



CLIMATE CORPS

Advancing Energy Management at Austin Independent School District

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EDF Climate Corps (edfclimatecorps.org) taps the talents of tomorrow's leaders to save energy, money and the environment by placing specially-trained EDF fellows in companies, cities and universities as dedicated energy problem solvers. The following report is the result of a 10 week Climate Corps fellowship at Austin Independent School District.

Executive Summary

Austin Independent School District (Austin ISD) can avoid annual energy costs of \$3.5 million or more by committing to an in-house energy management program led by a certified energy manager. Such a program focuses on achieving the district's mission and meeting stakeholder needs more efficiently, and does not need to sacrifice service quality or occupant comfort.

The most successful energy management programs at school districts across Texas and the United States maintain an integrated focus on facility design, operations and maintenance, and occupant behavior. Austin ISD is already a local leader in green building design and has taken some steps to reduce energy use through operational changes. However, the district's current energy performance and interviews with leading school districts indicate that significant additional cost avoidance opportunities are available. Currently, limited capacity to properly manage energy use through operations means the district may not be achieving the annual cost savings promised by higher initial investments in more efficient facilities and equipment.

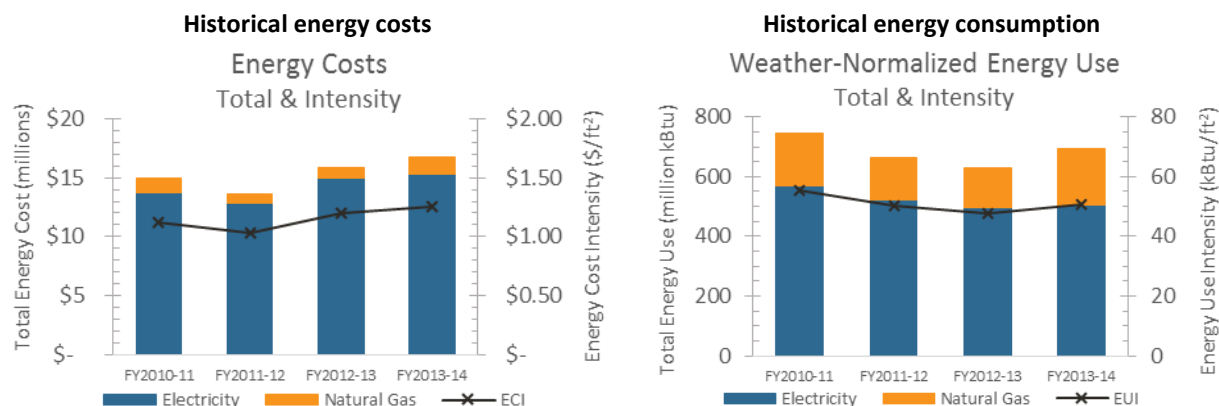
The actions required to capitalize on these opportunities are well-established and mostly involve low to no cost organizational and operational changes rather than high cost capital outlays. As such, energy management is considered a low-risk investment that allows the district to direct its limited financial resources to the more important work of educating and inspiring students to make a positive contribution to society.

Lower energy consumption reduces climate change-causing greenhouse gas emissions, local air pollution, and water consumption. Conducting campus engagement as part an energy management program offers youth a solutions-focused introduction to these increasingly important social and ecological challenges, and can expose students to growing job opportunities focused on energy efficiency and renewable energy.

Current State: Energy Costs and Performance

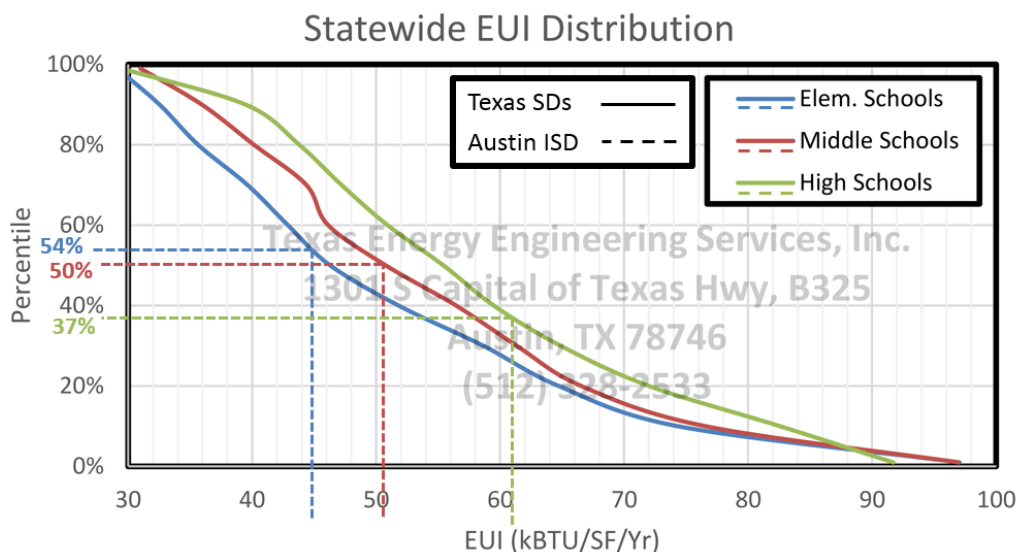
In FY2013-14, the district spent nearly \$16.7 million on energy and was on pace for around \$17 million in FY2014-15 (see bars on below left). Total spending over the previous four fiscal years fluctuated as a result of rising utility rates and up-and-down energy performance, but spending has generally increased.

Energy use intensity (EUI) is a standard metric for understanding a facility's energy performance (line on below right). It is equal to energy use per square foot per year and a lower EUI is better. In FY2013-14 the district used energy approximately 8.8% more efficiently than in FY2010-11, but 5.9% less efficiently than in FY2012-13. The 5.9% is equivalent to approximately \$1 million that could be avoided by an energy management program. See Section 2.1 for a more detailed explanation of the cost and consumption figures below.



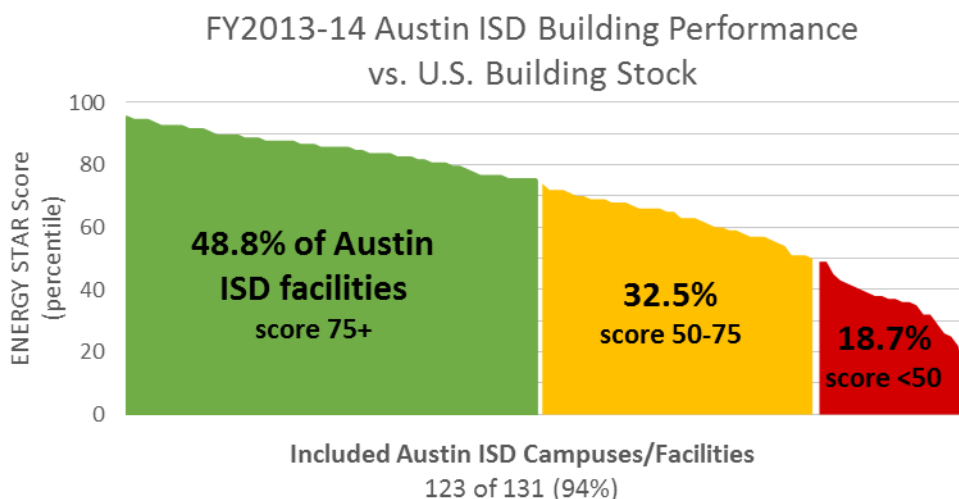
Compared to school districts across Texas, Austin ISD is a mid-range performer. In terms of EUI (bottom axis of the figure below), Austin ISD elementary and middle schools perform better than approximately half of Texas elementary and middle schools, and worse than the other half (left axis). Austin ISD high schools perform worse than approximately 63% of high schools across Texas. Although under 10% of district facilities, high schools consume approximately 31% of the district's energy.

Austin ISD campus EUI performance in FY2013-14 compared other Texas school districts



ENERGY STAR® scores allow one to compare building energy performance to equivalent buildings across the U.S. Scores are equivalent to percentiles, where a score of 75 means the building performs better than approximately 75% of other equivalent buildings. Austin ISD facilities receive a range of scores (below). **Most buildings receiving a score above 75 are elementary schools (the district's lowest energy users), while half of the district's high schools score less than 50 (the district's highest energy users).** See Section 2.3 for a more detailed explanation of the district's performance and the two figures above and below.

Breakdown of Austin ISD ENERGY STAR® scores



The Opportunity: Cost Avoidance Scenarios

School districts and other organizations across the U.S. have been successfully implementing energy management programs for more than two decades. The U.S. Environmental Protection Agency finds that just measuring energy data on a regular basis can yield EUI reductions of 7% to 9%.

School districts that have implemented energy management programs targeting building design, ongoing operations, and occupant behavior have decreased EUI by between 12% and 50%, with larger reductions achieved by districts that have maintained more comprehensive programs for longer periods of time. **Based on Austin ISD's current performance and the performance of other districts, Austin ISD can likely achieve annual energy cost avoidance between 20% and 30%.** This represents \$3.5 to \$5 million in annual energy spending. See Section 3 for a detailed explanation of the table below, including assumptions made regarding the avoided energy cost scenarios.

Cumulative avoided costs grow as long as the program is sustained (rightmost column). **Conversely, allowing the district's energy management capabilities to decline will erode performance and grow cumulative cost avoidance more slowly, causing the district to spend money on energy that can be better allocated elsewhere.**

Summary of avoided energy cost scenarios

Scenario	Annual Cost Avoidance Percentage by FY2020-21	Annual Avoided Costs by FY2020-21	Cumulative Cost Avoidance by FY2020-21
EPA General PM	7%	\$1.2M	\$4.2M
EPA K-12 PM	9%	\$1.6M	\$5.6M
CS Low	10%	\$1.7M	\$5.9M
CS Medium	20%	\$3.5M	\$13.2M
CS High	30%	\$5.2M	\$20.0M

Seizing the Opportunity: An Internal Energy Management Program

Case study interviews with school districts across Texas and the U.S. make it clear that an effective energy management program is a low-risk investment with a well-understood path to success. It primarily involves having a team of properly trained and experienced individuals given the responsibility, authority, and time. This team is tasked with managing an ongoing process of monitoring, investigating, and taking action on opportunities to achieve the district's mission more cost-effectively.

The team needs support. A successful long-term energy management program rests on five *Foundations* that shape district decisions and capabilities. **Sustained action on all of these will yield the greatest benefit over time, whereas disregarding any one means cost avoidance opportunities will be left unrealized.** In short:

1. **People** – Successful energy management requires giving people with the right capabilities the responsibility and authority to actively manage energy use.
2. **Data** – Every program needs a system to provide baseline and ongoing data so the energy management team can make informed decisions and measure and verify progress.
3. **Commitment** – Districts achieving the most significant cost savings have formal commitment and active support from the Board and senior administration.
4. **Design and Equipment** – Actively managing more energy efficient facilities and equipment will yield greater long term savings than efficiently operating less energy efficient facilities and equipment.
5. **Engagement** – Building a conservation culture across the district changes how people interact with energy.

Districts approach each *Foundation* in ways unique to their own situation and preferences, but common themes emerge that Austin ISD can learn from to build their own program. See Section 4 for an analytical framework to guide Austin ISD's energy management program and for more information on how to succeed with each *Foundation*.

Moving Forward: Recommended Next Steps

The district should take steps to continue to establish a strong standing in each of the *Foundations* listed above. I discuss recommended next steps for each *Foundation* throughout Section 4 and summarize them in Section 5.

As its first priority, I recommend the district start by hiring an energy manager and providing them with the authority and staff support necessary to begin building an effective long-term energy management program. To achieve the potential cost avoidance levels discussed above, the district will need to offer a salary that can attract an engineer with the right set of capabilities and experiences. Furthermore, at a minimum, the energy manager needs to be given authority over the district's heating, ventilation, and air conditioning (HVAC) operations. Section 4.1 provides more information on what is needed to build an effective energy management team and where to place them in the district. Initially, the energy manager should be supported by staff focused on managing the district's utility data and developing a campus engagement program. The potential salaries for this Basic Energy Management Team are summarized in the table below. Existing staff may be able to fill the two support positions, so new salary commitments may be lower than in the table below. To pay for their salaries, this team would need to reduce energy costs by only 1.78% versus FY2013-14 (rightmost column). I discuss salaries in Section 5.1.

Achieving and sustaining higher levels of cost avoidance will likely require additional staff or a reorganization of existing staff. As such, **as was recently done at Houston ISD, I recommend the energy manager investigate the 20 worst performing higher cost facilities over their first year and determine the cost avoidance that can be achieved by bringing these facilities back to at least the efficiency at which they were initially designed to operate. The energy manager should then use the results to conduct a cost-benefit analysis, calculating the costs of additional personnel and equipment (e.g., sensors, controls) needed to achieve and maintain the identified energy performance improvement opportunities in these 20 facilities. I urge the district to commit to considering the results of this cost-benefit analysis and funding the additional positions if the energy manager can demonstrate a net benefit.** Like above, some of these staff are likely already in the district, so not all salaries would be new. The potential salaries of the expanded energy management teams are summarized in the bottom two rows of the table below. Note that covering the salaries of the largest team requires annual cost avoidance of only 6.69%, which is less than all cost avoidance scenarios presented above. This team would be the same size as the energy management team at Houston ISD, which has more than twice as many facilities.

Summary of energy management team staff investment options

Energy Management Team Option	Total Salary plus Benefits	% Energy Cost Avoidance to Breakeven*
Basic Energy Management Team	\$296,923	1.78%
Basic Energy Management Team + Half Houston ISD-Scale Building Commissioning Team	\$635,715	3.81%
Basic Energy Management Team + Houston ISD-Scale Building Commissioning Team	\$1,116,800	6.69%

Note: All salaries are based on Houston ISD figures.

*Compared to FY2013-14 total energy costs.

Finally, I recommend Austin ISD invest in interval data meters (aka IDR meters) at eleven high schools. IDR meters allow the energy management team to monitor, analyze, and act on daily rather than monthly data. Where monthly data shows how much energy a facility used in one month compared to another, IDR meter data shows specifically how much energy was used when (in 15-minute intervals), thus indicating what equipment or behaviors could be responsible for the energy use. As such, IDR meters allow the team to more quickly identify and address specific issues leading to unnecessary energy spending. These eleven high schools are only 8.4% of facilities, but use 31.5% of the district's energy, making them a high value target for IDR meters. The total upfront cost of the IDR meters is estimated to be approximately \$7,150 with annual usage fees around \$17,820. I discuss this further in Section 5.2.

Table of Contents

EXECUTIVE SUMMARY	II
GLOSSARY	VII
1 INTRODUCTION	1
2 ENERGY PERFORMANCE AT AUSTIN ISD	2
2.1 HISTORICAL CONSUMPTION AND COSTS	3
2.2 PROPOSED AUSTIN ENERGY ELECTRICITY RATES	5
2.3 BENCHMARKING AUSTIN ISD ENERGY PERFORMANCE	6
2.3.1 <i>Performance Compared to Texas School Districts</i>	6
2.3.2 <i>Performance Compared to the U.S. Building Stock</i>	7
2.3.3 <i>Facility-Specific Performance</i>	8
3 COST AVOIDANCE SCENARIOS	9
4 A FRAMEWORK FOR ENERGY MANAGEMENT AT AUSTIN ISD	12
4.1 PEOPLE ENERGY MANAGEMENT TEAM	14
4.2 DATA UTILITY DATA SYSTEM & MANAGEMENT	17
4.3 COMMITMENT ONGOING BOARD & SENIOR STAFF SUPPORT	20
4.4 DESIGN & EQUIPMENT EFFICIENT DESIGN, REPLACEMENT, & COMMISSIONING	23
4.5 ENGAGEMENT CAMPUS & STAFF BEHAVIOR CHANGE	26
5 MOVING FORWARD: ADVANCING ENERGY MANAGEMENT AT AUSTIN ISD	30
5.1 RECOMMENDED ENERGY MANAGEMENT TEAM	31
5.2 COSTS OF INTERVAL DATA CAPABILITIES AT HIGH SCHOOLS	32
6 APPENDICES	33
6.1 REMAINING ENERGY DATA ERRORS	33
6.2 FACILITY ENERGY USE PERFORMANCE	34
6.3 FACILITY ENERGY STAR® SCORES	39
6.4 DETAILS OF INTERVAL DATA METER SAVINGS AT LYNDON B. JOHNSON	43
6.5 DETAILS OF ENERGY MANAGEMENT TEAM SALARIES	44
6.6 LIST OF CASE STUDY ORGANIZATIONS AND ASSOCIATED RESOURCES	45

Glossary

Not in alphabetical order. Related terms are positioned next to each other.

Energy Management: Involves actively designing, constructing, operating, and maintaining buildings and equipment to achieve more efficient and cost-effective energy use to provide desired services.

Energy Efficiency: Focuses on the design and construction of facilities to provide greater opportunity for efficient and cost-effective energy use.

Energy Conservation: Focuses on the operations and maintenance of facilities to maximize efficient and cost-effective energy use.

Energy Conservation Measure: Any type of action to reduce the consumption of energy in a facility.

Energy Use Intensity (EUI): Total energy consumption per square foot per year for a facility or group of facilities. This is the standard metric for building energy management and is measure in thousands of British thermal units per square foot per year (kBtu/ft²/year). For more information, see <http://bit.ly/1V9OGjK>.

Energy Cost Intensity (ECI): Total energy cost per square foot per year for a facility or group of facilities (\$/ft²/year).

Weather-normalized: Adjustment that can be made to energy use metrics to account for heating and cooling degree days in a given period of time. It is intended to represent the energy that would have been used under average conditions in a facility's climate zone. For more information, see <http://bit.ly/1V9OAZw>.

Heating and Cooling Degree Days: Measure the difference between outdoor temperatures and a temperature that people generally find comfortable indoors. A higher value for heating degree days (HDD) occurs during colder weather and means facilities are more likely to use more energy for heating. A higher value for cooling degree days (CDD) occurs during hotter weather means facilities are more likely to use more energy for cooling. For more information, see <http://1.usa.gov/1V9OuRF>.

ENERGY STAR® Score: Compare a facilities energy performance to other similar buildings across the United States. Comparisons are based on a facility's weather- and climate-normalized energy use intensity compared to a statistically significant sample of similar buildings. Climate-normalization involves accounting for account for differences in facilities' climate zones that could affect energy performance (e.g., Seattle vs. Miami). For more information, see <http://bit.ly/1V9OLUS> and <http://bit.ly/1V9OGjK>.

Cost Avoidance or Avoided Costs: Calculated as the difference between actual energy costs and how much would have been spent on energy if an energy conservation measure had not been implemented. Avoided costs account for changes in rates and square footage and allow an organization to understand the true value of investments in energy management. Cost avoidance can be calculated for other utilities as well as other investments intended to achieve lower future costs. For more information, see <http://bit.ly/1V9PghA>.

Electricity Demand: The amount of electricity a facility demands from the grid *at any given time*. It is measured in kilowatts (kW). For example, higher demand occurs when more equipment demands electricity at the same time.

Electricity Consumption: The amount of electricity consumed by a facility *over a period of time*. It is measured in kilowatt hours (kWh), or kilowatts (kW) multiplied by hours. For example, higher consumption occurs when equipment is left running for longer periods of time.

EnergyCenter: The district's utility data management system. For more information, see www.newenergytech.net.

Portfolio Manager: An online tool run by the U.S. Environmental Protection Agency that enables one to track and assess building energy and water use. For more information, see portfoliomanager.energystar.gov.

1 Introduction

Energy is one of the largest non-instructional related expenses in any school district. A lot of that energy is unnecessary to achieve desired service levels or unintentionally wasted. With tighter budgets, energy cost uncertainty, citizen concerns about environmental impacts, and new developments in technology, more school districts are building in-house capabilities and implementing program to more actively manage their energy to minimize waste and lower overall energy costs.

An effective **energy management** program that grows in and sustains its value over time targets each of the primary ways in which a school district interacts with energy. These interactions can be categorized into two groups of actions: energy efficiency and energy conservation.

Energy efficiency involves decisions and actions during facility design and construction as well as equipment purchases. **Energy conservation** occurs through the ongoing management of energy during operations and shifts in staff and stakeholder behavior and culture. Efficiency initially shapes the potential for cost-effective energy management, while conservation ultimately determines energy use and costs.

This report is intended to help guide Austin Independent School District (Austin ISD) build a sustainable, long-term energy management program that yields growing cumulative **avoided costs** over time. It targets both energy efficiency and conservation, but focuses on the importance of the latter to fully realizing and sustaining the cost-benefit outcomes promised by investments in the former. Results are based on an analysis of current district energy performance and interviews with districts across Texas and the United States that have managed successful energy management programs for several years.

