Susan Combs
Texas Comptroller of Public Accounts

Facility Preliminary Energy Assessments and Recommendations

City of Bryan

1111 Waco St.
Bryan, Texas 77803

Prepared by:

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SECO
State Energy Conservation Office

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Local Government Energy Management Program
City of Bryan
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Bryan, TX 77803
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1.0 EXECUTIVE SUMMARY

The City of Bryan, now referred to as the City, 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 City through the Local Government 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 local governments for the purpose of planning, funding, and implementing energy saving measures, which will ultimately reduce the City's annual energy costs.

The annual cost savings, implementation cost estimate and simple payback for all building energy retrofit projects identified in this preliminary analysis are summarized below. Individual building projects are summarized in Section 10.0 of this report.

Implementation Cost Estimate (Est.):	$431,300
Annual Energy Saving (MMBTU/Yr):	5,413
Est. Annual Greenhouse Gas Emissions Reduction (Metric Ton CO_2e/Yr):	704
Est. Annual Energy Cost Savings:	$102,300
Simple Payback (Yrs):	4.2

A follow-up visit to the City 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 City may require in planning, funding and implementing the recommendations of this report. The City is encouraged to direct any questions or concerns to either of the following contact persons:

SECO / Mr. Stephen Ross
(512) 463-1770

TEESI / Saleem Khan
(512) 328-2533

2.0 FACILITY DESCRIPTIONS

The City maintains and operates 15 buildings, as well as several parks and recreation facilities. Of these facilities, eight were chosen for a site survey and energy assessment. 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.

Buildings:	Aquatic Center
Stories:	Single story
Area (estimated):	15,507 SF
Bldg. Components:	Brick building, built up roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts
HVAC:	Split-DX units, Packaged Units, 4.5 MMBTUh boiler for pool heating
Controls:	Standard thermostats with digital time clocks, stand alone thermostat for pool heating, manufacturer: Johnson Controls

Buildings:	Justice Center
Stories:	Two stories
Area (estimated):	63,000 SF
Bldg. Components:	Concrete building, built up roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts T5 fluorescent fixtures with electronic ballasts
HVAC:	Packaged rooftop units serving VAV boxes with Hot Water (HW) reheat
Controls:	Energy Management System (EMS) – TAC Vista

Buildings:	Bryan Library
Stories:	Two stories
Area (estimated):	25,132 SF
Bldg. Components:	Brick building, built up roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts
HVAC:	Air-cooled chiller Chilled Water (ChW) system, boiler HW system
Controls:	Energy Management System (EMS) – TAC Vista

Buildings:	Federal Building *(Office rental property owned and operated entirely by the City. Formerly IRS offices, still referred to as "Federal Building".)*
Stories:	Two stories
Area (estimated):	13,500 SF
Bldg. Components:	Brick building, built up roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts
HVAC:	Air-cooled chiller Chilled Water (ChW) system, boiler HW system
Controls:	Energy Management System (EMS) – TAC Vista

Buildings:	Fire Station 1
Stories:	Single story

Area (estimated):	9,100 SF
Bldg. Components:	Brick building, built up roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts in conference rooms/offices and truck bays Recessed can Compact Fluorescent Lamps (CFLs) in corridors
HVAC:	Packaged rooftop units, gas-fired radiant heaters in truck bays
Controls:	Energy Management System (EMS) – TAC Vista
Notes:	City fire stations also use large amounts of energy to charge mobile equipment on ambulances and fire trucks.

Buildings:	Information Technology Building
Stories:	Single story
Area (estimated):	10,200 SF
Bldg. Components:	Brick building, built up roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts
HVAC:	Split-DX units, Packaged Units
Controls:	Standard thermostats with digital time clocks

Buildings:	Municipal Office Building
Stories:	Three stories plus basement level
Area (estimated):	43,500 SF
Bldg. Components:	Concrete building, built up roof, slab on grade
Typical Lighting Fixtures:	T8 fluorescent fixtures with electronic ballasts High Intensity Discharge (HID) fixtures above atrium.
HVAC:	Packaged rooftop units
Controls:	Energy Management System (EMS) – TAC Vista

Buildings:	Municipal Services Center
Stories:	Single story
Area (estimated):	17,500 SF
Bldg. Components:	Brick building, pitched metal roof, slab on grade
Typical Lighting Fixtures:	T12 fluorescent fixtures with magnetic ballasts T8 fluorescent fixtures with electronic ballasts High Intensity Discharge (HID) fixtures in warehouse area
HVAC:	Split-DX units, Packaged Units
Controls:	Standard thermostats with digital time clocks

City of Bryan Wastewater Treatment Plants

The City of Bryan operates three (3) Wastewater Treatment Plants (WWTPs). The plants consist of the Turkey Creek Wastewater Treatment Plant, Still Creek Wastewater Treatment Plant, and Burton Creek Wastewater Treatment Plant. The Turkey Creek WWTP is scheduled to be taken out of service in the near future and replaced by a new plant currently under construction at another site location in Bryan. Wastewater is conveyed to the WWTP by twenty (20) wastewater lift stations located throughout the city's service area.

Still Creek WWTP

Still Creek WWTP has a permitted average daily flow of 4.0 MGD and currently treats an average of 1.25 MGD. Still Creek WWTP is a conventional activated sludge process with a discharge limitation of 10 mg/l CBOD5, 15 mg/l TSS of and 3 mg/l NH3-N.

Incoming flow enters the main lift station at head of the plant after passing through a mechanical bar screen. The main lift station utilizes seven (7) pumps, two (2) 60-HP pumps and five (5) 25-HP pumps and wastewater is pumped to the aerated grit chamber. Normally, flow from the aerated grit chamber would enter the primary clarifier and trickling filter for treatment before being conveyed by gravity to the intermediate clarifier, but currently, the primary clarifier and trickling filter are out of service. At this time, flow from the aerated grit chamber is conveyed by gravity directly to the intermediate clarifier. From the intermediate clarifier the wastewater is then pumped to the aeration basin by five (5) 40-HP pumps.

The aeration basin consists of three (3) trains. Normally, only two (2) trains are in service at a time. All trains are equipped with ceramic fine bubble diffusers which have recently been replaced. Aeration is provided by two (2) blowers, one (1) 150-HP turbo blower and one (1) 150-HP centrifugal blower. The turbo blower was recently installed for energy efficiency and operates as the main blower in service with the centrifugal blower as a backup blower. A dissolved oxygen (D.O.) level of 4.0 mg/l is maintained within the trains. Although reducing D.O. level to 2.0 mg/l or less could reduce power required, D.O. levels cannot be lowered at this time due to fail-safe controls within the turbo-blower.

Flow from the aeration basin then enters two (2) gravity clarifiers before final treatment of chlorination and de-chlorination. Return activated sludge (RAS) from the clarifiers is returned to the head of the aeration basin by three (3) 30-HP pumps. Waste activated sludge (WAS) from the clarifiers is gravity fed to a gravity thickener before being conveyed by pumping to two (2) anaerobic digesters. Sludge is removed from digester by pumping to a belt filter press before final disposal.

Burton Creek WWTP

Burton Creek WWTP has a permitted average daily flow of 8.0 MGD and currently treats an average of 4.3 MGD. Burton Creek WWTP is a conventional activated sludge process with a discharge limitation of 10 mg/l CBOD5, 15 mg/l TSS and 2 mg/l NH3-N.

Incoming flow enters the main lift station at head of the plant after passing through a mechanical bar screen. The main lift station utilizes four (4) 125-HP pumps and wastewater is pumped to

the aerated grit chamber. Flow from aerated grit chamber enters the primary clarifier and then to a trickling filter for treatment before being conveyed by gravity to the intermediate clarifier. Waste sludge is removed from the primary clarifier and conveyed by gravity to a pump station located at the two (2) anaerobic digesters. A portion of supernatant from intermediate clarifier is re-circulated back to trickling filter by three (3) 30-HP re-circulation pumps. The majority of the supernatant from the intermediate clarifier is pumped to the aeration basin by six (6) 40-HP intermediate lift station pumps. WAS and scum from the intermediate clarifier is conveyed by gravity back to head of plant.

The aeration basin consists of three (3) trains. All trains are equipped with ceramic fine bubble diffusers, which have recently been replaced. Aeration is provided by two (2) blowers, one (1) 200-Hp turbo blower and one (1) 200-HP centrifugal blower. The turbo blower was recently installed for energy efficiency and operates as the main blower in service with the centrifugal blower as a backup blower. A dissolved oxygen (D.O.) level of 4.0 mg/l is maintained in the aeration chambers. Although reducing D.O. level to 2.0 mg/l or less could reduce power required, D.O. levels cannot be lowered at this time due to fail-safe controls within the turbo-blower.

Flow from the aeration basin then enters two (2) gravity clarifiers. Effluent from the clarifiers then receives final treatment by chlorination and de-chlorination before being discharged. Return activated sludge (RAS) from clarifiers is returned to head of aeration basin by three (3) 30-HP pumps. Waste activated sludge (WAS) from the clarifiers is conveyed by gravity back to main lift station. Sludge removed from the digester is pumped to belt filter press before final disposal.

3.0 ENERGY CONSUMPTION AND PERFORMANCE

TEESI analyzed baseline utility data from all City buildings, including those surveyed. The City's facilities comprise a total gross area of approximately 247,815 square feet.

Annual electric and natural gas invoices for City buildings were $536,549 for the 12-month period ending September 2011. A summary of annual utility costs is provided in **Appendix C**, Base Year Consumption History.

To help the City evaluate the overall energy performance of its facilities TEESI has calculated their Energy Utilization Index (EUI) and Energy Cost Index (ECI). The EUI represents a facility's annual energy usage per square foot; it is measured as thousand BTU's per square foot per year (kBTU/SF/Year). Similarly, ECI is measured as cost per square foot per year ($/SF/Year). The EUI and ECI performance for selected facilities are listed below (surveyed facilities in bold face):

Energy Cost and Consumption Benchmarks														
		Electric				Natural Gas				Total	Total	EUI	ECI	
	Building	kWh/Yr	MMBTU/Yr	kWh/SF	$Cost/Yr	MCF/Yr	MMBTU/Yr	MCF/kSF	$Cost/Yr	$Cost/Yr	MMBTU/Yr	kBTU/SF/Yr	$/SF/Yr	SF
1	**Aquatic Center**	**300,960**	**1,027**	**19.41**	**27,476**	**3,611**	**3,719**	**233**	**23,743**	**51,220**	**4,747**	**306**	**3.30**	**15,507**
2	**Justice Center**	**1,708,992**	**5,833**	**27.13**	**154,323**	**2,024**	**2,084**	**32**	**14,926**	**169,249**	**7,917**	**126**	**2.69**	**63,000**
3	**Bryan Library**	**394,320**	**1,346**	**15.69**	**35,885**	**105**	**108**	**4**	**836**	**36,720**	**1,454**	**58**	**1.46**	**25,132**
4	Carnegie Library	91,000	311	21.26	8,559	0	0	0	0	8,559	311	73	2.00	4,280
5	Facilities/Parks Building	107,160	366	20.04	10,006	0	0	0	0	10,006	366	68	1.87	5,346
6	**Federal Building**	**190,160**	**649**	**14.09**	**17,493**	**176**	**181**	**13**	**1,302**	**18,795**	**830**	**61**	**1.39**	**13,500**
7	**Fire Station 1**	**304,920**	**1,041**	**33.51**	**27,833**	**485**	**499**	**53**	**3,298**	**31,131**	**1,540**	**169**	**3.42**	**9,100**
8	Fire Station 2*	74,440	254	17.72	7,067	152	156	36	1,170	8,237	410	98	1.96	4,200
9	Fire Station 3*	104,360	356	23.45	9,755	178	184	40	1,366	11,120	540	121	2.50	4,450
10	Fire Station 4*	74,973	256	19.22	7,107	156	161	40	1,169	8,276	417	107	2.12	3,900
11	Fire Station 5*	159,840	546	12.11	14,752	295	304	22	2,265	17,017	849	64	1.29	13,200
12	**Information Technology**	**423,240**	**1,445**	**41.49**	**38,460**	**0**	**0**	**0**	**0**	**38,460**	**1,445**	**142**	**3.77**	**10,200**
13	**Municipal Office Building**	**739,968**	**2,526**	**17.01**	**67,025**	**293**	**302**	**7**	**1,992**	**69,017**	**2,827**	**65**	**1.59**	**43,500**
14	**Municipal Service Center**	**299,096**	**1,021**	**17.09**	**28,003**	**1,263**	**1,301**	**72**	**8,050**	**36,053**	**2,322**	**133**	**2.06**	**17,500**
15	Neil Rec. Center	236,840	808	15.79	21,699	122	125	8	990	22,689	934	62	1.51	15,000
		kWh/Yr	MMBTU/Yr	kWh/SF	$Cost/Yr	MCF/Yr	MMBTU/Yr	MCF/kSF	$Cost/Yr	$Cost/Yr	MMBTU/Yr	kBTU/SF/Yr	$/SF/Yr	SF
		5,210,269	17,783	21.02	475,443	8,858	9,124	36	61,106	536,549	26,906	109	2.17	247,815

*City fire station EUIs may appear high due to energy used to charge mobile ambulance and truck equipment.

Knowing the EUI and ECI of each facility is useful for determining the City's overall energy performance. In addition, the City's EUI was compared to TEESI's database of local government facilities. See **Appendix D** to determine how these facilities' EUIs compared to other local government facilities in Texas.

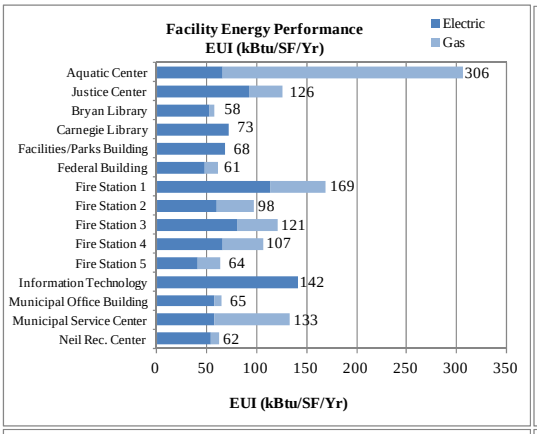
To help the City evaluate the overall energy performance of its wastewater treatment plants, TEESI has calculated their Energy Utilization Index (EUI) and Energy Cost Index (ECI). The WWTP EUI was calculated based on the facility's annual energy usage per annual average effluent flow; it is measured as thousand BTUs per gallons per day per year (kBTU/GPD/Year). Similarly, ECI is measured as cost per million gallons per day per year ($/MGD/Year). The EUI and ECI performance for each wastewater treatment plant is listed below.

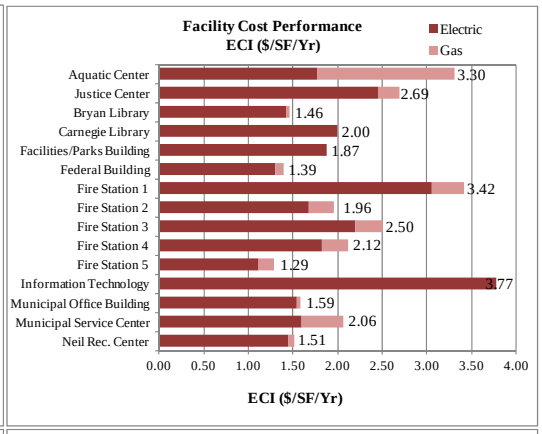
WWTP - Energy Cost and Consumption Benchmark

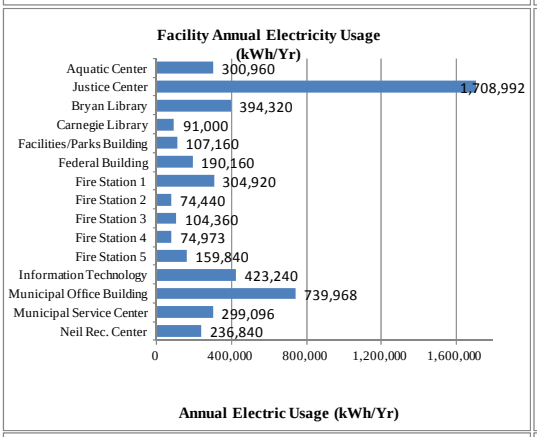
Facility	Electric[1]			Design Capacity (MGD)	Average Effluent Flow[3] (MGD)	EUI[4]	ECI[5]	National Average[6]		ENERGY STAR Rating[7, 8]
	kWh/Yr	kBtu/Yr[2]	$Cost/Yr			kBtu/GPD/Yr	$/MGD/Yr	kBtu/GPD/Yr	$/MGD/Yr	
Burton Creek	2,838,934	9,686,443	$271,806	8.00	4.43	2.2	$61,356	3.0	$76,634	67
Still Creek	1,703,524	5,812,424	$153,785	4.00	0.99	5.9	$155,338	4.0	$115,550	17
Turkey Creek	1,303,840	4,448,702	$117,793	0.75	0.64	7.0	$185,209	3.0	$75,955	1

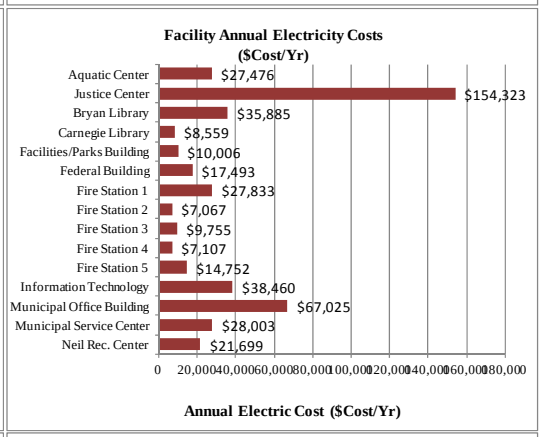
1. Electric consumption for WWTP is based on electric meter serving the main processing facility and does not account for other usage (i.e. lift stations, irrigation, etc.) which may be metered separately.
2. Electric consumption conversion based on 3.412 kBtu/kWh.
3. ENERGY STAR Portfolio Manager requires the Influent flow (MGD) to calculate a performance rating. For this analysis Effluent flow was considered to be sufficient for benchmarking purposes.
4. Energy Use Index (EUI) calculated based annual kBtu divided by the Average Effluent Flow in gallons per day (GPD).
5. Energy Cost Index (ECI) calculated based on annual energy cost divided by the Average Effluent Flow in million gallons per day (MGD).
6. National Average based on ENERGY STAR Portfolio Manager benchmarks.
7. ENERGY STAR Portfolio Manager requires the Average Influent BOD (mg/l) to calculate a performance rating. A default of 200 mg/l was selected for WW plant.
8. ENERGY STAR Portfolio Manager requires the Average Effluent (BOD) to calculate a performance rating. For this analysis the Average Effluent CBOD was considered to be sufficient for benchmarking purposes.

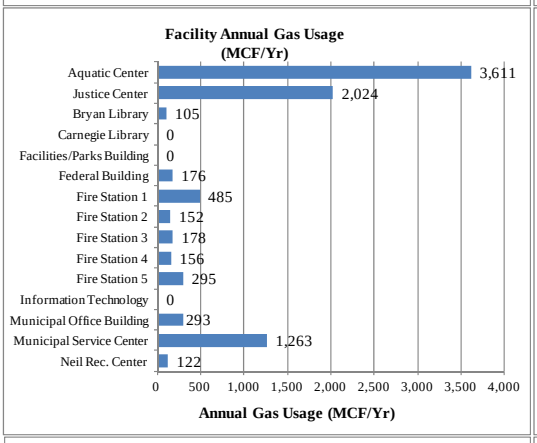
The following charts summarize the data presented in the previous table. See **Appendix C** for further detail.

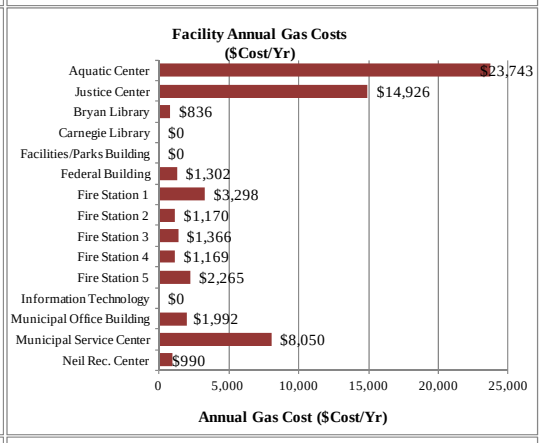


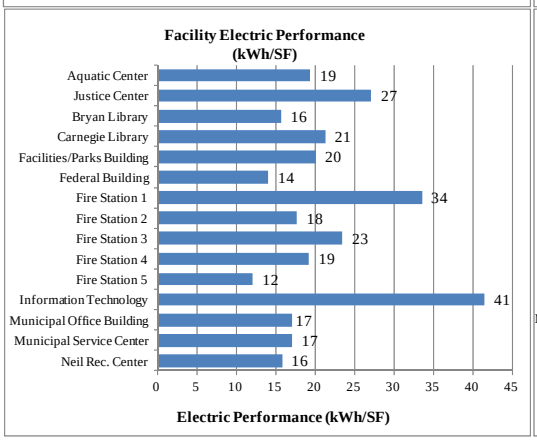


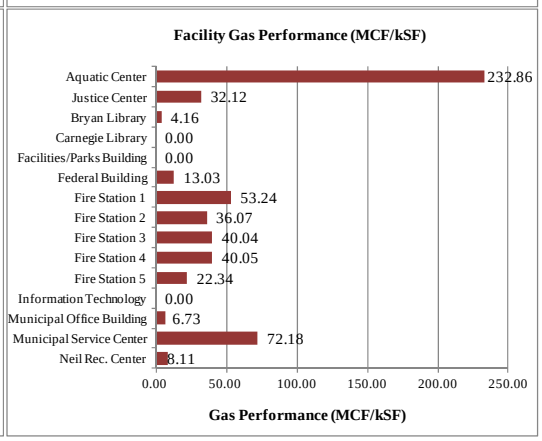




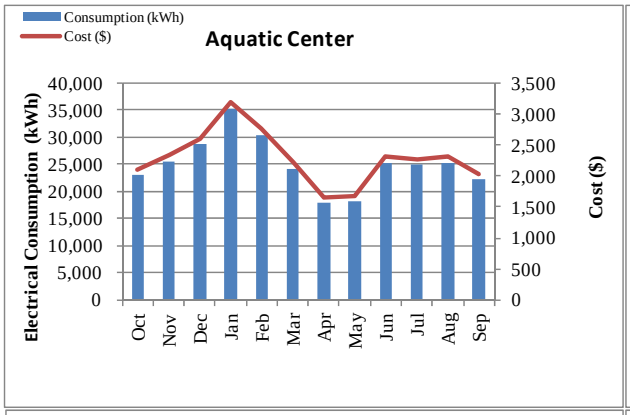


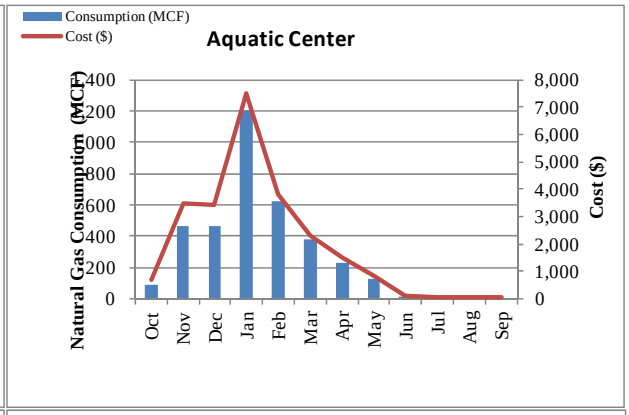


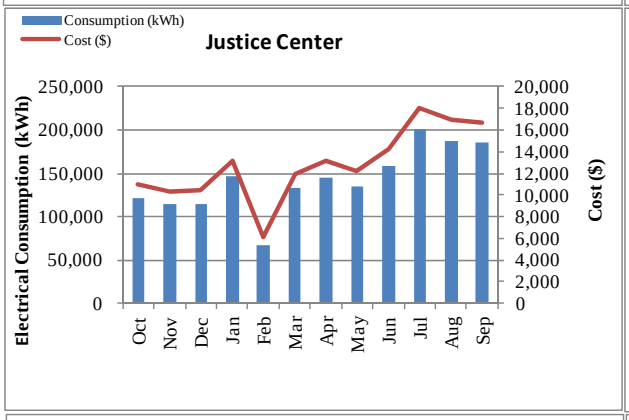


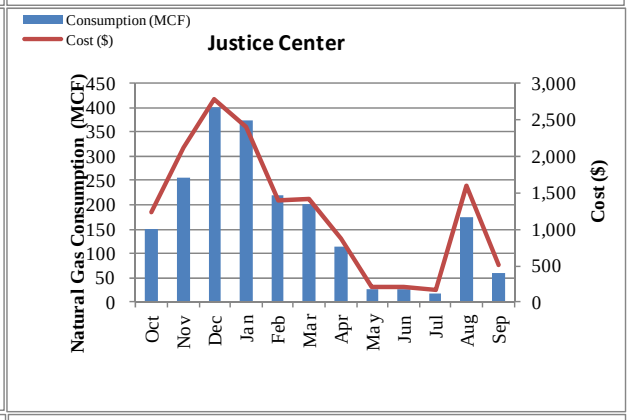


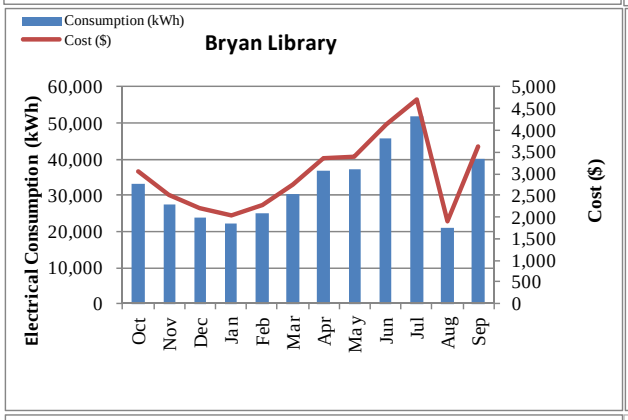
The following charts summarize each facility's monthly utility data. See **Appendix C** for further detail.

