Susan Combs
Texas Comptroller of Public Accounts

Facility Preliminary Energy Assessments and Recommendations

SOUTHWEST ISD

11914 Dragon Lane
San Antonio, Texas 78252

Prepared by:

Texas Energy Engineering Services, Inc.
1301 S. Capital of Texas Highway
Capital View Center – Suite B-325
Austin, Texas 78746
(512) 328-2533
TBPE# F-3502

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M. Saleem Khan, P.E.
Texas Registration #98125

SECO
State Energy Conservation Office

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Schools & Hospitals Energy Management Program
Southwest ISD
11914 Dragon Lane
San Antonio, TX 78252
Contact Person: Thomas Krueger, Construction Supervisor
Phone: 210-622-4370

1.0 EXECUTIVE SUMMARY

Southwest Independent School District, now referred to as the District, requested that Texas Energy Engineering Services, Inc. (TEESI) perform a Preliminary Energy Assessment (PEA) of their facilities. This report documents that analysis.

This service is provided at no cost to the District through the Schools Energy Management and Technical Assistance Program as administered by the Texas Comptroller of Public Accounts, State Energy Conservation Office (SECO). This program promotes and encourages an active partnership between SECO and Texas schools for the purpose of planning, funding, and implementing energy saving measures, which will ultimately reduce the District's annual energy costs.

The annual cost savings, implementation cost estimate and simple payback for all building energy cost reduction measures (ECRMs) identified in this preliminary analysis are summarized below. Individual building ECRMs are summarized in Section 8.0 of this report.

Implementation Cost Estimate:	$2,629,800
Annual Energy Cost Savings:	$263,000
Simple Payback:	10.0

Recommendations and information of interest to the District is provided in this report regarding Energy Consumption and Performance (Section 3.0), Energy Accounting (Section 4.0), Energy Legislation Overview (Section 5.0), Energy Management System Snapshot Review (Section 6.0), Recommended Maintenance & Operation Procedures (Section 7.0), Energy Cost Reduction Measures (Section 8.0), Energy Management Policy (Section 9.0), and Funding Options for Capital Energy Projects (Section 10.0). A follow-up visit to the District will be scheduled to address any questions pertaining to this report, or any other aspect of this program.

SECO is committed to providing whatever assistance the District may require in planning, funding and implementing the recommendations of this report. The District is encouraged to direct any questions or concerns to either of the following contact persons:

SECO / Ms. Juline Ferris	TEESI / Saleem Khan
(512) 936-9283	(512) 328-2533

2.0 FACILITY DESCRIPTIONS

This section provides a brief description of the facilities surveyed. The purpose of the onsite survey was to evaluate the major energy consuming equipment in each facility (i.e. Lighting, HVAC, and Controls Equipment). A description of each facility is provided below. Please reference **Appendix C-1** for building grouping.

Indian Creek Elementary

Stories:	Single story building
Area: 82,610	SF
Bldg. Components:	Brick exterior, flat built up roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts
HVAC:	Packaged roof top units
Controls: Standard	Thermostats

Kriewald Elementary

Stories:	Single story building
Area: 67,861	SF
Bldg. Components:	Brick exterior, flat built up roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts
HVAC:	Packaged roof top units
Controls:	Energy Management System (EMS), Manufacturer: AutomatedLogic

Sun Valley Elementary

Stories:	Single story building
Area: 82,256	SF
Bldg. Components:	Brick exterior, flat built up roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts
HVAC:	Packaged roof top units
Controls:	Energy Management System (EMS), Manufacturer: AutomatedLogic

Southwest Elementary

Stories:	Single story building
Area: 82,974	SF
Bldg. Components:	Brick buildings, flat built up tar and gravel roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts
HVAC:	Packaged roof top units
Controls:	Energy Management System (EMS), Manufacturer: AutomatedLogic

Scobee Middle School

Stories:	Two story building
Area: 163,541	SF
Bldg. Components:	Brick exterior, flat built up roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts
HVAC:	Air-cooled chilled water system, Gas fired boiler
Controls:	Energy Management System (EMS), Manufacturer: AutomatedLogic

Southwest High School

Stories:	Two story building
Area: 480,877	SF
Bldg. Components:	Concrete exterior, flat built up roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts
HVAC:	Air-cooled chilled water system, Gas fired boiler
Controls:	Energy Management System (EMS), Manufacturer: AutomatedLogic

3.0 ENERGY CONSUMPTION AND PERFORMANCE

Annual electric and natural gas invo ices for several of the District 's facilities were compiled for the periods between Fis cal Year (F Y) 2007 thr ough 2009. The facilities com prised a total gro ss area of approxim ately 1,560,000 square feet. Th e following tables and charts summarize the annual utility consum ption and costs. The annual ut ility data for each fa cility listed is provided in **Appendix C**, Base Year Consumption History.

To help the District evaluate the overall energy performance of its facilities TEESI has calculated their Energ y Utilizatio n Index (EUI) and Energy Cost Index (E CI). The EUI repre sents a facility's annual energy usage per square foot, it is m easured as thousand BTU's per square foot per yea r (k BTU/SF/Year). Sim ilarly, ECI is m easured as cos t per square foot per year ($/SF/Year). The EUI and ECI performance for selected facilities are listed below:

FY 07-08

Energy Cost and Cosumption Benchmarks

		Electric			Natural Gas			Total	Total	EUI	ECI	
	Building	KWH/Yr	MMBTU/Yr	$Cost/Yr	MCF/Yr	MMBTU/Yr	$Cost/Yr	$Cost/Yr	MMBTU/Yr	kBTU/SF/Yr	$/SF/Yr	SF
1	Indian Creek Elem.*	855,936	2,921	61,199	356	366	3,696	64,894	3,288	40	0.79	82,610
2	Big Country Elem.	845,760	2,887	63,290	396	408	4,017	67,307	3,294	40	0.82	81,650
3	Elm Creek Elem.	759,183	2,591	57,534	447	461	4,377	61,911	3,052	45	0.91	67,861
4	Kriewald Road Elem.*	858,280	2,929	59,948	191	196	1,975	61,923	3,126	46	0.91	67,861
5	Sky Harbour Elem.	1,421,250	4,851	99,364	254	262	2,615	101,979	5,113	52	1.03	98,620
6	Bob Hope Elem.	675,400	2,305	48,266	310	320	3,709	51,975	2,625	51	1.01	51,272
7	Hidden Cove Elem.	861,698	2,941	62,618	733	755	7,268	69,887	3,696	52	0.98	71,379
8	Sun Valley Elem.*	1,307,904	4,464	90,064	263	271	2,680	92,744	4,734	58	1.13	82,256
9	Southwest Elem.*	1,236,240	4,219	84,683	1,018	1,049	9,266	93,950	5,268	63	1.13	82,974
10	McNair Middle School	1,634,400	5,578	116,515	0	0	0	116,515	5,578	52	1.09	106,471
11	McAuliffe Middle School	1,697,328	5,793	112,243	771	794	7,910	120,153	6,587	52	0.96	125,546
12	Scobee Middle School*	2,376,000	8,109	163,977	2,422	2,495	24,163	188,139	10,604	65	1.15	163,541
13	Southwest High School*	9,607,696	32,791	606,450	7,692	7,923	93,864	700,315	40,714	85	1.46	480,877
		KWH/Yr	MMBTU/Yr	$Cost/Yr	MCF/Yr	MMBTU/Yr	$Cost/Yr	$Cost/Yr	MMBTU/Yr	kBTU/SF/Yr	$/SF/Yr	SF
		24,137,075	82,380	1,626,151	14,854	15,299	165,541	1,791,692	97,679	62	1.15	1,562,918

* Site Visit Performed

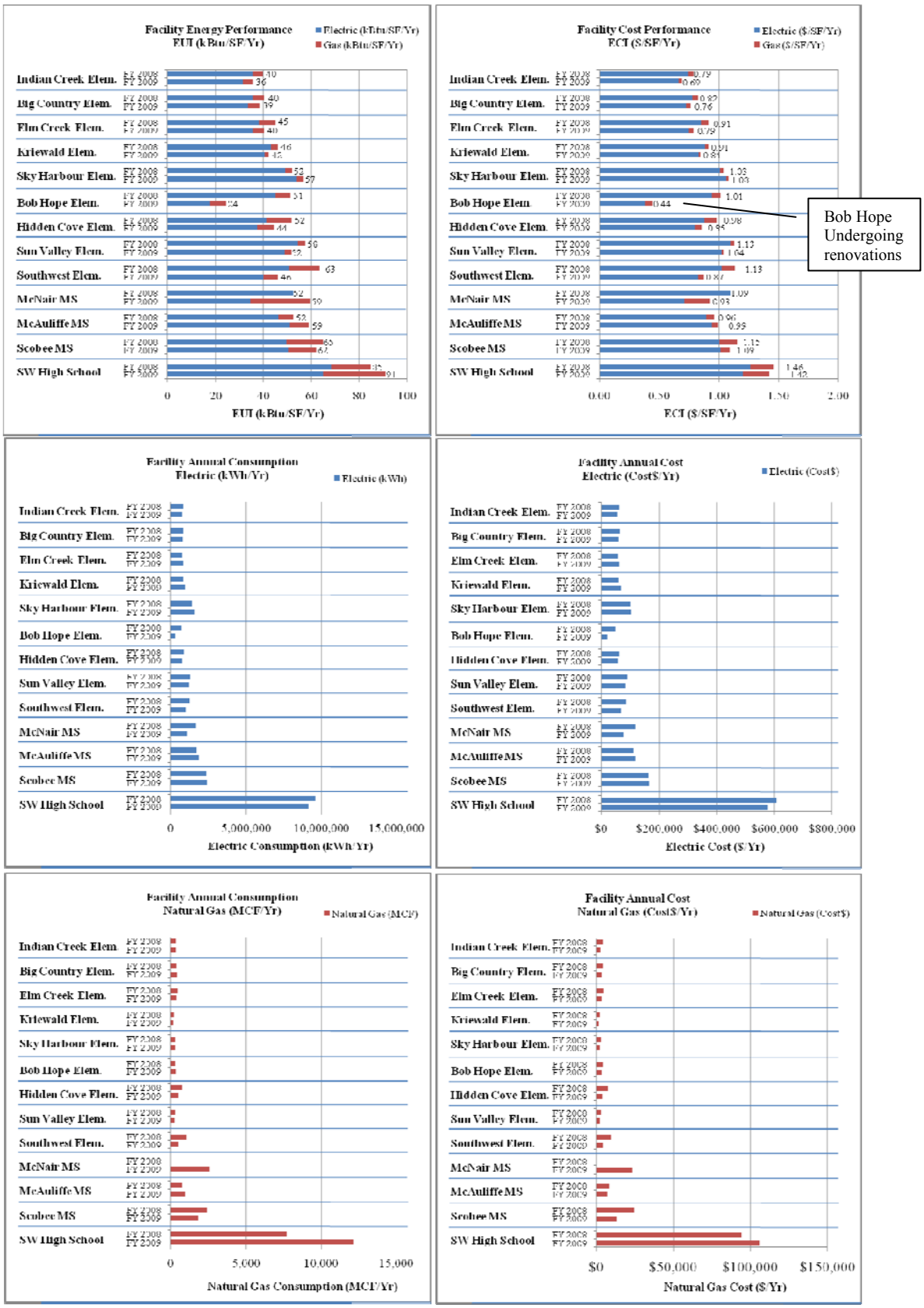
Energy Cost and Cosumption Benchmarks

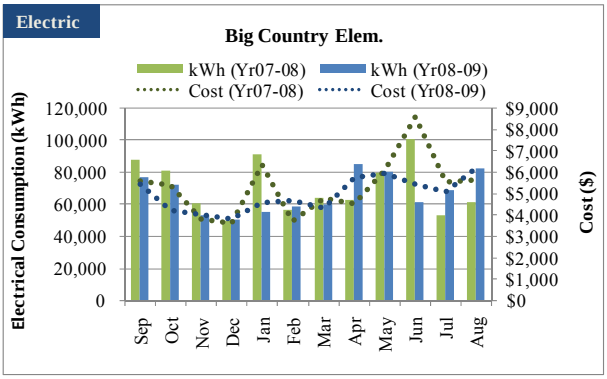
		Electric			Natural Gas			Total	Total	EUI	ECI	
	Building	KWH/Yr	MMBTU/Yr	$Cost/Yr	MCF/Yr	MMBTU/Yr	$Cost/Yr	$Cost/Yr	MMBTU/Yr	kBTU/SF/Yr	$/SF/Yr	SF
1	Indian Creek Elem.*	762,585	2,603	54,868	327	337	2,312	57,180	2,940	36	0.69	82,610
2	Big Country Elem.	800,832	2,733	59,280	403	415	2,897	62,177	3,148	39	0.76	81,650
3	Elm Creek Elem.	857,835	2,928	61,331	366	376	3,109	64,440	3,304	40	0.79	82,018
4	Kriewald Road Elem.*	972,449	3,319	68,213	141	145	1,057	69,271	3,464	42	0.84	82,018
5	Sky Harbour Elem.	1,554,000	5,304	104,373	277	285	2,002	106,375	5,589	57	1.08	98,620
6	Bob Hope Elem.**	265,000	904	19,689	336	346	2,845	22,534	1,251	24	0.44	51,272
7	Hidden Cove Elem.	782,384	2,670	57,269	481	496	3,512	60,781	3,166	44	0.85	71,379
8	Sun Valley Elem.*	1,179,264	4,025	83,936	230	237	1,681	85,617	4,262	52	1.04	82,256
9	Southwest Elem.*	973,440	3,322	68,563	481	495	3,981	72,544	3,818	46	0.87	82,974
10	McNair Middle School	1,078,500	3,681	75,435	2,576	2,653	23,129	98,564	6,334	59	0.93	106,471
11	McAuliffe Middle School	1,878,222	6,410	118,054	944	973	6,678	124,732	7,383	59	0.99	125,546
12	Scobee Middle School*	2,412,000	8,232	165,137	1,847	1,903	12,966	178,103	10,135	62	1.09	163,541
13	Southwest High School*	9,142,720	31,204	577,203	12,181	12,546	106,119	683,323	43,751	91	1.42	480,877
		KWH/Yr	MMBTU/Yr	$Cost/Yr	MCF/Yr	MMBTU/Yr	$Cost/Yr	$Cost/Yr	MMBTU/Yr	kBTU/SF/Yr	$/SF/Yr	SF
		22,659,231	77,336	1,513,352	20,591	21,208	172,287	1,685,640	98,544	62	1.06	1,591,232

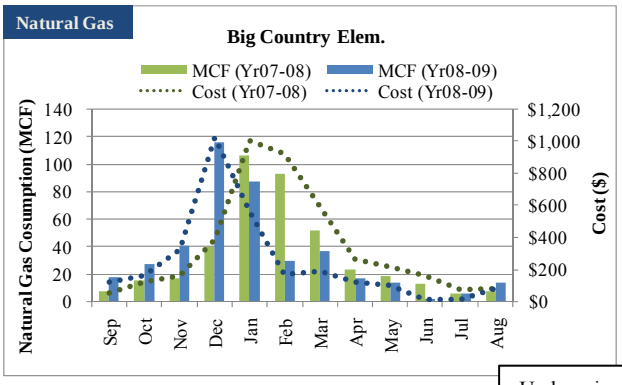
* Site Visit Performed
** Undergoing renovation

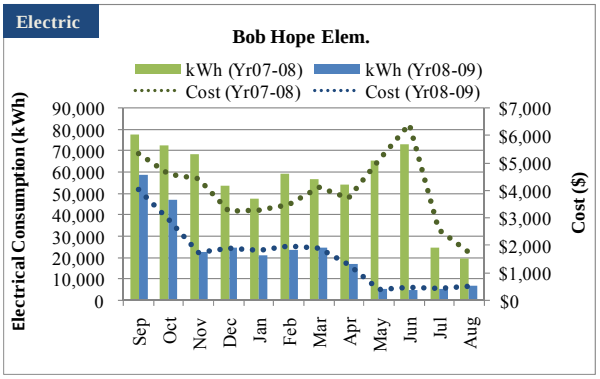
Knowing the EUI and ECI of each facility is useful to h elp determine the Dis trict's overall energy performance. In addition, the District's EUI was compared to TEESI's database of Texas schools. See **Appendix D** to determine how each facility ranked.

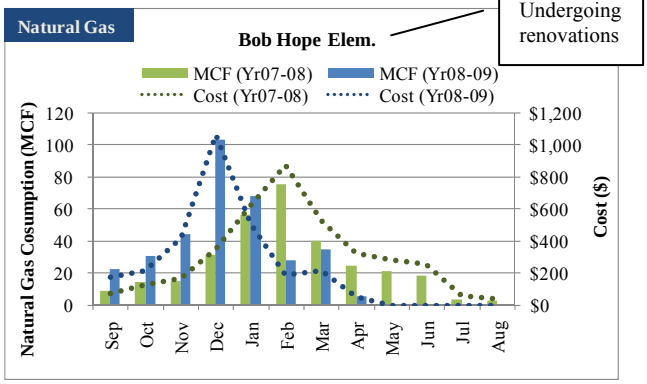
The following charts su mmarize the data presen ted in the previous tab le. See **Appendix C** for further detail.

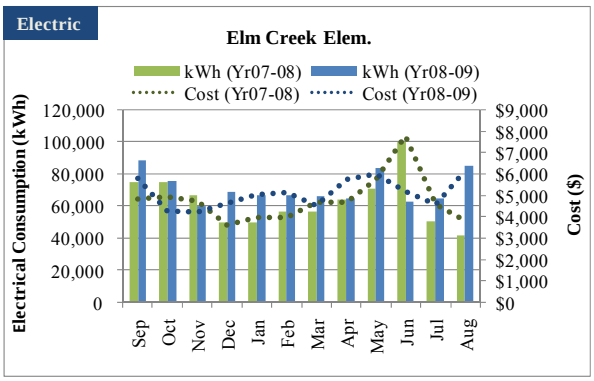


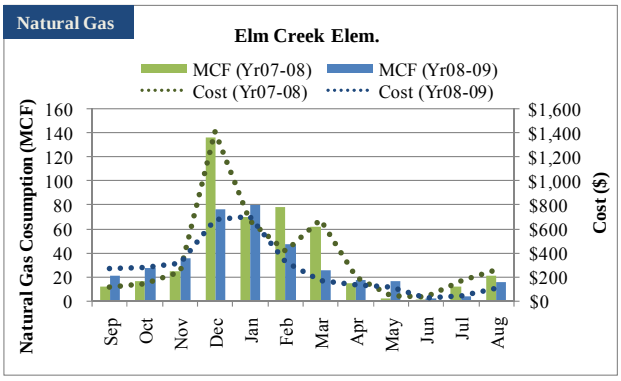

Electric
Big Country Elem.
kWh (Yr07-08)
kWh (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Electrical Consumption (kWh)
Cost ($)
Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug


Natural Gas
Big Country Elem.
MCF (Yr07-08)
MCF (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Natural Gas Cosumption (MCF)
Cost ($)
Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug


Electric
Bob Hope Elem.
kWh (Yr07-08)
kWh (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Electrical Consumption (kWh)
Cost ($)
Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug


Natural Gas
Bob Hope Elem.
Undergoing renovations
MCF (Yr07-08)
MCF (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Natural Gas Cosumption (MCF)
Cost ($)
Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug


Electric
Elm Creek Elem.
kWh (Yr07-08)
kWh (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Electrical Consumption (kWh)
Cost ($)
Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug


Natural Gas
Elm Creek Elem.
MCF (Yr07-08)
MCF (Yr08-09)
Cost (Yr07-08)
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Natural Gas Cosumption (MCF)
Cost ($)
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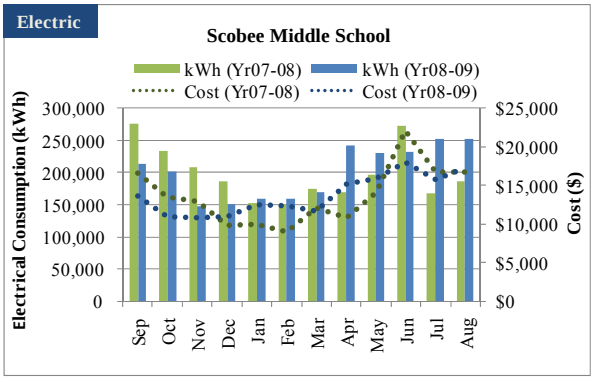
Electric
Scobee Middle School
kWh (Yr07-08)
kWh (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Electrical Consumption (kWh)
Cost ($)
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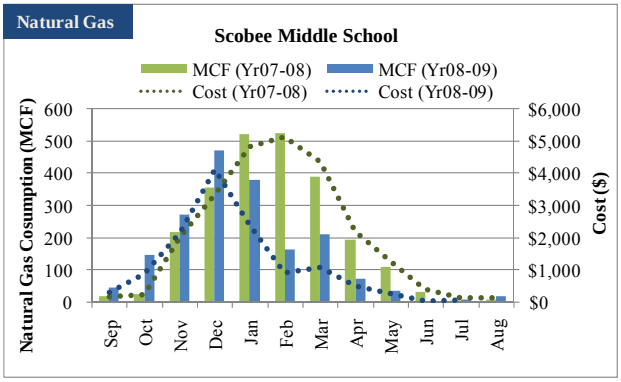
Natural Gas
Scobee Middle School
MCF (Yr07-08)
MCF (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
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Cost ($)
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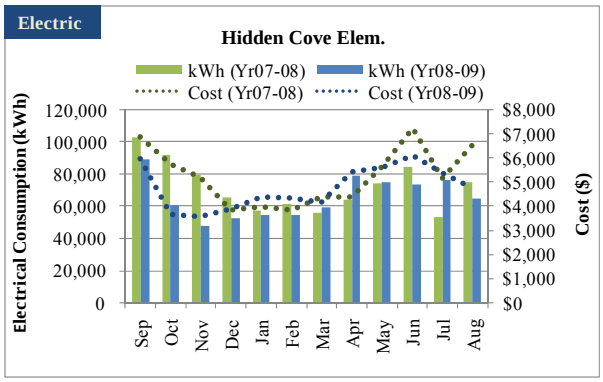
Electric
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kWh (Yr07-08)
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Cost (Yr08-09)
Electrical Consumption (kWh)
Cost ($)
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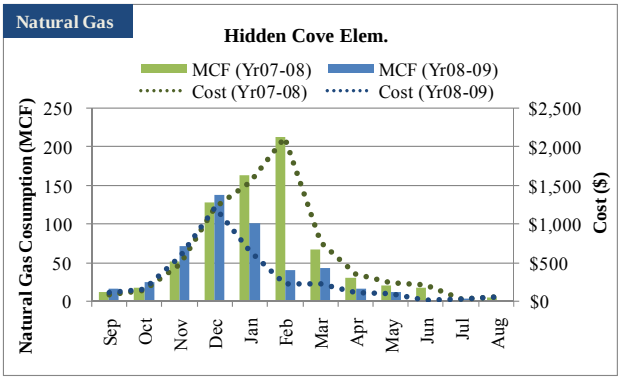
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Hidden Cove Elem.
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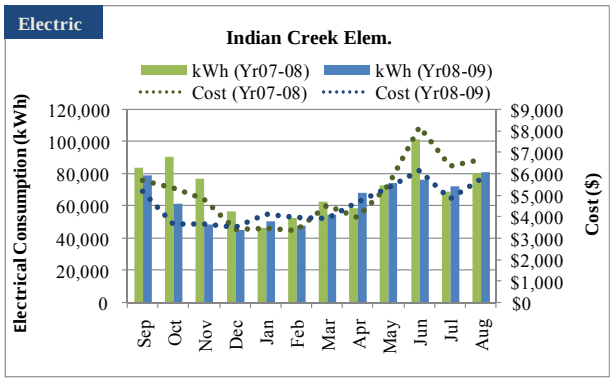
Electric
Indian Creek Elem.
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Cost (Yr07-08)
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Cost ($)
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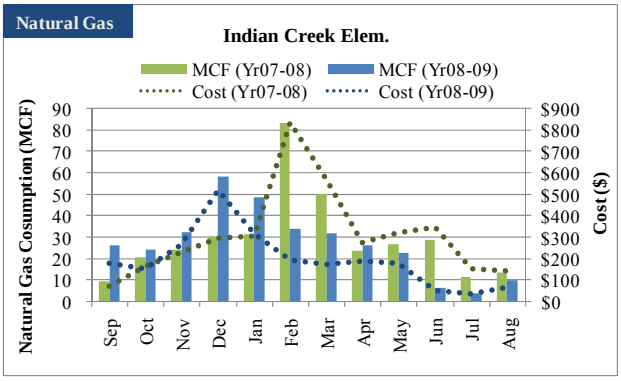
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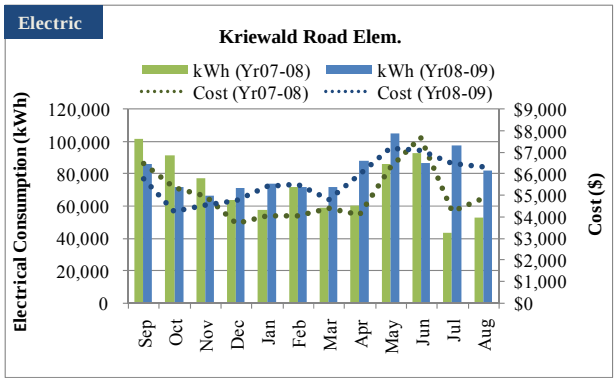
Electric
Kriewald Road Elem.
kWh (Yr07-08)
kWh (Yr08-09)
Cost (Yr07-08)
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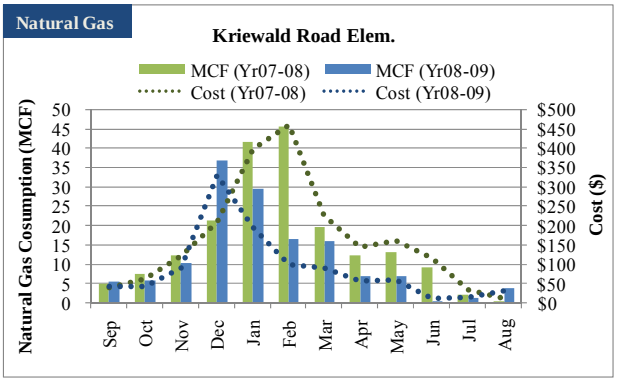
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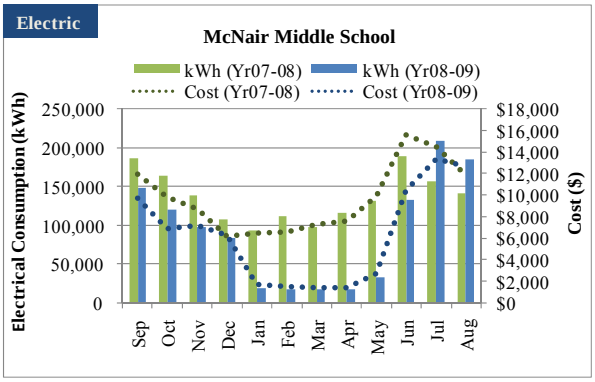
Electric
McNair Middle School
kWh (Yr07-08)
kWh (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Electrical Consumption (kWh)
Cost ($)
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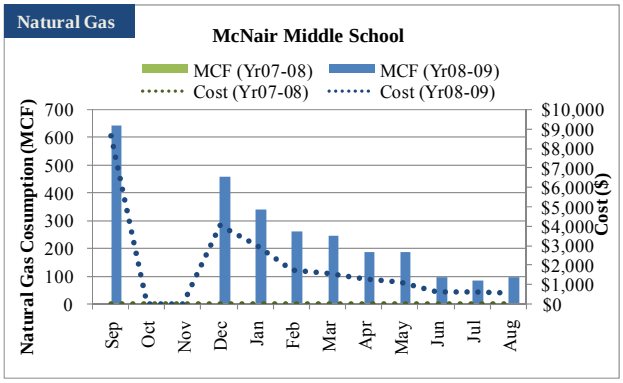
Natural Gas
McNair Middle School
MCF (Yr07-08)
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Cost (Yr08-09)
Natural Gas Cosumption (MCF)
Cost ($)
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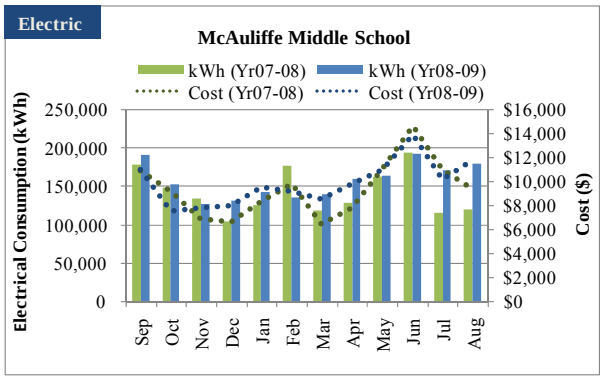
Electric
McAuliffe Middle School
kWh (Yr07-08)
kWh (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Electrical Consumption (kWh)
Cost ($)
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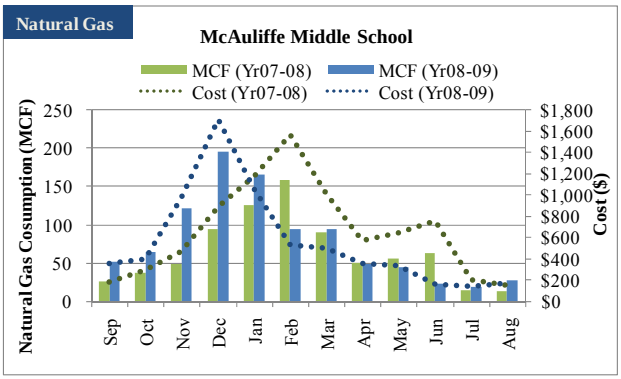
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McAuliffe Middle School
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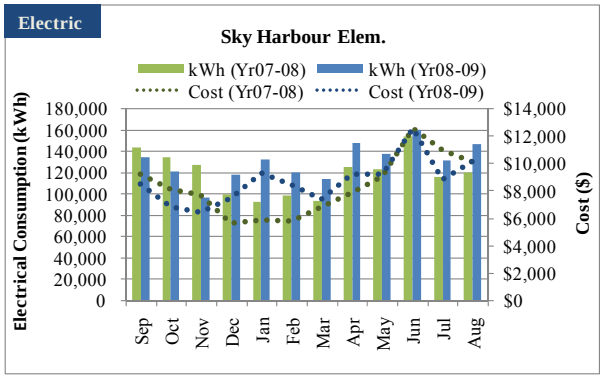
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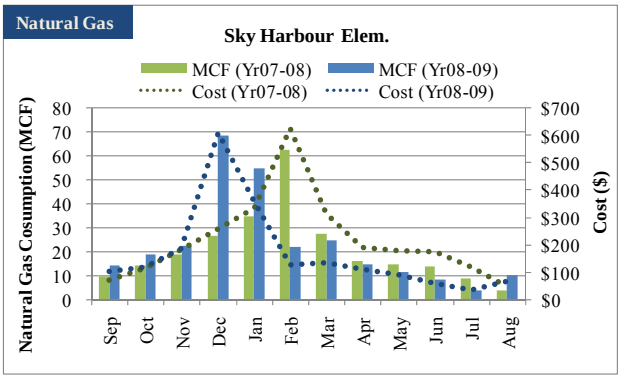
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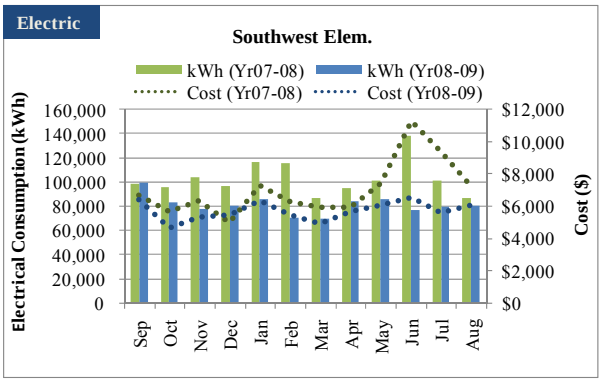
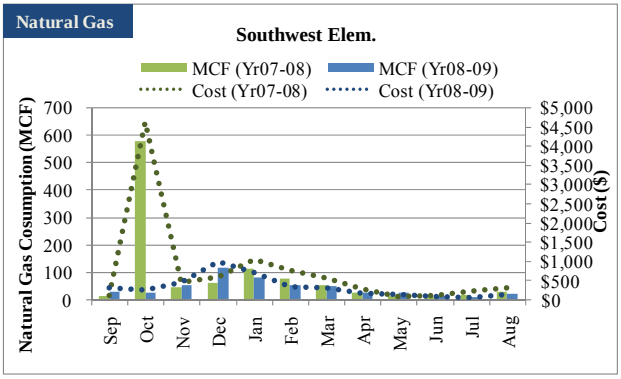
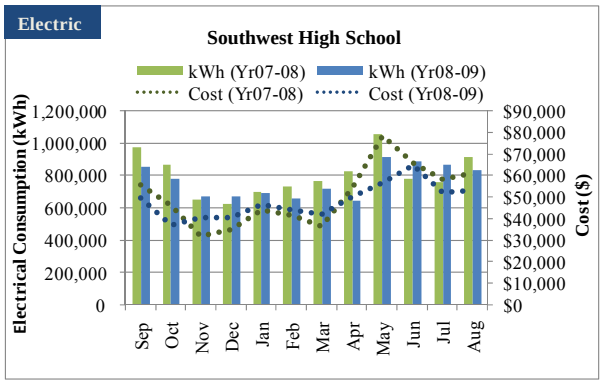
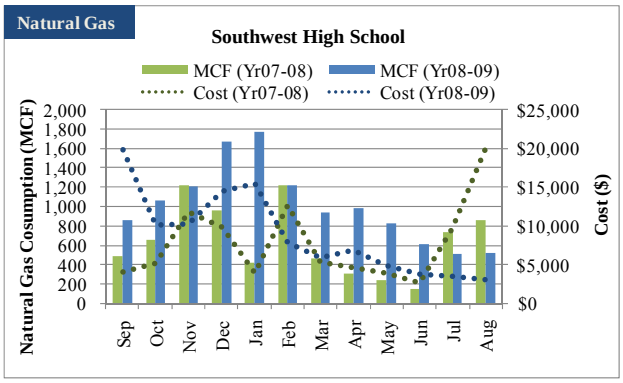
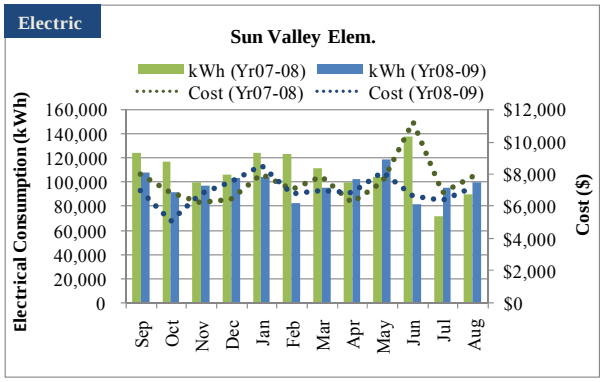
Cost (Yr07-08)
Cost (Yr08-09)
Natural Gas Cosumption (MCF)
Cost ($)
Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug

