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— ISSUETRAK —

A CEFPI Brief on Educational Facility Issues

Topic: Energy and Water Conservation:
Techniques to reduce waste and improve the budgetary bottom line

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CEFPI BRIEF

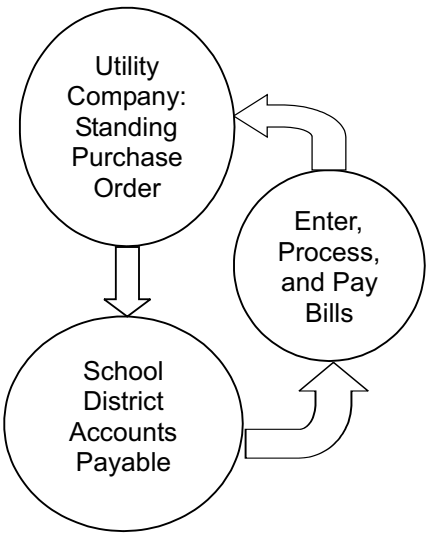
Introduction

The educational facility planning community has experienced significant changes in the approach to planning and designing learning environments. Technology advancements, delivery methods, student collaboration, community integration, and sustainable practices have become issues that school planners, designers, and facility managers must incorporate into a building. For new facilities these issues are easily addressed in the planning and design phases of construction. Unfortunately, the average age of school facilities across the country is 48 years and many buildings are difficult to retrofit and adapt to the needs of today's educational program and services. The one constant and primary concern to all facility managers, regardless of the age of their facilities, is the increasing maintenance and operations costs. According to the US EPA, the worst energy efficient schools use three times more energy than the best energy efficient school. This fact is important because energy inefficiency significantly affects a school district's costs. After salaries, utilities are the largest budget items confronting school districts. To further put this in perspective, one need only to consider the fact that schools spend more each year on energy costs than they do on books and computers. To compound the problem, districts are encouraged to build schools as inexpensively as possible in order to keep capital costs low. Standard, low-cost schools are usually energy inefficient and will be expensive to operate and maintain.

The US Department of Energy estimates that schools could save 25% of their energy costs by improving energy efficiency. As mechanical equipment manufacturers continue to focus on building a better mousetrap, we continue to reap the benefits. Modern energy-efficient heating and air conditioning (HVAC) equipment uses ½ of the electricity than does equipment purchased and installed 15 years ago. Modern energy efficient equipment and digital control systems enable schools to greatly reduce energy bills without negatively affecting the quality of education or the educational environment. Unfortunately, the majority of school districts are not in the financial position to purchase new equipment and complete major system replacements. There are, however, low-cost or no-cost energy conservation practices that have been implemented at Mesa Unified School District #4 in Mesa, Arizona that have greatly reduced the utilities bill, and which any district can employ.

Opportunities to Save

Although electricity is a large component of the utility expense for the district, water and sewer usage contribute approximately 10% to the overall bill. More importantly, Arizona is now facing its ninth year of drought. Water is a valuable resource in the desert, and due to the present condition, we must use it more wisely than ever before. Additionally, Arizona's explosive growth in the past several years has caused increased demand and has led to even greater shortages. A successful water conservation program not only saves money and energy, but promotes the ideals of a good neighbor, sets an example for the rest of the community to follow, and instills best practices that students and staff can take home and implement, resulting in even greater efforts to reduce water consumption.



Getting Started

Every project requires an initial phase of assessment to pinpoint the current situation and to determine what strategies must be implemented to reach the ultimate goal. The first step of any planning and program analysis is taking inventory. It is important to realize that although the school business is complex, it is also fragmented and many functions are accomplished without knowing much about the overall picture. This is especially true when it comes to school utilities and the monthly payment process. The majority of school districts follow a payment system similar to the following procedure:

- A standing purchase order issued with the service provider so that payment can be processed and paid promptly.
- The monthly bill arrives at the district office and is forwarded to *Accounts Payable.*
- The bill is entered into the accounting system and payment is authorized.
- The payment is sent and the facilities continue to function.

The problem with this model is that unlike residential situations, most schools do not review the bill to verify that it is accurate and they are unable to identify usage trends.

To address this issue, Mesa Public Schools conducted a thorough inspection of all facilities in order to identify the location of each meter and what it served. The results were eye opening! The district used a total of eight different utility service providers across the various accounts, which comprised of:

- 98 different sites
- 248 electrical meters (average of 3 per campus)
- 209 domestic water meters
- 87 landscape meters (no sewer charge)
- 82 gas meters
- 36 flood irrigation sites

The Results
Mesa Public Schools developed a systematic approach of tracking, accounting, and validating utility use and expenditures. In developing the system and taking inventory, the district discovered that:

- 15 meters were no longer in service, but the account had not been closed
- 12 meters had double billings
- Two schools were being serviced by one main meter, which unveiled:
  - A potential isolation problem
  - An analysis of usage that finally made sense
- Payment was being made for watering a city park
- The district was billed in excess of $500,000, which was paid.