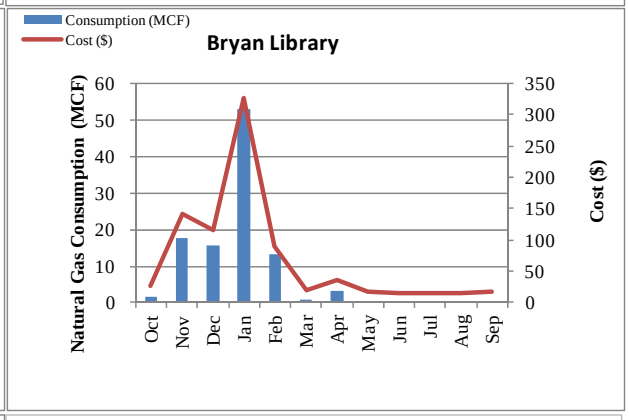


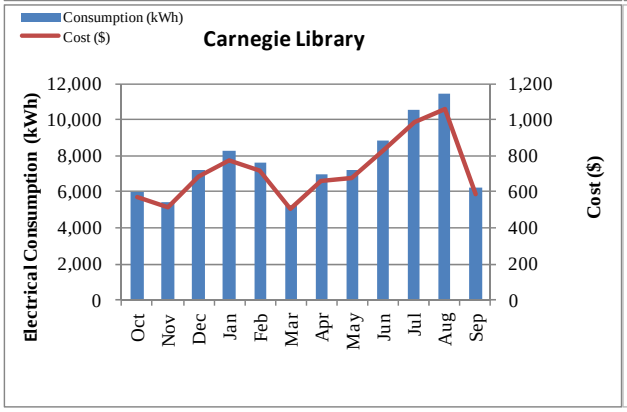












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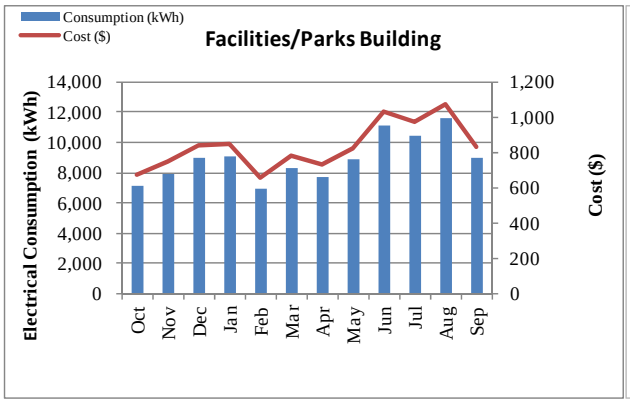

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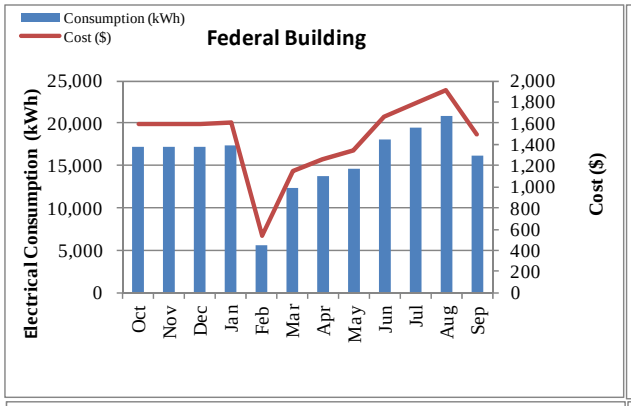
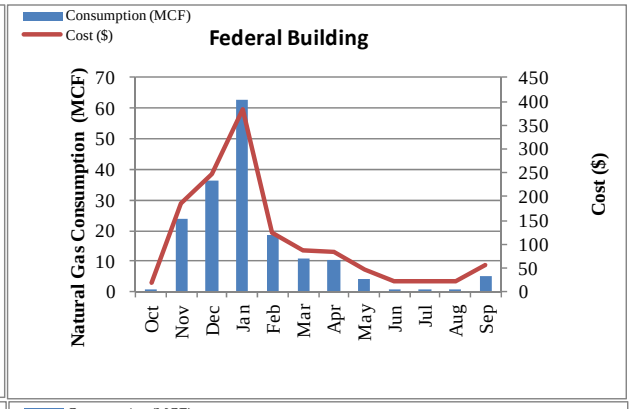
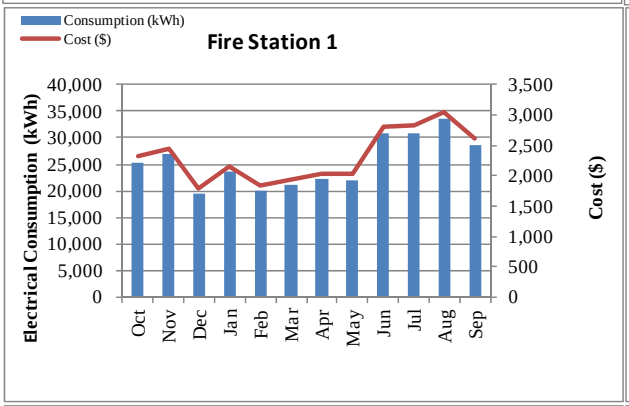
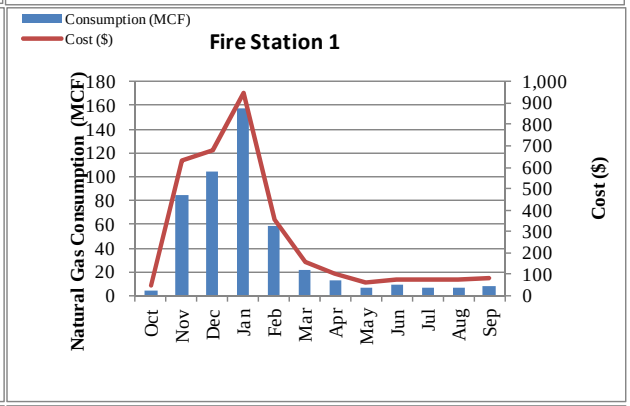
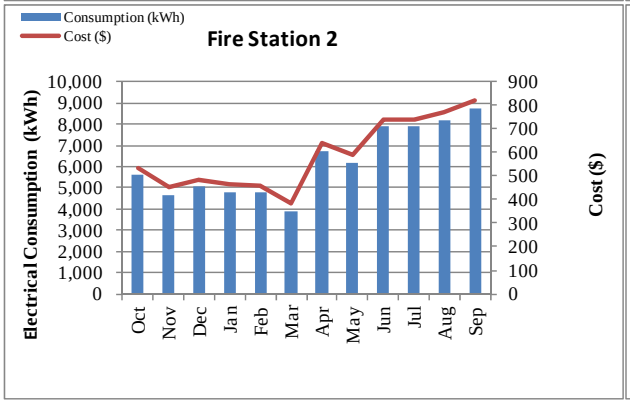
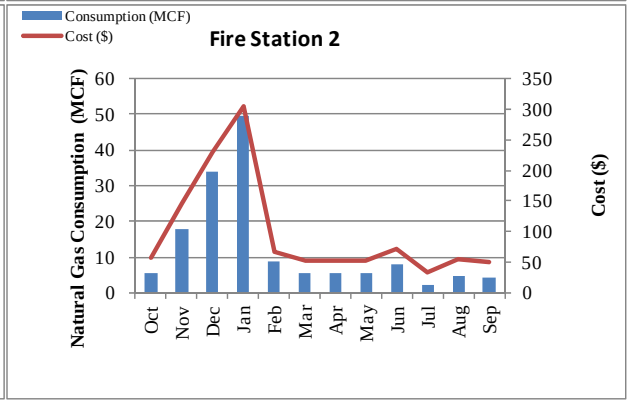


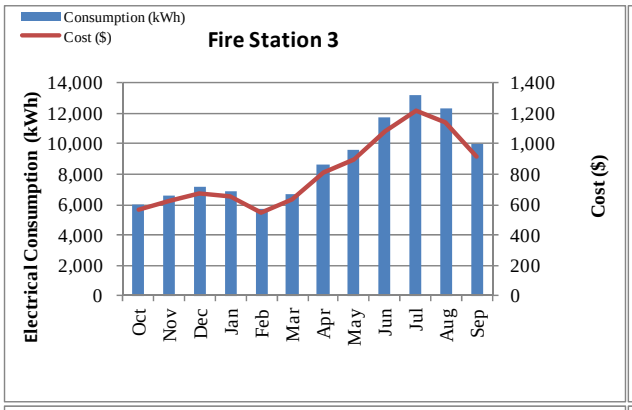


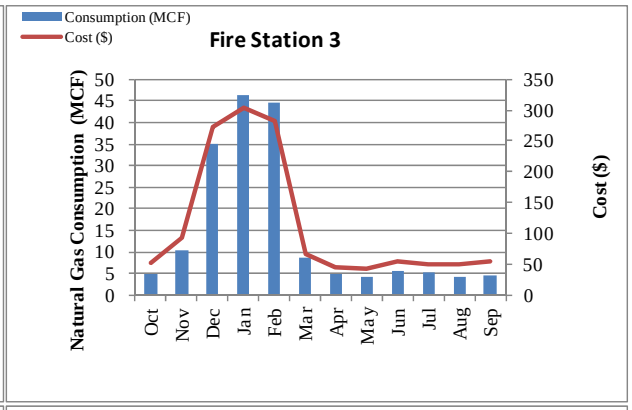


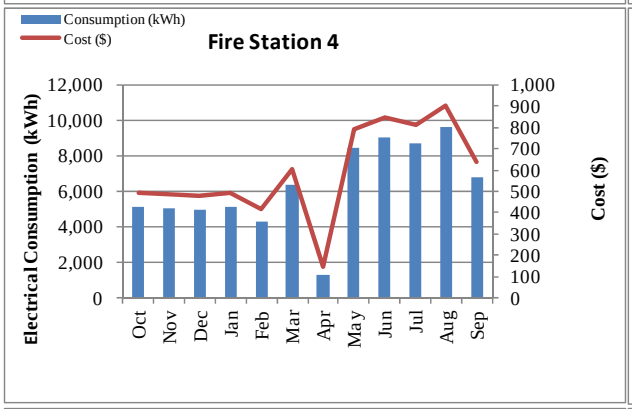


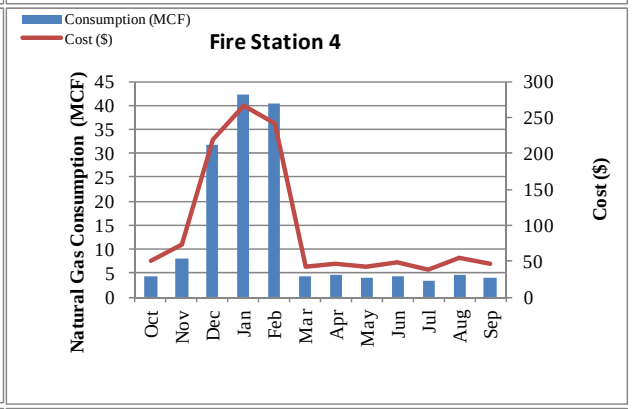


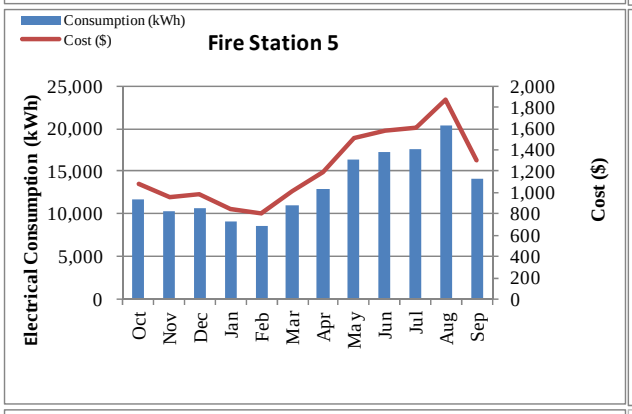


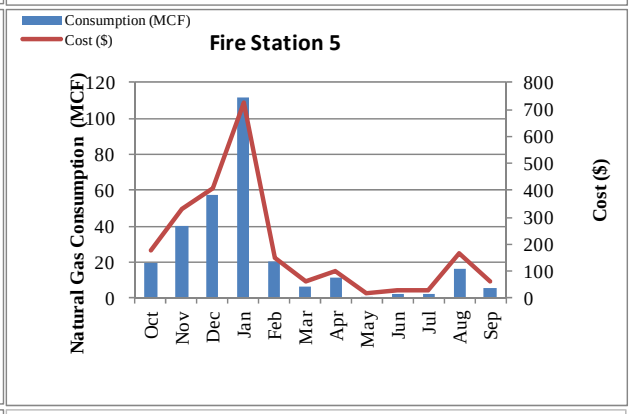


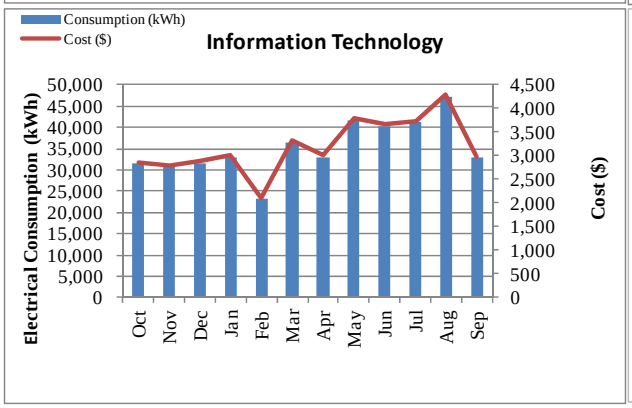




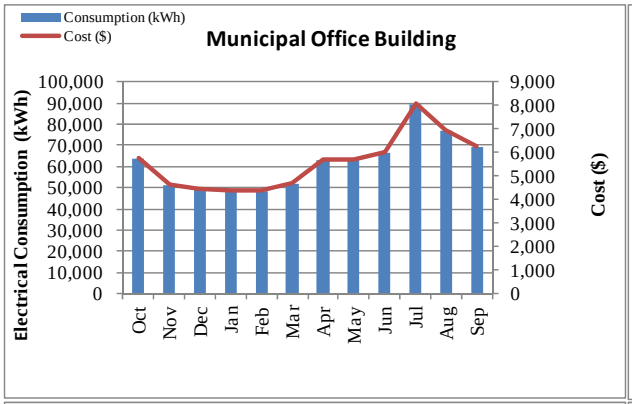


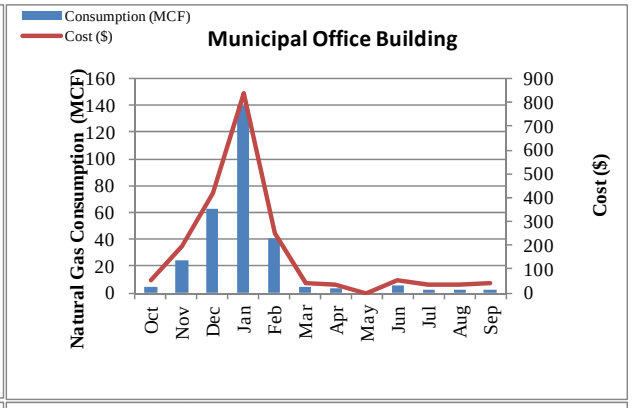


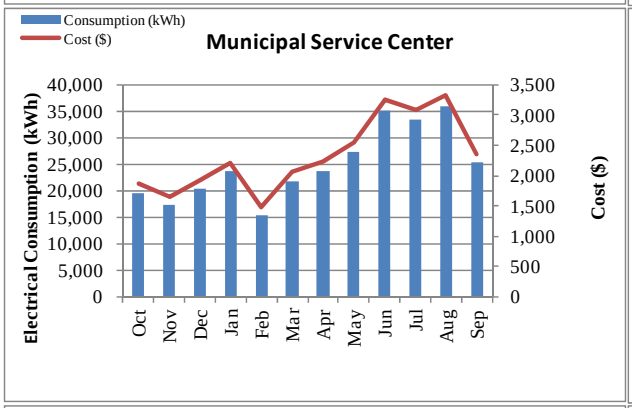


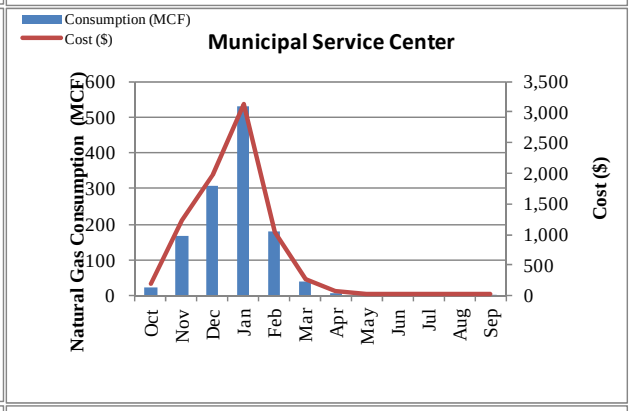


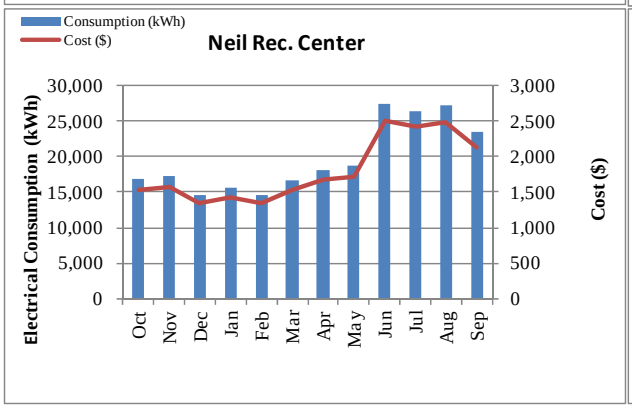
NATURAL GAS N/A

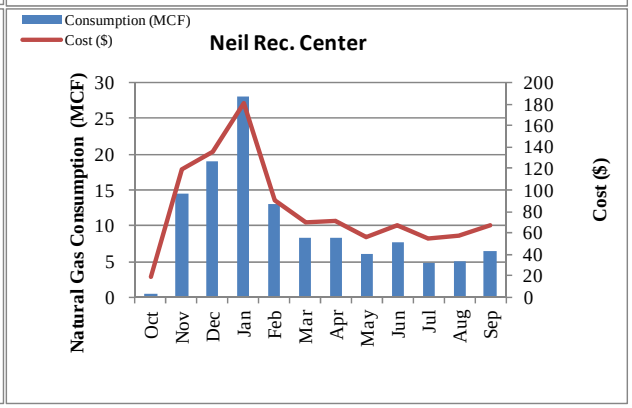

Consumption (kWh)
Cost ($)
Municipal Office Building
Electrical Consumption (kWh)
Cost ($)
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep

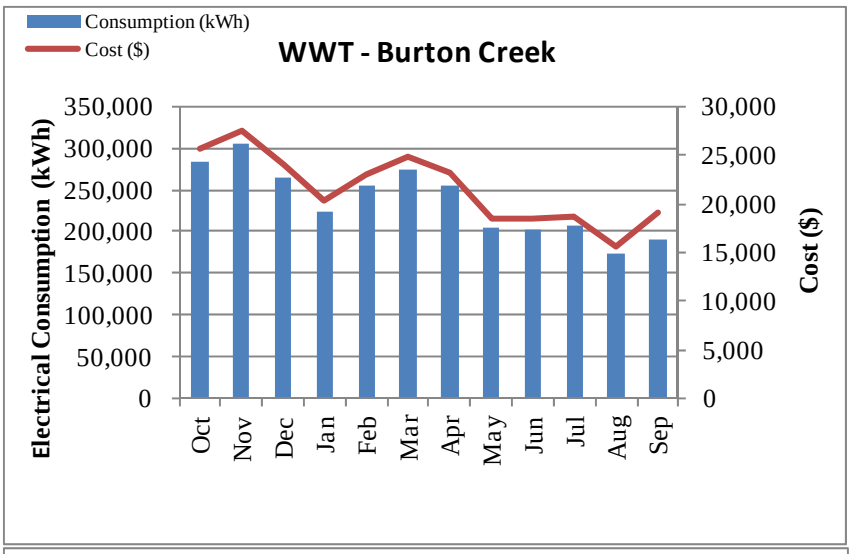

Consumption (MCF)
Cost ($)
Municipal Office Building
Natural Gas Consumption (MCF)
Cost ($)
160
140
120
100
80
60
40
20
0
900
800
700
600
500
400
300
200
100
0
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep

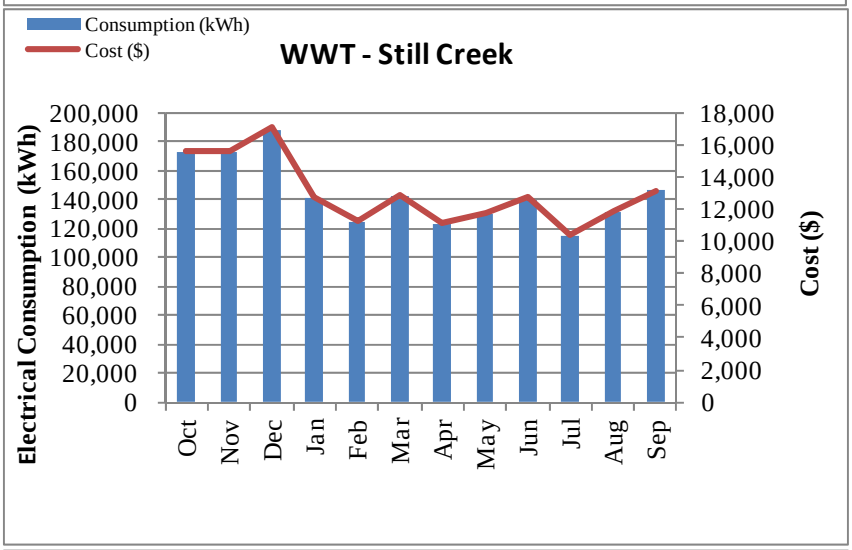

Consumption (kWh)
Cost ($)
Municipal Service Center
Electrical Consumption (kWh)
Cost ($)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep

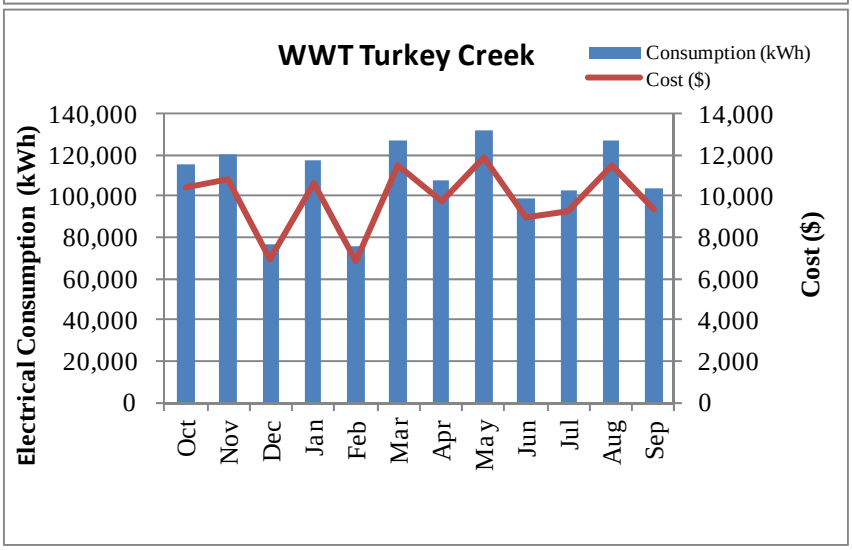

Consumption (MCF)
Cost ($)
Municipal Service Center
Natural Gas Consumption (MCF)
Cost ($)
600
500
400
300
200
100
0
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep


Consumption (kWh)
Cost ($)
Neil Rec. Center
Electrical Consumption (kWh)
Cost ($)
30,000
25,000
20,000
15,000
10,000
5,000
0
3,000
2,500
2,000
1,500
1,000
500
0
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep


Consumption (MCF)
Cost ($)
Neil Rec. Center
Natural Gas Consumption (MCF)
Cost ($)
30
25
20
15
10
5
0
200
180
160
140
120
100
80
60
40
20
0
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep


Consumption (kWh)
Cost ($)
WWT - Burton Creek
Electrical Consumption (kWh)
Cost ($)
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
30,000
25,000
20,000
15,000
10,000
5,000
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep


Consumption (kWh)
Cost ($)
WWT - Still Creek
Electrical Consumption (kWh)
Cost ($)
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep


WWT Turkey Creek
Consumption (kWh)
Cost ($)
Electrical Consumption (kWh)
Cost ($)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep

4.0 ENERGY STAR PORTFOLIO MANAGER

The City currently uses ENERGY STAR Portfolio Manager as a utility data tracking tool. ENERGY STAR is a joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE). Portfolio Manager helps organizations set investment priorities, identify under-performing facilities, verify efficiency improvements, and receive EPA recognition for superior energy performance.

Portfolio Manger is also an energy performance benchmarking tool. Portfolio Manager rates a facility's energy performance on a scale of 1–100 relative to similar facilities nationwide. The rating system is based on a statistically representative model utilizing a national survey conducted by the Department of Energy's Energy Information Administration. This national survey, known as the Commercial Building Energy Consumption Survey (CBECS), conducted every four years gathers data on building characteristics and energy use from thousands of buildings across the United States. A rating of 50 indicates that the facility, from an energy consumption standpoint, performs better than 50% of all similar facilities nationwide, while a rating of 75 indicates that the facility performs better than 75% of all similar facilities nationwide.

In addition, Portfolio Manager is used to generate a Statement of Energy Performance (SEP) for each facility, summarizing key energy information such as site and source energy intensity, greenhouse gas emission, energy reduction targets and energy cost. The Statement of Energy Performance is required for applying for ENERGY STAR Recognition from EPA/DOE, and can help in satisfying LEED for Existing Buildings (LEED-EB) requirements. For example, one of the requirements to receive ENERGY STAR Recognition is to achieve a minimum CBECS rating of **75**. A requirement to receive LEED-EB certification is an ENERGY STAR rating of **69**.

Some facility types are not able to receive an ENERGY STAR rating (at the time of this report, ENERGY STAR does not rate libraries, recreation centers, and fire stations). However, Portfolio Manager can still serve as a valuable tool for the city in tracking utility consumption and setting targets for performance of the City's facilities, including the water and wastewater treatment plants.

The City has previously tracked approximately two years of electricity and gas data for its facilities in ENERGY STAR Portfolio Manager. In addition, the City has entered various building space use data required by Portfolio Manager to generate the Energy Performance Rating. These inputs are critical and can significantly influence how Portfolio Manager computes the ENERGY STAR Rating. Many of these key inputs may vary over time and could influence the rating. **If an ENERGY STAR Label is pursued, these key inputs will need to be verified and certified by a qualified professional. Verification of this information is required when submitting the Statement of Energy Performance for ENERGY STAR's review.** The space use data required in Portfolio manager is summarized in the following table.

ENERGY STAR Portfolio Manager Example Space Use Data

Facility Type: Office

- 12 Months of Utility Data
- Gross Floor Area
- Weekly Operating Hours
- Workers on Main Shift
- Percent Cooled
- Percent Heated
- # of PCs

The ENERGY STAR rating for the office buildings (at present, only office buildings are eligible for ENERGY STAR ratings) is listed in the table below, using the space use data provided by the city. The target for facilities is a rating of 75 to qualify for ENERGY STAR. A benefit of using ENERGY STAR's Portfolio Manager is its ability to set goals for energy performance. It allows an energy performance target to be set and calculates the estimated savings per year to reach the goal. With performance targets of 69 and 75 set, the estimated yearly savings required for analyzed City office building eligible for a rating are shown below.