The recommendations are an evolution of efforts the district has been investing in for several years and align with some of the district's strategic priorities. Energy management is designed to optimize investments in staff and facility resources with a focus on cost-effectively meeting stakeholder needs. It would support Expected Result VI.4 of the *Preliminary Action Plans* for the *2015-2020 Strategic Plan*: "Optimized resources (buildings, programs, personnel, etc.) to ensure that they are utilized efficiently and effectively". Energy use reductions are also considered one of the cheapest sources of energy because they ultimately limit the need for new sources. Energy management thus complements the district's potential plan to "Implement alternative energy use for long-term savings".

An energy management program can also engage youth about sustainability with a focus on identifying and implementing solutions to problems. A sustained energy management program will directly and indirectly reduce greenhouse gas emissions and local air pollutants, further aligning Austin ISD with the priorities of the citizens it serves.

Current Actions at Austin ISD

The district has a history of engaging on sustainability issues with both the community, through the Environmental Stewardship Advisory Committee (ESAC), and professionals, through its Energy, Water, and Sustainability Group. In 2011, the Board of Trustees formalized its commitment with an Environmental Sustainability Policy.

Energy Efficiency

The district committed to achieving a minimum 2-star Austin Energy Green Building rating on projects over 10,000 ft², but has exceeded that in several cases. The district has received ten 3-star, five 4-star, and two 5-star ratings. Since 2004, the district has required commissioning on all construction projects. Austin ISD used the 2013 bond to upgrade several existing buildings with more efficient heating, ventilation, and air conditioning (HVAC) systems.

Energy Conservation

The Facilities department has run summer shutdown procedures since 2011 and compressed summer workweeks since 2012. In late 2014, the district hired a Sustainability Coordinator, whose role includes engaging with campuses and collaboratively developing a Sustainability Management Plan (including a focus on energy) over the 2015-16 school year. In early 2015, the Facilities department subscribed to a new utility database management system (EnergyCenter) and is regularly tracking energy and water use.

2 Energy Performance at Austin ISD

This section summarizes Austin ISD's current energy use and consumption. It also provides a snapshot of the district's energy performance compared to other school districts in Texas and similar buildings in the U.S. building stock. All references to energy include both electricity and natural gas.

It is important to consider demand, consumption, costs, and performance as distinct but interrelated issues. **Demand** is the amount of energy flowing from to the district *in any given instant*. It can be compared to the rate at which water flows through a pipe: the more the tap is opened, the higher the rate of flow through the pipe. Similarly, the more equipment using energy at any given time, the higher the demand. In the case of electricity, which is approximately 93% of Austin ISD energy costs, demand is measured in kilowatts (kW).

Consumption measures the total energy used *over a given period of time*. For electricity, consumption is measured in kilowatt hours (kWh), which is calculated as electricity demand in kilowatts (kW) multiplied by the duration of demand in hours. As such, consumption increases both as a result of more equipment using energy at any given time and how long the equipment uses the energy for. Combined electricity and natural gas consumption is measured in thousands of British thermal units (kBtu).

Cost is a function of electricity and natural gas consumption, electricity demand, and utility rates. For electricity, each month Austin ISD is charged both for its total consumption (per kWh rates) and its peak demand (per kW rates). As such, energy consumption and costs do not have a perfectly linear relationship. Rather, managing energy costs requires managing both total energy consumption and peak electricity demand.

Performance includes trends in both total consumption and costs, but is more accurately measured using intensity metrics. Intensity metrics allow for more accurate comparisons between time periods, facilities, and school districts. **Energy use intensity (EUI)** measures the total energy consumption per square foot per year (kBtu/ft²/year) for a facility, group of facilities, or the entire district. As such, it also allows for easy comparison of different sized facilities. It is similar to miles per gallon (MPG) for vehicles, except a lower EUI indicates better performance. **Weather-normalized EUI** is the energy a facility would have used under average conditions in the facility's climate zone. It adjusts EUI up or down to account for the number of **heating and cooling degree days** in a given year, allowing direct comparisons of performance in different years. Further adjustments can be made to weather-normalized EUI to account for differences in climate zones to facilitate comparisons to buildings and districts in other parts of the state and country (e.g., the climate of Seattle vs. Miami). **Energy cost intensity (ECI)** measures total energy costs per square foot per year (\$/ft²/year). Whereas EUI only captures energy consumption, ECI also reflects utility rates and costs incurred due to electricity demand. Both intensity metrics, EUI and ECI, can be used to track ongoing performance and set targets to guide energy management actions.

All figures were developed using data from EnergyCenter and Portfolio Manager. **EnergyCenter** is the utility database management software to which the district subscribes. **Portfolio Manager** is the U.S. Environmental Protection Agency's energy measurement and tracking tool for commercial buildings. Energy data since FY2010-11 have been verified as accurate through Portfolio Manager's data quality functions, a manual review of data in EnergyCenter, and review of utility bills where necessary. Any outstanding data quality issues are summarized in **Appendix 6.1** and are primarily due to unavailable data resulting from past utility transmission problems that have since been fixed.

What about water?

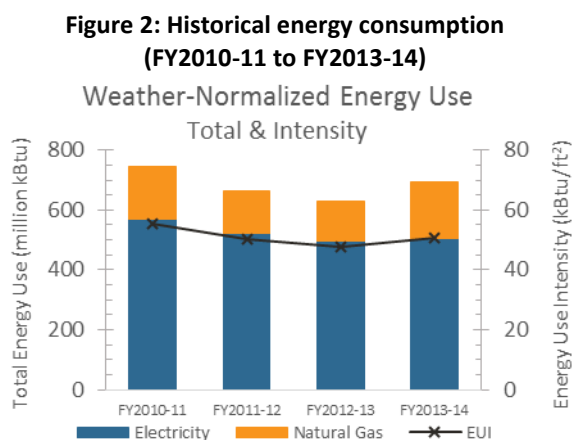
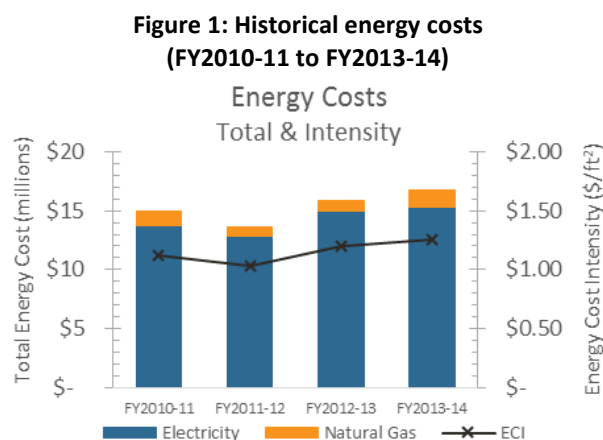
Water should be managed in much the same way as energy. This report focuses on energy because it is a much larger annual expense than water (~\$17 million vs. ~\$2.5 million) and tends to be the central focus of school district resource conservation management programs. Ultimately, Austin ISD's energy management team should focus on both energy and water, particularly as water is an increasingly important policy issue in Texas. Furthermore, on a macro level, energy and water are closely linked because the production of one requires consumption of the other.

2.1 Historical Consumption and Costs

The two figures below show historical energy costs and use over the last four fiscal years. **Figure 1** shows total energy costs (left, bars) and ECI (right, line) for all Austin ISD facilities. **Figure 2** shows total energy consumption (left, bars) and weather-normalized EUI (right, line).

Austin ISD spent approximately \$16.7 million on energy in FY2013-14, up from \$14.9 million in FY2010-11. The increase in both total energy costs and ECI between FY2011-12 and FY2012-13 (**Figure 1**) was due at least in part to Austin Energy electricity rate increases. Total energy consumption and EUI actually decreased during this time (**Figure 2**). The subsequent increase in both total costs and ECI in FY2013-14 was due to increases in both EUI and utility rates. Spending data from September 2014 through April 2015 indicate that cost will grow by an estimated 4% to \$17.3 million in FY2014-15. Part of this increase is likely due to the additions of Padron Elementary School and the Performing Arts Center.

Total energy consumption and weather-normalized EUI were approximately 15% lower in FY2012-13 than a four year high in FY2010-11 (**Figure 2**). Total energy consumption in FY2013-14 was approximately 6.5% lower than FY2010-11, while weather-normalized EUI was 10% lower. Consumption data from September 2014 through April 2015 indicate total energy use may be an estimated 1% to 2% higher in FY2014-15 compared to FY2013-14. At least part of this increase is likely due to the additions of Padron Elementary School and the Performing Arts Center. FY2014-15 EUI and ECI values were unknown at this time of writing this report.



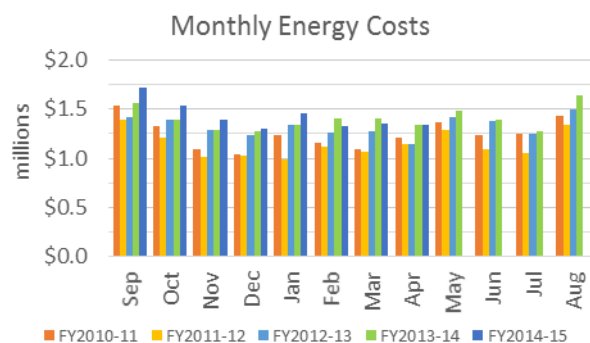
Notes:

- Total costs and total consumption for all fiscal years are slightly understated due to unavailable data (as detailed in **Appendix 6.1**). Missing data is from lower energy using facilities, so any increase would be small.
- ECI and EUI values for each fiscal year are based on FY2013-14 gross floor area values for each facility and thus do not account for changes due to portable removals and additions in previous fiscal years. Changes in gross floor area due to portable changes are small compared to the overall square footage of a building, therefore EUI and ECI should not change much when historical gross floor area values are updated. See **Appendix 6.1** for more detail.

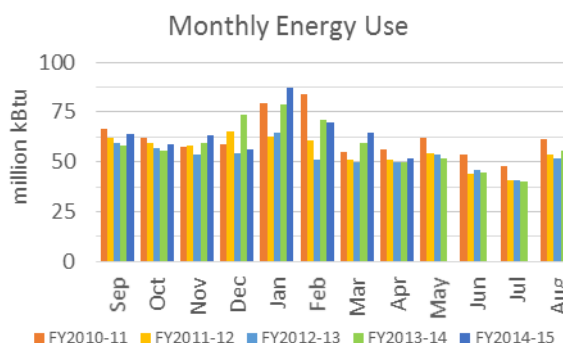
The two figures at the top of the next page show total energy costs and consumption by month since FY2010-11. **Figure 3** shows total energy costs by month since September 2010, while **Figure 4** shows total energy consumption. The Austin Energy electricity rate increase in late 2012 is clearly distinct in the jump between yellow and light blue bars in **Figure 3**. Energy consumption typically peaks in the winter when heating demand is highest.

As expected, consumption decreases during June and July when school buildings are being used less. However, electricity rates are higher between June and September (see **Section 2.2**). As can be seen in comparing the two figures, this leads the cost declines during the summer months to be lower in magnitude than the consumption declines. The higher summer rates also help make September one of the highest cost months each year.

**Figure 3: Historical energy spending by month
(Sep 2010 through Apr 2015)**



**Figure 4: Historical energy consumption by month
(Sep 2010 through Apr 2015)**



Notes:

- At the time of writing, monthly data was only available through April 2015. The delay in data availability is due to the fact that more than 1000 utility bills need to be entered into EnergyCenter each month manually and competing priorities for staff time (including collaborating on the verification of historical data back to FY2010-11).
- Both cost and consumption values may be understated by a small amount due to the data errors listed in **Appendix 6.1**, but should not have a significant effect on total values or trends.

Table 1 summarizes weather-normalized EUI for the district and different campus and facility types between FY2010-11 and FY2013-14. Because these values are weather-normalized, changes between fiscal years should not be due to more or fewer hot and cold days. Having only four years of verified data means it is unclear how energy performance in FY2010-11 compares to previous years. However, having additional past data would be of limited value in guiding the district into the future. Greater value can be gained from continuing to track performance from here forward and from comparing weather-normalized EUI to other school districts and U.S. buildings.

As expected, middle schools are more energy intensive than elementary schools, and high schools are more energy intensive than both. Although only 9% of Austin ISD's facilities are high schools (12 of 131), high schools account for approximately 25% of total energy costs. This makes high schools a valuable target for energy management actions.

Table 1: Austin ISD weather-normalized EUI by facility type

	FY2010-11	FY2011-12	FY2012-13	FY2013-14	Average
Elementary Schools	49.3	43.1	41.3	44.0	44.4
Middle Schools	56.5	51.8	49.3	50.5	52.0
High Schools	63.6	60.4	56.7	60.8	60.4
Athletic Facilities	25.9	22.7	23.3	23.6	23.9
Special Campuses	70.1	59.8	52.6	56.4	59.7
Support Facilities	70.1	65.5	66.3	69.9	67.9
All Buildings	55.4	50.3	47.8	50.6	51.0

Note: The EUI error notes under Figure 1 and 2 regarding gross floor area applies to these values as well.

2.2 Proposed Austin Energy Electricity Rates

Approximately 93% of energy costs over the last four years have been from electricity consumption. By far the largest supplier of electricity to Austin ISD is Austin Energy. As such, Austin Energy rates have a significant influence on energy costs and those responsible for energy management should consider how the district is being charged for electricity. As noted above, electricity charges are based on both total consumption and peak demand.

Recall, demand is the amount of electricity Austin ISD is pulling from the grid at any given time and is measured in kilowatts (kW). Peak demand is the maximum amount of electricity (kW) the district demanded at any one time during the month. The higher the peak, the higher that month's demand-based charges. Put simply, higher demand occurs when more equipment and devices are demanding electricity at the same time.

Conversely, and again put simply, higher consumption occurs when more equipment and devices are left running for longer periods of time. Electricity consumption is measured in kilowatt hours (kWh), or kilowatts (kW) multiplied by hours.

The distinction between these two types of electricity rates is important to understand because upcoming changes in Austin Energy's rate schedule may influence how the district wants to approach energy management.

Table 2 summarizes three years of Austin Energy electricity rates. The rightmost columns list proposed rates effective November 1, 2015 and mark what may be an important shift in the way Austin Energy charges for electricity. Starting November 1, 2015, consumption-based charges are expected to decrease by 12% to 13% (depending on the month) while demand-based charges increase by 12% to 13%.

Further analysis would be needed to understand exactly how these rate changes will affect overall electricity costs. However, the shift to higher demand-based charges suggests that Austin ISD may want to ensure that its energy management team has the tools necessary to identify and reduce demand-related charges. In particular, the district may want to invest in interval data meters (aka IDR meters) at facilities with higher peak demands (primarily high schools), as well as the software required to manage them. This is discussed further in **Section 4.2**.

Table 2: Austin Energy historical, current, and proposed electricity rates

	Effective Nov 1, 2013		Effective Nov 1, 2014		Effective Nov 1, 2015	
	Oct - May	Jun - Sep	Oct - May	Jun - Sep	Oct - May	Jun - Sep
<i>Consumption-based charges (per kWh)</i>						
Energy Charge	\$0.01747	\$0.02247	\$0.01747	\$0.02247	\$0.01747	\$0.02247
Power Supply Adjustment	\$0.03709	\$0.03709	▲ \$0.03945	▲ \$0.03945	▼ \$0.03139	▼ \$0.03139
Community Benefit Charges	\$0.00407	\$0.00407	\$0.00407	\$0.00407	\$0.00407	\$0.00407
Total per kWh	\$0.05863	\$0.06363	\$0.06099	\$0.06599	\$0.05293	\$0.05793
<i>Peak demand-based charges (per kW)</i>						
Electric Delivery	\$4.50	\$4.50	\$4.50	\$4.50	\$4.50	\$4.50
Demand Charge	\$6.85	\$7.85	\$6.85	\$7.85	\$6.85	\$7.85
Regulatory Charges	\$2.49	\$2.49	▲ \$2.60	▲ \$2.60	▲ \$4.43	▲ \$4.43
Total per kW	\$13.84	\$14.84	\$13.95	\$14.95	\$15.78	\$16.78

Notes: Rates effective on Nov 1, 2015 are expected to be approved in September. No rate changes were found for the energy charge, community benefit charges, electric delivery, and the demand charge, so those are assumed to have been constant over the last three years.

Sources: Current and Historical Austin Energy Commercial Rates are taken from <http://bit.ly/1ML8p33>. Proposed rates come from a discussion with and files from Austin Energy during the week of Aug 15, 2015.

2.3 Benchmarking Austin ISD Energy Performance

Benchmarking is one of the first steps any organization should take to decide how to move forward with energy management. The sections below compare Austin ISD's energy performance in FY2013-14 to the energy performance of Texas school districts and the overall U.S. building stock.

2.3.1 Performance Compared to Texas School Districts

Figure 5 compares Austin ISD's energy use intensity (EUI) performance against other Texas school districts. Texas school district performance is represented by three solid curves, one each for elementary, middle, and high schools. Austin ISD performance is represented by corresponding horizontal and vertical dashed lines. Austin ISD performance is mapped onto the related Texas school district curve based on weather-normalized EUI.

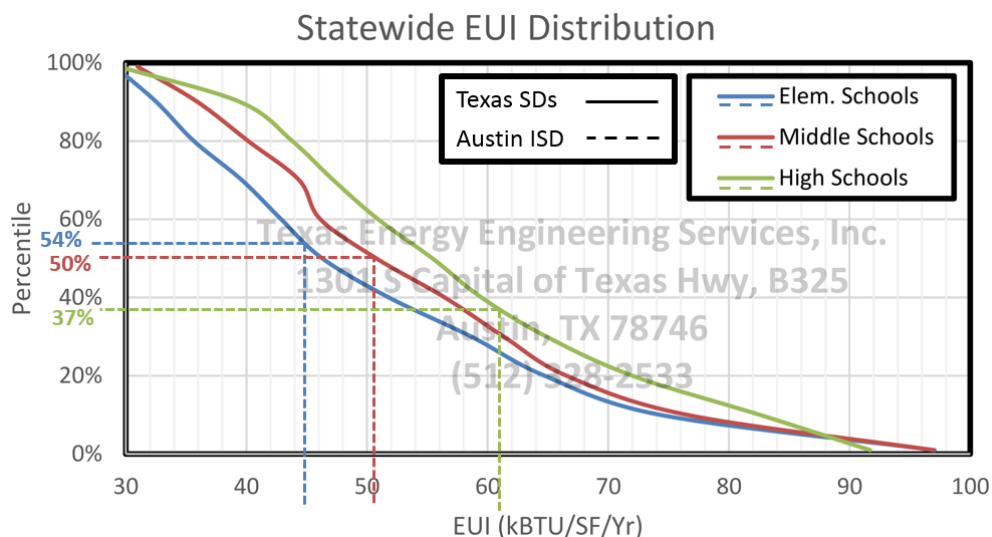
"...the district still has room to improve. The most energy efficient campus [at Klein ISD] has reported 25 kBtus per square foot, while the average is around 40 kBtus per square foot..." – Chad Corbitt, Energy Manager, Klein ISD (<http://bit.ly/1fJraqy>)

The average weather-normalized EUI for Austin ISD high schools in FY2013-14 was 60.8 kBtu/ft²/year. Tracing the dashed vertical line up, then left shows that Austin ISD high schools fall into approximately the 37th percentile in terms of EUI performance across Texas school districts. As such, approximately 63% of high schools across Texas are operating more efficiently than Austin ISD's high schools, indicating significant opportunity for energy use reductions and related cost avoidance.

Austin ISD middle schools are at approximately the 50th percentile, meaning about half of Texas middle schools are performing more efficiently than Austin ISD middle schools. Austin ISD elementary schools reach the 54th percentile, meaning they are being operated more efficiently than approximately 54% of elementary schools statewide.

Figure 6 compares Austin ISD FY2013-14 ECI to other Texas school districts in the same way as **Figure 5** compares EUI performance. Comparing ECI is generally less instructive than comparing EUI due to differences in the electricity and natural gas rates paid by different districts. However, ECI does capture electricity demand (per kW) charges, which EUI does not. Austin ISD middle schools perform significantly worse on ECI than EUI, indicating middle schools may be incurring higher demand charges than at other districts. Confirming this would require further investigation.

