B. Baseline Analysis

An electricity and natural gas utility bill analysis was performed for the seven City buildings. The results of this analysis are provided in the following sections:

- the baseline conditions for all buildings
- utility bill summaries by building
- detailed utility rates / unit energy costs (e.g. $/kWh) by building
- energy performance indexes (e.g. Energy Utilization Index / EUI) by building
- a greenhouse gas emissions evaluation that outlines the environmental benefits of implementing a comprehensive Energy Performance Contract

This analysis is important, because the current baseline energy consumption is then used to calculate the percentage of projected and guaranteed energy savings that will be generated from Energy Conservation Measure improvements.

Ameresco also evaluated each building's utility rates to ensure accuracy when calculating the projected and guaranteed consumption savings generated by energy conservation measures. Of note, there are considerable Xcel Energy demand charge costs ranging from $16 to $18.50/kW. Our savings calculations in the Energy Conservation Measures section only account for demand charge savings, if the technology specifically reduces the demand during peak consumption periods. The savings also needs to be consistent and verifiable to be considered in the guaranteed savings applied to the business case for the ESPC. In addition, the energy use intensity analysis provides a means to identify buildings that are exceeding average energy consumption based on facility area. With their significant plug loads, heating/cooling loads, and pool facilities, the Recreation Center, FunPlex and Senior Center produced high energy use intensities (kBTu/SF) ranging from 107.4 kBtu/SF at the Recreation Center to 371.9 kBtu/SF for the FunPlex. The Police Headquarters and Secondary Building also had high energy use intensities – 115.3 kBTU/SF and 130.4 kBTU/SF respectively – due to 24/7 operations and equipment plug loads. For our region, this compares to average energy use intensities of 90 kBTU/SF for offices and 102 kBTU/SF for public assembly facilities. This deviation in energy use intensity indicates a realistic benchmark to estimate the potential energy savings at the City's facilities.

Finally, many customers wish to know the potential reduction in greenhouse gas emissions, if the Energy Savings Performance Contract is implemented per the scope of work. While these figures may not reflect a financial return on investment, community members may appreciate the City's efforts to reduce these types of emissions. For this reason, Ameresco also calculated a baseline and estimated reduction of greenhouse gas emissions based on the natural gas and electricity consumed by the facilities within the scope of the energy audit.

Summary of Utility Accounts

Electricity and natural gas are provided to the City by several different utility providers, including Xcel Energy, Seminole Energy Services, and Atmos Energy. Xcel Energy is the sole electricity provider to these facilities. Atmos Energy is the primary natural gas utility, but Seminole Energy provides transport services to five of the buildings, including the Recreation Center, FunPlex, Lincoln Park Annex, and the two Police Headquarter facilities. A summary of utility accounts is provided below. Note that some information in the table was not provided by the City or utilities such as account numbers, meter numbers or rate codes.

Utility Account Summary

Building	Service type	Account Number	Meter/Premise Number	Rate Code	Provider
Rec Center	Electric	53-1957161-2	59961188	PG	Xcel
	Natural Gas	60-000111919-0784990-5	118224	-	Atmos
	Natural Gas	-	N/A	-	Seminole
Civic Center	Electric	53-1957161-2	59961188	PG	Xcel
	Natural Gas	60-000111919-0784990-5	237645	01MP	Atmos
Senior Center	Electric	53-1957161-2	51868T	SG	Xcel
	Natural Gas	60-000111919-0784990-5	G0015774	01MP	Atmos
FunPlex	Electric	53-7202663-6	6357373	SG	Xcel
	Electric	53-7202663-6	5191333	C	Xcel
	Electric	53-7202663-6	5172681	C	Xcel
	Natural Gas	60-000111919-0784990-5	22818	-	Atmos
	Natural Gas	-	N/A	-	Seminole
Lincoln Park Annex	Electric	53-1957161-2	6357385	SG	Xcel
	Electric	Parking Lighting	N/A	N/A	Xcel
	Natural Gas	60-000111919-0784990-5	118223	-	Atmos
	Natural Gas	-	N/A	-	Seminole
Police HQ	Electric	-	-	-	Xcel
	Natural Gas	60-000111919-0784990-5	22817	-	Atmos
	Natural Gas	-	N/A	-	Seminole
Police Secondary Building	Electric	-	-	-	Xcel
	Natural Gas	60-000111919-0784990-5	22818	-	Atmos
	Natural Gas	-	N/A	-	Seminole

Baseline Summary

Ameresco performed a thorough analysis of the City-provided utility bills to establish the baseline annual consumption for each of the facilities. Establishing an accurate and representative baseline is crucial to provide an accurate Investment Grade Audit (IGA), finance an Energy Savings Performance Contract (ESPC), and then perform measurement and verification services to confirm the guaranteed consumption savings. The baseline condition for each facility is stipulated as that facility's "typical" annual energy consumption and carried forward over the course of an ESPC project. In the project development phase, the independent energy savings calculations performed for the proposed conservation measures are compared to

the baseline as a legitimacy check to ensure realistic and reasonable savings are proposed. In some cases, the baseline is used directly for certain savings calculations. Furthermore, during the Monitoring and Verification (M&V) phase after a project has been implemented and closed, the baseline may be compared to the post-implementation utility bills to verify that the proposed energy savings are, in reality, being realized.

The annual baseline consumption values were calculated as an average of the yearly energy consumption during three years (2009 – 2011) of utility data. For some buildings, a full three years of utility data were not available, in which case the baseline was calculated as a two-year average or an annual total, whichever was more applicable. Data that was considered anomalous was investigated for accuracy and replaced with an appropriate estimate if deemed inaccurate. Data that was missing altogether was filled with an appropriate estimate. The annual electricity and natural gas baseline for each facility is provided in the table below

Electricity						
Building	Building Area (ft^2)	Total Annual Demand (kW)	Annual Demand Cost ($)	Annual Consumption (kWh)	Annual Consumption Cost ($)	Total Annual Cost ($)
Rec Center	117,776	3,268	$48,057	1,074,477	$46,545	$110,804
Civic Center	71,000	2,465	$36,253	479,673	$16,354	$59,664
Senior Center	31,470	1,497	$24,664	623,253	$21,729	$50,956
FunPlex	51,400	5,221	$90,896	2,057,760	$75,790	$180,974
Lincoln Park Annex	68,785	3,064	$49,712	1,013,400	$34,794	$93,285
Police HQ	49,922	1,848	$30,728	955,040	$33,182	$69,556
Police HQ Secondary Building	26,450	546	$9,923	251,680	$8,701	$19,741
Total/Average	416,803	17,910	$290,233	6,455,283	$237,095	$584,979

Natural Gas			
Building	Building Area (ft^2)	Annual Consumption (Therms)	Total Annual Cost ($)
Rec Center	117,776	89,791	$64,953
Civic Center	71,000	14,860	$11,156
Senior Center	31,470	14,801	$11,222
FunPlex	51,400	120,970	$63,744
Lincoln Park Annex	68,785	36,503	$26,889
Police HQ	49,922	24,986	$19,606
Police HQ Secondary Building	26,450	25,893	$19,405
Total	416,803	327,804	$216,974

Utility Bills

The City provided historical utility data and bills from calendar years 2009 – 2011 to Ameresco. Summaries of the bills from calendar year 2011 are listed in the section below.

Recreation Center & Union Colony Civic Center Combined

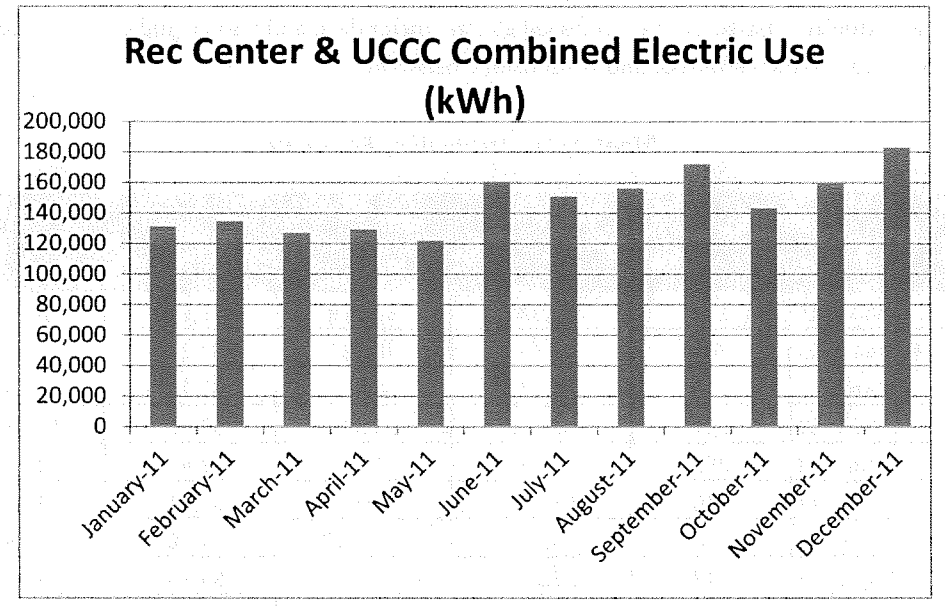
The Rec Center shares one electric meter with the adjacent Civic Center. This is the only electric meter for both buildings. The monthly utility bills for this meter are represented below. A breakout of each building's estimated monthly electricity use – based on both known and stipulated equipment loads and run hours – is also provided below.