	ENERGY STAR Rating			ENERGY STAR Rating Target			ENERGY STAR Rating Target		
	EXISTING RATING			TARGET RATING = 69			TARGET RATING = 75		
Facility	Current ENERGY STAR Rating	Current Utility Cost $/SF/yr	Greenhouse Gas Emissions ($MtCO_2e$/yr) / ($kgCO_2e/ft^2$/yr)	Target Utility Cost $/SF/yr	Potential Target Savings $/yr	Greenhouse Gas Emissions (MtCO2e/yr) / (kgCO2e/ft2/yr)	Target Utility Cost $/SF/yr	Potential Target Savings $/yr	Greenhouse Gas Emissions (MtCO2e/yr) / (kgCO2e/ft2/yr)
Federal Building*	28	$1.39	132 / 10	$0.87	$7,019	83 / 6	$0.80	$7,968	77 / 6
Municipal Service Center	30	$2.06	387 / 22	$1.34	$12,618	252 / 14	$1.22	$14,781	228 / 13
Municipal Office	63	$1.59	472 / 11	$1.49	$4,141	444 / 10	$1.36	$9,662	406 / 9

*Note that space use data has a large impact on Energy Star Rating. The Bryan Federal Building is currently mostly unoccupied, which negatively impacts its rating.

Similarly, the table below shows savings targets for City of Bryan Wastewater plants.

	ENERGY STAR Rating			ENERGY STAR Rating Target			ENERGY STAR Rating Target		
	EXISTING RATING			TARGET RATING = 69			TARGET RATING = 75		
Facility	Current ENERGY STAR Rating	Current Utility Cost $/MGD/yr	Greenhouse Gas Emissions ($MtCO_2e$/yr) / ($kgCO_2e$/MGD/yr)	Target Utility Cost $/MGD/yr	Potential Target Savings $/yr	Greenhouse Gas Emissions ($MtCO_2e$/yr) / ($kgCO_2e$/MGD/yr)	Target Utility Cost $/MGD/yr	Potential Target Savings $/yr	Greenhouse Gas Emissions ($MtCO_2e$/yr) / ($kgCO_2e$/MGD/yr)
Burton Creek WWTP	67	$57,397	1,616 / 365	$56,823	$2,543	1,600 / 361	$52,231	$22,884	1,471 / 332
Still Creek WWTP	17	$155,338	971 / 981	$85,436	$69,203	534 / 539	$79,222	$75,355	495 / 500
Turkey Creek WWTP*	1	$185,209	743 / 1,161	$55,562.89	$82,455	223 / 348	$51,858	$84,811	208 / 325

*Turkey Creek WWTP to be disconinued this year

[1]WWTP Ratings assume ENERGY STAR default values for Influent/Effluent BOD5 and fixed film trickle filtration process.

[2]ENERGY STAR uses influent flows to generate ratings. Effluent flows were used and assumed to be sufficiently equal to influent flows for this analysis.

The City is encouraged to continue using Portfolio Manager for utilities tracking and setting of energy performance goals. Should the City have any questions on the use of or capabilities in Portfolio Manager, please contact TEESI or refer to the short guide in Appendix G.

5.0 ENERGY ACCOUNTING

UTILITY PROVIDERS

Bryan Texas Utilities provides electric service to the City. Atmos Energy provides Natural Gas service to the City.

MONITORING AND TRACKING

Currently, the City uses ENERGY STAR Portfolio Manager to track monthly electricity and gas data (kWh, MCF, and $). Peak demand in each month (kW) is also an important part of each facility's electric bill, and it is recommended to track this data as well (kW demand tracking is currently a shortfall of Portfolio Manager). See Section 6.0 for further discussion of peak demand and its effect on City energy costs.

An effective energy tracking system is an essential tool by which an energy management program's activities are monitored. The system should be centralized and available for all engaged staff members to use in verifying progress toward established targets and milestones. Having this historical data improves the City's awareness of their energy performance and will help in tracking their energy reduction goals.

The steps below are essential for an effective energy management tracking system:

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

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

3. 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** and **Senate Bill(s)** reporting requirements. Please see Section 7.0 for additional information regarding these requirements.

6.0 ELECTRICAL DEMAND AND LOAD FACTOR ANALYSIS

Most electrical utility companies charge costumers for both consumption and demand. Demand (kW) charges stem from a facility's peak power draw during a billing period, as opposed to consumption (kWh) charges, which total the energy usage over this period. Bryan Texas Utilities (BTU) meters the monthly demand for City of Bryan accounts, but does not charge for demand under the current rate agreement. Nevertheless, analyzing the peak demand in comparison to the monthly consumption can still be useful for monitoring a facility's load profile. This can be done by calculating a load factor for each month.

The load factor is equal to the average demand divided by the peak demand for a given period, and represents the consistency of a facility's energy usage. Typical load factors vary depending on facility type and operating hours, as well as season and building efficiency. An average value for a single-shift building is around 30%. In general, an excessively low load factor means higher demand peaks than total consumption would indicate. Excessively high load factors indicate more constant energy usage, suggesting equipment is not being shut down when it could be.

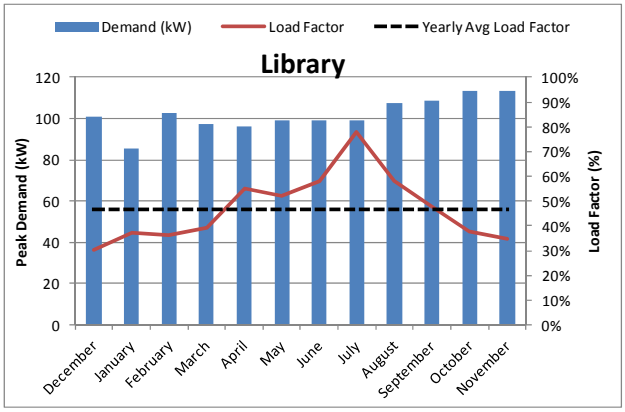
BTU bills most commercial accounts and some City accounts using a rate schedule that is dependent on the load factor. Because a higher load factor, meaning more consistent energy usage, is desirable for an electrical utility provider, BTU offers discounted rates for facilities with higher load factors. Under the load factor rate schedule, the cost per kWh varies depending on what range a facility's annual average load factor falls into. However, currently most City accounts are billed a constant rate per kWh, regardless of their load factor. The table below shows the rates of each load factor bracket under the load factor rate schedule, as well as the current flat rate for most City accounts. All accounts are also billed a $0.038/kWh fuel charge in addition to the charges below.

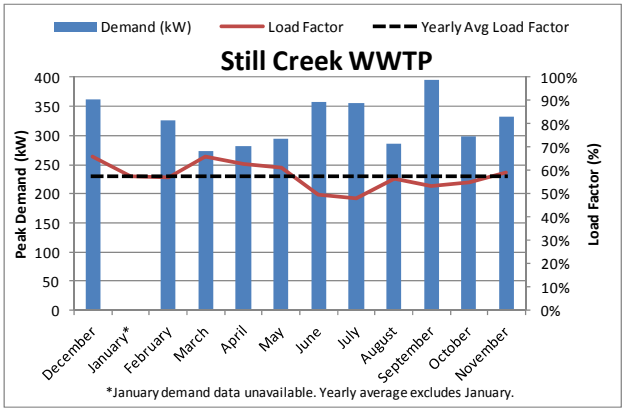
Annual Load Factor Range	Consumption Cost per kWh
60% and over	$0.0339
40%-59.9%	$0.0387
30%-39.9%	$0.0415
20%-29.9	$0.0481
Current City Accounts	$0.0491

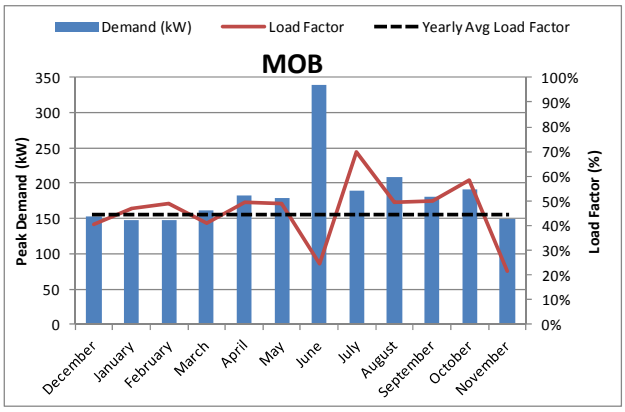
Note that all load factor rates are lower than the current consumption charge on most City accounts. For accounts with higher load factors (which many City facilities have due to extended operating hours), the load factor rate schedule would lead to significant monetary savings**. This needs more in-depth analysis and review of rate structures and associated documentation. It is recommended to consult with BTU about the possibility of switching to the load factor rate schedule**. Potential savings from a rate schedule change at facilities with the largest accounts, based on consumption and average load factor for the 12 month period ending September 2011, are shown in the following table.

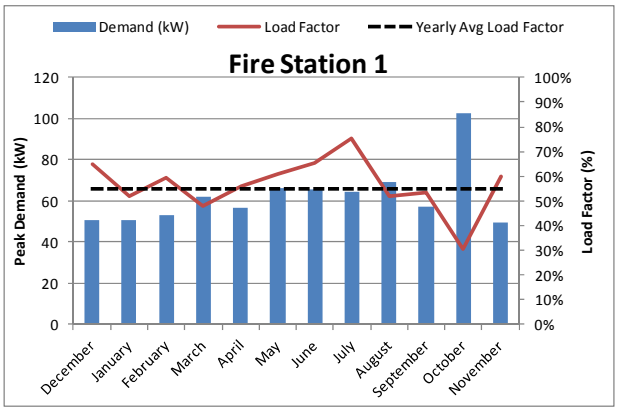
Facility	12-month Average Load Factor	Potential Savings
Burton Creek WWTP	54%	$29,486
Still Creek WWTP	57%	$17,716
Turkey Creek WWTP	77%	$19,818
Justice Center	68%	$25,977
MOB	45%	$7,696
Fire Station 1	55%	$3,171
IT	64%	$6,433
Library	47%	$4,101
TOTAL	**-**	**$114,398**

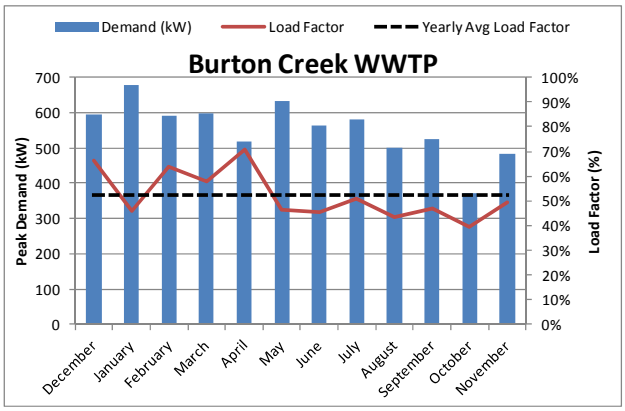
The figures on the following page show monthly peak demand and load factor for selected large City accounts. The annual average load factor is also depicted as an indication of what rate might be available under the load factor rate schedule.

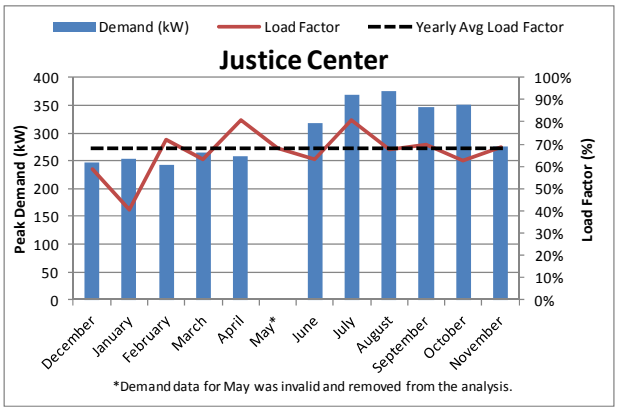

Demand (kW)
Load Factor
Yearly Avg Load Factor
Library
Peak Demand (kW)
Load Factor (%)
December
January
February
March
April
May
June
July
August
September
October
November

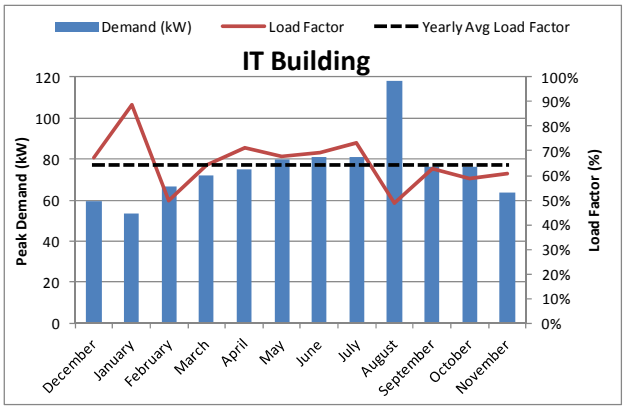

Demand (kW)
Load Factor
Yearly Avg Load Factor
Still Creek WWTP
Peak Demand (kW)
Load Factor (%)
December
January*
February
March
April
May
June
July
August
September
October
November
*January demand data unavailable. Yearly average excludes January.

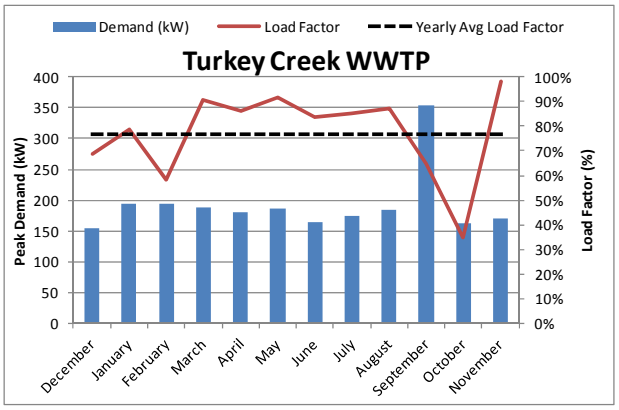

Demand (kW)
Load Factor
Yearly Avg Load Factor
MOB
Peak Demand (kW)
Load Factor (%)
December
January
February
March
April
May
June
July
August
September
October
November


Demand (kW)
Load Factor
Yearly Avg Load Factor
Fire Station 1
Peak Demand (kW)
Load Factor (%)
December
January
February
March
April
May
June
July
August
September
October
November


Demand (kW)
Load Factor
Yearly Avg Load Factor
Burton Creek WWTP
Peak Demand (kW)
Load Factor (%)
December
January
February
March
April
May
June
July
August
September
October
November


Demand (kW)
Load Factor
Yearly Avg Load Factor
Justice Center
Peak Demand (kW)
Load Factor (%)
December
January
February
March
April
May*
June
July
August
September
October
November
*Demand data for May was invalid and removed from the analysis.


Demand (kW)
Load Factor
Yearly Avg Load Factor
IT Building
Peak Demand (kW)
Load Factor (%)
December
January
February
March
April
May
June
July
August
September
October
November


Demand (kW)
Load Factor
Yearly Avg Load Factor
Turkey Creek WWTP
Peak Demand (kW)
Load Factor (%)
December
January
February
March
April
May
June
July
August
September
October
November

7.0 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.

Following are key requirements established by the above energy legislation:

Establish a goal of reducing electric consumption by five percent (5%) each state fiscal year for six (6) years, beginning on September 1, 2007.

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.

Energ-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.

A summary description of SB 12 and HB 3693 is available in Appendix A. Further detail regarding each bill can be found in the Texas Legislature website (http://www.capitol.state.tx.us/Home.aspx).

8.0 RECOMMENDED MAINTENANCE & OPERATING PROCEDURES

Sound Maintenance and Operation (M&O) 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 may currently be practiced by the City, and should be encouraged and continued to ensure sustainable energy savings.

M&O Recommendations - Buildings

The following are general design and maintenance and operations recommendations that may improve energy performance for City buildings.

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 City should establish a goal to reduce the number of small appliances and to limit their usage. For example, the use of small space heaters should be discouraged; hence, all space heating should be accomplished by the building'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.

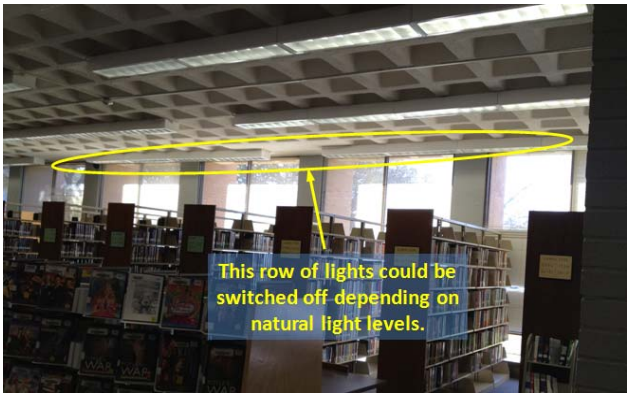
PRE-IDENTIFY PREMIUM EFFICIENCY MOTOR (PEM) REPLACEMENTS

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 at least one motor of each size and type that is in service at numerous locations.

IMPROVE CONTROL OF INTERIOR & EXTERIOR LIGHTING

Establish procedures to monitor use of lighting at times and places of possible/probable unnecessary use: offices (at lunchtime), maintenance shops, closets, exterior and parking lots during daylight hours, etc. Encouraging staff (i.e. custodial, maintenance) to participate in the City's efforts to limit unnecessary lighting use would help improve this effort. For example, the photo below shows fluorescent lighting on in one side of the truck bay at Fire Station 1. Light meter readings on the other side of the bay, where lights were switched off, showed nearly identical lighting levels due to the abundance of natural light. It is recommended to switch all overhead lighting off when daylight is sufficient for the area.

Similarly, the photo below shows fluorescent lighting in the Bryan Library. The row of lights nearest to the windows could be switched off whenever natural lighting levels allow. Light sensors are available to control the fixtures in this way.



EXTERIOR SECURITY AND SITE LIGHTING RETROFIT

Most city facilities utilize High Intensity Discharge (HID) fixtures for exterior lighting. It is recommended that the City replace the existing HID fixtures with a combination of Pulse Start Metal Halide (MH), LED, and Compact Fluorescent (CFL) fixtures suitable for the application. Care should be used when developing a retrofit/replacement strategy so that minimum security lighting levels are not sacrificed when the retrofit is complete. Therefore, lighting levels should be calculated to determine if the post retrofit levels are acceptable. 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 lamps with greater lumen maintenance can have sustainable energy savings with minimal impact. The following table lists several retrofit possibilities.

SECURITY/SITE LIGHTING RETROFIT STRATEGY			
Existing Fixture	**Existing Example Lamp Type and Wattage**	**Retrofit Scope**	**Retrofit Lamp Type and Wattage**
Pole Light (*)	1500W HID	Lamp/Ballast Replacement	1000W MH
Pole Light (*)	1000W HID	Lamp/Ballast Replacement	750W MH
Pole Light (*)	400W HID	Lamp/Ballast Replacement	320W MH
Pole Light, Short (*)	250W HID	Lamp/Ballast Replacement	200W MH
Security Wall Pack	150W/175W HID	LED Security Wall Pack Fixture Replacement	56W LED
Security Wall Pack, Low	70 HID	LED Security Wall Pack Fixture Replacement	26W LED
Security Wall Pack, Flood	250 HID	Lamp/Ballast Replacement	200W MH
Surface Mount	150W/175W HID	LED Surface Mount Fixture Replacement	56W LED
Recessed	70 HID	Lamp Replacement with CFL	50W CFL
Recessed, High	100 HPS/MH	Lamp Replacement with CFL	80W CFL
Incandescent Wall	100W Incandescent	Lamp Replacement with CFL	26W CFL

(*) Replacing outdoor MH fixtures with LED and/or Induction fixtures is increasingly cost effective as more choices become available at lower prices. Check pricing at decision time.

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 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.

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.

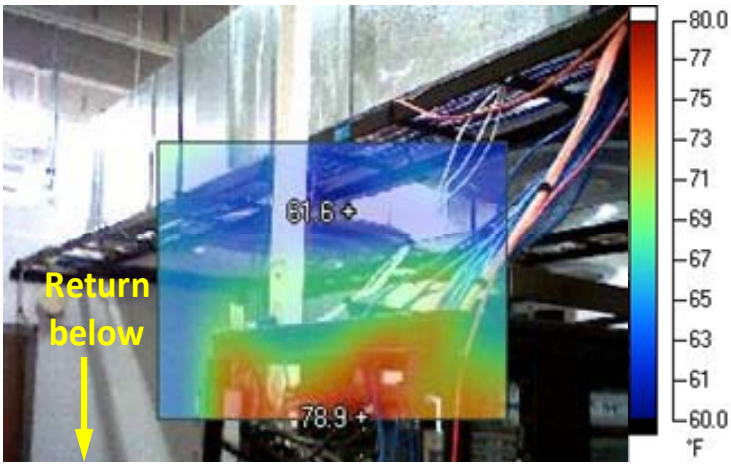
INSTALL ENERGY SAVING DEVICES ON VENDING MACHINE

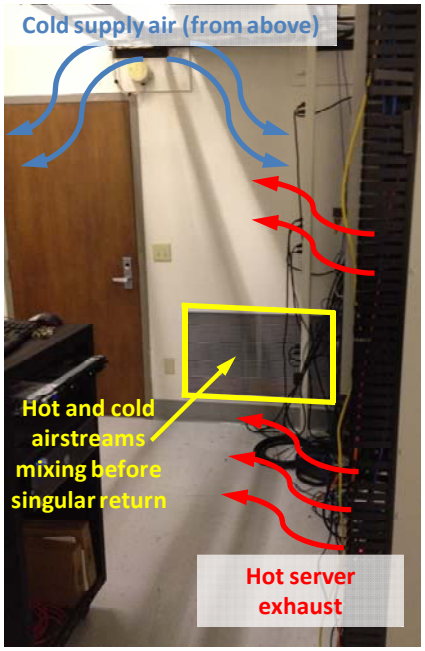
Install energy saving devices on vending machines with non-perishable food items to reduce the equipment power usage. These devices shut the vending machines down during unoccupied

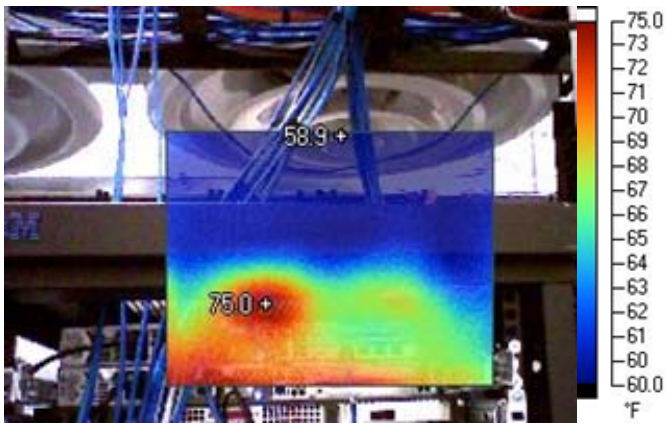
periods. There are several commercially available devices that can be easily installed on existing vending machines. These devices typical have a motion sensor which powers down the equipment after periods of inactivity. For example if the motion sensor does not sense activity within 15 minutes the device 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.

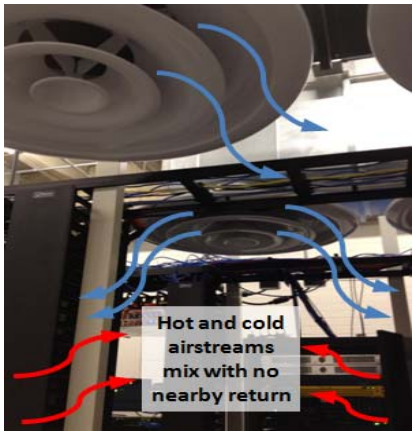
DATACENTER EFFICIENCY MEASURES

Datacenters can consume 25% to 50% more electricity than standard office spaces. Below are a few recommendations that could help improve the efficiency of an existing datacenter. Datacenter equipment can produce very concentrated heat loads. Proper air management to minimize or eliminate mixing between the cooling air supplied to equipment and the hot air rejected from the equipment can reduce operating costs, increase the data center's watt density (W/SF) capacity, and reduce heat related processing interruptions or failures. Proper placement of server equipment, location of supply and returns, and the configuration of the equipment's air intake and heat exhaust ports all influence air flow patterns in the room. The placement and orientation of server equipment should create distinct Hot/Cold aisle to prevent mixing of the hot air exhausted by the racks and the cool air supplied to the racks. The photographs and thermal images below were taken at the City of Bryan Information Technology (IT) Building server room. The distribution of cold air from the A/C system is shown along with server equipment exhausts and return vent position.