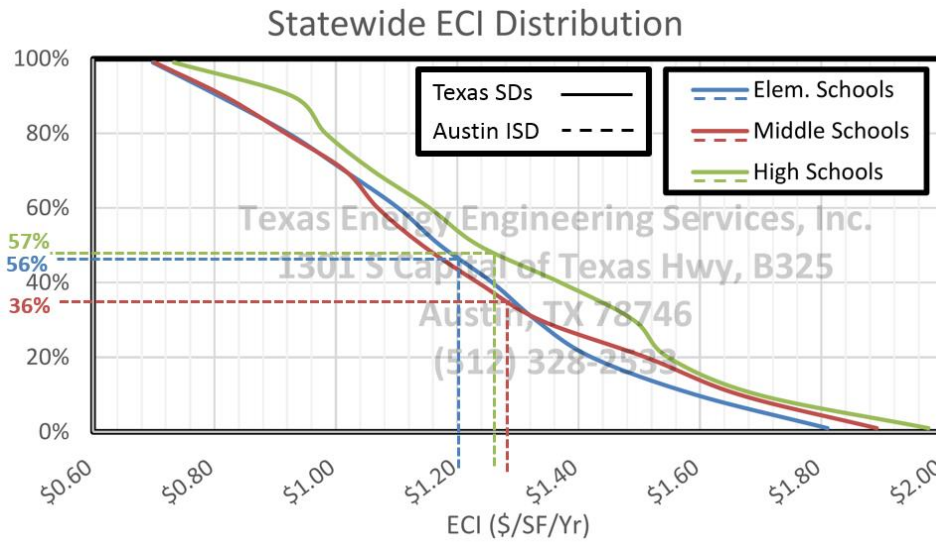
Figure 5: Austin ISD campus EUI performance in FY2013-14 compared other Texas school districts



Note: The ECI error regarding gross floor area noted under Figure 1 and 2 applies to EUI values here. Austin ISD EUI values are weather-normalized, whereas Texas school district EUI values are not. Neither issue should change the overall takeaways of the figure.

Source: Texas school district performance was provided by Texas Energy Engineering Services, Inc. in July 2015. The data were collected between 1998 and 2014 from individual schools at approximately 90 school districts covering a variety of climate regions across Texas.

Figure 6: Austin ISD campus ECI performance in FY2013-14 compared other Texas school districts



Notes: The ECI error regarding gross floor area noted under Figure 1 and 2 applies to ECI values here, however any changes will likely be minor.
Source: Texas school district performance was provided by Texas Energy Engineering Services, Inc. in July 2015. The data were collected between 1998 and 2014 from individual schools at approximately 90 school districts covering a variety of climate regions across Texas.

2.3.2 Performance Compared to the U.S. Building Stock

The U.S. Environmental Protection Agency (EPA) runs an international program called the ENERGY STAR® program to help make the building stock (and consumer and commercial products) more energy efficient. As part of this, ENERGY STAR® provides an online platform called **Portfolio Manager** that helps organization evaluate and compare the performance of their buildings. The standard metric used to compare buildings is the ENERGY STAR® score.

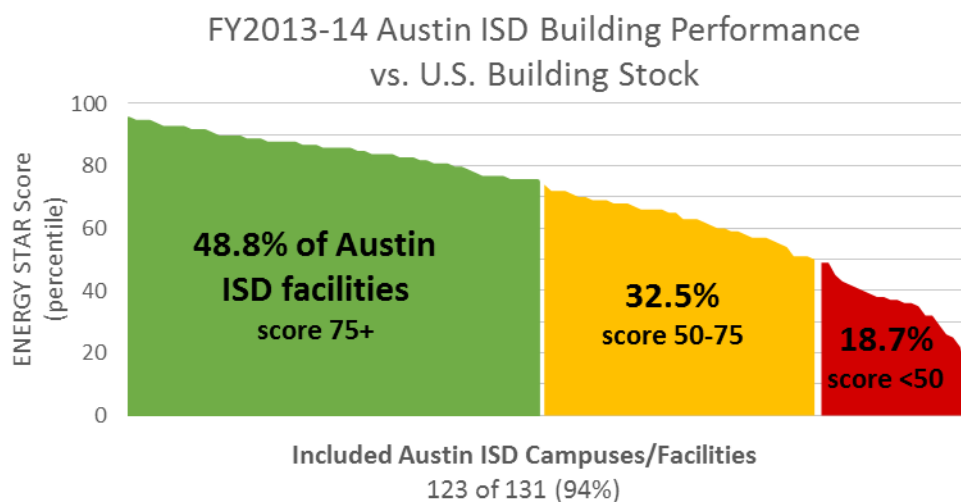
The **ENERGY STAR® score** compares a building's EUI performance against buildings of similar type, size, and use. It accounts for differences in both annual weather and climate zone (e.g., New York vs. Texas). A building receives a score between 1 and 100 based on its EUI performance compared to a statistically significant survey of the U.S. building stock called the Commercial Buildings Energy Consumption Survey (CBECS). For example, a score of 60 indicates that the building is performing at the 60th percentile based on the CBECS data, meaning it is being operated more efficiently than approximately 60% of the buildings in the survey at the time of the survey. Buildings that achieve an ENERGY STAR® score of 75 or higher are eligible to receive ENERGY STAR® certification (similar to LEED, but only measures energy performance instead of other environmental attributes). Currently, no Austin ISD buildings have been ENERGY STAR® certified, though some may qualify.

ENERGY STAR® scores for most building types, including K-12 schools, are currently based on the 2003 CBECS data because errors occurred with the 2007 survey that made the data unusable. In late 2015 or early 2016, the CBECS data will be updated and ENERGY STAR® scores will be based on a 2012 survey of the U.S. building stock. The performance of the buildings in the 2012 survey will likely be better than in the 2003 survey, so the ENERGY STAR® scores presented below may decrease, but it is unknown by how much. More information on the data update can be found at <http://1.usa.gov/1LAXg66>.

Figure 7 summarizes how Austin ISD school campuses and other facilities performed in FY2013-14 compared to the 2003 U.S. building stock using ENERGY STAR® scores. Austin ISD facilities are grouped into three categories based on their ENERGY STAR® score. In FY2013-14, almost 50% of Austin ISD facilities received an ENERGY STAR® score of at least 75. The vast majority of these were elementary schools. No high schools and only two middle schools scored above 75. Altogether, a large percentage of Austin ISD buildings are performing well.

At the other end of the spectrum, almost 20% of Austin ISD facilities received an ENERGY STAR® score under 50. In FY2013-14, these facilities performed in the bottom half of similar buildings in the 2003 U.S. building stock. More than half of Austin ISD high schools fall into this category. The remainder of facilities fall somewhere between these two extremes and also offer room for energy cost reductions. Given the ENERGY STAR® certification cut-off is at 75, the district may consider setting an initial target to bring all facilities to a minimum score of 75.

Figure 7: Breakdown of Austin ISD ENERGY STAR® scores



Note: The ECI error regarding gross floor area noted under Figure 1 and 2 applies to ENERGY STAR® scores because they are based on EUI, however any changes will likely be minor.

Table 3 summarizes the average score for six categories of buildings for FY2010-11 through FY2013-14. The results indicate that Austin ISD elementary schools are performing relatively efficiently overall, while there is significant opportunity to reduce energy use and costs at middle and high schools, special campuses, and support facilities.

Table 3: Austin ISD ENERGY STAR® scores by building type

	FY2010-11	FY2011-12	FY2012-13	FY2013-14	Average
Elementary Schools	68.5	↗ 76.5	↗ 80.8	↘ 77.1	75.7
Middle Schools	50.1	↗ 57.6	↗ 60.4	↘ 57.6	56.5
High Schools	38.3	↗ 44.9	↗ 49.3	↘ 43.3	43.9
Athletic Facilities	60.2	↗ 64.0	↘ 62.4	↗ 69.5	64.0
Special Campuses	46.2	↗ 58.5	↗ 65.3	↘ 61.3	57.8
Support Facilities	36.7	↗ 43.1	↗ 43.3	↘ 41.9	41.3
All Buildings	60.1	↗ 67.7	↗ 71.6	↘ 68.4	66.9

Note: The ECI error regarding gross floor area noted under Figure 1 and 2 applies to ENERGY STAR® scores because they are based on weather-normalized EUI, however any changes will likely be minor.

2.3.3 Facility-Specific Performance

Figures in the appendices summarize the FY2013-14 performance of each facility. **Appendix 6.2** presents weather-normalized EUI compared to Texas schools districts. **Appendix 6.3** focuses on ENERGY STAR® scores. Texas Energy Engineering Services, Inc. performed preliminary energy audits on 25 schools in 2015 and will have more specific recommendations for those facilities. The audits were funded by the State Energy Conservation Office (SECO).

3 Cost Avoidance Scenarios

Organizations have increasingly embraced the opportunity to reap the financial and non-financial benefits that result from committing to and investing in an ongoing energy management program. In some respects, school districts have been leading the way. As of 2014, there were over 8,000 ENERGY STAR® certified school buildings in the U.S. (score greater than 75 as verified by an auditor) and more K-12 schools had been designed to be ENERGY STAR® certified than any other type of building.

The content of and recommendations in this report are based on, among other things, case studies of twelve school districts, two colleges, and one university (**Appendix 6.6**). Nine case studies were based in Texas. All case studies were selected due to ongoing success with energy management. Energy management staff at every school district emphasized the tremendous value the program has brought to their district.

The largest financial benefit to investing in and resourcing a team to manage a district's energy demand and consumption is cost savings resulting from cost avoidance. Energy **cost avoidance** is energy costs the district avoided as a result of energy efficiency and conservation actions. Cost avoidance accounts for changes in square footage and energy costs by calculating the difference between what the district spent on energy over a given time period and what the district would have spent had they not implemented the energy management actions.

The figures below summarize the financial benefits from reduced energy use across five potential scenarios. The five scenarios were developed using two methodologies (described below). The cost avoidance scenarios are summarized in **Table 4**, including the annual cost avoidance achieved under each scenario. For each scenario, I calculate avoided costs against a baseline of FY2014-15.

The first two scenarios are based on EPA data showing the EUI reductions achieved by facilities in Portfolio Manager. Both scenarios are based on a 2012 EPA report summarizing the percentage EUI reduction achieved by facilities using Portfolio Manager between 2008 and 2011 (<http://1.usa.gov/1JmWcil>).

The data in this report do not account for whether or not the organizations managing these facilities engaged in any sort of energy management activities other than measuring their facilities' energy performance in Portfolio Manager. As such, these scenarios are more conservative.

EUI reductions in the **EPA General PM** scenario are based on a facility's current ENERGY STAR® score. Facilities with lower scores are assumed to achieve deeper EUI reductions. For example, facilities starting with a score between 30 and 40 ultimately achieve a 9% EUI reduction, whereas facilities with a score between 80 and 90 achieve a 3.5% reduction. Applied to Austin ISD's portfolio of facilities and based on FY2013-14 ENERGY STAR® scores, this scenario yields an overall energy use reduction of 7%.

"It's remarkable that we saved \$20 million in a six-year period at the same time we built five new campuses, added the network operation center, a police facility and the South Transportation Center,"
- Superintendent Jim Cain of Klein ISD (<http://bit.ly/1fJragv>)

"Since program inception our district has avoided \$63 million of unnecessary energy and water costs."
- Case Study Interviewee

"Over the first four years of my employment as the Energy Manager for Round Rock ISD, we experienced a 27.9% net reduction in direct operating expenses. We cut our energy cost index from \$1.65/ft² to \$1.19/ft². During the same period, the district added 22.4% more campus areas, an increase of 1.3 million square feet. By applying a higher level of energy management over-site and by improving our HVAC service skill levels, we increased our total savings plus cost avoidance to \$3.3 Million per year. And that was without effecting teacher or student comfort."
- Wesley Perkins, Department of Energy Management, Round Rock ISD

The **EPA K-12 PM** scenario is based on the average EUI reductions achieved by facilities designated as K-12 Schools. The 2012 EPA report found that these facilities achieved a 9% reduction in EUI, which is applied to all Austin ISD facilities in this scenario.

The other three scenarios are based on energy use and EUI reductions achieved by school districts interviewed for this report. These organizations have been actively working to operate facilities efficiently for varying amounts of time.

The case study organizations have achieved energy use and EUI reductions between 12% and 50%. Unsurprisingly, districts that have maintained and resourced active energy management teams longer have tended to achieve larger annual and cumulative cost savings. The majority of organizations have achieved energy use or EUI reductions greater than 20%. For example, in terms of EUI, Klein ISD is currently around 40 kBtu/ft² and is targeting even greater reductions. Round Rock ISD and Gresham-Barlow are each at approximately 35 kBtu/ft². Achieving the same EUI as Klein ISD would represent a decrease of approximately 20%, while achieving the same EUI as Round Rock ISD and Gresham-Barlow School District would represent a 30% decrease. Based on the performance of case study school districts, I developed three scenarios: **CS Low** achieves a 10% reduction in total energy costs, **CS Medium** achieves 20%, and **CS High** achieves 30%.

"15% cost avoidance is very achievable, especially if the district has not had program targeting operations. We've achieved 35%." – Case Study Interviewee

"We have decreased total energy use by about 20% while increasing our building space." – Case Study Interviewee

Table 4: Summary of avoided energy cost scenarios

Scenario	Annual Cost Avoidance Percentage by FY2020-21	Annual Avoided Costs by FY2020-21	Cumulative Cost Avoidance by FY2020-21
EPA General PM	7%	\$1.2M	\$4.2M
EPA K-12 PM	9%	\$1.6M	\$5.6M
CS Low	10%	\$1.7M	\$5.9M
CS Medium	20%	\$3.5M	\$13.2M
CS High	30%	\$5.2M	\$20.0M

For simplicity's sake, I make three assumptions. First, I assume that EUI improvements translate directly into avoided energy costs for all scenarios. Actual avoided energy costs will depend on how effectively the district is able to reduce costs related to both electricity consumption (kWh) and peak demand (kW), as well as any changes in both electricity and natural gas rates. For example, reducing energy consumption (kWh) by 10% may lead to annual avoided costs of greater than or less than 10%.

Second, I assume that it takes six years for Austin ISD to achieve the ultimate annual avoided cost prescribed by each scenario. I assume that the program begins in FY2015-16, but that this year is used more for set up and preparation than implementation. I then assume it takes five years to reach to ultimate annual avoided cost percentage for each scenario. I assume the increases in annual cost avoidance occur relatively linearly. These assumptions are meant to be more conservative. The case study organizations all achieved energy use reductions at different rates. Some achieved double digit energy use reductions in their first year, while others required a few years of sustained effort to reach the same level.

"We have avoided around \$25 million over the last 12 years. Now we are spending about \$4 million less on energy each year than we would if we hadn't put an emphasis on energy management in our operations." – Paul Raabe, Energy Management Coordinator, North East ISD

Third, I assume the total square footage of Austin ISD remains at its current level going forward. This is unlikely, however the results are meant to demonstrate the potential for cost savings through active energy management at

Austin ISD, not predict actual cost avoidance achieved by taking any specific path. If EUI performance is maintained, actual avoided costs will increase as the square footage of the district increases.

Each scenario is summarized in **Figure 8** and **Figure 9**. The left axis in **Figure 8** show projected annual energy costs, while the right axis shows annual avoided energy costs relative to FY2014-15. Energy costs in FY2014-15 are assumed to be 4% higher than in FY2013-14 based on year-to-date performance to date. Even the lowest level of avoided costs, those based on the EPA scenarios introduced above, yields annual cost avoidance over \$1 million per year.

With sustained commitment, effort, and performance, annual avoided energy costs yield significant savings over time. **Figure 9** presents the cumulative energy cost savings achieved under each scenario. In the medium case study scenario (CS Medium), cumulative cost savings are \$13.2 million by the time the district reaches its assumed level of sustained energy performance. From then on, if continuing to maintain its improved EUI performance, the district will avoid \$3.5 million in electricity and natural gas costs each year.

Figure 8: Annual energy cost avoidance pathways for each scenario

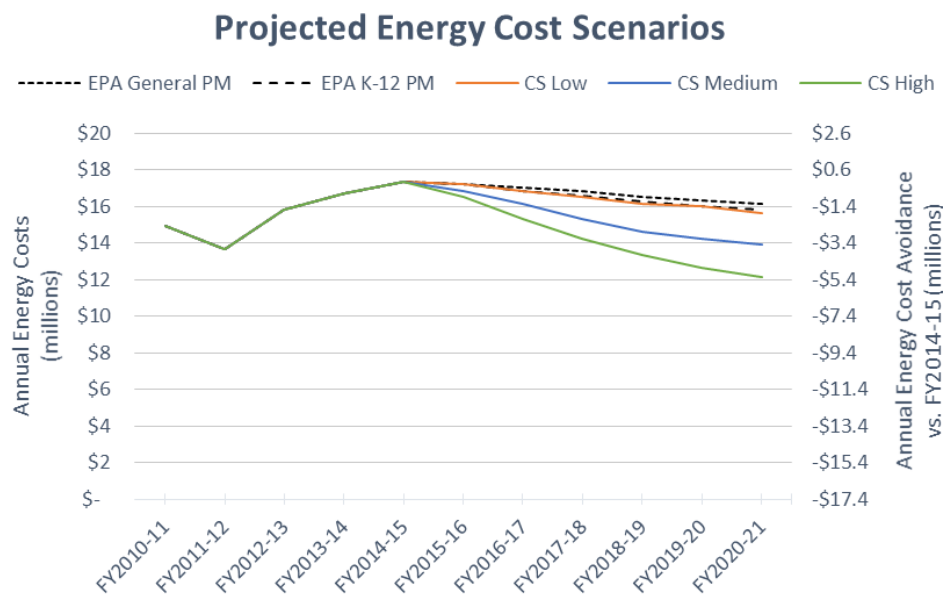
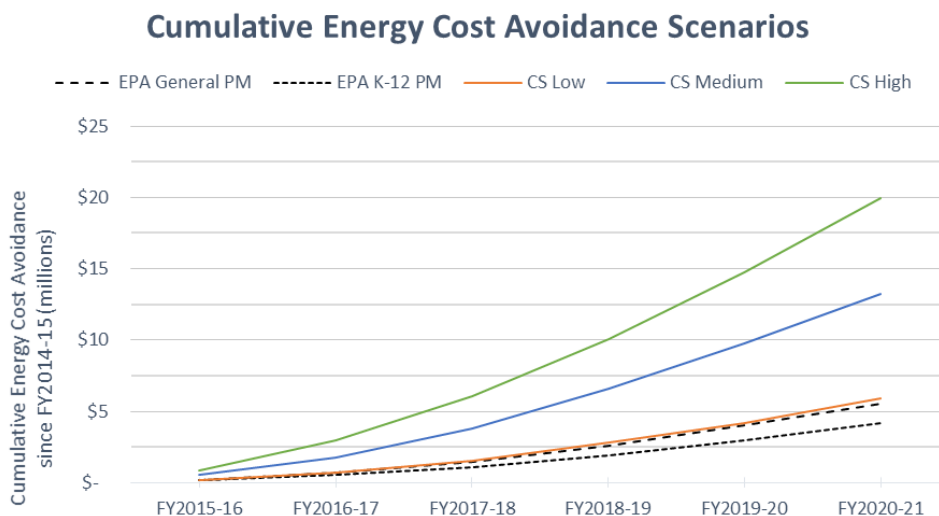


Figure 9: Cumulative energy cost avoidance achieved in each scenario



4 A Framework for Energy Management at Austin ISD

Moving forward with energy management, Austin ISD has the opportunity to learn from school districts and other organizations that have had success and learned lessons along the way. The framework on the next page is intended to provide the district with direction and inspiration with which to move forward. The framework is broken into three parts. See **Appendix 6.6** for a list of case study organizations and links to elements of their program.

The Foundations of an Effective Energy Management Program:

Five *Foundations* emerged as being key to an effective long-term energy management program. These comprise what is necessary to achieve lasting energy use reductions, the resulting cost avoidance, and their associated non-financial benefits. Although presented separately, the sections below will make it clear that aspects of the *Foundations* overlap with one another. Over the next year, Austin ISD and a district energy management team should take action to continue developing each *Foundation* and embed them into the organization to achieve long-term success.

1. **People** – Successful energy management requires giving people with the right capabilities the responsibility and authority to actively manage energy use.
2. **Data** – Every program needs a system to provide baseline and ongoing data so the energy management team can make informed decisions and measure and verify progress.
3. **Commitment** – Districts achieving the most significant cost savings have formal commitment and active support from the Board and senior administration.
4. **Design and Equipment** – Actively managing more energy efficient facilities and equipment will yield greater long term savings than efficiently operating less energy efficient facilities and equipment.
5. **Engagement** – Building a conservation culture across the district changes how people interact with energy.

The sections below discuss each *Foundation*, briefly summarize the district’s current standing, and conclude with recommendations to help the district strengthen its ability to maintain an effective energy management program. The recommendations are based on the case study interviews and the current standing of Austin ISD in each area.