Electricity consumption at the two buildings remains fairly constant throughout the year. However, there is a slight increase during summer months due to the increased cooling load. Natural gas usage peaks in the winter months due to the increased heating load. A minimum natural gas consumption is required even during the summer to meet pool heating and domestic hot water loads.

Monthly Electricity Bills, Recreation Center and Civic Center Combined

Month	Facility Peak Demand (kW)	Facility Peak Demand Cost ($)	Electricity Consumption (kWh)	Electricity Consumption Cost ($)	Total Cost ($)
January-11	321	$4,950	131,377	$4,338	$10,078
February-11	364	$5,613	134,758	$4,419	$10,860
March-11	384	$5,921	127,094	$4,239	$10,995
April-11	436	$6,723	129,321	$4,956	$16,656
May-11	444	$6,936	122,248	$4,629	$17,233
June-11	543	$10,001	160,816	$6,234	$17,375
July-11	558	$10,234	150,964	$6,221	$17,589
August-11	610	$11,187	156,487	$6,483	$18,865
September-11	582	$10,564	172,219	$6,881	$18,629
October-11	504	$7,726	143,329	$5,541	$14,245
November-11	400	$6,132	159,841	$6,188	$13,252
December-11	379	$5,799	183,073	$6,777	$13,522
Total	5,525	$91,787	1,771,527	$66,905	$179,298

Monthly Electricity Consumption



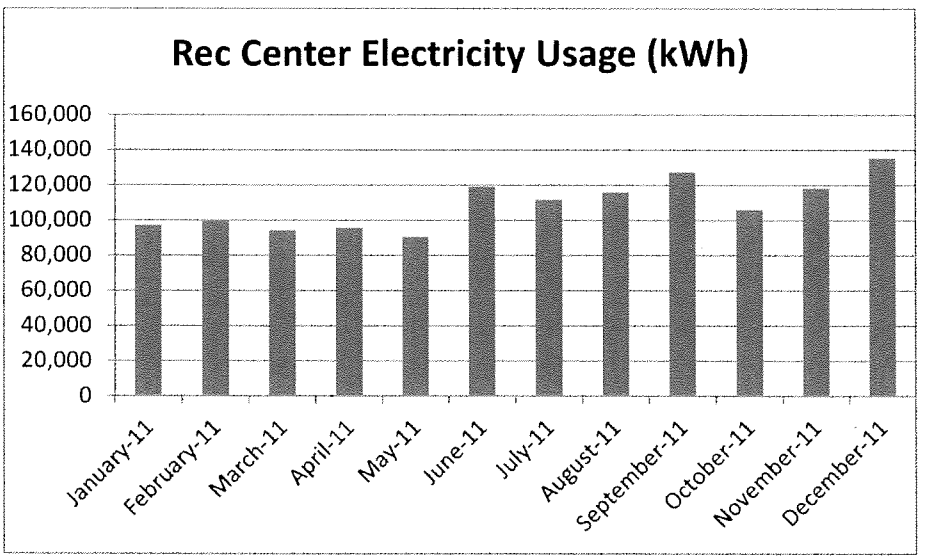
Recreation Center

The stipulated monthly electricity usage for the Recreation Center is represented the Table and Figure below. The values are stipulated based on the combined electric meter data, and known and estimated equipment loads and run hours gathered on-site and from facility personnel.

Monthly Electricity Bills, Rec Center

Month	Facility Peak Demand (kW)	Facility Peak Demand Cost ($)	Electricity Consumption (kWh)	Electricity Consumption Cost ($)	Total Cost ($)
January-11	183	$2,821	97,219	$3,210	$6,551
February-11	207	$3,199	99,721	$3,270	$7,059
March-11	219	$3,375	94,050	$3,137	$7,147
April-11	249	$3,832	95,698	$3,667	$10,826
May-11	253	$3,953	90,464	$3,425	$11,201
June-11	310	$5,701	119,004	$4,613	$11,294
July-11	318	$5,833	111,713	$4,603	$11,433
August-11	348	$6,377	115,800	$4,797	$12,262
September-11	332	$6,022	127,442	$5,092	$12,109
October-11	287	$4,404	106,063	$4,100	$9,259
November-11	228	$3,495	118,282	$4,579	$8,614
December-11	216	$3,305	135,474	$5,015	$8,789
Total	3,149	$52,319	1,310,930	$49,510	$116,544

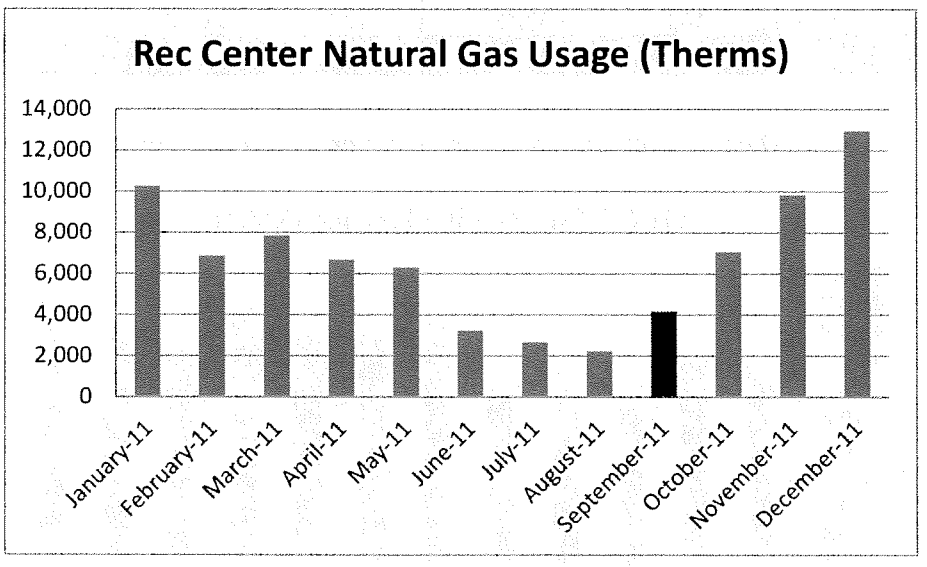
Monthly Electricity Consumption, Rec Center



Monthly Natural Gas Bills, Recreation Center

Month	Natural Gas Consumption (Therms)	Total Natural Gas Cost ($)
January-11	10,267	$12,231
February-11	6,869	$8,182
March-11	7,870	$4,212
April-11	6,680	$3,851
May-11	6,320	$3,563
June-11	3,240	$1,889
July-11	2,680	$1,595
August-11	2,240	$3,206
September-11	4,170	$2,427
October-11	7,070	$4,004
November-11	9,840	$5,278
December-11	12,950	$6,848
Total	80,196	$57,288

Monthly Natural Gas Consumption, Recreation Center



Union Colony Civic Center

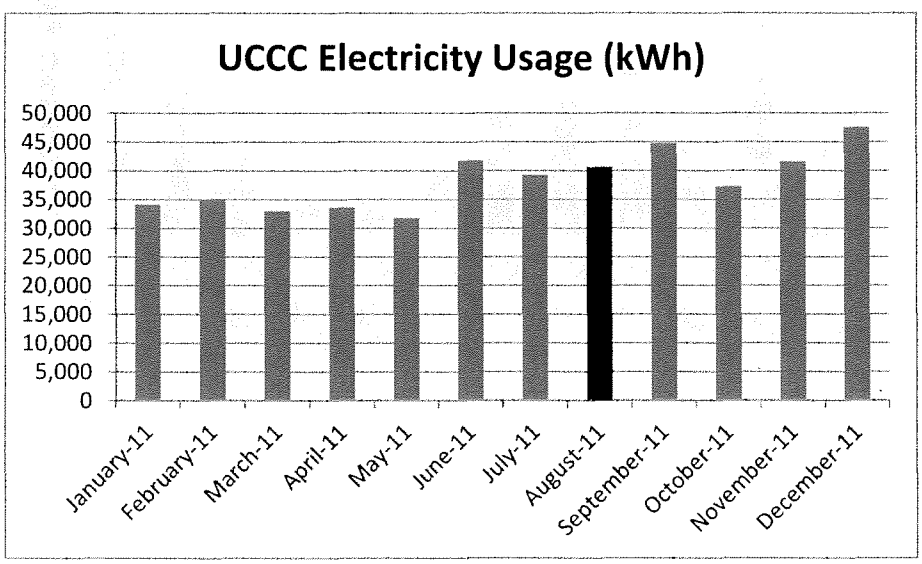
The stipulated monthly electricity usage for the Civic Center is represented below.

Electricity consumption remains fairly constant throughout the year but with a slight increase in the summer months due to the increased cooling load. Natural gas consumption peaks in the winter months due to the increased heating load.