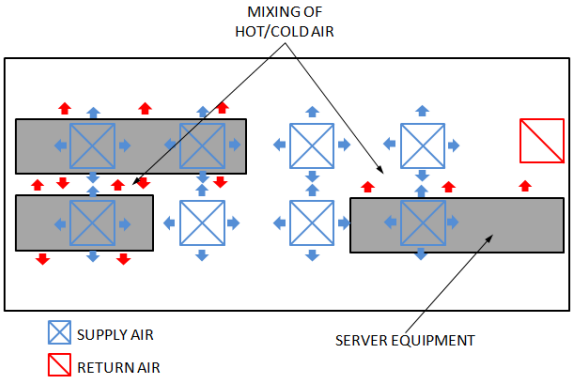




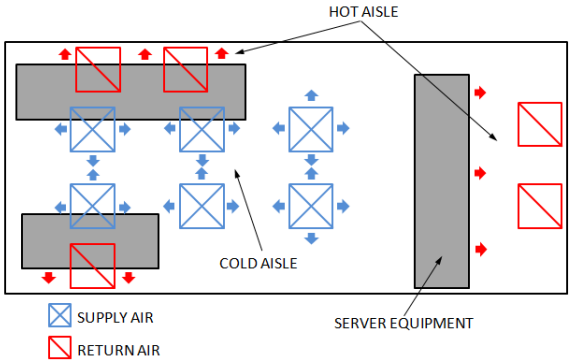


Other energy efficiency measures that may be applied to datacenters are: increasing the temperature difference between return and supply air; increase allowable humidity range (30%-70%); utilize high efficiency power supplies in IT computing equipment that meet the Server System Infrastructure (SSI) minimum recommended efficiency. For more information, please visit the following resources: Server System Infrastructure (www.ssiforums.org), High-Performance Buildings for High Tech Industries (http://hightech.lbl.gov/datacenters.html). Based on preliminary observation of the IT Building server room, it appears the server room's existing air distribution configuration could be modified to ensure proper air flow management suitable for a server room. Modification of the server room air conditioning layout will help improve air management, cooling efficiency, and equipment reliability. The sketches below provide a schematic/rough layout of the server room's configuration, followed by some suggestions that may improve the server room's distribution of air and increase system efficiency:

PRESENT CONFIGURATION



MODIFIED CONFIGURATION



Items causing improper Air management

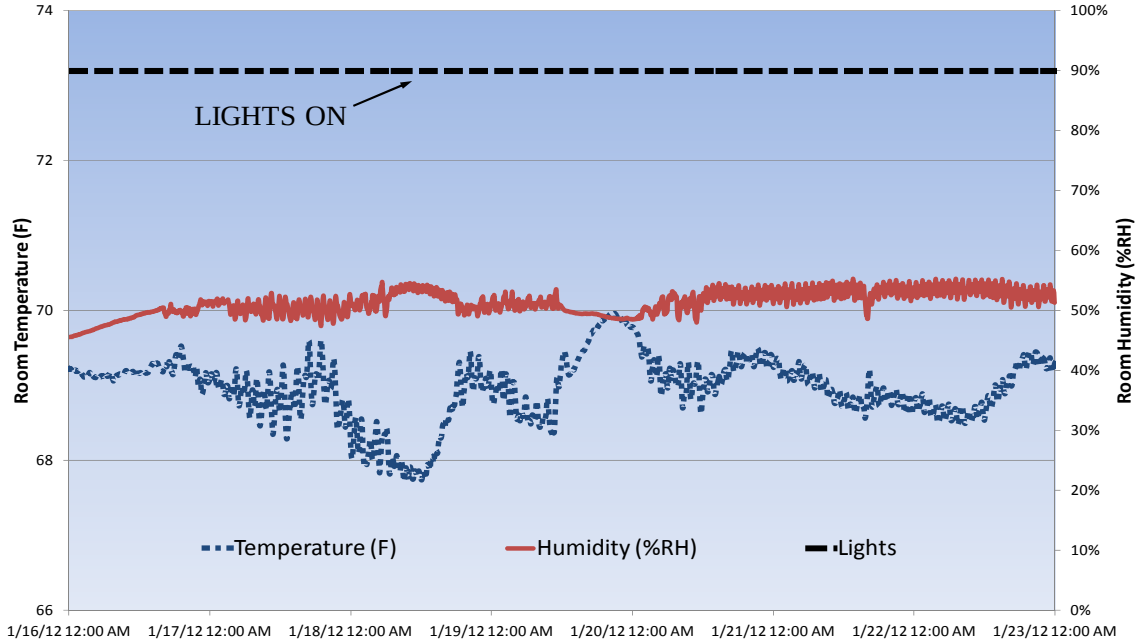
- Supply air (SA) diffusers locations and lack of return air vents are causing mixing of cold and hot air.

Modifications to create distinct hot/cold aisles.

- Re-position server equipment's inlet/outlet to create distinct Hot/Cold aisles.
- Re-position server racks so that supply air is delivered to the cold aisles.
- Install additional return paths to prevent hot/cold aisle mixing.

Important: The above is a schematic layout only and not intended to be a design guide for the application. Detailed analysis and design for modifications and future expansion (s) must be done by professional engineer experienced with data center layouts and design.

The following plot shows the temperature, humidity, and lighting status of the server room during a typical one-week period in January. Note that the lights were on around the clock during this time.



MAINTAIN RECOMMENDED BOILER RETURN TEMPERATURE LIMITS

Non-condensing boilers (such as the Raypak boiler used to heat the Aquatic Center swimming pool), need to maintain a boiler entering water temperature of above approximately 106°F. Return temperatures below this limit increases the acidity level of the combustion gases, causing corrosion of the boiler tubes. It is recommended to maintain the return temperature above this limit in order to increase the useful life of the boiler. This can be accomplished by feeding back hot supply water to the boiler inlet.

HAIL GUARDS ON CONDENSING AND PACKAGED ROOFTOP UNITS

When an HVAC unit is replaced, the City 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 if any existing unit(s) have damaged condensing coil fins the condensing fins should be straightened using a fin comb. The photo below shows a new Rooftop Unit (RTU) at the MOB without hail guards. Guards should be installed to protect these units from future damage.

PERFORM DETAILED ANALYSIS ON AQUATIC CENTER FILTRATION SYSTEM

The swimming pool filtration system at the Bryan Aquatic Center employs redundant 30 hp pumps that pump pool water through a filter and gas fired boiler when conditions require. Based on a preliminary analysis of typical water change rates for a pool of this size, it would appear less pumping power should be required. It is recommended to perform a detailed analysis of the system to identify unnecessary restrictions and/or reconfigure piping, reducing total head and pump power requirement while maintaining required filtration flow rates.

M&O Recommendations - Water and Wastewater Treatment Plants

The following are general design and maintenance and operations recommendations that may improve energy performance for water system and wastewater treatment facilities.

UTILIZE HIGH EFFICIENCY PUMPS AND MOTORS

When replacing pumping units, procure high efficiency pumps and motors. Energy savings could account for 10%-15% difference when compared to existing units.

ADD VFD OR “SOFT-START” TO PUMPING UNITS 50 HP AND GREATER

A soft-start feature would reduce start-up amperage surcharge saving money when rate structures consider start-up amperage draw.

EVALUATE PIPE SIZING WITHIN SERVICE AREA TO REDUCE FRICTION LOSSES

Performing a water distribution system analysis could recommend the most efficient piping size for the service area. Constructing non-restrictive piping would reduce system head requirements and save power.

ADD VARIABLE FREQUENCY DRIVES (VFDs) TO HIGH SERVICE PUMP STATIONS

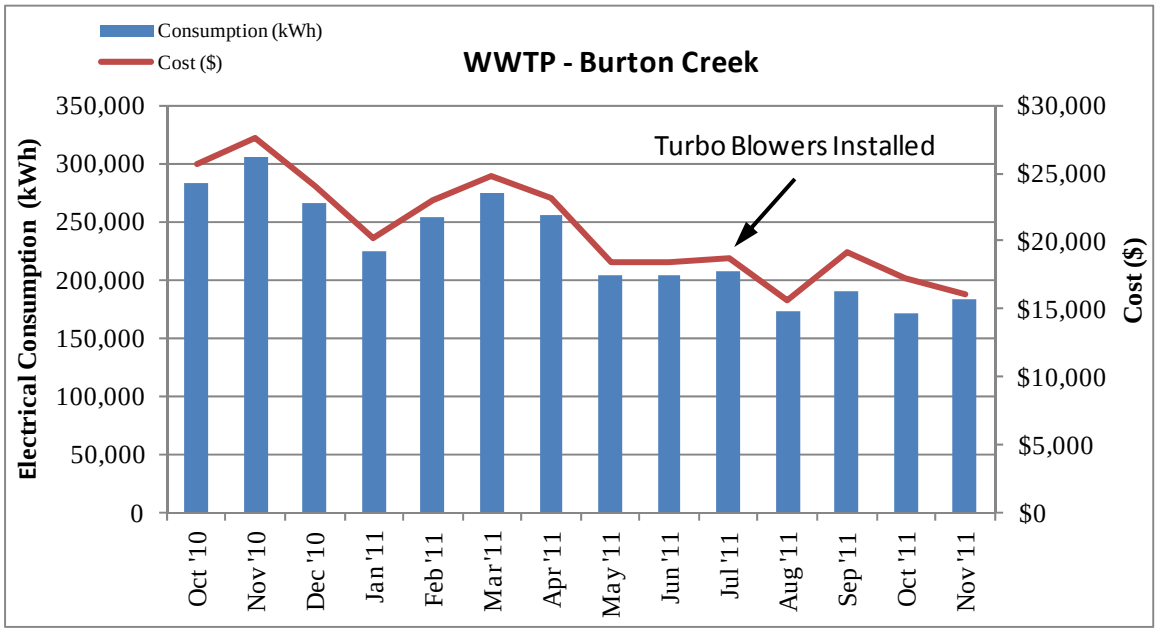
A VFD controlled pump station could serve as an alternative system pressure control to enable elevated storage to be taken out of service for painting or repairs.

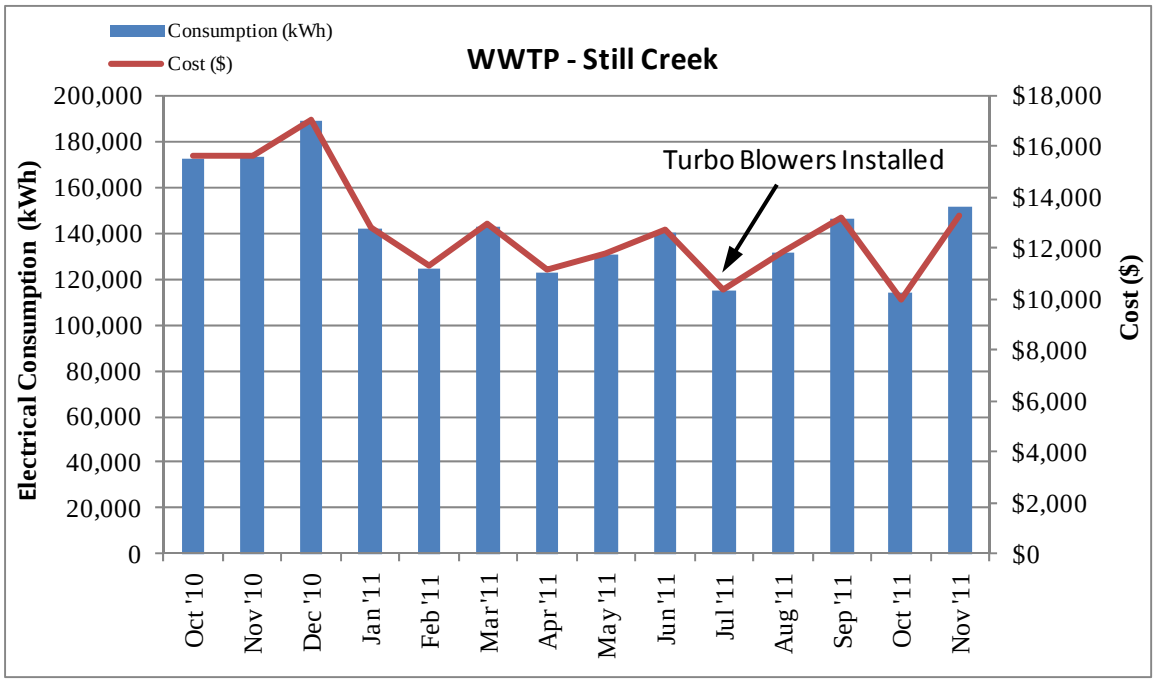
CONTROL DISSOLVED OXYGEN LEVEL IN WWTP

Reducing aeration to maintain dissolved oxygen levels of 2.0 mg/l or less could reduce power draw. Variable Frequency Drive, dual speed motors, or simply operating fewer units to maintain minimum dissolved oxygen levels would save power.

MONITOR POST-RETROFIT CONSUMPTION TO VERIFY EXPECTED SAVINGS

Measurement and Verification (M&V) is an essential part of any energy retrofit project. The plots on the following page show the electrical consumption and cost for the two main City wastewater plants (Still Creek and Burton Creek) over a 14 month period. High efficiency turbo blowers were installed at these plants in July of 2011. More energy projects are in progress for these plants, and consumption for both plants should continue to be monitored to ensure energy retrofits provide the desired savings results.


Consumption (kWh)
Cost ($)
WWTP - Burton Creek
Turbo Blowers Installed
Electrical Consumption (kWh)
Cost ($)
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
Oct '10
Nov '10
Dec '10
Jan '11
Feb '11
Mar '11
Apr '11
May '11
Jun '11
Jul '11
Aug '11
Sep '11
Oct '11
Nov '11


Consumption (kWh)
Cost ($)
WWTP - Still Creek
Turbo Blowers Installed
Electrical Consumption (kWh)
Cost ($)
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
$18,000
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$0
Oct '10
Nov '10
Dec '10
Jan '11
Feb '11
Mar '11
Apr '11
May '11
Jun '11
Jul '11
Aug '11
Sep '11
Oct '11
Nov '11

9.0 ENERGY MANAGEMENT SYSTEM (EMS) SAMPLE SCREEN SHOTS

During the preliminary walk-through, several screen shots of City Facilities' EMS frontends were taken. The EMS snap shots help provide a sample of the HVAC equipment settings (Temperature Setpoints, Equipment On/Off Status, etc.). While this information only provides a brief example of the indoor conditions, it is helpful in providing a general understanding of a facility's HVAC system operations. Since the HVAC system is the major energy consumer in most facilities, investigating these systems can help identify energy reduction opportunities. Such an investigation is a large part of a comprehensive building Retro-Commissioning (RCx) program, an energy reduction measure that is recommended and discussed further in Section 10.0. Below are some examples of the information obtained from the City of Bryan EMS. Please note the following images were obtained during the month of January 2011.

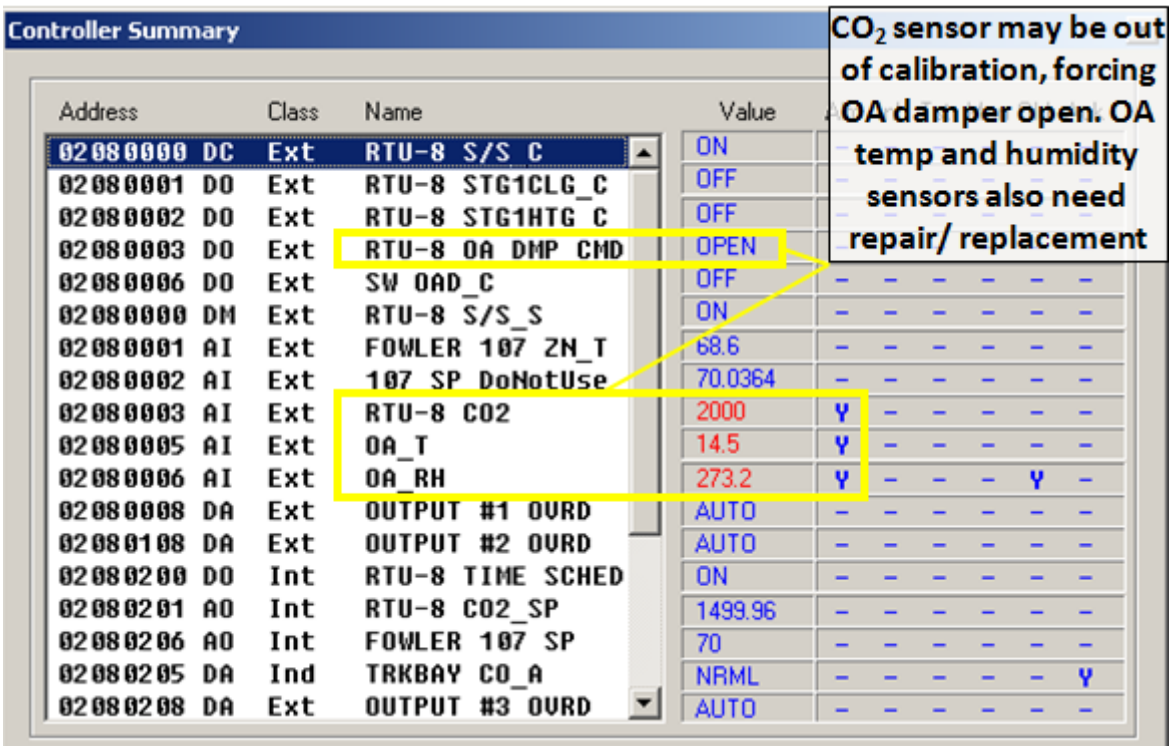


Figure 1. Rooftop Unit (RTU) at Bryan Fire Station. CO_2 reading is exceeding sensor limits, forcing Outside Air (OA) dampers open. The sensor may be out of calibration. Faulty OA temperature and humidity readings may also affect unit operation.

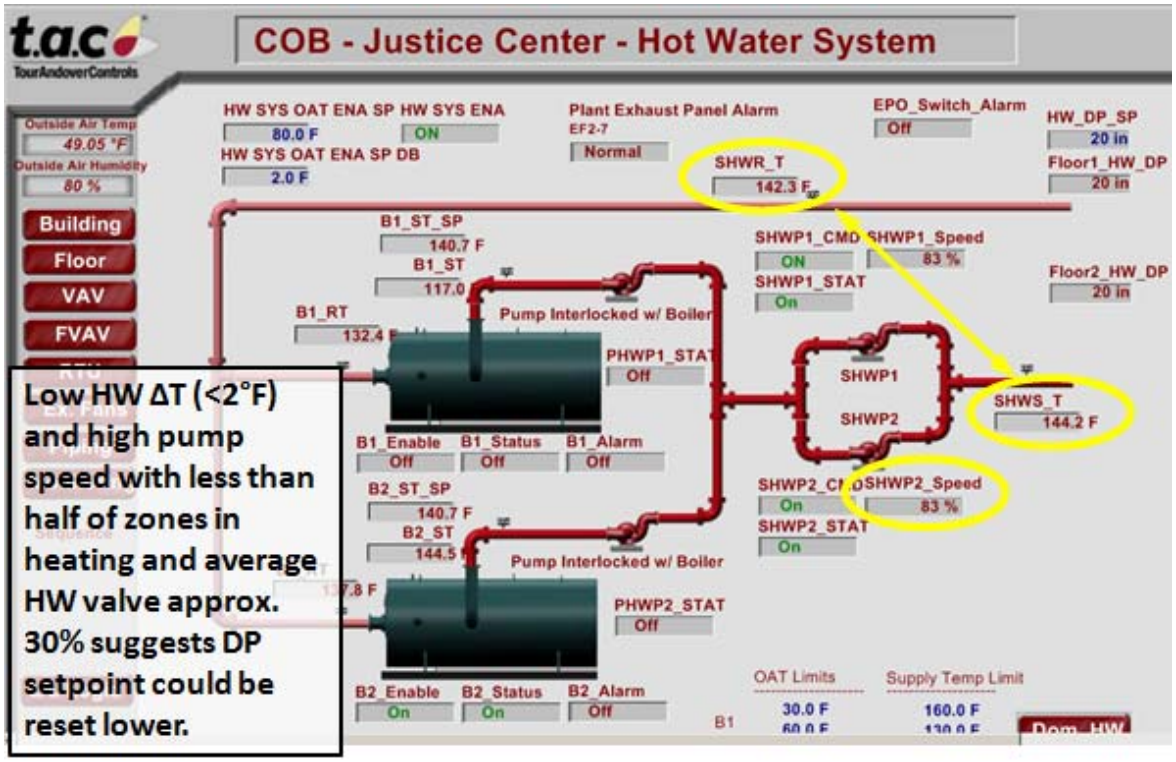


Figure 2. Bryan Justice Center boiler plant. Hot Water (HW) loop temperature drop is extremely low while pump speed is at 83%. Slower pump speed (by resetting DP setpoint) can save on pumping power and yield cooler return water, increasing boiler efficiency.

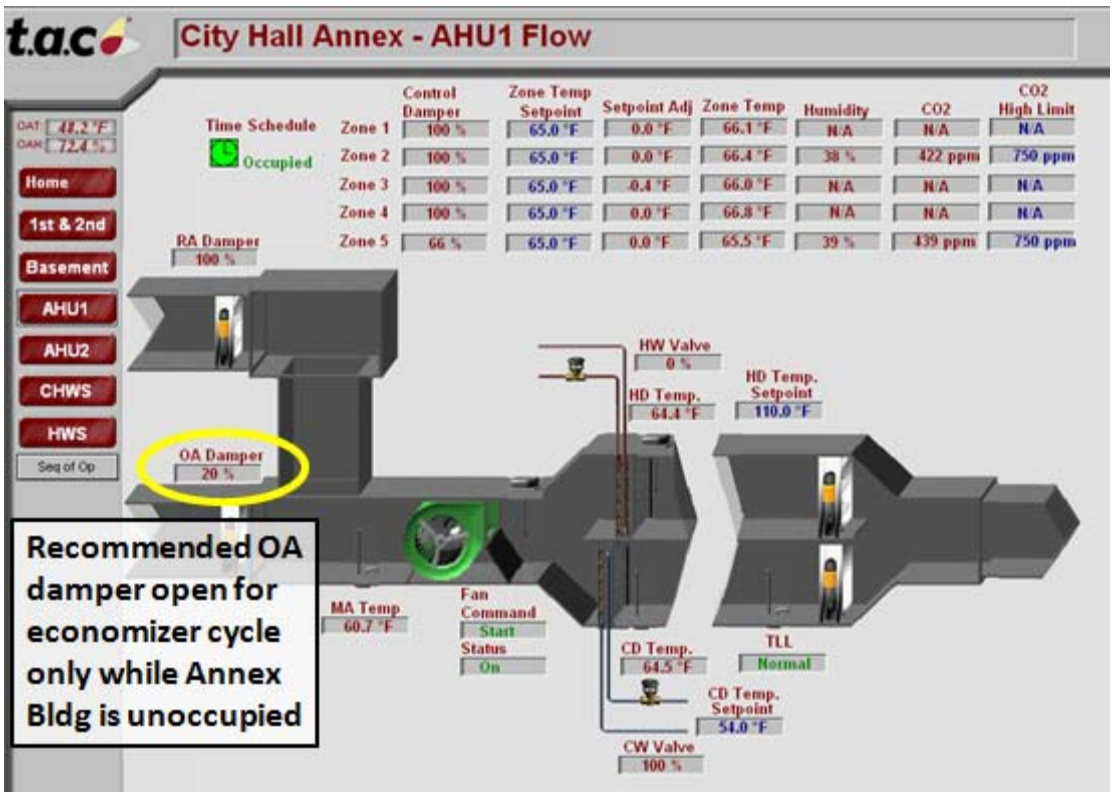


Figure 3. The City Hall Annex is currently unoccupied. Annex AHUs are set for limited operating hours to maintain indoor environment. It is recommended to close OA dampers fully during operation except when in economizer mode.

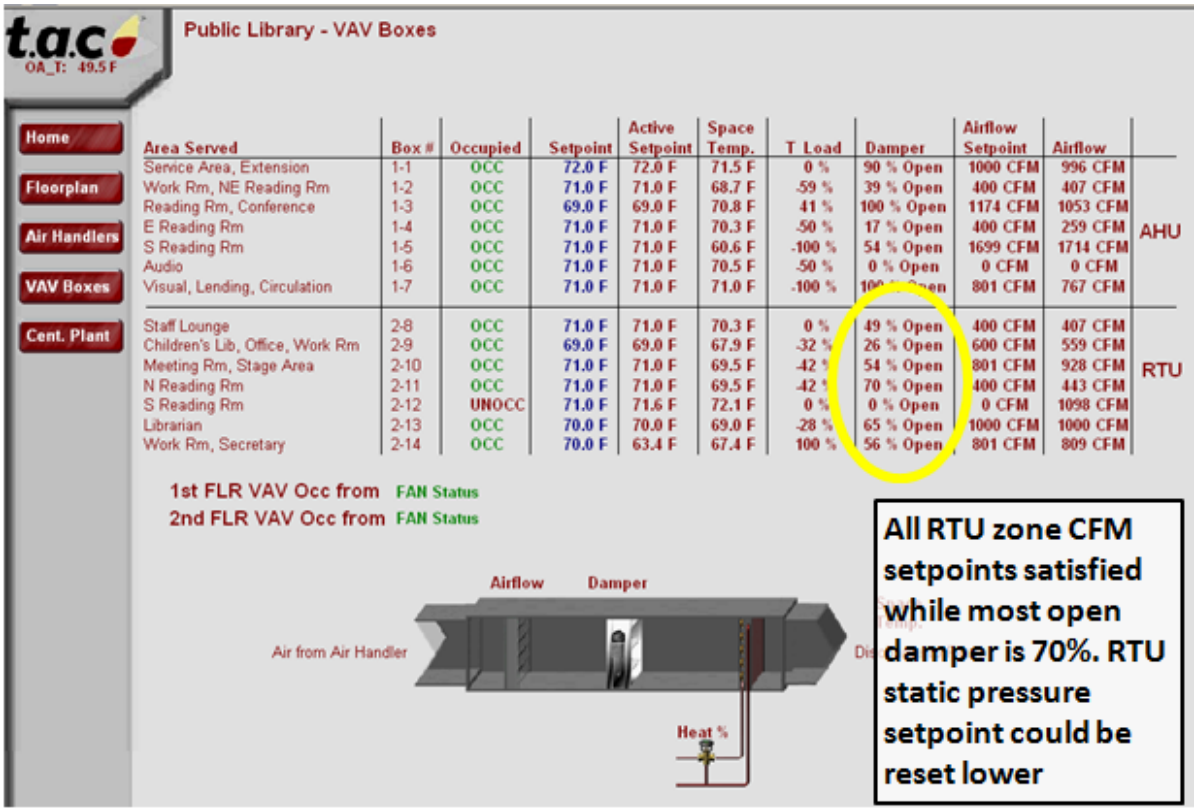


Figure 4. Bryan Library VAV box summary. Boxes served by the Library RTU are pressure independent. Primary fan static pressure setpoint can be reset lower so long as box CFM setpoints are satisfied (typically reset to maintain most open damper at 90% open).

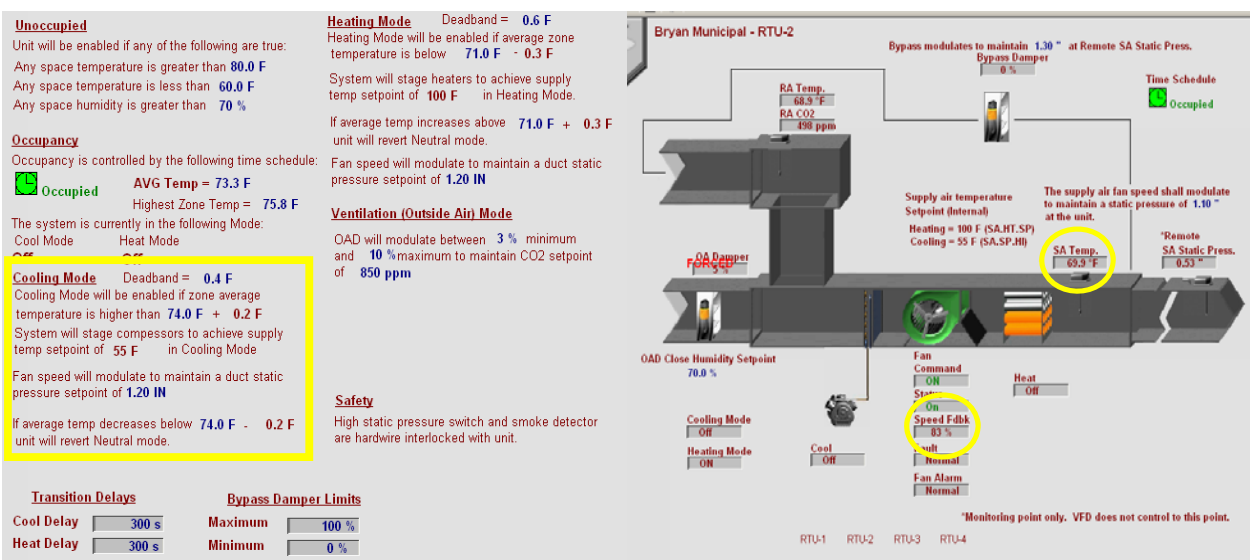


Figure 5. Bryan MOB sequence for all RTUs sets unit to neutral mode when average zone temperature falls below setpoint. This leads to higher fan speeds (more flow) with warmer air, generally consuming more energy than colder air at lower fan speeds for the same cooling load.