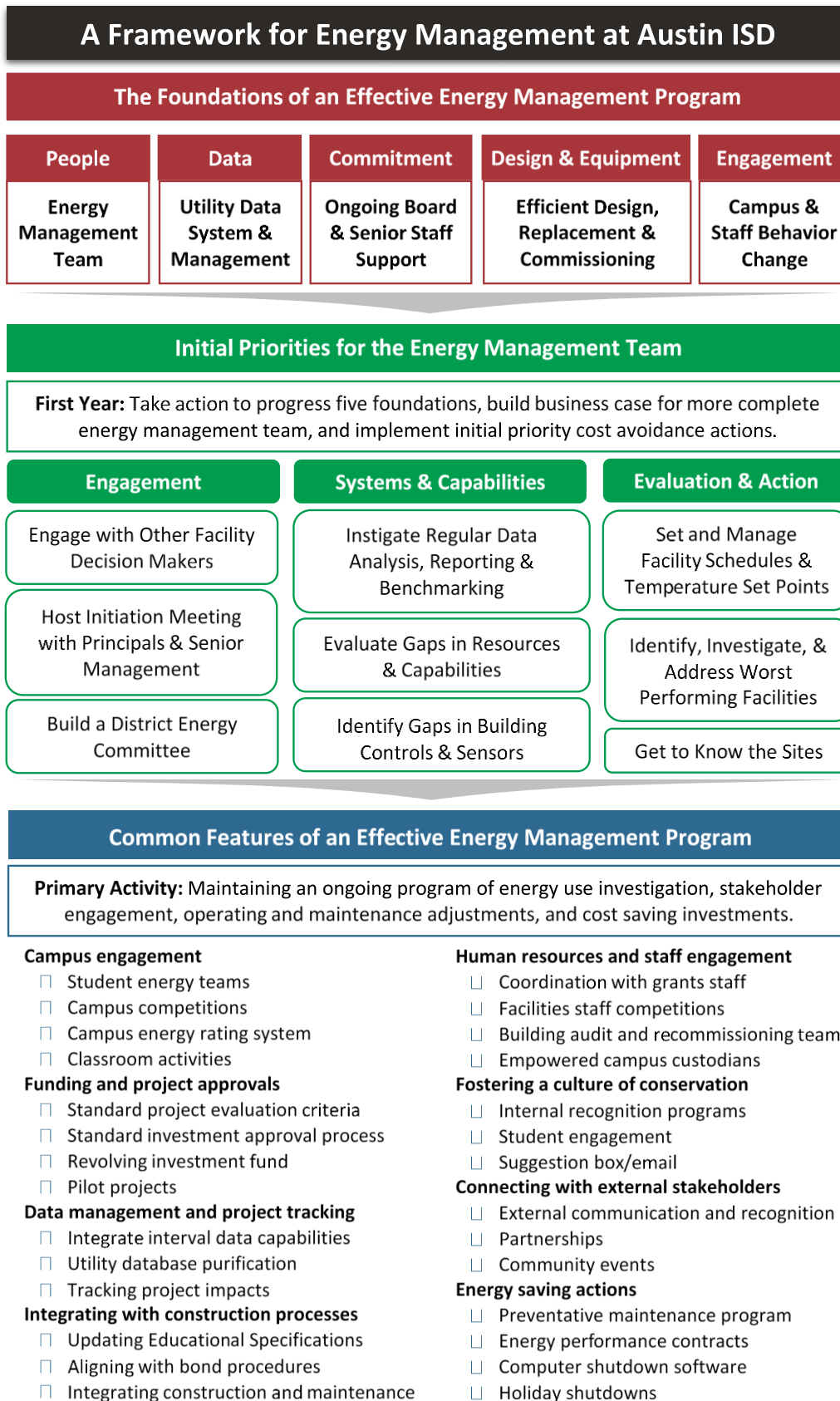
Initial Priorities for the Energy Management Team: These are high priority early actions for the energy management team. The *Initial Priorities* are based only on case study interviews, so are more general and overlap with recommendations at the end of each *Foundation* section. They have been developed to achieve three early priorities.

1. Smoothly integrate the energy management team into the existing organization.
2. Complete a gap analysis between facility management (e.g., controls, sensors) and human resource needs and capabilities and build a business case to address any gaps.
3. Identify and act on high impact energy reduction opportunities to build buy-in and momentum.

Common Features of an Effective Energy Management Program: The items in this category can be thought of as a menu of useful tools to help the energy management team succeed in improving the district’s energy performance. It was generated based on the actions, programs, and tools used at other districts. Several are discussed in the *Foundations* sections below.

“Honestly, it’s diligence. I don’t think there is any one silver bullet. It takes a multi-pronged approach that requires a certain amount of staff education (how and why it’s important, what there is to be gained), building management systems (your eyes and ears on the way your system operates, having things in a good state of repair, having people to manage your buildings), scheduling buildings appropriately (straddling a line between how the building is intended to be used and accommodating customers, a fine line that requires policy), and then obviously commissioning (if not set up, built, and operating correctly from get-go then there is no way to maintain it into an effective operating condition).”
- Nate Slavik, Director, Energy & Physical Plant, Wake County Public School System

Figure 10: Framework for effective energy management



4.1 PEOPLE | Energy Management Team

The energy management team is the group of staff tasked with managing the ongoing energy use of an organization. They are in charge of monitoring, reporting, analyzing, and acting on issues leading to energy waste and opportunities for reductions. Without a team of people with the responsibility and authority to actively manage energy use, an organization will always miss out on energy use reduction opportunities and inevitably spend more money on energy than is necessary.

Team Composition: In its most basic form, the team should consist of an Energy Manager, a person to monitor and analyze energy data, and someone to build and implement a campus engagement program; however, team composition varies by organization and approach. Other common staff on the energy management team include individuals dedicated to building controls monitoring and management (including HVAC), building auditing and commissioning, and quality assurance (of maintenance and replacement projects). Most case studies emphasized the importance of having an adequate number of properly trained controls and scheduling staff.

Energy Manager Capabilities: Most case study districts emphasize that the person in this role should be a Certified Energy Manager (CEM) as designated by the Association of Energy Engineers or have similar certification from ASHRAE. Some preferred experience and capabilities include:

- Understanding of HVAC operations
- Previous experience with energy management and conservation
- Working knowledge of and experience with a school district
- Experience conducting and presenting financial analyses
- The ability to navigate organizational structures, develop relationships based on trust, and build coalitions
- The ability to empathize with what other district staff need to succeed at their jobs
- Interpersonal skills that allow the individual to work with, support, and understand the needs of facilities and maintenance staff, campus leadership, custodians, and senior district administration

Alignment with HVAC Management: Case study school districts put a particular emphasis on the importance of aligning the energy management team with management of a district's heating, ventilation, and air conditioning (HVAC) system. HVAC is by far the largest user of electricity in a school district. Most case study school districts either

"Energy is one of the largest annual expenses any district incurs and it's necessary to actively manage energy use and cost to avoid unnecessary expenditures. Energy purchases deserve good oversight and management. A purchase order is required to buy most anything else in the district and it is easy to see the value of having a project manager overseeing a multimillion dollar renovation. Energy budgets should be approached in a similar way." - Case Study Interviewee

"One of the opportunities we missed at the beginning was having engineers on staff. We realized we needed a combination of a professional engineer that could understand the technical energy issues, while also have staff that assisted on being able to talk to people, understand behavioral issues, and develop and implement strategy is key to our success." - Stephanie Perrone, Sr. Project Manager, Energy and Water Conservation Program, University of Texas; Chair of the Infrastructure Committee for ESAC at Austin ISD

"Good Energy managers do not just manage energy; they manage people's expectations." - Case Study Interviewee

"One of the biggest accomplishments we have achieved is to get the Energy Management and Building Controls departments to work together on an ongoing basis. This has been very important to the success of our program." - Paul Raabe, Energy Management Coordinator, North East ISD

"Don't mistake responsibility for authority. The energy manager and energy management team need the authority to drive decision making for conservation on a daily basis." - Allen Goldapp, Energy Management Coordinator, Northside ISD

situate HVAC monitoring and scheduling directly within the energy management team or ensure that the senior staff in charge of Energy Management and HVAC operations work closely together.

Start with Facility Schedules and Temperature Set Points: Most districts noted that one of the first steps an energy management team should take is setting and implementing a regular schedule and temperature set points. Committing to the implementation of such a policy will help reduce energy waste from the largest user of energy in the district. Make sure to implement these policies in a way that does not negatively affect relations between the energy management team and campus staff because these relationships are important to succeeding with efforts to change occupant behavior.

"An adequately staffed scheduling department can lead to more efficient use of space. Aggressive scheduling can eliminate wasted energy and money unnecessarily spent running entire facilities for long standard hours." - Allen Goldapp, Energy Management Coordinator, Northside ISD

Bridging Facilities and Construction Management: As discussed above, effective energy management will engage both the Construction Management and Facilities departments through energy efficiency and conservation, respectively. As such, in addition to their relationship to HVAC operations, the energy management team may want to have positions (e.g., the energy manager) that provide a bridge between the two departments.

Coordination with Grants Staff: Most successful energy management programs leverage external funding and resources as much as possible (e.g., utility incentive programs). Coordinating Austin ISD's energy management team with district staff already working to identify and obtain external funding and resources will help the district avoid unnecessary energy costs faster and at a lower cost. Understanding what resources are available may also help the team prioritize energy conservation measures.

"Energy savings and the optimum indoor teaching environment are both achieved through an outstanding preventive maintenance program. In other words, if all the building systems are at peak performance the district will have both energy savings and comfort." - Allen Goldapp, Energy Management Coordinator, Northside ISD

Building Audit and Recommissioning Team: Some school districts with more mature energy management programs have invested in full-time teams to conduct ongoing retro-commissioning processes on a year round basis as part of the district's preventative maintenance program. These teams focus on ensuring building systems and equipment are performing as originally designed. They identify issues that may need to be resolved before they lead to larger equipment problems or significant energy waste. These staff need to be trained to understand energy conservation. Over time, this should become a central part of a long-term energy management program, requiring the district to both identify what systems require commissioning and ensure staff are properly trained to conduct commissioning.

Natural Gas Waste at Travis High School

During the summer of 2015, an inspection of a boiler at Travis High School led the inspector to note that the boiler should have been fixed or replaced "long ago". The Facilities department has since taken steps to address the problem. The state requires the district to inspect its boilers every two years. As with most school districts, Austin ISD has limited staff capacity to conduct preventative maintenance and ongoing building inspections, meaning equipment problems can persist for longer than desired, leading to increased energy costs and potentially the need to replace equipment before the end of its expected useful life. Looking at Travis High School in EnergyCenter, it is immediately clear that natural gas use is abnormally high (see **Appendix 6.2**). In fact, natural gas use has been very high since at least FY2010-11, indicating the boiler may have been operating inefficiently for several years. An energy management team tasked with reviewing energy use data on a regular basis and given authority to ensure equipment issues are dealt with quickly could have identified and addressed this problem before it led to several years of unnecessary energy costs.

PEOPLE | Current Status and Recommended Next Steps

The district is currently missing the most important person to an effective energy management program: the energy manager. Hiring an energy manager with the right combination of capabilities, experience, and interpersonal skills should be a top priority. Attracting the right person will likely require a higher salary than the district initially expected to pay or may have previously paid, but the potential financial benefits of a well-functioning energy management program significantly outweigh the incremental cost of a higher salary.

Once hired, ensure the energy manager is supported with staff focused on the utility database management system (EnergyCenter, Portfolio Manager, and any IDR meters) and campus and staff engagement.

In terms of organizational structure, the energy manager should be put in a position of authority over or be aligned with HVAC operations. The district should also consider how to use the energy management team to bridge Facilities and Construction Management.

The district will certainly be able to fill some of the additional basic energy management team roles internally, including utility database management, campus engagement, and HVAC and building controls monitoring, scheduling, and repair. However, the new energy manager should work with the Executive Director of Facilities and Director of Maintenance to evaluate current resources and capacity in more detail, and compare them to what is needed to ensure facilities can be run as efficiently as designed, and that equipment problems can be identified and addressed in a timely manner so as to avoid significant unnecessary energy spending.

I discuss the potential costs of building the district's basic energy management team **Section 5.1** and detail calculations and assumptions in **Appendix 6.4**. I also include the potential costs of expanding this team to include a full-time building audit and recommissioning team in the future, but do not recommend that the district pursue this approach until the energy manager has evaluated current capabilities, needs, and facility-specific cost avoidance opportunities.

Finally, one of the best initial steps the district can take is implementing and supporting a formal policy for facility schedule hours and temperature set points. Make sure to communicate and coordinate this effectively with the staff that will be affected to ensure that this process runs relatively smoothly and the district maintains positive relations between campuses and the energy management team to support future work.

4.2 DATA | Utility Data System & Management

You cannot manage what you do not measure. An energy management program cannot succeed without a system to track utility data and the people and procedures to manage the system. EnergyCenter, the districts utility data system, provides the core set of information the energy management team needs to succeed, so the district needs to ensure procedures are in place to keep it properly managed.

Monthly Data Procedures: The primary purpose of the system is to allow the energy management team to identify opportunities to improve performance. To do this, the district needs to ensure that someone is actively managing EnergyCenter to keep the data up-to-date and accurate. With this system in place, the energy management team can use the data for the following:

- Tracking – monthly and annual utility use, cost, and intensity
- Analysis – comparing monthly and annual performance among Austin ISD building portfolio to identify potential issues and opportunities
- Benchmarking – comparing district facilities against one another and to other U.S. buildings via EPA’s Portfolio Manager
- Reporting – providing monthly, seasonal, and annual reports to facilities managers, campuses, and senior administration
- Evaluation – evaluating potential and actual energy use reductions and cost avoidance achieved through individual energy conservation projects and cumulatively across all implemented projects
- Engagement – providing facilities and campus staff and students easy-to-understand, relevant, and actionable data to help support behavior change and distribute responsibility for energy conservation

Interval Data Capabilities (IDR Meters): Advanced utility data management systems integrate interval data. Whereas a standard school district utility data management system provides energy consumption (kWh) and demand (kW) data on a monthly basis, interval data provides energy consumption and demand data in smaller increments such as 15-, 5-, or 1-minute intervals. Data may be provided to users in real-time or near real-time, the next day, or at the end of the month.

Interval data offers the energy management team a significantly higher resolution picture of how much energy is being used when and where. Monthly energy use data will signal to the energy management team that some energy using device at a campus is operating sub-optimally. Interval data will show the team specifically when sub-optimal energy use is occurring, allowing the team to eliminate wasted spending more quickly and with greater precision. Interval data is particularly important for addressing demand-related charges, which are set to increase at Austin Energy.

Interval data will also allow the energy management team to find problems that would be difficult and time consuming to identify in aggregated monthly data. For example, energy demand at schools running set schedules will decrease at the same time every weekday. If energy demand does not decrease, it likely means something is malfunctioning at the campus. Interval data allows the team to see exactly how much energy is being demanded by the campus when electricity using equipment shuts down. If they see that more energy is being demanded than the previous day at the same time, they know something is wrong, can investigate it, and possibly address the problem within days rather than months.

“The critical place to start is with monthly and historical utility data. But when we added the eGauge (IDR) meters, we had a new understanding of what we needed to do to reduce energy waste.” - Julie North, Natural and Renewable Resources Coordinator, Aurora Public Schools

“IDR data has been one of the most recent things we have done, after lots of other work, but it has been a phenomenal help.” - Chris Baker, Energy Systems, Coordinator, Kenton County School District

“Near real-time 15-minute interval data has been critical to us achieving deeper energy savings. As your energy management program matures, move towards driving your daily decisions using real-time energy use data from IDR meters.” - Terry Taylor, Director of Facilities, Gresham Barlow School District

The case study organizations interviewed for this report were split on whether or not a district should immediately invest in interval data capabilities. The top two reasons for delaying implementation were (1) monthly data provides enough information for an energy management team to begin eliminating waste and (2) interval data significantly increases the amount of data that the team must learn to use and monitor on a regular basis. The main argument for installing interval data capabilities on at least some campuses is that the data allows for a much more detailed understanding of campus energy use, which yields higher energy use reduction and cost avoidance more quickly. Some districts have are managing or beginning to manage energy on a daily basis using the interval data.

Integrating interval data capabilities would require the district to invest in interval data recorders (aka IDR meters) (a one-time investment in equipment) and the utility database management setup to capture and report on the data (an ongoing expense). Districts with interval data capabilities indicated that focusing on worse performing buildings will likely yield a quick payback on the required investment.

IDR Meter Saves \$25,000 at Lyndon B. Johnson High School

Austin ISD recently added a single IDR meter to Lyndon B. Johnson (LBJ) high school to better understand the potential opportunity associated with having this extra level of data. In July 2015, the IDR meter allowed an Austin ISD staff to determine that equipment at the high school was demanding more than twice as much electricity during afterhours than it should. (325 kW vs. 150 kW). The staff person alerted the HVAC Foreman, who identified two minor issues causing the energy waste, and addressed them within a few days. Without the IDR meter and the staff to manage it, the issue would have likely continued, wasting energy and money unless someone happened to inspect the equipment causing the problem, which would be unlikely given the normal school district challenge of limited facilities staff capacity. Using conservative assumptions, this issue would have cost the district approximately \$485 per week, or just over \$25,000 per year (see **Appendix 6.4** for details). The meter at LBJ was provided for free, but would have already paid for itself several times over if the district had paid for it (see **Section 5.2** for details on IDR meter costs).

DATA | Current Status and Recommended Next Steps

The district began using a new utility database management software called EnergyCenter in early 2015. EnergyCenter provides all the current and likely most of the future functionality that the district needs, including the ability to satisfy the five key uses bulleted above, integrate interval data, and be used as a campus engagement and empowerment tool. With a few exceptions, all building, electricity, natural gas, and water data have been reviewed and corrected where necessary going back to FY2010-11. Remaining data errors are either being investigated by district staff at the time of writing this report or are due to utility transmission errors and cannot be fixed (transmission errors have since been fixed). As such, the district is very close to having accurate historical data that can be used to (1) develop consumption and cost baselines and (2) identify and take action on poor performing buildings. The district should finish cleaning up the existing data system to ensure it is accurate, then decide on a baseline year against which to track performance.

Currently, utility data from over 1000 paper bills is currently manually entered into EnergyCenter each month. This is a time consuming process that has a high risk of human error. The majority of the district's utility accounts are with Austin Energy. Coordinating with Austin Energy to receive digital energy use and cost data would free staff time to focus on higher value energy management activities.

Austin ISD has a single IDR meter located at Lyndon B. Johnson High School. I recommend that Austin ISD install at least one IDR meter at each of the remaining high schools (except Garza due to its smaller size and consumption) and purchase the interval data add-on capabilities for EnergyCenter. More than one IDR meter may be appropriate in cases where electricity consumption is spread more evenly between two or more meters. The reasons for this recommendation are as follows:

- Demand-based electricity charges make up a high percentage of electricity bills and Austin Energy's rates are shifting towards increasing demand-based charges and decreasing consumption-based charges effective November 1, 2015.
- Nearly all districts interviewed for this report indicated that adding interval data allowed them to identify significantly more opportunities to reduce energy consumption and avoid demand costs. At some point in the future, Austin ISD will want to have access to minute-scale interval data to achieve more significant cost savings.
- Until interval data capabilities are acquired, issues causing energy waste cost the district money every month.

I discuss the costs of this interval data meter recommendation in **Section 5.2**.

4.3 COMMITMENT | Ongoing Board & Senior Staff Support

All case study organizations highlight the value of having both formal and informal top-down support of the energy management team. Support from the Board of Trustees, Superintendent, Associate Superintendents, and other senior administration staff can lead to a smoother start-up process and thus yield greater results sooner. Over the long-term, support from and coordination with these and other senior staff will be very important to achieving higher levels of cost avoidance. Not all staff listed here need to be involved, but the energy management team should look for champions at different levels of the organization.

Formalizing Support: A signed and approved policy and/or memo from the Board and Superintendent can be a valuable tool for the energy management team. The policy is the district's formal commitment to saving energy. Its contents can vary from the broad (e.g., high level direction for energy management strategies) to the specific (e.g., rules for regular campus scheduling and temperature set points). Most school districts agreed that an energy management policy can play a key role in getting the program started and help keep it a priority over time, particularly before the program requires behavior change. A formal document from the top levels of the organization sets a tone for the rest of the organization and can make initial interactions between the energy management team and campus leaders more productive.

Energy Management Plan: Case study school districts were mixed on the importance of an energy management plan. Where the policy focuses on 'what' the district is committed to, the plan focuses on 'how' the district will achieve success. The plan lays out the activities the energy management team and other district stakeholders will engage in to achieve their desired objectives. Some districts emphasized the value of developing an effective plan at the inception of the program. Others never formalized such a plan. More important is getting ongoing commitment from key staff and district stakeholders.

Ongoing Commitment: School districts report that ongoing demonstrations of support from Associate Superintendents and senior administration involved with both facilities and campuses has been an important part of maintaining and increasing ongoing energy savings. For example, Associate Superintendents may email Principals and Assistant Principals at the beginning of each school year to remind them of the various initiatives the district is engaging in to save money and the role the campuses have to play. Over time, the behavioral change aspects of the energy management program require a cultural shift in both staff operations and on campuses. Regular reminders of why and how the district is engaging in energy management help this shift occur successfully.