Monthly Electricity Bills, Union Colony Civic Center

Month	Facility Peak Demand (kW)	Facility Peak Demand Cost ($)	Electricity Consumption (kWH)	Electricity Consumption Cost ($)	Total Cost ($)
January-11	138	$2,128	34,158	$1,128	$3,527
February-11	157	$2,414	35,037	$1,149	$3,801
March-11	165	$2,546	33,044	$1,102	$3,848
April-11	187	$2,891	33,623	$1,289	$5,830
May-11	191	$2,982	31,784	$1,204	$6,032
June-11	233	$4,301	41,812	$1,621	$6,081
July-11	240	$4,400	39,251	$1,617	$6,156
August-11	262	$4,811	40,687	$1,685	$6,603
September-11	250	$4,543	44,777	$1,789	$6,520
October-11	217	$3,322	37,266	$1,441	$4,986
November-11	172	$2,637	41,559	$1,609	$4,638
December-11	163	$2,494	47,599	$1,762	$4,733
Total	2,376	$39,468	460,597	$17,395	$62,754

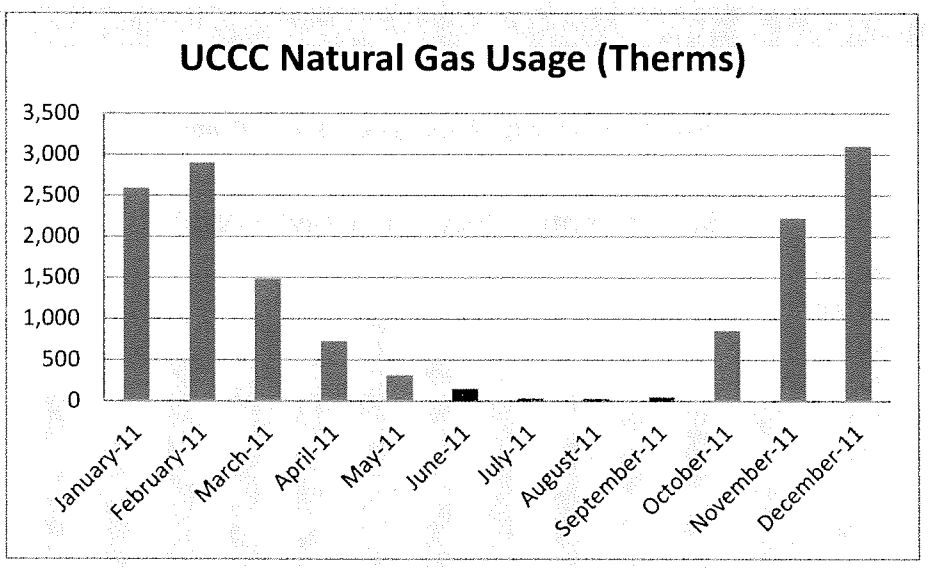
Monthly Electricity Consumption, Union Colony Civic Center



Monthly Natural Gas Bills, Union Colony Civic Center

Month	Natural Gas Consumption (Therms)	Total Natural Gas Cost ($)
January-11	2,590	$1,795
February-11	2,899	$2,006
March-11	1,486	$1,041
April-11	729	$524
May-11	317	$243
June-11	152	$130
July-11	38	$52
August-11	34	$50
September-11	53	$62
October-11	858	$613
November-11	2,227	$1,594
December-11	3,104	$2,212
Total	14,488	$10,320

Monthly Natural Gas Consumption, Union Colony Civic Center



Senior Center

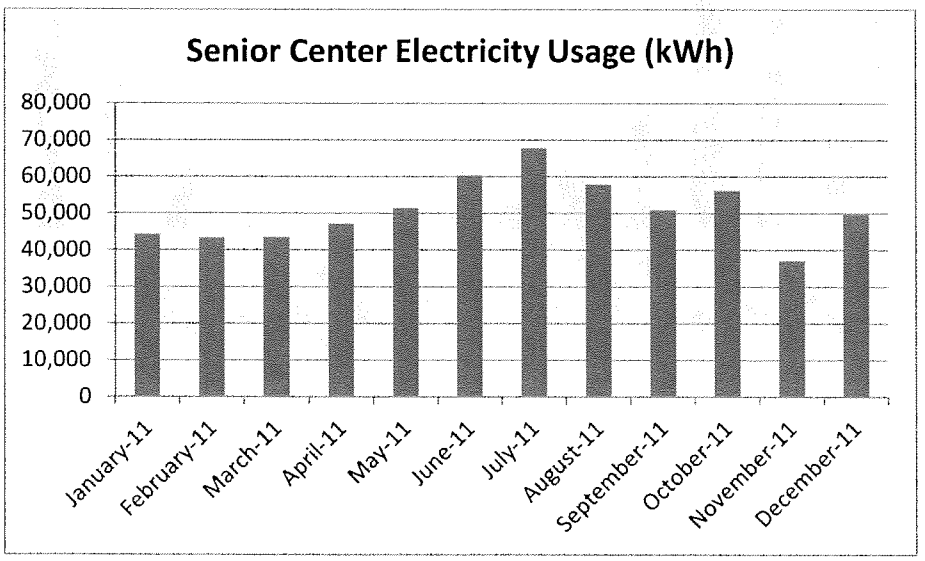
The monthly utility bills from the Senior Center are represented in the tables and figures below.

Electricity consumption peaks in the summer months due to the increased cooling load. Natural gas consumption peaks in the winter months due to the increased heating load.

Monthly Electricity Bills, Senior Center

Month	Facility Peak Demand (kW)	Facility Peak Demand Cost ($)	Electricity Consumption (kWH)	Electricity Consumption Cost ($)	Total Electricity Cost ($)
January-11	93	$1,611	44,320	$1,473	$3,242
February-11	101	$1,749	43,360	$1,441	$3,354
March-11	117	$2,026	43,520	$1,555	$3,805
April-11	112	$1,940	47,200	$1,812	$3,984
May-11	150	$2,820	51,520	$1,979	$5,083
June-11	155	$3,136	60,320	$2,390	$5,845
July-11	163	$3,291	67,840	$2,770	$6,403
August-11	142	$2,867	57,920	$2,365	$5,533
September-11	136	$2,565	51,040	$2,041	$4,877
October-11	118	$2,033	56,320	$2,194	$4,479
November-11	120	$2,068	37,120	$1,446	$3,730
December-11	91	$1,564	49,760	$1,771	$3,543
Total	1,498	$27,671	610,240	$23,237	$53,879

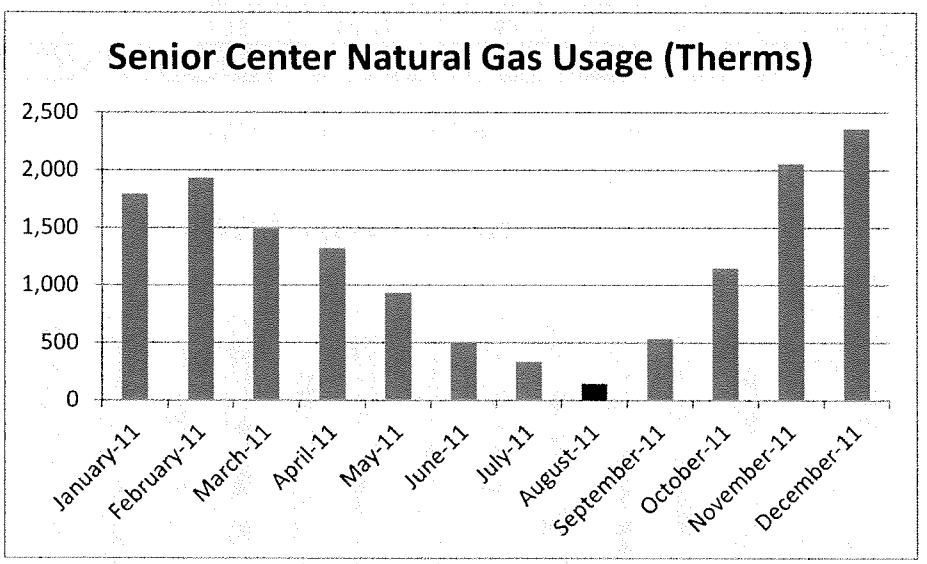
Monthly Electricity Consumption, Senior Center



Monthly Natural Gas Bills, Senior Center

Month	Natural Gas Consumption (Therms)	Total Natural Gas Cost ($)
January-11	1,795	$1,252
February-11	1,935	$1,414
March-11	1,490	$1,043
April-11	1,324	$930
May-11	937	$666
June-11	507	$372
July-11	338	$257
August-11	146	$126
September-11	536	$393
October-11	1,148	$811
November-11	2,058	$1,475
December-11	2,360	$1,688
Total	12,639	$10,427