10.0 RETROFIT OPPORTUNITIES

Energy retrofit projects identified during the preliminary analysis are detailed below. Project cost estimates include complete design and construction management services.

T12 TO T8 FLUORESCENT LIGHTING RETROFIT

The City has a combination of T8 and T12 (4' and 8') Fluorescent fixtures. Existing T12 fixtures consist of a combination of standard and high output (HO) applications. It is recommended that the City replace the existing T12 fluorescent lamps and magnetic ballasts with high efficiency T-8 fluorescent lamps and electronic ballasts. A typical four-foot, two-lamp (34W) fixture with magnetic ballast requires approximately 75 watts, while two F28T8 lamps with electronic ballast in the same fixture configuration require only 55 watts and produce 95% as much light while consuming 73% as much energy. In areas with eight-foot T12 fixtures, conversion kits are available to retrofit existing lamps with two four-foot T8 lamps. The table below indicates the facilities where T-12 fluorescent lamps were observed during the preliminary walkthrough. The cost and savings noted below are based on preliminary observations of the facilities. Exact cost, quantities, and lamp types can be identified through a detailed energy audit. In addition, a detailed lighting design calculation will help ensure the appropriate lighting replacement is selected. For example, a detailed design calculation may identify areas that could operate with fewer lamps per fixtures or with low-wattage T8 lamps while still maintaining adequate lighting levels. The cost and savings calculations below are based on 48” F28T8, extended life linear fluorescent lamps and 1 (one) ballast per fixture. Lamp and ballast recycling is included in the cost estimates.

T12 TO T8 LIGHTING RETROFIT				
Building	**Estimated Implementation Cost**	**Estimated Annual Savings ($/yr)**	**Estimated Annual MMBTU Savings (MMBTU/yr)**	**Simple Payback (years)**
Municipal Service Center	$12,600	$2,500	93	5.0
TOTAL	**$12,600**	**$2,500**	**93**	**5.0**

REPLACE EXISTING T8 FLUORESCENT LAMPS WITH LOWER WATTAGE LAMPS

Low-wattage T8 fluorescent lamps are available in 30, 28 and 25-watt versions. The City should consider replacing existing 32-watt T8 Fluorescent lamps with lower wattage lamps in most cases. However, lower wattage T8 lamps produce a little less light, so it is important to verify by calculation beforehand that recommended lighting levels will be maintained. Lighting levels should be measured 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 reduce energy use by about 12% while dropping the lighting level only about 4%.

The estimated costs and savings noted below are based on replacement of existing 32-watt T8 lamps and do not account for ballast replacements (if existing are incompatible) or reduced lamp counts (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. The cost and savings calculations below are based on 48" F28T8, extended life linear fluorescent lamps. Lamp recycling is included in the cost estimates.

LOW WATTAGE T8 FLUORESCENT LIGHTING RETROFIT				
Building	**Estimated Implementation Cost**	**Estimated Annual Savings ($/yr)**	**Estimated Annual MMBTU Savings (MMBTU/yr)**	**Simple Payback (years)**
Aquatic Center	$2,800	$500	19	5.6
Bryan Library	$4,500	$900	33	5.0
Federal Building	$2,400	$400	15	6.0
Fire Station 1	$1,600	$300	11	5.3
Information Technology	$1,800	$500	19	3.6
Municipal Office Building	$7,800	$1,100	41	7.1
Municipal Service Center	$600	$100	4	6.0
TOTAL	**$21,500**	**$3,800**	**141**	**5.7**

REPLACE INDOOR HID LIGHTING WITH INDUCTION LIGHTING

The Bryan Municipal Office Building (MOB) utilizes High Intensity Discharge (HID) fixtures over its atrium (shown in the photo below). It is recommended that the City replace these fixtures with higher efficiency alternatives such as induction lighting or LED.

In addition to lower energy usage and heat generation, induction lamps and LEDs have significantly longer life spans than HIDs (approximately 80,000 rated hours versus 15,000 rated hours for metal halides). In this particular application, scaffolding must be assembled across the MOB atrium whenever a lamp needs changing. Retrofitting with a longer-life alternative could greatly reduce labor intensive lamp changes. Induction lighting and LEDs can also yield better color rendering and lumen maintenance than HIDs. The cost and savings estimates below are based on preliminary observations and analysis of energy cost savings alone (labor and material savings excluded). **Note that due to these fixtures mostly operating at night time, the payback period from an energy standpoint is relatively high. The project may still be justifiable however when maintenance and labor are considered.** A detailed analysis is required to identify suitable replacements and retrofit scope.

INDOOR HID LIGHTING RETROFIT				
Building	**Estimated Implementation Cost**	**Estimated Annual Savings ($/yr)**	**Estimated Annual MMBTU Savings (MMBTU/yr)**	**Simple Payback (years)**
Municipal Office Building	$6,600	$400	15	16.5
TOTAL	**$6,600**	**$400**	**15**	**16.5**

INSTALL OCCUPANCY SENSORS FOR INDOOR LIGHTING CONTROL

It is recommended the City 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 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 and 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, offices, break rooms, etc.).

MOTION SENSOR INSTALLATION				
Building	**Estimated Implementation Cost**	**Estimated Annual Savings ($/yr)**	**Estimated Annual MMBTU Savings (MMBTU/yr)**	**Simple Payback (years)**
Aquatic Center	$1,100	$100	4	11.0
Justice Center	$11,000	$1,800	67	6.1
Bryan Library	$1,800	$200	7	9.0
Federal Building	$3,300	$400	15	8.3
Fire Station 1	$1,500	$300	11	5.0
Information Technology	$1,100	$200	7	5.5
Municipal Service Center	$2,600	$400	15	6.5
TOTAL	**$22,400**	**$3,400**	**126**	**6.6**

INSTALL SOLAR THERMAL POOL HEATING SYSTEM FOR AQUATIC CENTER

The Bryan Aquatic Center currently uses a 4.5 million BTU boiler for pool heating. The pool is outdoors and maintained at over 80°F year-round. The natural gas bill for this facility was $23,743 for the 12 month period ending September 2011. It is recommended that the City install a solar thermal heating system to supplement the existing gas fired heating. A full system generally requires collector area approximately 75% as large as the pool itself. This would require collectors to be ground mounted near the pool. With a partial system designed merely to assist the existing boiler, collectors could be installed on the office roof (see aerial photo below). The following table provides the estimated project costs and projected energy savings associated with a partial solar pool heating system for the Bryan Aquatic Center using plastic absorbers. A detailed analysis would be necessary to determine the type of system needed and the mode of integration into the existing boiler loop.

SOLAR THERMAL POOL HEATING SYSTEM				
Building	**Estimated Implementation Cost**	**Estimated Annual Savings ($/yr)**	**Estimated Annual MMBTU Savings (MMBTU/yr)**	**Simple Payback (years)**
Aquatic Center	$65,000	$4,900	767	13.3
TOTAL	**$65,000**	**$4,900**	**767**	**13.3**

HVAC COMMISSIONING (Cx)

Detailed HVAC & Control system commissioning in an existing building involves analysis of existing systems to ensure compliance with original set-up/design conditions and, where feasible, analyzing the design to adjust operating parameters to enhance comfort and reduce energy consumption. Overall, the goal of commissioning is to deliver a system that operates optimally, meets the needs of the building owner and occupants, and is understood by the 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. For general information on Cx, please refer to Appendix H.

HVAC Retro-commissioning (RCx) involves the optimization of an existing building's energy usage through testing and documentation. Typically, this procedure will review and improve a building's energy consumption levels by investigating staff and occupant observations as well as optimizing the building systems to meet or surpass the original design goals. This process is especially appropriate for buildings that have not been commissioned recently.

Preliminary examination (utility data review, discussion with staff, EMS review, and walkthrough) of City facilities indicate potential for energy cost savings primarily in the HVAC systems operations at the Justice Center. The facility would greatly benefit by implementing a comprehensive building commissioning (Cx) program beyond standard RCx 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 requires 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. The duration of such a program typically runs 12-14 months.

Preliminary analysis also indicates potential for HVAC energy savings at the Federal Building, Fire Station 1, Information Technology, Municipal Office Building, and Municipal Service Center. **However, at these facilities it is believed a more traditional RCx program or building "tune-up" would be more cost effective.** Measures would include optimization of space setpoints, dehumidification sequences, schedules, deadbands, and identification of malfunctioning sensors or equipment. Although less intensive than a comprehensive Cx program, significant savings are still possible with short payback periods.

The following estimates are based on a preliminary walkthrough, available utility data analysis, and discussion with staff. The project, if authorized, would normally be accomplished by an organization/firm with engineers specializing in enhanced commissioning techniques and project implementation. The table below summarizes the implementation costs, annual savings, and payback for a comprehensive commissioning program at the sites. *Note: The table below includes estimated budget/cost for deferred maintenance items. The deferred maintenance budget is for repair items that the owner needs to address (such as sensor replacement, damper repair, etc.) that may be identified by the commissioning team.*

BUILDING COMMISSIONING (Cx)				
Building	**Estimated Implementation Cost**	**Estimated Annual Savings ($/yr)**	**Estimated Annual MMBTU Savings (MMBTU/yr)**	**Simple Payback (years)**
Justice Center	$37,840	$9,440	350	4.0
Federal Building	$3,280	$1,120	42	2.9
Fire Station 1	$1,920	$640	24	3.0
Information Technology	$1,840	$560	21	3.3
Municipal Office Building	$9,120	$2,640	98	3.5
Municipal Service Center	$4,240	$1,440	53	2.9
Deferred Maintenance	$14,560	$3,960	147	3.7
TOTAL	**$72,800**	**$19,800**	**734**	**3.7**

IMPROVE WWTP TURBO BLOWER TURNDOWN

It is recommended to modify controls within wastewater plant turbo blowers to allow for more turndown in order to lower dissolved oxygen (DO) concentrations in aeration trains. By maintaining the DO level between 0.5 mg/l and 2.0 mg/l, significant power savings could be realized. A detailed analysis should be conducted to identify precise turndown needs and strategies. Estimated costs and savings from improving turbo blower turndown at Burton Creek and Still Creek WWTPs are shown in the table below.

IMPROVE TURBO BLOWER TURNDOWN				
Building	**Estimated Implementation Cost**	**Estimated Annual Savings ($/yr)**	**Estimated Annual MMBTU Savings (MMBTU/yr)**	**Simple Payback (years)**
Still Creek WWTP	$5,000	$2,500	95	2.0
Burton Creek WWTP	$5,000	$8,400	318	0.6
TOTAL	**$10,000**	**$10,900**	**413**	**0.9**

INSTALL TRICKLING FILTER PROCESS BYPASS LINE

This project would require the installation of a bypass line from the aerated grit chamber to the aeration basin. The primary clarifier and trickling filter process may be considered a non-essential unit process as long as flows remain under 70% of plant capacity. This new line would allow for the diversion of flow as it leaves the aerated grit chamber to be conveyed directly to aeration basin, thus bypassing the primary clarifier, trickling filter, intermediate clarifier and intermediate lift station. Power consumption would be reduced due to less pumping head and would result in lower electrical power costs. Estimated costs and savings for this project are shown in the table below.

INSTALL TRICKLING FILTER PROCESS BYPASS LINE				
Building	**Estimated Implementation Cost**	**Estimated Annual Savings ($/yr)**	**Estimated Annual MMBTU Savings (MMBTU/yr)**	**Simple Payback (years)**
Still Creek WWTP	$45,000	$11,000	417	4.1
Burton Creek WWTP	$45,000	$45,000	1,706	1.0
TOTAL	**$90,000**	**$56,000**	**2,123**	**5.1**

INSTALL WASTE ACTIVATED SLUDGE (WAS) LINE FROM RETURN ACTIVATED SLUDGE (RAS) PUMP STATION TO DIGESTER

Wasting settled sludge out of RAS pump station would allow for a more stabilized sludge to be wasted and reduce the pumping head caused by sending all WAS back to the aerated grit chamber. Estimated costs and savings for this project are shown in the table below.

INSTALL W.A.S. LINE FROM R.A.S. PUMP STATION TO DIGESTER				
Building	**Estimated Implementation Cost**	**Estimated Annual Savings ($/yr)**	**Estimated Annual MMBTU Savings (MMBTU/yr)**	**Simple Payback (years)**
Burton Creek WWTP	$18,000	$1,000	38	18.0
TOTAL	**$18,000**	**$1,000**	**38**	**18.0**

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 ($/yr)**	**Estimated Annual MMBTU Savings (MMBTU/yr)**	**Simple Payback (years)**
T12 TO T8 LIGHTING RETROFIT	$12,600	$2,500	93	5.0
LOW WATTAGE T8 FLUORESCENT LIGHTING RETROFIT	$21,500	$3,800	141	5.7
INDOOR HID LIGHTING RETROFIT	$6,600	$400	15	16.5
MOTION SENSOR INSTALLATION	$22,400	$3,400	126	6.6
SOLAR THERMAL POOL HEATING SYSTEM	$65,000	$4,900	767	13.3
BUILDING COMMISSIONING (Cx)	$72,800	$19,800	734	3.7
IMPROVE TURBO BLOWER TURNDOWN	$10,000	$10,900	413	0.9
INSTALL TRICKLING FILTER PROCESS BYPASS LINE	$90,000	$56,000	2,123	1.6
INSTALL W.A.S. LINE FROM R.A.S. PUMP STATION TO DIGESTER	$18,000	$1,000	38	18.0
TOTAL:	**$318,900**	**$102,700**	**4,450**	**3.1**

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 (competitive bidding) would be in accordance with City requirements, and construction management would be provided by the engineering group who prepared the drawings and specifications.

11.0 ENERGY MANAGEMENT POLICY

At present, the City of Bryan has not adopted a comprehensive City-wide energy management policy. The City is committed to improving their energy performance and this is evident by the request to perform a Preliminary Energy Assessment. However, in order to ensure and sustain long-term energy efficient practices, a comprehensive Energy Management Policy should be adopted by the City.

A City-wide energy management plan adopted by the governing board sends a strong signal that energy management is an institutional priority. At a minimum, the energy management plan should address the following:

- 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. <u>ESTABLISH ROUTINE ENERGY TRACKING AND REPORTING PROCEDURES</u>
   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. <u>ESTABLISH AN ENERGY MANAGEMENT STEERING COMMITTEE</u>
   The Energy Management Steering Committee will include representatives from a cross section of the City. 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 City energy costs and consumption. Regular meetings will ensure City goals are being met prior to the end of the year.

3. <u>PROMOTE ENERGY AWARENESS</u>
   The energy management steering committee members shall establish a program to publicize City energy goals and progress on a quarterly or semiannually basis. Continuous promotion of City goals will ensure the sustainability of the energy management program and help achieve further energy savings.

4. <u>ESTABLISH ACCEPTABLE EQUIPMENT PARAMETERS</u>
   Establish a department-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 Set points: 74 F ±

Unoccupied Cooling Temperature Set points: 85 F

Occupied Heating Temperature Set points: 68 F ±

Unoccupied Heating Temperature Set point: 55 F

5. DISALLOW OR DISCOURAGE PERSONAL APPLIANCES

Establish a policy that prohibits use of personal appliances by City staff, such as mini refrigerators and space heaters. Alternatively, establish disincentives such as a periodic fee for use of such appliances. Collected fees could be used for energy awareness and management in other areas.

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 City 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.

12.0 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 City proceeds to implement funded projects through the traditional bid/specification process. Contact: Eddy Trevino (512/463-1876).

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 City 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, CenterPoint Energy provides incentives for efficiency measures such as installation of high efficiency equipment, lighting upgrades, and building commissioning. These energy efficiency programs' incentives typically cover $0.06/kWh and $175/kW of verifiable energy and demand reductions, respectively. For further information, contact your utility provider to determine what programs are available in your area.

Build America Bonds

Under the American Recovery and Reinvestment Act, the Build America Bond program provides funding for local and state governments in order to allow for capital projects on public buildings, including public schools, water and sewer projects, energy projects, and environmental projects. The bonds work by having the Treasury Department issue a state or local government 35 percent of an interest payment on the bonds. This will cause the borrowing costs incurred by the state of local government to be much less, allowing them to reach further sources of borrowing. For further information, please visit http://www.ustreas.gov.

Energy Efficiency and Conservation Block Grant (EECBG)

The Office of Weatherization and Intergovernmental Programs (WIP) has administered the EECBG, which provides funding to state and local governments for the purpose of improving energy usage and efficiency, as well as improving environmental effects. It is being funded under the ARRA, and can include building retrofits and audits, which aim to reduce energy use in buildings and transportation. The State Energy Conservation Office receives a portion of these funds to distribute to cities and counties interested in these projects. Further information can be found by visiting: http://www1.eere.energy.gov/wip/eecbg.html

Qualified Energy Conservation Bonds (QECB)

Energy projects can be eligible for QECBs, which are tax credit bonds that serve to assist with energy efficient capital projects, renewable energy usage, and reductions in energy consumption. The federal government has issued this loan program, which assists with funding of the interest costs for the bonds. These energy conservation bonds are different from tax-exempt bonds traditionally used because they can be regarded as taxable income. For more information on QECBs, please visit http://www.dsireusa.org.

13.0 ANALYST(S) IDENTIFICATION

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

M. Saleem Khan, P.E., CxA
Robert Thonhoff, P.E.

APPENDICES

APPENDIX A

ENERGY LEGISLATION
(SB12 AND HB3693)

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 Citys, 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 Citys 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 Citys 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 Citys; 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:

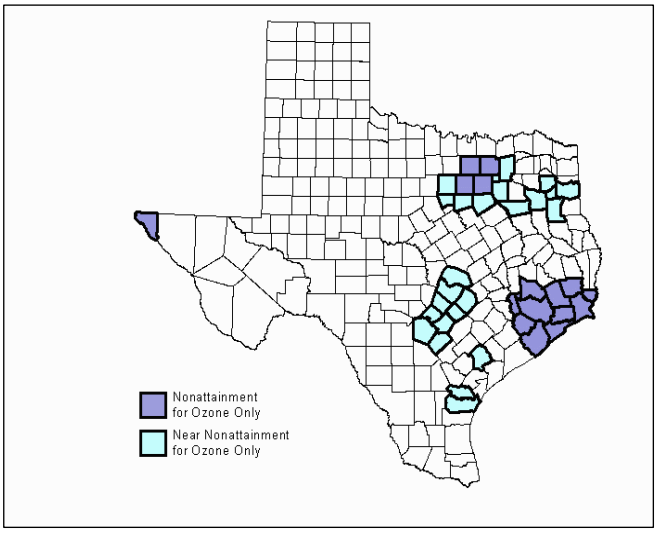
• installation of insulation and high-efficiency windows and doors • modifications or replacement of HVAC systems, lighting fixtures and electrical systems • installation of automatic energy control systems • installation of energy recovery systems or renewable energy generation equipment • building 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:
Eddy Trevino - 512-463-1876
Eddy.Trevino@cpa.state.tx.us

Schools & Local Govt. Partnership Program:
Stephen Ross - 512-463-1770
Stephen.Ross@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:
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Alternate Fuels / Transportation:
Venita Porter - 512-463-1779
Venita.Porter@cpa.state.tx.us

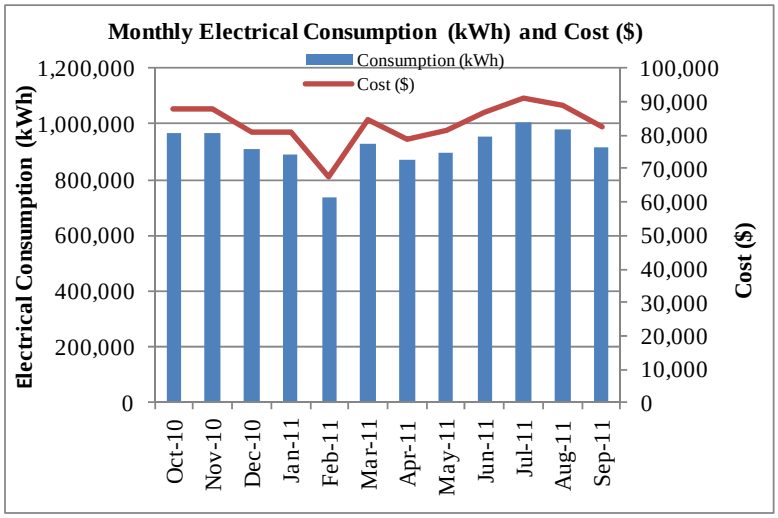
APPENDIX B

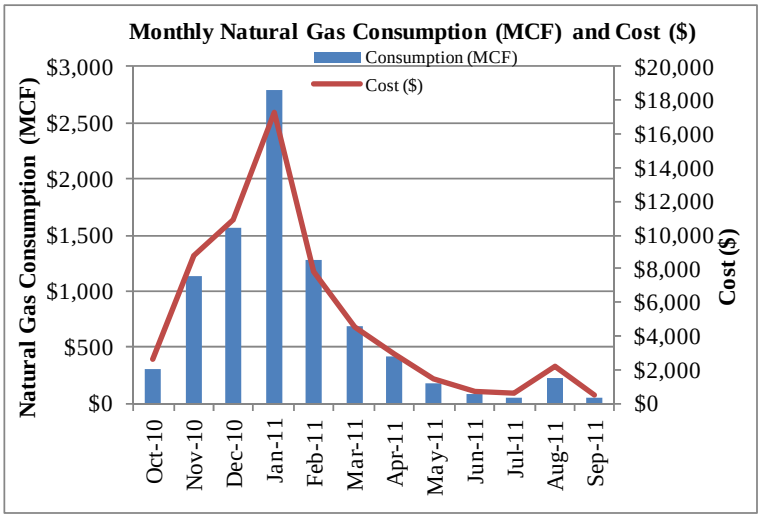
SAMPLE UTILITY DATA REPORTING FORM

City of Bryan - Sample Utility Input Form

MONTH	ELECTRICITY			NATURAL GAS		
	KWH	COST $	Avg. Rate $/KWH	MCF	COST $	Avg. Rate $/MCF
Oct-10	966,296	87,693	$0.0908	$308	$2,603	$8.4
Nov-10	965,945	87,661	$0.0908	$1,130	$8,749	$7.7
Dec-10	910,265	80,980	$0.0890	$1,570	$10,907	$6.9
Jan-11	888,152	80,652	$0.0908	$2,799	$17,309	$6.2
Feb-11	739,833	67,289	$0.0910	$1,284	$7,868	$6.1
Mar-11	930,902	84,504	$0.0908	$695	$4,582	$6.6
Apr-11	869,587	78,950	$0.0908	$421	$2,993	$7.1
May-11	897,300	81,477	$0.0908	$183	$1,427	$7.8
Jun-11	953,185	86,512	$0.0908	$77	$715	$9.3
Jul-11	1,006,056	91,276	$0.0907	$51	$589	$11.6
Aug-11	977,122	88,636	$0.0907	$225	$2,199	$9.8
Sep-11	915,234	82,660	$0.0903	$46	$552	$12.0
Total	11,019,877	$998,291	$0.0906	8,788	$60,492	$6.9

Gross Building Area:	247,815	SF





APPENDIX C

BASE YEAR CONSUMPTION HISTORY

Energy Cost and Consumption Benchmarks														
		Electric				Natural Gas				Total	Total	EUI	ECI	
	Building	kWh/Yr	MMBTU/Yr	kWh/SF	$Cost/Yr	MCF/Yr	MMBTU/Yr	MCF/kSF	$Cost/Yr	$Cost/Yr	MMBTU/Yr	kBTU/SF/Yr	$/SF/Yr	SF
1	**Aquatic Center**	**300,960**	**1,027**	**19.41**	**27,476**	**3,611**	**3,719**	**233**	**23,743**	**51,220**	**4,747**	**306**	**3.30**	**15,507**
2	**Justice Center**	**1,708,992**	**5,833**	**27.13**	**154,323**	**2,024**	**2,084**	**32**	**14,926**	**169,249**	**7,917**	**126**	**2.69**	**63,000**
3	**Bryan Library**	**394,320**	**1,346**	**15.69**	**35,885**	**105**	**108**	**4**	**836**	**36,720**	**1,454**	**58**	**1.46**	**25,132**
4	Carnegie Library	91,000	311	21.26	8,559	0	0	0	0	8,559	311	73	2.00	4,280
5	Facilities/Parks Building	107,160	366	20.04	10,006	0	0	0	0	10,006	366	68	1.87	5,346
6	**Federal Building**	**190,160**	**649**	**14.09**	**17,493**	**176**	**181**	**13**	**1,302**	**18,795**	**830**	**61**	**1.39**	**13,500**
7	**Fire Station 1**	**304,920**	**1,041**	**33.51**	**27,833**	**485**	**499**	**53**	**3,298**	**31,131**	**1,540**	**169**	**3.42**	**9,100**
8	Fire Station 2	74,440	254	17.72	7,067	152	156	36	1,170	8,237	410	98	1.96	4,200
9	Fire Station 3	104,360	356	23.45	9,755	178	184	40	1,366	11,120	540	121	2.50	4,450
10	Fire Station 4	74,973	256	19.22	7,107	156	161	40	1,169	8,276	417	107	2.12	3,900
11	Fire Station 5	159,840	546	12.11	14,752	295	304	22	2,265	17,017	849	64	1.29	13,200
12	**Information Technology**	**423,240**	**1,445**	**41.49**	**38,460**	**0**	**0**	**0**	**0**	**38,460**	**1,445**	**142**	**3.77**	**10,200**
13	**Municipal Office Building**	**739,968**	**2,526**	**17.01**	**67,025**	**293**	**302**	**7**	**1,992**	**69,017**	**2,827**	**65**	**1.59**	**43,500**
14	**Municipal Service Center**	**299,096**	**1,021**	**17.09**	**28,003**	**1,263**	**1,301**	**72**	**8,050**	**36,053**	**2,322**	**133**	**2.06**	**17,500**
15	Neil Rec. Center	236,840	808	15.79	21,699	122	125	8	990	22,689	934	62	1.51	15,000
		kWh/Yr	MMBTU/Yr	kWh/SF	$Cost/Yr	MCF/Yr	MMBTU/Yr	MCF/kSF	$Cost/Yr	$Cost/Yr	MMBTU/Yr	kBTU/SF/Yr	$/SF/Yr	SF
		5,210,269	17,783	21.02	475,443	8,858	9,124	36	61,106	536,549	26,906	109	2.17	247,815

