US3

Lighting Retrofit – University of New Hampshire – Lundholm Gymnasium, United States

1 Photos

Figure 1: Lundholm Gymnasium

2 Project summary

The existing light level on the basketball court of the University of New Hampshire Gymnasium was 161 lumens/m^2 which was far below IES standards for intercollegiate athletic events. The existing electrical connected load for the lighting was 15,816 watts and with 4 Tube light fixtures using T-12 high output fluorescent lamps and magnetic ballasts. This light level was used for both general use and athletic events. The primary purpose of the lighting retrofit was to increase light levels for games while reducing energy and subsequently improving energy efficiency. The goal was to increase event light levels to 646 lumens/m^2 on the main court area.
This project was completed in 2001.

3 Site

The University of New Hampshire is located in the rural town of Durham, New Hampshire, USA. UNH is within 20 minutes of the Maine and New Hampshire seacoasts, and one hour of Boston, Massachusetts; Portland, Maine and the White Mountains of the New England Section of the USA. The location is 43.1°N and 80°W.

4 Building description /typology

4.1 Typology / Age

College and University	1850-1900	1900-1940	1941-1970	1971-2000	2001 -
Campus		●			

4.2 General information

Year of construction:	1930
Year of renovation (as described here):	Year of Upgrade – 2001
Total floor area (m^2):	836
Number of pupils:	NA
Number of classrooms:	NA

4.3 Architectural drawings

Drawings not applicable to this study

5 Previous heating, ventilation, cooling and lighting systems

The existing lighting system had 4 tube fluorescent fixtures using T-12 tubes with magnetic ballasts.

6 Retrofit energy saving features

6.1 Energy saving concept

The energy saving concept was to upgrade the lighting system over the main court area with T-5 lamps and new 3-Tube fixtures. Computerized lighting controls were used and provided by the existing building automation system (BAS). The BAS control will allow for three light levels on the main court area, low (1 tube per fixture), medium (2 tubes per fixture) and high (all tubes). The low level will be used for general purpose use of the area and the high level will be used for games and athletic team practices. The BAS will allow for accurate data logging of hours used for all sets of lamps in the fixtures. This data will allow cost effective group replacement of lamps at 70 percent of rated lamp life.

6.2 Building

N/A

6.3 Heating

N/A

6.4 Ventilation:

N/A

6.5 Lighting

See above

6.6 Other environmental design elements

N/A

7 Resulting Energy Savings

Existing Conditions

24 four-lamp 8-foot high output T12 fixtures with magnetic ballasts.
253 Watts per 2-lamp ballast, two ballasts per fixture = 506 Watts per fixture.
Total for 8-foot fixtures = 24 @ 506 Watts = 12,144 Watts.

12 four-lamp 4-foot high output T12 fixtures with magnetic ballasts.
153 Watts per 2-lamp ballast, two ballasts per fixture = 306 Watts per fixture.
Total for 4-foot fixtures = 12 @ 306 = 3,672 Watts.

Total existing Watts = 12,144 + 3,672 = 15,816 Watts.

Connected electrical load: 15,816 Watts
Horizontal illumination at 1.22m (4 feet) above floor: 161 lumens/m2 (15 foot-candles).
Annual electricity consumption: 62,048 kWh
Annual electricity cost @ $ 0.08/kWh €0,07/kWh: approximately €4,100

Post-Retrofit Conditions

40 three-lamp 4-foot high output T5 fixtures with electronic ballasts.

Low level = 1 lamp per fixture (inboard) tandem wired with 2-lamp ballasts where possible. Odd-numbered fixtures use a 1-lamp ballast.
18 two-lamp ballasts @117 Watts each = 2,106 Watts
4 one-lamp ballasts @ 61 Watts each = 244 Watts
Total low level wattage = 2,106 + 244 = 2,350 Watts

Medium Level = 2 lamps per fixture (outboards) wired with one 2-lamp ballast per fixture.
40 two-lamp ballasts @ 117 Watts each = 4,680 Watts.

High Level = 3 lamps per fixture.
58 two-lamp ballasts @ 117 Watts each = 6,786 Watts
4 one-lamp ballasts @ 61 Watts each = 244 Watts
Total high level wattage = 6,786 + 244 = 7, 030 Watts.

Connected electrical load:
High Level: 7,030 Watts
Medium Level: 4,680 Watts
Low Level: 2,350 Watts
Horizontal illumination at 4 feet above floor:
High Level: 646 Lumens/m2 (60 foot-candles)
Medium Level: 431 Lumens/m2 (40 foot-candles)
Low Level: 215 Lumens/m2 (20 foot-candles)

Annual electricity consumption: 15,408 kWh
Annual electricity cost @ $0.08/kWh €0,07/kWh: approximately €1008.

8 User evaluation

Quality of daylight / artificial light: Light levels were increased to 646 lumens/m2 at 1.22 meters above the floor. The users found that the quality of light was much better for game conditions.

9 Renovation costs

€26,200

Figure 2: These three photographs show the various light levels and how the overall light level has improved.



10 Experiences/Lessons learned

10.1 Energy use

Reduction of 46,640 kWh in energy use for the year or 55.6 Kwh/m^2/yr. Project personnel realized the upgrading of lighting to a new level and technology has several benefits other than energy savings and reduced costs. The other benefits include more uniform light levels, better quality of light, less fatigue for the athletes because of reduced glare and an overall improvement to the playing environment.

11 General data

11.1 Address of project

The University of New Hampshire, Durham, NH 03824 USA

11.2 Project dates

Project initiation: Spring 2000
Design completed: Autumn 2000
Renovation construction completed: Winter 2000-2001
Monitoring and evaluation completed: Autumn 2001

11.3 Date of this report/revision no.

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12 Acknowledgements

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13 References

none