

2013 Case Study

Johnson Controls Inc.

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Major: Biological Engineering
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Manhattan, Kansas



Company background

Johnson Controls Inc. is an international company that provides services to more than 150 countries. Johnson Controls employs nearly 170,000 people around the globe. The headquarters is located at Glendale, Wisconsin.

There are three sub-businesses associated with Johnson Controls: building efficiency, automotive experience, and power solutions. This intern project focused mainly on building efficiency. The purpose of building efficiency is to lower operating costs and increase energy optimization. This is to be done while maintaining comfort level and not compromising the intended use of the building.

Project background

The main focus of the project was conducting audits on about 90 buildings throughout Kansas State University's campus. The purpose of these audits was to find energy savings to fund a new infrastructure project. The auditing was done over a six-week period and consisted of several engineers that inspected all aspects of building operations.

Kansas State was willing to consider all energy savings opportunities that will have a 30- year payback. Since the direction of the project was open ended, savings were considered in several areas.

Incentives to change

Johnson Controls Inc. is an energy service company that provides services to increase building efficiency. Johnson Controls has taken on projects at Kansas State for several years. Recently, K-State brought them back to help create and update the infrastructure the university will need to move forward with the '2025 Master Plan.' K-State has been working for some time on making improvements in its energy consumption, while still performing at high academic and research levels. The project that Johnson Controls has taken on with K-State could potentially be worth 50+ million

dollars. Ideally, the university will see significant energy savings through the auditing efforts and also expand the chilled-water loop so the university can continue to evolve

Projects reviewed for E2/P2 potential

1. Water conservation

Water conservation was the focus of many projects on campus. To reduce the amount of water being consumed by Kansas State University, the following projects were recommended:

- **Domestic Water-Cooled Condensing Units**
Currently, domestic water is run through a compressor to cool the unit down, after which it goes directly to the drain. By implementing a closed system, the water used to cool the system will be continuously reused. This will eliminate water use and sewer costs.
- **Condensation from cooling coils to steam return**
Pumping the condensation created on air-conditioning units back to the steam plant will eliminate the amount of make-up water necessary to keep the steam production up to demand.
- **RO reject water to cooling tower make-up**
To filter the water used in the steam plant, a reverse osmosis (RO) process is used. When the filters become full, a large back-flush of water is used to clean out the impurities. This goes straight to the drain. It's proposed the water be pumped to an already existing, chemically treated cooling tower and reused.
- **Pool covers:**
covers are being recommended to the KSU natatorium to reduce the amount of water evaporated from the pools.

2. Controls/ability to add controls

- **Direct digital controls (DDC)**
DDC will allow for pumps, fans, dampers, etc. to run more efficiently. Motors will have the ability to fluctuate speeds rather than run at their maximum.
- **Variable volume pumping**

Pressure sensors will be used at the top of the demand lines. The pump will then have the ability to sense when it can back off. The speed of the pump will then vary to match the needed water volume for each coil.

- *Vending misers*

Vending misers are recommended for 80 pop machines across campus. They conserve energy by powering down to a lower setting when no one has walked by or used the machine over a period of time. During this setting, it will cycle when necessary to maintain the product temperature.

3. Chilled-water plant

This project is the main focus of phase IV. With the new chilled-water plant operating, buildings currently operating their own chillers will be added to the loop, decreasing operating costs of each building.

4. Steam tunnel pipe insulation

Piping insulation added to the steam tunnels, mechanical rooms, and all the joints within will reduce the amount of heat transfer out of the pipes. This will reduce the heat that is escaping into the buildings and underground. Keeping high temperatures within the pipes will reduce the amount of natural gas combusted and the amount of greenhouse gases released into the atmosphere.

5. Building envelope

By improving a building's envelope, energy can be conserved. Due to the conservation of energy within the HVAC systems, significant amounts of greenhouse gases can be eliminated from the atmosphere. The

Summary of 2013 recommendations for Kansas State University

Project description	Annual estimated	Annual estimated cost	Status
Water conservation	Pending	Pending	Recommended
Controls/ability for future controls	Pending	Pending	Recommended
Chilled water Plant	Pending	Pending	Recommended
Building envelope	Pending	Pending	Recommended
Steam tunnel pipe insulation	Pending	Pending	Recommended
Building envelope	Pending	Pending	Recommended
Fleet CNG	Pending	Pending	Recommended
Lighting	Pending	Pending	Recommended
Total savings *	Pending	Pending	
GHG reductions *	Not yet calculated		

- Does not include projects that are “not recommended” or where “further research is needed.”
- To find cost savings and more details on projects, please refer to the Investment Grade Audit that Johnson Controls Inc., prepared for Kansas State University as of September 2013.

envelope improvements are being considered for 22 buildings across campus. In these buildings, the caulking, weather stripping, and insulation will be added or repaired. Also, as part of this project, window replacements are being considered for Anderson, Eisenhower, and Fairchild halls, and the English Counseling Services.

6. Fleet CNG

Converting the normal gasoline vehicle to natural gas or dual fuel is being considered for 50+ of Kansas State's vehicles. The number of vehicles is still fluctuating while the age and condition of each vehicle is being considered on an individual basis. With the conversion to CNG, the university will be saving money since CNG is less expensive. Also, an additional benefit is the reduction of the greenhouse gases being emitted into the atmosphere.

7. Lighting

All current 32-watt fluorescent bulbs will be switched out to 25-watt. Incandescent light bulbs will also be swapped for compact fluorescents lamps. Also, occupancy sensors will be implemented to conserve energy by powering down lights when space is not in use.