Monthly Natural Gas Consumption, Senior Center



Family FunPlex

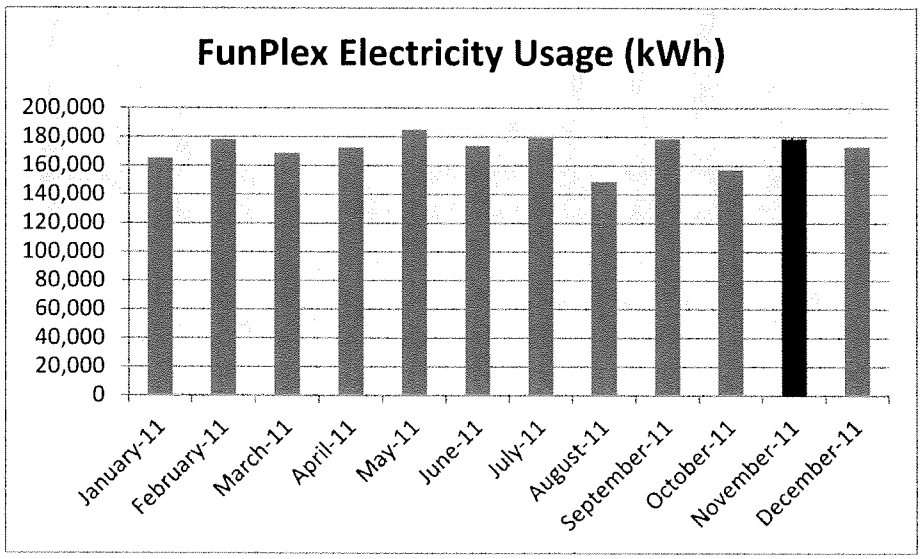
The monthly utility bills from the FunPlex are represented in the tables and figures below.

Electricity consumption stays fairly constant throughout the year. Natural gas usage peaks in the winter months due to the increased heating load. A minimum natural gas consumption is required even during the summer to meet pool heating and domestic hot water loads.

Monthly Electricity Bills, FunPlex

Month	Facility Peak Demand (kW)	Facility Peak Demand Cost ($)	Electricity Consumption (kWH)	Electricity Consumption Cost ($)	Total Electricity Cost ($)
January-11	334	$5,785	165,241	$5,536	$11,959
February-11	413	$7,153	178,029	$5,958	$13,839
March-11	438	$7,586	168,750	$5,773	$14,099
April-11	529	$9,162	172,586	$6,663	$16,691
May-11	505	$8,980	185,355	$7,154	$17,015
June-11	457	$9,261	173,874	$6,772	$16,909
July-11	490	$9,893	179,298	$7,370	$18,195
August-11	468	$9,450	148,957	$6,145	$16,439
September-11	495	$9,857	178,960	$6,501	$18,116
October-11	492	$8,477	157,308	$6,178	$15,446
November-11	320	$5,514	178,921	$7,021	$13,223
December-11	331	$5,698	173,249	$6,618	$12,993
Total	5,272	$96,816	2,060,528	$77,689	$184,924

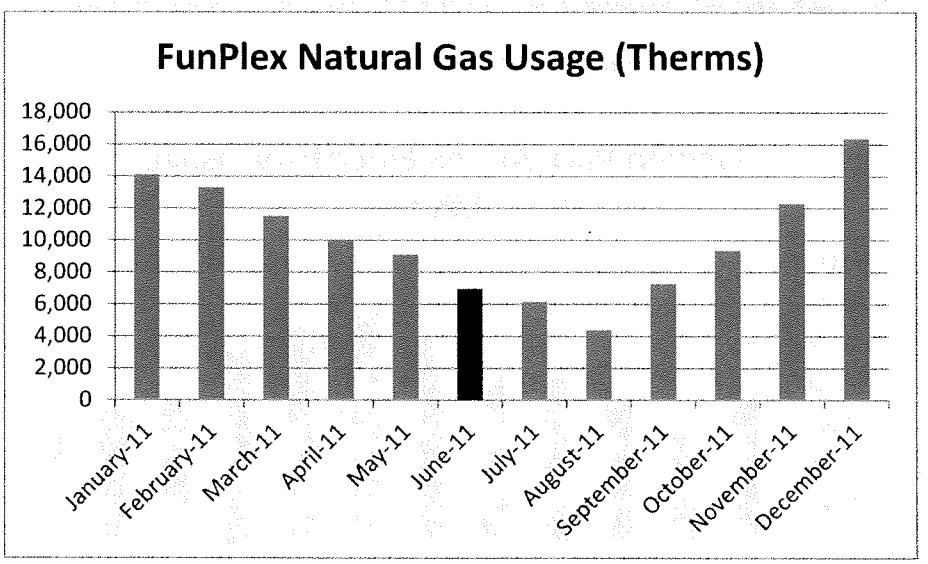
Monthly Electricity Consumption, FunPlex



Monthly Natural Gas Bills, FunPlex

Month	Natural Gas Consumption (Therms)	Total Natural Gas Cost ($)
January-11	14,110	$6,937
February-11	13,310	$5,871
March-11	11,520	$6,121
April-11	10,030	$5,736
May-11	9,110	$5,015
June-11	6,990	$4,038
July-11	6,160	$3,618
August-11	4,410	$2,599
September-11	7,290	$3,950
October-11	9,370	$4,960
November-11	12,300	$6,428
December-11	16,370	$8,471
Total	120,970	$63,744

Monthly Natural Gas Consumption, FunPlex



Lincoln Park Annex

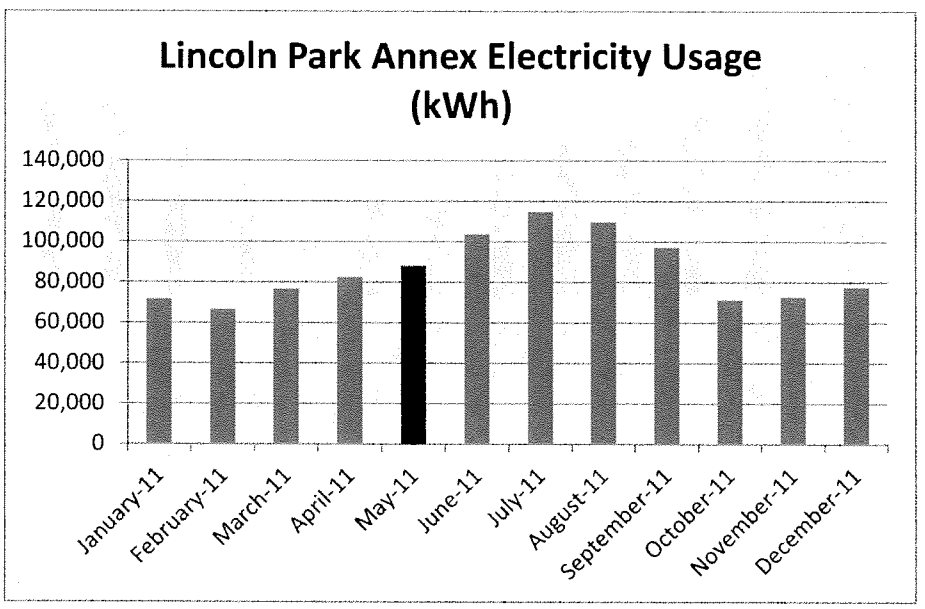
The monthly utility bills from the Lincoln Park Annex are represented below.

Electricity consumption peaks in the summer months due to the increased cooling load. Natural gas consumption peaks in the winter months due to the increased heating load.

Monthly Electricity Bills, Lincoln Park Annex

Month	Facility Peak Demand (kW)	Facility Peak Demand Cost ($)	Electricity Consumption (kWH)	Electricity Consumption Cost ($)	Total Electricity Cost ($)
January-11	269	$4,615	71,700	$2,383	$7,273
February-11	269	$4,634	66,600	$2,214	$7,240
March-11	269	$4,634	76,800	$2,693	$7,731
April-11	269	$4,634	82,500	$3,168	$8,229
May-11	269	$4,898	88,200	$3,387	$8,736
June-11	267	$5,406	103,800	$4,081	$9,981
July-11	279	$5,633	114,900	$4,691	$11,334
August-11	279	$5,633	109,800	$4,483	$10,664
September-11	279	$5,367	97,200	$3,910	$9,795
October-11	282	$4,859	71,400	$2,782	$8,094
November-11	279	$4,807	72,900	$2,840	$8,068
December-11	279	$4,798	77,700	$2,842	$8,061
Total	3,289	$59,918	1,033,500	$39,475	$105,205