"Commitment from senior staff in the district, and particularly our Associate Superintendent of Facilities, has been one of the most critical success factors." - Case Study Interviewee

"In setting up our HVAC scheduling policy it required a lot of client engagement and I think it would have been easier if we had a letter from leadership stating that this was an initiative with top-level support. Later on, when we got vocal support from the top, we saw big growth in behavioral change and participation in our programs." - Stephanie Perrone, Sr. Project Manager, Energy and Water Conservation Program, University of Texas; Chair of the Infrastructure Committee for ESAC at Austin ISD

"Our Energy Master Plan stakeholders include our energy management team, utility representatives, facilities staff, and people from construction management and the bond office" - Kellie Williams, Senior Manager, Energy & Sustainability, Houston ISD

"When I was hired, I was told, 'We have already taken all the low hanging fruit. I don't know what you're going to do, but you have to save enough money to pay for your salary.' There is a distinctive difference between 'going after the low hanging fruit' and actively managing the low hanging fruit already taken. Only the latter leads to sustainable conservation and cost savings." - Wesley Perkins, Department of Energy Management, Round Rock ISD

"Patience, time, and support are key to success." - Case Study Interviewee

"Having engaged senior leadership that allows energy management to be a priority is a foundational reason for our success." - Case Study Interviewee

"Your goal in the end needs to be to maintain the system. When you start, you'll see big savings for a few years. Then the savings will decrease. Instead of lowering your costs by \$2 million in a year you will lower them by \$100,000. You have to remember that you are still saving \$2.1 million every year from what you could be spending. You might be tempted to think that you can cut out pieces of the program and you will maintain those savings, but it won't work. The key to keeping your costs down is to maintain the program." - Case Study Interviewee

Aligning Priorities: Over time, the energy management program should become an embedded part of the organization. To help achieve this, and to maintain ongoing senior level commitment, the energy management team should ensure their energy management strategy includes initiatives that align with priorities of the Board and senior administration, such as those identified in the *2015-2020 Strategic Plan* and annual *District Improvement Plans*. It will be particularly important to align with these activities during the early stages of the energy management program, to demonstrate value and that energy management serves the goals of the district.

"It's like a fitness program. We notice the most noticeable results early on. There is a limiting factor, but as [Associate Superintendent of Facilities Robert Robertson] said, 'It's a lifestyle.' If we let things slide, it will go up." - Chad Corbitt, Energy Manager, Klein ISD (<http://bit.ly/1fjraqy>)

Connecting with Teaching and Learning: Although energy management will be managed and implemented by people in the Facilities and Construction Management departments, support from and coordination with other parts of the district will help ensure success of the program. To this end, senior administration in these two departments should coordinate with counterparts in the Office of Teaching and Learning to both develop support for the energy management program and ensure the program is developed to be supportive of the Office's objectives and policies. Coordinating with the Office of Teaching and Learning can also be useful in terms of embedding energy management activities into the district for the long-term.

During these conversations, senior staff may also want to discuss opportunities for in-classroom activities and other student engagement programs. These programs can provide youth with the knowledge, skills, and opportunities to understand and have a meaningful impact on increasingly prevalent energy and sustainability issues. Educating youth in this way may, in fact, lead to the largest overall impact of the energy management program in that it can influence the way Austin ISD graduates engage with the world, look at career opportunities, and consider their role as local and global citizens.

Communicating (for) Success: The energy management team should also be sure to report on progress and successes consistently. Other school districts note that ENERGY STAR® scores, recognition from external organizations (e.g., through awards and press), and activities that engage students and the community can be particularly helpful in this regard. One school district noted that once senior staff began to see energy management as a revenue source once they understood how much it could help the bottom line.

"A communications strategy can have huge value. Always relate financial savings to what it means in real terms for the school district, students, teachers, and the community." - Case Study Interviewee

Change Management: Senior-level facilities staff, such as Directors, may need to play a more hands-on role during the initial transition. Increasing Austin ISD's focus on energy management will require change in policy and day-to-day decision making. As with any change process, success can be stymied if not carefully managed. My discussions with Executive Directors, Directors, and Foremen indicate that there is a great deal of support for increasing energy management capabilities and practices within the organization. Austin ISD appears to be well-positioned to succeed. However, challenges always arise as the details and realities of a change process begin to emerge.

Staying the Course: When senior staff and Board members leave and new people join the organization, the energy management team should work with the outgoing and incoming individuals to ensure that the commitment to energy management continues. The team can work to do so by demonstrating energy management’s value to the organization and the importance of ongoing vigilance and support to maintaining success.

COMMITMENT | Current Status and Recommended Next Steps

Discussions with foremen, directors, executive directors, and others indicate that key players in both facilities and senior administration are ready to commit to, support, and engage in the activities and change management necessary for the district to succeed. Although I cannot account for the perspectives of the Board of Trustees, in my estimation, the district is in a very good position to begin making the adjustments and investments necessary to develop a successful energy management program. The district / energy management team should work to identify champions in various parts of the organization, including senior administration, within the Facilities department, and on school campuses.

Investing in an energy manager with the right set of capabilities, experience, and interpersonal skills would be an important next step to committing to that success. Following this, I recommend:

- Board of Trustees and Superintendent – The district’s Environmental Sustainability Policy provides a general commitment to conservation and efficiency. Once an energy manager has been hired, I recommend that the district issue updates or additions to Goals 3 and 4 that set more specific commitments to both energy efficiency (construction) and conservation (operations and behavior), including an energy use intensity (EUI) reduction target.
- Executive Directors of Facilities and of Construction Management – Embed energy management into any planned reorganization of the Facilities department. In the short term, ensure energy management staff have or share authority over at least HVAC scheduling. Also, connect with counterparts in the Office of Teaching and Learning to develop support for the energy management program and ensure the program is developed to be supportive of the Office’s objectives and policies. In the medium term, build a case to add a full-time building optimization team dedicated to recommissioning and fixing building and equipment issues causing energy waste.
- Director of Maintenance – Act as a champion for energy management to more senior and more junior staff. With the Executive Director of Facilities, ensure that high quality data management procedures are in place and that energy data begins being communicated to campuses. Carefully and actively manage the changes necessary to re-orient the Facilities department to achieve the district’s new energy use intensity reduction target.

The district’s Facility Master Plan provides details on how the district works to improve energy efficiency as well as other environmental sustainability goals (e.g., water conservation). The Plan is set to be revised every two years. I recommend that energy management strategies focused on operations continue to be reflected in the Facility Master Plan to signal that energy conservation is being embedded as ‘business as usual’ at Austin ISD.


4.4 DESIGN & EQUIPMENT | Efficient Design, Replacement, & Commissioning

The maximum operating costs that can be avoided by a district's energy management program will largely depend on the design of and equipment in the facilities owned by district and how facilities and equipment are maintained. It is here that decisions about capital investments overlap with the day-to-day choices of building operators and maintenance staff. To give the energy management team the best chance to reduce energy use and avoid costs, the district should design buildings and choose equipment that leads to the lowest lifecycle costs. Then, senior facilities staff need to ensure that maintenance and replacement decisions maintain the lower operating costs the facility was designed to achieve, so as not to undermine previous upfront investments in higher efficiency facilities. Likewise, to ensure wise investments are being made, the energy management team should conduct data-driven financial analyses to understand and present the financial case associated with any facility and equipment projects with a higher initial upfront cost.

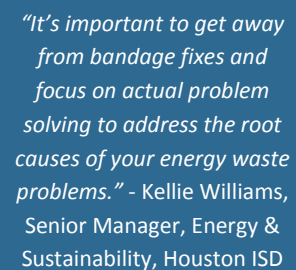
Integrate Energy Efficient Design Standards into Educational Specifications: As noted at the end of this section, the district already uses two tools to ensure energy efficiency is considered in building design. Neither of these is currently reflected in the district's Educational Specifications. The Educational Specifications outline the district's formal standards for facilities, including equipment and technology needs. Augmenting these to incorporate energy management considerations can help ensure that the existing energy efficiency design guidelines are formally embedded into district decision making. In addition to facility design and equipment selection, these standards should also consider structural and equipment issues that can support effective ongoing management to maximize cost avoidance. For example, ensure new facilities are equipped with the sensors and controls capabilities that building operators need to identify and address energy waste issues. Additionally, consider building layout to site meters adjacent to internet network access points so that interval data (IDR) meters can be installed more easily in the future. Targeting these building components during the construction phase can lead to lower overall investment costs.

Align Maintenance and Replacement Decisions with New Construction Standards: Energy efficient and sustainable design guidelines are commonly focused on projects meeting certain size or funding requirements (e.g., greater than 10,000 ft², funding coming from the bond process). Therefore, decisions about maintenance, equipment replacement, and smaller construction projects will not necessarily be aligned with the initial design and investment decisions that initially went into a facility and were part of its initial lifecycle cost analysis. As a result, decisions in the facilities department may, completely unintentionally, undermine the value energy efficiency investments made during construction. To avoid this situation, districts can take steps to apply standards for design and construction to maintenance and replacement decisions. It will take time and organizational change efforts to fully align these energy management considerations in the context of competing priorities (e.g., fixing an HVAC system quickly to return heat to a building in winter), so districts should seek out opportunities to start aligning standards and procedures.

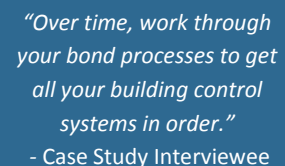
Coordinate with Existing Bond Procedures: Building audits are conducted as part of identifying potential bond projects. Incorporating energy efficiency considerations into this process could help leverage existing resources already dedicated to building audits to identify gaps in energy management capabilities and opportunities for energy efficiency upgrades. Opportunities for energy efficiency upgrades should lead to overall cost savings (as verified by a financial analysis) and



"It's critical to be in the school. That is where the real opportunities are identified."
- Case Study Interviewee



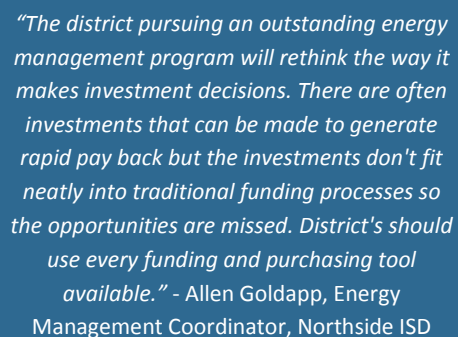
"It's important to get away from bandage fixes and focus on actual problem solving to address the root causes of your energy waste problems." - Kellie Williams, Senior Manager, Energy & Sustainability, Houston ISD



"Over time, work through your bond processes to get all your building control systems in order."
- Case Study Interviewee

thus may be attractive to the Bond Advisory Committee. Even if the findings do not lead to bond projects, they can still help inform ongoing operational decisions.

Establish Standard Project Evaluation and Approval Criteria: An energy management program will involve making ongoing decisions about where to focus resources at any given time. Some of these decisions will require operating and capital investments that must be approved by the Board, senior administration, or bond committee. Senior administration (particularly in finance) should work alongside the energy management team to agree on a set of financial analyses and thresholds that can be done to evaluate and prioritize potential projects. Commonly used analyses include using lifecycle costs, conducting cost-benefit analysis, and calculating payback period. The energy management team should work with other facilities staff to identify and incorporate potential costs savings and ancillary benefits from things like reduced labor requirements (e.g., LEDs do not need to be replaced as often).



"The district pursuing an outstanding energy management program will rethink the way it makes investment decisions. There are often investments that can be made to generate rapid pay back but the investments don't fit neatly into traditional funding processes so the opportunities are missed. District's should use every funding and purchasing tool available." - Allen Goldapp, Energy Management Coordinator, Northside ISD

Designate a Funding Pool for Certain Projects between Bonds: Energy management staff at several districts discussed difficulties getting funding for projects that would lower unnecessary energy costs in short period of time. A common challenge is that the energy management team will identify problems (e.g., equipment degradation or failure) leading to unnecessary energy use and expenditures month-after-month until they can be addressed. At this point, the options may be to invest in the action needed to solve the problem immediately, or pay for a stop-gap measure to temporarily stop or reduce the problem then invest in the action needed to solve the problem later. 'Later' typically refers to when the net bond process. The required solution may or may not be approved during the bond process. During this time, the district may be spending money on energy unnecessarily, lowering the true cost-benefit of the investment required to ultimately solve the problem.

One way to overcome this challenge would be to set aside a specific funding pool that can be used in such cases. Projects would need to meet a certain set of requirements (including financial metrics) to access the funds. The fund could either pay for the entire amount required to fully solve the energy waste problem or only the additional amount required to fully solve the problem compared to the cost to apply the standard stop-gap measure. In the latter case, the remainder would be paid from the appropriate budget (e.g., the Facilities Department budget).

The district would need to determine how to fund this pool. One option would be to apply for funding for undesignated projects during the bond process. The uses of these undesignated funds could be set during the approval process, including specific project requirements. Alternatively, or additionally, the district could set aside a certain percentage of total avoided costs from successful energy management projects for reinvestment in other energy management projects. The district could agree to undertake this process for a limited number of years to more quickly increase cost avoidance during the early stages of the energy management program. The district could then re-evaluate the value of reinvestment fund and determine whether to continue it, or whether to increase the use of avoided costs for other purposes.

Perform Initial Commissioning: One of the last things done on a construction project is commissioning. Commissioning is the process of verifying that all building subsystems (e.g., electrical, plumbing, mechanical) achieve the requirements and specifications set out during the design process by the district and the project's architects and engineers. Because construction projects are often delayed and tight on budget, building commissioning may be skipped altogether. As a result, for example, high efficiency equipment that was just purchased at a premium may not necessarily be operating as designed, and thus will not yield the cost savings expected at the outset.

Conduct Preventative Maintenance and Ongoing Recommissioning: Building and equipment performance can degrade through use or decline as a result of some sort of problem with the equipment. This leads facilities to perform worse than designed, leading to unnecessary spending. Just bringing existing building back to the efficiency they were originally designed to operate at can save a significant amount of money. Furthermore, many of the solutions will likely be low and no cost items that Facilities staff simply are not aware of or do not currently have the resources to address. As noted toward the end of **Section 4.1**, some school districts with more mature energy management programs have invested in full-time teams to conduct ongoing retro-commissioning processes on a year round basis as part of a preventative maintenance program. These teams focus on ensuring building systems and equipment are performing as originally designed. They identify issues that may need to be resolved before they lead to larger problems or significant energy waste. Ultimately, this is key to moving away almost completely from applying temporary fixes to fully addressing energy waste issues costing the district money.

DESIGN & EQUIPMENT | Current Status and Recommended Next Steps

The district has already committed to achieving at least a 2-star Austin Energy Green Building rating on all construction projects over 10,000 ft², and the district's Energy, Water, and Sustainability group uses a Sustainability Scorecard to guide facility design. These two sets of guidelines have been applied in concert with one another and led to successful outcomes, including several facilities that have scored 3-star, 4-star, and 5-star Austin Energy Green Building ratings. In building an energy management program that involves both efficiency and conservation, the district should consider two steps to extend the effectiveness of these existing tools.

1. Integrate the existing energy efficiency design standards into the district's Educational Specifications.
2. Start identifying and working to reduce barriers that may cause facility maintenance and replacement decisions to reduce building performance below its design specifications.

Prepare for and align with the next set of bond activities. First, identify energy waste problems that require capital investments. Prioritize these according to an agreed upon evaluation and prioritization criteria (below). Second, determine what controls, sensors, and meter capabilities may be missing and may be necessary to manage energy at certain facilities. Make a case for why these are important to effective energy management and apply for funding to address these needs.

The energy management team, senior Facilities and Construction Management staff, and Finance staff should set up standard project evaluation and prioritization criteria (e.g., payback period). The next bond process could be a useful place to begin to use these standardized criteria. At the same time, consider discussing ideas for how to set up a limited pool of funding to pay for projects that may be too large for annual operating budgets, but that cost the district a significant amount of unnecessary energy costs each month (e.g., undesignated bond funding).

In terms of initial commissioning, the district has required that all new construction projects end with commissioning since 2004. The Construction Management and Facilities Departments should take steps to ensure that this policy is always followed and apply the same process to any new equipment installations or fixes.

Finally, once an energy manager is hired, spend the first several months to a year of the program investigating the worst performing facilities. Determine how efficiently the building is operating compared to how it was designed to operate. Calculate the cost avoidance that can be achieved by addressing these buildings and what internal resources would be needed to do so. Build a business case with these figures to increase the staff resources and capabilities to bring each of these buildings back to how they were designed to operate, and use this business case to hire and train the additional resources needed.

4.5 ENGAGEMENT | Campus & Staff Behavior Change

Ultimately, achieving deep energy use reductions and maintaining achieved levels of cost avoidance needs to be supported by shifts in behavior and culture. Engagement at other districts tends to focus on both organizational (staff) and campus (e.g., student) behavior. As an educational institute, a school district has a unique ability to affect the way people behave in their communities and society as well. Engagement can help the energy management team and the district:

- Foster relationships and generate buy-in from campus leaders, facilities managers, and custodians
- Tap into and share institutional knowledge to brainstorm and trial ideas for new programs
- Expand responsibility for energy conservation to include campus leaders
- Educate youth about the importance of conservation and how they can take action
- Introduce students to opportunities to learn about and engage in the growing fields of energy efficiency, renewable energy, and sustainability
- Foster behavior change to achieve deeper energy use reductions at the district and outside of it

Energy Committee: Although a core energy management team is officially tasked with energy management, actual energy use is determined by the everyday decisions of tens of thousands of students, staff, and other people that spend every day on campuses or in district facilities. Likewise, actions initiated and taken by the energy management team can have an effect on these individuals and their everyday experience of the school district. An energy committee can bring together representatives from all campuses and key departments to discuss ideas, provide feedback, and share actions the campuses are taking to reduce energy use.

"We seek to support the school district by ensuring our buildings are operated as efficiently as possible while meeting the needs of district stakeholders." - Case Study Interviewee

Sharing Energy Data: At the most basic level, energy management teams typically provide campus leaders with energy use reports as part of regular reporting and data analysis. Regular data reports help campus leaders understand their energy use and spending as well as how their performance compares to previous months and years. Figures and data in these reports should be shared in a format that is easily understood and actionable by non-energy experts. The reports should emphasize why the ongoing support of campus staff is important to the success of the program and acknowledge ongoing efforts and successes. The reports can serve as a useful reminders of the value of saving energy and, over time, help integrate energy conservation into campus and district culture.

"Share cost information with Principals early and in a way that they can understand to generate buy-in from campuses. Most people don't realize how much it costs to run a school." - Case Study Interviewee

Ongoing Campus Engagement Program: Some districts interviewed for this report (both small and large) employ full-time staff to regularly engage with students, teachers, assistant principals, and principals. These staff run the behavioral change and student education components of the energy management program. Some districts have developed behavior-focused programs that recur on an annual basis and note the value of this approach to embedding energy management as business-as-usual for the district and for influencing students to shift their thinking and actions outside of school. Common features of these programs include student energy teams, campus competitions, regularly sharing energy data, holiday shutdowns, and classroom activities.

"A big part of our program is providing people the data they need, but be careful not to overwhelm campuses with too much information." - Allen Goldapp, Energy Management Coordinator, Northside ISD

Student Energy Teams: Student energy teams can act as energy conservation champions on campuses to help shift the behavior of staff and other students. These teams can engage in annual activities such as conducting basic energy conservation audits at the beginning of the semester and helping with holiday shutdown procedures before each break. These students can work more closely with the energy management team to how to address energy waste and possibly identify opportunities or propose ideas that would have been missed by people that do not spend every day in the school. Students might be encouraged by the opportunity to do some volunteering or get recognition for their efforts and successes through an ongoing recognition program.

"Principals are responsible for ensuring the schools abide by the energy management policies and we have found this to be an effective approach." - Case Study Interviewee

Friendly Campus Competitions and Awards: Several districts get schools into the competitive spirit by running annual energy conservation competitions. For example, a district can recognize energy conservation successes with a banner or other easy-to-see token that is awarded to the school that achieves the greatest success on some sort of energy metric over the previous month. Different tokens could be used for different groupings of schools (e.g., elementary schools, high schools) and the competition could be designed to ensure that the token does not cycle through the same set of high performing schools. Increasingly, districts are turning to technology to run these sorts of competitions and track and share ongoing results. Taking this a step further, the energy management team can help embed energy conservation into campus and staff culture by holding an annual awards program at the end of the year to recognize efforts and successes.

Holiday Shutdowns: School shutdowns are an effective way to engage both students and custodians / building managers while significantly reducing energy waste. In addition to multi-month summer shutdowns, several districts have shutdown programs and procedures that they apply to winter holidays, spring breaks, and even some long weekends. Less technical aspects of these shutdowns can be implemented by student teams. The district can also link holiday shutdowns to friendly competitions and awards programs for both students and staff.

Community Events: To engage and influence the larger community, the district can hold an annual event that brings people together. The event can be used to increase awareness about conservation and what the district is doing to save energy, money, and other resources. The district could also use the event to raise funds for campus energy management projects. Students and campus staff could apply to use these funds to implement their own small energy management projects.