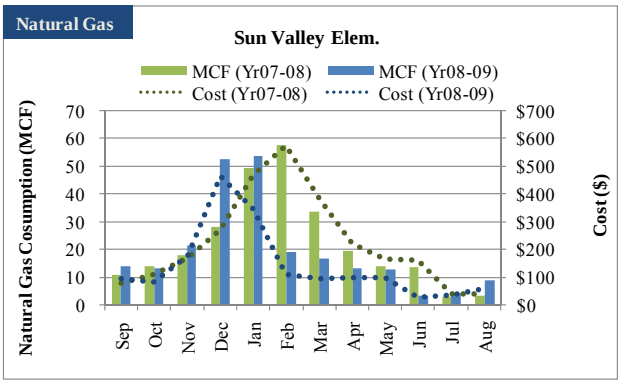

Electric
Southwest Elem.
kWh (Yr07-08)
kWh (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Electrical Consumption (kWh)
Cost ($)
Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug


Natural Gas
Southwest Elem.
MCF (Yr07-08)
MCF (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Natural Gas Cosumption (MCF)
Cost ($)
Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug


Electric
Southwest High School
kWh (Yr07-08)
kWh (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Electrical Consumption (kWh)
Cost ($)
Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug


Natural Gas
Southwest High School
MCF (Yr07-08)
MCF (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Natural Gas Cosumption (MCF)
Cost ($)
Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug


Electric
Sun Valley Elem.
kWh (Yr07-08)
kWh (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Electrical Consumption (kWh)
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$0
Cost ($)
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug


Natural Gas
Sun Valley Elem.
MCF (Yr07-08)
MCF (Yr08-09)
Cost (Yr07-08)
Cost (Yr08-09)
Natural Gas Cosumption (MCF)
70
60
50
40
30
20
10
0
$700
$600
$500
$400
$300
$200
$100
$0
Cost ($)
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug

4.0 ENERGY ACCOUNTING

UTILITY PROVIDERS

CPS provides electric service and West Texas provides natural gas service to the District.

MONITORING AND TRACKING

The District currently utilizes an energy accounting software program (School Dude) to track and monitor their energy usage. The system consolidates and records all of the District's utility accounts (i.e., Electricity, Natural Gas, Water, etc.). The District uses this data to track utility consumption patterns and budget utility expenses. Having this historical data improves the District's awareness of their energy performance and will help in tracking their energy reduction goals.

In general the following steps below are essential for an effective energy management tracking system:

1. Utility Meter Mapping: Develop a working document identifying meters, account numbers, and associated buildings served by the utility service. Due to large number of accounts and buildings served this step is recommended.

2. Bill Rate Analysis: Periodic spot checks of the applicable utility rates (TDSP Charges, demand ratchet clauses, power factor charges, etc.) to identify any abnormal situation.

3. Perform regular updates: An effective system requires current and comprehensive data. Monthly updates should be strongly encouraged.

4. Conduct periodic reviews: Such reviews should focus on progress made, problems encountered, and potential rewards.

5. Identify necessary corrective actions: This step is essential for identifying if a specific activity is not meeting its expected performance and is in need of review.

In addition, having this historical utility data would facilitate **House Bill 3693** and **Senate Bill 12** reporting requirements. Please see Section 5.0 for additional information regarding these requirements.

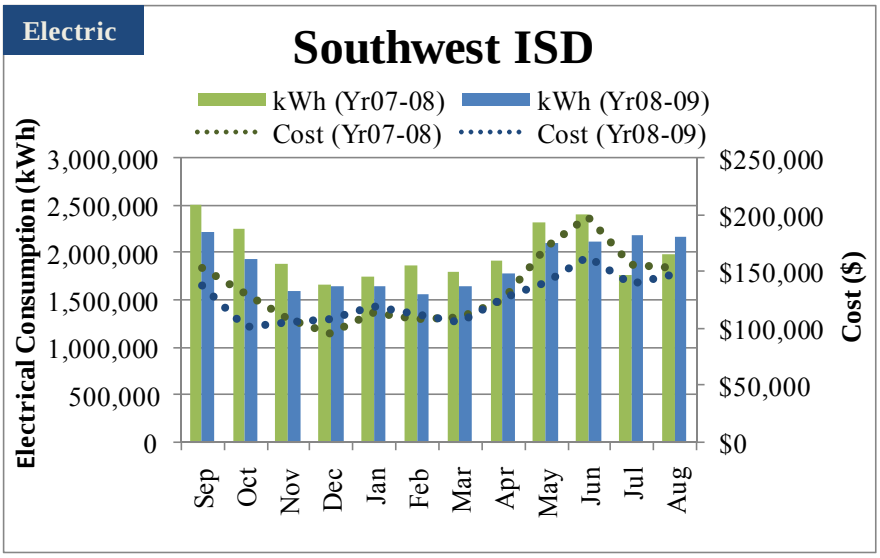
Furthermore, below is a sample format the District can customize to help summarize their overall utility usage and costs.

The data presented below is a summ ation of the da ta provided by the Distri ct. Th is data below includes only selected utility accounts and is for reference purposes only and does not represent the District's total utility data. See **Appendix C** for further detail reg arding each utility account represented in the table below.

Southwest ISD - Sample Utility Data Input Form

	ELECTRICITY								
	Consumption			Cost			Avg. Rate		
	FY 07-08 (kWh)	FY 08-09 (kWh)	% Change	FY 07-08 ($)	FY 08-09 ($)	% Change	FY 07-08 ($/kWh)	FY 08-09 ($/kWh)	% Change
Sep	2,506,668	2,222,735	11%	153,371	138,312	10%	$0.061	$0.062	-2%
Oct	2,254,891	1,934,148	14%	130,388	102,074	22%	$0.058	$0.053	9%
Nov	1,888,939	1,605,023	15%	108,449	106,659	2%	$0.057	$0.066	-16%
Dec	1,663,350	1,646,002	1%	95,597	108,420	-13%	$0.057	$0.066	-15%
Jan	1,747,834	1,653,036	5%	114,700	119,732	-4%	$0.066	$0.072	-10%
Feb	1,864,995	1,563,703	16%	108,180	113,575	-5%	$0.058	$0.073	-25%
Mar	1,801,812	1,655,326	8%	109,460	106,684	3%	$0.061	$0.064	-6%
Apr	1,918,928	1,792,799	7%	125,759	126,997	-1%	$0.066	$0.071	-8%
May	2,319,700	2,103,299	9%	171,805	140,365	18%	$0.074	$0.067	10%
Jun	2,410,462	2,123,317	12%	199,175	163,210	18%	$0.083	$0.077	7%
Jul	1,776,239	2,186,541	-23%	155,983	139,100	11%	$0.088	$0.064	28%
Aug	1,983,257	2,173,302	-10%	153,283	148,225	3%	$0.077	$0.068	12%
Total	24,137,075	22,659,231	6%	$1,626,151	$1,513,352	7%	$0.067	$0.067	1%

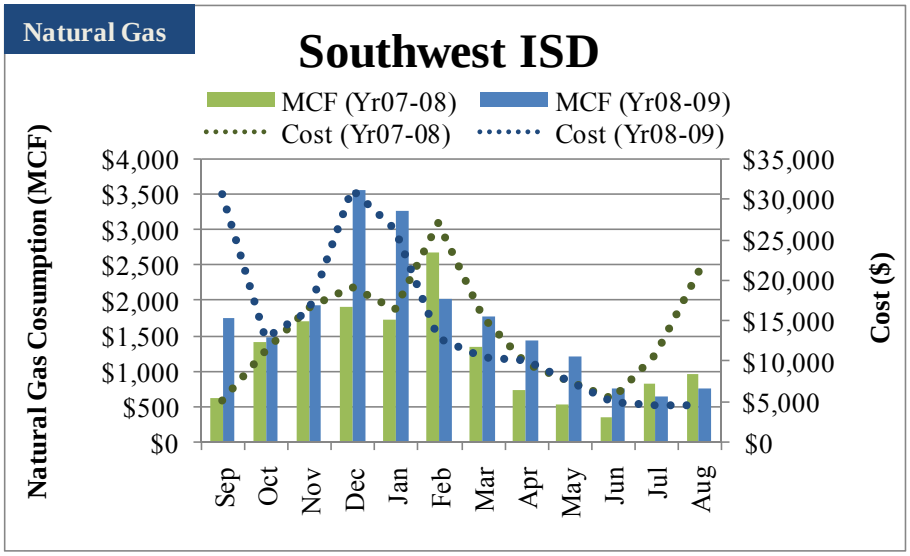
	Gross Building Area:	
FY 07-08	1,562,918	SF
FY 08-09	1,591,232	SF



Southwest ISD - Sample Utility Data Input Form

	NATURAL GAS								
	Consumption			Cost			Avg. Rate		
	FY 07-08 (MCF)	FY 08-09 (MCF)	% Change	FY 07-08 ($)	FY 08-09 ($)	% Change	FY 07-08 ($/MCF)	FY 08-09 ($/MCF)	% Change
Sep	$620	$1,761	-184%	$5,180	$30,583	-490%	$8.4	$17.4	-108%
Oct	$1,412	$1,472	-4%	$11,324	$12,859	-14%	$8.0	$8.7	-9%
Nov	$1,710	$1,930	-13%	$16,483	$16,246	1%	$9.6	$8.4	13%
Dec	$1,911	$3,555	-86%	$19,152	$31,264	-63%	$10.0	$8.8	12%
Jan	$1,728	$3,262	-89%	$16,351	$26,252	-61%	$9.5	$8.0	15%
Feb	$2,685	$2,021	25%	$26,956	$12,841	52%	$10.0	$6.4	37%
Mar	$1,344	$1,767	-31%	$15,348	$10,543	31%	$11.4	$6.0	48%
Apr	$743	$1,432	-93%	$9,620	$10,077	-5%	$13.0	$7.0	46%
May	$547	$1,211	-121%	$7,602	$7,584	0%	$13.9	$6.3	55%
Jun	$365	$769	-111%	$5,412	$4,910	9%	$14.8	$6.4	57%
Jul	$825	$651	21%	$10,948	$4,611	58%	$13.3	$7.1	47%
Aug	$964	$758	21%	$21,164	$4,518	79%	$22.0	$6.0	73%
Total	14,854	20,591	-39%	$165,541	$172,287	-4%	$11.1	$8.4	25%

	Gross Building Area:	
FY 07-08	1,562,918	SF
FY 08-09	1,591,232	SF



5.0 ENERGY LEGISLATION OVERVIEW

In 2007, the 80th Texas Legislature passed Senate Bill 12 (**SB12**) which among other things extended the timeline set by Senate Bill 5 (**SB5**). SB5, commonly referred to as the Texas Emissions Reduction Plan, was adopted in 2001 by the 77th Texas Legislature to comply with the federal Clean Air Act standards. Also in 2007, the 80th Texas Legislature passed House Bill 3693 (**HB3693**) which amended provisions of several codes relating primarily to energy efficiency.

In 2009, the 81st Texas Legislature passed Senate Bill 300 (**SB300**). This bill specifically addressed the requirement for Texas Schools. This bill repealed the requirement in HB3693 that school districts must establish a goal of reducing electric consumption by 5% each year for six years starting Fiscal Year (FY) 2007. SB300 instead requires that school districts establish a long-range energy plan to reduce the overall electricity use by 5% beginning FY 2008. Besides this change, other requirements set forth in SB12 and HB3693 applicable to schools still apply.

Following are key requirements established by the above energy legislation:

Per SB300 a district should establish a Long-Range Energy Plan to reduce the District's electric consumption by five percent (5%) beginning with the 2008 state fiscal year and to consume electricity in subsequent fiscal years in accordance with the plan. The Long-Range Energy Plan should include strategies in the plan for achieving energy efficiency that result in net savings or that can be achieved without financial cost to the district. The Plan should account for the initial, short-term capital costs and lifetime costs and savings that may occur from implementation of the strategy. Each strategy should be evaluated based on the total net costs and savings that may occur over a seven-year period following implementation of the strategy.

Record electric, water, and natural gas utility services (consumption and cost) in an electronic repository. The recorded information shall be on a publicly accessible Internet Web site with an interface designed for ease of navigation if available, or at another publicly accessible location. To help with the utility reporting process a sample input form can be found in **Appendix B** of this report.

EnergyEnergy-efficient light bulbs for buildings, requires an institution to purchase commercially available light bulbs using the lowest wattages for the required illumination levels.

Installation of energy saving devices in Vending Machines with non-perishable food products. **Not required by School Districts but highly recommended.**

A summary description of SB12, HB3693, and SB300 are available in **Appendix A.**

6.0 SAMPLE MONITORING OF INDOOR ENVIRONMENT CONDITIONS

During the preliminary walk-through, data-logging equipment was deployed throughout several of District's facilities (Southwest High School, Southwest Elementary, and Sun Valley Elementary), to take snapshot readings of the building's typical Heating Ventilation and Air-Conditioning (HVAC) Systems and Interior Lighting operations. The data-logging equipment recorded the room's light intensity, indoor temperature, indoor relative humidity and outdoor temperature conditions at fifteen-minute intervals. Below are example charts illustrating the results, see **Appendix E** for the source data charts and data-logger placement locations. In addition, several screenshot of the facility's Energy Management System (EMS) were taken during the walkthrough. The EMS screenshots help provide a snapshot of the HVAC equipment settings (Temperature Setpoints, Equipment On/Off Status, etc.).

While this information only provides a brief sample of the indoor conditions, this information is helpful in providing a general understanding of a facility's HVAC and Lighting system operations. Since HVAC and Lighting systems are the major energy using systems in a facility, investigating these systems will help identify energy reduction opportunities. Below are some examples of the information obtained using the data-logging equipment and EMS screenshots. Please note the following images and data was obtained during the months of June and July 2009.

EMS Screenshot
Southwest High School – Hot Water Heating System

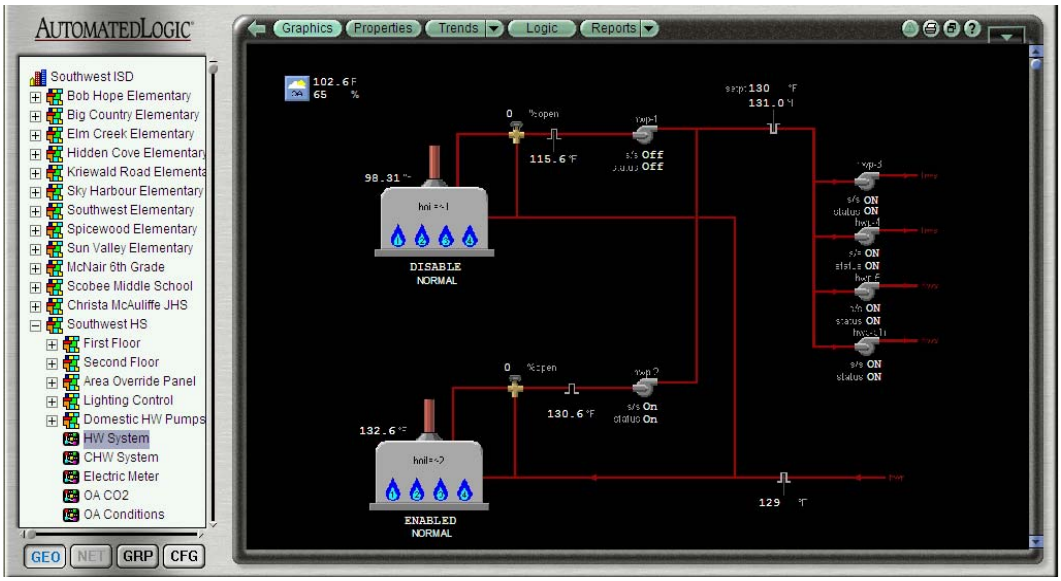


Figure 1. This screenshot of the SWHS Boiler systems was taken during the 2009 summer session. The building's boiler system is supplying near 130°F hot water to the building. **Hot Water Reset Schedule** may be considered. A Hot Water Reset Schedule will modulate the hot water temperature according to the outside ambient temperature, time of day, or other appropriate scheduling variable. Implementing a Hot Water Reset Schedule will help eliminate unnecessary heating losses and reduce both heating and cooling energy.

EMS Screenshot
Southwest HS – Cafetria (AHU-113)

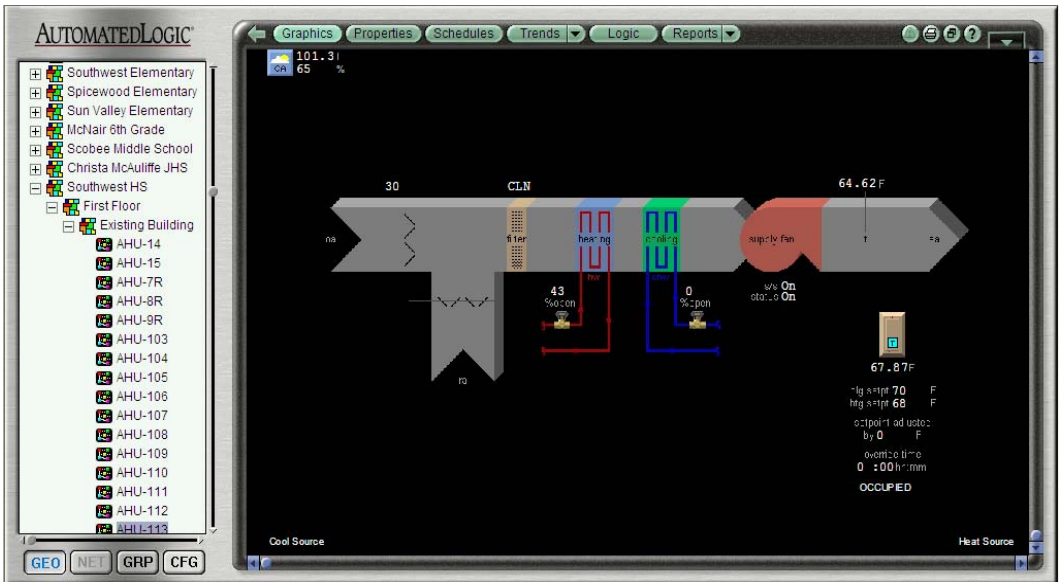


Figure 2a. EMS Screenshot of AHU-113 serving Southwest HS Cafeteria. The image indicates the space temperature is below 68°F, therefore activating the heating valve.

Data-logger Chart
Southwest High School – Cafeteria

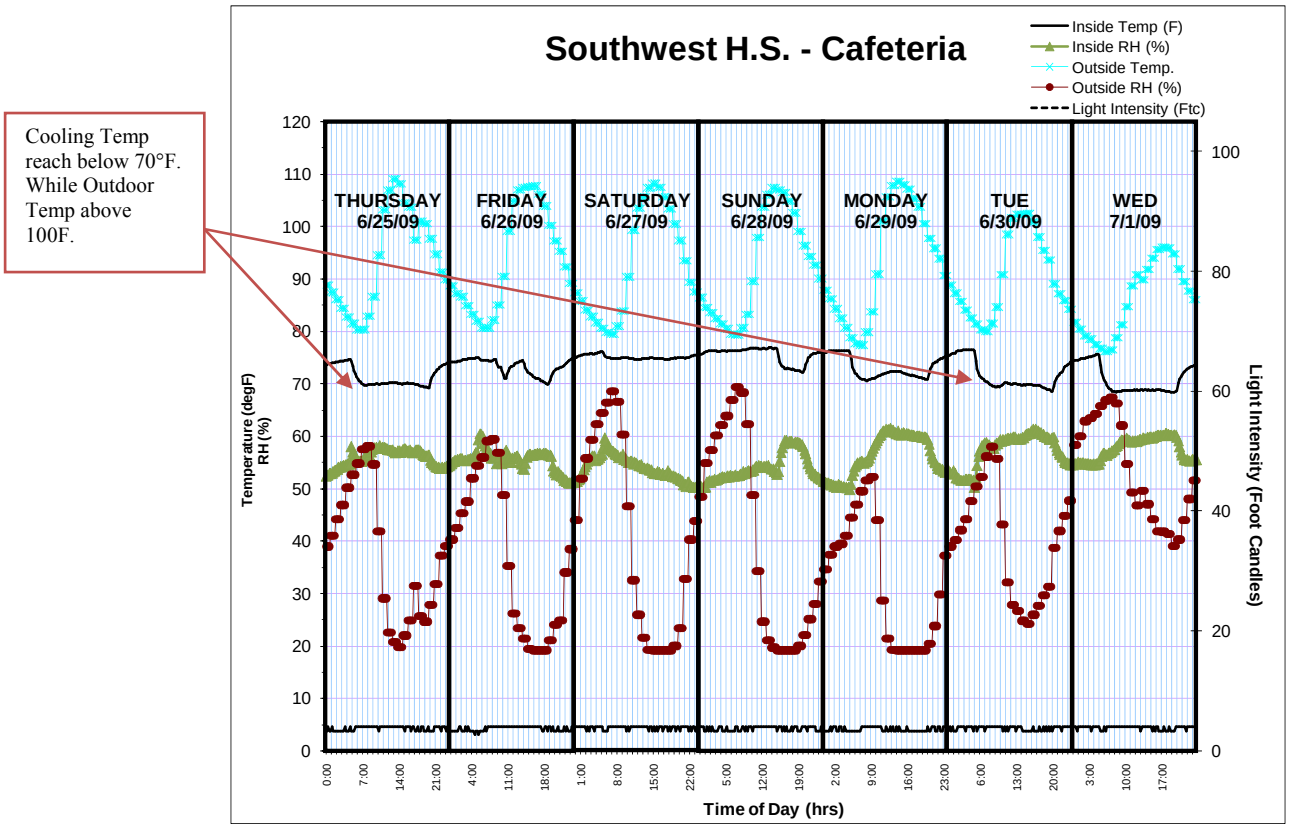


Figure 2c. Data-logging chart of deployed at the Southwest HS Cafeteria, temperatures typically reached below 70°F during daytime hours.

EMS Screenshot
Southwest HS – 1st Floor Science Wing (AHU MZ-1)

Outside Ambient Temp 102.4°F, June 16, 2009 at 3:03Pm.

Economizer/OA Damper appears to be 20% open. Need to verify.

Relatively low CO_2 levels 601.6 ppm indicating adequate ventilation air and/or low occupancy levels.

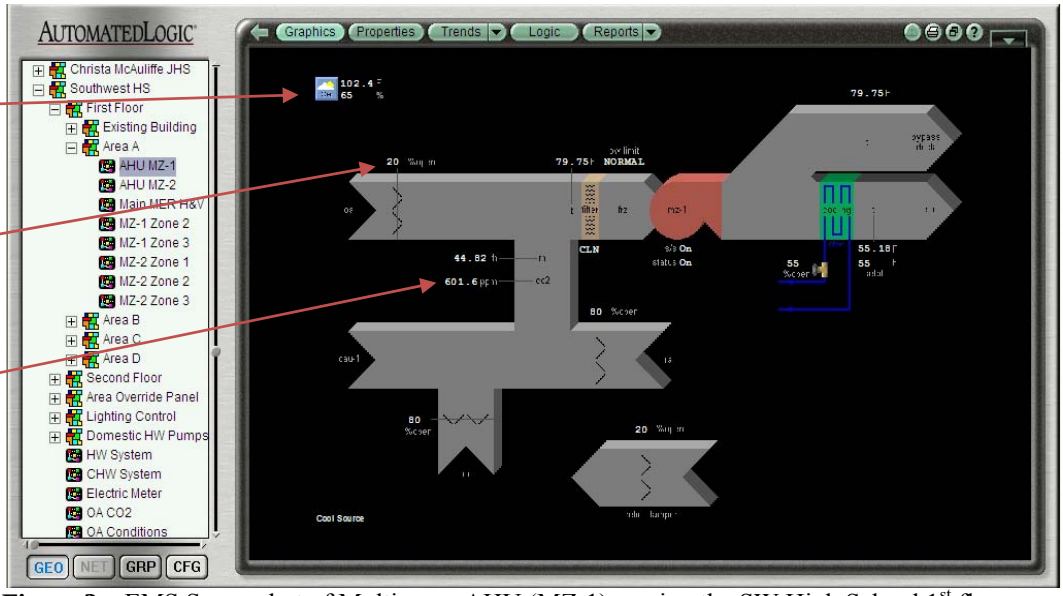


Figure 3a. EMS Screenshot of Multi-zone AHU (MZ-1) serving the SW High School 1st floor Science Wing.

EMS Screenshot
Southwest HS – 1st Floor Science Wing (Rms 303, 304, 306)

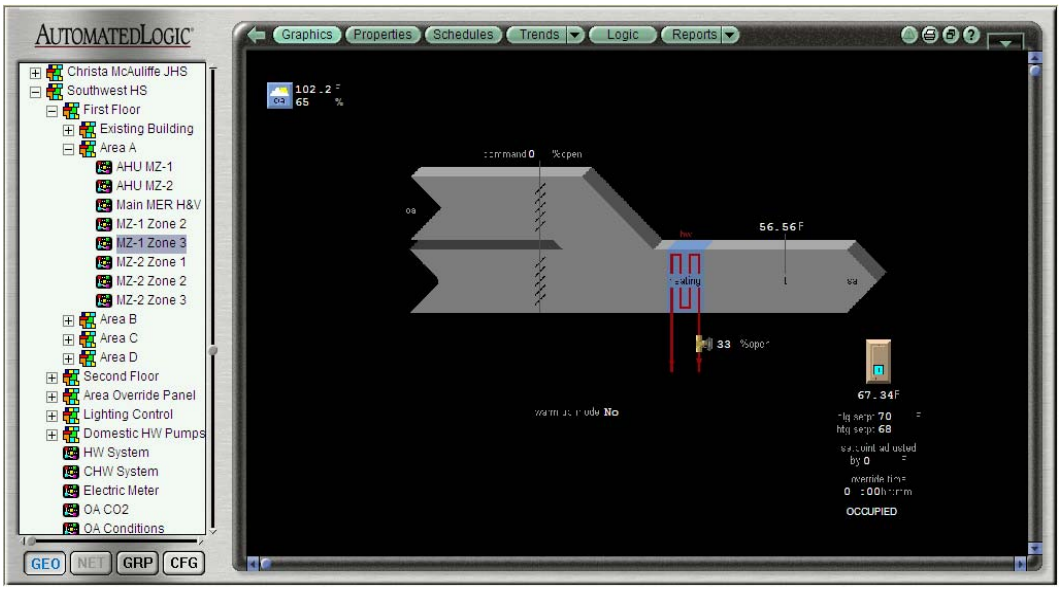


Figure 3b. EMS Screenshot of zone duct heating coil (HWC-1/3). This heating coil receives cold supply air from MZ-1. HWC-1/3 provides heating/cooling to Rms 303, 304, and 306. Temperature is below heating setpoint of **68°F** as a result heating coil is activated.