The time and effort spent on the inventory paid for itself by more than 50 times what was expended in labor to complete the task. The over-billings ceased and the money was recouped. In addition, the database of information is now a power tool for the district's facilities toolbox. The district is now able to accurately verify renovation impacts and efficiencies, identify problem areas, such as large spikes in usage, validate costs for rentals, and identify areas for savings. The overall analysis showed where the district spends most of the money, which helped direct additional conservation strategies.

A Few *Golden Nuggets* to Control Energy Costs
The majority of energy conservation techniques and tips are actually no-cost or low-cost solutions that are easy to implement. One simple, no-cost measure is to contact the account representative for each utility service. School districts are good customers; they pay utility providers a lot of money and the bill is paid on time. In fact, school districts may be one of the largest customers. However, school districts may not be treated as a preferred customer. Many times schools are forgotten and the accounts taken for granted. This should not be the case. Many providers send individual bills for each meter. This not only costs the service provider more money and extra paperwork, it causes each bill to be processed separately. School district personnel must request that the utility service provide a complete list of all meters and/or services that are billed, and a history of those bills. Request a summary bill so that one bill lists all of the accounts. This strategy will reduce time spent processing individual bills and will minimize the possibility of misplacing bills.

Once the bill is posted as a summary statement of all services, it becomes easy to identify trends, analyze usage and to consider moving all possible accounts to a time-of-use billing plan. In the case of Mesa Public Schools, the analysis showed that every school with an aggregate yearly billing over $4,000 should be on a time-of-use plan. A total of 123 meters were switched to this plan. The bottom-line savings from August 2002 to August 2003 was a grand total of **$494,784.26**; **a cost savings of 7.8%.** There was no cost to change the accounts and it was done seamlessly.

Mesa Public Schools Operations Department also worked with the utility provider to implement a program called SPATIA, which allows the district to review energy usage at each facility in 15-minute intervals. This program has made a significant contribution to the energy conservation efforts. The perception was that it took 2 hours for a mechanical system to condition a space; however, SPATIA helped verify that buildings could recover from nighttime setback temperatures in approximately 30 minutes. This information has allowed the district to adjust start times and save 1-½ hours per day on mechanical system operation. The SPATIA system has also shown where systems were operating during weekends when they should not be, and it has helped to track the time of use cycle so that usage can be curtailed during the peak demand and billing times.

Mesa Unified School District also implemented the *Lights Out* program. *Lights Out* is an aggressive program in which teachers are reminded to turn off the lights when they leave for the day. Typically, the school day ends at 3:00PM, yet custodians do not reach many classrooms until 8:00 or 9:00PM for the daily cleaning. This means that the majority of empty classrooms had the lights on and the district was wasting 5-6 hours of electricity usage every day. Additionally, all custodians performed a security check 1-hour after classes end to ensure that all doors were locked and that the lights were turned off. If a teacher works late, the custodian provides a friendly reminder to turn out the lights when they leave. When it is time to clean the room, the custodian turns on the lights, cleans the room, and turns the lights

off when he leaves. Meter tests show that lighting expenses are typically reduced 30-40% when lights are shut off in unoccupied classrooms.

Mesa has also been able to verify that computers need to be turned off at the end of the day and when not in use. There has been a misconception that turning off a computer is not good for it so it should be left on all the time. This notion is especially true in school computer labs. Not only is this practice a large waste of energy, there is a significant head-load added to the facility, which is unnecessary. The bottom line should be . . . turn computers off.

The HVAC set points were also adjusted. The cooling set point was 78°F with a 2° swing, and set back to 85°F in the unoccupied mode. Heating set points were placed at 70°F with 2° swing. The information provided by the HVAC industry indicates that 2% saving can be realized for every degree that T-Stat is raised in the cooling mode.

ADDITIONAL TIPS TO SAVE ENERGY

- Repair/replace loose weather stripping
- Keep classroom doors closed
- Take coffee pots, refrigerators and microwaves out of classrooms
- Use pleated filters and replace every 6 weeks
- Reduce hallway lighting
- Reduce parking lot lighting after hours
- Put timers on hot water heaters and vending machines
- Apply solar film to windows
- Install programmable thermostats (minimum)/EMS Systems (ideal)
- Change out incandescent bulbs to fluorescent, which can realize a 75% savings
- Cycle bathroom exhaust fans with sensors
- VFD's on fans – 20% speed reduction may yield 50% power difference
- Change EXIT lights to LED

These efforts and strategies implemented have paid off tremendously for Mesa Public Schools. From October 2002 to October 2003, energy consumption has decreased by 3,401,929 KWH with **a net savings of $431,368.21**. Switching to a time-of-use plan and reducing energy consumption has realized **a net savings of almost $1 million**.