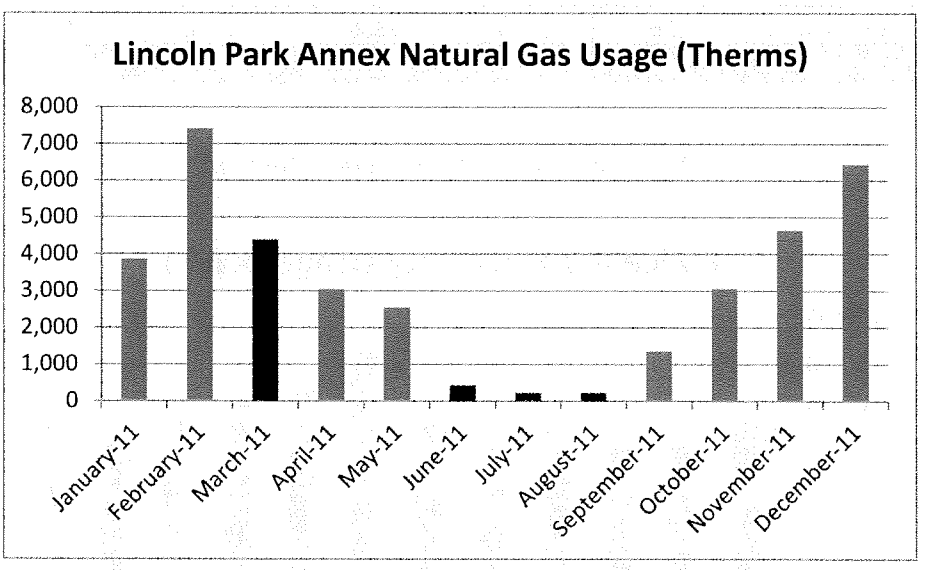
Monthly Electricity Consumption, Lincoln Park Annex



Monthly Natural Gas Bills, Lincoln Park Annex

Month	Natural Gas Consumption (Therms)	Total Natural Gas Cost ($)
January-11	3,862	$4,324
February-11	7,424	$8,308
March-11	4,400	$2,360
April-11	3,050	$1,777
May-11	2,550	$1,444
June-11	440	$294
July-11	230	$168
August-11	230	$167
September-11	1,360	$792
October-11	3,060	$1,754
November-11	4,650	$2,481
December-11	6,450	$3,182
Total	37,705	$27,051

Monthly Natural Gas Consumption, Lincoln Park Annex



Police Headquarters

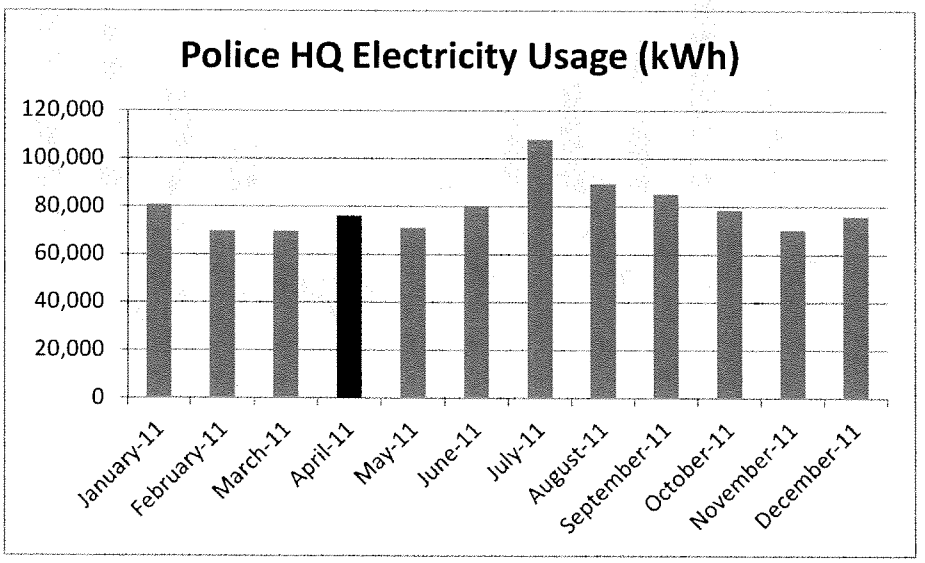
The monthly utility bills from the Police Headquarters are represented in the tables and figures below.

Electricity consumption peaks in the summer months due to the increased cooling load. Natural gas consumption peaks in the winter months due to the increased heating load.

Monthly Electricity Bills, Police HQ

Month	Facility Peak Demand (kW)	Facility Peak Demand Cost ($)	Electricity Consumption (kWH)	Electricity Consumption Cost ($)	Total Electricity Cost ($)
January-11	128	$2,205	80,880	$2,669	$5,159
February-11	131	$2,269	69,840	$2,321	$4,865
March-11	135	$2,338	69,840	$2,321	$4,937
April-11	138	$2,390	76,080	$2,836	$5,532
May-11	159	$2,754	71,040	$2,728	$5,801
June-11	180	$3,522	80,400	$3,087	$6,986
July-11	187	$3,748	108,000	$4,348	$8,575
August-11	183	$3,655	89,520	$3,655	$7,757
September-11	191	$3,814	85,200	$3,479	$7,741
October-11	173	$3,079	78,720	$3,106	$6,575
November-11	144	$2,449	70,320	$2,740	$5,522
December-11	128	$2,177	75,840	$2,955	$5,459
Total	1,877	$34,401	955,680	$36,245	$74,909

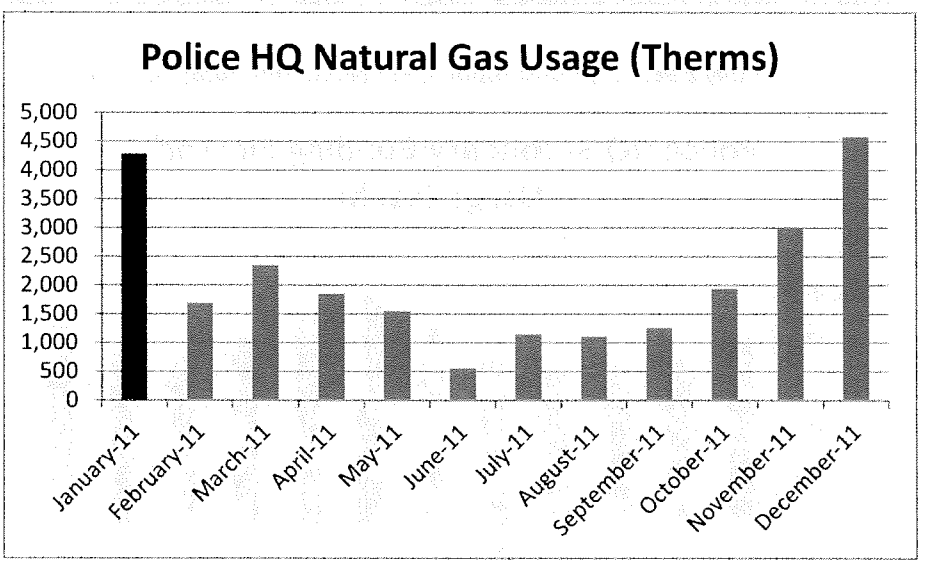
Monthly Electricity Consumption, Police HQ



Monthly Natural Gas Bills, Police HQ

Month	Natural Gas Consumption (Therms)	Total Natural Gas Cost ($)
January-11	4,287	$4,852
February-11	1,689	$1,913
March-11	2,350	$1,276
April-11	1,850	$1,052
May-11	1,550	$888
June-11	560	$358
July-11	1,150	$700
August-11	1,110	$692
September-11	1,260	$756
October-11	1,940	$1,121
November-11	3,010	$1,738
December-11	4,580	$2,423
Total	25,336	$17,768

Monthly Natural Gas Consumption, Police HQ



Police Headquarters Secondary Building

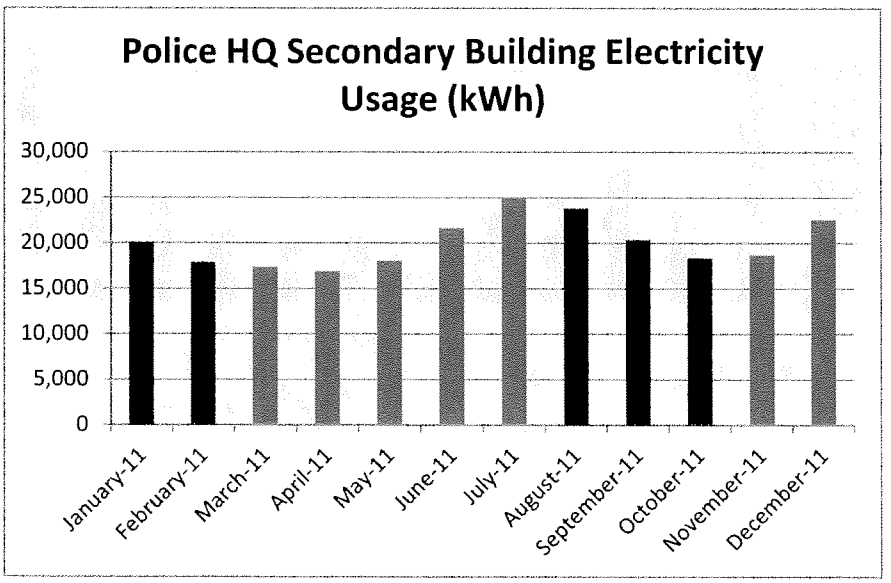
The monthly utility bills from the Police Headquarters Secondary Building are represented in the tables and figures below.

