Smart Energy Design Assistance Center

SEDAC TECHNOTE 05-1, December 2005

About SEDAC

The mission of the Smart Energy Design Assistance Center (SEDAC) is to further implement energy efficient practices throughout the State of Illinois. The SEDAC is administered by the University of Illinois at Urbana-Champaign in partnership with the Geothermal Heat Pump Consortium. SEDAC provides services for the Small Business $mart Energy (SB$E) program which is part of the State's Opportunity Returns initiative directed by the Illinois Department of Community and Economic Opportunity (DCEO). The SB$E program provides small businesses building code support, design assistance, education and strategic outreach to building designers, owners and users in order to help adopt sustainable practices that reduce energy use and costs while realizing important environmental benefits.

Contact us:

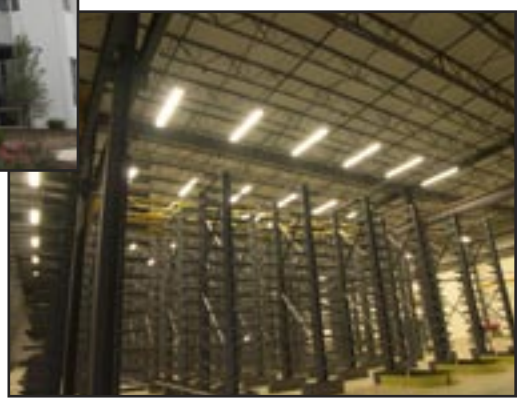
Smart Energy Design
Assistance Center
University of Illinois
1 E. St. Mary's Road
Champaign, IL 61820
info@sedac.org
800-214-7954

Chicago Tube & Iron

South Creek Corporate Center, Romeoville, Illinois.

Founded in 1914, Chicago Tube & Iron (CT&I) is one of the largest steel service centers in the United States. With more than 1.2 million square feet of warehouse, storage, and processing space, CT&I currently houses more than 30,000 line items of inventory – including pipe and tubing products, valves, and fittings – in several buildings on Chicago's south side. In addition to its product storage and processing services, CT&I has begun to offer "value added" light manufacturing operations (e.g. tube bending) to its customers. While these light manufacturing operations only account for approximately 10 percent of the company's current revenues, CT&I expects these operations will grow to half of their revenues in ten years. To accommodate this projected growth and to consolidate all of its operations into one building, CT&I has constructed a new single, larger facility in Romeoville, Illinois. In late 2004, CT&I asked the Smart Energy Design Assistance Center (SEDAC) to complete a life-cycle cost analysis for energy efficient improvements to be applied to the new CT&I facility.

CT&I headquarters



CT&I warehouse

The Analysis

In October, 2004, SEDAC staff met with CT&I personnel to discuss and assess the planned energy systems for the new Romeoville facility. Following the visit, SEDAC staff conducted a complete four-step energy analysis of the 360,400 sf warehouse:

1. **Baseline Energy Model** – Using Trane's TRACE 700 software, a building energy simulation estimated the building's annual energy consumption and utility costs.
2. **Lighting Simulation Program** – Using Visual Pro 2.03, lighting alternatives were simulated to compare energy use and cost to the baseline building lighting design.
3. **Energy Conservation Measures** – After consulting with CT&I staff and reviewing the baseline building plans, the model was adjusted to incorporate ECMs and to learn their impact on the buildings energy use and utility bills.
4. **Life Cycle Cost Analysis** – Using life-cycle cost analyses, the estimated savings and additional costs of implementing the recommended ECMs were analyzed.

Key Points

Annual Energy Consumption & Cost: Model Results

Baseline Building	Electricity (kWh)	Demand (kW)	Gas (Therms)	Total
Consumption	4,304,026	1,362	137,761	
Cost	$145,989	$240,841	$120,257	$507,087
Building after ECMs				
Consumption	3,933,593	1,240	142,817	
Cost	$133,536	$219,499	$124,554	$477,589
Implemented ECMs				Annual Savings
Consumption	370,433	142	(5,056)	
Cost	$12,453	$21,342	($4,297)	$29,498

Building Data

Location: Romeoville, Illinois
IL Economic Region: North East
Total Space: 1.2 million sf
Warehouse Space: 360,400 sf
Total Additional Cost: $52,250
Monthly Energy Savings: $2,458
Loan Payment: $600
Net Cash Flow: $1,858
(All savings measures financed at 6.75% over 10 years)
IRR: 86.1% NPV: $205,200

The Findings and Implementation

The SEDAC investigated :

- Energy efficient lighting (T5 high bays) and occupancy controls in the warehouse.

CT&I installed the T5 lighting with occupancy controls despite first costs being slightly higher than the original design/build lighting layout. CT&I cited three reasons for implementing these ECMs:

- The life-cycle costs of the T5 lights were lower than the original design. (CT&I will own this facility for the next 90 years; they will be in this building for the "long run.")
- CT&I employees prefer fluorescent instead of metal halide lighting sources. (Fluorescent light is less of a point source and strains eyes less.)
- Fluorescent lights are easily and cheaply turned on/off with occupancy sensors; thus, they can save more money.

For this application, T5 high bay fixtures are favorable for a number of reasons. First, they have a higher efficacy than metal halide high bay fixtures. Lighting fixture efficiency, or "efficacy," is defined as lighting output (lumens) per electrical energy output (watt). This higher efficacy is achieved by the type of phosphorus used in the T5 lamps and the advanced electronic ballasts. The metal halide lights operate at about 71 lumens per watt, while T5 high bays operate at about 87 lumens per watt. This is more than a 20 percent improvement in efficiency.

Lumen depreciation is a common characteristic of discharge sources of lighting (fluorescent and metal halide). The lighting output decreases over time. Over lamp life, the lighting output from T5 high bays decreases about six percent, while metal halide output decreases 24 percent. Lighting designs account for lumen depreciation by installing additional fixtures to account for this depreciation making T5 lamps the better choice. Finally, T5 high bay lights can be effectively controlled by occupation sensors because they reach full brightness rather quickly, whereas metal halide lights take nearly 15 minutes to reach full illumination.

Investing in more efficient lighting and controls yields an internal rate of return (IRR) of 86.1 percent and a net present value (NPV) of $205,200. Projects are typically considered attractive if the IRR is greater than the discount rate and the NPV is greater than zero. Life cycle cost assumptions include a 20-year study period and a discount rate of 10 percent.