WWTP - Energy Cost and Consumption Benchmark

Facility	Electric[1]			Design Capacity (MGD)	Average Effluent Flow[3] (MGD)	EUI[4]	ECI[5]	National Average[6]		ENERGY STAR Rating[7, 8]
	kWh/Yr	kBtu/Yr[2]	$Cost/Yr			kBtu/GPD/Yr	$/MGD/Yr	kBtu/GPD/Yr	$/MGD/Yr	
Burton Creek	2,835,204	9,673,716	$254,269	8.00	4.43	2.2	$57,397	3.0	$76,634	67
Still Creek	1,703,524	5,812,424	$153,785	4.00	0.99	5.9	$155,338	4.0	$115,550	17
Turkey Creek	1,303,840	4,448,702	$117,793	0.75	0.64	7.0	$185,209	3.0	$75,955	1

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Aquatic Center

FLOOR AREA: 15,507 estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	22,960		0		2,099	92	726
Nov	2010	25,520		0		2,329	463	3,473
Dec	2010	28,640		0		2,610	465	3,419
Jan	2011	35,200		0		3,202	1,205	7,506
Feb	2011	30,400		0		2,769	628	3,784
Mar	2011	24,240		0		2,214	381	2,289
Apr	2011	17,920		0		1,645	233	1,480
May	2011	18,240		0		1,673	123	845
Jun	2011	25,360		0		2,315	10	87
Jul	2011	24,960		0		2,279	5	46
Aug	2011	25,280		0		2,308	4	49
Sep	2011	22,240		0		2,034	3	39
TOTAL		300,960				27,476	3,611.0	23,743

Annual Total Energy Cost = 51,220 $/year

Total KWH/yr x 0.003413 = 1,027.18 MMBTU/year

Total MCF/yr x 1.03 = 3,719.33 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 4,747 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 306 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 3.30 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Justice Center

FLOOR AREA: 63,000 estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	122,112		0		11,032	150	1,232
Nov	2010	114,624		0		10,358	257	2,123
Dec	2010	115,200		0		10,410	400	2,780
Jan	2011	146,304		0		13,212	374	2,401
Feb	2011	66,816		0		6,050	219	1,396
Mar	2011	132,480		0		11,966	202	1,413
Apr	2011	145,728		0		13,160	116	863
May	2011	134,784		0		12,174	27	218
Jun	2011	157,824		0		14,250	27	218
Jul	2011	200,448		0		18,090	17	171
Aug	2011	187,776		0		16,949	174	1,595
Sep	2011	184,896		0		16,672	61	516
TOTAL		1,708,992		0		154,323	2,023.6	14,926

Annual Total Energy Cost = 169,249 $/year

Total KWH/yr x 0.003413 = 5,832.79 MMBTU/year

Total MCF/yr x 1.03 = 2,084.31 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 7,917 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 126 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 2.69 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Bryan Library

FLOOR AREA: 25,132 estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	33,360		0		3,036	2	27
Nov	2010	27,360		0		2,495	18	142
Dec	2010	24,000		0		2,192	16	115
Jan	2011	22,080		0		2,019	53	327
Feb	2011	25,040		0		2,286	13	91
Mar	2011	30,320		0		2,762	1	20
Apr	2011	36,800		0		3,346	3	35
May	2011	37,200		0		3,382	0	16
Jun	2011	45,680		0		4,146	0	15
Jul	2011	51,760		0		4,694	0	15
Aug	2011	20,800		0		1,904	0	15
Sep	2011	39,920		0		3,623	0	18
TOTAL		394,320		0		35,885	104.6	836

Annual Total Energy Cost = 36,720 $/year

Total KWH/yr x 0.003413 = 1,345.81 MMBTU/year

Total MCF/yr x 1.03 = 107.74 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 1,454 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) = 1.46 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Carnegie Library

FLOOR AREA: 4,280 estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	6,000		0		571	0	0
Nov	2010	5,400		0		517	0	0
Dec	2010	7,240		0		682	0	0
Jan	2011	8,280		0		776	0	0
Feb	2011	7,640		0		718	0	0
Mar	2011	5,280		0		506	0	0
Apr	2011	6,960		0		657	0	0
May	2011	7,200		0		679	0	0
Jun	2011	8,840		0		826	0	0
Jul	2011	10,560		0		981	0	0
Aug	2011	11,400		0		1,057	0	0
Sep	2011	6,200		0		589	0	0
TOTAL		91,000		0		8,559	0.0	0

Annual Total Energy Cost = 8,559 $/year

Total KWH/yr x 0.003413 = 310.58 MMBTU/year

Total MCF/yr x 1.03 = 0.00 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 311 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 73 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 2.00 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Facilities/Parks Building

FLOOR AREA: 5,346 estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	7,160		0		675	0	0
Nov	2010	7,960		0		747	0	0
Dec	2010	8,960		0		837	0	0
Jan	2011	9,080		0		848	0	0
Feb	2011	6,920		0		653	0	0
Mar	2011	8,320		0		780	0	0
Apr	2011	7,760		0		729	0	0
May	2011	8,840		0		826	0	0
Jun	2011	11,080		0		1,028	0	0
Jul	2011	10,480		0		974	0	0
Aug	2011	11,600		0		1,075	0	0
Sep	2011	9,000		0		832	0	0
TOTAL		107,160		0		10,006	0.0	0

Annual Total Energy Cost = 10,006 $/year

Total KWH/yr x 0.003413 = 365.74 MMBTU/year

Total MCF/yr x 1.03 = 0.00 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 366 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 68 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.87 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Federal Building

FLOOR AREA: 13,500 estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	17,280		0		1,587	1	20
Nov	2010	17,280		0		1,587	24	186
Dec	2010	17,280		0		1,587	37	248
Jan	2011	17,440		0		1,601	63	384
Feb	2011	5,680		0		542	19	123
Mar	2011	12,400		0		1,147	11	87
Apr	2011	13,680		0		1,263	10	85
May	2011	14,560		0		1,342	4	46
Jun	2011	18,080		0		1,659	1	22
Jul	2011	19,440		0		1,782	1	22
Aug	2011	20,800		0		1,904	1	22
Sep	2011	16,240		0		1,493	5	57
TOTAL		190,160		0		17,493	175.9	1,302

Annual Total Energy Cost = 18,795 $/year

Total KWH/yr x 0.003413 = 649.02 MMBTU/year

Total MCF/yr x 1.03 = 181.18 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 830 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 61 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.39 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Fire Station 1

FLOOR AREA: 9,100 estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	25,320		0		2,311	4	48
Nov	2010	26,840		0		2,448	85	633
Dec	2010	19,520		0		1,789	104	681
Jan	2011	23,680		0		2,164	158	945
Feb	2011	20,120		0		1,843	59	359
Mar	2011	21,120		0		1,933	22	156
Apr	2011	22,160		0		2,027	13	102
May	2011	22,080		0		2,019	7	63
Jun	2011	30,920		0		2,816	9	78
Jul	2011	30,960		0		2,820	7	75
Aug	2011	33,640		0		3,061	7	77
Sep	2011	28,560		0		2,603	8	81
TOTAL		304,920		0		27,833	484.5	3,298

Annual Total Energy Cost = 31,131 $/year

Total KWH/yr x 0.003413 = 1,040.69 MMBTU/year

Total MCF/yr x 1.03 = 499.04 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 1,540 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 169 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 3.42 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Fire Station 2

FLOOR AREA: 4,200 estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	5,600		0		535	6	58
Nov	2010	4,670		0		451	18	146
Dec	2010	5,030		0		483	34	230
Jan	2011	4,810		0		463	49	305
Feb	2011	4,770		0		460	9	67
Mar	2011	3,910		0		382	6	53
Apr	2011	6,750		0		638	6	52
May	2011	6,190		0		588	5	52
Jun	2011	7,900		0		742	8	71
Jul	2011	7,880		0		740	2	33
Aug	2011	8,190		0		768	5	54
Sep	2011	8,740		0		817	4	51
TOTAL		74,440		0		7,067	151.5	1,170

Annual Total Energy Cost = 8,237 $/year

Total KWH/yr x 0.003413 = 254.06 MMBTU/year

Total MCF/yr x 1.03 = 156.05 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 410 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 98 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.96 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Fire Station 3

FLOOR AREA: 4,450 estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	5,960		0		567	5	52
Nov	2010	6,560		0		621	10	92
Dec	2010	7,160		0		675	35	272
Jan	2011	6,920		0		653	46	303
Feb	2011	5,720		0		545	45	282
Mar	2011	6,720		0		635	9	68
Apr	2011	8,600		0		805	5	46
May	2011	9,600		0		895	4	43
Jun	2011	11,680		0		1,082	6	55
Jul	2011	13,160		0		1,216	5	50
Aug	2011	12,320		0		1,140	4	49
Sep	2011	9,960		0		919	5	55
TOTAL		104,360		0		9,755	178.2	1,366

Annual Total Energy Cost = 11,120 $/year

Total KWH/yr x 0.003413 = 356.18 MMBTU/year

Total MCF/yr x 1.03 = 183.55 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 540 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 121 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 2.50 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Fire Station 4

FLOOR AREA: 3,900 estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	5,164		0		495	4	49
Nov	2010	5,028		0		483	8	73
Dec	2010	4,979		0		479	32	219
Jan	2011	5,110		0		490	42	267
Feb	2011	4,264		0		414	40	242
Mar	2011	6,411		0		608	4	43
Apr	2011	1,336		0		150	5	46
May	2011	8,464		0		793	4	41
Jun	2011	9,052		0		846	4	49
Jul	2011	8,698		0		814	3	38
Aug	2011	9,661		0		900	5	54
Sep	2011	6,806		0		635	4	47
TOTAL		74,973		0		7,107	156.2	1,169

Annual Total Energy Cost = 8,276 $/year

Total KWH/yr x 0.003413 = 255.88 MMBTU/year

Total MCF/yr x 1.03 = 160.89 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 417 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 107 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 2.12 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Fire Station 5

FLOOR AREA: 13,200

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	11,680		0		1,082	20	177
Nov	2010	10,240		0		953	40	333
Dec	2010	10,640		0		989	57	409
Jan	2011	9,040		0		845	112	728
Feb	2011	8,640		0		808	21	148
Mar	2011	10,960		0		1,018	7	64
Apr	2011	12,880		0		1,190	12	100
May	2011	16,400		0		1,508	1	21
Jun	2011	17,280		0		1,587	2	27
Jul	2011	17,520		0		1,609	2	27
Aug	2011	20,400		0		1,868	17	166
Sep	2011	14,160		0		1,296	6	64
TOTAL		159,840		0		14,752	294.9	2,265

Annual Total Energy Cost = 17,017 $/year

Total KWH/yr x 0.003413 = 545.53 MMBTU/year

Total MCF/yr x 1.03 = 303.75 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 849 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 64 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.29 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Information Technology

FLOOR AREA: 10,200

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	31,520		0		2,870	0	0
Nov	2010	30,720		0		2,798	0	0
Dec	2010	31,640		0		2,881	0	0
Jan	2011	33,080		0		3,011	0	0
Feb	2011	23,200		0		2,120	0	0
Mar	2011	36,560		0		3,324	0	0
Apr	2011	32,960		0		3,000	0	0
May	2011	41,720		0		3,789	0	0
Jun	2011	40,360		0		3,666	0	0
Jul	2011	41,160		0		3,739	0	0
Aug	2011	47,200		0		4,283	0	0
Sep	2011	33,120		0		2,980	0	0
TOTAL		423,240		0		38,460	0.0	0

Annual Total Energy Cost = 38,460 $/year

Total KWH/yr x 0.003413 = 1,444.52 MMBTU/year

Total MCF/yr x 1.03 = 0.00 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 1,445 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 142 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 3.77 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Municipal Office Building

FLOOR AREA: 43,500

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	63,744		0		5,773	5	52
Nov	2010	50,880		0		4,614	25	196
Dec	2010	49,152		0		4,459	63	418
Jan	2011	48,192		0		4,372	140	837
Feb	2011	48,384		0		4,389	40	250
Mar	2011	52,032		0		4,718	4	41
Apr	2011	62,976		0		5,704	3	36
May	2011	62,784		0		5,687	0	0
Jun	2011	66,240		0		5,998	5	53
Jul	2011	89,088		0		8,057	2	35
Aug	2011	76,992		0		6,967	3	37
Sep	2011	69,504		0		6,286	3	39
TOTAL		739,968		0		67,025	292.8	1,992

Annual Total Energy Cost = 69,017 $/year

Total KWH/yr x 0.003413 = 2,525.51 MMBTU/year

Total MCF/yr x 1.03 = 301.58 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 2,827 MMBTU/year

Energy Use Index:

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

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 1.59 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Service Center

FLOOR AREA: 17,500

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	19,628		0		1,858	23	192
Nov	2010	17,319		0		1,650	168	1,232
Dec	2010	20,296		0		1,919	308	1,981
Jan	2011	23,616		0		2,218	529	3,126
Feb	2011	15,415		0		1,479	178	1,037
Mar	2011	21,853		0		2,059	41	280
Apr	2011	23,693		0		2,225	9	76
May	2011	27,422		0		2,561	1	25
Jun	2011	35,233		0		3,264	1	22
Jul	2011	33,358		0		3,096	1	22
Aug	2011	35,883		0		3,323	1	22
Sep	2011	25,380		0		2,351	2	34
TOTAL		299,096		0		28,003	1,263.1	8,050

Annual Total Energy Cost = 36,053 $/year

Total KWH/yr x 0.003413 = 1,020.81 MMBTU/year

Total MCF/yr x 1.03 = 1,300.99 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 2,322 MMBTU/year

Energy Use Index:

Total site BTU's/Yr ÷ Total Area (SF) = 133 kBTU/SF/year

Energy Cost Index:

Total Energy Cost/Yr ÷ Total Area (SF) = 2.06 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: Neil Rec. Center

FLOOR AREA: 15,000

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	16,760		0		1,540	1	19
Nov	2010	17,200		0		1,580	14	120
Dec	2010	14,560		0		1,342	19	136
Jan	2011	15,560		0		1,432	28	181
Feb	2011	14,560		0		1,342	13	90
Mar	2011	16,560		0		1,522	8	69
Apr	2011	18,160		0		1,666	8	71
May	2011	18,760		0		1,720	6	57
Jun	2011	27,520		0		2,510	8	67
Jul	2011	26,520		0		2,419	5	55
Aug	2011	27,240		0		2,484	5	58
Sep	2011	23,440		0		2,142	7	67
TOTAL		236,840		0		21,699	121.7	990

Annual Total Energy Cost = 22,689 $/year

Total KWH/yr x 0.003413 = 808.33 MMBTU/year

Total MCF/yr x 1.03 = 125.35 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 934 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) = 1.51 $/SF/year

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: WWT - Burton Creek

FLOOR AREA: N/A estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	283,488		0		25,602	0	0
Nov	2010	304,944		0		27,535	0	0
Dec	2010	283,488		0		23,937	0	0
Jan	2011	223,800		0		20,224	0	0
Feb	2011	253,944		0		22,940	0	0
Mar	2011	274,176		0		24,763	0	0
Apr	2011	255,984		0		23,124	0	0
May	2011	203,616		0		18,406	0	0
Jun	2011	203,496		0		18,395	0	0
Jul	2011	205,584		0		18,583	0	0
Aug	2011	172,536		0		15,606	0	0
Sep	2011	170,148		0		15,153	0	0
TOTAL		2,835,204				254,269	0.0	0

Annual Total Energy Cost = 254,269 $/year

Total KWH/yr x 0.003413 = 9,676.55 MMBTU/year

Total MCF/yr x 1.03 = 0.00 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 9,677 MMBTU/year

Energy Use Index:

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

Energy Cost Index:

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

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: WWT - Still Creek

FLOOR AREA: N/A estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	172,800		0		15,599	0	0
Nov	2010	173,400		0		15,653	0	0
Dec	2010	185,880		0		16,778	0	0
Jan	2011	138,240		0		12,485	0	0
Feb	2011	122,400		0		11,058	0	0
Mar	2011	140,880		0		12,723	0	0
Apr	2011	120,840		0		10,918	0	0
May	2011	127,920		0		11,556	0	0
Jun	2011	137,400		0		12,410	0	0
Jul	2011	111,960		0		10,118	0	0
Aug	2011	128,404		0		11,566	0	0
Sep	2011	143,400		0		12,921	0	0
TOTAL		1,703,524				153,785	0.0	0

* Natural Gas service not included in this summary.

Annual Total Energy Cost = 153,785 $/year

Total KWH/yr x 0.003413 = 5,814.13 MMBTU/year

Total MCF/yr x 1.03 = 0.00 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 5,814 MMBTU/year

Energy Use Index:

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

Energy Cost Index:

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

Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

Entity: City of Bryan

ACCOUNT# _____ Electric

_____ Gas

BUILDING: WWT Turkey Creek

FLOOR AREA: N/A estimated

		ELECTRICAL					NATURAL GAS / FUEL	
			DEMAND			TOTAL ALL		
		CONSUMPTION	METERED	CHARGED	COST OF	ELECTRIC	CONSUMPTION	TOTAL
MONTH	YEAR	KWH	KW	KW	DEMAND ($)	COSTS ($)	MCF	COSTS ($)
Oct	2010	115,760		0		10,460	0	0
Nov	2010	120,000		0		10,842	0	0
Dec	2010	76,600		0		6,932	0	0
Jan	2011	117,720		0		10,637	0	0
Feb	2011	75,920		0		6,870	0	0
Mar	2011	126,680		0		11,444	0	0
Apr	2011	107,360		0		9,703	0	0
May	2011	131,520		0		11,880	0	0
Jun	2011	99,240		0		8,972	0	0
Jul	2011	102,520		0		9,267	0	0
Aug	2011	127,000		0		11,473	0	0
Sep	2011	103,520		0		9,314	0	0
TOTAL		1,303,840				117,793	0.0	0

Annual Total Energy Cost = 117,793 $/year

Total KWH/yr x 0.003413 = 4,450.01 MMBTU/year

Total MCF/yr x 1.03 = 0.00 MMBTU/year

Total Other x_____ = 0.0 MMBTU/year

Total Site MMBTU's/yr = 4,450 MMBTU/year

Energy Use Index:

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

Energy Cost Index:

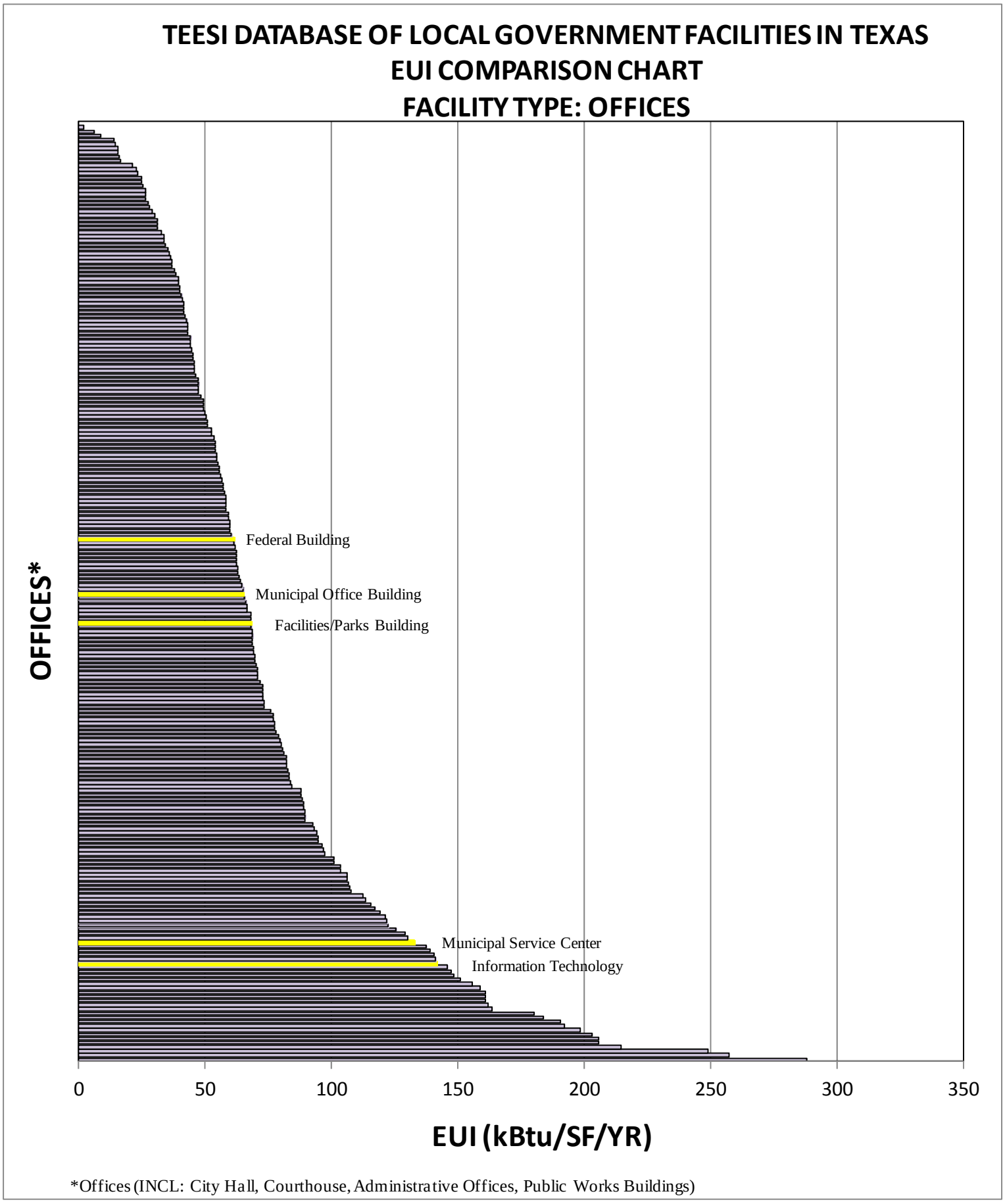
Total Energy Cost/Yr ÷ Total Area (SF) = N/A $/SF/year

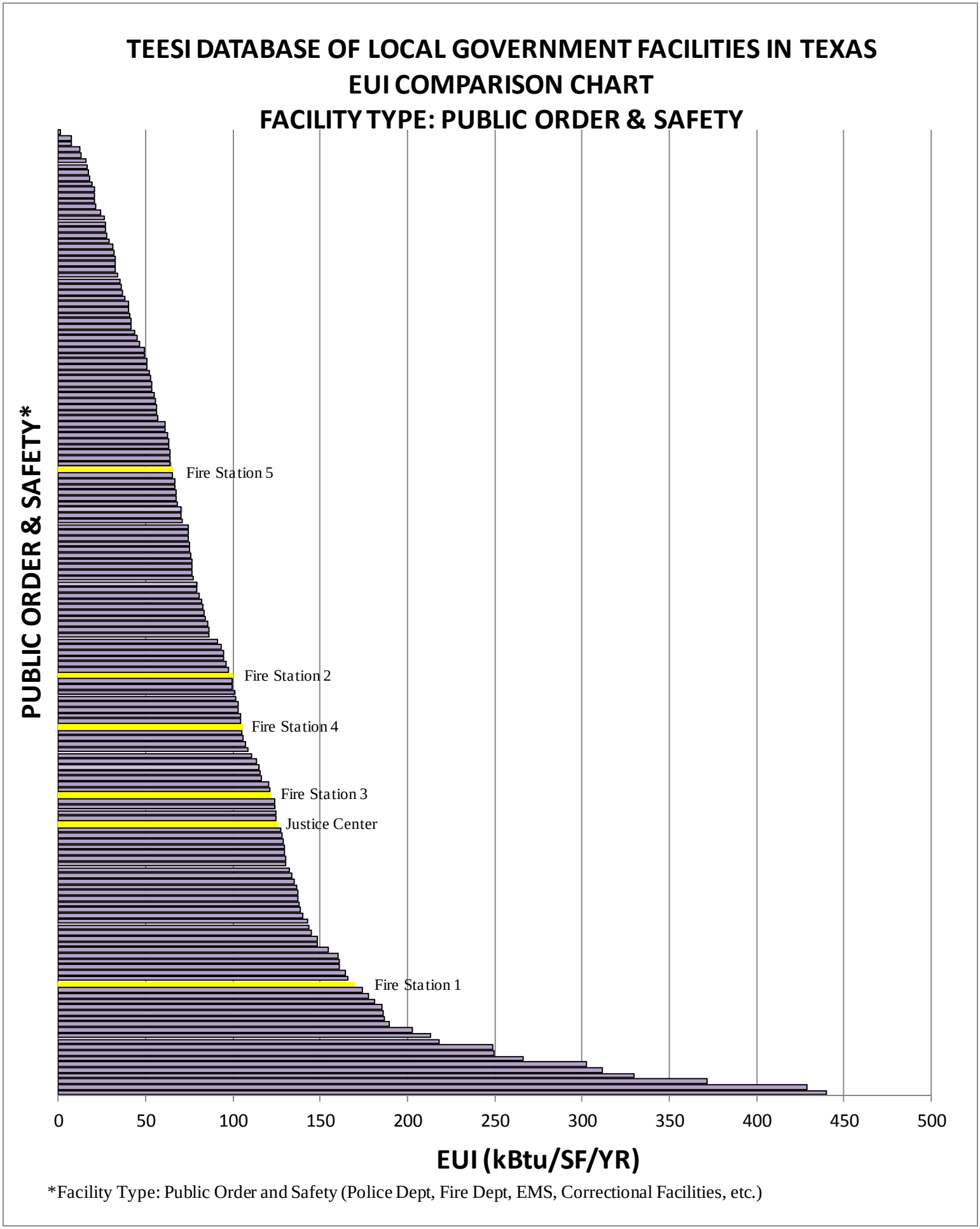
Electric Utility: Bryan Texas Utilities

Gas Utility: Atmos Energy

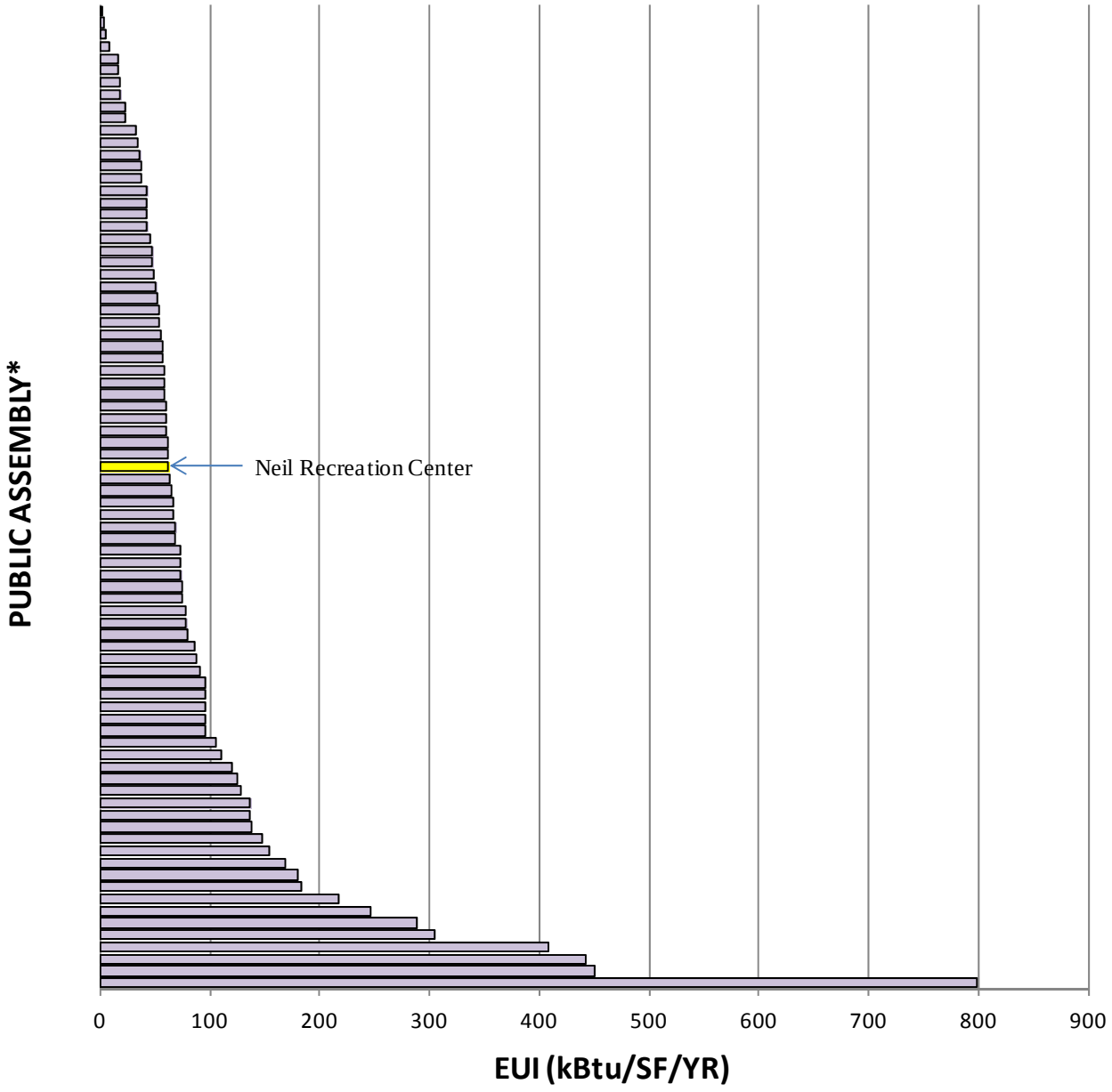
APPENDIX D

ENERGY PERFORMANCE COMPARISON CHARTS


TEESI DATABASE OF LOCAL GOVERNMENT FACILITIES IN TEXAS
EUI COMPARISON CHART
FACILITY TYPE: OFFICES
OFFICES*
Federal Building
Municipal Office Building
Facilities/Parks Building
Municipal Service Center
Information Technology
0
50
100
150
200
250
300
350
EUI (kBtu/SF/YR)
*Offices (INCL: City Hall, Courthouse, Administrative Offices, Public Works Buildings)