Electricity consumption peaks in the summer months due to the increased cooling load. Natural gas consumption peaks in the winter months due to the increased heating load.

Monthly Electricity Bills, Police HQ Secondary Building

Month	Facility Peak Demand (kW)	Facility Peak Demand Cost ($)	Electricity Consumption (kWH)	Electricity Consumption Cost ($)	Total Electricity Cost ($)
January-11	46	$797	20,080	$667	$1,580
February-11	44	$762	17,920	$596	$1,468
March-11	35	$606	17,360	$609	$1,319
April-11	40	$693	16,880	$648	$1,451
May-11	46	$845	18,080	$694	$1,659
June-11	53	$1,073	21,680	$853	$2,065
July-11	59	$1,191	24,960	$1,019	$2,362
August-11	59	$1,191	23,840	$973	$2,314
September-11	50	$962	20,400	$821	$1,913
October-11	38	$655	18,400	$717	$1,482
November-11	40	$689	18,720	$729	$1,531
December-11	38	$654	22,560	$825	$1,594
Total	548	$10,117	240,880	$9,152	$20,738

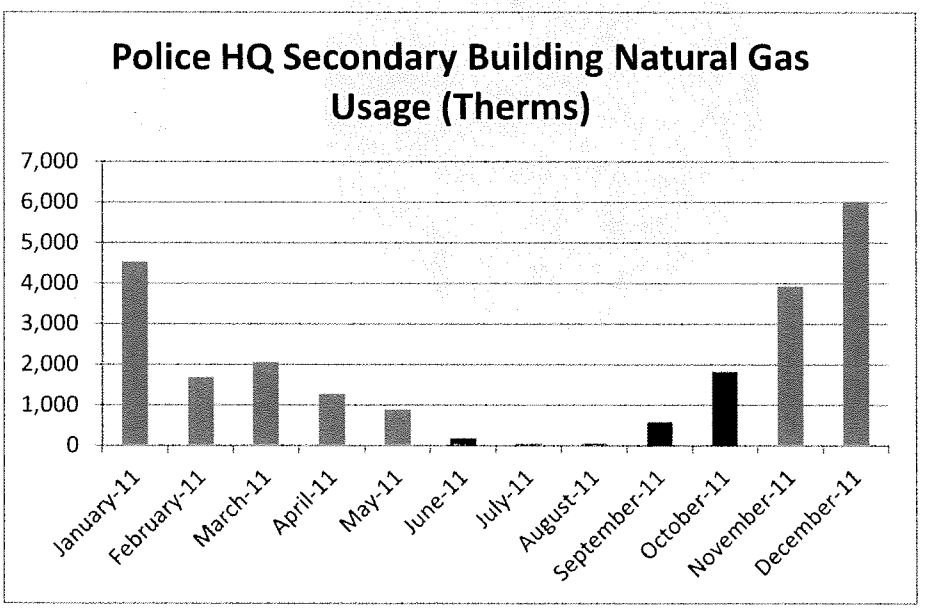
Monthly Electricity Consumption, Police HQ Secondary Building



Monthly Natural Gas Bills, Police HQ Secondary Building

Month	Natural Gas Consumption (Therms)	Total Natural Gas Cost ($)
January-11	4,535	$5,348
February-11	1,687	$1,836
March-11	2,060	$1,151
April-11	1,280	$762
May-11	890	$528
June-11	190	$142
July-11	50	$68
August-11	60	$91
September-11	590	$405
October-11	1,830	$1,100
November-11	3,930	$2,220
December-11	6,030	$3,178
Total	23,133	$16,829

Monthly Natural Gas Consumption, Police HQ Secondary Building

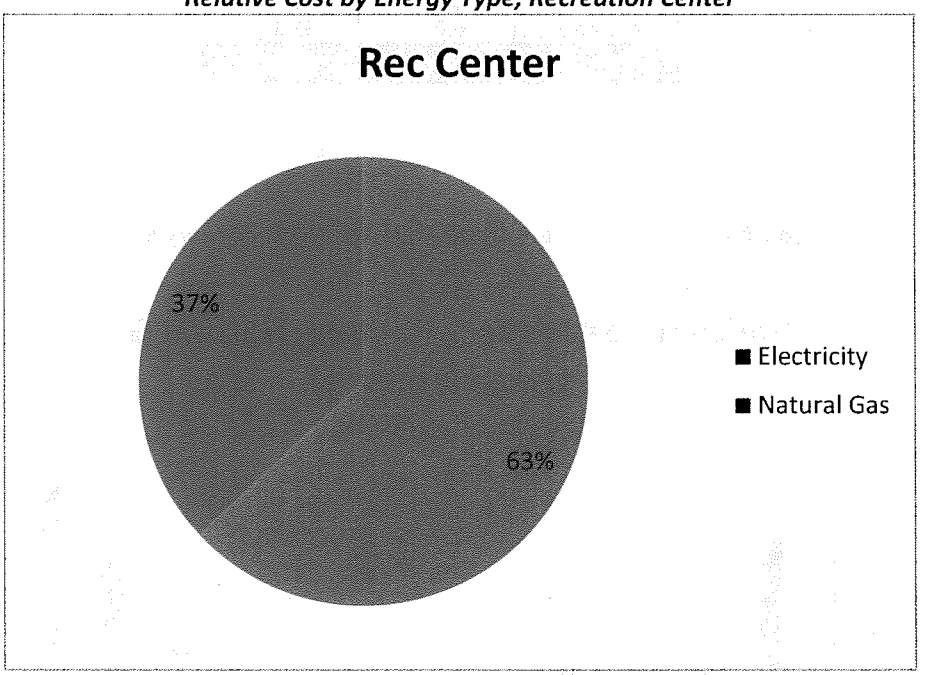


Costs by Energy Type

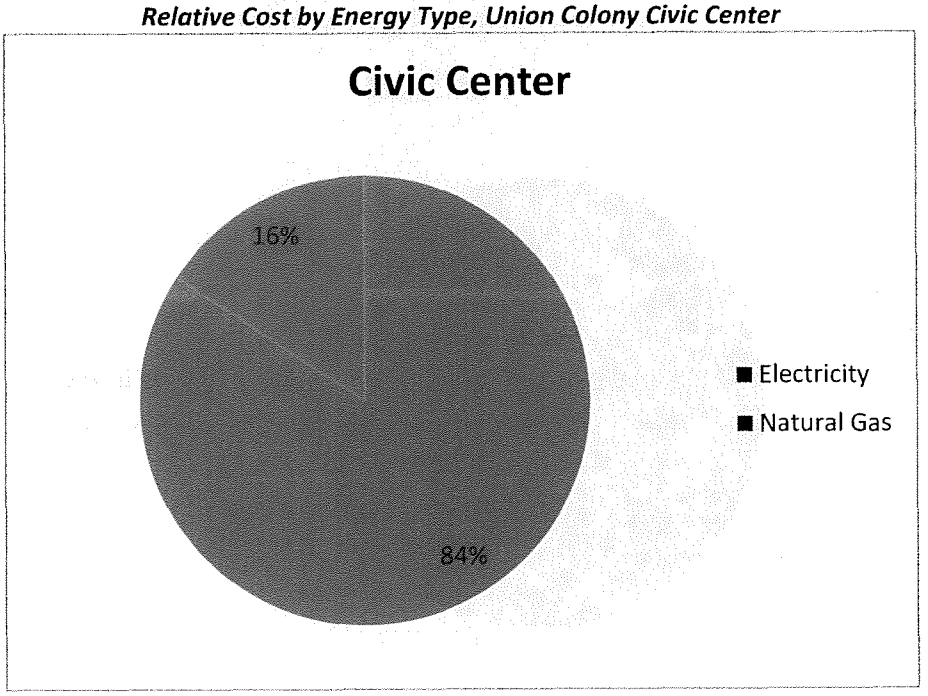
The City's utility expenditures include electricity and natural gas. The relative costs of each utility type (the percentage each utility type contributes to the building's total utility cost) are shown graphically below. This information is useful to both Ameresco and the City because it provides insight into potential problem areas at each facility and helps to target specific efforts for energy conservation measures.

For all buildings, electricity costs accounted for the majority of the utility expenditures. This is typical among nearly all building types due to several reasons: modern facilities contain an extensive and constantly growing amount of power-using equipment, being anything from computers and vending machines to kitchen equipment to lights and heavy mechanical motors. Additionally, the relatively high cost to the provider to generate and distribute electricity results in a higher unit purchasing price to the customer, in this case the City, compared to natural gas. The high usage and cost of electricity makes it a primary focus for energy conservation measure analysis.