Pilot Programs: Districts commonly use pilots to test possible campus engagement programs and determine whether they want to expand them to most or all schools. Pilot programs may be evaluated according to their impact on energy use as well as the resources and perceived challenges in expanding the programs. Over the first few years of a program, a district can employ this approach to determine what to include in an ongoing engagement program.

Financial Incentive Programs: Financial incentive programs involve direct payments to campuses that participate in energy conservation programs or achieve certain energy conservation milestones. They do not include non-financial incentives (e.g., lunches or awards ceremonies). They also do not include the financial benefit that campuses may reap from diverting district spending from energy to other expenses (e.g., textbooks). Based on the case studies interviewed, the importance or value of financial incentive programs is unclear. Not many districts interviewed for this report provided (now or in the past) financial incentives to encourage energy conservation activities at the campus level. Some districts highlighted challenges and concerns related to equity, budgeting for incentives year-after-year, and keeping campuses motivated if financial incentives stop. Furthermore, districts have achieved significant energy cost reductions without providing direct financial incentives (e.g., through campus competitions).

"Conservation is ultimately about changing culture. Buildings don't use energy, people use energy." - Case Study Interviewee

Campus and Staff Engagement Program Examples

*Links to more information on these examples can be found in **Appendix 6.6**.*

District-Wide Energy Committee at Arlington ISD, Texas

Every school and several departments at Arlington ISD are represented on the district's Energy Committee. In addition to providing feedback at regular meetings, Committee members share ideas and spearhead energy conservations projects, like energy awareness month activities, Blackout Friday, and campus-led grant applications. The district holds an annual Fun Run to raise awareness in the community and money for a fund that Committee members can apply to for small conservation projects. Every year, schools also compete in an energy savings competition. The competition rewards schools for both participation and performance and the winning schools and other facilities earn awards at an end-of-year ceremony as well as one of the district's Energy Savings Spotlight School Flag.

Energy Reduction Challenge at Aurora Public Schools, Colorado

At Aurora Public Schools, the entire district is competing in the U.S. Departments of Energy's Better Buildings Challenge. To help schools succeed, the district runs the Compete to Reduce Energy Challenge, which sees schools compete to reduce energy use in tiers based on their ENERGY STAR® scores. Students lead the way at each school while the district's Conservation of Energy department offers support and guidance on activities like energy mapping. Schools track their energy reduction results against others via an online energy dashboard and winning schools earn a portion of the district's total energy cost savings in the form of cash rewards. The district's energy team runs a parallel competition for custodians focused on reducing energy use through holiday shutdowns, with prizes for the winners.

Student-Led Energy Teams at Kenton County School District, Kentucky

Energy education is the big focus at Kenton County School District. The district engages students with its Energy WISE program (Wisdom is Saving Energy). Student led teams focus on three components every year. As part of monitoring, teams conduct secret energy audits throughout the year focused on student and faculty behavior. The teams then raise awareness by developing and implementing campaigns to support energy conservation behavior. Finally, the teams educate other students and faculty by presenting what they have learned and demonstrating conservation activities. The district's energy management team produces reports on their progress and provides support along the way.

Internal Stakeholder Participation at Klein ISD, Texas

Klein ISD's energy manager attributes much of the district's success to so much participation from internal stakeholders on KISD's Energy Management Team. The Team counts a few Principals among its membership, but is largely comprised of representatives from different departments, including a designate of the Chief Financial Officer and the Chief of Police. The presence of the Chief of Police fostered collaboration that reduced both energy use and vandalism. The Associate Superintendent of Facilities and School Services has played a big role in getting representatives representing all key district functions on the team and keeping them involved. The team meets twice each semester and has been crucial to maintaining the senior level support needed to achieve and sustain the district's energy cost reductions.

ENGAGEMENT | Current Status and Recommended Next Steps

The district's Sustainability Coordinator is already tasked with engaging with campuses regarding sustainability and could become a core part of the energy management team. Over the upcoming school year, the Sustainability Coordinator will be engaging campus and other stakeholders as part of developing the district's Sustainability Management Plan. This is a great opportunity to begin to explore how campus staff and students would like to be engaged and what they think might work best for their schools. Furthermore, this is a good opportunity to identify staff and student champions that may want to join an Energy Committee as well as campuses that might be interested in trying pilot programs.

Over the next year, the energy management team should assemble an Energy Committee with members from campuses and important district functions (e.g., food services, transportation). This Committee could be part of the district's Environmental Stewardship Advisory Committee (ESAC), thereby building on existing knowledge and relationships. Alongside senior Facilities and Construction Management staff, the energy management team and ESAC could host a kick-off meeting to officially launch the campus engagement program. This meeting should be used to communicate about district and campus-specific energy costs, introduce people to energy management and its value to the district, campuses, and students, and ask for ideas on how to make the engagement portion of the program successful. One of the primary goals could be to begin implementing a full-year program by August or September 2016.

After the kick-off meeting but before the beginning of the next school year, the energy management team could begin providing regular energy consumption and cost reports. This will help campus staff begin to get use to the presentation of the data, and will allow the energy management team to solicit feedback regarding how to make the reports easier to understand. Once a campus engagement program is launched, campus staff will also have a frame of reference to understand the results of any actions they are taking.

Finally, the Facilities department already runs summer shutdown periods. Part of the new campus engagement program could involve increasing the number of holiday shutdown periods and getting student energy teams and other campus stakeholders involved.

5 Moving Forward: Advancing Energy Management at Austin ISD

Moving forward, I recommend the district focus on (1) hiring and providing authority to an energy manager with the right set of capabilities and experiences and (2) continuing to establish a strong standing in each of the five *Foundations* outlined in **Figure 10**. Based on the case study interviews, the energy management team should focus on the set of *Initial Priorities* in the middle of **Figure 10**. **Table 5** summarizes another set of next steps the district should take. These steps are based on the case study interviews and current status of energy management at Austin ISD. They were discussed in the sections above and overlap somewhat with the *Initial Priorities* in **Figure 10**.

Austin ISD can achieve the higher cost avoidance levels by ensuring it has adequate, suitably trained, and properly tasked staff to identify and address issues causing energy waste quickly and proactively. Cost can be avoided faster by taking action sooner. As such, I recommend the energy manager lead a team to investigate the 20 worst performing facilities during their first year, and use the results to develop a business case to expand the energy management team to properly address these issues and prevent them from occurring in the future. I provide cost estimate for the energy management team in **Section 5.1** and for adding interval data capabilities for high schools in **Section 5.2**.

Table 5 Summary of Recommended Next Steps

PEOPLE	Hire energy manager with the right combination of skills and experience
	Position the energy manager with authority over or in alignment with HVAC operations
	Consider whether / how to position the energy management team between Facilities and Construction Management
	Ensure energy manager is initially supported with staff focused on data management and engagement
	Set and implement a formal policy for facility HVAC schedules and temperature set points
DATA	Coordinate with Austin Energy to receive digital energy (and water) data on a monthly basis for upload into EnergyCenter
	Finish cleaning up any outstanding errors with historical utility data for FY2010-11 through FY2013-14
	Decide on a baseline year for energy (and water) performance tracking
	Implement monthly data tracking, analysis, and reporting procedures
	Implement interval data capabilities at eleven high schools
COMMITMENT	Identify champions in senior administration, the Facilities department, and on campuses
	Formally commit to an energy use intensity (EUI) reduction target
	Set specific efficiency and conservation commitments for Environmental Sustainability Policy goals 3 and 4
	Embed energy management into any planned reorganization of the Facilities department
	Executive Directors of Facilities and of Construction Management coordinate with the Office of Teaching and Learning
	Director of Maintenance take a leadership role during any change management required to develop the program
	Update operations-focused conservation strategies in Facility Master Plan biannually
DESIGN & EQUIPMENT	Integrate the existing energy efficiency design standards into the district's Educational Specifications
	Take steps to ensure choices made during maintenance and replacement align with energy efficient design standards
	Agree on and formalize a standard set of project evaluation and prioritization criteria (e.g., lifecycle costs, payback)
	Discuss setting up a limited fund for projects too large for operating budgets, but worth addressing before the next bond
	Identify and prioritize energy efficiency improvement opportunities for the next bond process
	Identify gaps in energy management capabilities (e.g., sensors, controls) to apply for in the next bond process
	Ensure existing commissioning requirement is followed on construction projects, equipment replacements, and repairs
	Audit worst performing facilities and build a business case for the team needed to fix and properly manage these
ENGAGEMENT	Identify potential campus staff and student champions during the Sustainability Management Plan engagement process
	Determine a set of behavior-focused conservation strategies to start using through Sustainability Master Plan process
	Identify schools that may be interested in being involved in campus engagement pilot programs
	Assemble an Energy Management Committee and host a kick-off meeting
	Begin providing regular energy (and water) consumption and cost reports to campuses and solicit feedback on them
	Expand number of holiday shutdown periods and begin to engage students in these procedures

5.1 Recommended Energy Management Team

At this stage, I recommend that Austin ISD move forward with the basic energy management team. This includes an Energy Manager, Campus Engagement Coordinator, and Utility Data Analyst. However, I recommend that the district be willing to expand the team to allow for higher levels of cost avoidance moving forward. Specifically, I recommend that the energy manager investigate the 20 worst performing facilities over their first year and determine the cost avoidance that can be achieved by bringing these facilities back to at least the efficiency at which they were initially designed to operate. The energy manager should then use the results to conduct a cost-benefit analysis, calculating the costs of additional personnel and equipment (e.g., sensors) needed to achieve and maintain the identified EUI improvement opportunities in these facilities. As was recently done at Houston ISD, I urge that the district commit to considering the results of this cost-benefit analysis and funding the additional positions if the energy manager can demonstrate a net benefit.

In **Table 6** below, I summarize the total salary and benefits costs for three scales of energy management team. The salaries and team composition are based on a similar approach taken by Houston ISD over the past year. The smallest team includes the three positions listed as part of a basic energy management team above. The largest team is based on the energy management team in place at Houston ISD, while the middle team is approximately half the scale of the largest team. Houston ISD approved expansion of an initial energy management team to the largest team in 2015. Some of these positions already existed at Houston ISD, but are now formally part of the energy management team. Individual positions, their salaries, and any assumptions are presented in **Appendix 6.4**.

In the leftmost column, I list how much energy costs would need to be reduced from FY2013-14 (cost avoidance) to pay for the salary and benefits listed in the middle column. For example, Austin ISD would need to achieve energy cost avoidance of 6.69% to fund an energy management team of the same scale found at Houston ISD. This level of cost avoidance is approximately equal to the lower of the two EPA projections presented in **Section 3**. Austin ISD is likely already funding some of these positions and instead needs to reorient them towards including a focus on energy conservation.

Importantly, additional costs will need to be incurred to achieve high levels of energy cost avoidance. For example, investments in IDR meters, missing or damaged sensors and control systems, or high energy efficiency equipment. Some of these other costs would already be incurred by the district and some would be additional costs that are unknowable at this time. Therefore, the actual cost avoidance necessary to fund each energy management program will be higher, but by how much cannot be calculated at this time. As noted by other districts, most energy use reductions are achieved by having the right set of staff focused on energy conservation implementing low and no cost actions. Altogether, the experiences of other school districts indicate that overall financial return is positive and significant.

Table 6: Summary of energy management team staff investment options

Energy Management Team Option	Total Salary plus Benefits	% Energy Cost Avoidance to Breakeven
Basic Energy Management Team	\$296,923	1.78%
Basic Energy Management Team + Half Houston ISD-Scale Building Commissioning Team	\$635,715	3.81%
Basic Energy Management Team + Houston ISD-Scale Building Commissioning Team	\$1,116,800	6.69%

Note: All salaries are based on Houston ISD figures.

5.2 Costs of Interval Data Capabilities at High Schools

I recommend that Austin ISD implement interval data capabilities on all high schools, except Garza Independence High School due to its relatively small size and energy consumption. These high schools represent under 10% of all Austin ISD facilities, but over 25% of electricity use and spending each year (**Table 8**).

Implementing interval data capabilities at these schools requires both an upfront investment and annual expenses, as summarized in **Table 8**. The total annual expenses lists here are uncertain at this stage due to a lack of information regarding an annual fee at Austin Energy. The most recent interactions with Austin Energy indicate that there may be no annual fee and steps are currently being undertaken to verify this. To be conservative, a potential annual expense for Austin Energy has been included based on estimates provided alongside EnergyCenter integration costs.

To cover upfront and annual costs associated with these meters, Austin ISD only needs to achieve a very small level of electricity cost avoidance. I do not include natural gas costs because these meters are used for managing electricity, not natural gas. In the first year, Austin ISD must achieve avoided electricity costs of at least 0.65% to breakeven on the meters. After year one, the district must maintain electricity cost avoidance of at least 0.46% to cover the annual expenses of the meters. Recall that in July 2015 an IDR meter being trialed at Lyndon B. Johnson high school resulted in an estimated \$25,000 in annual cost avoidance by identifying just one equipment issue that likely would not have been identified otherwise (see end of **Section 4.2**). Addressing that one equipment issue could cover the costs of IDR meters at all high schools.

Table 8: High school energy use statistics

High School Percentage of all Austin ISD Facilities	
Number of Facilities	8.4%
Gross Floor Area (square footage)	25.3%
Energy Use (kBtu)	31.5%
Electricity Use (kWh)	26.5%
Energy Cost (\$)	26.2%
Electricity Cost (\$)	25.2%

Table 8: Interval data meter costs

Interval Data Meter Costs*	Per meter	Total
One-Time Installation Cost	\$650	\$7,150
Annual Usage Fees	\$1,620	\$17,820
<i>EnergyCenter integration</i>	\$720	\$7,920
<i>Austin Energy data usage fee**</i>	\$900	\$9,900

*Assuming one meter per school.

**The Austin Energy data usage fee is to be confirmed by Austin Energy. Most recent inquiries indicate that there may be no fee.

6 Appendices

6.1 Remaining Energy Data Errors

The data in Austin ISD's utility data management system was reviewed in depth before developing the figures in this report. A small number of energy data errors remain. Some of these are still being investigated, while others cannot be fixed. Austin ISD will need to consider this latter category when developing an energy baseline. Data errors are summarized in the table below.

Facility	Data Issue and Potential Impact	FYs Affected
Casis Elementary School	Waiting for utility bill to verify high natural gas use in Feb 2013. Should be fixed shortly. May have a negligible effect on total energy use and cost figures. May have a small effect on Casis EUI and ECI.	2012-13
Cunningham Elementary School	Incorrect electricity use and cost due to meter/billing error between Oct 2011 and May 2014. Cannot be fixed. Having this data may increase total energy use and cost values. Potentially affect intensity figures in this report exclude Cunningham.	2011-12 2012-13 2013-14
Overton Elementary School	Incorrect electricity use and cost due to meter/billing error between Sep 2012 and Jun/Jul 2015. Uncertain whether it can be fixed. Austin Energy to follow up in Nov 2015 after end of current billing cycle. Having this data may increase total energy use and cost values. Potentially affect intensity figures in this report exclude Overton.	2012-13 2013-14
Sunset Valley Elementary School	Incorrect electricity use and cost due to meter/billing error between Jul and Sep 2012. Cannot be fixed. Having this data may increase total energy use and cost values. Sunset Valley has been excluded from intensity figures included in this report to avoid skewing results.	2010-11 2011-12
Various	All square footage values are based on each facility's square footage during FY2013-14 value. They do not account for changes between fiscal years due to portables. Correct square footage values for each facility for each fiscal year can be calculated using data in TRIRIGA, the district's facility lifecycle management database. Updating them requires time that was not available ahead of the development of this report. Fiscal year EUI and ECI values may change slightly.	2010-11 2011-12 2012-13

6.2 Facility Energy Use Performance

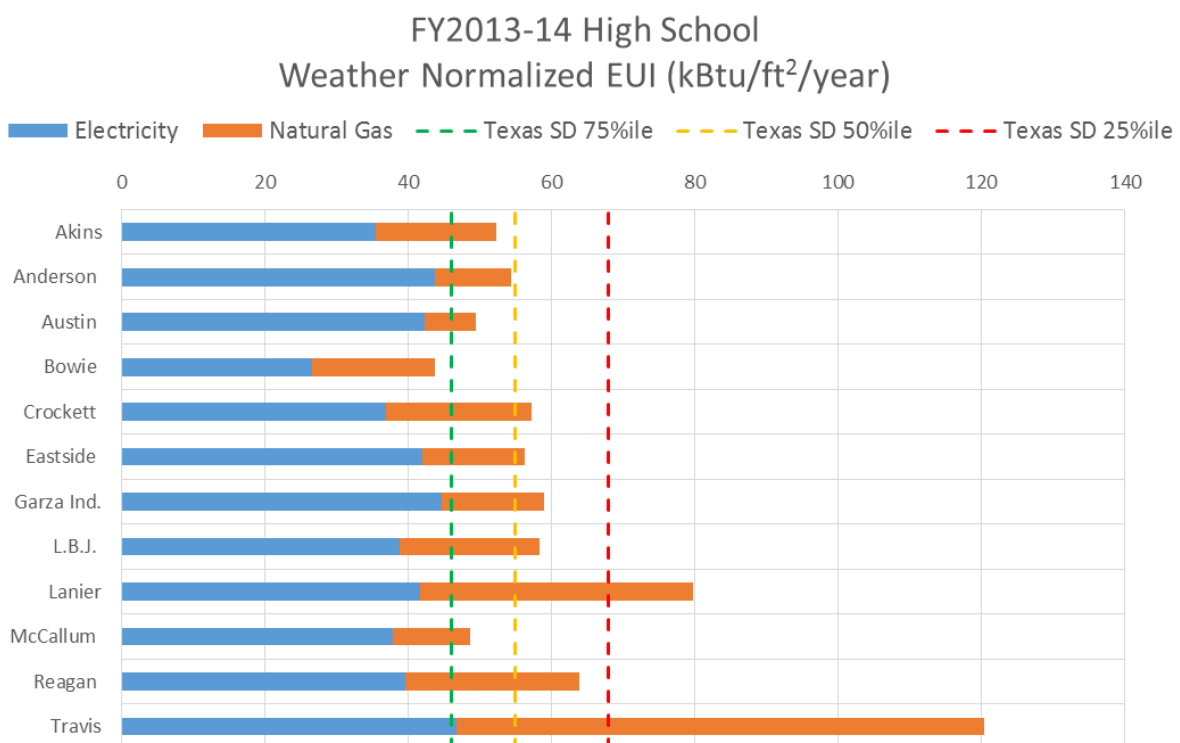
The set of figures below present weather-normalized EUI for all facilities in FY2013-14.

Four rows are missing values. Data for Cunningham and Overton Elementary Schools are not available for FY2013-14 due to meter or billing errors (see **Appendix 6.1**). Padron Elementary School and the Performing Arts Center begin operation during or after FY2013-14 so do not have data for that fiscal year.

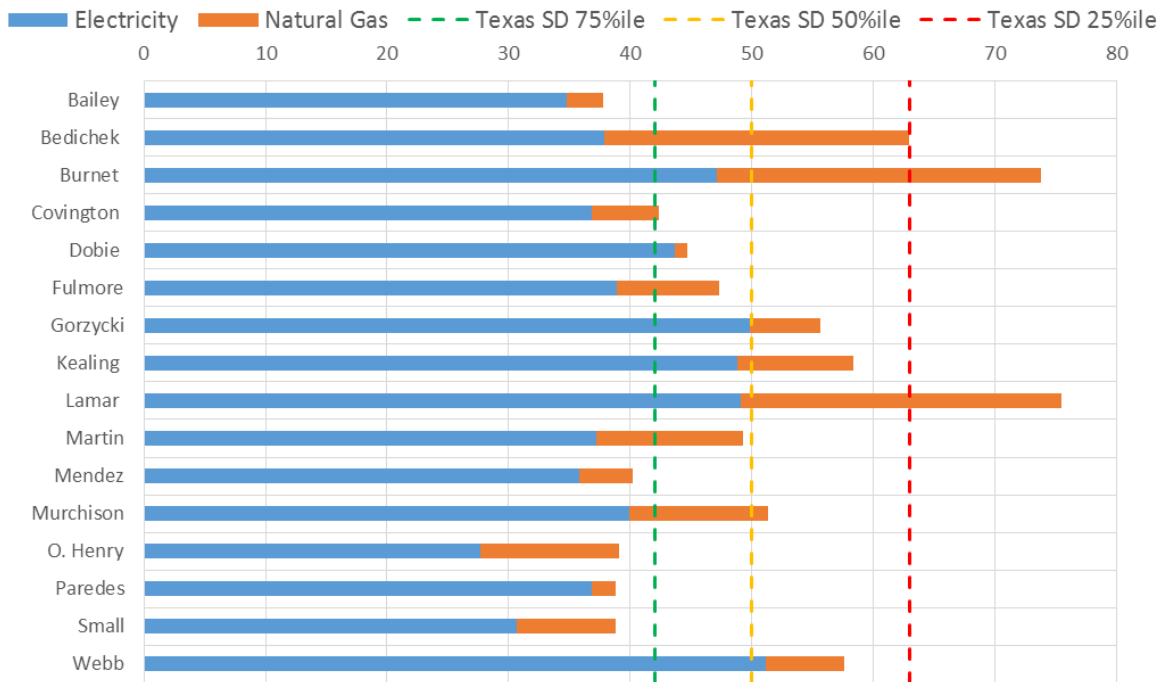
Elementary, middle, and high schools are compared against the performance of their statewide counterparts via dashed vertical lines representing the 25th, 50th, and 75th percentile values for each category. Schools with a weather-normalized EUI to the left of any dashed line score better than the percentile the dashed line represents.

