

**Campus-Wide Energy Efficiency Improvements**  
**Jeff Trick, Director, Physical Plant**  
**Wright State University**

3640 Colonel Glenn Highway  
Dayton, Ohio 45435-0001  
(937) 775-4139 Office  
(937) 775-4149 Fax  
Email: [jeff.trick@wright.edu](mailto:jeff.trick@wright.edu)

## ABSTRACT

### Campus-Wide Energy Efficiency Improvements

Ohio State House Bill 251 requires a 20% reduction in our energy usage by 2014. To accomplish this tall order, we hired Brewer Garrett in the fall of 2008 to perform an energy utilization audit of our facilities. From that study they developed a 15 year strategic energy reduction plan to exceed the energy efficiency gains required by HB251.

This plan became the basis of a competitive Request for Proposal that was advertised across the State in January, 2009. Four proposals were submitted and critically evaluated. Linc Mechanical was selected as the most responsive to our needs and provided the best overall value for the dollars invested.

Linc's proposal includes a variety of energy efficiency projects such as:

- Lighting Upgrades-the interior light fixtures across campus will be retrofitted with higher efficiency ballasts and lower wattage bulbs.
- Demand Control Ventilation-control technology will be added that allows us to limit the amount of outside air based upon area occupancy, thus reducing the unnecessary airflow that is heated or cooled.
- Retro Commissioning-all building HVAC and automation controls will be calibrated and verified for the most efficient operation.
- Building Automation System-a campus-wide HVAC and lighting controls system will be integrated with existing equipment that will enable us to further monitor and control our facilities operation and implement new control strategies.
- Air Handler Retrofits-many of our air handlers that supply conditioned air to our buildings will be upgraded with newer equipment and technology such as variable speed motors.
- Lab Exhaust Heat Recovery-we will capture the heat contained in air exhausted from our labs to preheat the incoming make-up air.
- Library Boiler Replacement-these original units will be upgraded with high efficiency models.
- Quad Chiller Plant-the chillers that supply cooling to several buildings will be replaced and new control strategies implemented that operate this group of chillers as one highly efficient plant.

All together, these projects will cost \$11.4 million to implement over an 18 month period. They will result in more than a 22% reduction in our energy usage. This savings translates to an annual savings of approximately \$1.3 million.

Ohio House Bill 7 allows for a unique funding mechanism for energy efficiency projects. Under this scenario, Linc Mechanical will contractually guarantee that we save enough energy to cover the monthly payments on the project loan. If we fall short of these specified savings, Linc will pay WSU the difference.

Project work started in June, 2009 and will be completed by December, 2010.

## INTRODUCTION OF THE ORGANIZATION

Wright State University's main campus in Dayton, Ohio is home to approximately 17,000 students seeking higher education degrees. The campus and several off-site locations consist of 460 acres and 30 major buildings that total almost 3 million square feet of space. All of this space will be impacted by one or more of the energy conservation measures in this project.

## STATEMENT OF THE PROBLEM/INITIATIVE

Per Ohio House Bill 251, Wright State must reduce its total energy consumption by 20%, based on an MMBTU/Square Foot basis. This monumental task is even more difficult in our present economic downturn with very scarce State funding available for projects. Wright State University chose to implement this project using Ohio House Bill 7 and hired a performance contractor that guarantees energy savings of 22%. These savings will more than cover the project bond payments.

## DESIGN

In the fall of 2008, Wright State University initially chose an energy consultant, (the team of Brewer-Garrett, URS and First Metrix) to develop a 15-year energy efficiency plan (required by HB 251).

This plan determined that it was, in fact, feasible to develop a construction project that could save the University at least 20% of its energy consumption with a Return of Investment of 10 years or less (required by Ohio HB 7).

Using this initial study as the core of an RFP specification; WSU obtained four very detailed and robust energy efficiency proposals. These proposals were each given critical evaluation.

Ultimately, the proposal with the best and most practical energy saving ideas; the best ROI; and the one that proposed a minimum of 20% guaranteed savings was chosen. This proved to be Linc Mechanical.

We then spent many hours working with Linc to evaluate and choose the best Energy Conservation Measures (ECM's). ECM's were chosen that not only provided a good ROI, but ones that took care of critical capital equipment replacements-equipment that was problematic but was not scheduled for replacement funding in the near future.

Some examples of 'must haves' in the project included:

- New campus-wide HVAC control system
- Boiler & chiller replacements
- Air handler upgrades
- Conversion of two problematic buildings from pneumatic to digital control

- A 'green' component to demonstrate environmental stewardship

The energy team worked with the Faculty through the Buildings and Grounds Committee and the Registrar's office to obtain feedback and approval for classroom lighting upgrades. This included the removal of incandescent bulbs and dimming systems in favor of energy efficient compact fluorescent lamps.

The \$11.4 million was financed by selling Build America Bonds. The net 3% interest rate is less expensive than traditional tax exempt debt.

The net result of this project will produce a yearly energy savings of \$1.3 million in 2009 dollars. This savings will grow as the price of energy rises.

