

Akard Elementary School, Sullivan County Schools, Tennessee, United States

US2

1 Photos



Figure 1: Akard elementary school.
Top: North side
Below: South side

2 Project summary

The project included the replacement of all old fluorescent T-12 fixtures with premium quality T-8 lamps and electronic ballasts. Replacement of all existing incandescent exit signs with LED type; all existing incandescent lamps with compact fluorescent (CFL) and existing high output lamps in multipurpose rooms with T-8 fixtures. Replacement of 40 windows with Low-E double glazed windows – 537 Sq Meters. Installation of Energy Management Systems with controls on selected HVAC equipment. Replacement of coal boilers with high-efficiency gas fired condensing boilers. Replacement of hot water heaters and upgrading of plumbing fixtures. This project started in the summer of 2001 and was completed in the summer of 2002.

3 Site

Akard elementary school is located in the foothills of the Appalachian Mountains in Eastern Tennessee, United States.

Latitude: 36.6°N. Longitude: 82.2°W.

The school is situated in a residential area in the county with a large field surrounding it.

Degree Days: 8354°(F)

4 Building description /typology

4.1 Typology / Age

Typology/Age	Pre 1910	1910–30	1930–50	1950–70	1970–
The multi-storey school				•	
The central corridor school				•	

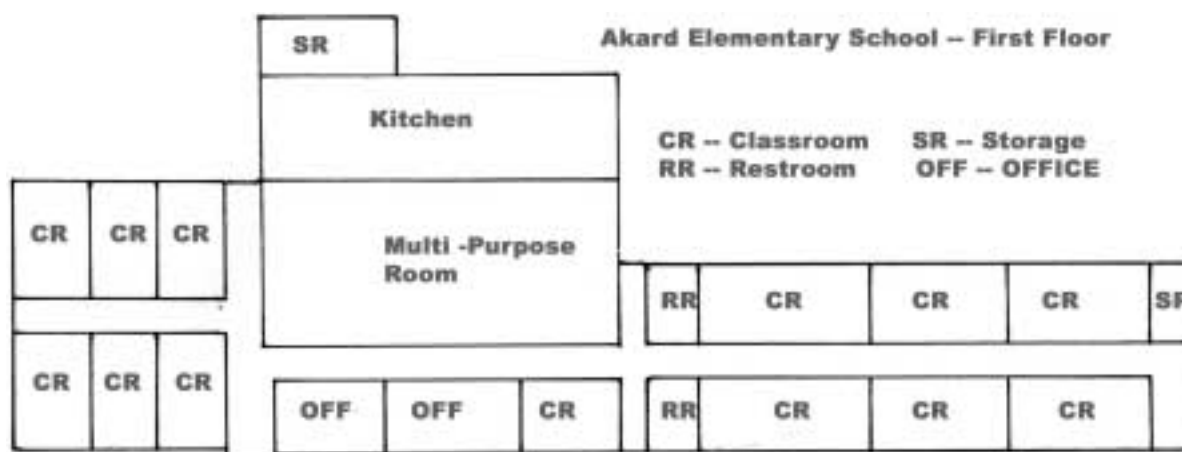
Educational level: Kindergarten to Fifth Grade (US)

4.2 General information

Year of construction:	1963
Year of renovation (as described here):	2002
Total floor area:	3534 m ²
Number of pupils:	223
Number of classrooms:	16
Typical classroom	
size:	75 m ²
window/glass areas:	13 m ²
number of pupils:	18-20
Hours of operation:	8 Hours /day for 200 days

4.3 Architectural drawings

Figure 2: Floor plan - first floor



5 Previous heating, ventilation, cooling and lighting systems

The existing school had old technology in lighting and heating systems. Lights were old T-12 fluorescents, incandescent lamps were used in other areas and old technology emergency exit lights were in use. A limited ventilation system within the school with windows in the classrooms serving as the major source of fresh air was retained. Cooling system was window units, which were retained.

6 Retrofit energy saving features

6.1 Energy saving concept

This project was designed to improve the teaching and learning environment while reducing energy consumption and allowing for the improvement, not only to the energy related systems in the school but also other operations like the cafeteria, communications and technology.