For example, the EUI of Bowie high school on the first figure below ends to the left of the dashed green line. This indicates that Bowie high school is being operated more efficiently than at least 75% of high schools statewide.

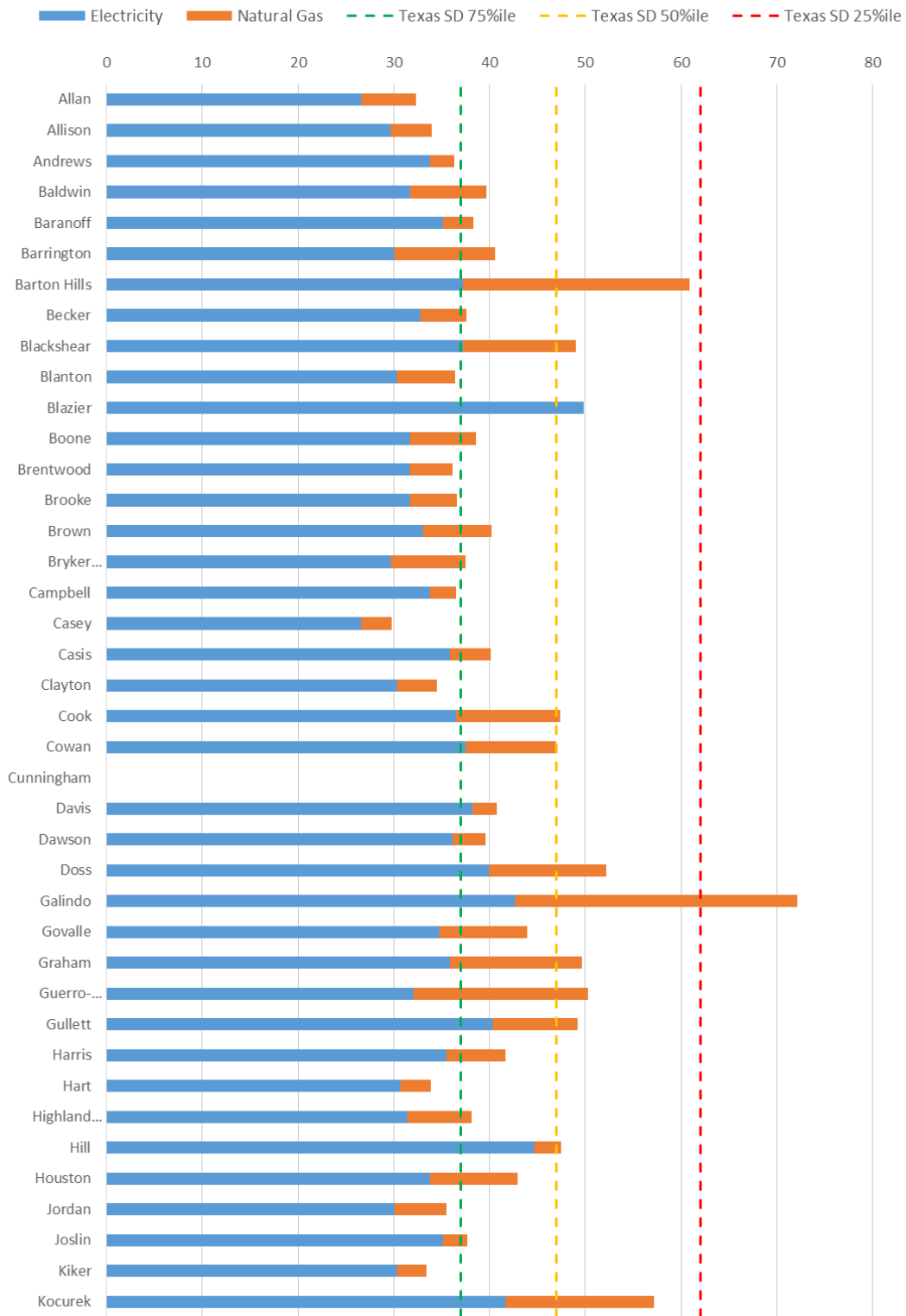
Statewide EUI values were not available for other types of facilities.



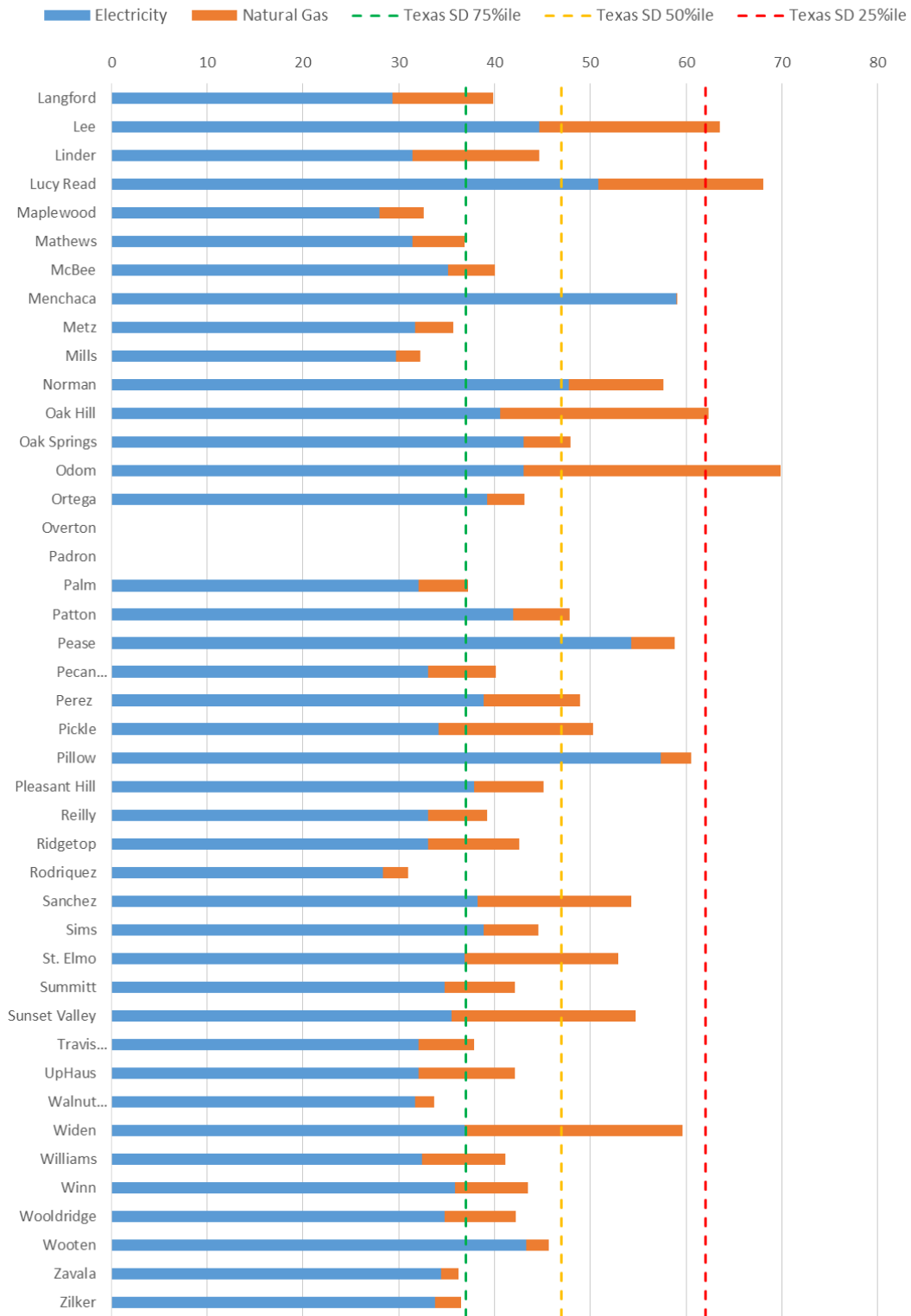
FY2013-14 Middle School Weather Normalized EUI (kBtu/ft²/year)



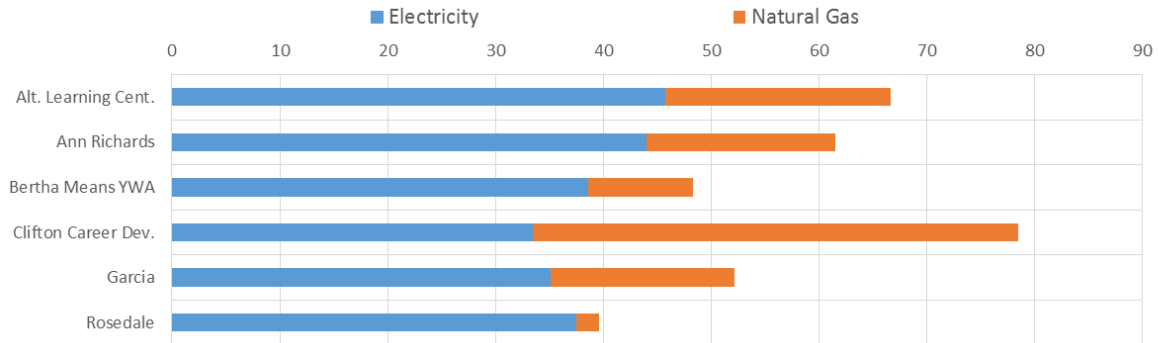
FY2013-14 Elementary School Weather Normalized EUI (kBtu/ft²/year) (A-K)



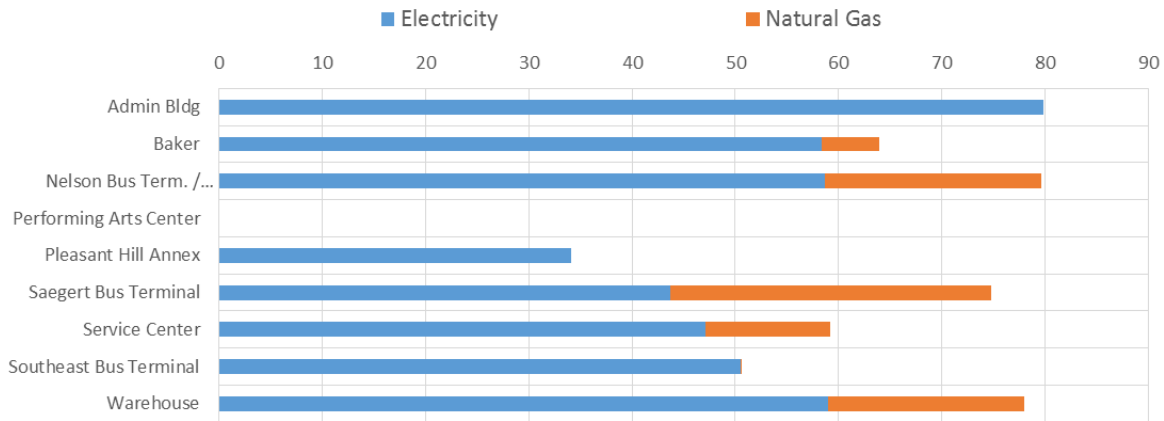
FY2013-14 Elementary School Weather Normalized EUI (kBtu/ft2/year) (L-Z)



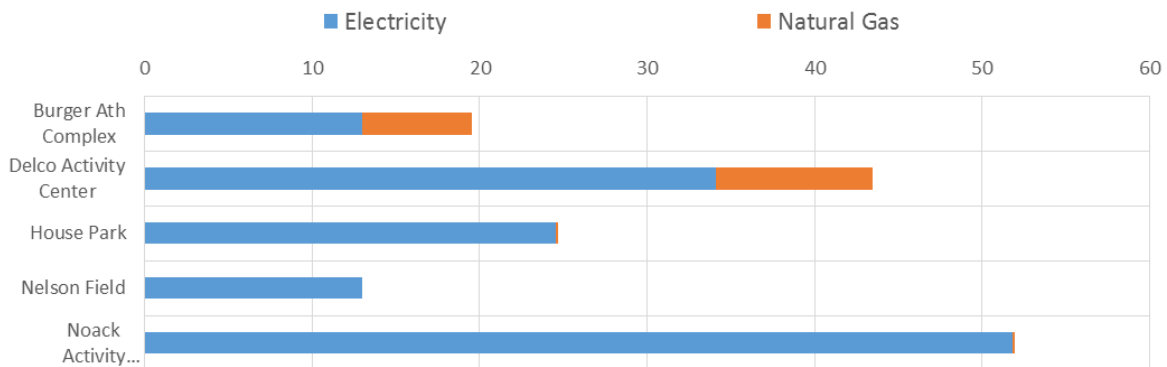
FY2013-14 Special Campus Weather Normalized EUI (kBtu/ft²/year)



FY2013-14 Support Facility Weather Normalized EUI (kBtu/ft²/year)



FY2013-14 Athletic Facility Weather Normalized EUI (kBtu/ft²/year)

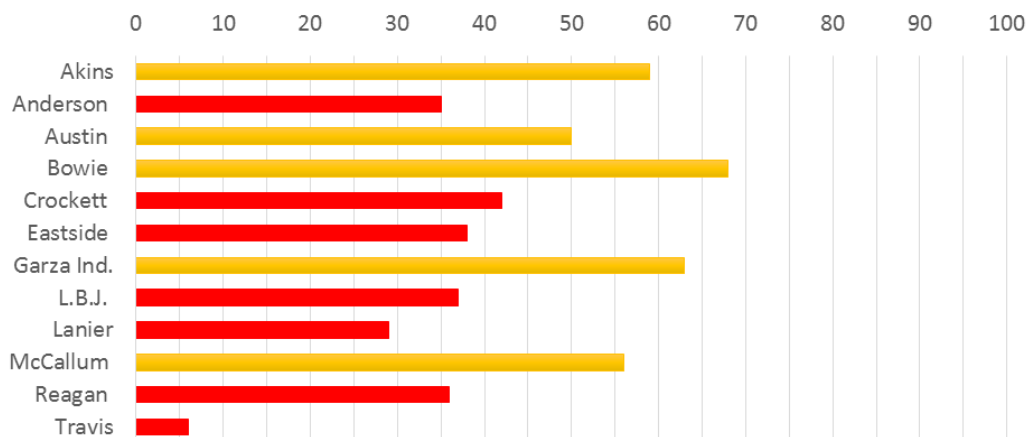


6.3 Facility ENERGY STAR® Scores

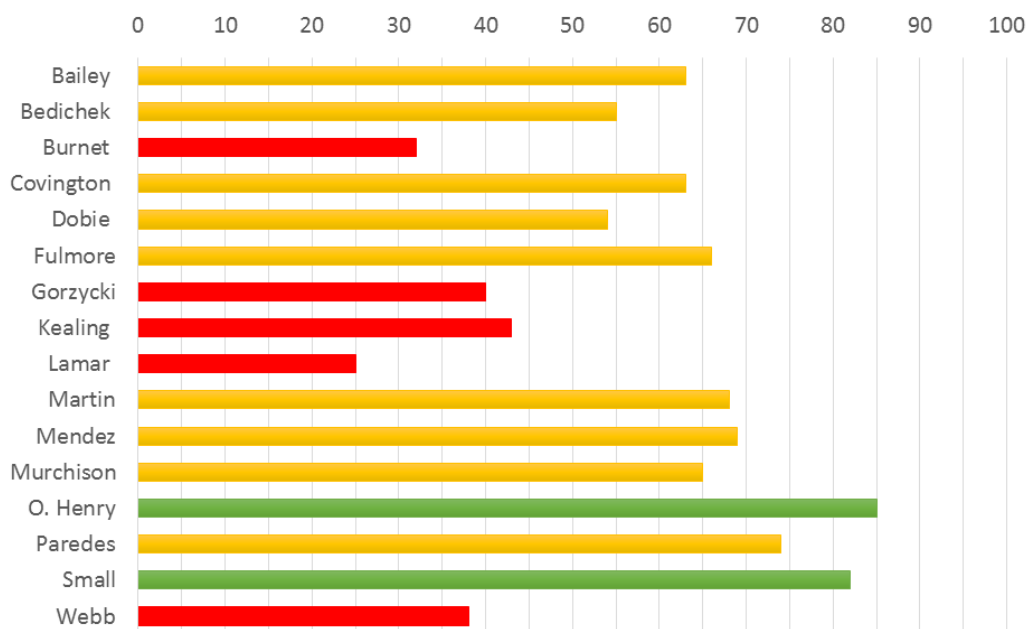
The set of figures below present the FY2013-14 ENERGY STAR® scores for all facilities. Green lines indicate a score of 75 or higher, yellow lines are scores between 50 and 75, and red lines are score below 50.

Six rows are missing values. Data for Cunningham and Overton Elementary Schools are not available for FY2013-14 due to meter or billing errors (see **Appendix 6.1**). Padron Elementary School and the Performing Arts Center begin operation during or after FY2013-14 so do not have data for that fiscal year. The square footage of Noack Activity Center falls below the threshold required to receive an ENERGY STAR® score. Based on Southeast Bus Terminal's building use details, Portfolio Manager categorizes this property as ineligible for an ENERGY STAR® score.