## IMPLEMENTATION

Working with our performance contractor, we developed a realistic 18 month implementation time frame. This took into consideration the class and break schedules so as to minimize the disruption to campus. We quickly developed a very successful working rapport with our contractor. Both parties agreed that it was in our best interest to get the project done on or ahead of schedule and to ensure the energy savings.

We continue to work with Linc to 'morph' the project ECM's. We found that some, like the lab heat recovery, proved to be too costly to justify for the amount of energy savings. These funds were redirected into more profitable ECM's. Up front, we established the criticality of detailed and agreed-upon documentation of project costs and the subsequent energy savings. We agreed to establish these cost/savings during the implementation, and not at the end of the project.

We set up a daily interface between the WSU project manager and Linc's team leader. Weekly meetings occur with Linc, the HVAC controls contractor, WSU Physical Plant, WSU Engineering and Construction and the WSU computer/data group. We publish monthly updates on the project's progress and upcoming schedule to the WSU campus community.

## BENEFITS

This energy efficiency project benefits the Wright State University campus in several ways:

- \$11.4 million in energy efficiency upgrades.
- Bond payments are covered with guaranteed energy savings.
- Will save \$1.3 million per year in today's dollars.
- Achieved the replacement of many capital equipment items that were problematic and would not have otherwise been funded for years.
- New campus-wide HVAC control system for better energy utilization, improved student/staff comfort and improved trouble shooting capability.
- All new light bulbs and ballasts provide operational budget cost avoidance.
- Went energy 'green' with solar heating of the swimming pool water.
- Utilized Build America Bonds for a net interest rate of 3%, less expensive than traditional tax exempt debt.

Attached is the Business Case Analysis that shows the project investment, the energy savings payback and the net savings over the 10 year savings guarantee period.

5/19/09 FINAL

## Wright State University Business Case Analysis

Total Project Cost:	<b>\$11,231,514</b>
Total Savings Over Term:	<b>\$2,242,292</b>
Rate of Financing:	<b>4.00%</b>
Term of Financing:	<b>10</b>
Annual Utility Rate Increase:	<b>3.00%</b>
Annual Operation Rate Increase:	<b>3.00%</b>
Annual Service Cost Increase:	<b>3.00%</b>
Total Cash Flow:	<b>\$2,242,292</b>
Simple Payback:	<b>8.15</b>

Note: Project cost = Implementation Cost - Utility Incentives  
 $\$11,331,514 = \text{Cost}$   
 $\$100,000 = \text{DP\&L Incentives}$

M&V costs represent 4% of annual savings.

YEAR	(C - A + B)			(Optional)			(G - D - F)		
	A Savings From Facility Impr.	B Savings From Operations	C Total Program Savings	D Annual Project Cost	E Monitor and Verification	F Total Program Cost	G Annual Cash Flow	H Accumulative Cash Flow	
0	\$650,000	\$0	\$650,000	\$0	\$0	\$0	\$650,000	\$650,000	
1	\$1,329,070	\$49,350	\$1,378,420	\$1,360,030	\$53,163	\$1,413,193	(\$34,772)	\$615,228	
2	\$1,368,942	\$50,831	\$1,419,773	\$1,360,030	\$54,758	\$1,414,788	\$4,985	\$620,213	
3	\$1,410,011	\$52,355	\$1,462,366	\$1,360,030	\$56,400	\$1,416,430	\$45,936	\$666,148	
4	\$1,452,311	\$53,926	\$1,506,237	\$1,360,030	\$58,092	\$1,418,122	\$88,115	\$754,263	
5	\$1,495,880	\$55,544	\$1,551,424	\$1,360,030	\$59,835	\$1,419,865	\$131,559	\$885,822	
6	\$1,540,757	\$57,210	\$1,597,967	\$1,360,030	\$61,630	\$1,421,660	\$176,307	\$1,062,129	
7	\$1,586,979	\$58,926	\$1,645,906	\$1,360,030	\$63,479	\$1,423,509	\$222,397	\$1,284,526	
8	\$1,634,589	\$60,694	\$1,695,283	\$1,360,030	\$65,384	\$1,425,414	\$269,870	\$1,554,395	
9	\$1,683,627	\$62,515	\$1,746,142	\$1,360,030	\$67,345	\$1,427,375	\$318,767	\$1,873,162	
10	\$1,734,135	\$64,391	\$1,798,526	\$1,360,030	\$69,365	\$1,429,395	\$369,130	\$2,242,292	
<b>Totals</b>	<b>\$15,886,302</b>	<b>\$565,742</b>	<b>\$16,452,044</b>	<b>\$13,600,300</b>	<b>\$609,452</b>	<b>\$14,209,752</b>	<b>\$2,242,292</b>	<b>\$2,242,292</b>	

## RETROSPECT

We could have enlarged the project for even greater benefits, but felt constrained due to the lack of familiarity and comfort with performance contracting.

Next time we would prevent the energy consultant that was hired to perform the preliminary campus assessment from being able to compete for the project implementation. When this consulting team was not hired for the actual project, it created hard feelings and created additional work to justify our decision.

Next time we would include a larger contingency fund to allow for greater project flexibility as new opportunities were discovered during the project implementation.