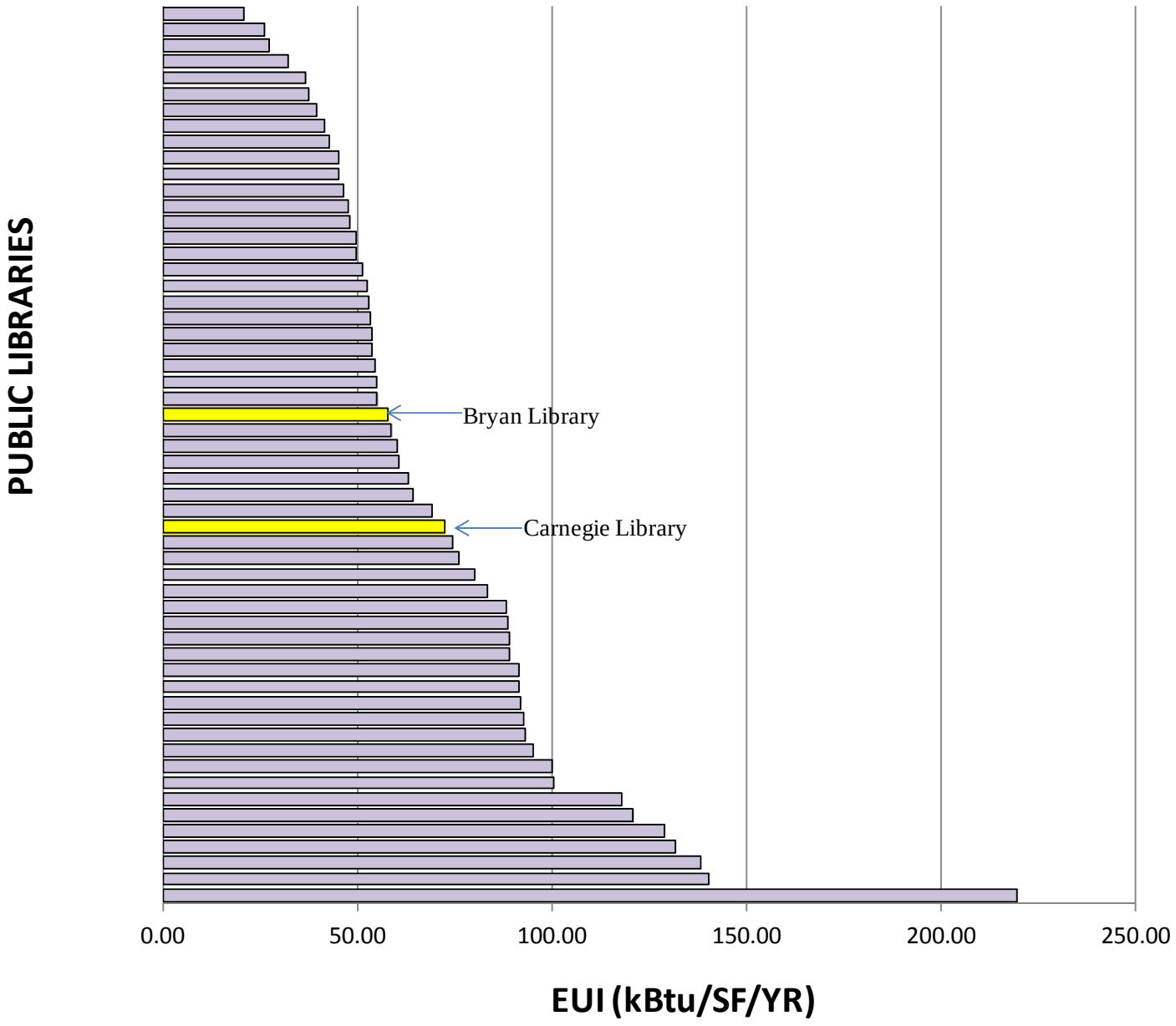

TEESI DATABASE OF LOCAL GOVERNMENT FACILITIES IN TEXAS
EUI COMPARISON CHART
FACILITY TYPE: PUBLIC ORDER & SAFETY
PUBLIC ORDER & SAFETY*
Fire Station 5
Fire Station 2
Fire Station 4
Fire Station 3
Justice Center
Fire Station 1
0
50
100
150
200
250
300
350
400
450
500
EUI (kBtu/SF/YR)
*Facility Type: Public Order and Safety (Police Dept, Fire Dept, EMS, Correctional Facilities, etc.)

TEESI DATABASE OF LOCAL GOVERNMENT FACILITIES IN TEXAS
EUI COMPARISON CHART
FACILITY TYPE: PUBLIC ASSEMBLY



*Public Assembly (INCL: Convention Centers, Community Centers, Assembly Buildings)

TEESI DATABASE OF LOCAL GOVERNMENT FACILITIES IN TEXAS
EUI COMPARISON CHART
FACILITY TYPE: PUBLIC LIBRARY



APPENDIX E

TYPICAL EQUIPMENT MAINTENANCE CHECKLISTS

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		

Boilers Checklist (contd)

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	

Boilers Checklist (contd)

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

Pumps Checklist

Description	Comments	Maintenance Frequency			
		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) 463-1876

APPENDIX G

ENERGY STAR PORTFOLIO MANAGER REFERENCE MATERIAL

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INTRODUCTION TO ENERGY STAR PORTFOLIO MANAGER

An entity's energy baseline can be developed using ENERGY STAR's Portfolio Manager. One of the primary reasons for using ENERGY STAR Portfolio Manager is its ability to normalize the baseline according to several key factors (i.e. Weather, Square Feet, Hours of Operation, Number of Computers, etc.). It is also a free online resource available to all registered users, and is a user-friendly web-based tool.

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE). ENERGY STAR has developed Portfolio Manager, an innovative online energy management tool, designed to help organizations track and assess energy and water consumption of their facilities. Portfolio Manager helps organizations set investment priorities, identify under-performing facilities, verify efficiency improvements, and receive EPA recognition for superior energy performance.

Portfolio Manger is also an energy performance benchmarking tool. Portfolio Manager rates a facility's energy performance on a scale of 1–100 relative to similar buildings and WWTPs nationwide. The rating system based on a statistically representative model utilizing a national survey conducted by the Department of Energy's Energy Information Administration. This national survey, known as the Commercial Building Energy Consumption Survey (CBECS), conducted every four years gathers data on building characteristics and energy use from thousands of buildings across the United States. A rating of 50 indicates that the facility, from an energy consumption standpoint, performs better than 50% of all similar facilities nationwide, while a rating of 75 indicates that the facility performs better than 75% of all similar facilities nationwide.

In addition, Portfolio Manager is used to generate a Statement of Energy Performance (SEP) for each facility, summarizing key energy information such as site and source energy intensity, greenhouse gas emission, energy reduction targets and energy cost. The Statement of Energy Performance is required for applying for ENERGY STAR Recognition from EPA/DOE. If ENERGY STAR recognition is pursued, the SEP will need to be verified and certified by a qualified professional.

Some facility types are not able to receive an ENERGY STAR rating. However, Portfolio Manager can still serve as a valuable tool for in tracking utility consumption and setting targets for performance of these facilities.

To develop an entity's baseline, 12 months of utility consumption, cost data, and Building Space Use information is required. The following is reference materials that explain how to input this information as well as perform other basic tasks within Portfolio Manager. For further information, please visit ENERGY STAR'S Portfolio Manager at:

http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

LOGGING IN TO PORTFOLIO MANAGER

Log in to Portfolio Manager with user name and password. This will bring the user to the My Portfolio page, which includes a summary of the user's facilities.

Website: https://www.energystar.gov/istar/pmpam/

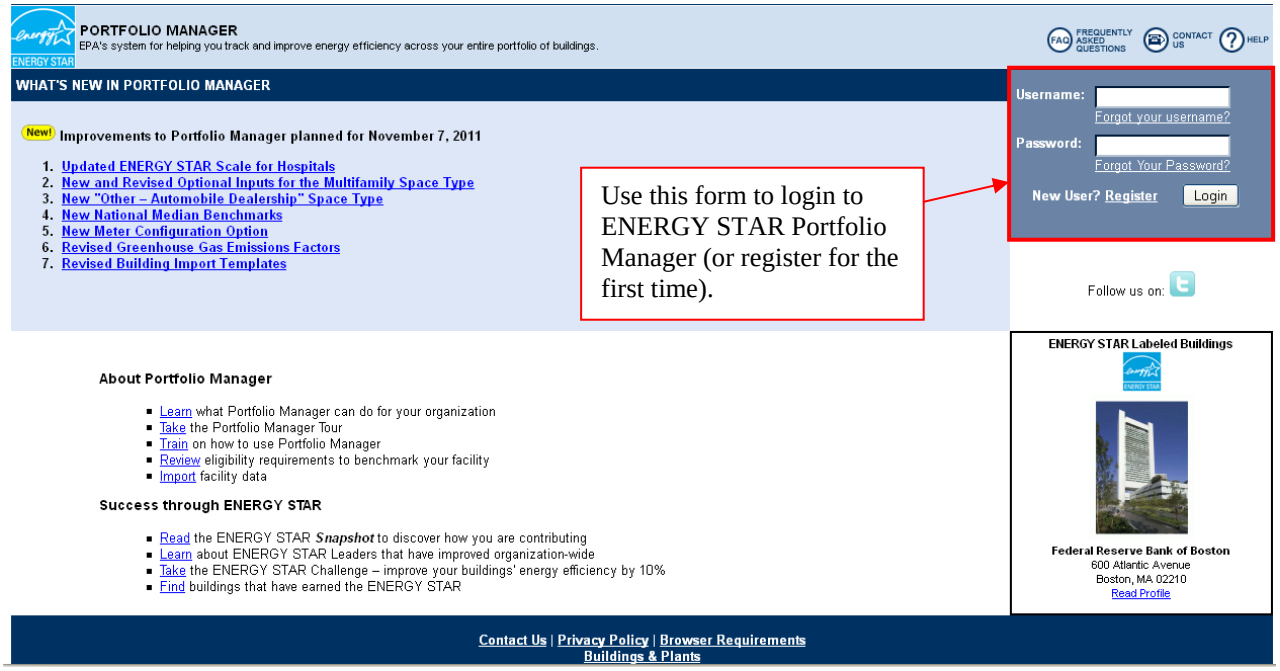

Figure 1: ENERGY STAR Portfolio Manager Homepage

Appendix G-3

ADDING A FACILITY/PROPERTY

If a facility does not already exist in Portfolio Manager, the user can use the 'Add a Property' link to create an entry in Portfolio Manager for that single facility.

Click the '*Add a Property*' selection located near the top of the main 'My Portfolio' page, as seen in Figure 2.

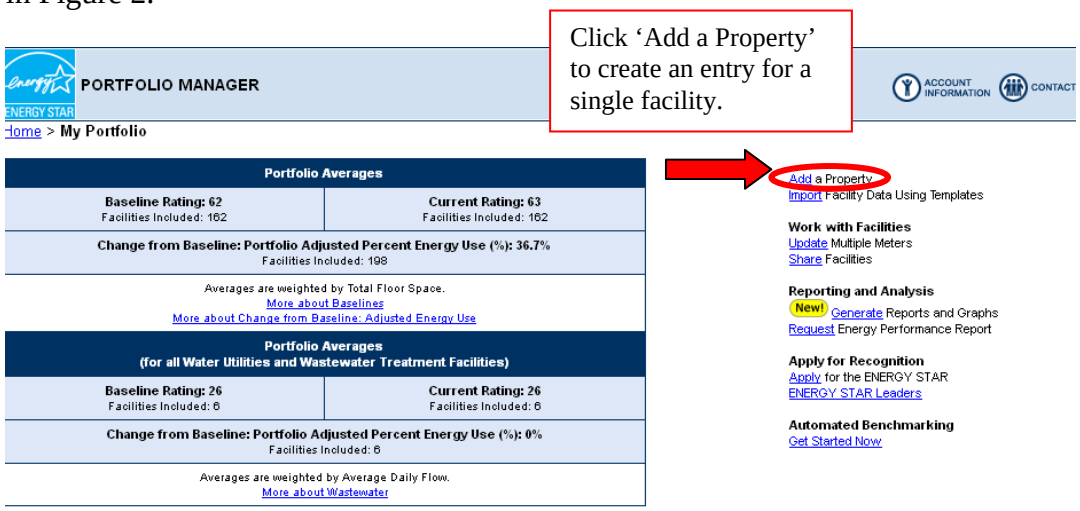

Figure 2: My Portfolio main page

In Figure 3 below, check the type of property (i.e. a single facility, wastewater treatment plant, etc.) and enter basic information about the property, including facility name, facility details, and address. Click **SAVE** when completed.

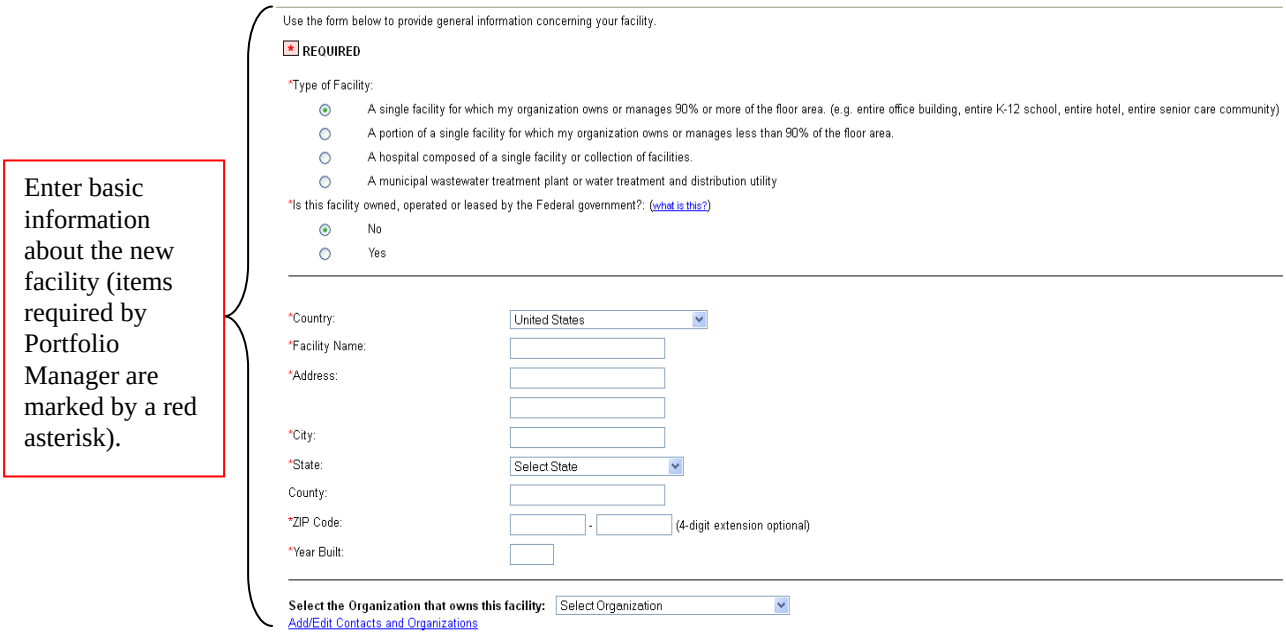

Figure 3: General Facility Information

Appendix G-4

ADDING/EDITING SPACES

From the Facility page, scroll to the 'Space Use' tab (as seen in Figure 4 below) and click 'Add Space.'

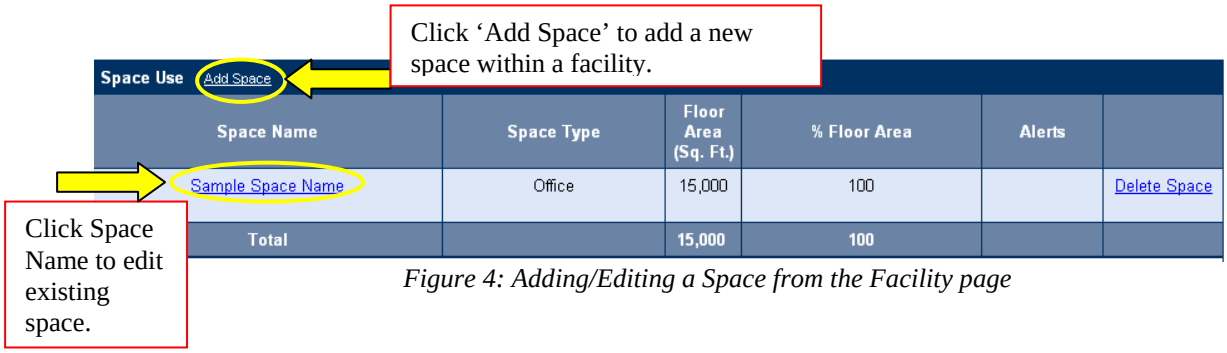

Figure 4: Adding/Editing a Space from the Facility page

After clicking 'Add Space', Portfolio Manager will prompt the user to enter the Space Details, as seen below in Figure 5. They must be entered in correctly and accurately in order to be eligible for ENERGY STAR recognition. If ENERGY STAR recognition is not a primary goal, or if precise attribute values are initially unknown, default values may be used temporarily. These values can be edited at **any** time from the Facility main page (Figure 4) by clicking the assigned space name.

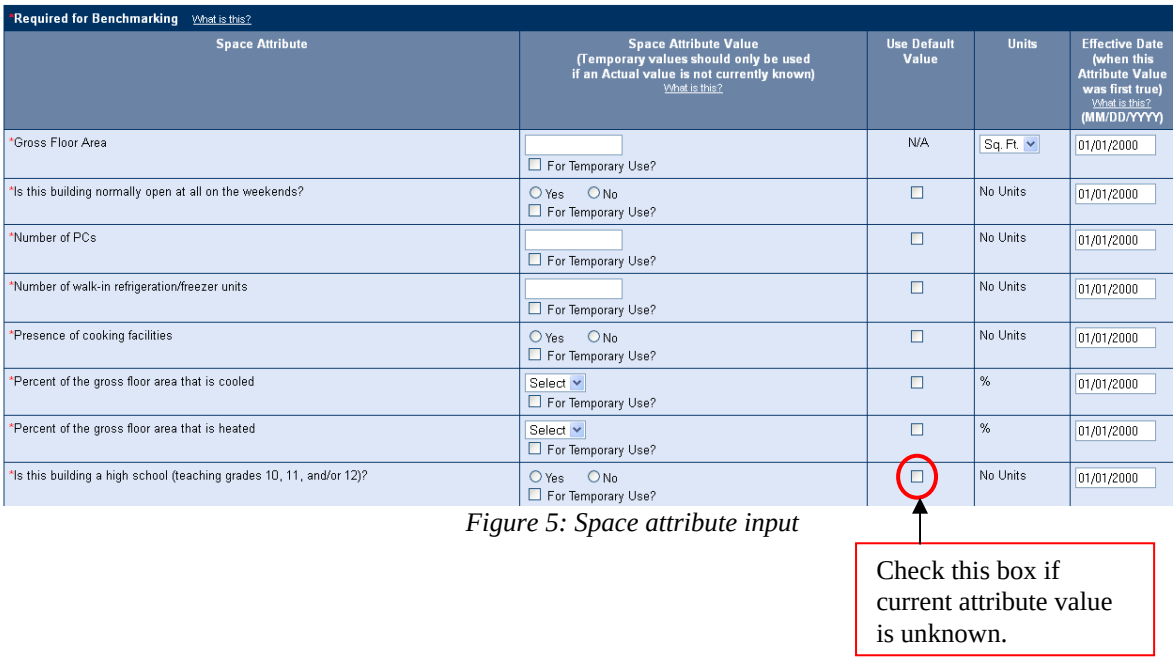

Figure 5: Space attribute input

Appendix G-5

ADDING/EDITING ENERGY METERS

From the Facility page, scroll to the 'Energy Meters' section and click 'Add Meter' (as seen in Figure 6). To edit an existing meter, click the meter name, as shown below.

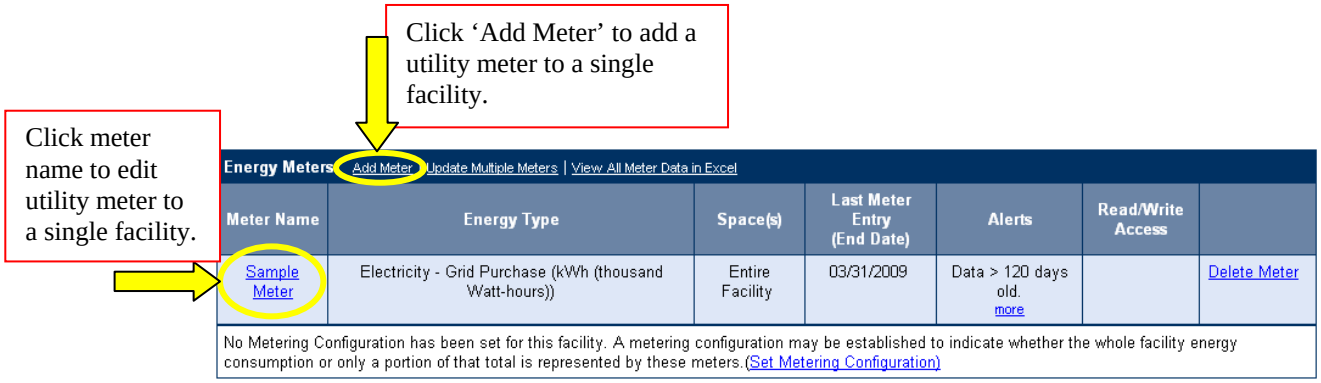

Figure 6: Adding an Energy Meter from the Facility page

Select the number of entries (in months) to add to the energy meter, input the start date of the data to be entered (form the facility utility bill) and click **CONTINUE**.

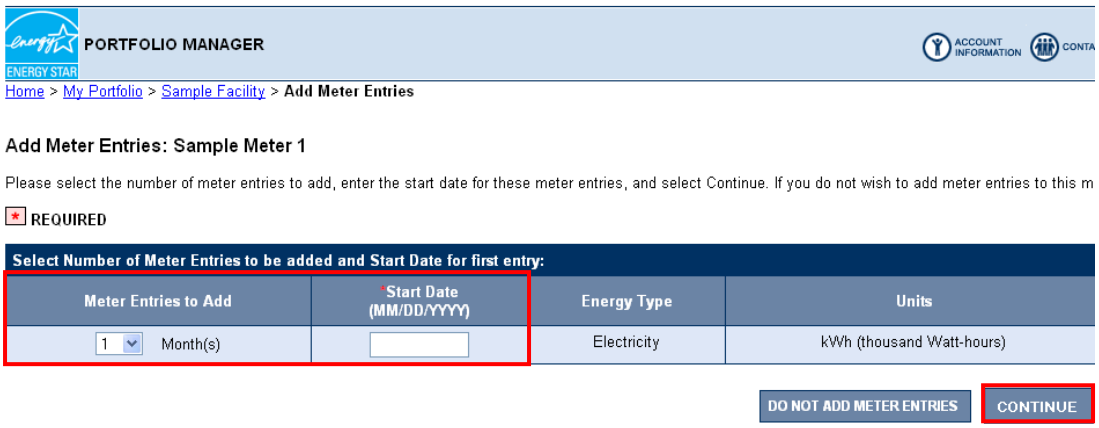

Figure 7: Configuring meter entries

Appendix G-6

Figure 9 shows a sample utility bill. Use this information to input monthly energy data (including start and end dates, energy use and cost), and click **SAVE** (see Figure 8).