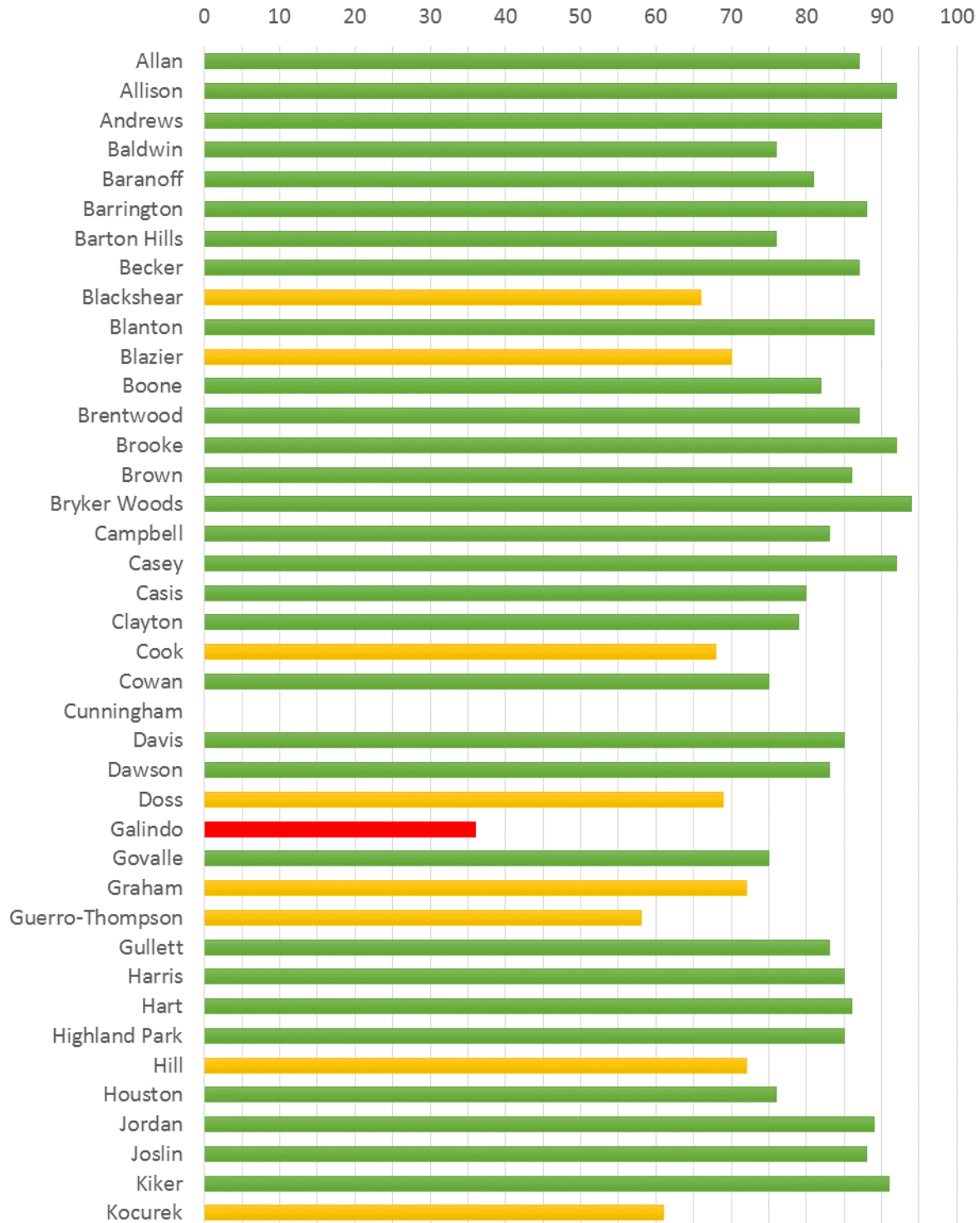
FY2013-14 High School ENERGY STAR Scores



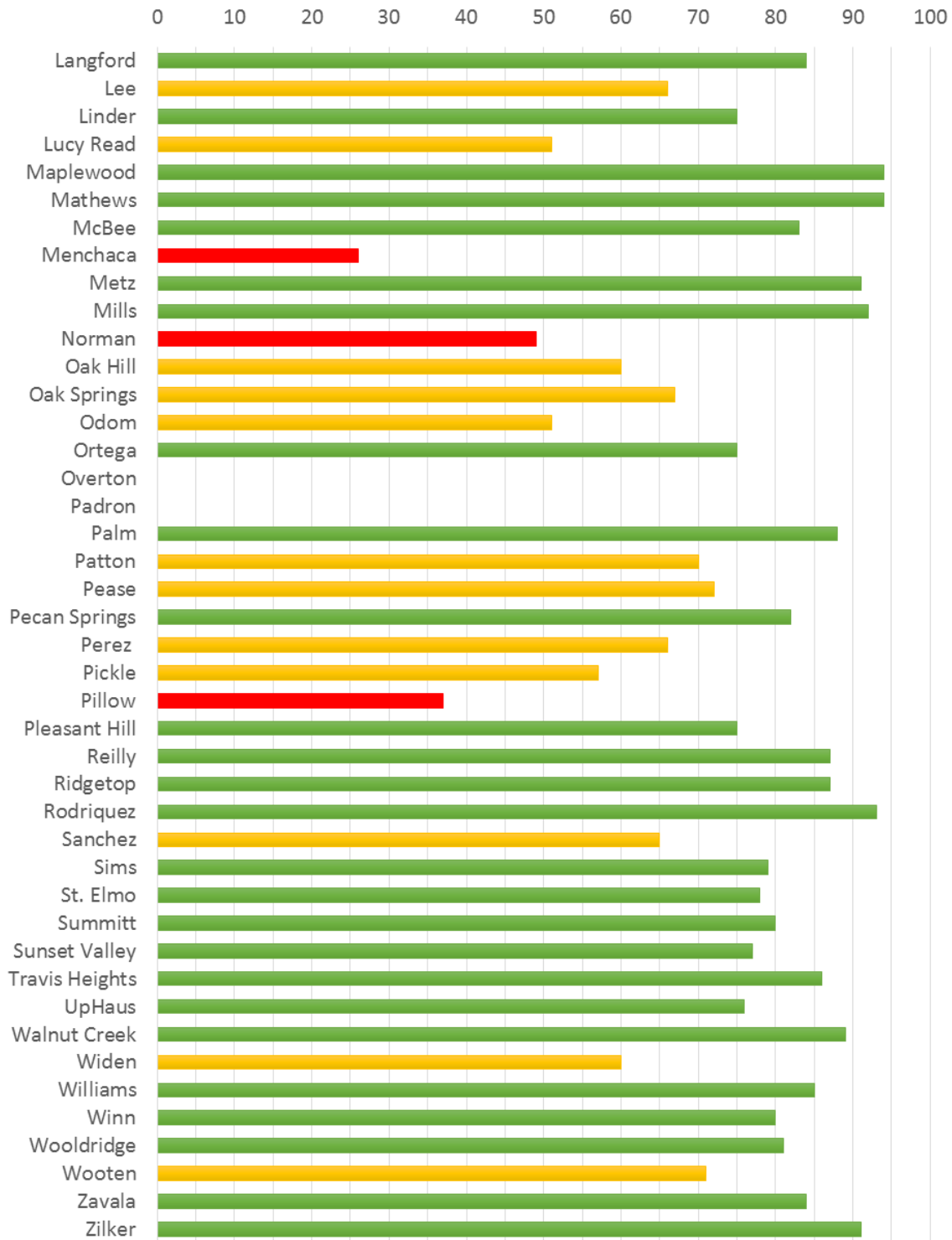
FY2013-14 Middle School ENERGY STAR Scores



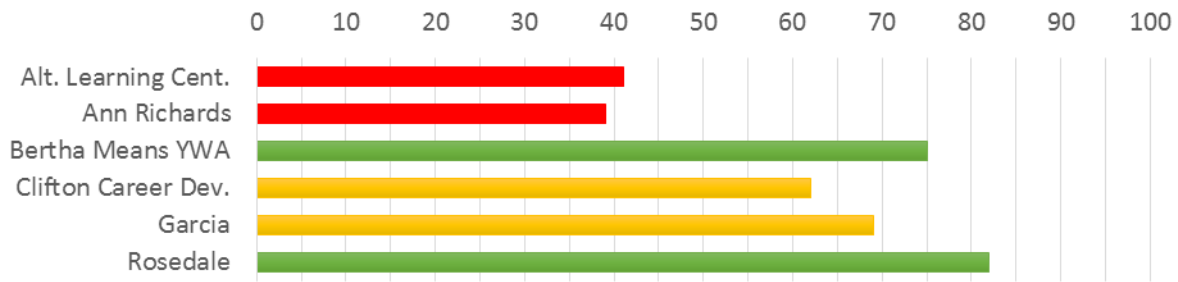
FY2013-14 Elementary School ENERGY STAR Scores (A-K)



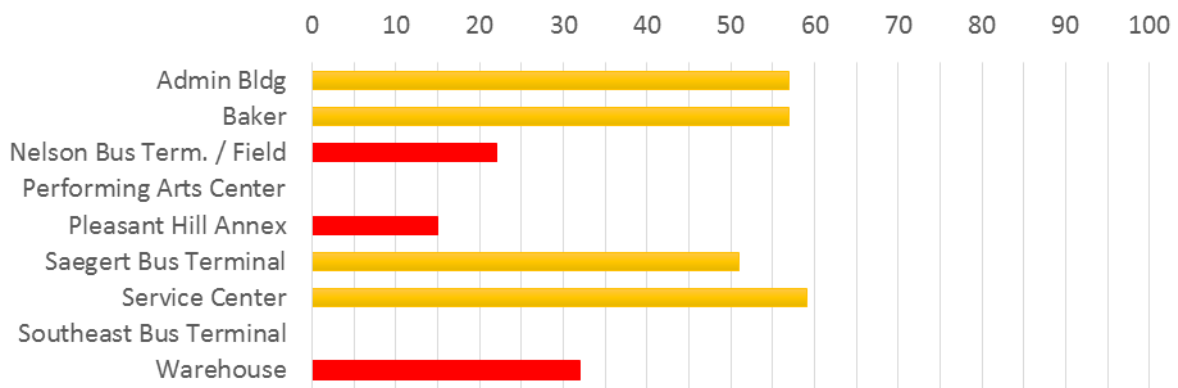
FY2013-14 Elementary School ENERGY STAR Scores (L-Z)



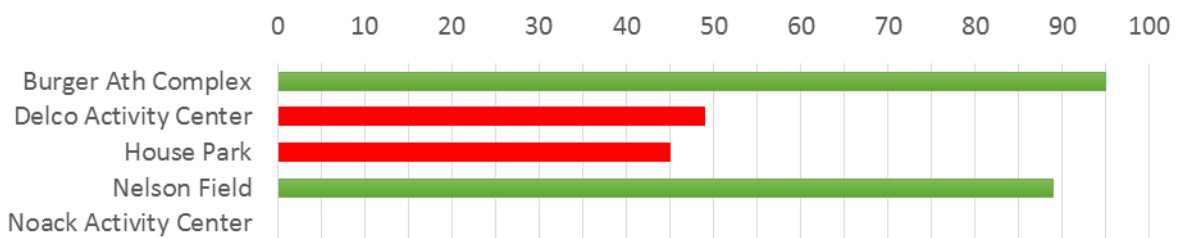
FY2013-14 Special Campus ENERGY STAR Scores



FY2013-14 Support Facility ENERGY STAR Scores



FY2013-14 Athletic Facility ENERGY STAR Scores



6.4 Details of Interval Data Meter Savings at Lyndon B. Johnson

Inputs and Assumptions

	Value	Unit	Assumption/Source
Weekday overnight after-hours per day	6.5	hours	Visual inspection of normal operation on LBJ IDR meter graph
Weekdays per week	5	days	
Weekend after-hours per day	6.5	hours	Assumed to be the same as weekday - likely conservative
Weekend days per week	2	days	
Normal after-hours demand	150	kW	Conservative visual estimate of LBJ IDR meter graph - demand appears to be steady around 125 to 130
Problem after-hours demand	325	kW	Conservative visual estimate of LBJ IDR meter graph - demand appears to fluctuate between 320 and 360 kW
Cost per kWh	0.06099	\$/kWh	Based on 2014-15 winter rate - lower so more conservative savings
Weeks per year	52	weeks	Assume holiday shutdowns do not affect after hours consumption

Calculations

Normal Operation	Calculation	Unit
Normal operation - weekday	975	kWh
Normal operation - weekend day	975	kWh
Normal operation - week	6825	kWh
Cost per week	416.26	\$
Abnormal Operation		
Problem - weekday	2112.5	kWh
Problem - weekend day	2112.5	kWh
Problem - week	14787.5	kWh
Cost per week	901.89	\$
Difference		
Difference in cost per week	485.63	\$
Difference in cost per year	25252.91	\$

6.5 Details of Energy Management Team Salaries

Job descriptions for most of the roles listed below are included in the following attached files from Houston ISD:

- Job Description Manager, Energy & Sustainability.pdf
- Job Description Quality Assurance Analyst.pdf
- Job Description DDC Controls Specialist.pdf
- Job Description Senior HVAC Repairer.pdf
- Job Description Senior Business Analyst.pdf

Basic Energy Management Team

Job Title	Houston ISD Pay Grade	Midpoint Salary	Salary + Benefits	Notes
Manager, Energy	32	\$ 94,519	\$ 120,039.13	
Manager, Sustainability	31	\$ 85,926	\$ 109,126.02	
Data Analyst	26	\$ 53,353	\$ 67,758.31	
		\$ 233,798.00	\$ 296,923.46	

Basic Energy Management Team + Half Houston ISD-Scale Building Commissioning Team

Job Title	Houston ISD Pay Grade	Midpoint Salary	Salary + Benefits	Notes
Manager, Energy	32	\$ 94,519	\$ 120,039.13	
Manager, Sustainability	31	\$ 85,926	\$ 109,126.02	
Quality Assurance Analyst - Energy	26	\$ 53,353	\$ 67,758.31	
Data Analyst	26	\$ 53,353	\$ 67,758.31	
DDC Technician	26	\$ 53,353	\$ 67,758.31	Part of Houston ISD Building Commissioning Team
DDC Monitoring	26	\$ 53,353	\$ 67,758.31	Assumed to be the same salary as the DDC Technician
DDC Monitoring	26	\$ 53,353	\$ 67,758.31	Assumed to be the same salary as the DDC Technician
Sr. HVAC Repairer	26	\$ 53,353	\$ 67,758.31	Part of Houston ISD Building Commissioning Team
		\$ 500,563.00	\$ 635,715.01	

Basic Energy Management Team + Houston ISD-Scale Building Commissioning Team

Job Title	Houston ISD Pay Grade	Midpoint Salary	Salary + Benefits	Notes
Manager, Energy	32	\$ 94,519	\$ 120,039.13	
Manager, Sustainability	31	\$ 85,926	\$ 109,126.02	
Team Lead	27	\$ 58,689	\$ 74,535.03	
Quality Assurance Analyst - Energy	26	\$ 53,353	\$ 67,758.31	
Quality Assurance Analyst - Energy	26	\$ 53,353	\$ 67,758.31	
Quality Assurance Analyst - Sustainability	26	\$ 53,353	\$ 67,758.31	
DDC Technician	26	\$ 53,353	\$ 67,758.31	Part of Houston ISD Building Commissioning Team
DDC Technician	26	\$ 53,353	\$ 67,758.31	Part of Houston ISD Building Commissioning Team
DDC Monitoring	26	\$ 53,353	\$ 67,758.31	Assumed to be the same salary as the DDC Technician
DDC Monitoring	26	\$ 53,353	\$ 67,758.31	Assumed to be the same salary as the DDC Technician
DDC Monitoring	26	\$ 53,353	\$ 67,758.31	Assumed to be the same salary as the DDC Technician
DDC Monitoring	26	\$ 53,353	\$ 67,758.31	Assumed to be the same salary as the DDC Technician
Sr. HVAC Repairer	26	\$ 53,353	\$ 67,758.31	Part of Houston ISD Building Commissioning Team
Sr. HVAC Repairer	26	\$ 53,353	\$ 67,758.31	Part of Houston ISD Building Commissioning Team
Senior Business Analyst	26	\$ 53,353	\$ 67,758.31	Role: Rentals and Data Analysis
		\$ 879,370.00	\$ 1,116,799.90	

6.6 List of case study organizations and associated resources

Arlington ISD, Texas

Danny Helm, Energy Manager

- Energy Management Homepage - <http://bit.ly/1Fq4QhK>
- Energy and Utility Management Plan and Procedures - <http://bit.ly/1FbH3Cz> (also attached to report)
- Energy Management Program Update Memo - <http://bit.ly/1KromcT> (also attached to report)
- Utility Report Cards (District and Campuses) - <http://bit.ly/1KrosBe> (also attached to report)
- Energy Committee Members - <http://bit.ly/1KrousU> (also attached to report)
- Energy Committee Meeting Schedule - <http://bit.ly/1KroqJl>
- Energy Committee Sample Activities - <http://bit.ly/1KroDwv> (also attached to report)
- Energy Committee Activity Fund Guidelines - <http://bit.ly/1KrogC5> (also attached to report)
- Energy Committee Activity Fund Application - <http://bit.ly/1KrokSg> (also attached to report)
- Energy Committee Awards Overview - <http://bit.ly/1KrolAm> (also attached to report)
- School Energy Competition Kick-off Memo - <http://bit.ly/1Kropp8> (also attached to report)
- School Energy Competition Sample Scorecard - <http://bit.ly/1KroeKu> (also attached to report)
- Annual Energy Awareness and Fundraising Fun Run - <http://bit.ly/1FbPYUB>
- Facility Scheduling Quick Step Guide - attached to report

Aurora Public School System, Colorado

Julie North, Natural and Renewable Resource Coordinator

- Energy and Resource Conservation Homepage - <http://bit.ly/1FbHwV9>
- Conservation Standards - <http://bit.ly/1FbHDA5> (also attached to report)
- Start of School Year HVAC Scheduling Memo - <http://bit.ly/1FbHX1l>
- HVAC Policy and Scheduling Requests - <http://bit.ly/1FbHMDK>
- Energy Shut Down Homepage - <http://bit.ly/1FbHLj5>
- Energy Shut Down Checklist - <http://bit.ly/1FbHEnC> (also attached to report)
- Campus Energy Challenge Homepage - <http://bit.ly/1FbHH2L>
- Campus Energy Challenge Overview - <http://bit.ly/1KvSBgu> (also attached to report)
- Campus Energy Challenge Memo - attached to report
- Spring Semester Campus Competition Flyer - attached to report
- Energy Conservation Tips for Teachers - <http://bit.ly/1FbQmCv> (also attached to report)

Austin Community College, Texas

Darien Clary, Sustainability Coordinator

Gresham-Barlow School District, Oregon

Terry Taylor, Director of Facilities

- Program Overview Presentation - attached to report
- Four Cornerstones of Building a Successful Conservation Culture - <http://bit.ly/1KrlFlp> (also attached to report)
- Puzzle Pieces of a Comprehensive Resource Conservation Management Program - <http://1.usa.gov/1KrlOeL> (also attached to report)

Houston ISD, Texas

Kellie Williams, Energy Manager

- Energy and Sustainability Expansion Business Case Presentation - attached to report
- Energy and Sustainability Team Reorganizations Overview - attached to report
- Energy Management Organizational Chart - attached to report
- Job Description Manager, Energy & Sustainability - attached to report
- Job Description Quality Assurance Analyst - attached to report
- Job Description DDC Controls Specialist - attached to report
- Job Description Senior HVAC Repairer - attached to report
- Job Description Senior Business Analyst - attached to report

Kenton County School District, Kentucky

Chris Baker, Energy Systems Coordinator

- Energy Management Program Overview - <http://1.usa.gov/1KrlhJG>
- Energy Policy - <http://1.usa.gov/1Krm79v> (also attached to report)
- Campus Engagement Program Overview - <http://bit.ly/1FbQQIA> (also attached to report)

Klein ISD, Texas

Chad Corbitt, Energy Manager

- Energy Management Homepage - <http://bit.ly/1KrnC7r>
- Energy Management Team Members - <http://bit.ly/1QyM34o> (also attached to report)
- Energy Directive - <http://bit.ly/1KrmPDD> (also attached to report)
- Energy Planning Presentation - attached to report
- HVAC Policy and Scheduling Homepage - <http://bit.ly/1Krnzc1>
- Normal Air & Lighting Schedules for the 2014-15 School Year - attached to report
- Quick-Start Guide for Air and Lighting Request Form - attached to report
- Air and Lighting Request Procedures - attached to report
- Thermostat Instructions - attached to report
- Utility Cost and Usage Report - attached to report
- Initial Campus Presentation - <http://bit.ly/1QyLaJa> (also attached to report)
- Second Campus Presentation - <http://bit.ly/1QyLbWL> (also attached to report)
- Initial Home Presentation - <http://bit.ly/1QyLcka> (also attached to report)
- 'Why all the fuss?' Poster - <http://bit.ly/1QyLp77> (also attached to report)

Loudoun County Public Schools, Virginia

Mike Barancewicz, Energy Specialist

- Program Overview and Objectives - <http://bit.ly/1KrmSPL>
- Overview of Alignment with ENERGY STAR® and Program Benefits - <http://bit.ly/1KrlziS>
- 2015 ENERGY STAR® Partner of the Year Application (2015 Program Highlights) - <http://bit.ly/1Krn01S> (also attached to report)
- Supplemental Materials for 2015 ENERGY STAR® Partner of the Year Application - attached to report
- 2014 ENERGY STAR® Partner of the Year Application (Overall Program Overview) - <http://bit.ly/1KrnbtZ> (also attached to report)
- Supplemental Materials for 2014 ENERGY STAR® Partner of the Year Application - attached to report
- Overview of How Loudoun County uses ENERGY STAR® and Portfolio Manager - attached to report
- Design and Construction Policy - <http://bit.ly/1Krnmp6>
- Operations and Behavior Policy - <http://bit.ly/1KrnWb>

North East ISD, Texas

Paul Raabe, Energy Management Coordinator

- Energy Management Overview Site - <http://bit.ly/1KrRTE>
- Campus Staff and Faculty Energy Management Roles - <http://bit.ly/1Krl0GF> (also attached to report)
- Annual Energy Management Reports - <http://bit.ly/1KrlAV5>

Northside ISD, Texas

Allen Goldapp, Energy Management Coordinator

- Energy Management Homepage - <http://bit.ly/1FbTb6B>

Round Rock ISD, Texas

Wesley Perkins, Energy Manager

- Energy Management Homepage - <http://bit.ly/1KrKxEo>
- Annual Energy Management Reports - <http://bit.ly/1KrlsF4>
- FY2014 Energy Efficiency Report - attached to report
- Thermostat Setpoints Policy - <http://bit.ly/1KrKf75> (also attached to report)
- Energy Emergency (Demand Response) Action Plan - <http://bit.ly/1KrKJnl> (also attached to report)
- Facility Requests Homepage - <http://bit.ly/1KrKlzM>
- Watt Watchers Program - <http://bit.ly/1KrKM2i>
- Watt Watchers Campus Project Boxes - <http://bit.ly/1KrKPeJ>

San Jacinto College, Texas

Bill Miller, Former Energy Manager

University of Texas

Stephanie Perrone, Sr. Project Manager, Energy and Water Conservation Program

- Energy and Water Conservation Program Homepage - <http://bit.ly/1KrmDnY>
- Utilities and Energy Management Organizational Chart - <http://bit.ly/1QyMbku> (also attached to report)

Wake County Public School System, North Carolina

Nate Slavik, Director of Energy & Physical Plant

- Energy and Physical Plant Homepage - <http://bit.ly/1FbTdLF>