THE ECONOMIC IMPACT OF COMMERCIAL BUILDING ENERGY CODES IN LOUISIANA

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In late 1996, when Louisiana was moving toward the adoption of its first building energy code, the Department of Energy (DOE) was requested to study the economic impact of the adoption of ASHRAE 90.1-1989[1] as the state's commercial building energy code.

The two studies summarized below were recommended by the DOE as representative of the results that the State of Louisiana might realize if the state adopted one of the most current Commercial Building Energy Conservation Codes. These studies are illustrative of the fact that energy codes can, and do, save money. Remember that the two states discussed in this article are from totally different climate zones: Texas, Zones 2 and 3; Michigan, Zones 5 and 6. In both cases, the cost to install lighting equipment decreased in the majority of building types, primarily due to decreased lighting power density (LPD) requirements of the newer codes and increased efficiency of today's lighting equipment. The combination of these two items allows fewer lighting fixtures in most spaces. Lighting designers have adapted to specifying the appropriate fixtures to provide high-quality, uniform lighting that meets today's codes and use considerably less energy than older lighting designs and technologies.

The study conducted by the Pacific Northwest National Laboratory (PNL), dated January 21, 1997, was based largely on a previous PNL report, Hadley and Halverson, 1993. In the 1993 study, ten building types were compared, and the savings potential was presented (Table 1):

Table 1. Building Type Savings Potential, 1993

Building Type	Energy Savings, %	Savings, ¢ / s.f.
Apartment	3.4	2
Small Office	11.5	22
Medium Office	13.5	22
Large Office	11.9	21
Church	7.4	3
School	10.0	6
Hotel	7.8	19
Anchor Retail	28.6	65
Strip Shopping Mall	10.1	19
Warehouse	10.7	3
Straight Average	11.5	18

Source: Pacific Northwest National Laboratory, Hadley and Halverson, 1993

Most of the savings is associated with lighting and cooling. Newer codes allow lower LPD values, while newer lighting technologies require fewer fixtures to meet lighting requirements. Fewer lights result in lower cooling

[1] The current ASHRAE standards are products of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE), are approved by the American National Standards Institute (ANSI) and are jointly sponsored by the Illuminating Engineering Society of North America (IESNA). The most recent standard would then be properly listed as ANSI/ASHRAE/IESNA Standard 90.1-2004.

loads. In many cases, air conditioning equipment has been downsized due to reduced loads.

The 1997 study assumed that then-current building practices in Louisiana met ASHRAE 90A-1980 standards, which were not very strict. The study concluded by stating, "The results of this study, based on simulations for a hybrid Retail/Office building in Shreveport, Louisiana, and adjusted for new construction trends using the DOE's Commercial Building Energy Conservation Survey data set, show that the energy savings potential for Louisiana is about 23%."

The 1997 Louisiana Legislature enacted the Commercial Building Energy Conservation Code (CBECC). The state legislation was mandated by Congress as part of the National Energy Policy Act of 1992 (EPAct) which requires that states incorporate energy efficiency standards into their building codes for commercial buildings. In Louisiana, commercial buildings are defined as all buildings designed for human occupancy, except residential buildings of three stories or less. For multifamily residential buildings of three stories or less, the applicable code was the Council of American Building Officials Model Energy Code (CABO MEC). For all other commercial buildings, the applicable code was ASHRAE/IES 90.1-1989. The energy code took effect July 1, 1998, for state buildings and January 1, 1999, for all other commercial buildings. Effective June 21, 2005, the State of Louisiana adopted ASHRAE 90.1-2001 as its CBECC. This ASHRAE code applies to commercial buildings and multi-family residential structures over three (3) stories. The applicable code for multi-family structures three (3) stories or less is 2000 IECC.

Today, many states are upgrading to more stringent energy codes. The construction of better, more energy-efficient buildings is one of the results of the adoption of newer codes. There are other benefits as well. Several studies have been conducted to analyze the potential savings of lighting system installation costs in conjunction with the energy savings.

In 2001, the State of Texas adopted the International Energy Conservation Code (IECC) 2001 as its commercial building energy code. Recently, the State Energy Conservation Office of Texas asked the DOE to analyze the cost-effectiveness of upgrading their commercial lighting requirements to the 2003 IECC, including the LPD allowances that are a part of the 2004 standard. The main interests of the new lighting guidelines are the LPD allowances and requirements for automatic lighting shutoff controls. The building types and specific changes are shown in Table 2.

The DOE analysis results are summarized as follows:

- 31 of 32 building types show a decrease in allowed LPD.
- 28 of 32 building types show estimated decreases in lighting installation costs.
- The weighted average LPD change across all building types is an estimated decrease of 0.44 watts per square foot statewide compared to new buildings observed during the 1990s.
- The weighted average effect of the cost change across all building types is an estimated decrease in lighting installation costs of $0.79 per square foot across the state based on new buildings observed during the 1990s.
- On a whole-building weighted basis, the lighting controls will produce a payback in less than 5 years.
- From 2006 through 2030, the net present value of the energy and lighting fixture cost savings is estimated to be more than $6 billion.

The State of Michigan currently has ASHRAE 90.1-1999 as its commercial building energy code and is

considering an upgrade to the 2004 standard. They requested the DOE to determine the energy effect and the cost-effectiveness of the lighting requirements of the 2004 edition of the ASHRAE standard. The comparison of the 1999 and 2004 standards reveals the changes in each building category as indicated in Table 3.