The project included:

- Replacement of all old fluorescent T-12 fixtures with premium quality T8 lamps and electronic ballasts.
- Replacement of all existing incandescent exit signs with LED type
- Replacement of all existing incandescent lamps with compact fluorescent (CFL)
- Replacement of existing high output lamps in multipurpose rooms with T-8 fixtures.
- Replacement of 40 windows with Low-E double glazed windows – 537 Sq Meters
- Installation of Energy Management Systems with controls on selected HVAC equipment
- Replacement of coal boilers with high efficiency gas fired condensing boilers
- Replacement of hot water heaters and upgrading of plumbing fixtures.

6.2 Building

The feature included in this project that affected the insulation of the facility was the replacement of existing single pane windows with low-e windows. These windows will reduce solar gain and improve daylighting to a degree.

6.3 Heating

The heating system in the building was a hot water radiator system using two coal fired boilers. These boilers were replaced with high efficiency natural gas boilers, with control by an Energy Management System.

6.4 Ventilation:

Strategy and systems; natural/mechanical/hybrid;

Comfort cooling: Yes – Central air conditioning

Dehumidification: No

Pre-heating of ventilation air: No

Heat recovery: None

Controls: Energy Management – Central Controlled

6.5 Lighting

Installation of T-8 fluorescent lighting in all areas with electronic ballasts. Installation of LED exit lights and replacement of all incandescent lamps with compact fluorescent.

6.6 Other environmental design elements

None

7 Resulting Energy Savings

Cooling: Included in lighting usage

Ventilation: Included in lighting usage

Lighting: 140,531 Kwh – Baseline Year – 2000 (Not including AC)

Reduction in Energy Consumption: 125,000 kWh or 35 kWh/m²/year.

8 User evaluation

Indoor air quality: No specific problems were identified for correction by this project. Operable windows have been retained for providing adequate ventilation to the classrooms and other areas of the school. Improved temperature control through automation of the system will assist in the improvement of the overall climate of the facility. After completion of the project and a year of operations the results of how this improved the IAQ will be better known.

Quality of daylight / artificial light: Quality of the daylight will improve with the installation of new low-E windows.

Sound quality: Low-E Windows will reduce the level of outside noise influencing the classroom, and result in an overall lowering of the background dB level in the classroom.

General feeling: Under current systems operations and controls the general feeling of the staff and students is neutral to the adequacy of the building and its systems.

Technical functionality: This will only be determined after a good year of operations by school and maintenance personnel.

Architectural quality: The architecture of the building was not changed as a result of the improvements made to the energy systems of the building. The only noticeable change will be in the windows with some replacement of the glass blocks that were installed with the original construction.

9 Renovation costs

Specific cost per technology

Envelope: Improvement of window systems (Replacement with Low-E windows) – €77,300 or \$85,500

Systems:

Lighting systems: \$53,000 or €48,200

Heating HVAC: €204,500 or \$225,000

Hot Water: €10,900

Plumbing System Upgrades:

Note: Final costs will be known once the project is completed.

10 Experiences/Lessons learned

10.1 Energy use

See the other sections.

10.2 Impact on indoor climate

The improved lighting levels and improved controls on comfort should result in improved indoor climate. Evaluation of staff and students will take place in the 2004 school year. Education of teaching staff, students and maintenance personnel will be critical to the achievement of the final energy use and savings.

10.3 Economics

Energy savings planned and calculated through the energy improvements accomplished on this building will result in paying for these improvements.

10.4 Practical experiences of interest for a broader audience

See above.

10.5 Resulting design guidance

No specific design guidance is provided. The upgrading of this building was accomplished for two purposes: 1) to improve the energy efficiency of this building and 2) to improve the overall climate within the building including the quality of lighting and temperature control.

11 General data

11.1 Address of project

Akard Elementary School, 224 Mt. Area Drive, Bristol, Tennessee, USA

11.2 Project dates

Project initiation: 1999

Design completed: 2001

Renovation construction completed: 2002

Monitoring and evaluation completed: 2003

11.3 Date of this report/revision no.

July 2003/revision No.2

12 Acknowledgements

Builder: Energy Systems Group

Architect: Energy Systems Group

Engineer: Energy Systems Group

National, international support programmes: NONE

Author (of this description): Lorenz V. Schoff

13 References

none