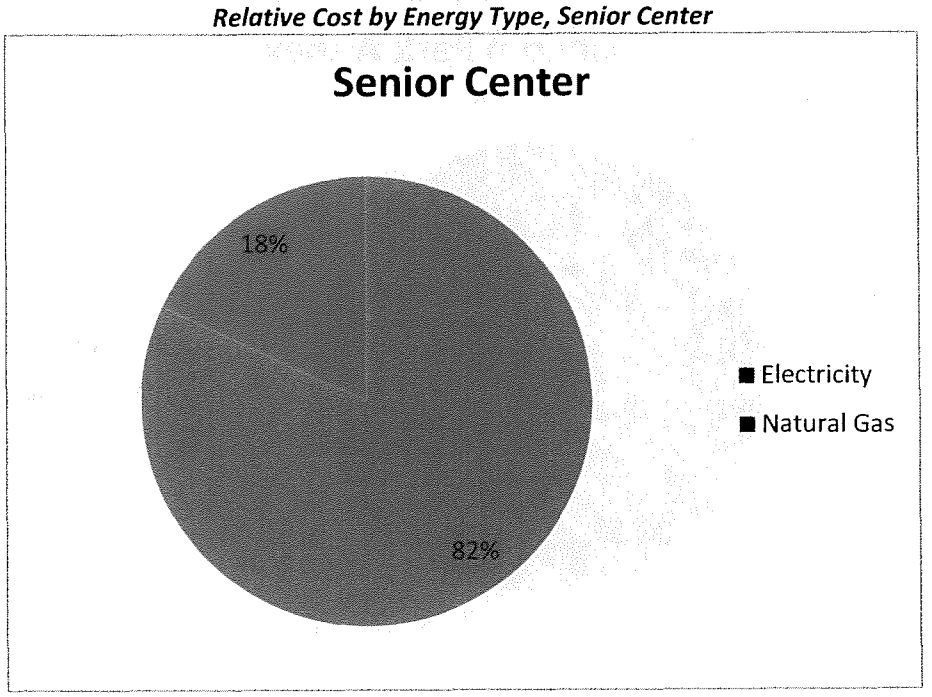
Relative Cost by Energy Type, Recreation Center



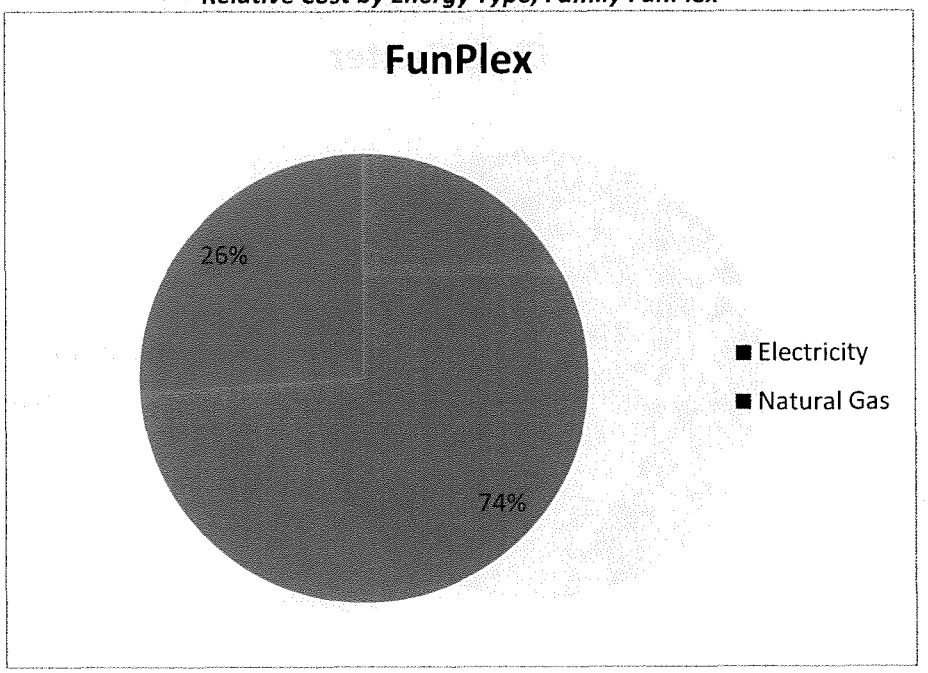
Relative Cost by Energy Type, Union Colony Civic Center



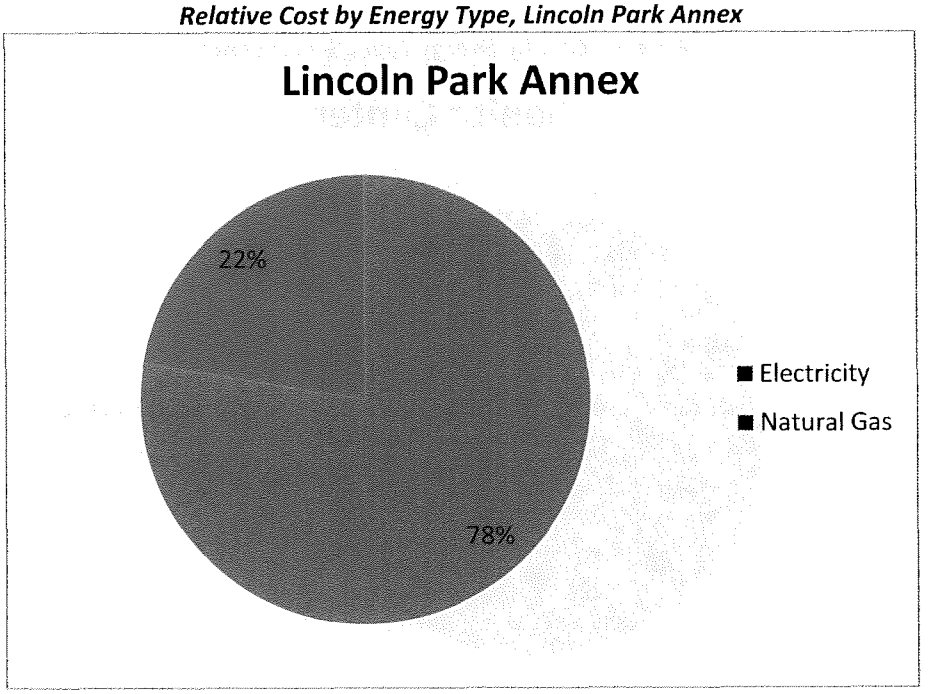
Relative Cost by Energy Type, Senior Center



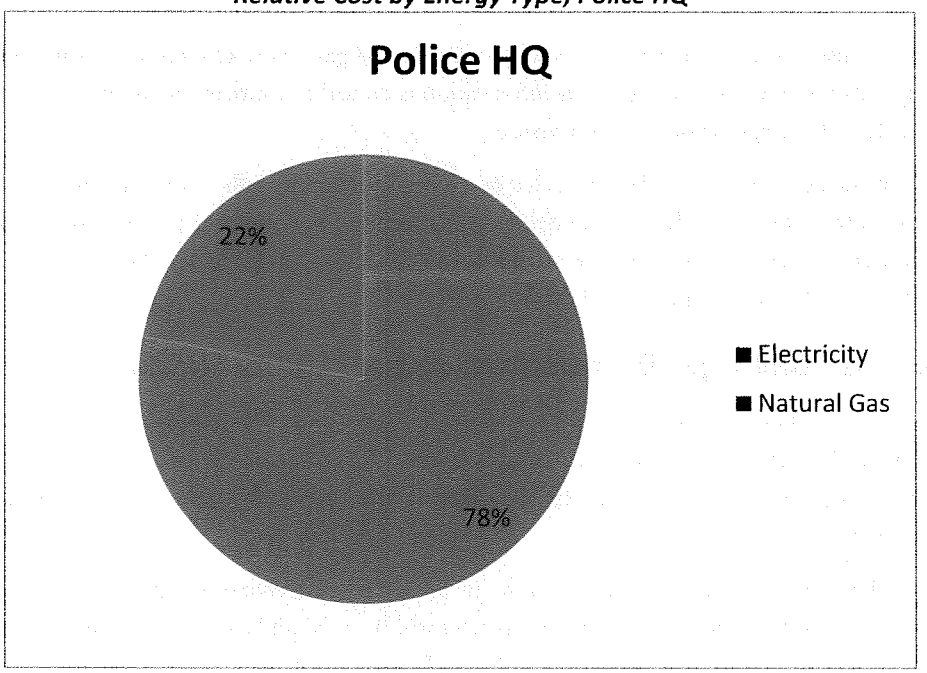
Relative Cost by Energy Type, Family FunPlex