Data-logger Chart
Southwest HS – 1st Floor Science Wing (Rms 303, 304, 306)

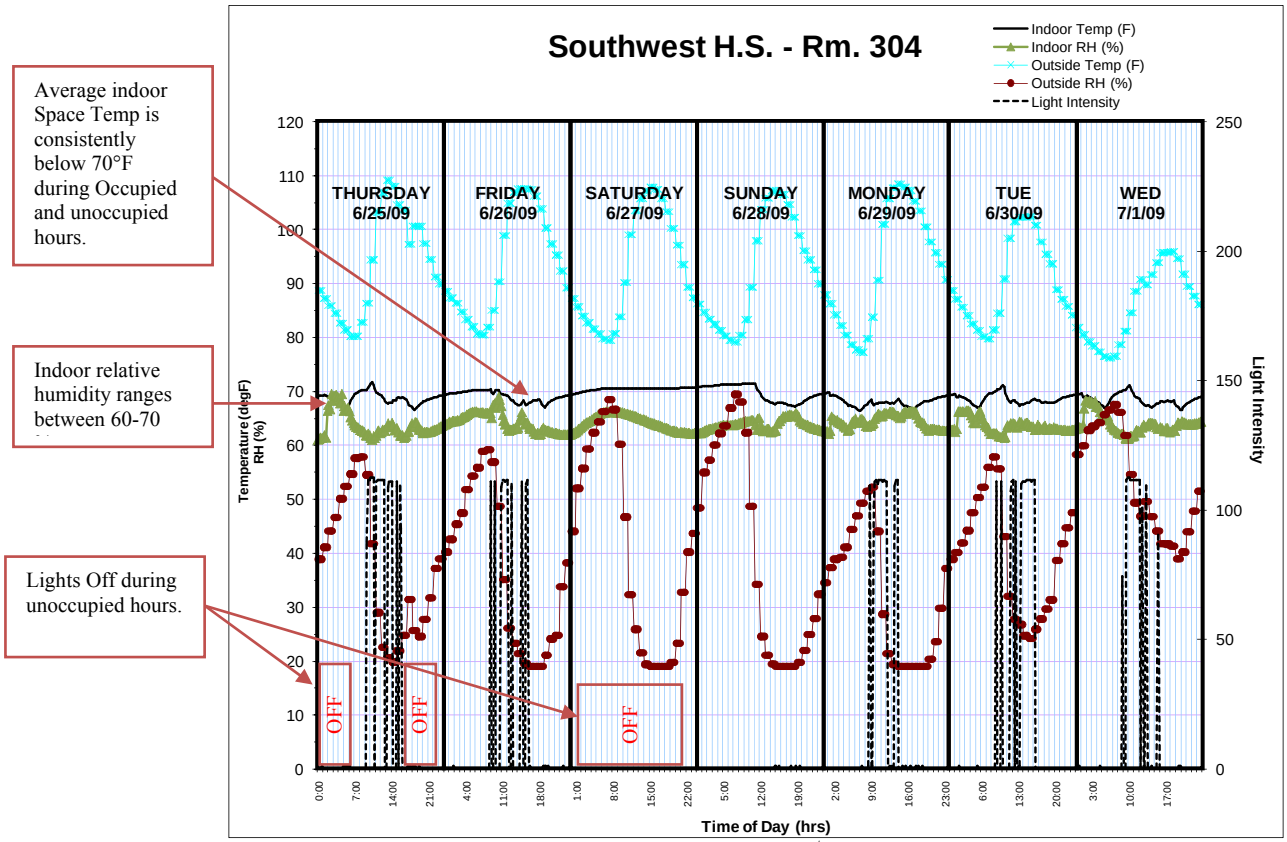


Figure 3c. Data-logger chart of Rm# 304 located in 1st Floor Science Wing. This room is served by MZ-1 and HWC-1/3 previously described in the Figures 3a & 3b. The data-logger data indicated that indoor space temperature was consistently averaging below 70°F during unoccupied and occupied hours. Light intensity indicated the lights were regularly being turned off during unoccupied hours and on weekends. Also, indoor humidity levels appeared to peak during nighttime hours (between 1:00-5:00 am). Further investigation in the outside air system's operation may be necessary.

EMS Screenshot
Southwest HS – Existing Building Classroom Wing (AHU-109)

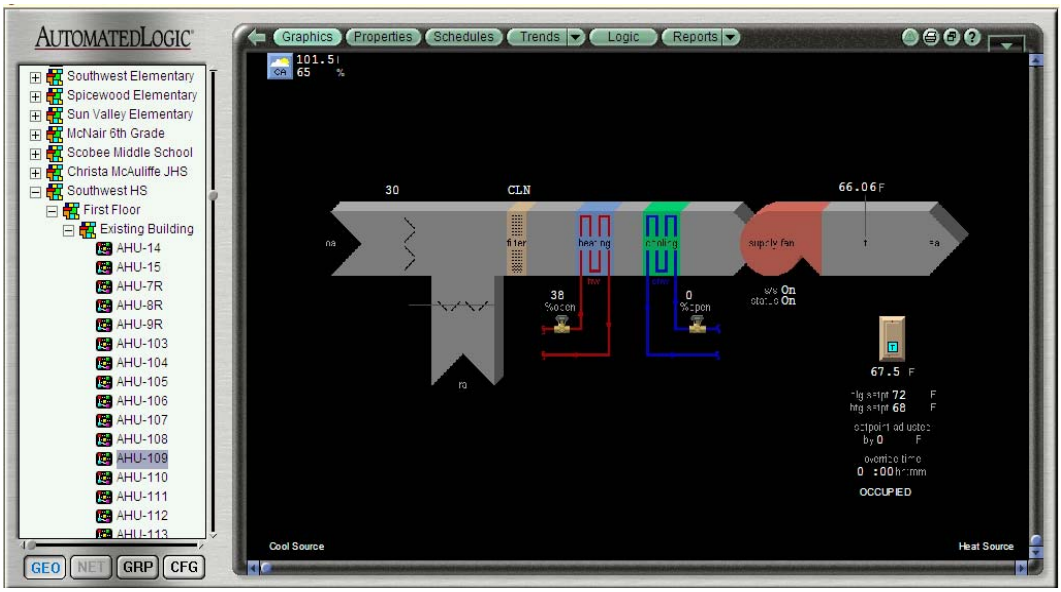


Figure 4. Data-logger chart of Rm# 304 located in 1st Floor Science Wing. This room is served by MZ-1 and HWC-1/3 previously described in the Figures 3a & 3b. The data-logger data indicated that the indoor space temperature was consistently averaging below 70°F during both unoccupied and occupied hours. Light intensity indicated the lights were regularly being turned off during unoccupied hours and on weekends. Also, indoor humidity levels appeared to peak during nighttime hours (between 1:00-5:00 am). Further investigation of the outside air system's operation may be necessary.

Datalogger Chart
Sun Valley Elementary – Administration Office

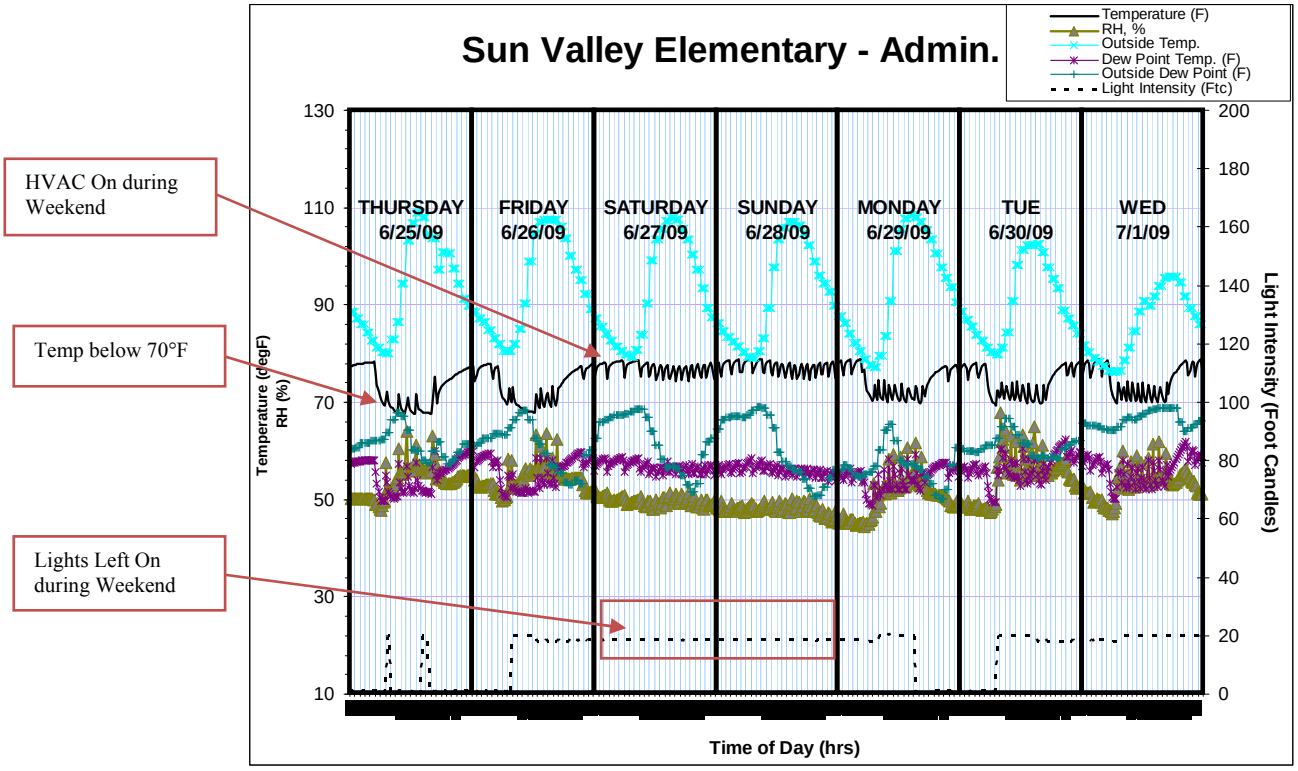


Figure 5. Datalogger Chart of Administration Office in Sun Valley Elementary. It appears the Lights and HVAC was left on during unoccupied periods. Or the HVAC unoccupied temperature is set too low since the unit is excessively cycling on and off during the weekend and nighttime hours.

OBSERVATION SUMMARY OF INDOOR ENVIRONMENT SYSTEMS

During this preliminary assessment, several energy saving opportunities were observed especially dealing with the optimization of the HVAC systems. Preliminary review of the walkthrough data, EMS operations and data recorded from data-logging equipment indicates potential energy reduction and comfort improvement opportunities from implementing a comprehensive building commissioning program specially designed for existing buildings HVAC and Controls optimization.

Please note while this section may seem critical in regards to the District's HVAC controls and operations, it is important to note that the majority of this section was focused on the High School since it exhibited the lowest energy performance amongst the other District's facilities. It was at the request of the District's staff to specifically address what if any energy solutions were available at the High School. Many of the finding were observed using specialized techniques not available to the District. In general, improving the High School's energy performance requires significant resources in terms of capital retrofits along with systems upgrades and optimization (see Section 8.0 and 9.0 for energy opportunities).

7.0 RECOMMENDED MAINTENANCE & OPERATION PROCEDURES

Sound Maintenance and Operation procedures significantly improve annual utility costs, equipment life, and occupant comfort. Generally, maintenance and operation procedural improvements can be made with existing staff and budgetary levels. Below are typical maintenance and operations procedures that have energy savings benefits. **Please note that some of the recommendations noted below are currently being practiced by the District.** With this in mind, the following maintenance and operation procedures should be encouraged/continued to ensure sustainable energy savings.

PUBLICIZE ENERGY CONSERVATION

Promote energy awareness at regular staff meetings, on bulletin boards, and through organizational publications. Publicize energy cost reports showing uptrends and downtrends.

MANAGE SMALL ELECTRICAL EQUIPMENT LOADS

Small electrical equipment loads consists of small appliances/devices such as portable heaters, microwaves, small refrigerators, coffee makers, stereos, cell phone chargers, desk lamps, etc. The District should establish a goal to reduce the number of small appliances and to limit their usage. For example, the use small space heaters should be discouraged; hence, all space heating should be accomplished by the District's main heating system. In addition, many small devices such as radios, printers, and phone chargers can consume energy while not in use. To limit this "stand-by" power usage these devices should be unplugged or plugged into a power strip that can act as a central "turn off" point while not in use. With an effective energy awareness campaign to encourage participation, managing small electrical loads can achieve considerable energy savings.

ESTABLISH HVAC UNIT SERVICE SCHEDULES

Document schedules and review requirements for replacing filters, cleaning condensers, and cleaning evaporators. Include particulars such as filter sizes, crew scheduling, contract availability if needed, etc. Replace filters with standard efficiency pleated units. Generally, appropriate service frequencies are as follows -- filters: monthly; condensers: annually; evaporators: 5 years.

PRE-IDENTIFY PREMIUM EFFICIENCY MOTOR (PEM) REPLACEMENTS

Pre-identify supply sources and PEM stock numbers for all HVAC fan and pump motors so that as failures occur, replacement with PEM units can take place on a routine basis. As funding allows, pre-stock PEM replacements according to anticipated demand, i.e., motors in service more than 10 years, motors in stressful service, and particular motor types that are in service at several locations.

IMPROVE CONTROL OF INTERIOR & EXTERIOR LIGHTING

Establish procedures to monitor use of lighting at times and places of possible/probable unnecessary use: Offices and classes at lunchtime, maintenance shops, closets, parking lots during daylight hours, etc. One or two friendly reminders for minor infractions will usually result in lower electric bills. When sufficient natural light is present, some architectural lighting (i.e. cove lighting, wall sconces, etc.) may be switched off. This process can be accomplished manually by staff member or automatically with the installation of photosensor control. Please note this procedure should ensure minimum lighting levels are maintained during occupied hours. It was noted several schools have skylights and sufficient window openings that may be good candidates for daylighting.

TYPICAL EQUIPMENT MAINTENANCE CHECKLISTS

Effective operation and maintenance of equipment is one of the most cost effective ways to achieve reliability, safety, and efficiency. Failing to maintain equipment can cause significant energy waste and severely decrease the life of equipment. Substantial savings can result from good operation and maintenance procedures. In addition, such procedures require little time and cost to implement. Examples of typical maintenance checklists for common equipment including, boilers, chillers, building controls, pumps, fans, and electric motors, are provided in **Appendix E**. These checklists from the Federal Energy Management Program (FEMP), a branch of the Department of Energy (DOE), are based on industry standards and should supplement, not replace those provided by the manufacturer.

CONTROL OUTSIDE AIR INFILTRATION

Conduct periodic inspections of door and window weather-stripping, and schedule repairs when needed. Additionally, make sure doors and windows are closed during operation of HVAC systems (heating or cooling). Unintended outside air contributes to higher energy consumption and increases occupant discomfort.

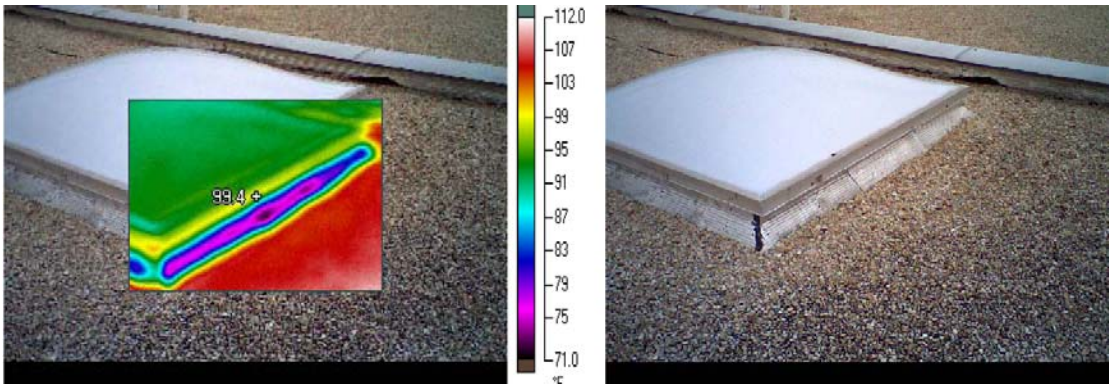
REPLACE INCANDESCENT LAMPS WITH COMPACT FLUORESCENTS

Replace existing incandescent lamps with compact fluorescent lamps as they burn out. Compact fluorescents use 50 to 75 percent less wattage for the same light output, with ten times the operating life of incandescents.

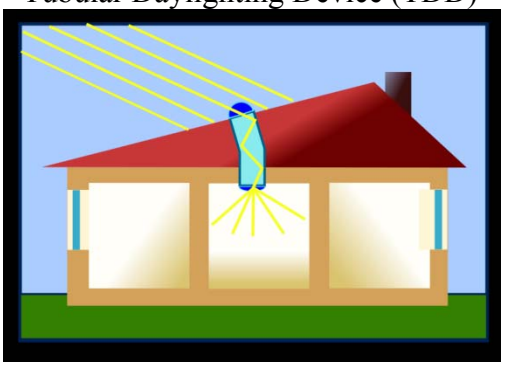
THERMAL IMAGING OF BUILDING SKYLIGHTS

During the preliminary walkthrough a Thermal Imaging Camera was used to take snapshots of exterior views of some of the buildings. Below is a sample thermal image of a skylight at Southwest Elementary. The thermal image indicates the temperature gradient surrounding the Skylight's roofing curb. The temperature varies from 112°F to 75°F (red to magenta). It appears the greatest temperature variation is near the skylights roofing curb which may be due to a thermal break. While this is just a snapshot of a typical skylight, it does reveal that thermal breaks in skylight assemblies may exist. Therefore, in future building projects additional emphasis on the energy implications associated with the thermal properties of a skylight's assembly should be considered. Incorporating natural light, passive solar, or day-lighting technologies in a building offer several energy and indoor environment benefits. Therefore, the District should encourage the continued use of these types of technology (i.e. skylights, light shelves, etc.) in future projects. With this in mind, there are other alternative forms of skylighting systems such as a Tubular Daylighting Device (TDD) which may be considered (see TDD example below).

Southwest Elementary –
Thermal Image of Skylights



Tubular Daylighting Device (TDD)



A TDD consists of roof-mounted light transmitting dome and light reflecting tube that focus the light from the dome through the tube and into the interior space. The TDD allows daylight to enter while minimizing the heat transfer from the roof to the interior.

ENERGY STAR POWER MANAGEMENT

ENERGY STAR Power Management Program promotes placing monitors and computers (CPU, hard drive, etc.) into a low-power "sleep mode" after a period of inactivity. The estimated annual savings can range from $25 to $75 per computer. ENERGY STAR recommends setting computers to enter system standby or hibernate after 30 to 60 minutes of inactivity. Simply touching the mouse or keyboard "wakes" the computer and monitor in seconds. Activating sleep features saves energy, money, and helps protect the environment.

INSTALL ENERGY SAVING DEVICES ON VENDING MACHINE

Install energy saving devices on vending machines with non-perishable food items to reduce the equipment power usage. These devices shut the vending machines down during unoccupied periods. There are several commercially available devices that can be easily installed on existing vending machines. These devices typical have a motion sensor which powers down the equipment after periods of inactivity. For example if the motion sensor does not sense activity within 15 minutes the device will shutdown the vending machine and turn on once motion is sensed. These devices range in price from $100 to $250 and have a typical annual savings of $20 to $150 per vending machine.

PERIODIC ENERGY MANAGEMENT SYSTEM (EMS) VERIFICATION

The District should periodically (at minimum monthly) verify the operating schedules and temperature setting of various HVAC units via each building's Energy Management Systems (EMS). Performing a general inspection and verification of the EMS will ensure the equipment is operating accordingly.

HAIL GUARDS ON CONDENSING AND PACKAGED ROOFTOP UNITS

When an HVAC unit is replaced the District should ensure the new unit be specified with hail guards. The hail guards protect the condensing unit's heat exchanger coils from hail damage. Damage to the condensing unit heat exchangers reduces the efficiency of the units. It is recommended unit(s) with damaged condensing fins be straightened using a fin comb. The picture below is an example of damage condensing coil fins.

Packaged Rooftop Units –
Southwest Elementary

8.0 ENERGY COST REDUCTION MEASURES

Energy cost reduction measures identified during the preliminary analysis are detailed below. **Please note the energy projects described below were identified only for the facilities surveyed.**

REPLACE EXISTING T8 FLUORESCENT LAMPS WITH LOWER WATTAGE LAMPS

Low-wattage T8 fluorescent lamps are available in 30, 28 and 25-watt versions. It is recommended replacing existing 32-watt T8 Fluorescent lamps with lower wattage lamps (where applicable). Changing to a lower wattage T8 Lamp is a relatively straightforward process however, lower wattage T8 lamps do have limitations and are only suitable for certain applications. Lower wattage T8 lamps have reduced lighting levels therefore, it is important to ensure recommended lighting levels are maintained. Lighting levels should be verified prior to and after lamp replacement. In addition, compatibility with existing ballasts, local codes and other requirements must be verified prior to retrofitting. Nevertheless, if suitable for the application, switching to lower wattage T8 lamps will have sustainable energy savings with minimal impact. For example, replacing a 32-watt T8 lamp with a 28-watt T8 lamp will approximately have a 12% lighting energy reduction with only a lighting level drop near 4%.

The estimated costs and savings noted below are based on replacement of existing 32-watt T8 lamps and **does not account for ballast replacements** (if existing ballasts are incompatible) or reduced lamps (if existing lighting levels are above recommended levels). Estimates are based on a preliminary walkthrough of the facilities. A detailed lighting analysis will be required to determine exact cost, quantities and configuration to maximize the energy savings and lighting performance.

LOW-WATTAGE T8 LAMP REPLACEMENT			
Building	**Estimated Implementation Cost**	**Estimated Annual Savings**	**Payback (years)**
Southwest High School*	$108,200	$36,100	3.0
Scobee Middle School*	$39,200	$12,300	3.2
Southwest Elem.*	$19,900	$5,700	3.5
Sun Valley Elem.*	$19,700	$5,600	3.5
Kriewald Road Elem.*	$19,700	$5,600	3.5
TOTAL	**$206,700**	**$65,300**	**3.2**

GYMNASIUM HID TO FLUORESCENT FIXTURE LIGHTING RETROFIT

The Gyms noted in the table below utilize High Intensity Discharge (HID) fixtures to light the Gym. It is recommended that the District replace the existing HID fixtures with fluorescent fixtures suitable for gym applications. Fluorescent fixtures offer improved control and lighting levels, and energy performance. In addition, due to the long re-strike times associated with HID fixtures, they cannot be effectively switched on/off during unoccupied periods. This causes the HID lamps to operate longer, which both consumes more energy and affects lamp life. The cost and savings estimates below are based on preliminary observations and analysis.

GYM LIGHTING REPLACEMENT			
Building	**Estimated Implementation Cost**	**Estimated Annual Savings**	**Payback (years)**
Scobee Middle School*	$28,600	$9,500	3.0
Southwest Elem.*	$5,900	$1,700	3.5
Sun Valley Elem.*	$5,900	$1,700	3.5
TOTAL	**$40,400**	**$12,900**	**3.1**

INSTALLATION OF OCCUPANCY SENSORS FOR INDOOR LIGHTING CONTROL

It is recommended the District consider installing occupancy sensors to improve control of interior lighting. Occupancy sensors will help ensure lights are only on when the space is occupied. The following table below provides an estimated cost and energy savings for the installation of these types of sensors. Please note this estimation is based on a preliminary assessment, exact sensor location, technology (Infrared, Ultrasonic, and Dual Technology) and quantity can be determined during a detailed energy assessment or design phase. In general, enclosed areas with intermittent use, are typically good candidates for occupancy sensors (i.e. hallways, specific classrooms, administration office, break rooms, etc.).

MOTION SENSOR INSTALLATION			
Building	**Estimated Implementation Cost**	**Estimated Annual Savings**	**Payback (years)**
Southwest High School*	$46,600	$7,800	6.0
Scobee Middle School*	$15,800	$2,700	5.9
Southwest Elem.*	$7,900	$1,300	6.1
TOTAL	**$70,300**	**$11,800**	**6.0**

REPLACE HVAC SYSTEMS AND EMS INSTALLATION

Indian Creek Elementary (HVAC Replacement and EMS Installation) – HVAC units to be replaced at Indian Creek Elementary consist of thirty-one (31) Roof-mounted packaged units (RTUs) totaling approximately 215 tons of cooling capacity (average age range 15 to 22 years). The existing AHUs require extensive maintenance and have reached their useful life. In addition, Indian Creek Elementary presently utilizes standard thermostat to control the HVAC equipment. Installing an EMS will help minimize the run time of the units while maintaining comfort throughout the facility. Additionally, EMS can remotely diagnose and document HVAC maintenance problems. The EMS systems proposed in the estimation below will have basic functions such as remote access capabilities, multiple scheduling, space temperature reset, and optimum start/stop features. Replacing the existing inefficient RTUs with new high efficiency RTUs and integrated EMS installation will improve comfort, enhance control, and increase energy performance. The table below summarizes the estimated cost and savings for the HVAC replacement and EMS Installation.

HVAC REPLACEMENT AND EMS INSTALLATION			
Building	**Estimated Implementation Cost**	**Estimated Annual Savings**	**Payback (years)**
Indian Creek Elem.*	$406,000	$17,400	23.3
TOTAL	**$406,000**	**$17,400**	**23.3**

SOUTHWEST HIGH SCHOOL AHU REPLACEMENT

Southwest High School "Original Section" – HVAC units to be replaced at the Southwest High School consist of forty (40) Roof-mounted Air-handling Units (AHU) serving the "Original Section" of the High School. These Roof-mounted AHUs serve the original section of the High School building and are the original units installed in the early eighties (1980s). In addition, they account for approximately the majority of the cooling/heating capacity of the original section. The existing AHUs require extensive maintenance and have reached their useful life. Replacing the existing inefficient AHUs with new high efficiency AHUs will improve comfort, enhance control, and increase energy performance. The table below summarizes the estimated cost and savings for replacing the roof-mounted AHUs serving the Orignial Section of the High School.

SWHS AHU REPLACEMENT			
Building	**Estimated Implementation Cost**	**Estimated Annual Savings**	**Payback (years)**
Southwest High School*	$1,440,000	$55,400	26.0
TOTAL	**$1,440,000**	**$55,400**	**26.0**

UPGRADE ENERGY MANAGEMENT SYSTEM (EMS)

Install/upgrade Direct Digital Control (DDC) Energy Management System (EMS) to provide optimum scheduling and precise temperature supervision for the HVAC systems.

Southwest High School – The majority of High School HVAC equipment is DDC however the High School roof-mounted AHUs serving the "Original Section" are controlled by pneumatically operated controls. It is recommended that these controls be upgraded to a full Direct Digital Control (DDC) system. In addition, EMS upgrades such as installation of Variable frequency drives (VFD), sensor calibration/change out, enhanced control sequences will help facilitate the optimization of the HVAC control system. A full DDC control system along with installed VFDs and enhanced control sequences as recommended by a commissioning assessment program will help improve the overall system's performance. The estimation below is based on preliminary review of existing systems. A detailed energy assessment will identify exact quantities, costs and savings. The table below summarizes the estimated cost and saving for this projects.

EMS UPGRADE			
Building	**Estimated Implementation Cost**	**Estimated Annual Savings**	**Payback (years)**
Southwest High School*	$177,900	$17,800	10.0
TOTAL	**$177,900**	**$17,800**	**10.0**

HVAC SYSTEMS COMMISSIONING (Cx)

Detailed HVAC & Controls systems commissioning in an existing building involves analysis of existing systems to ensure compliance with original set-up/design conditions and where feasible conduct basic research to adjust operating parameters to enhance comfort and reduce energy consumption. For more information regarding building commissioning, the different forms of commissioning, list of certification bodies, typical costs and benefits see **Appendix H**.

Overall, the goal of commissioning is to deliver a facility that operates as it was intended, meets the needs of the building owner and occupants, and provides training of facility operators. To reach this goal it is necessary for the commissioning process to provide documentation and verification of the performance of all building equipment and systems. For the process to work successfully it is equally important to have good communications between all participants (owners, operators and the commissioning agent) and to keep all parties involved and informed of all pertinent decisions.

Preliminary examination (utility data review, discussion with staff, EMS review, data-logging and walkthrough) of the Southwest High School indicate potential for energy cost savings primarily in the HVAC systems operations. This facility would greatly benefit by implementing a comprehensive building Commissioning (Cx) program that ensures the optimization of HVAC systems for the building's existing conditions, works to improve the building air quality, increase comfort levels, and resolve any operating problems. The Commissioning program chosen by the District should require collaborative efforts between the commissioning engineers and the facility staff, and is an ongoing process that continues to both commission the building as well as train the facility staff.

Cx is typically characterized as fast payback, usually 12 - 48 months. Examples include chiller, boiler, air handler and terminal box service and/or operation and sequences verification and adjustment, calibration of control systems and temperature settings, balancing conditioned air and/or chilled water flows etc.

The following is a summary of the High School's major HVAC equipment (based on review of construction drawing provided by the District). Optimization of these systems will be the intent under a comprehensive building commissioning program.