Table 2. Texas Whole Building Model Comparison, ASHRAE 2001 to 2004

Building Type	90.1-2001 LPD, W/sf	90.1-2004 LPD, W/sf	LPD Change, W/sf	Cost Change, $/sf
Automotive Repair	1.5	0.9	(0.6)	(0.97)
Convention Center	1.4	1.2	(0.2)	(0.34)
Courthouse	1.4	1.2	(0.2)	(0.62)
Dining-Bar Lounge/Leisure	1.5	1.3	(0.2)	(0.22)
Dining-Café/Fast Food	1.8	1.4	(0.4)	0.09
Dining-Family	1.9	1.6	(0.3)	0.32
Dormitory	1.5	1.0	(0.5)	(2.53)
Exercise Center	1.4	1.0	(0.4)	(0.09)
Fire Station	1.3	0.8	(0.5)	(0.52)
Gymnasium	1.7	1.1	(0.6)	(0.07)
Healthcare-Hospital	1.6	1.2	(0.4)	(0.92)
Hotel	1.7	1.0	(0.7)	(1.92)
Library	1.5	1.3	(0.2)	(0.25)
Manufacturing	2.2	1.3	(0.9)	(0.98)
Motel	2.0	1.0	(1.0)	(2.32)
Multi-Family	1.0	0.7	(0.3)	(0.33)
Museum	1.6	1.1	(0.5)	(0.65)
Office	1.3	1.0	(0.3)	(0.77)
Parking Garage	0.3	0.3	0.0	0.04
Penitentiary	1.2	1.0	(0.2)	(0.54)
Police Station	1.3	1.0	(0.3)	(0.57)
Post Office	1.6	1.1	(0.5)	(1.12)
Religious	2.2	1.3	(0.9)	(1.13)
Retail	1.9	1.5	(0.4)	(1.51)
School-College	1.5	1.2	(0.3)	(0.26)
Sports Arena	1.5	1.1	(0.4)	(0.90)
Theater-Performing Arts	1.5	1.6	0.1	0.01
Theater-Motion Picture	1.6	1.2	(0.4)	(0.40)
Town Hall	1.4	1.1	(0.3)	(0.66)
Transportation	1.2	1.0	(0.2)	(0.10)
Warehouse	1.2	0.8	(0.4)	(0.10)
Workshop	1.7	1.4	(0.3)	(0.16)

Source: Pacific Northwest National Laboratory, September 2005

The DOE analysis produced the following energy and economic savings potentials for the State of Michigan:

- 30 of 32 building types analyzed show a decrease in allowed LPD.
- 28 of 32 building types show estimated decreases in lighting installation costs.
- The weighted average LPD change across all building types is estimated to decrease 0.39 watts per square foot.
- The weighted average effect of the cost change across all building types is estimated to decrease $0.63 per square foot for lighting installations.

Table 3. Michigan Whole Building Model Comparison, ASHRAE 1999 to 2004

Building Type	LPD Change, W/sf	Cost Change, $/sf
Automotive Repair	(0.6)	(1.00)
Convention Center	(0.2)	(0.26)
Courthouse	(0.2)	(0.63)
Dining-Bar Lounge/Liesure	(0.2)	(0.22)
Dining-Café/Fast Food	(0.4)	0.09
Dining-Family	(0.3)	0.33
Dormitory	(0.5)	(2.60)
Exercise Center	(0.4)	(0.09)
Fire Station	(0.5)	(0.54)
Gymnasium	(0.6)	(0.07)
Healthcare-Hospital	(0.4)	(0.94)
Hotel	(0.7)	(1.97)
Library	(0.2)	(0.26)
Manufacturing	(0.9)	(1.01)
Motel	(1.0)	(2.38)
Multi-Family	(0.3)	(0.34)

Building Type	LPD Change, W/sf	Cost Change, $/sf
Museum	(0.5)	(0.67)
Office	(0.3)	(0.79)
Parking Garage	0.0	0.04
Penitentiary	(0.2)	(0.55)
Police Station	(0.3)	(0.59)
Post Office	(0.5)	(1.15)
Religious	(0.9)	(1.17)
Retail	(0.4)	(1.56)
School-College	(0.3)	(0.26)
Sports Arena	(0.4)	(0.92)
Theater-Performing Arts	0.1	0.03
Theater-Motion Picture	(0.4)	(0.39)
Town Hall	(0.3)	(0.67)
Transportation	(0.2)	(0.11)
Warehouse	(0.4)	(0.10)
Workshop	(0.3)	(0.16)

Source: Pacific Northwest National Laboratory, September 2006

Code requirements may increase construction costs by a small margin for some products. The energy performance standards for fenestration products, including windows and doors, are more stringent in newer codes and can cause these products to have slightly higher initial costs. Once area suppliers stock units that meet code, prices become very competitive with older models. This has been the case in several other states. What cost increase there is will be off-set by energy savings over time.

Modern construction practices produce structures that are not only safer and more energy-efficient than older buildings, but may actually achieve this without significant increases in related construction costs. Building codes continue to change, usually becoming stricter than earlier codes, but technology also improves, often offsetting the cost increases. Adapting to new codes and utilizing the latest technology, building design and construction techniques are the keys to developing cost-effective buildings in today's environment.

The CBECC is updated or amended by the Office of the State Fire Marshal, Code Enforcement and Building Safety, in consultation with the Facility Planning and Control Section of the Division of Administration and the Technology Assessment Division of the Department of Natural Resources. These agencies acted together, utilizing this process, when the CBECC was updated in 2005.