Conserving Water is as Important as Conserving Electricity

Due to the current drought in Arizona, and the fact that 10% of the utility costs for Mesa Public Schools can be attributed to water and sewer, reducing water consumption was targeted. The district again took inventory of its usage; this time through a survey to discover the major improvement areas. Three issues were quickly identified: sprinkler control and master scheduling; leaking fixtures; and winter rye grass over seeding.

After consulting with the groundsmen, it became apparent that Mesa Public Schools did not have even the most basic understanding of when and for how long turf was watered. In fact, many campuses had evidence of mushroom growth, which indicates complete over watering. The over watering also caused excessive grass growth that required additional manpower for mowing and trimming. Every controller was located and the settings recorded. After analysis, a master control schedule was developed and all units were reprogrammed to eliminate the over watering.

Additionally, the facility assistants and custodians at each campus were challenged to identify all leaking fixtures at their site and report the leaks. As a result, 415 lavatories, toilets and other fixtures have been repaired since August 15, 2003. Custodians are committed to fixing reported leaks within 48 hours of discovery.

Finally, the district decided against over-seeding Bermuda grass, which goes dormant in the winter. An exception was made only for the high school varsity baseball and softball fields. There were some negative comments initially, but when all of the municipalities agreed to participate in this effort the objections diminished. The added benefit of this initiative was that an average of **96 man-hours per week were saved** in the reduction of mowing and fertilizing the grounds.

The result of these water savings efforts pleasantly surprised the district. From December 2002 to December 2003, water consumption was reduced by 48,408,954 gallons, **which realized a savings of $309,985.53.**

Throwing Money Away

Trash can be costly for school districts and refuse services should also be reviewed regularly. Once again, the majority of school personnel look at refuse as a necessary evil that receives very little attention. Mesa Unified School District examined the refuse services for the district to see if there were money saving opportunities. The district discovered a cash cow. The first and easiest savings of all efforts were realized when a simple phone call was made. The district requested that service be suspended during the winter and spring breaks. Because school is not in session and the facilities closed during these periods, there was no need for the service. **This simple exercise saved the district a total of $20,387.**

The district not only stopped unnecessary refuse service, but the service to all sites was examined. The district discovered that over the years extra containers were added and extra pick-ups requested. These additions to the service continued even though there was no apparent reason to continue except that no one had bothered to stop it. Once the refuse analysis was completed, the district determined that all elementary schools required two containers to be picked up twice a week; junior high schools required three containers to be picked up

three times a week; and high schools required five containers to be picked up three time a week. Based on this needs assessment, a new contract was proposed and accepted. **The result was a savings of $289,641 per year.** Additionally, the district previously paid $73,663 a year to have individual recycling bins serviced at each campus. Instead, the district changed to centralized cardboard recycling. Currently the district returns cardboard to the warehouse in delivery trucks that previously ran empty. **Not only has the district saved on the annual costs, but they also turned the cardboard into $1,100 by selling it at $35 per ton.**

Conclusion

Saving energy and becoming energy efficient may significantly impact a school district's bottom line as well as simply being the right thing to do. There are many opportunities to conserve that can be implemented at little or no cost. To be successful, a school district must allow employees to gather data, analyze it, make appropriate decisions, and then implement changes. The savings can be tremendous if a district is serious about developing and supporting an energy conservation and reduction plan.

In the case of Mesa Public Schools, the efforts outlined realized a **total savings of approximately $1,599,441 per year**, and this is just the beginning. From capital projects to turning the lights out, these efforts will add up greatly over the years. The vision for every facility initiative is that the educational environment will not be disturbed or interrupted — only enhanced. The formula to remember is:

Energy Conservation = Savings = The Right Thing

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David has been the Director of Operations of the Mesa Unified School District #4 for the past three years. Prior to this, he was the Director of Construction for five years. His current responsibilities include managing a staff of 600 employees that carry out the maintenance, grounds care, custodial, construction, facility planning, and all environmental issues for the district. He has been responsible for the planning and design of 18 campuses during his tenure with the Mesa Unified School District. He holds a Bachelor of Science degree in Engineering from the U.S. Navel Academy and Master degree in Civil Engineering from Arizona State University.

Mesa Unified School District #4

Mesa Unified School District #4 is the largest public school district in Arizona. The District serves 76,000 students housed in 78 schools that cover an area 200 square miles. The district maintains approximately 10,000,000 square feet of facility space. The oldest school was built in 1949 and the newest school was opened in 2003.

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