AIR HANDLER UNIT SCHEDULE			
Original Section		New Section	
Mark	CFM	Mark	CFM
AHU 101	7950	MZ-1	14600
AHU 102	1889	MZ-2	16200
AHU 103	5712	MZ-3	15500
AHU 104	6512	MZ-4	17300
AHU 105	5263	PH-1	8300
AHU 106	6765	PH-2	3000
AHU 107	10742	AHU-1	4890
AHU 108	9590	AHU-2	3320
AHU 109	9597	AHU-3	2020
AHU 110	9866	AHU-4	3830
AHU 111	9866	AHU-5	6500
AHU 112	9864	AHU-6	7420
AHU 113	9866	AHU-7,8	4100
AHU 114	2020	AHU-9	9700
AHU 115	1175	AHU-10	9000
AHU 116	1592	AHU-11	9300
AHU 117	3401	AHU-12	8330
AHU 118	4888	AHU-14	5600
AHU 201	6103	AHU-15	2760
AHU 202	8823	AHU-13,16	4900
AHU 203	6930		
AHU 204	6081		
AHU 205	6580		
AHU 206	5633		
AHU 207	5224		
AHU 208	3830		
AHU 209	5432		
AHU 210	6237		
AHU 211	9651		
AHU 212	3880		
AHU 213	1430		
AHU 214	5803		
AHU 215	5059		
AHU 216	5088		
AHU 217	5042		
AHU 218	7125		
Gym RTU-1	5395		
Gym RTU-2	4980		
Gym RTU-3	1940		
Gym RTU-4	4176		

PUMP SCHEDULE				
Mark	Flow (GPM)	HEAD FT.	R.P.M.	HP
HWP-1, HWP-2	460	48	1760	7.5
HWP-3, HWP-5	300	53	1760	7.5
HWP-4	75	50	1760	2
HWP-1R	-	-	-	7.5
CHP-1,2,3,4	760	36	1760	10
CWP-1	2000	25	1160	20
CWP-2	500	55	1760	10
CWP-3	500	40	1760	7.5
CWP-4	600	70	1760	15
CWP-1R	-	-	-	40
CWP-2R,3R	1440	-	-	60
CWP-4R	300	-	-	10
CWP-5	230	50	1760	5

CHILLER SCHEDULE			
Mark	Tons	Flow	Temp In/Out
CH-2,3	300	720	55/45
CH-1,4	340	810	55/45

OUTSIDE AIR UNIT SCHEDULE			
Mark	Type	Supply CFM	Exhaust CFM
OAU-1	ERV	16800	16800

BOILER SCHEDULE	
	MBH
B-1	5025
B-2	5025

At the building level, typical comm issioning measures will look into opportunities to verify and optimize the operations of HVAC e quipment. Detailed commissioning measures at the bu ilding level may include the following:

1. Central Plant Optimization.
   - Select enabled chiller set (and speed, if variable) for best chiller efficiency.
   - Optimize Chilled Water (CHW) flows between chillers for peak combined efficiency.
   - Select each hydronic loop pump set to match the head/flow^2 ratio of that loop.
   - Control each hydronic loop pump relative speed from most open valve and/or highest relative pump speed of downstream tier.
   - Boiler start/stop operation and reset schedule.

2. Optimize AHU operations.
   - Develop base schedule of occupancy (expressed as people count) for each AHU.
   - Develop base optimal start schedule (or optimized start routine, if supported by EMS) for each AHU.
   - Develop means of easily accommodating after-hours use.
   - Develop optimal discharge temperature setpoint routine for each AHU heating and cooling coil.
   - Add or expand economizer cycle use where feasible.
   - Develop minimum ventilation assurance routine. Use CO_2, moisture, or heat to detect occupant count in assembly areas. Use heat/person ratio to set fresh air fraction limits in low-occupant-density areas with little shell load. Use fresh air measurement to control to scheduled occupancy in predictable occupancy areas.
   - Optimize air distribution where necessary.

3. Recalibrate sensors.
   - Temperature: occupied spaces, return air, discharge air, cold and hot deck, outdoor
   - Differential Pressure: primary supply duct – space, space – outdoors, ChWS – ChWR, HWS – HWR.
   - Humidity: occupied spaces, return air, humidifier discharge, outdoor
   - Airflow Measurement: Outdoor intake, supply air, return, relief and exhaust where applicable, zone terminal unit (hot, cold and/or mixed, as applicable).

4. Set up trends for major parameters.
   - Air Temperatures: discharge (cold and hot deck, as applicable), return, zone supply, occupied spaces, outdoor.
   - Duct static pressures.
   - Run status (and speed if variable) for each chiller, AHU and pump
   - kW, Tons, SST & SCT for each chiller
   - Run status and capacity fraction for each boiler.
   - AHU airflows, where available; supply (hot & cold), outdoor intake
   - Hydronic valve opening fractions.
   - Hydronic loop differential pressures, and pump differential pressures where available.
   - Hydronic system flows (as available) directly read or by equipment pressure drop or pump head and speed.

- Hydronic system supply and return temperatures
- Chiller plant load, tons
- Heating plant load, MBH.

5. Identify malfunctioning devices.
   - Failed or disconnected valve and damper actuators.
   - Valves and dampers that do not travel through full range
   - Leaky valves and dampers
   - Disconnected damper linkages.

6. Reprogram control sequences where required
   - Air Handling Systems
   - Terminal Boxes
   - Central Plant (Chillers, Boilers, Cooling Towers, Pumps etc.)

The cost and savings estimates presented here are for a detailed commissioning program. The project implementation duration may vary from a 12 to 18 months period.

The following estimates are based on a preliminary walkthrough, available utility data analysis, and discussion with staff. Project (detailed assessment plan, analysis and implementation), if authorized, would normally be accomplished by an organization/firm with professional engineers specializing in Cx techniques and project implementation. The following table summarizes the implementation costs, annual savings and payback for the above project. Please note this Cx project is dependent upon the EMS upgrades previously discussed in the section as many of the deferred maintenance items will need to be corrected and potential software and hardware upgrades implemented for successful commissioning program.

BUILDING COMMISSIONING (Cx)			
Building	**Estimated Implementation Cost**	**Estimated Annual Savings**	**Payback (years)**
Southwest High School*	$288,500	$82,400	3.5
TOTAL	**$288,500**	**$82,400**	**3.5**

The following table summarizes the implementation costs, annual savings and simple payback for the above projects:

SUMMARY OF ENERGY COST REDUCTION MEASURES			
Project Description	**Estimated Implementation Cost**	**Estimated Annual Savings**	**Payback (years)**
LOW-WATTAGE T8 LAMP REPLACEMENT	$206,700	$65,300	3.2
GYM LIGHTING REPLACEMENT	$40,400	$12,900	3.1
MOTION SENSOR INSTALLATION	$70,300	$11,800	6.0
HVAC REPLACEMENT AND EMS INSTALLATION	$406,000	$17,400	23.3
SWHS AHU REPLACEMENT	$1,440,000	$55,400	26.0
EMS UPGRADE	$177,900	$17,800	10.0
BUILDING COMMISSIONING (Cx)	$288,500	$82,400	3.5
TOTAL:	**$2,629,800**	**$263,000**	**10.0**

The above projects implementation costs and annual savings are estimated based on a preliminary examination of the facilities. Furthermore, maintenance cost savings are not included in this preliminary energy assessment. Final costs will be determined from detailed building assessments, engineering calculations, and contractor estimates

Project design (drawings and specifications), if authorized, would normally be accomplished by professional engineers. Project acquisition (RFQ/RFP, competitive bidding etc.) would be in accordance with District requirements, and construction management would be provided by the engineering group who prepared the drawings and specifications.

9.0 ENERGY MANAGEMENT POLICY

By requesting this study, the District has demonstrated interest in taking a more aggressive approach to energy management. In order to establish an effective Energy Management Program it should have support from top management. An Energy Management Policy adopted by the school board sends a strong signal that energy management is an institutional priority. A formal Energy Management Policy can be as simple as a two-page document that clearly states the District's energy management objectives. The policy should cover items such as:

- who is accountable for energy management
- what your energy savings targets are
- how you will monitor, review and report on progress
- staffing and training to support the policy
- criteria for energy management investment
- working energy efficiency into new capital investments

Along with a clear energy **policy** an energy management **plan** should be developed to ensure sustained energy savings. The energy management plan is a document that details roles, responsibilities, and objectives. Following are key items that should be included in an energy management plan:

1. ESTABLISH ROUTINE ENERGY TRACKING AND REPORTING PROCEDURES Establishing a procedure to monitor energy usage and cost will help identify energy use patterns. The data will also help determine the effectiveness of the Energy Management Program.

2. ESTABLISH AN ENERGY MANAGEMENT STEERING COMMITTEE The Energy Management Steering Committee will include representatives from a cross section of the District. The steering committee will serve as a review board to evaluate all energy management recommendations before adoption and implementation. The steering committee will meet **quarterly or semiannually** to review the District's energy cost and consumption. Regular meetings will ensure the Districts goals are being met prior to the end of the year.

3. PROMOTE ENERGY AWARENESS The energy management steering committee members shall establish a program to publicize the District's energy goals and progress on a **quarterly or semiannually** basis. For example, student drawn posters of the District's energy savings can be placed in hallways. This will encourage student involvement and act as an educational tool. Continuous promotion of the District's goals will ensure the sustainability of the energy management program and help achieve further energy savings.

4. ESTABLISH ACCEPTABLE EQUIPMENT PARAMETERS Establish a District-wide uniform temperature set point for all HVAC units. Having a standard setpoint will help keep HVAC runtimes to a minimum. The following are some suggested temperature settings, however, the district will need to monitor and ensure that other building parameters (humidity levels etc.) are within acceptable limits. Also, areas with special equipment (MDF/IDF, server rooms, etc.) or materials (wood flooring, paper storage, etc.) shall be maintained at the equipment supplier's recommended settings and settings appropriate to the material.

Occupied Cooling Temperature Setpoints:

Instructional Areas	73 F – 76 F
Admin Areas	72 F – 74 F

Unoccupied Cooling Temperature Setpoints:

Instructional Areas	85 F
Admin Areas	85 F

Occupied Heating Temperature Setpoints:

Instructional Areas	67 F – 69 F
Admin Areas	67 F – 69 F

Unoccupied Heating Temperature Setpoints:

Instructional Areas	55 F
Admin Areas	55 F

5. STAFF INCENTIVES AND RECOGNITION PROGRAM Establishing a student, staff, and campus incentive and recognition program would help promote and encourage support from staff and custodial members. The District may consider implementing a staff incentive and recognition program. Following are some program examples.

- The energy accounting system can be used to monitor cost savings and compare it to the base year consumption. An energy incentive plan consisting of a 50-50 sharing with the school campus and the Energy Management Program could be employed. The school would get 50% of the savings resulting from energy cost reduction. The school would be free to use the money for educational programs such as materials, supplies, etc. The other 50% would be used for continuing energy management efforts. The following is an example of the Building savings summary report.

EXAMPLE:

High School - Annual Total Electric Cost

Baseline (2006 - 07)	Current (2007 - 08)	Savings	50% Savings
$248,483	$240,483	$8,000	$4,000

In this example, the High School saved $8,000 where 50% ($4,000) will be assigned to the school. This money would be paid in October of the following fiscal year.

- An energy flag program should be implemented. There would be three energy flags, one flag per each grade level. An energy flag would be awarded to the schools exhibiting the greatest percentage reduction in energy costs. Energy flags would be awarded on a rotating basis each summer. In order to provide motivation, maintain enthusiasm, and recognize individuals doing their part to save the District taxpayers money through the Energy Management Program, the local media (including district newsletters) should be informed of the energy flag results. The energy flags would be awarded in January and August of each year based on the energy consumption of the previous four months.

- The successes of the program should also be communicated to the public through the media to show what the District is doing to reduce costs to taxpayers.

6. NEW BUILDING AND CONSTRUCTION Ensure proper maintenance and operation of energy using equipment in new buildings by required adequate documentation of all systems and control strategies, specifying minimum content of M&O manuals; specifying contractor requirements for cleaning and adjusting equipment prior to occupancy; specifying on-site vendor training for M&O staff; and requiring as-built drawings.

7. ESTABLISH A WATER MANAGEMENT PROGRAM Along with saving energy the District should establish a program to reduce water consumption. The following conservation measures should be employed.

   a. Investigate the use of water conserving faucets, showerheads, and toilets in all new and existing facilities.
   b. Utilize water-pervious materials such as gravel, crushed stone, open paving blocks or previous paving blocks for walkways and patios to minimize runoff and increase infiltration.
   c. Employ Xeriscaping, using native plants that are well suited to the local climate, that are drought-tolerant and do not require supplemental irrigation.
   d. Utilize drip irrigation systems for watering plants in beds and gardens.
   e. Install controls to prevent irrigation when the soil is wet from rainfall.
   f. Establish a routine check of water consuming equipment for leaks and repair equipment immediately.

10.0 FUNDING OPTIONS FOR CAPITAL ENERGY PROJECTS

Institutional organizations have traditionally tapped bond money, maintenance dollars, or federal grants to fund energy-efficient equipment change outs or additions such as energy-efficient lighting systems, high efficiency air conditioning units, and computerized energy management control systems. Today, a broader range of funding options are available. A number of these are listed below.

Texas LoanSTAR Program

The LoanSTAR (Saving Taxes and Resources) Program, which is administered by the State Energy Conservation Office, finances energy-efficient building retrofits at a low interest rate (typically 3 percent). The program's revolving loan mechanism allows borrowers to repay loans through the stream of cost savings realized from the projects. Projects financed by LoanSTAR must have an average simple payback of ten years or less and must be analyzed in an Energy Assessment Report by a Professional Engineer. Upon final loan execution, the School District proceeds to implement funded projects through the traditional bid/specification process. Contact: Eddy Trevino (512/463-1080).

Internal Financing

Improvements can be paid for by direct allocations of revenues from an organization's currently available operating or capital funds (bond programs). The use of internal financing normally requires the inclusion and approval of energy-efficiency projects within an organization's annual operating and capital budget-setting process. Often, small projects with high rate of return can be scheduled for implementation during the budget year for which they are approved. Large projects can be scheduled for implementation over the full time period during which the capital budget is in place. Budget constraints, competition among alternative investments, and the need for higher rates of return can significantly limit the number of internally financed energy-efficiency improvements.

Private Lending Institutions or Leasing Corporations

Banks, leasing corporations, and other private lenders have become increasingly interested in the energy efficiency market. The financing vehicle frequently used by these entities is a municipal lease. Structured like a simple loan, a municipal leasing agreement is usually a lease-purchase arrangement. Ownership of the financed equipment passes to the School District at the beginning of the lease, and the lessor retains a security interest in the purchase until the loan is paid off. A typical lease covers the total cost of the equipment and may include installation costs. At the end of the contract period the lessee pays a nominal amount, usually a dollar, for title to the equipment.

Performance Contracting with an Energy Service Company

Through this arrangement, an energy service company (ESCO) uses third party financing to implement a comprehensive package of energy management retrofits for a facility. This turnkey service includes an initial assessment by the contractor to determine the energy-saving potential for a facility, design work for identified projects, purchase and installation of equipment, and overall project management. The ESCO guarantees that the cost savings generated by the projects will, at a minimum, cover the annual payment due to the ESCO over the term of the contract.

Utility Sponsored Energy Efficiency Incentive Programs

Many of the State's utilities offer energy efficiency incentive programs to offset a portion of the upfront cost associated with energy efficiency measures. The program requirements and incentives range from utility to utility. For example, City Public Service (CPS) Energy provides incentives for efficiency measures such as installation of high efficiency equipment, and lighting upgrades. For further information, contact your utility provider to determine what programs are available in your area.

APPENDICES

APPENDIX A

ENERGY LEGISLATION
(SB12, HB3693 AND SB300)

How to comply with SB12 & HB 3693

What you need to know about Texas Senate Bill 12

The passage of Senate Bill 12 (SB12) by the 80th Texas Legislature signified the continuance of Senate Bill 5 (SB5), the 77th Texas Legislature's sweeping approach in 2001 to clean air and encourage energy efficiency in Texas. SB12 was enacted on September 1, 2007 and was crafted to continue to assist the state and its political jurisdictions to conform to the standards set forth in the Federal Clean Air Act. The bill contains energy-efficiency strategies intended to decrease energy consumption while improving air quality.

All political subdivisions in the 41 non-attainment or near non-attainment counties in Texas are required to:

*1) Adopt a goal to reduce electric consumption by 5 percent each year for six years, beginning September 1, 2007**

2) Implement all cost-effective energy-efficiency measures to reduce electric consumption by existing facilities. (Cost effectiveness is interpreted by this legislation to provide a 20 year return on investment.)

3) Report annually to the State Energy Conservation Office (SECO) on the entity's progress, efforts and consumption data.

*Note: The recommended baseline data for those reporting entities will consist of the jurisdiction's 2006 energy consumption for its facilities and based on the State Fiscal Year (September 1, 2006 to August 31, 2007).

What you need to know about Texas House Bill 3693

The passage of House Bill 3693 (HB3693) by the 80th Texas Legislature is intended to provide additional provisions for energy-efficiency in Texas. Adopted with an effective date of September 1, 2007, HB 3693 is an additional mechanism by which the state can encourage energy-efficiency through various means for School Districts, State Facilities and Political Jurisdictions in Texas.

HB 3693 includes the following state-wide mandates that apply differently according to the nature and origin of the entity:

Record, Report and Display Consumption Data
All Political Subdivisions, School Districts and State-Funded Institutes of Higher Education, are mandated to record and report the entity's metered resource consumption usage data for electricity, natural gas and water on a publically accessible internet page.
Note: The format, content and display of this information are determined by the entity or subdivision providing this information.

Energy Efficient Light Bulbs
All School Districts and State-Funded Institutes of Higher Education shall purchase and use energy-efficient light bulbs in education and housing facilities.

Who must comply?
The provisions in this bill will apply to entities including: Cities and Counties; School Districts; Institutes of Higher Education; State Facilities and Buildings.

How do you define energy-efficiency measures?

Energy-efficiency measures are defined as any facility modifications or changes in operations that reduce energy consumption. Energy-efficiency is a strategy that has the potential to conserve resources, save money** and better the quality of our air. They provide immediate savings and add minimal costs to your project budget.

Examples of energy-efficiency measures include:

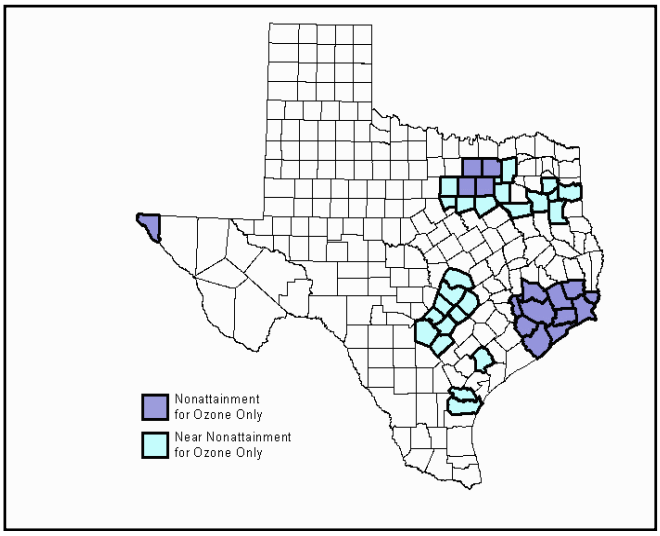
• installation of insulation and high-efficiency windows and doors • modifications or replacement of HVAC systems, lighting fixtures and electrical systems • installation of automatic energy control systems • installation of energy recovery systems or renewable energy generation equipment • building commissioning • development of energy efficient procurement specifications • employee awareness campaigns

***SECO's Preliminary Energy Assessment (PEA) program is an excellent resource for uncovering those energy-efficiency measures that can benefit your organization.*

What counties are affected?

All political jurisdictions located in the following Non-attainment and affected counties:

Bastrop Bexar Brazoria Caldwell Chambers Collin
Comal Dallas Denton El Paso Ellis Fort Bend
Galveston Gregg Guadalupe Hardin Harris Harrison
Hays Henderson Hood Hunt Jefferson Johnson
Kaufman Liberty Montgomery Nueces Orange Parker
Rockwall Rusk San Patricio Smith Tarrant Travis
Upshur Victoria Waller Williamson Wilson



What assistance is available for affected areas?

The Texas Energy Partnership is a partner with Energy Star©, who partners across the nation with the goal of improving building performance, reducing air emissions through reduced energy demand, and enhancing the quality of life through energy-efficiency and renewable energy technologies.

To assist jurisdictions, the Texas Energy Partnership will:

- Present workshops and training seminars in partnership with private industry on a range of topics that include energy services, financing, building technologies and energy performance rating and benchmarking

- Prepare information packages – containing flyers, documents and national lab reports about energy services, management tools and national, state and industry resources that will help communities throughout the region

- Launch an electronic newsletter to provide continuous updates and develop additional information packages as needed

Please contact Stephen Ross at 512-463-1770 for more information.

SECO Program Contact Information

LoanSTAR;
Preliminary Energy Assessments:
Theresa Sifuentes - 512-463-1896
Theresa.Sifuentes@cpa.state.tx.us

Schools Partnership Program:
Glenda Baldwin - 512-463-1731
Glenda.Baldwin@cpa.state.tx.us

Engineering (Codes / Standards):
Felix Lopez - 512-463-1080
Felix.Lopez@cpa.state.tx.us

Innovative / Renewable Energy:
Pamela Groce - 512-463-1889
pam.groce@cpa.state.tx.us

Energy / Housing
Partnership Programs:
Stephen Ross - 512-463-1770
Stephen.Ross@cpa.state.tx.us

Alternate Fuels / Transportation:
Mary-Jo Rowan - 512-463-2637
Mary-Jo.Rowan@cpa.state.tx.us

BILL ANALYSIS

Senate Research Center

S.B. 300
By: Patrick, Dan
Education
7/1/2009
Enrolled

AUTHOR'S / SPONSOR'S STATEMENT OF INTENT

Many independent school districts across Texas are reporting severe financial difficulties due to several factors, including the requirement to fulfill unfunded mandates. These mandates are particularly burdensome to fast-growth school districts. In a difficult economic climate and with dwindling resources, districts are forced to fulfill unnecessary mandates rather than focus on their basic mission, which is to educate students.

S.B. 300 amends current law relating to eliminating or modifying certain mandates on school districts.

RULEMAKING AUTHORITY

This bill does not expressly grant any additional rulemaking authority to a state officer, institution, or agency.

SECTION BY SECTION ANALYSIS

SECTION 1. Amends Section 11.1513(d), Education Code, as follows:

(d) Requires that the employment policy provide that not later than the 10th school day before the date on which a district fills a vacant position for which a certificate or license is required as provided by Section 21.003, other than a position that affects the safety and security of students as determined by the board of trustees, the district is required to provide to each current district employee notice of the position by posting the position on a bulletin board at certain locations or, rather than and, the district's Internet website, if the district has a website, and a reasonable opportunity to apply for the position.

SECTION 2. Amends Section 25.112, Education Code, by amending Subsection (d) and adding Subsections (e)-(g), as follows:

(d) Authorizes the commissioner of education (commissioner), on application of a school district (district), to except the district from the limit in Subsection (a) (relating to the prohibition of more than 22 students enrolled in an elementary school class) if the commissioner finds the limit works an undue hardship on the district. Provides that an exception expires at the end of the school year for which it is granted. Deletes existing text providing that an exception expires at the end of the semester for which it is granted, and prohibiting the commissioner from granting an exception for more than one semester at a time.

(e) Requires a district seeking an exception under Subsection (d) to notify the commissioner and apply for the exception not later than the later of October 1 or the 30th day after the first school day the district exceeds the limit in Subsection (a).

(f) Authorizes the commissioner, if a district repeatedly fails to comply with this section, to take any appropriate action authorized to be taken by the commissioner under Section 39.131 (Sanctions for Districts).

(g) Requires the Texas Education Agency, not later than January 1, 2011, to report to the legislature the number of applications for exceptions under Subsection (d) submitted by

each district and for each application indicate whether the application was granted or denied. Provides that this subsection expires February 1, 2011.

SECTION 3. Amends Section 34.0021, Education Code, by amending Subsections (a) and (b) and adding Subsection (c-1), as follows:

(a) Authorizes, rather than requires, each school district, pursuant to the safety standards established by the Department of Public Safety under Section 34.002, to conduct a training session for students and teachers concerning procedures for evacuating a school bus during an emergency.

(b) Provides that a school district that chooses to conduct a training session under Subsection (a) is encouraged to conduct the school bus emergency evacuation training session in the fall of the school year. Provides that the school district is also encouraged to structure the training session so that the session applies to school bus passengers, a portion of the session occurs on a school bus, and the session lasts for at least one hour. Deletes existing text requiring a school district to conduct the school bus emergency evacuation training at least twice each school year, with one training session occurring in the fall and one training session occurring in the spring. Deletes existing text requiring that a portion of the training session occur on a school bus and requiring the training session to last for at least one hour.

(c-1) Provides that a school district, immediately before each field trip involving transportation by school bus, is encouraged to review school bus emergency evacuation procedures with the school bus passengers, including a demonstration of the school bus emergency exits and the safe manner to exit.

SECTION 4. Amends Section 44.902, Education Code, as follows:

Sec. 44.902. New heading: LONG-RANGE ENERGY PLAN TO REDUCE CONSUMPTION OF ELECTRIC ENERGY. (a) Creates this subsection from existing text. Requires the board of trustees of a district to establish a long-range energy plan to reduce the district's annual electric consumption by five percent beginning with the 2008 state fiscal year and consume electricity in subsequent fiscal years in accordance with the district's energy plan. Deletes existing text requiring the board of trustees of a district to establish a goal to reduce the school district's annual electric consumption by five percent each state fiscal year for six years beginning September 1, 2007.

(b) Requires that the plan required under Subsection (a) include strategies for achieving energy efficiency that result in net savings for the district or can be achieved without financial cost to the district and for each strategy identified under Subdivision (1), the initial, short-term capital costs and lifetime costs and savings that may result from implementation of the strategy.

(c) Requires the board of trustees, in determining under Subsection (b) whether a strategy may result in financial cost to the district, to consider the total net costs and savings that may occur over the seven-year period following implementation of the strategy.

(d) Authorizes the board of trustees to submit the plan required under Subsection (a) to the State Energy Conservation Office for the purposes of determining whether funds available through loan programs administered by the office are available to the district.

SECTION 5. Repealer: Section 44.901(b) (regarding the requirement that the board of trustees establish a goal to reduce electric consumption by five percent each year for six years), Education Code.

SECTION 6. Provides that this Act applies beginning with the 2009-2010 school year.

SECTION 7. Effective date: upon passage or September 1, 2009.

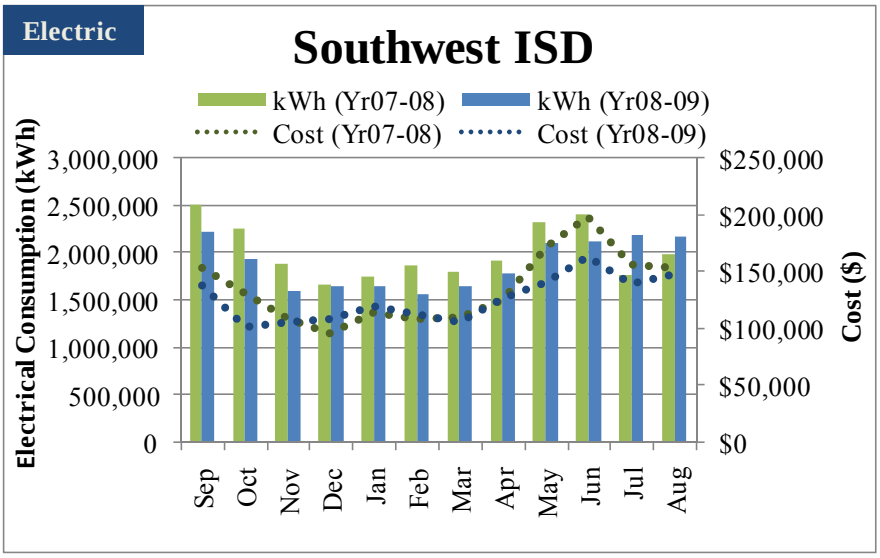
APPENDIX B

SAMPLE UTILITY DATA REPORTING FORM

Southwest ISD - Sample Utility Data Input Form

	ELECTRICITY								
	Consumption			Cost			Avg. Rate		
	FY 07-08 (kWh)	FY 08-09 (kWh)	% Change	FY 07-08 ($)	FY 08-09 ($)	% Change	FY 07-08 ($/kWh)	FY 08-09 ($/kWh)	% Change
Sep	2,506,668	2,222,735	11%	153,371	138,312	10%	$0.061	$0.062	-2%
Oct	2,254,891	1,934,148	14%	130,388	102,074	22%	$0.058	$0.053	9%
Nov	1,888,939	1,605,023	15%	108,449	106,659	2%	$0.057	$0.066	-16%
Dec	1,663,350	1,646,002	1%	95,597	108,420	-13%	$0.057	$0.066	-15%
Jan	1,747,834	1,653,036	5%	114,700	119,732	-4%	$0.066	$0.072	-10%
Feb	1,864,995	1,563,703	16%	108,180	113,575	-5%	$0.058	$0.073	-25%
Mar	1,801,812	1,655,326	8%	109,460	106,684	3%	$0.061	$0.064	-6%
Apr	1,918,928	1,792,799	7%	125,759	126,997	-1%	$0.066	$0.071	-8%
May	2,319,700	2,103,299	9%	171,805	140,365	18%	$0.074	$0.067	10%
Jun	2,410,462	2,123,317	12%	199,175	163,210	18%	$0.083	$0.077	7%
Jul	1,776,239	2,186,541	-23%	155,983	139,100	11%	$0.088	$0.064	28%
Aug	1,983,257	2,173,302	-10%	153,283	148,225	3%	$0.077	$0.068	12%
Total	24,137,075	22,659,231	6%	$1,626,151	$1,513,352	7%	$0.067	$0.067	1%

	Gross Building Area:	
FY 07-08	1,562,918	SF
FY 08-09	1,591,232	SF



APPENDIX C

BASE YEAR CONSUMPTION HISTORY

FY 07-08

Energy Cost and Cosumption Benchmarks												
		Electric			Natural Gas			Total	Total	EUI	ECI	
	Building	KWH/Yr	MMBTU/Yr	$Cost/Yr	MCF/Yr	MMBTU/Yr	$Cost/Yr	$Cost/Yr	MMBTU/Yr	kBTU/SF/Yr	$/SF/Yr	SF
1	Indian Creek Elem.*	855,936	2,921	61,199	356	366	3,696	64,894	3,288	40	0.79	82,610
2	Big Country Elem.	845,760	2,887	63,290	396	408	4,017	67,307	3,294	40	0.82	81,650
3	Elm Creek Elem.	759,183	2,591	57,534	447	461	4,377	61,911	3,052	45	0.91	67,861
4	Kriewald Road Elem.*	858,280	2,929	59,948	191	196	1,975	61,923	3,126	46	0.91	67,861
5	Sky Harbour Elem.	1,421,250	4,851	99,364	254	262	2,615	101,979	5,113	52	1.03	98,620
6	Bob Hope Elem.	675,400	2,305	48,266	310	320	3,709	51,975	2,625	51	1.01	51,272
7	Hidden Cove Elem.	861,698	2,941	62,618	733	755	7,268	69,887	3,696	52	0.98	71,379
8	Sun Valley Elem.*	1,307,904	4,464	90,064	263	271	2,680	92,744	4,734	58	1.13	82,256
9	Southwest Elem.*	1,236,240	4,219	84,683	1,018	1,049	9,266	93,950	5,268	63	1.13	82,974
10	McNair Middle School	1,634,400	5,578	116,515	0	0	0	116,515	5,578	52	1.09	106,471
11	McAuliffe Middle School	1,697,328	5,793	112,243	771	794	7,910	120,153	6,587	52	0.96	125,546
12	Scobee Middle School*	2,376,000	8,109	163,977	2,422	2,495	24,163	188,139	10,604	65	1.15	163,541
13	Southwest High School*	9,607,696	32,791	606,450	7,692	7,923	93,864	700,315	40,714	85	1.46	480,877
		KWH/Yr	MMBTU/Yr	$Cost/Yr	MCF/Yr	MMBTU/Yr	$Cost/Yr	$Cost/Yr	MMBTU/Yr	kBTU/SF/Yr	$/SF/Yr	SF
		24,137,075	82,380	1,626,151	14,854	15,299	165,541	1,791,692	97,679	62	1.15	1,562,918

* Site Visit Performed

District: Southwest ISD

ACCOUNT# E300-0533-017 lectric

300-0533-014 Gas

BUILDING: Indian Creek Elem.*

FLOOR AREA: 82,610

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	83,808				5,692	10	71
October	2007	90,720				5,316	21	162
November	2007	77,472				4,811	24	230
December	2008	57,024				3,414	30	293
January	2008	46,944				3,456	32	303
February	2008	52,704				3,349	83	834
March	2008	63,360				4,522	50	570
April	2008	59,040				3,983	24	275
May	2008	73,440				5,455	27	318
June	2008	101,952				8,184	29	345
July	2008	69,120				6,350	12	151
August	2008	80,352				6,666	14	143
TOTAL		855,936				61,199	355.6	3,696

* Site Visit Performed

Annual Total Energy Cost = 64,894 $/year

Total KWH/yr x 0.003413 = 2,921.31 MMBTU/year

Total MCF/yr x 1.03 = 366.27 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 3,288 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 40 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.79 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

Version 1

District: Southwest ISD

ACCOUNT# E300-0532-492 300-0532-490 300-0532-495 lectric

300-0532-487 Gas

BUILDING: Big Country Elem.

