOM's Energy Policy is a comprehensive set of guidelines adopted by the Institution and managed by the Office of Campus Operations to assist departments and individuals with energy conservation measures. Several of the guidelines are briefly detailed below. Other guidelines include space heaters, window air conditioning units, and personal responsibilities for faculty, staff, and students.

A. Lighting Retrofits

Interior lighting is being replaced with fluorescent using 25/28 watt T8 lamps and the latest generation of high efficiency electronic ballasts. Interior and exterior incandescent and decorative lighting is discouraged. Exterior lighting will be high-pressure sodium (or metal halide) when appropriate and will meet current safety and security requirements. Lighting level guidelines from the Illuminating Engineering Society of North America (IESNA) will be used to avoid over lighting.

Occupancy/vacancy motion sensors (ultrasonic and infrared) wired to area lighting will be installed wherever possible to reduce and/or turn off lights in unoccupied, vacated areas. Day-lighting controls will be installed to automatically adjust lighting levels as appropriate. Use of natural light from windows and skylights and task lighting (desk lamps using compact fluorescent lamps) is strongly encouraged to diminish use of general room lighting.

B. Motors

As renovations or new construction are planned, NEMA Premium efficiency motors will be used when the annual operation is expected to exceed 1,800 hours. This will apply to all NEMA Design A and B, three-phase induction motors rated from 1-500 hp with speeds of 1200, 1800, and 3600 rpm.

C. Temperature Set Backs

During winter months, room temperatures will be maintained between 68° - 70°F and between 75° - 78°F during summer months when occupied. With the exception of animal care units and research facilities with documented need for constant or warmer temperatures, temperatures during unoccupied periods will be set back to 55°F or above in the winter and will be allowed to rise to 85°F or below in the summer.

D. Holiday Periods

The campus steam system will be reduced as much as possible and buildings will be minimally heated or cooled during holiday periods. Buildings or spaces that contain special collections or sensitive equipment, or buildings that will remain open during these periods are exempt.

E. Operating Hours of Heating, Ventilating, and Air Conditioning Equipment (HVAC)

Building HVAC systems will be operated only between normal working hours (7:30 a.m. to 6 p.m.) or as dictated by program requirements. Fume hood operation entails the heating and/or cooling of large amounts of outdoor air via main fan systems, and will be minimized to the greatest extent allowable within appropriate safety guidelines. At the current billing rate, the approximate cost to operate one fume hood is $600 per year.

F. Water

Although not a specific component of HB251, NEOUCOM is continuously working on water conservation as a part of our overall energy savings plan. For example, equipment cooling systems that use potable city water are prohibited as large amounts of potable water go down the drain. Also, conversion of 29 conventional urinals with waterless urinals will result in an anticipated savings of approximately 31,200 cubic feet of water per year.

G. Purchasing

The purchase of energy-efficient equipment with the 'Energy Star' label is encouraged.

Guideline 6

Fiscal Effects of Energy Efficiency and Conservation

The fiscal effects of any capital energy efficiency and conservation project undertaken and developed by NEOUCOM will be disclosed to the Board through periodic reports. These reports will include measures such as life-cycle cost analysis and efficiencies obtained.

Guideline 7

Reporting Mechanisms

Beginning July 1, 2010, the Institution will include a prospective view of energy efficiency and conservation accomplishments, future plans, and challenges as part of the Six Year Capital Plan brought biannually before the Board of Trustees for approval and submitted to the Ohio Board of Regents.