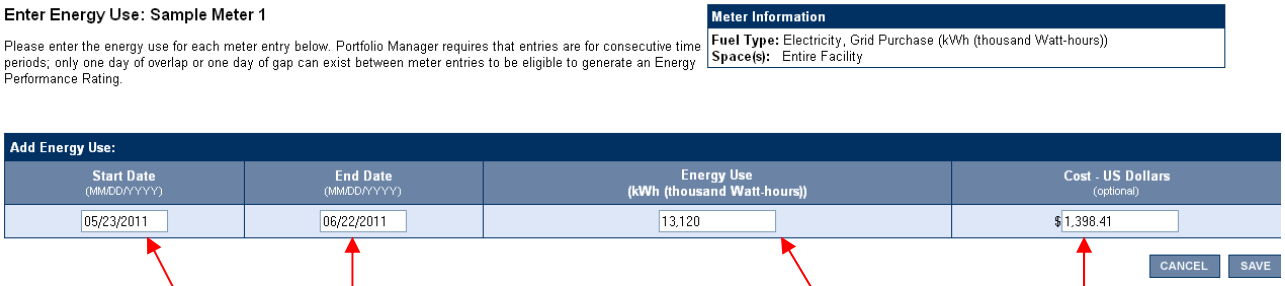

Figure 8: Entering energy data

Enter correct billing period from the monthly utility bill.

Enter monthly energy use data from utility bill.

Enter monthly cost data from utility bill.

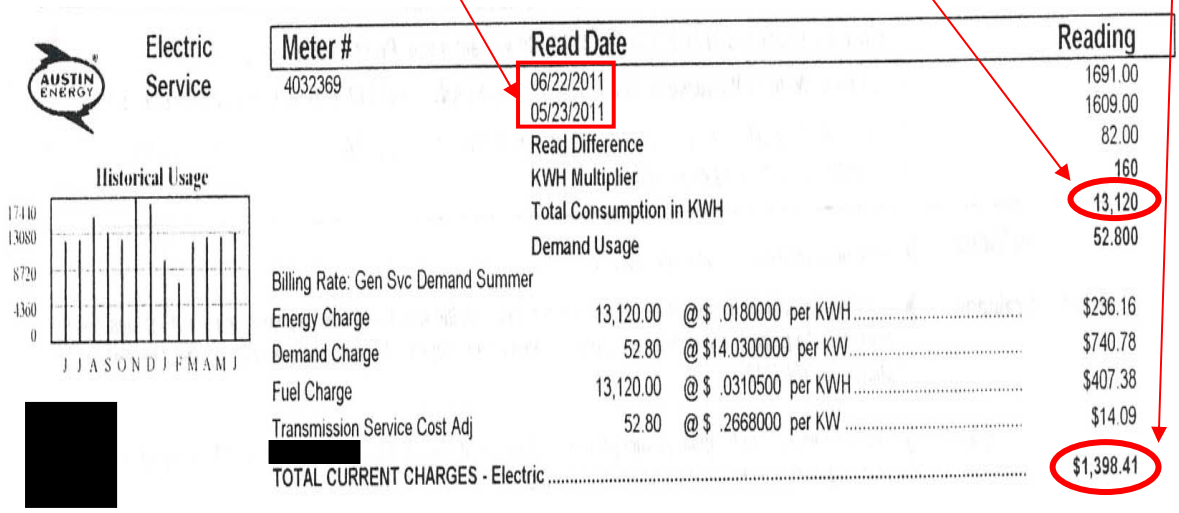

Figure 9: Sample facility utility bill

Appendix G-7

GENERATING A STATEMENT OF ENERGY PERFORMANCE

A Statement of Energy Performance (SEP) is a required document in applying for ENERGY STAR recognition. It can also be used for purposes other than applying for ENERGY STAR, such as formalizing information regarding a facility's energy performance or energy and environmental performance impacts.

Near the top of the Facility page, click 'Generate a Statement of Energy Performance', as shown below.

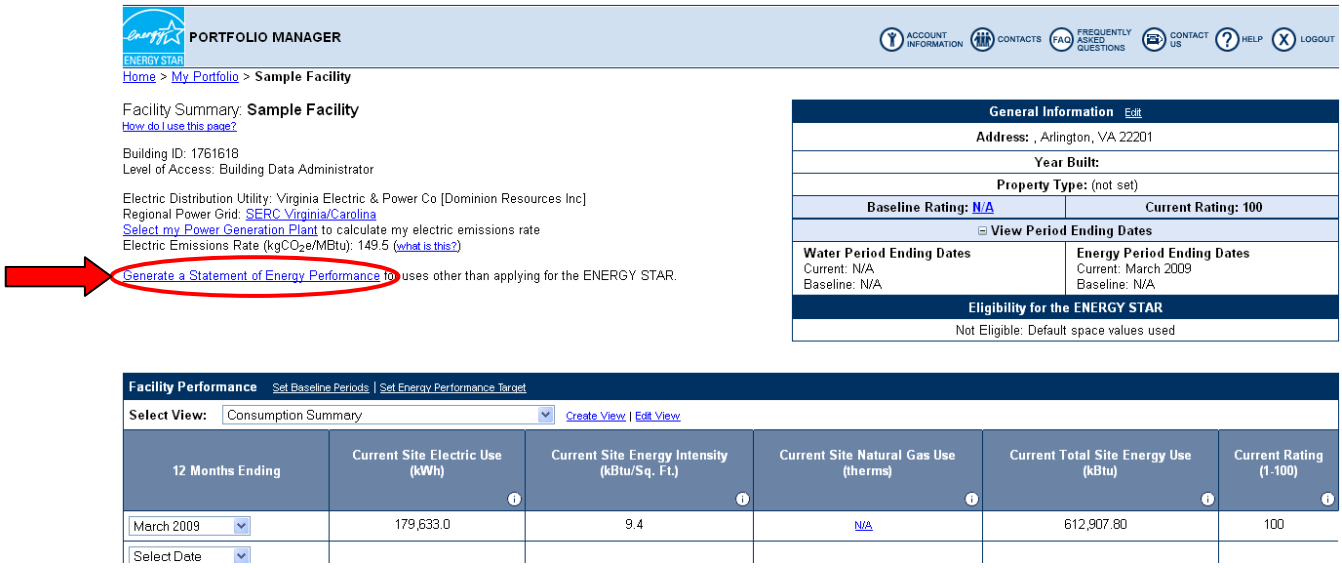

Figure 10: Generating a Statement of Energy Performance from the Facility page

Select reporting options for SEP as shown below, and click **GENERATE REPORT**.

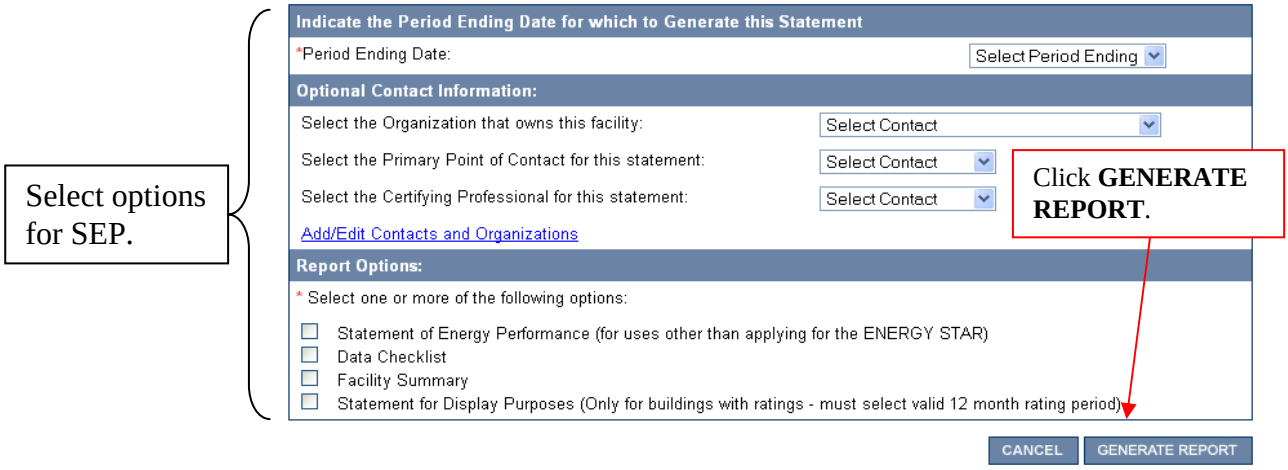

Figure 11: Setting up Statement of Energy Performance

Appendix G-8

SETTING ENERGY PERFORMANCE BASELINES AND TARGETS

An energy 'Baseline Period' for a facility is a 12-month period of complete energy data that can be compared to a facility's current energy performance. To set a baseline period for a particular facility, click 'Set Baseline Periods' on the main facility page (as shown below).

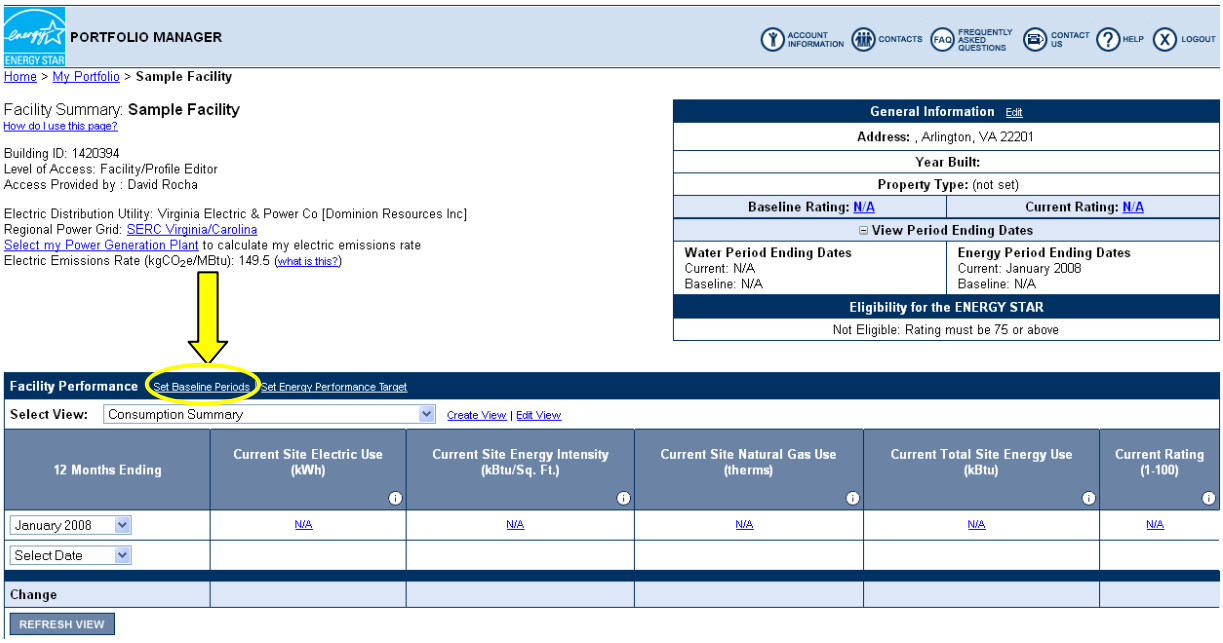

Figure 12: Setting a baseline period for a single facility from the Facility page

Use the drop down menus to select an Energy Baseline Period to compare with the current period. Then click **SAVE**. This will establish the baseline period for the facility. This period can be changed as necessary.

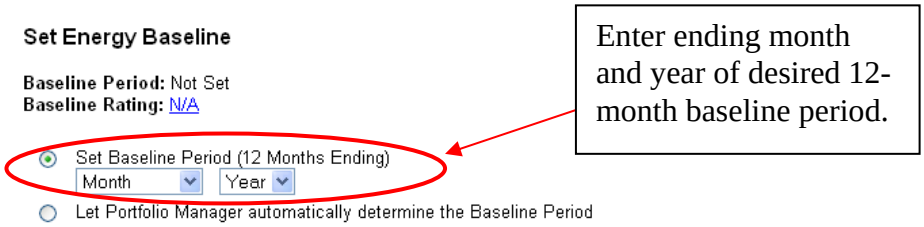

Figure 13: Setting a baseline period for a single facility

Setting an Energy Performance Target for a single facility allows the user to select a desired energy use reduction goal. It can also provide the user with the amount of total energy use reduction required to obtain a particular ENERGY STAR rating. To set an Energy Performance Target for a particular facility, click 'Set Energy Performance Target' on the main facility page (as shown below).

Appendix G-9

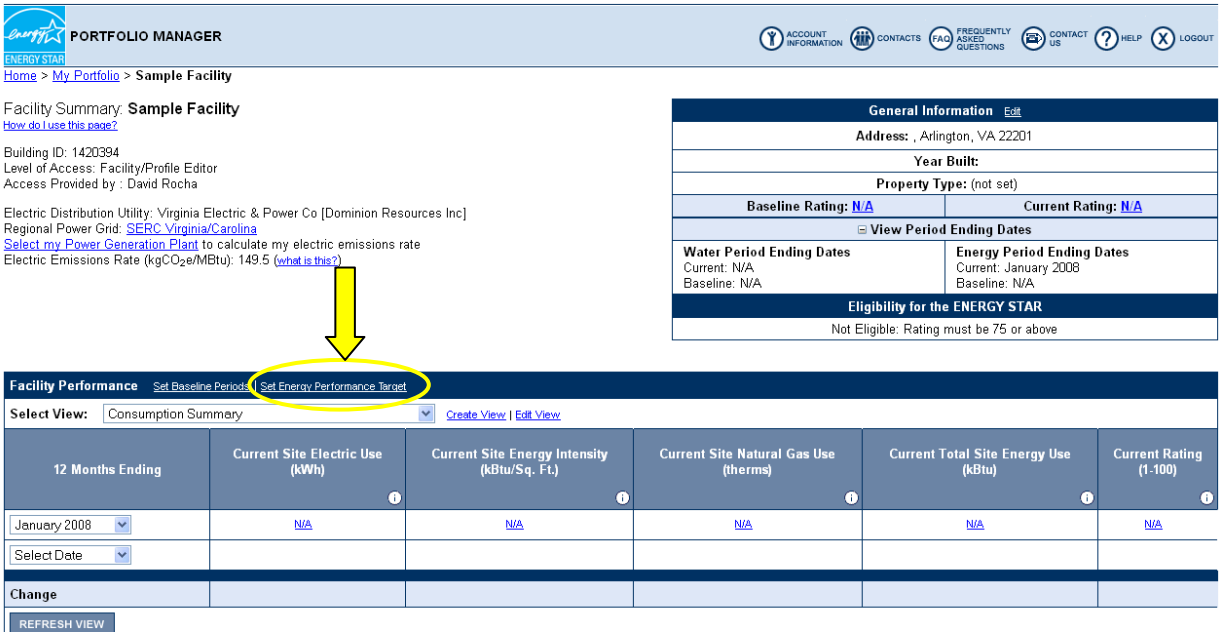

Figure 14: Setting an Energy Performance Target for a single facility from the Facility page

The user can choose one of two methods to set an energy performance target: by ENERGY STAR rating or target reduction (%). Click the desired method, and specify a desired target (as seen below). Click **RECALCULATE** to view the 'Target Energy Use' and 'Energy Cost Savings' results set by the target, and click **SAVE** to keep the current target and return to the Facility page.

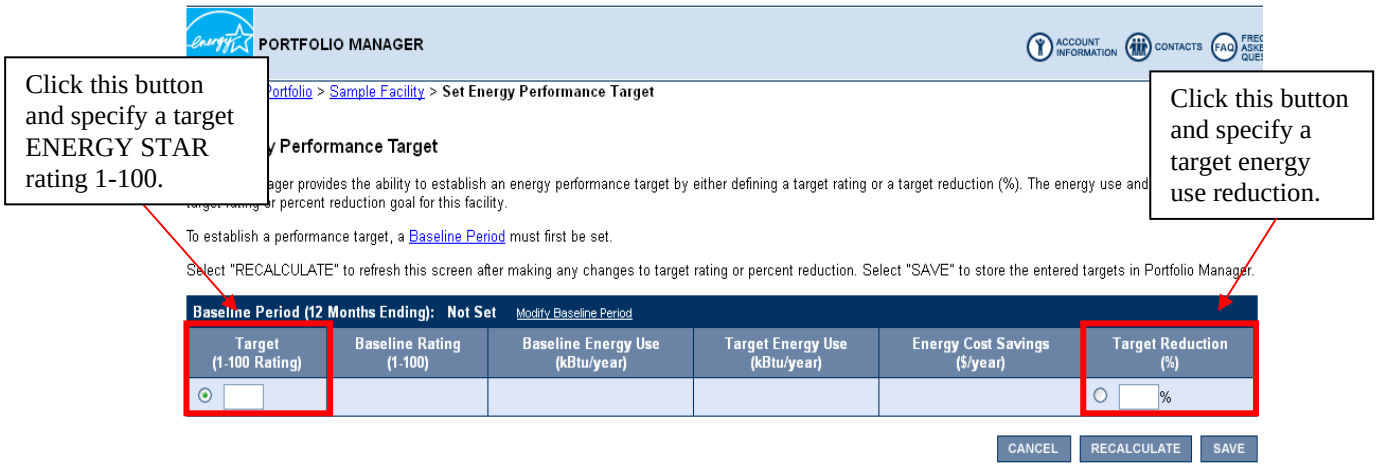

Figure 15: Setting an Energy Performance Target for a single facility

DELETING A FACILITY, SPACE, OR METER

Deleting a facility from Portfolio Manager will delete *everything* associated with that particular facility, including general information (address, year built, type of facility), any spaces designated within the facility, and any Energy/Water meters. To delete a facility, click 'Delete this Facility from Portfolio Manager' on the Main Facility Page, as shown in Figure 16 below.

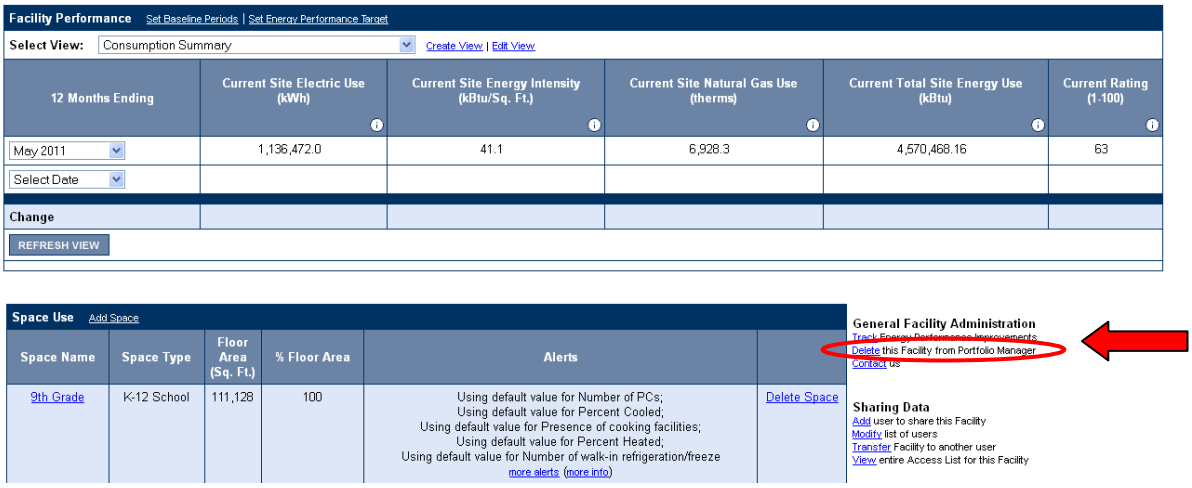

Figure 16: Deleting a facility from the Facility page

Deleting a space from within a facility will remove that single space from the Main Facility page, including any space attribute data associated with the space. To delete a single space from a facility, click 'Delete Space' on the corresponding space from the Main Facility page, as shown in Figure 17 below.

Deleting a meter from a facility will remove *any* data associated with the meter, including energy consumption and cost data. To delete a meter from a facility, click 'Delete Meter' on the corresponding meter form the Main Facility page, as shown below.

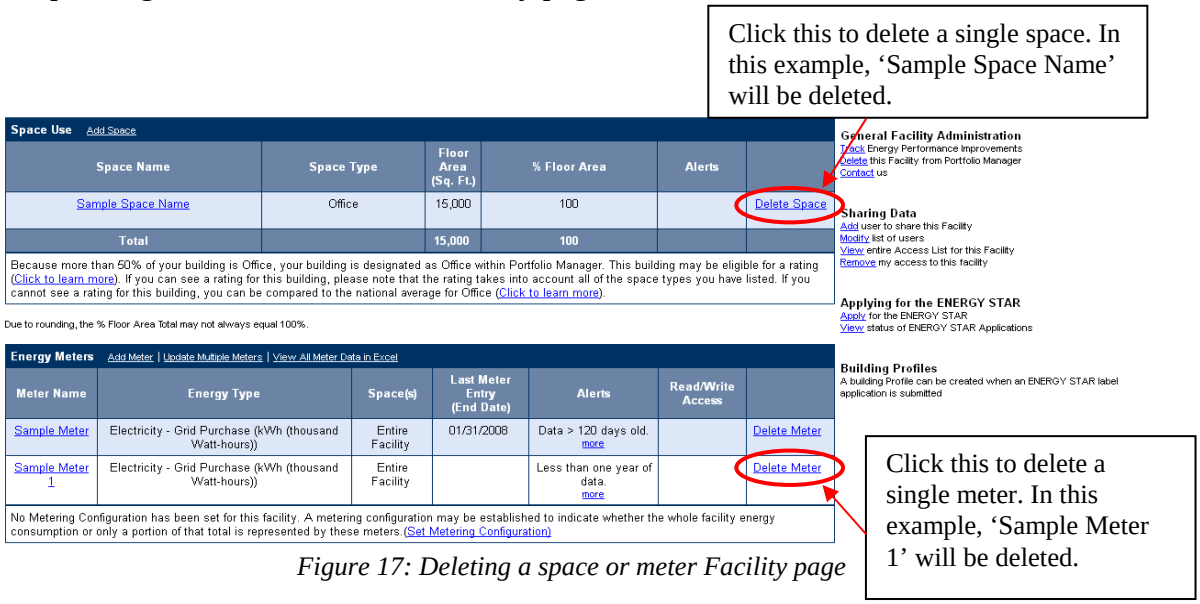

Figure 17: Deleting a space or meter Facility page

Appendix G-11

VIDEO TUTORIAL AND ONLINE HELP

ENERGY STAR provides Step-by-Step video tutorials for benchmarking using Portfolio Manager. These videos can be found at the following link:

http://www.energystar.gov/ia/business/benchmarking_training/benchmarking.html

In addition, ENERGY STAR provides a detailed 'HELP' section online, as seen in Figure 18.

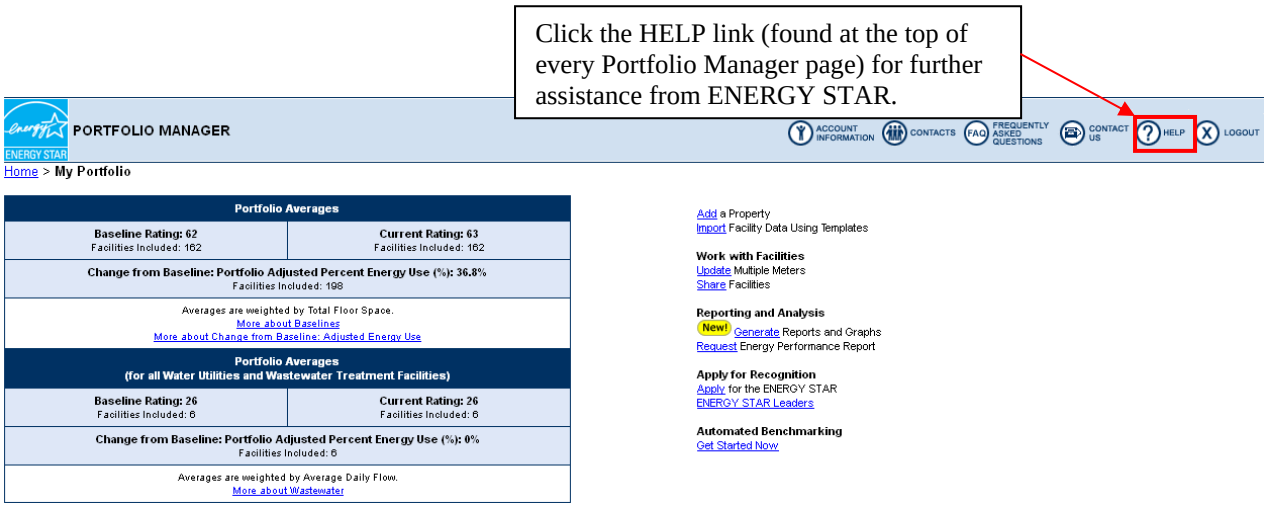

Figure 18: ENERGY STAR Portfolio Manager Help Section

It can also be found at the following link:

https://www.energystar.gov/istar/pmpam/help/portfolio_manager_online_help.htm

The information found in this section provides a wealth of information regarding operation of Portfolio Manager, including a glossary of terms, step-by-step tutorials, instructions for applying for ENERGY STAR recognition, and managing user accounts. It also includes a 'Search' function, which allows the user to locate applicable Help topics.

APPENDIX H

BUILDING COMMISSIONING INFORMATION

BUILDING COMMISSIONING GENERAL INFORMATION

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 to the owner vary between forms, 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, for typical new construction or renovation projects, the following lists the commissioning costs as percentages of each system cost.

- 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.

END

[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.

APPENDIX I

REQUEST FOR ENERGY ASSISTANCE

State Energy Conservation Office

Local Governments and Municipalities

Preliminary Energy Assessment Service Agreement

Investing in our communities 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 City of Bryan, 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: Jayson Barfknecht

Date: 08/02/2011

Name (Mr./Ms./Dr.): Dr. Jayson Barfknecht

Title: Public Works Director

Organization: City of Bryan

Phone: 979 209 5929

Street Address: 1111 Waco Street

Fax: 979 209 5959

Mailing Address: P.O. Box 1000

E-Mail: jbarfknecht@bryantx.gov

Bryan, TX 77803

County: Brazos

Contact Information:

Name (Mr./Ms./Dr.): MARK JURICA

Title: Treatment + Compliance Manager

Phone: 979 209 5932

Fax: 979 209 5959

E-Mail: mjurica@bryantx.gov

County: Brazos

Please sign and mail or fax to: Stephen Ross, Local Governments and Municipalities Program Administrator, State Energy Conservation Office, 111 E. 17th Street, Austin, Texas 78774. Phone: 512-463-1770. Fax 512-475-2569.