FLOOR AREA: 81,650

		Electrical					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	87,552				5,575	7	51
October	2007	80,832				5,336	15	118
November	2007	60,672				3,782	17	162
December	2008	49,728				3,579	40	383
January	2008	90,816				6,342	106	1,004
February	2008	56,448				3,664	93	926
March	2008	63,552				4,754	52	588
April	2008	62,208				4,484	23	262
May	2008	79,104				6,090	18	212
June	2008	100,416				8,565	13	159
July	2008	53,184				5,504	5	73
August	2008	61,248				5,614	7	80
TOTAL		845,760				63,290	395.7	4,017

Annual Total Energy Cost = 67,307 $/year

Total KWH/yr x 0.003413 = 2,886.58 MMBTU/year

Total MCF/yr x 1.03 = 407.57 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 3,294 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 40 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.82 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-0532-427 300-0532-430 300-1829-780 lectric

066-014-0960-51 Gas

BUILDING: Elm Creek Elem.

FLOOR AREA: 67,861

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	75,359				4,855	12	112
October	2007	74,979				4,960	16	139
November	2007	67,081				4,762	24	245
December	2008	50,025				3,631	136	1,412
January	2008	49,869				3,977	70	669
February	2008	56,880				3,993	78	412
March	2008	56,736				4,712	61	682
April	2008	64,229				4,679	15	201
May	2008	70,877				5,747	2	40
June	2008	100,474				7,809	1	34
July	2008	50,858				4,593	12	167
August	2008	41,816				3,818	21	263
TOTAL		759,183				57,534	447.1	4,377

Annual Total Energy Cost = 61,911 $/year

Total KWH/yr x 0.003413 = 2,591.09 MMBTU/year

Total MCF/yr x 1.03 = 460.51 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 3,052 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 45 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.91 $/SF/year

Electric Utility: CPS

Gas Utility: West Texas

District: Southwest ISD

ACCOUNT# E300-0532-412 300-0532-415 300-1737-356 lectric

300-0532-418 Gas

BUILDING: Kriewald Road Elem.*

FLOOR AREA: 67,861

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	101,893				6,462	5	40
October	2007	91,350				5,355	8	63
November	2007	77,506				4,943	12	120
December	2008	63,863				3,661	21	208
January	2008	57,414				4,036	42	396
February	2008	71,947				4,017	45	459
March	2008	58,718				4,362	20	226
April	2008	60,634				4,088	12	144
May	2008	85,917				6,246	13	159
June	2008	92,788				7,682	9	115
July	2008	43,356				4,242	2	33
August	2008	52,894				4,854	1	11
TOTAL		858,280				59,948	190.5	1,975

* Site Visit Performed

Annual Total Energy Cost = 61,923 $/year

Total KWH/yr x 0.003413 = 2,929.31 MMBTU/year

Total MCF/yr x 1.03 = 196.22 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 3,126 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 46 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.91 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-1740-817 lectric

300-1788-086 Gas

BUILDING: Sky Harbour Elem.

FLOOR AREA: 98,620

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	143,250				9,167	10	71
October	2007	133,500				8,070	14	115
November	2007	126,750				7,714	19	182
December	2008	99,000				5,610	27	260
January	2008	92,250				5,885	35	336
February	2008	98,250				5,737	63	626
March	2008	93,000				6,795	28	315
April	2008	124,500				7,801	17	190
May	2008	123,000				9,070	15	179
June	2008	153,000				12,532	14	174
July	2008	115,500				10,926	9	120
August	2008	119,250				10,059	4	47
TOTAL		1,421,250				99,364	254.4	2,615

Annual Total Energy Cost = 101,979 $/year

Total KWH/yr x 0.003413 = 4,850.73 MMBTU/year

Total MCF/yr x 1.03 = 262.03 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 5,113 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 52 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.03 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-0533-022 300-0532-498 lectric

300-1560-545 Gas

BUILDING: Bob Hope Elem.

FLOOR AREA: 51,272

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	78,000				5,356	9	77
October	2007	72,800				4,609	14	130
November	2007	68,600				4,471	15	170
December	2008	54,000				3,256	31	349
January	2008	47,600				3,313	56	621
February	2008	59,400				3,505	75	873
March	2008	56,800				4,122	40	528
April	2008	54,200				3,724	24	323
May	2008	65,800				5,124	21	284
June	2008	73,400				6,441	18	254
July	2008	24,800				2,600	4	59
August	2008	20,000				1,746	3	41
TOTAL		675,400				48,266	310.3	3,709

Annual Total Energy Cost = 51,975 $/year

Total KWH/yr x 0.003413 = 2,305.14 MMBTU/year

Total MCF/yr x 1.03 = 319.61 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 2,625 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 51 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.01 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-0533-008 300-0533-011 lectric

300-0533-005 Gas

BUILDING: Hidden Cove Elem.

FLOOR AREA: 71,379

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	102,246				6,853	13	94
October	2007	91,779				5,726	18	144
November	2007	78,990				5,199	52	488
December	2008	65,171				3,818	128	1,214
January	2008	57,182				3,953	164	1,540
February	2008	61,204				3,815	213	2,116
March	2008	55,905				4,346	67	763
April	2008	63,568				4,358	31	355
May	2008	74,014				5,630	21	245
June	2008	84,401				7,231	18	215
July	2008	52,657				5,130	2	32
August	2008	74,581				6,559	6	64
TOTAL		861,698				62,618	733.3	7,268

Annual Total Energy Cost = 69,887 $/year

Total KWH/yr x 0.003413 = 2,940.98 MMBTU/year

Total MCF/yr x 1.03 = 755.30 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 3,696 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 52 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.98 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-1601-571 lectric

300-1568-813 Gas

BUILDING: Sun Valley Elem.*

FLOOR AREA: 82,256

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	124,032				7,984	11	77
October	2007	116,736				6,848	14	110
November	2007	99,456				6,241	18	169
December	2008	106,368				6,427	28	271
January	2008	123,648				8,017	49	468
February	2008	123,264				7,022	57	575
March	2008	111,744				7,816	33	381
April	2008	99,456				6,211	19	222
May	2008	104,064				7,533	14	165
June	2008	137,856				11,262	13	163
July	2008	71,808				6,834	3	39
August	2008	89,472				7,868	3	39
TOTAL		1,307,904				90,064	262.6	2,680

* Site Visit Performed

Annual Total Energy Cost = 92,744 $/year

Total KWH/yr x 0.003413 = 4,463.88 MMBTU/year

Total MCF/yr x 1.03 = 270.51 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 4,734 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 58 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.13 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-1244-303 300-0532-468 lectric

066-013-0410-01 Gas

BUILDING: Southwest Elem.*

FLOOR AREA: 82,974

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	98,640				6,688	13	121
October	2007	95,760				5,711	577	4,609
November	2007	104,400				6,370	45	449
December	2008	96,480				5,008	58	612
January	2008	116,640				7,316	112	1,064
February	2008	115,920				6,317	78	770
March	2008	86,400				5,947	52	580
April	2008	95,040				5,950	22	279
May	2008	101,520				7,450	12	92
June	2008	138,240				11,279	6	121
July	2008	100,800				9,406	18	244
August	2008	86,400				7,240	26	324
TOTAL		1,236,240				84,683	1,018.4	9,266

* Site Visit Performed

Annual Total Energy Cost = 93,950 $/year

Total KWH/yr x 0.003413 = 4,219.29 MMBTU/year

Total MCF/yr x 1.03 = 1,048.95 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 5,268 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 63 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.13 $/SF/year

Electric Utility: CPS

Gas Utility: West Texas

District: Southwest ISD

ACCOUNT# E300-053-483 300-0532-462 300-0532-477 lectric

Gas

BUILDING: McNair Middle School

FLOOR AREA: 106,471

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	186,000				11,981	0	0
October	2007	163,800				9,781	0	0
November	2007	138,300				8,733	0	0
December	2008	108,000				6,201	0	0
January	2008	93,900				6,513	0	0
February	2008	112,200				6,578	0	0
March	2008	98,100				7,349	0	0
April	2008	116,400				7,640	0	0
May	2008	131,100				9,917	0	0
June	2008	189,000				15,553	0	0
July	2008	156,300				14,408	0	0
August	2008	141,300				11,860	0	0
TOTAL		1,634,400				116,515	0.0	0

Annual Total Energy Cost = 116,515 $/year

Total KWH/yr x 0.003413 = 5,578.21 MMBTU/year

Total MCF/yr x 1.03 = 0.00 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 5,578 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 52 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.09 $/SF/year

Electric Utility: CPS

Gas Utility:

District: Southwest ISD

ACCOUNT# E300-0533-051 300-0533-048 lectric

300-0533-045 Gas

BUILDING: McAuliffe Middle School

FLOOR AREA: 125,546

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	177,408				10,886	25	184
October	2007	148,235				9,156	36	294
November	2007	133,632				6,942	49	465
December	2008	103,683				6,674	94	891
January	2008	125,571				8,359	125	1,178
February	2008	175,498				9,846	158	1,562
March	2008	117,897				6,477	90	1,015
April	2008	127,493				7,824	50	569
May	2008	161,664				11,066	55	645
June	2008	192,775				14,626	63	751
July	2008	114,816				11,012	15	202
August	2008	118,656				9,373	13	153
TOTAL		1,697,328				112,243	771.3	7,910

Annual Total Energy Cost = 120,153 $/year

Total KWH/yr x 0.003413 = 5,792.98 MMBTU/year

Total MCF/yr x 1.03 = 794.44 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 6,587 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 52 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.96 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-0532-424 lectric

300-0532-421 Gas

BUILDING: Scobee Middle School*

FLOOR AREA: 163,541

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	276,480				16,585	21	158
October	2007	233,280				13,509	28	231
November	2007	208,080				12,842	220	2,021
December	2008	187,200				9,755	357	3,331
January	2008	151,920				9,945	522	4,832
February	2008	151,200				8,958	524	5,129
March	2008	174,960				12,009	391	4,346
April	2008	169,920				10,796	195	2,170
May	2008	196,560				14,087	111	1,286
June	2008	272,880				22,085	33	402
July	2008	167,040				16,722	8	123
August	2008	186,480				16,684	11	134
TOTAL		2,376,000				163,977	2,422.0	24,163

* Site Visit Performed

Energy Use Index:

Annual Total Energy Cost = 188,139 $/year

Total site BTU's/Yr ÷ Total Area (SF) = 65 kBTU/SF/year

Total KWH/yr x 0.003413 = 8,109.29 MMBTU/year

Total MCF/yr x 1.03 = 2,494.66 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 10,604 MMBTU/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.15 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-2045-625 300-0532-433 lectric

066-242-0025-00 Gas

BUILDING: Southwest High School*

FLOOR AREA: 480,877

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2007	972,000				55,288	485	4,125
October	2007	861,120				46,010	652	5,210
November	2007	648,000				31,640	1,215	11,782
December	2008	622,808				34,563	960	9,928
January	2008	694,080				43,587	416	3,939
February	2008	730,080				41,378	1,218	12,673
March	2008	764,640				36,250	460	5,354
April	2008	822,240				54,220	310	4,631
May	2008	1,052,640				78,391	238	3,975
June	2008	773,280				65,927	147	2,678
July	2008	756,000				58,255	736	9,704
August	2008	910,808				60,941	855	19,865
TOTAL		9,607,696				606,450	7,692.3	93,864

* Site Visit Performed

Annual Total Energy Cost = 700,315 $/year

Total KWH/yr x 0.003413 = 32,791.07 MMBTU/year

Total MCF/yr x 1.03 = 7,923.07 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 40,714 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 85 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.46 $/SF/year

Electric Utility: CPS

Gas Utility: West Texas

Energy Cost and Cosumption Benchmarks

		Electric			Natural Gas			Total	Total	EUI	ECI	
	Building	KWH/Yr	MMBTU/Yr	$Cost/Yr	MCF/Yr	MMBTU/Yr	$Cost/Yr	$Cost/Yr	MMBTU/Yr	kBTU/SF/Yr	$/SF/Yr	SF
1	Indian Creek Elem.*	762,585	2,603	54,868	327	337	2,312	57,180	2,940	36	0.69	82,610
2	Big Country Elem.	800,832	2,733	59,280	403	415	2,897	62,177	3,148	39	0.76	81,650
3	Elm Creek Elem.	857,835	2,928	61,331	366	376	3,109	64,440	3,304	40	0.79	82,018
4	Kriewald Road Elem.*	972,449	3,319	68,213	141	145	1,057	69,271	3,464	42	0.84	82,018
5	Sky Harbour Elem.	1,554,000	5,304	104,373	277	285	2,002	106,375	5,589	57	1.08	98,620
6	Bob Hope Elem.**	265,000	904	19,689	336	346	2,845	22,534	1,251	24	0.44	51,272
7	Hidden Cove Elem.	782,384	2,670	57,269	481	496	3,512	60,781	3,166	44	0.85	71,379
8	Sun Valley Elem.*	1,179,264	4,025	83,936	230	237	1,681	85,617	4,262	52	1.04	82,256
9	Southwest Elem.*	973,440	3,322	68,563	481	495	3,981	72,544	3,818	46	0.87	82,974
10	McNair Middle School	1,078,500	3,681	75,435	2,576	2,653	23,129	98,564	6,334	59	0.93	106,471
11	McAuliffe Middle School	1,878,222	6,410	118,054	944	973	6,678	124,732	7,383	59	0.99	125,546
12	Scobee Middle School*	2,412,000	8,232	165,137	1,847	1,903	12,966	178,103	10,135	62	1.09	163,541
13	Southwest High School*	9,142,720	31,204	577,203	12,181	12,546	106,119	683,323	43,751	91	1.42	480,877
		KWH/Yr	MMBTU/Yr	$Cost/Yr	MCF/Yr	MMBTU/Yr	$Cost/Yr	$Cost/Yr	MMBTU/Yr	kBTU/SF/Yr	$/SF/Yr	SF
		22,659,231	77,336	1,513,352	20,591	21,208	172,287	1,685,640	98,544	62	1.06	1,591,232

* Site Visit Performed

** Undergoing renovation

District: Southwest ISD

ACCOUNT# E300-0533-017 lectric

300-0533-014 Gas

BUILDING: Indian Creek Elem.*

FLOOR AREA: 82,610

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	79,449		290		5,198	26	178
October	2008	61,920		274		3,688	25	151
November	2008	48,672		254		3,681	32	264
December	2008	45,504		254		3,518	59	522
January	2009	50,688		254		4,147	49	317
February	2009	48,384		254		3,982	34	193
March	2009	54,720		254		3,916	32	171
April	2009	68,544		276		4,670	26	189
May	2009	74,304		281		5,345	23	176
June	2009	76,608		246		6,153	7	48
July	2009	72,288		222		4,833	4	35
August	2009	81,504		284		5,737	10	67
TOTAL		762,585				54,868	327.3	2,312

Annual Total Energy Cost = 57,180 $/year

Total KWH/yr x 0.003413 = 2,602.70 MMBTU/year

Total MCF/yr x 1.03 = 337.12 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 2,940 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 36 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.69 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

Version 1

District: Southwest ISD

ACCOUNT# E300-0532-492 300-0532-490 300-0532-495 lectric

300-0532-487 Gas

BUILDING: Big Country Elem.

FLOOR AREA: 81,650

		Electrical					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	76,416		321		5,424	18	121
October	2008	72,192		276		4,181	27	164
November	2008	52,800		266		4,000	40	327
December	2008	50,304		266		3,787	115	1,021
January	2009	54,912		266		4,537	87	563
February	2009	58,176		266		4,655	29	168
March	2009	59,712		266		4,318	36	192
April	2009	84,480		305		5,724	17	125
May	2009	80,256		313		5,960	13	104
June	2009	61,056		254		5,409	2	16
July	2009	68,160		268		5,082	5	14
August	2009	82,368		326		6,204	13	83
TOTAL		800,832				59,280	402.8	2,897

Annual Total Energy Cost = 62,177 $/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 39 kBTU/SF/year

Total KWH/yr x 0.003413 = 2,733.24 MMBTU/year

Total MCF/yr x 1.03 = 414.88 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 3,148 MMBTU/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.76 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-0532-427 300-0532-430 300-1829-780 lectric

066-014-0960-51 Gas

BUILDING: Elm Creek Elem.

FLOOR AREA: 82,018

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	88,722		305		5,805	21	263
October	2008	76,180		279		4,280	27	273
November	2008	60,141		245		4,216	35	312
December	2008	68,885		251		4,608	76	672
January	2009	67,148		245		5,044	79	700
February	2009	67,145		276		5,144	47	319
March	2009	66,727		259		4,518	26	170
April	2009	64,997		325		5,741	17	130
May	2009	84,218		311		6,017	17	111
June	2009	63,292		216		5,214	2	22
July	2009	64,925		228		4,577	4	36
August	2009	85,455		314		6,167	16	101
TOTAL		857,835				61,331	365.5	3,109

Annual Total Energy Cost = 64,440 $/year

Total KWH/yr x 0.003413 = 2,927.79 MMBTU/year

Total MCF/yr x 1.03 = 376.47 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 3,304 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 40 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.79 $/SF/year

Electric Utility: CPS

Gas Utility: West Texas

District: Southwest ISD

ACCOUNT# E300-0532-412 300-0532-415 300-1737-356 lectric

300-0532-418 Gas

BUILDING: Kriewald Road Elem.*

FLOOR AREA: 82,018

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	86,382		337		5,785	6	43
October	2008	71,889		311		4,236	6	42
November	2008	66,161		274		4,561	10	90
December	2008	71,363		274		4,746	37	331
January	2009	73,627		274		5,425	29	194
February	2009	71,877		317		5,523	17	98
March	2009	71,597		285		4,823	16	89
April	2009	88,284		351		5,969	7	55
May	2009	104,990		354		7,208	7	58
June	2009	86,545		300		7,109	1	11
July	2009	97,776		297		6,486	1	15
August	2009	81,958		363		6,340	4	30
TOTAL		972,449				68,213	141.0	1,057

* Site Visit Performed

Annual Total Energy Cost = 69,271 $/year

Total KWH/yr x 0.003413 = 3,318.97 MMBTU/year

Total MCF/yr x 1.03 = 145.23 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 3,464 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 42 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.84 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-1740-817 lectric

300-1788-086 Gas

BUILDING: Sky Harbour Elem.

FLOOR AREA: 98,620

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	133,500		410		8,513	15	102
October	2008	120,750		447		6,837	19	119
November	2008	96,000		347		6,442	23	187
December	2008	117,750		361		7,459	69	611
January	2009	132,000		386		9,300	55	357
February	2009	119,250		377		8,456	22	128
March	2009	113,250		379		7,366	25	135
April	2009	147,750		414		9,231	15	110
May	2009	137,250		382		9,218	12	92
June	2009	159,750		419		12,577	9	60
July	2009	130,500		371		8,808	4	35
August	2009	146,250		448		10,167	11	67
TOTAL		1,554,000				104,373	276.8	2,002

Annual Total Energy Cost = 106,375 $/year

Total KWH/yr x 0.003413 = 5,303.80 MMBTU/year

Total MCF/yr x 1.03 = 285.10 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 5,589 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 57 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.08 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# Electric 300-0533-002 300-0532-498

300-1560-545 Gas

BUILDING: B ob Hope Elem.**

FLOOR AREA: 51,272

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	59,000		223		4,066	23	179
October	2008	47,200		216		2,970	31	217
November	2008	23,000		216		1,775	44	419
December	2008	25,000		216		1,912	103	1,062
January	2009	21,600		216		1,834	68	510
February	2009	24,000		216		2,008	28	187
March	2009	25,000		216		1,913	34	213
April	2009	17,200		216		1,343	5	57
May	2009	5,400		13		414	0	0
June	2009	5,200		15		485	0	0
July	2009	5,400		18		445	0	0
August	2009	7,000		20		523	0	0
TOTAL		265,000				19,689	336.1	2,845

** Undergoing renovations.

Annual Total Energy Cost = 22,534 $/year

Total KWH/yr x 0.003413 = 904.45 MMBTU/year

Total MCF/yr x 1.03 = 346.18 MMBTU/year

Total Other x _____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 1,251 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 24 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.44 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-0533-008 300-0533-011 lectric

300-0533-005 Gas

BUILDING: Hidden Cove Elem.

FLOOR AREA: 71,379

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	88,496		323		5,974	17	114
October	2008	60,038		261		3,654	25	154
November	2008	47,499		251		3,567	72	581
December	2008	52,343		251		3,890	138	1,220
January	2009	54,149		251		4,394	101	650
February	2009	54,099		251		4,333	41	229
March	2009	58,728		251		4,165	44	233
April	2009	78,700		300		5,410	16	121
May	2009	74,893		302		5,600	13	102
June	2009	72,922		251		6,114	2	18
July	2009	76,024		258		5,401	4	34
August	2009	64,493		316		4,767	9	55
TOTAL		782,384				57,269	481.4	3,512

Annual Total Energy Cost = 60,781 $/year

Total KWH/yr x 0.003413 = 2,670.28 MMBTU/year

Total MCF/yr x 1.03 = 495.84 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 3,166 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 44 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.85 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-1601-571 300-0533-033 lectric

300-1568-813 Gas

BUILDING: Sun Valley Elem.*

FLOOR AREA: 82,256

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	107,520		339		6,964	14	95
October	2008	91,392		319		5,113	13	82
November	2008	96,768		396		6,816	21	177
December	2008	103,680		471		7,517	52	466
January	2009	104,448		496		8,533	54	348
February	2009	82,560		454		6,786	19	110
March	2009	94,848		448		6,995	17	92
April	2009	102,144		353		6,831	13	97
May	2009	119,040		342		8,112	12	98
June	2009	81,408		244		6,654	3	26
July	2009	95,232		255		6,394	4	33
August	2009	100,224		340		7,219	9	57
TOTAL		1,179,264				83,936	230.2	1,681

* Site Visit Performed

Annual Total Energy Cost = 85,617 $/year

Total KWH/yr x 0.003413 = 4,024.83 MMBTU/year

Total MCF/yr x 1.03 = 237.11 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 4,262 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 52 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.04 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-1244-303 300-0532-468 lectric

066-013-0410-01 Gas

BUILDING: Southwest Elem.*

FLOOR AREA: 82,974

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	99,360		319		6,421	26	324
October	2008	82,800		302		4,667	25	250
November	2008	77,760		302		5,343	51	443
December	2008	80,640		302		5,433	114	998
January	2009	85,680		302		6,343	81	712
February	2009	70,560		302		5,472	50	338
March	2009	69,840		302		4,949	48	311
April	2009	84,240		302		5,656	22	167
May	2009	85,680		293		6,079	23	146
June	2009	77,040		280		6,529	14	97
July	2009	79,200		270		5,614	7	58
August	2009	80,640		323		6,058	21	136
TOTAL		973,440				68,563	480.8	3,981

* Site Visit Performed

Annual Total Energy Cost = 72,544 $/year

Total KWH/yr x 0.003413 = 3,322.35 MMBTU/year

Total MCF/yr x 1.03 = 495.22 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 3,818 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 46 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.87 $/SF/year

Electric Utility: CPS

Gas Utility: West Texas

District: Southwest ISD

ACCOUNT# E300-053-483 300-0532-462 300-0532-477 lectric

Gas

BUILDING: McNair Middle School

FLOOR AREA: 106,471

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	148,200		492		9,776	642	8,611
October	2008	120,000		445		6,906	0	0
November	2008	98,100		438		7,182	0	0
December	2008	83,100		438		6,303	455	4,029
January	2009	18,900		438		1,680	340	3,017
February	2009	17,100		438		1,514	258	1,724
March	2009	17,400		438		1,411	243	1,546
April	2009	17,100		438		1,400	184	1,309
May	2009	32,100		219		2,680	184	1,132
June	2009	132,600		327		10,447	93	598
July	2009	209,100		458		13,420	84	604
August	2009	184,800		525		12,717	93	560
TOTAL		1,078,500				75,435	2,576.0	23,129

* Under Contractor possession prior to November 2008.

Annual Total Energy Cost = 98,564 $/year

Total KWH/yr x 0.003413 = 3,680.92 MMBTU/year

Total MCF/yr x 1.03 = 2,653.28 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 6,334 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 59 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.93 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-0533-051 300-0533-048 lectric

300-0533-045 Gas

BUILDING: McAuliffe Middle School

FLOOR AREA: 125,546

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	190,090		474		10,972	52	355
October	2008	151,307		440		7,488	64	394
November	2008	125,962		392		7,784	121	969
December	2008	130,953		393		7,934	194	1,703
January	2009	141,724		399		9,548	165	1,051
February	2009	134,792		410		9,139	94	526
March	2009	138,624		437		8,521	94	495
April	2009	159,360		483		9,767	49	356
May	2009	163,968		532		11,021	44	339
June	2009	191,616		437		13,931	23	167
July	2009	170,496		372		10,151	18	143
August	2009	179,330		530		11,799	27	178
TOTAL		1,878,222				118,054	944.4	6,678

Annual Total Energy Cost = 124,732 $/year

Total KWH/yr x 0.003413 = 6,410.37 MMBTU/year

Total MCF/yr x 1.03 = 972.73 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 7,383 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 59 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 0.99 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-0532-424 lectric

300-0532-421 Gas

BUILDING: Scobee Middle School*

FLOOR AREA: 163,541

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	213,120		757		13,605	48	332
October	2008	202,320		575		10,952	149	880
November	2008	146,880		575		10,804	273	2,162
December	2008	151,200		575		10,916	472	4,104
January	2009	159,840		575		12,550	382	2,399
February	2009	159,120		575		12,364	166	908
March	2009	169,200		575		11,681	213	1,085
April	2009	241,920		815		15,231	74	528
May	2009	231,120		811		15,911	36	285
June	2009	232,560		690		18,016	4	49
July	2009	252,000		674		15,822	9	86
August	2009	252,720		847		17,285	22	148
TOTAL		2,412,000				165,137	1,847.2	12,966

* Site Visit Performed

Annual Total Energy Cost = 178,103 $/year

Total KWH/yr x 0.003413 = 8,232.16 MMBTU/year

Total MCF/yr x 1.03 = 1,902.62 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 10,135 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 62 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.09 $/SF/year

Electric Utility: CPS

Gas Utility: CPS

District: Southwest ISD

ACCOUNT# E300-2045-625 300-0532-433 lectric

066-242-0025-00 Gas

BUILDING: Southwest High School*

FLOOR AREA: 480,877

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
September	2008	852,480		2,303		49,809	855	19,865
October	2008	776,160		2,125		37,102	1,063	10,132
November	2008	665,280		2,058		40,487	1,207	10,315
December	2008	665,280		2,101		40,397	1,671	14,525
January	2009	688,320		2,026		46,398	1,773	15,434
February	2009	656,640		2,026		44,198	1,216	7,915
March	2009	715,680		2,026		42,109	939	5,809
April	2009	638,080		2,405		50,023	987	6,833
May	2009	910,080		2,425		56,798	828	4,939
June	2009	882,720		2,132		64,573	612	3,798
July	2009	865,440		2,036		52,066	506	3,519
August	2009	826,560		2,347		53,243	524	3,037
TOTAL		9,142,720				577,203	12,181.0	106,119

* Site Visit Performed

Annual Total Energy Cost = 683,323 $/year

Total KWH/yr x 0.003413 = 31,204.10 MMBTU/year

Total MCF/yr x 1.03 = 12,546.43 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 43,751 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 91 kBTU/SF/year

Energy Cost Index:

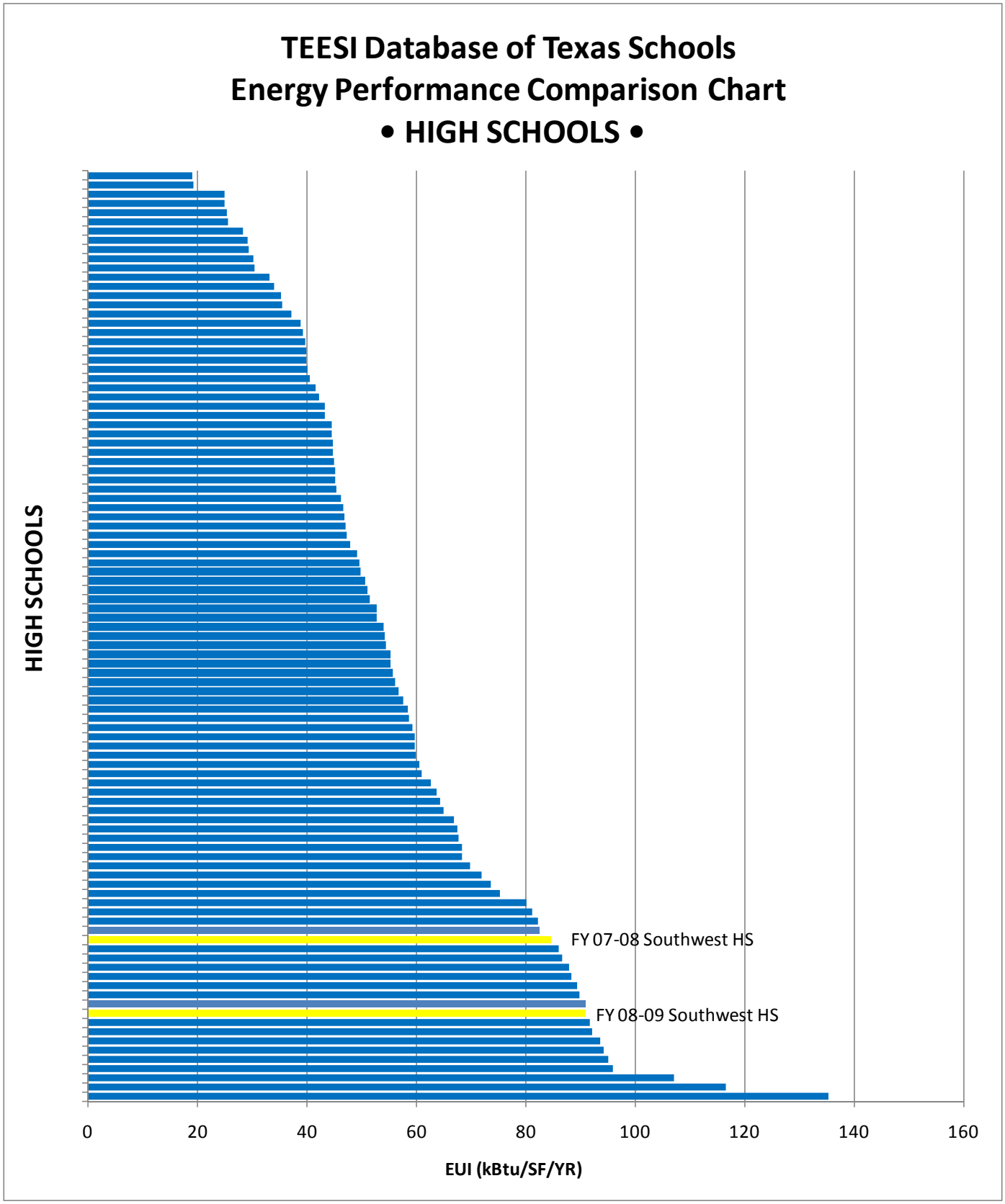
Total Energy Cost/Yr ÷ Total Area (SF) = 1.42 $/SF/year

Electric Utility: CPS

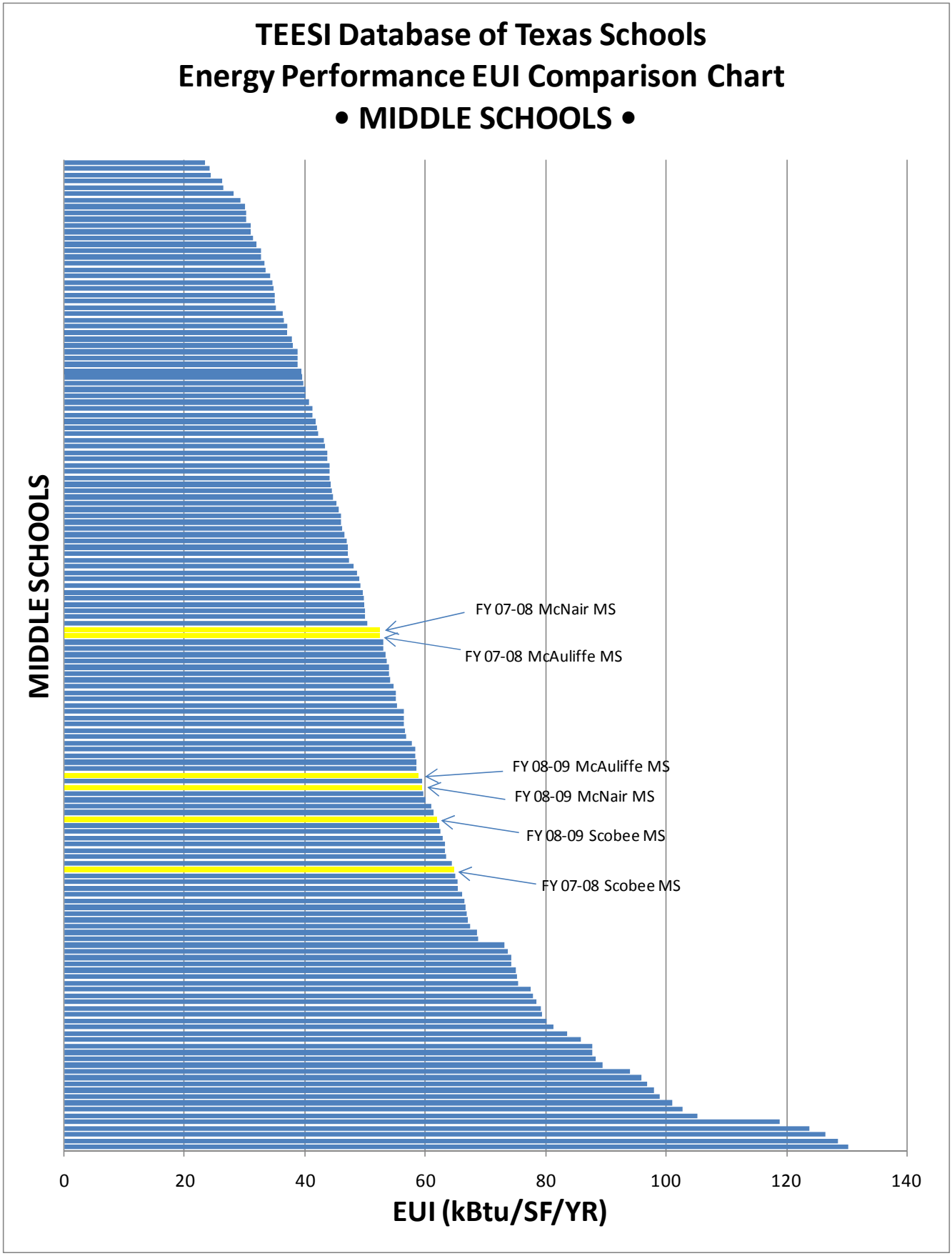
Gas Utility: West Texas

APPENDIX D

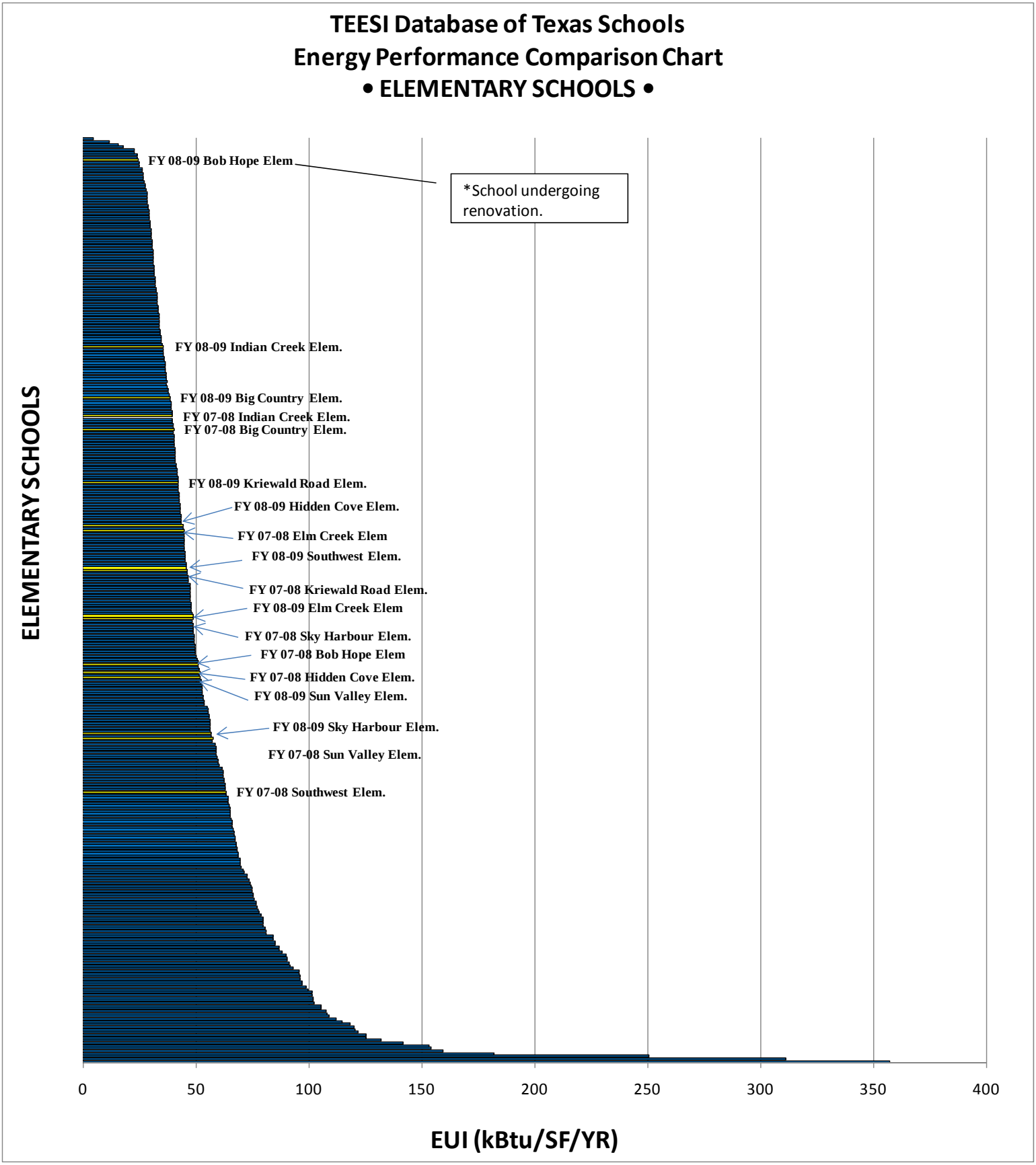
ENERGY PERFORMANCE COMPARISON CHARTS



(The chart above is a comparison of EUIs based on sample data from TEESI's database of Texas Schools)



(The chart above is a comparison of EUIs based on sample data from TEESI's database of Texas Schools)



(The chart above is a comparison of EUIs based on sample data from TEESI's database of Texas Schools)

APPENDIX E

TYPICAL EQUIPMENT MAINTENANCE CHECKLISTS

9.2.9 Boilers Checklist

Description	Comments	Maintenance Frequency			
		Daily	Weekly	Monthly	Annually
Boiler use/sequencing	Turn off/sequence unnecessary boilers	X			
Overall visual inspection	Complete overall visual inspection to be sure all equipment is operating and safety systems are in place	X			
Follow manufacturer's recommended procedures in lubricating all components	Compare temperatures with tests performed after annual cleaning	X			
Check steam pressure	Is variation in steam pressure as expected under different loads? Wet steam may be produced if the pressure drops too fast	X			
Check unstable water level	Unstable levels can be a sign of contaminates in feedwater, overloading of boiler, equipment malfunction	X			
Check burner	Check for proper control and cleanliness	X			
Check motor condition temperatures	Check for proper function	X			
Check air temperatures in boiler room	Temperatures should not exceed or drop below design limits	X			
Boiler blowdown	Verify the bottom, surface and water column blow downs are occurring and are effective	X			
Boiler logs	Keep daily logs on: • Type and amount of fuel used • Flue gas temperature • Makeup water volume • Steam pressure, temperature, and amount generated Look for variations as a method of fault detection	X			
Check oil filter assemblies	Check and clean/replace oil filters and strainers	X			
Inspect oil heaters	Check to ensure that oil is at proper temperature prior to burning	X			
Check boiler water treatment	Confirm water treatment system is functioning properly	X			
Check flue gas temperatures and composition	Measure flue gas composition and temperatures at selected firing positions - recommended O2% and CO2% Fuel / O2 % / CO2% Natural gas / 1.5 / 10 No. 2 fuel oil / 2.0 / 11.5 No. 6 fuel oil / 2.5 / 12.5 Note: percentages may vary due to fuel composition variations		X		

Description	Comments	Maintenance Frequency			
		Daily	Weekly	Monthly	Annually
Check all relief valves	Check for leaks		X		
Check water level control	Stop feedwater pump and allow control to stop fuel flow to burner. Do not allow water level to drop below recommended level.		X		
Check pilot and burner assemblies	Clean pilot and burner following manufacturer's guidelines. Examine for mineral or corrosion buildup.		X		
Check boiler operating characteristics	Stop fuel flow and observe flame failure. Start boiler and observe characteristics of flame.		X		
Inspect system for water/ steam leaks and leakage opportunities	Look for: leaks, defective valves and traps, corroded piping, condition of insulation		X		
Inspect all linkages on combustion air dampers and fuel valves	Check for proper setting and tightness		X		
Inspect boiler for air leaks	Check damper seals		X		
Check blowdown and water treatment procedures	Determine if blowdown is adequate to prevent solids buildup			X	
Flue gases	Measure and compare last month's readings flue gas composition over entire firing range			X	
Combustion air supply	Check combustion air inlet to boiler room and boiler to make sure openings are adequate and clean			X	
Check fuel system	Check pressure gauge, pumps, filters and transfer lines. Clean filters as required.			X	
Check belts and packing glands	Check belts for proper tension. Check packing glands for compression leakage.			X	
Check for air leaks	Check for air leaks around access openings and flame scanner assembly.			X	
Check all blower belts	Check for tightness and minimum slippage.			X	
Check all gaskets	Check gaskets for tight sealing, replace if do not provide tight seal			X	
Inspect boiler insulation	Inspect all boiler insulation and casings for hot spots			X	
Steam control valves	Calibrate steam control valves as specified by manufacturer			X	
Pressure reducing/regulating valves	Check for proper operation			X	

Description	Comments	Maintenance Frequency			
		Daily	Weekly	Monthly	Annually
Perform water quality test	Check water quality for proper chemical balance			X	
Clean waterside surfaces	Follow manufacturer's recommendation on cleaning and preparing waterside surfaces				X
Clean fireside	Follow manufacturer's recommendation on cleaning and preparing fireside surfaces				X
Inspect and repair refractories on fireside	Use recommended material and procedures				X
Relief valve	Remove and recondition or replace				X
Feedwater system	Clean and recondition feedwater pumps. Clean condensate receivers and deaeration system				X
Fuel system	Clean and recondition system pumps, filters, pilot, oil preheaters, oil storage tanks, etc.				X
Electrical systems	Clean all electrical terminals. Check electronic controls and replace any defective parts.				X
Hydraulic and pneumatic valves	Check operation and repair as necessary				X
Flue gases	Make adjustments to give optimal flue gas composition. Record composition, firing position, and temperature.				X
Eddy current test	As required, conduct eddy current test to assess tube wall thickness				X

9.4.8 Chillers Checklist

Description	Comments	Maintenance Frequency			
		Daily	Weekly	Semi-Annually	Annually
Chiller use/sequencing	Turn off/sequence unnecessary chillers	X			
Overall visual inspection	Complete overall visual inspection to be sure all equipment is operating and safety systems are in place	X			
Check setpoints	Check all setpoints for proper setting and function	X			
Evaporator and condenser coil fouling	Assess evaporator and condenser coil fouling as required		X		
Compressor motor temperature	Check temperature per manufacturer's specifications		X		
Perform water quality test	Check water quality for proper chemical balance		X		
Leak testing	Conduct leak testing on all compressor fittings, oil pump joints and fittings, and relief valves		X		
Check all insulation	Check insulation for condition and appropriateness		X		
Control operation	Verify proper control function including: • Hot gas bypass • Liquid injection		X		
Check vane control settings	Check settings per manufacturer's specification			X	
Verify motor load limit control	Check settings per manufacturer's specification			X	
Verify load balance operation	Check settings per manufacturer's specification			X	
Check chilled water reset settings and function	Check settings per manufacturer's specification			X	
Check chiller lockout setpoint	Check settings per manufacturer's specification				X
Clean condenser tubes	Clean tubes at least annually as part of shutdown procedure				X

Building Controls Checklist

Description	Comments	Maintenance Frequency			
		Daily	Weekly	Semi-Annually	Annually
Overall visual inspection	Complete overall visual inspection to be sure all equipment is operating and safety systems are in place	X			
Verify control schedules	Verify in control software that schedules are accurate for season, occupancy, etc.	X			
Verify setpoints	Verify in control software that setpoints are accurate for season, occupancy, etc.	X			
Time clocks	Reset after every power outage	X			
Check all gauges	Check all gauges to make sure readings are as expected		X		
Control tubing (pneumatic system)	Check all control tubing for leaks		X		
Check outside air volumes	Calculated the amount of outside air introduced and compare to requirements		X		
Check setpoints	Check setpoints and review rational for setting		X		
Check schedules	Check schedules and review rational for setting		X		
Check deadbands	Assure that all deadbands are accurate and the only simultaneous heating and cooling is by design		X		
Check sensors	Conduct thorough check of all sensors - temperature, pressure, humidity, flow, etc. - for expected values			X	
Time clocks	Check for accuracy and clean			X	
Calibrate sensors	Calibrate all sensors: temperature, pressure, humidity, flow, etc.				X

Description	Comments	Daily	Weekly	Monthly	Annually
Pump use/sequencing	Turn off/sequence unnecessary pumps	X			
Overall visual inspection	Complete overall visual inspection to be sure all equipment is operating and safety systems are in place	X			
Check lubrication	Assure that all bearings are lubricated per the manufacture's recommendation			X	
Check packing	Check packing for wear and repack as necessary. Consider replacing packing with mechanical seals.			X	
Motor/pump alignment	Aligning the pump/motor coupling allows for efficient torque transfer to the pump			X	
Check mountings	Check and secure all pump mountings			X	
Check bearings	Inspect bearings and drive belts for wear. Adjust, repair, or replace as necessary.				X
Motor condition	Checking the condition of the motor through temperature or vibration analysis assures long life				X

Fans Checklist

Description	Comments	Maintenance Frequency			
		Daily	Weekly	Monthly	Annually
System use/sequencing	Turn off/sequence unnecessary equipment	X			
Overall visual inspection	Complete overall visual inspection to be sure all equipment is operating and safety systems are in place	X			
Observe belts	Verify proper belt tension and alignment			X	
Inspect pulley wheels	Clean and lubricate where required			X	
Inspect dampers	Confirm proper and complete closure control; outside air dampers should be airtight when closed			X	
Observe actuator/linkage control	Verify operation, clean, lubricate, adjust as needed			X	
Check fan blades	Validate proper rotation and clean when necessary			X	
Filters	Check for gaps, replace when dirty - monthly			X	
Check for air quality anomalies	Inspect for moisture/growth on walls, ceilings, carpets, and in/outside of duct-work. Check for musty smells and listen to complaints.			X	
Check wiring	Verify all electrical connections are tight				X
Inspect ductwork	Check and refasten loose connections, repair all leaks				X
Coils	Confirm that filters have kept clean, clean as necessary				X
Insulation	Inspect, repair, replace all compromised duct insulation				X

Electric Motors Checklist

Description	Comments	Maintenance Frequency			
		Daily	Weekly	Monthly	Annually
Motor use/sequencing	Turn off/sequence unnecessary motors	X			
Overall visual inspection	Complete overall visual inspection to be sure all equipment is operating and safety systems are in place	X			
Motor condition	Check the condition of the motor through temperature or vibration analysis and compare to baseline values		X		
Check lubrication	Assure that all bearings are lubricated per the manufacture's recommendation			X	
Check packing	Check packing for wear and repack as necessary. Consider replacing packing with mechanical seals.			X	
Motor alignment	Aligning the motor coupling allows for efficient torque transfer to the pump			X	
Check mountings	Check and secure all motor mountings			X	
Check terminal tightness	Tighten connection terminals as necessary			X	
Cleaning	Remove dust and dirt from motor to facilitate cooling			X	
Check bearings	Inspect bearings and drive belts for wear. Adjust, repair, or replace as necessary.				X
Motor condition	Checking the condition of the motor through temperature or vibration analysis assures long life				X
Check for balanced three-phase power	Unbalanced power can shorten the motor life through excessive heat build up				X
Check for over-voltage or under-voltage conditions	Over- or under-voltage situations can shorten the motor life through excessive heat build up				X

APPENDIX F

LOANSTAR INFORMATION

Texas LoanSTAR Program

FACTS ABOUT LoanSTAR

The State of Texas LoanSTAR (Saving Taxes and Resources) Program finances energy efficient facility up-grades for state agencies, public schools, institutions of higher education, local governments, municipalities, and hospitals. The program's revolving loan mechanism allows participants to borrow money and repay all project costs through the stream of **cost savings** produced.

ELIGIBLE PROJECTS

Up-grades financed through the program include, but are not limited to, (1) energy efficient lighting systems; (2) high efficiency heating, ventilation and air conditioning systems; (3) energy management systems; (4) boiler efficiency improvements; (5) energy recovery systems; (6) building shell improvements; and (7) load management projects. The prospective borrower hires a Professional Engineer to analyze the potential energy efficient projects that will be submitted for funding through the Loan STAR Program. All engineering costs are covered under the program.

PROGRAM REQUIREMENTS

Once the projects are analyzed and the prospective borrower agrees with the recommended projects, the engineer prepares an Energy Assessment Report (EAR) with the project descriptions and calculations. The EAR must be prepared according to the LoanSTAR Technical Guidelines. The EAR is reviewed and approved by the State Energy Conservation Office (SECO) technical staff before project financing is authorized. Projects financed by LoanSTAR must have an average simple payback of ten years or less. Borrowers do, however, have the option of buying down paybacks to meet the composite ten-year limit.

To ensure up-grade projects are designed and constructed according to the EAR, SECO performs a review of the design documents at the 50% and 100% completion phases. On-site construction monitoring is also performed at the 50% and 100% completion phases.

SAVINGS VERIFICATION

To ensure that the Borrower is achieving the estimated energy savings, monitoring and verification is required for all LoanSTAR funded projects. The level of monitoring and verifications may range from utility bill analysis to individual system or whole building metering depending on the size and type of retrofit projects. If whole building metering is required, metering and monitoring cost can be rolled into the loan.

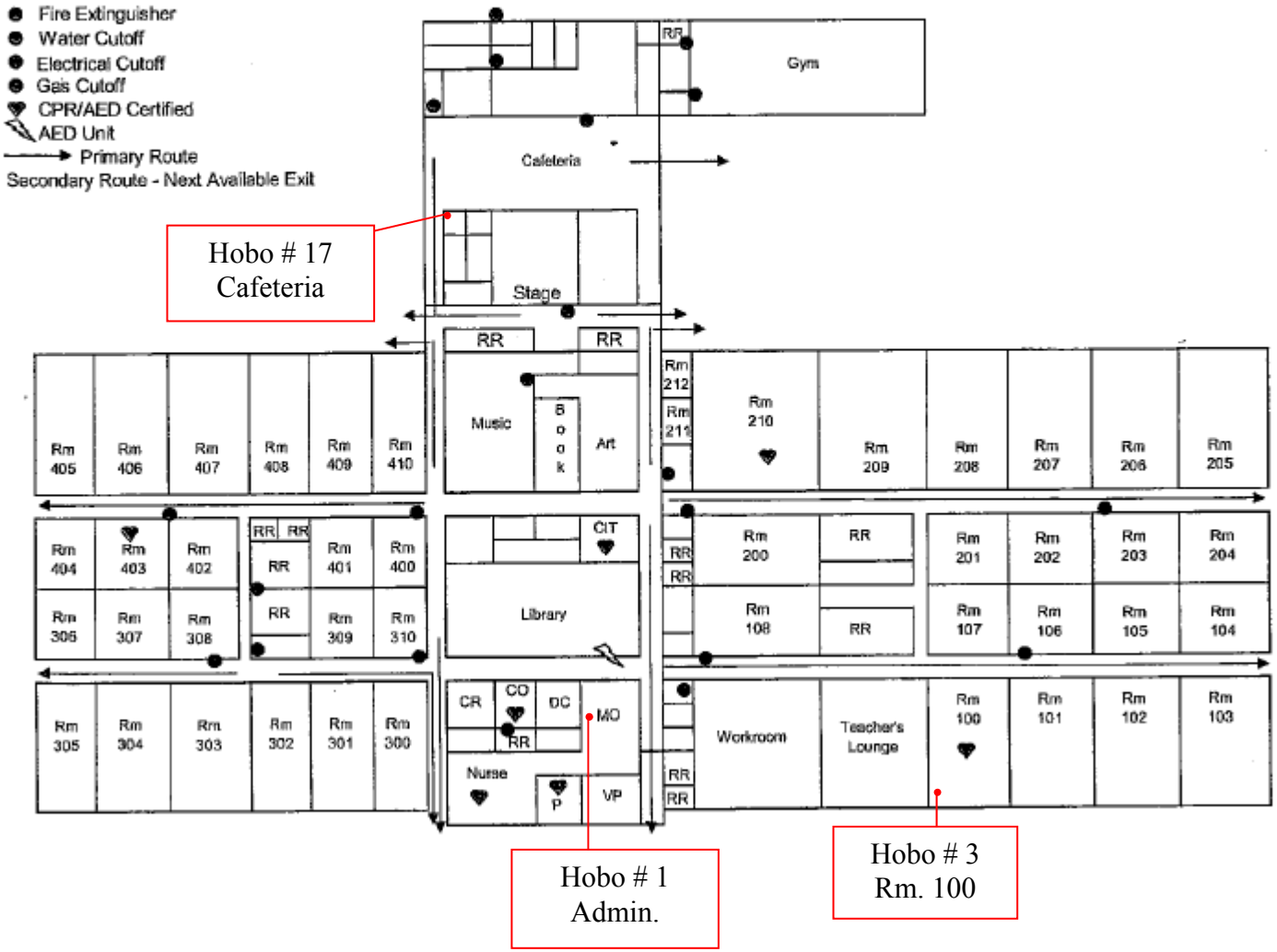
For additional information regarding the
LoanSTAR program, please contact:

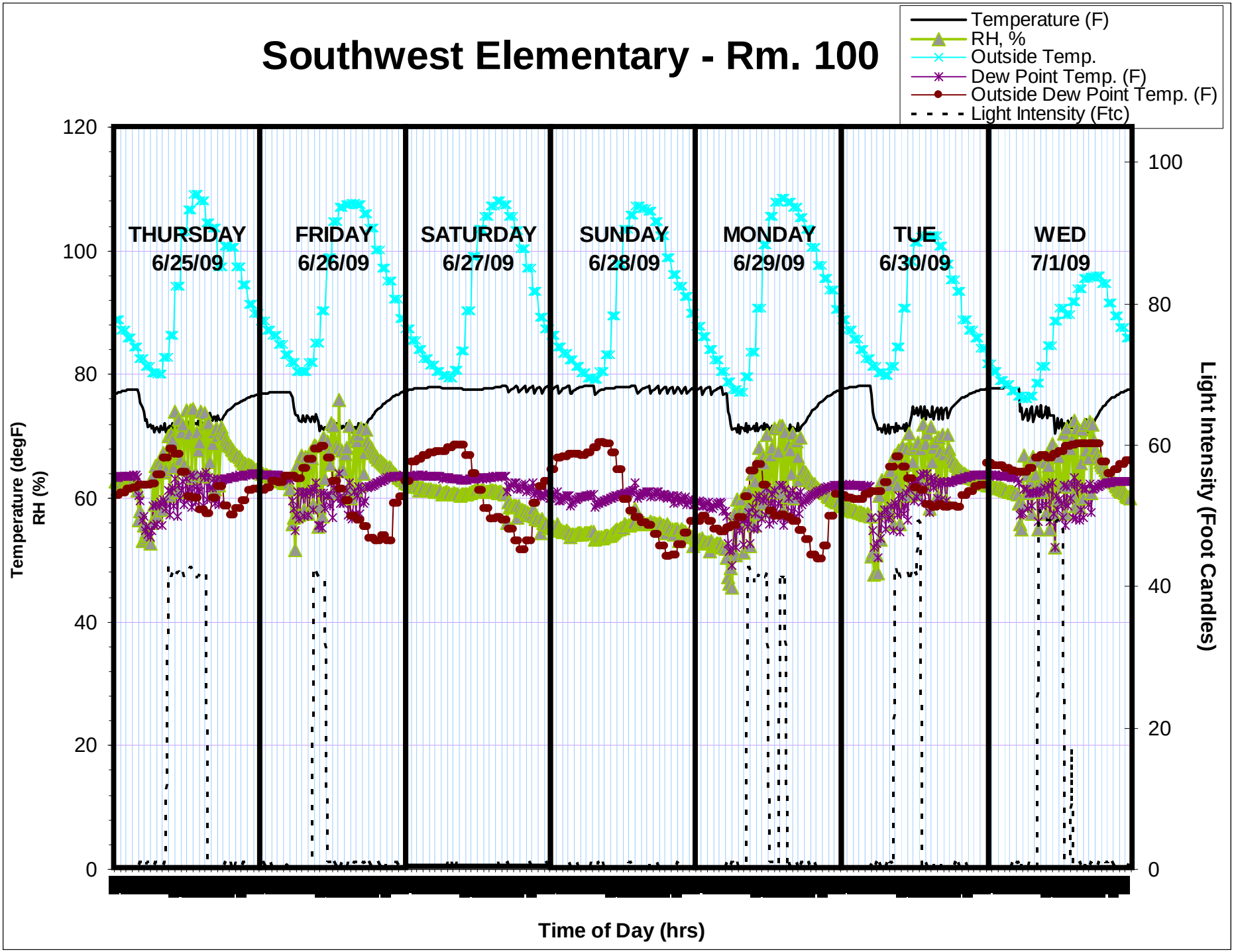
Eddy Trevino
SECO, LoanSTAR Program Manager
(512) 463-1080

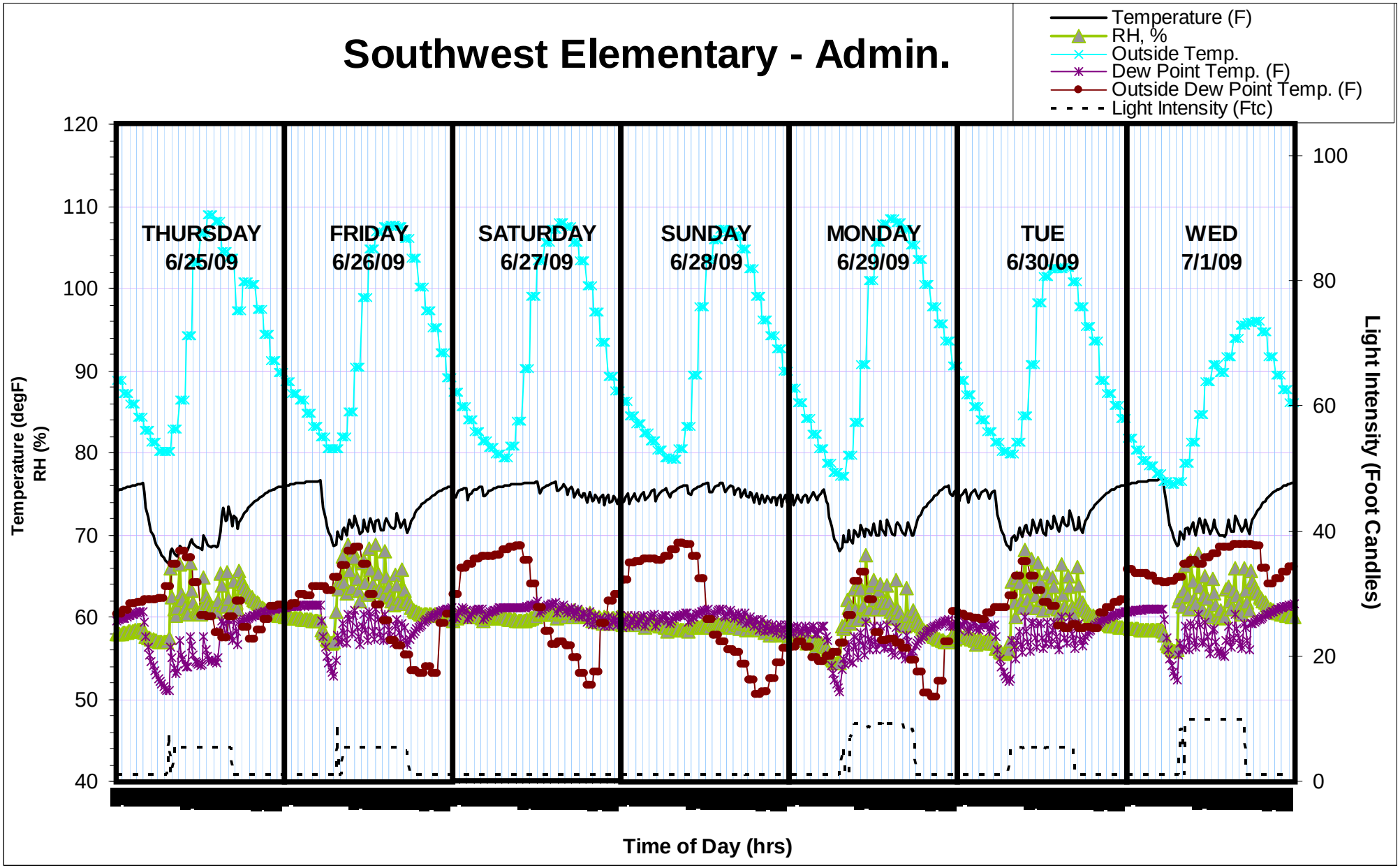
APPENDIX G

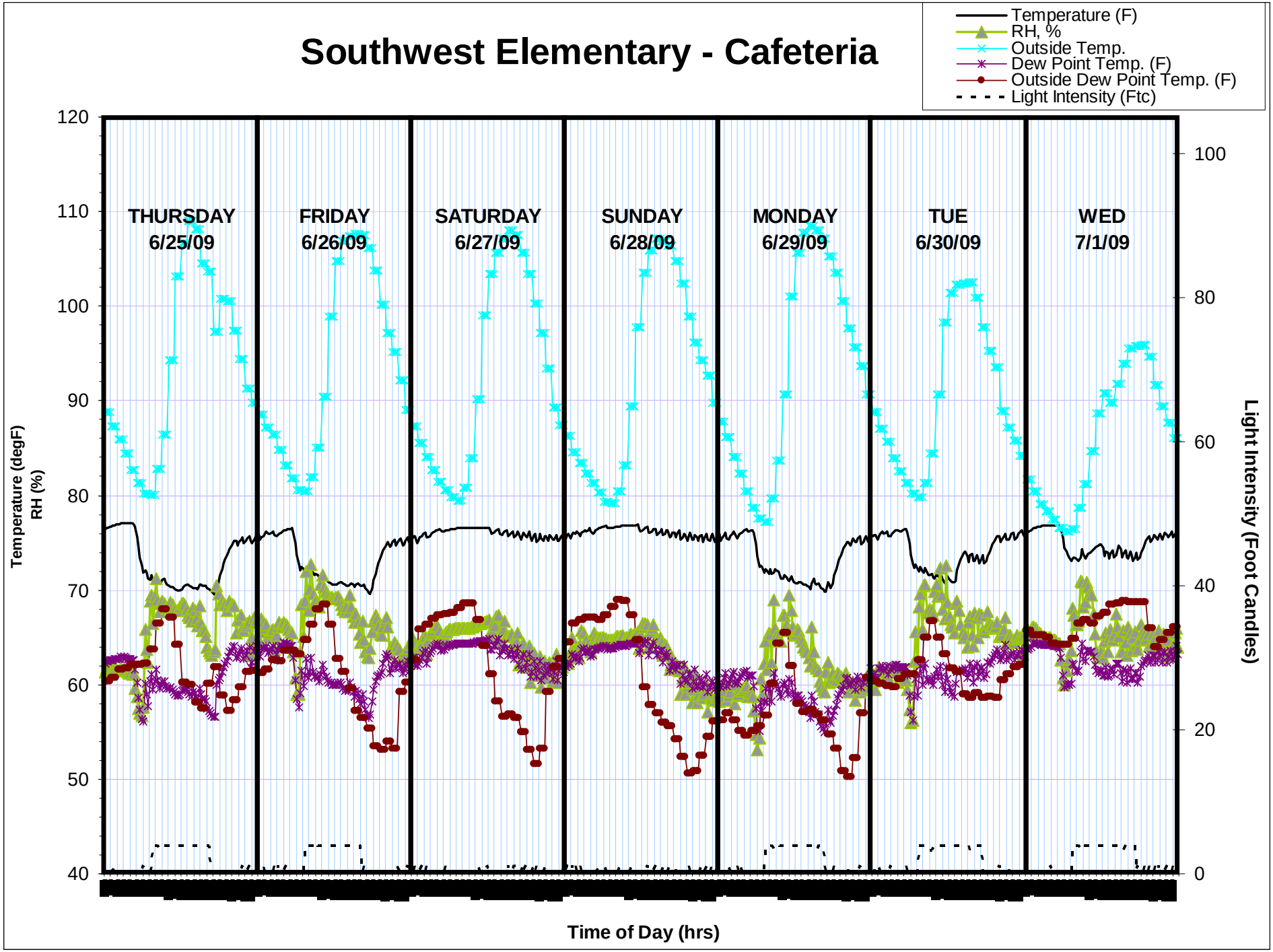
DATALOGGER CHARTS

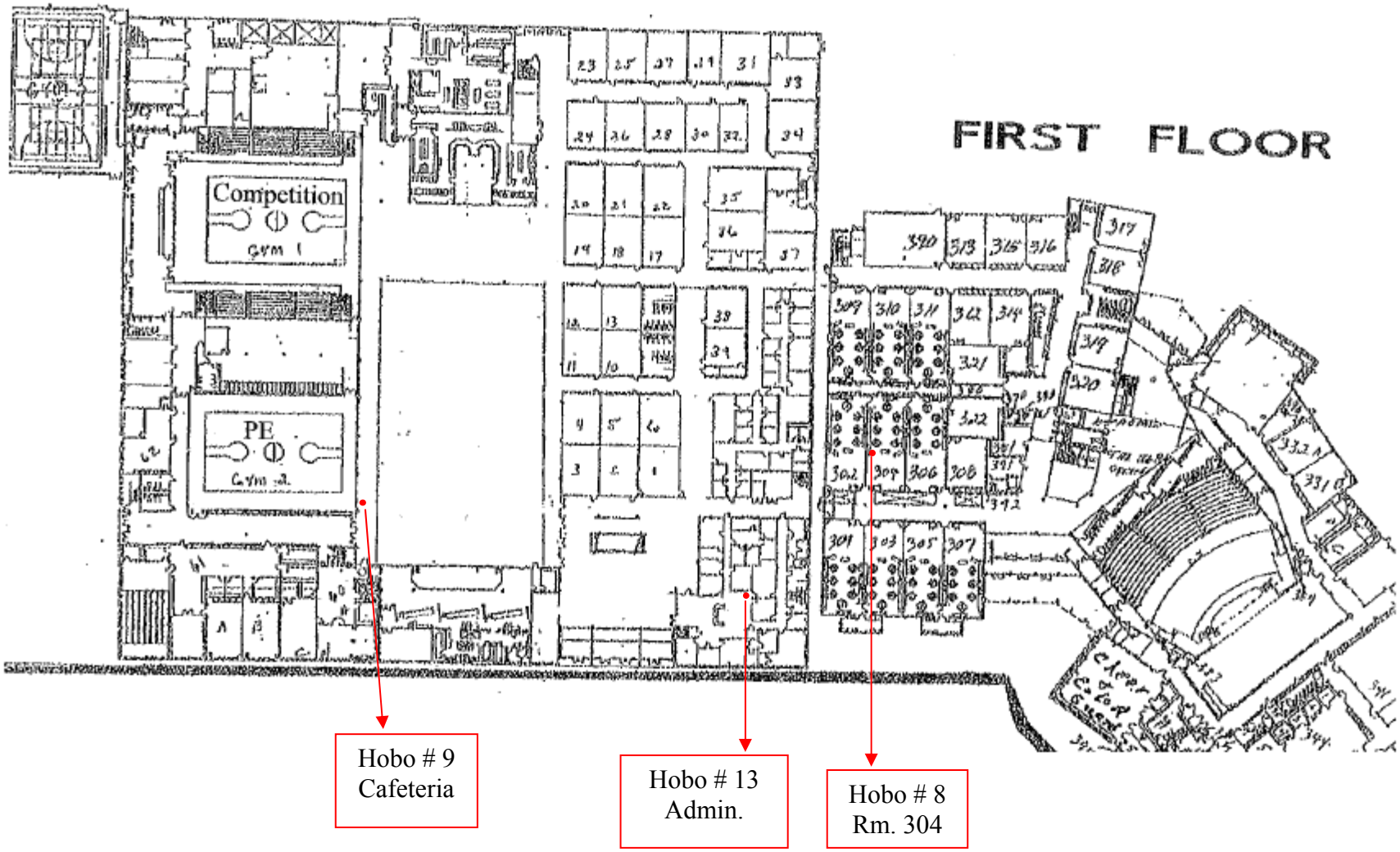
Southwest Elementary Evacuation Plan

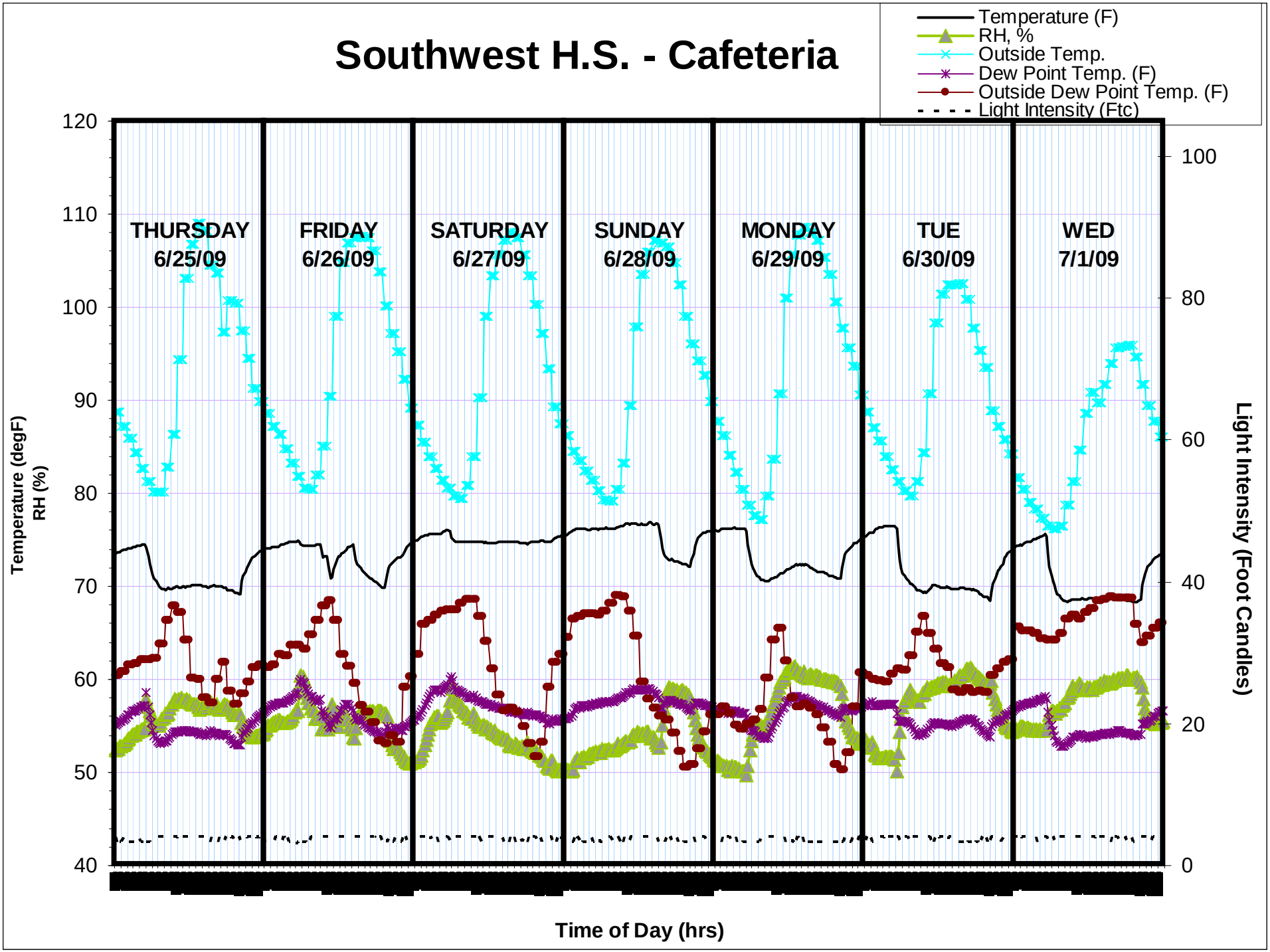


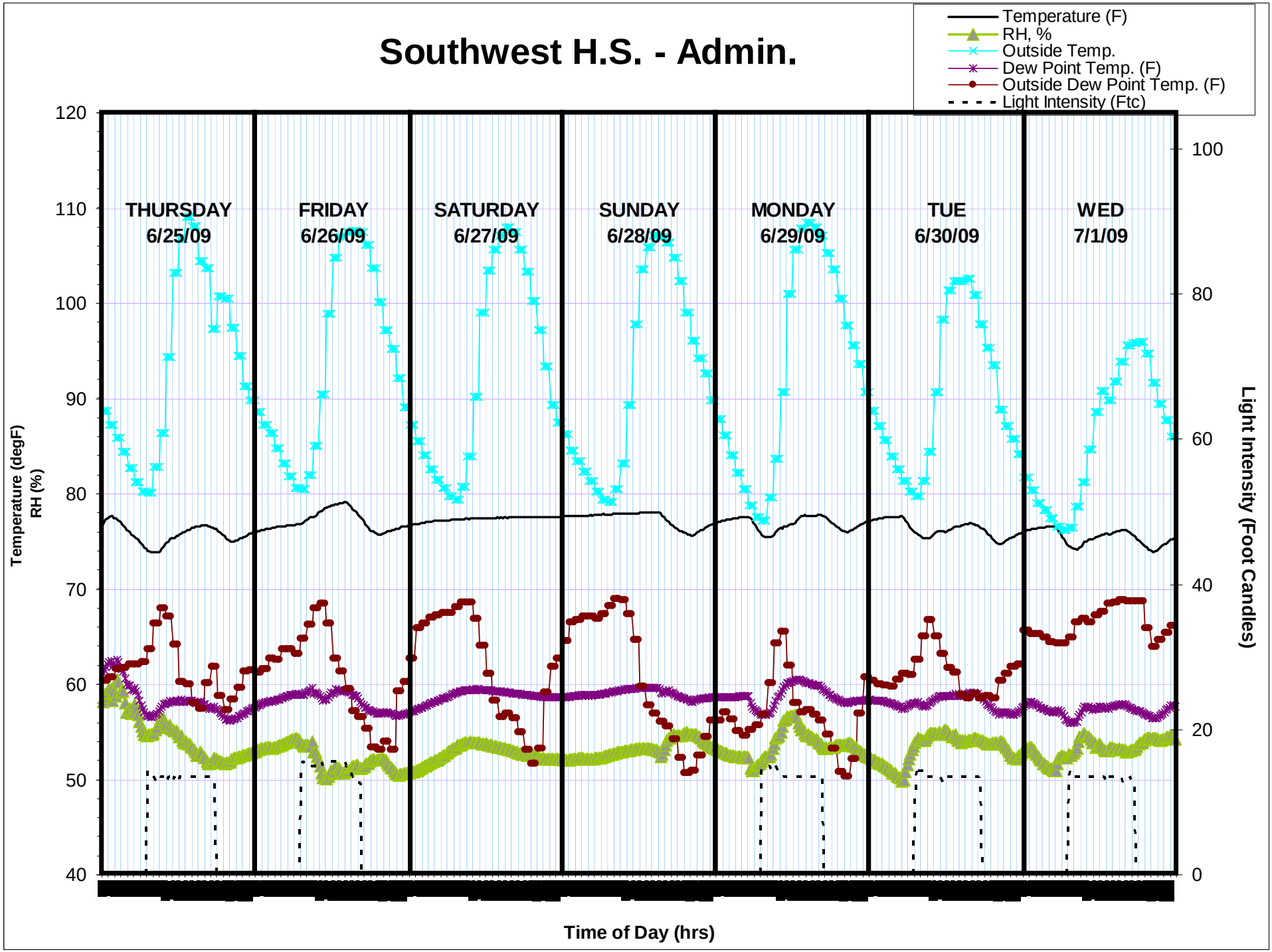

Southwest Elementary - Rm. 100
Temperature (F)
RH, %
Outside Temp.
Dew Point Temp. (F)
Outside Dew Point Temp. (F)
Light Intensity (Ftc)
THURSDAY 6/25/09
FRIDAY 6/26/09
SATURDAY 6/27/09
SUNDAY 6/28/09
MONDAY 6/29/09
TUE 6/30/09
WED 7/1/09
Temperature (degF) RH (%)
Light Intensity (Foot Candles)
Time of Day (hrs)
0
20
40
60
80
100
120

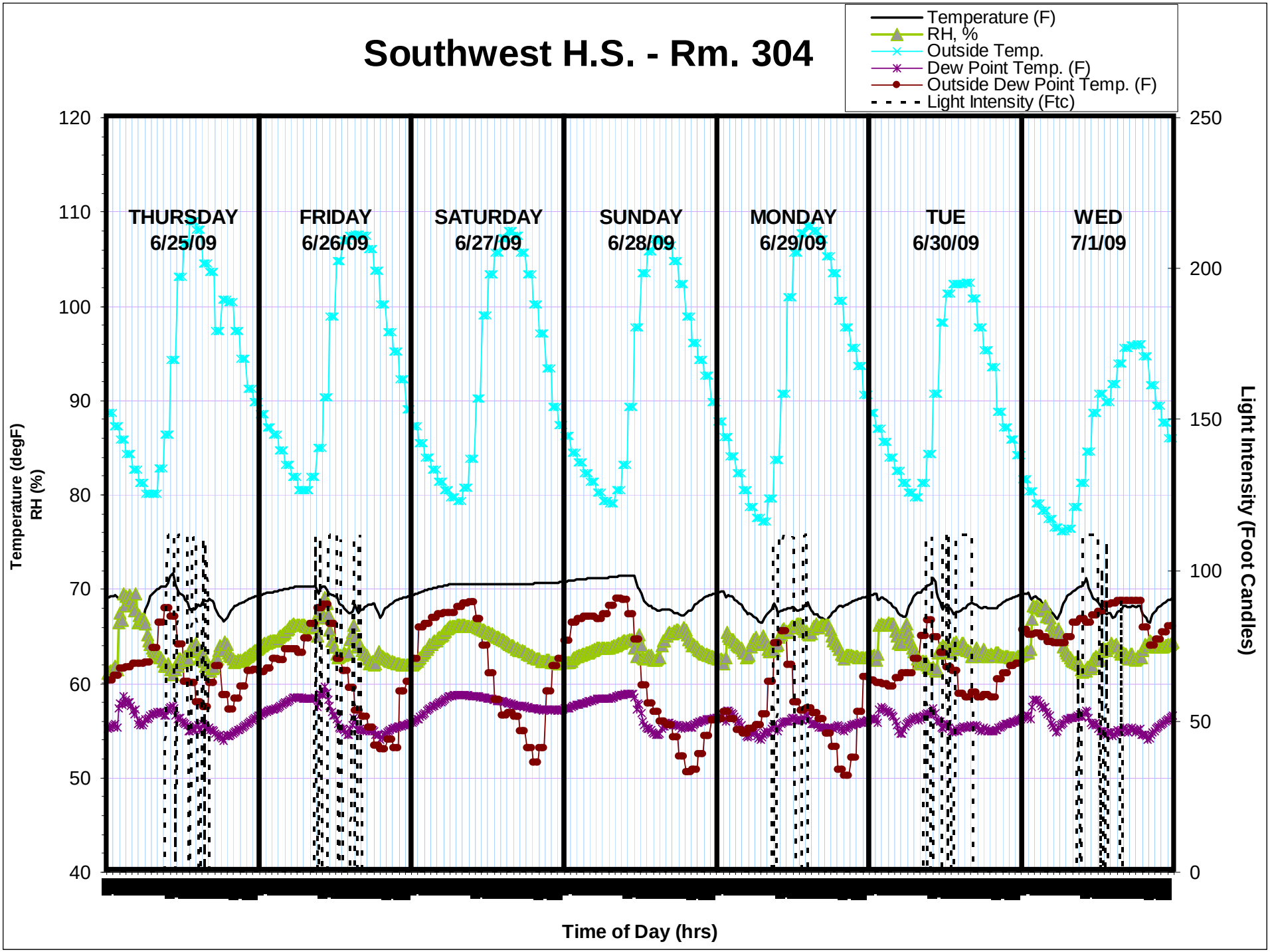

Southwest Elementary - Admin.
Temperature (F)
RH, %
Outside Temp.
Dew Point Temp. (F)
Outside Dew Point Temp. (F)
Light Intensity (Ftc)
THURSDAY 6/25/09
FRIDAY 6/26/09
SATURDAY 6/27/09
SUNDAY 6/28/09
MONDAY 6/29/09
TUE 6/30/09
WED 7/1/09
Temperature (degF) RH (%)
Light Intensity (Foot Candles)
Time of Day (hrs)
120
110
100
90
80
70
60
50
40
100
80
60
40
20
0

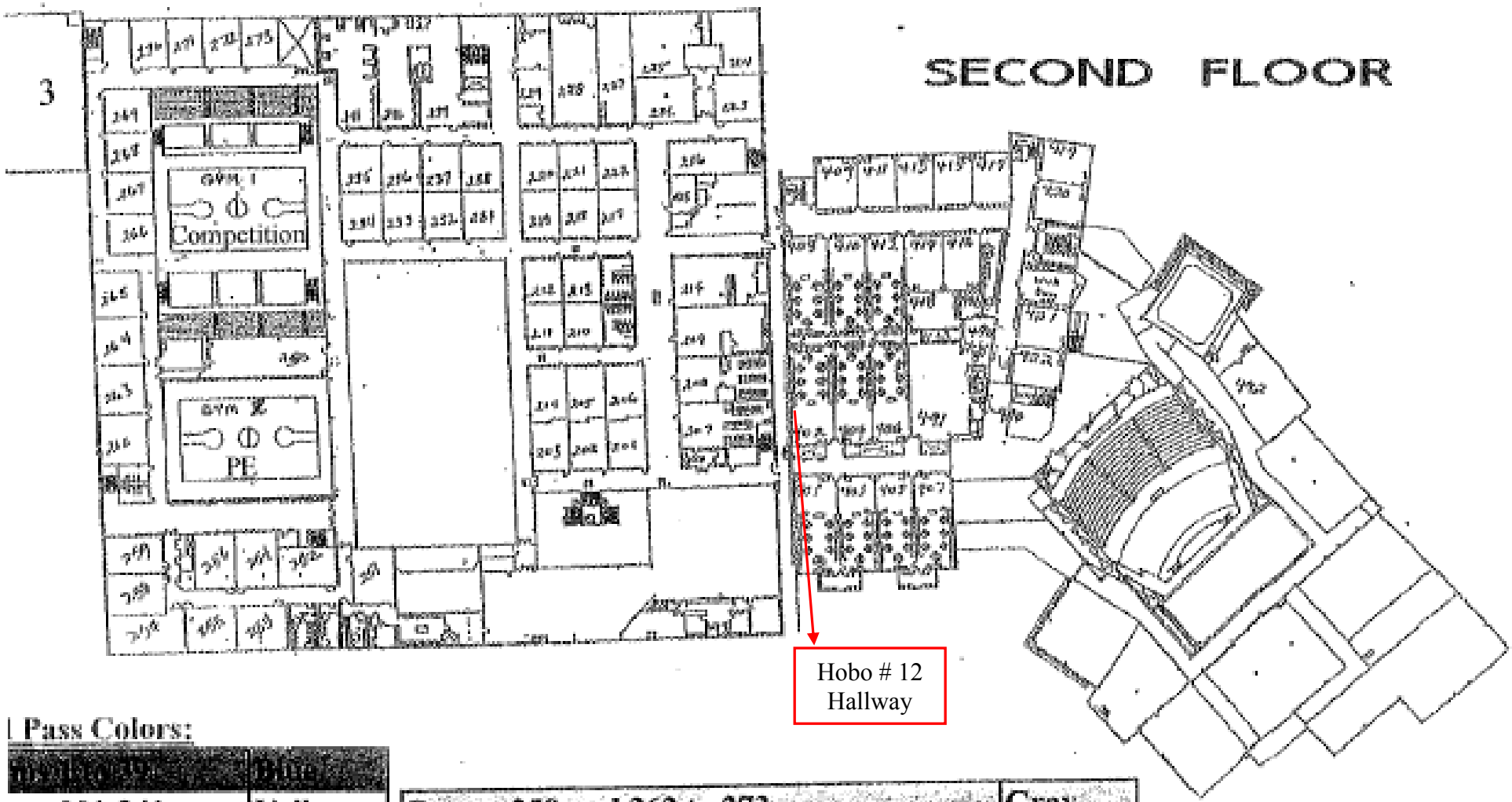

Southwest Elementary - Cafeteria
Temperature (F)
RH, %
Outside Temp.
Dew Point Temp. (F)
Outside Dew Point Temp. (F)
Light Intensity (Ftc)
THURSDAY 6/25/09
FRIDAY 6/26/09
SATURDAY 6/27/09
SUNDAY 6/28/09
MONDAY 6/29/09
TUE 6/30/09
WED 7/1/09
Temperature (degF) RH (%)
Light Intensity (Foot Candles)
Time of Day (hrs)
120
110
100
90
80
70
60
50
40
100
80
60
40
20
0


FIRST FLOOR
Competition
Gym 1
PE
Gym 2
Hobo # 9
Cafeteria
Hobo # 13
Admin.
Hobo # 8
Rm. 304


Southwest H.S. - Cafeteria
Temperature (F)
RH, %
Outside Temp.
Dew Point Temp. (F)
Outside Dew Point Temp. (F)
Light Intensity (Ftc)
THURSDAY 6/25/09
FRIDAY 6/26/09
SATURDAY 6/27/09
SUNDAY 6/28/09
MONDAY 6/29/09
TUE 6/30/09
WED 7/1/09
Temperature (degF) RH (%)
Light Intensity (Foot Candles)
Time of Day (hrs)
120
110
100
90
80
70
60
50
40
100
80
60
40
20
0

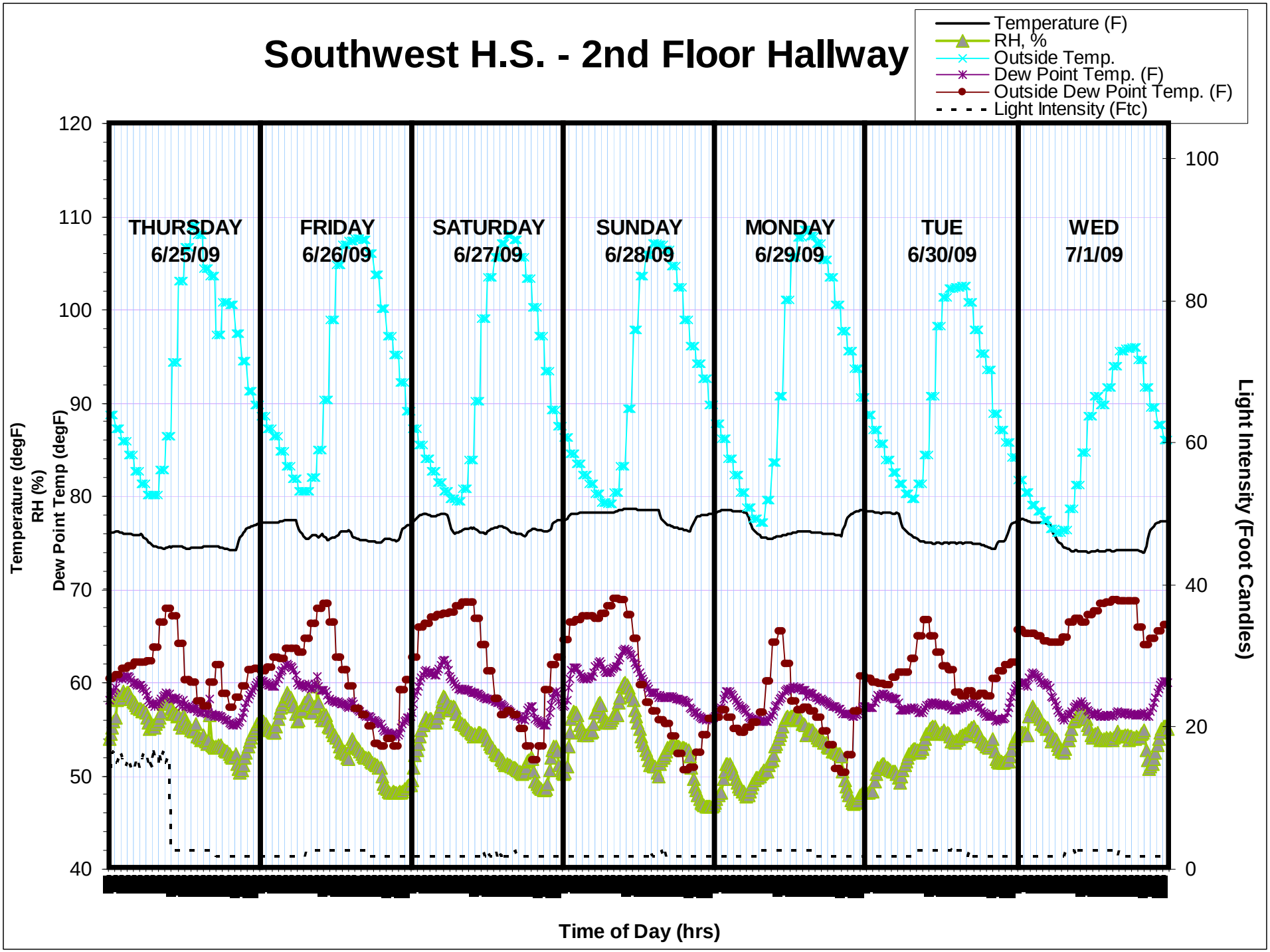

Southwest H.S. - Admin.
Temperature (F)
RH, %
Outside Temp.
Dew Point Temp. (F)
Outside Dew Point Temp. (F)
Light Intensity (Ftc)
THURSDAY 6/25/09
FRIDAY 6/26/09
SATURDAY 6/27/09
SUNDAY 6/28/09
MONDAY 6/29/09
TUE 6/30/09
WED 7/1/09
Temperature (degF) RH (%)
Light Intensity (Foot Candles)
Time of Day (hrs)
120
110
100
90
80
70
60
50
40
100
80
60
40
20
0

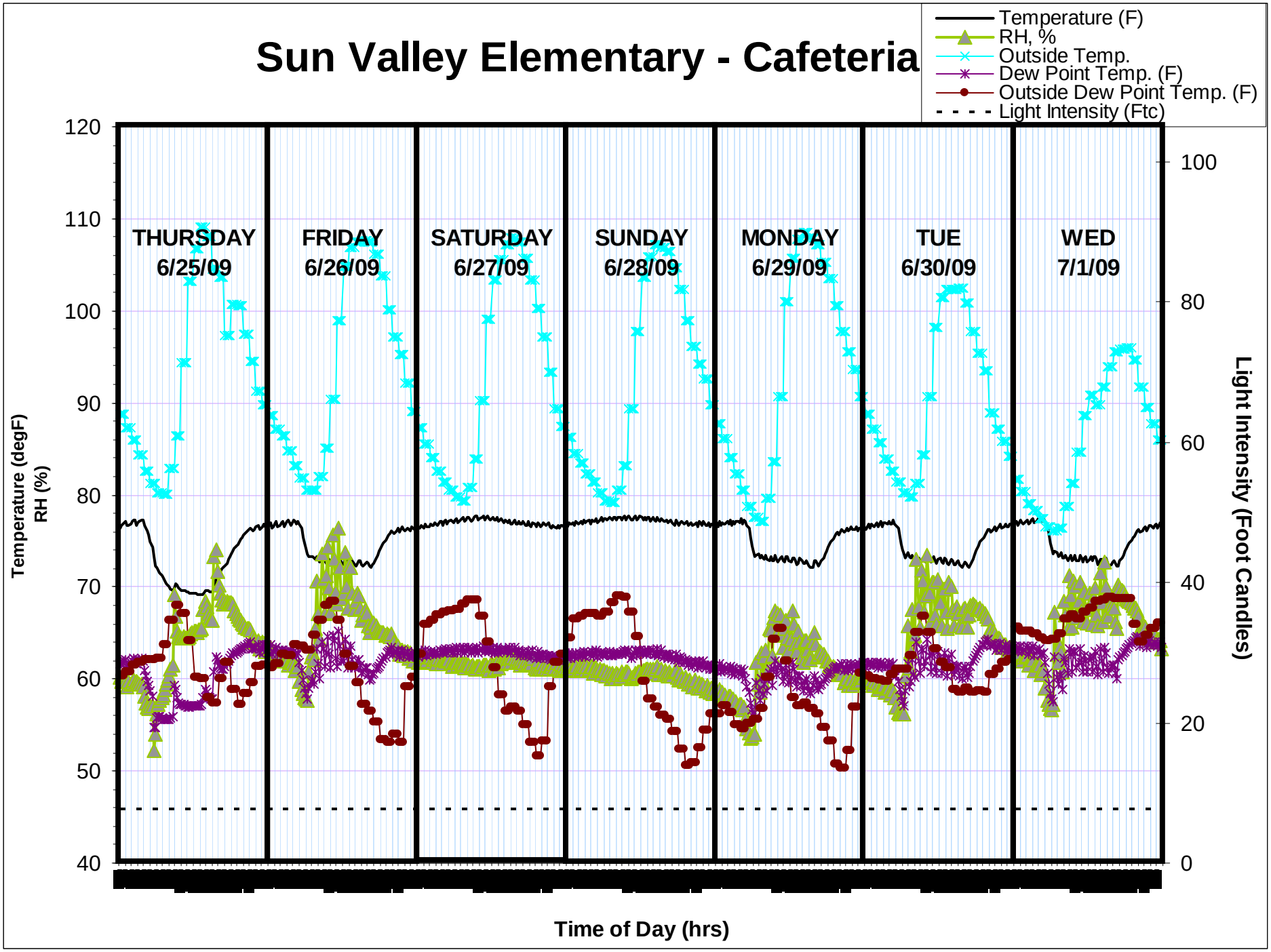

Southwest H.S. - Rm. 304
Temperature (F)
RH, %
Outside Temp.
Dew Point Temp. (F)
Outside Dew Point Temp. (F)
Light Intensity (Ftc)
THURSDAY 6/25/09
FRIDAY 6/26/09
SATURDAY 6/27/09
SUNDAY 6/28/09
MONDAY 6/29/09
TUE 6/30/09
WED 7/1/09
Temperature (degF) RH (%)
Light Intensity (Foot Candles)
Time of Day (hrs)
120
110
100
90
80
70
60
50
40
250
200
150
100
50
0

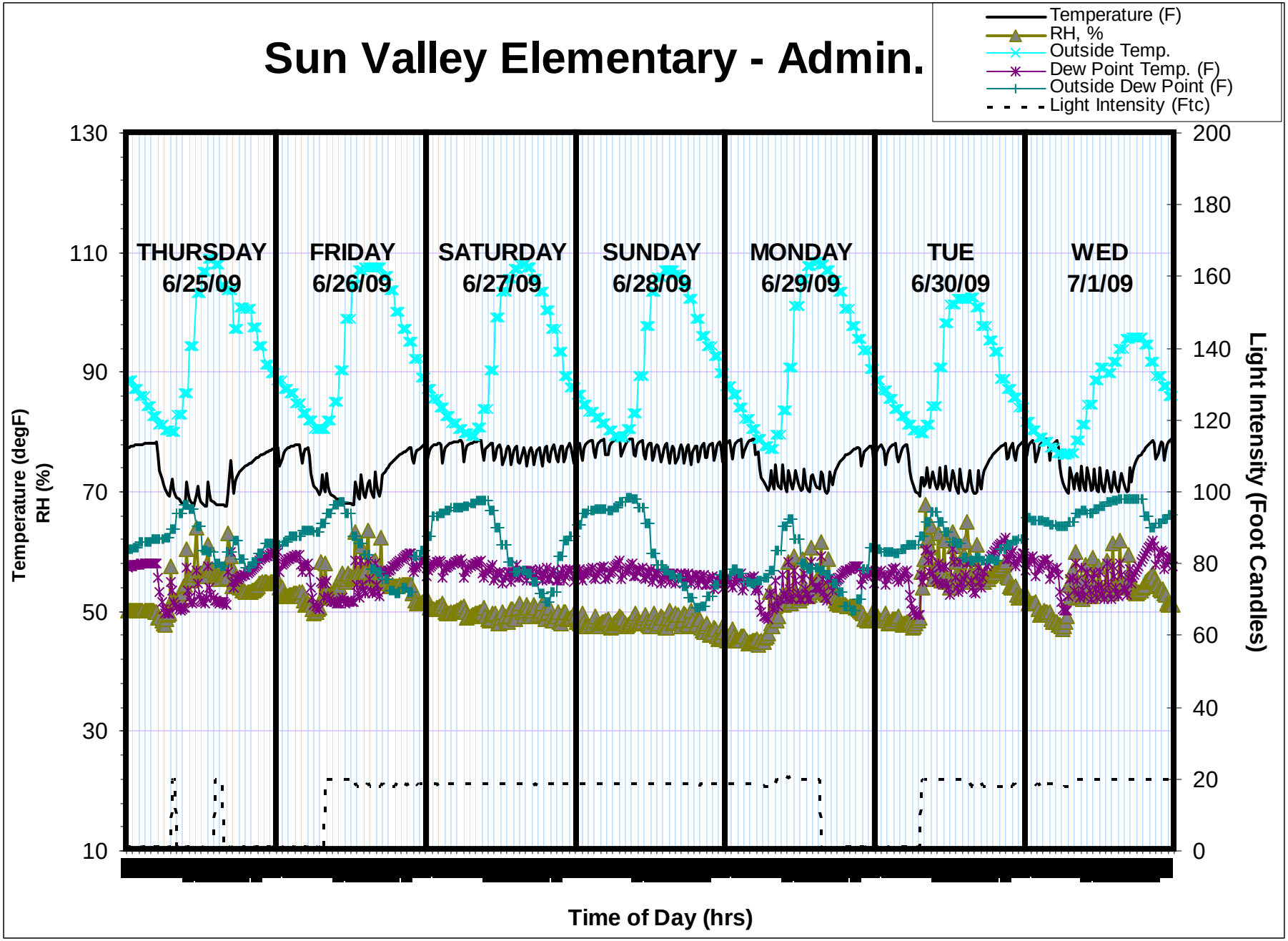


Pass Colors:	
[illegible]	[illegible]
ms 201-241	Yellow
ms 301-322	Orange

Rooms 250 and 262 to 273	Gray
Room 61(ROTC)/Gyms	Gold


Southwest H.S. - 2nd Floor Hallway
Temperature (F)
RH, %
Outside Temp.
Dew Point Temp. (F)
Outside Dew Point Temp. (F)
Light Intensity (Ftc)
THURSDAY 6/25/09
FRIDAY 6/26/09
SATURDAY 6/27/09
SUNDAY 6/28/09
MONDAY 6/29/09
TUE 6/30/09
WED 7/1/09
Temperature (degF)
RH (%)
Dew Point Temp (degF)
Light Intensity (Foot Candles)
Time of Day (hrs)
120
110
100
90
80
70
60
50
40
100
80
60
40
20
0


Sun Valley Elementary - Cafeteria
Temperature (F)
RH, %
Outside Temp.
Dew Point Temp. (F)
Outside Dew Point Temp. (F)
Light Intensity (Ftc)
THURSDAY 6/25/09
FRIDAY 6/26/09
SATURDAY 6/27/09
SUNDAY 6/28/09
MONDAY 6/29/09
TUE 6/30/09
WED 7/1/09
Temperature (degF) RH (%)
Light Intensity (Foot Candles)
Time of Day (hrs)
120
110
100
90
80
70
60
50
40
100
80
60
40
20
0


Sun Valley Elementary - Admin.
Temperature (F)
RH, %
Outside Temp.
Dew Point Temp. (F)
Outside Dew Point (F)
Light Intensity (Ftc)
THURSDAY 6/25/09
FRIDAY 6/26/09
SATURDAY 6/27/09
SUNDAY 6/28/09
MONDAY 6/29/09
TUE 6/30/09
WED 7/1/09
Temperature (degF) RH (%)
Light Intensity (Foot Candles)
Time of Day (hrs)
130
110
90
70
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200
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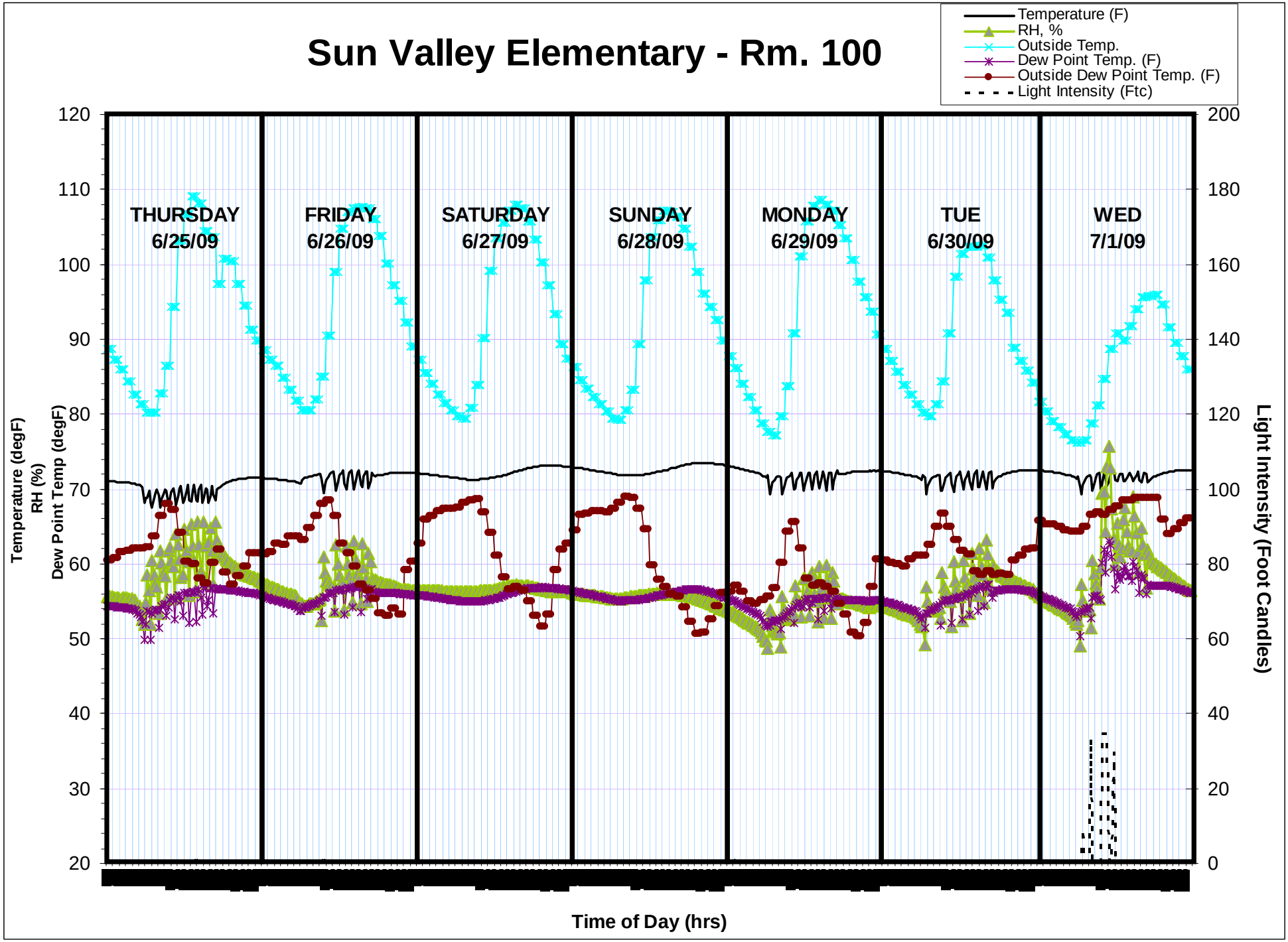
140
120
100
80
60
40
20
0


Sun Valley Elementary - Rm. 100
Temperature (F)
RH, %
Outside Temp.
Dew Point Temp. (F)
Outside Dew Point Temp. (F)
Light Intensity (Ftc)
THURSDAY 6/25/09
FRIDAY 6/26/09
SATURDAY 6/27/09
SUNDAY 6/28/09
MONDAY 6/29/09
TUE 6/30/09
WED 7/1/09
Temperature (degF)
RH (%)
Dew Point Temp (degF)
Light Intensity (Foot Candles)
Time of Day (hrs)
120
110
100
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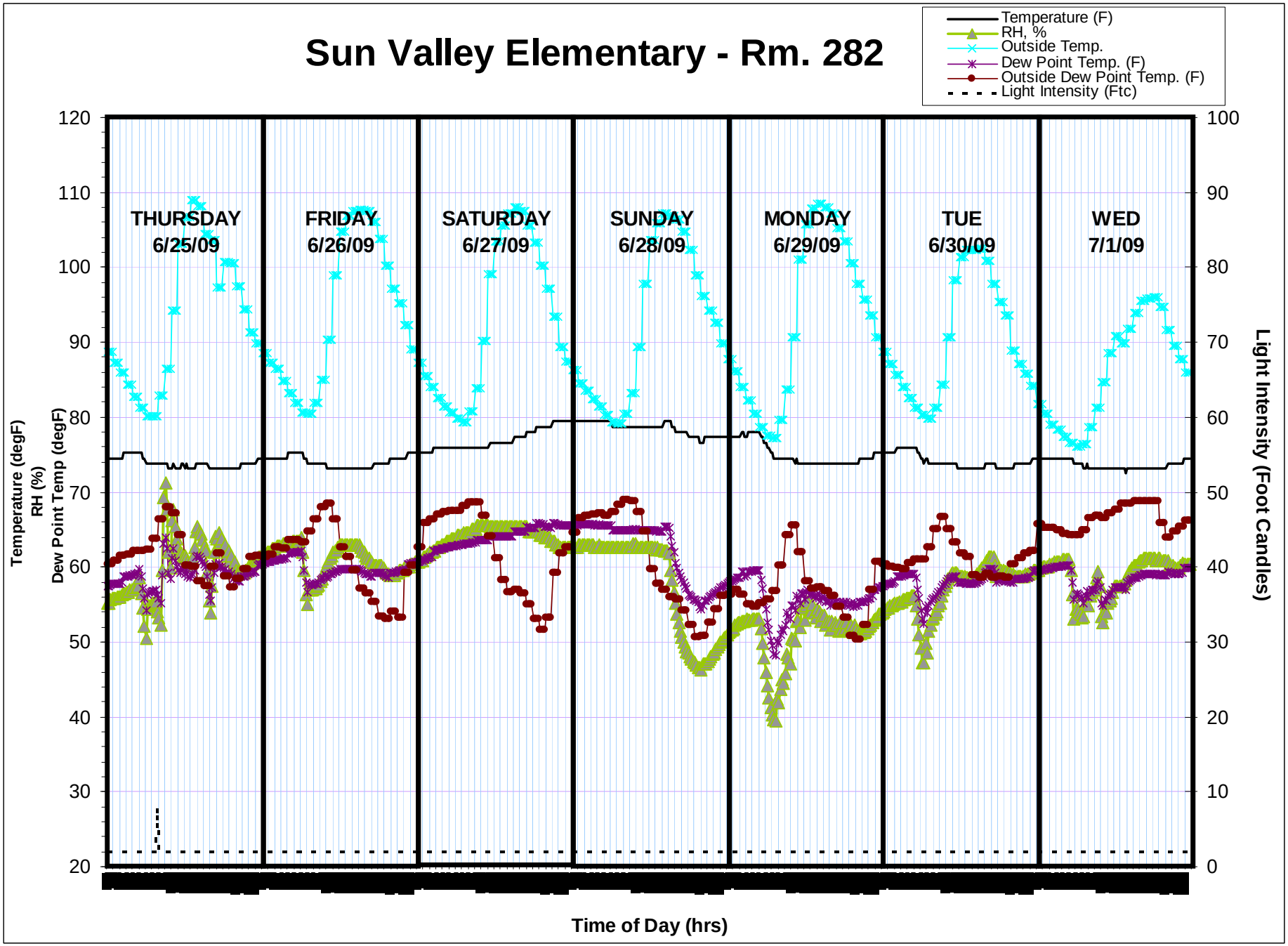
100
80
60
40
20
0


Sun Valley Elementary - Rm. 282
Temperature (F)
RH, %
Outside Temp.
Dew Point Temp. (F)
Outside Dew Point Temp. (F)
Light Intensity (Ftc)
THURSDAY 6/25/09
FRIDAY 6/26/09
SATURDAY 6/27/09
SUNDAY 6/28/09
MONDAY 6/29/09
TUE 6/30/09
WED 7/1/09
Temperature (degF)
RH (%)
Dew Point Temp (degF)
Light Intensity (Foot Candles)
Time of Day (hrs)
120
110
100
90
80
70
60
50
40
30
20
100
90
80
70
60
50
40
30
20
10
0

APPENDIX H

BUILDING COMMISSIONING INFORMATION

BUILDING COMMISSIONING GENERAL INFORMATION

Commissioning (Cx), in general, is a process ensuring that all of the systems of a building perform according to their unique design, as well as meets the needs of both the owner and the occupants. Commissioning is common in all types of building systems, including heating, ventilating, and air-conditioning (HVAC), lighting, electric, and safety controls such as fire protection and security.

Commissioning is available in many forms, the first of which is new construction commissioning. This type aims to construct a facility that obtains the performance and operation requirements of its occupants and owner, and begins during the pre-design portion of the project. If it is comprehensive commissioning, the process starts with the criteria for the facility's functionality, and constantly verifies this in all parts of the facility's creation, including design, construction, and building operation. Construction phase commissioning occurs when the Owner does not include commissioning requirements in the original design, and begins when construction is already underway.

The second form is existing building commissioning, which is identified by two types. Retro-commissioning involves buildings that have never before been commissioned, and involves documenting methods to improve the building's systems and reach the original design intentions. It is an involved process starting with obtaining utility bills, talking to the building's occupants, performing diagnostic tests on the building, and preparing the information for the owner. The second type is re-commissioning, which is different from retro-commissioning in that the building's systems have previously had commissioning performed at some point, whether in the design or construction phases. However, it is similar to retro-commissioning because it arises from system performance problems or inadequacies.

A more specific form of HVAC systems commissioning for existing building is Continuous Commissioning® (CC®). Unlike the other forms, Continuous Commissioning ensures the optimization of HVAC systems for the building's existing conditions. It also works to improve the building air quality, increase comfort levels, and resolve any operating problems. When implemented, Continuous Commissioning can decrease energy usage by 20% on average [1]. It is a joint effort between the commissioning engineers and the facility staff, and is an ongoing process that continues to both commission the building as well as train the facility staff.

All of these forms of commissioning can be used to meet several of the requirements under the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) rating system. The LEED rating system considers building commissioning to be an essential step towards sustainability. This is evident by the fact that many of the LEED rating systems (LEED-EB, LEED-NC, etc) require building commissioning as a pre-requisite.

The scope of commissioning can involve a wide range of building systems, selectable by the building owner. Mechanical systems including HVAC systems, plumbing, piping, boilers, heaters, and valves can be commissioned. Electrical systems such as lighting, transformers, and lighting control is often included, as well as other systems like fire safety, security, and standby power systems.

[1] *Continuous Commissioning Guidebook for Federal Energy Managers* (Energy Systems Laboratory at Texas A&M University)

The costs of commissioning for the owner vary from each form, as well as from building to building. The cost per square foot (SF) of the facility to be commissioned may vary from $.40/SF to $2.00/SF. However, there are general estimates in place. The following lists the percentages of the commissioning costs for each system.

- 2% to 3% of mechanical cost for Mechanical Systems (HVAC and controls)[2]
- 1% to 2% of electrical cost for Electrical Systems[3]
- 0.5% to 1.5% of construction cost for HVAC, controls, and light electrical

There are many benefits to commissioning for the designer, the building's owner, and its occupants.

- HVAC systems simultaneously operate adequately, resulting in less expense during construction and after occupancy. Satisfied occupants also lead to increased productivity.
- Commissioning reviews decrease errors in the design phase, which ultimately reduces callbacks for the engineer.
- More efficient scheduling and design coordination reduce construction errors for the contractor, and thus reduces cost and keeps the project on schedule.
- Documentation helps prevent assumptions made during design, which reduces unnecessary expenditures.

Selecting a commissioning service provider is a vital step in the process. First, the provider should be a certified commissioning professional by an industry accepted certification body (see sample certification bodies below). Next, the owner makes a formal request of the provider's qualifications in commissioning. An independent, third party commissioning provider is mostly recommended because they can objectively perform the work using practical experience. Other requirements for the provider include documentation, communication, and organization skills. This ensures the commissioning process is performed effectively. In addition, the earlier the commissioning authority can be implemented into the facility's construction or design, the more effective the process will be.

[2] Wilkison, R. (2000) Establishing Commissioning Fees, ASHRAE Journal 42 (4): 41-47

[3] PECI, 2000. The National Conference of Building Commissioning Proceedings, Portland Energy Conservation Inc. OR.

Sample list of Building Commissioning Certifications and Organizations:

AABC Commissioning Group (ACG) - "Certified Commissioning Authority (CxA)"
www.commissioning.org

Building Commissioning Association (BCA) - "Certified Cx Professional (CxP)"
www.bcxa.org

Association of Energy Engineers (AEE) - "Certified Building Cx Professional"
www.aeecenter.org

National Environmental Balancing Bureau (NEBB) - "Systems Cx Administrator"
www.nebb.org

Testing Adjusting and Balancing Bureau - "Certified Commissioning Contractor"
www.tabbcertified.org

For more information on building commissioning, you may contact any of the above. Below is contact info for two of organizations listed above:

Building Commissioning Association
1400 SW 5th Ave, Suite 700
Portland, OR 97201
Phone: (877) 666-2292
Fax: (503) 227-8954
info@bcxa.org

AABC Commissioning Group
1518 K Street KW
Washing, DC 20005
Phone: (202) 737-7775
Fax: (202) 638-4833
info@commissioning.org

For more information on Continuous Commissioning, you may contact:

Energy Systems Laboratory
Texas A&M University
3581 TAMU
214 Wisenbaker Engineering Research Center
Bizzel Street
College Station, Texas 77943
Phone: (979) 845-9213
Fax: (979) 862-8687

Additional Reference:

"Building Commissioning - A Golden Opportunity for Reducing Energy Costs and Greenhouse-Gas Emissions" by Even Mills, Ph.D., Lawrence Berkeley National Laboratory, July 21, 2009, http://cx.lbl.gov/2009-assessment.html

APPENDIX I

REQUEST FOR ENERGY ASSISTANCE

State Energy Conservation Office

Public Schools, Colleges and Non-Profit Hospitals

Preliminary Energy Assessment
Service Agreement

Investing in our public schools, colleges and non-profit hospitals through improved energy efficiency in public buildings is a win-win opportunity for our communities and the state. Energy-efficient buildings reduce energy costs, increase available capital, spur economic growth, and improve working and living environments. The Preliminary Energy Assessment Service provides a viable strategy to achieve these goals.

Description of the Service

The State Energy Conservation Office (SECO) will analyze electric, gas and other utility data and work with SWISD, hereinafter referred to as Partner, to identify energy cost-savings potential. To achieve this potential, SECO and Partner have agreed to work together to complete an energy assessment of mutually selected facilities.

SECO agrees to provide this service at no cost to the Partner with the understanding that the Partner is ready and willing to consider implementing the energy savings recommendations.

Principles of the Agreement

Specific responsibilities of the Partner and SECO in this agreement are listed below.

- ✓ Partner will select a contact person to work with SECO and its designated contractor to establish an Energy Policy and set realistic energy efficiency goals.
- ✓ SECO's contractor will go on site to provide walk through assessments of selected facilities. SECO will provide a report which identifies no cost/low cost recommendations, Capital Retrofit Projects, and potential sources of funding. Portions of this report may be posted on the SECO website.
- ✓ Partner will schedule a time for SECO's contractor to make a presentation of the assessment findings key decision makers.

Acceptance of Agreement

This agreement should be signed by your organization's chief executive officer or other upper management staff.

Signature: Thomas J Krueger
Date: 3/8/10
Name (Mr./Ms./Dr.) THOMAS KRUEGER
Title: CONSTRUCTION SUPERVISOR
Organization: SOUTHWEST ISD
Phone: 210-622-4370
Street Address: 11914 DRAGON LN. BLDG 700
Fax: 210-622-4371
Mailing Address: SAN ANTONIO, TX. 78252
E-Mail: tkrueger@swisd.net
County: BEXAR

Contact Information:

Name (Mr./Ms./Dr.): THOMAS KRUEGER
Title: ↓
Phone: SAME AS ABOVE
Fax: ↓
E-Mail: ↓
County: ↓

Please sign and mail or fax to: Juline Ferris, **Schools and Education** Program Administrator, State Energy Conservation Office, 111 E. 17th Street, Austin, Texas 78774. Phone: 512-936-9283. **Fax 512-475-2569.**