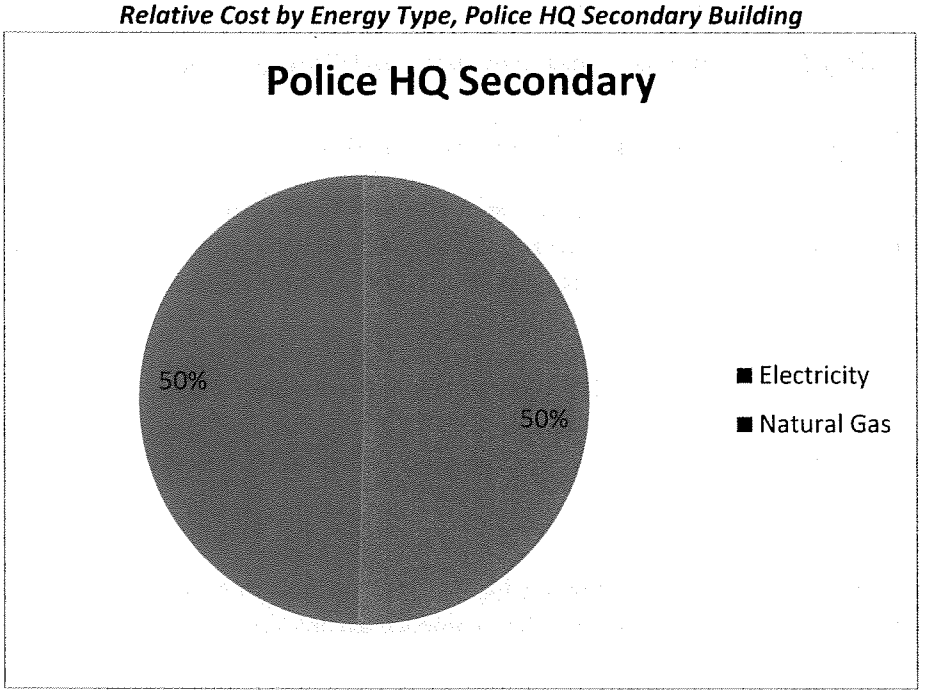
Relative Cost by Energy Type, Lincoln Park Annex



Relative Cost by Energy Type, Police HQ



Relative Cost by Energy Type, Police HQ Secondary Building



Utility Rates

Utility rates – or the dollar cost per unit of electricity or natural gas –were calculated for each building based on the utility bills provided by the City. This information is critical to estimate the utility cost savings associated with each energy conservation measure.

It is typically more accurate to calculate the rates based on actual utility bills rather than rely on the published rate tariffs from the utility providers. In reality, the effective rates that are paid by the customer are often subject to additional fees and taxes that are not always published by the provider. An in-depth discussion on the calculation of utility rates is provided below.

Energy Cost Savings: Blended vs. Actual Utility Rates

In an Energy Savings Performance Contract, actual energy and water consumption savings, in the form of electricity, gas, and water are calculated for various measures, and guaranteed to the customer. These "guaranteed" energy and water savings are then multiplied by current utility rates to show the "projected" energy cost savings.

This brings to light an important point about how the projected cost savings are determined. For electricity in particular, an important distinction exists between electrical demand and electrical consumption. This distinction not only applies to the energy savings for an Energy Conservation Measure (ECM), but also to how electricity is charged by utility providers.

Distinguishing Between Electrical Demand and Consumption

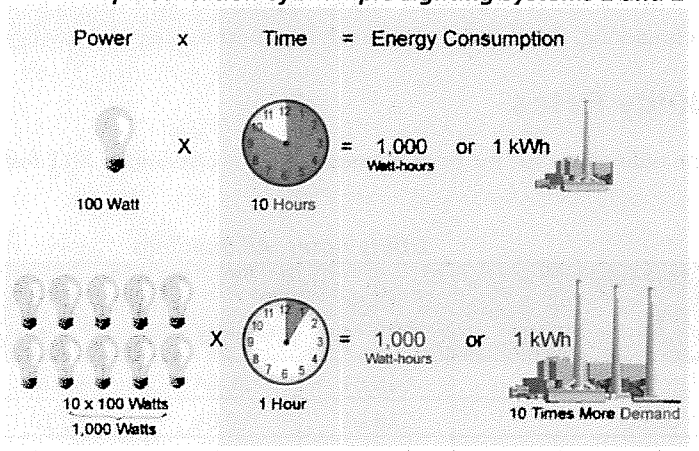
The examples below are used to distinguish between electrical demand and consumption:

- **Example Lighting System 1:** One 100-watt light bulb burning for 10 hours consumes 1,000 watt-hours, or 1 kWh. The entire time the light bulb is on it requires, or "demands", 100 watts, or 0.1 kW from the utility provider. The utility must have 0.1 kW available whenever the customer turns the lamp on.

- **Example Lighting System 2:** Ten 100-watt light bulbs burning for 1 hour consume 1,000 watt-hours, or 1 kWh. The entire time the light bulb is on, it requires, or "demands" 1000 watts or 1.0 kW from the utility provider. The utility must have 1.0 kW available whenever the customer turns the lamp on.

Note that in both examples, the consumption is 1 kWh. However, for the second scenario, the lighting system requires or "demands" the utility provider to produce ten times as much electrical capacity, 1 kW versus 0.1 kW, in the same instant.

Visual Representation of Example Lighting Systems 1 and 2



Distinguishing Between Electrical Demand Cost and Consumption Cost

For the reasons explained above, among others, electrical utility providers typically charge commercial customers separately for demand and consumption. These charges are often a part of extremely complicated tariff structures that include tiered rates, time of day rates, ratchets, riders, and other surcharges.

Example Simplified Actual Utility Tariff:

- Electricity Demand Charge: $5.00 per kW
- Electricity Consumption Charge: $0.08 per kWh

In specific cases, blended utility rates are often used by end-users for cost related calculations in lieu of actual tariffs. The term blended usually refers to the fact that the demand cost is blended into the consumption cost for an "effective" electricity rate. As illustrated in the following examples, this methodology can sometimes lead to an overestimation of the cost savings associated with a particular measure.

Example Determination of a Blended Utility Rate:

- Total Annual Electricity Demand: 400 kW
- Total Annual Electricity Consumption: 100,000 kWh
- Total Annual Electricity Charges: (400 kW x $5.00) + (100,000 kWh x $0.08) = $10,000
- Blended Utility Rate: 100,000 kWh / $10,000 = $0.10 / kWh

Example Savings Calculation Comparison: Using Actual vs. Blended Rates:

- Total Annual Electricity Demand Savings Resulting from an Installed Measure: 60 kW
- Total Annual Electricity Consumption Savings Resulting from an Installed Measure: 20,000 kWh
- Total Annual Cost Savings Using Actual Rate = (60 kW x $5.00) + (20,000 kWh x $0.08) = $1,900
- Total Annual Cost Savings Using Blended Rate =(20,000 kWh x $0.10) = $2,000
- Error Introduced By Using Blended Rate: 5.3%

It is important to note that in some cases, it may be appropriate to use blended utility rates, such as for purposes of benchmarking, simplified / rapid analysis, or estimating cost savings.

Baseline Utility Rates

A summary of the utility rates for the period January 2011 – December 2011 for all buildings is provided below.

Utility Rates, All Buildings

Building	Electricity Demand Rate ($/kW)	Electricity Consumption Rate ($/kWh)	Blended Annual Electricity Rate ($/kWh)	Natural Gas Rate ($/Therm)
Rec Center	$16.61	$0.04	$0.10	$0.71
Civic Center	$16.61	$0.04	$0.10	$0.71
Senior Center	$18.47	$0.04	$0.09	$0.72
FunPlex	$18.36	$0.04	$0.09	$0.53
Lincoln Park Annex	$18.22	$0.04	$0.10	$0.72
Police HQ	$18.33	$0.04	$0.08	$0.70
Police Secondary Building	$18.46	$0.04	$0.09	$0.73

Energy Use Intensity and Benchmarking

The energy utilization index, or EUI, is measured in kBtu/square-foot (energy use per unit of floor area) and is a single-number measure of a facility's overall energy performance or energy use intensity. It represents a facility's electricity and fuel consumption normalized by square footage. This provides an effective means to compare like-buildings and make broad observations on a facility's energy performance. A lower index generally equates to a higher efficiency building. The EUI is not an absolute measure of performance, however. Longer operation, higher occupant density (people/square foot), or a greater number of computer workstations in the building than normal are just a few instances in which the EUI may appear high, when in fact the building could be operating efficiently. As an example, the average office building in the United States has an EUI of 92.9 kBtu/square-foot (U.S. Energy Information Agency, http://www.eia.gov/).

The energy cost index, or ECI, is measured in $/square-foot and is a general measure of the cost to operate a facility from an energy standpoint. A lower cost index equates to a facility that is relatively less expensive to operate.

In these terms, the Family FunPlex is the City's least efficient energy user by a substantial margin. Its performance indices are very high, even when compared to the Recreation Center, which is a similar facility type.

The EUI for each building is provided in the table below.

Energy Utilization Indices, All Buildings

Building	Electricity EUI (kBtu/SF)	Natural Gas EUI (kBtu/SF)	Total Facility EUI (kBtu/SF)
Rec Center	31.1	76.2	107.4
Civic Center	23.1	20.9	44.0
Senior Center	67.6	47.0	114.6
FunPlex	136.6	235.4	371.9
Lincoln Park Annex	50.3	53.1	103.3
Police HQ	65.3	50.1	115.3
Police Secondary Building	32.5	97.9	130.4
Overall	52.8	78.6	131.5

The ECI for each building is provided in the table below.

Energy Cost Indices, All Buildings

Building	Electricity ECI ($/SF)	Natural Gas ECI ($/SF)	Total Facility ECI ($/SF)
Rec Center	$0.94	$0.55	$1.49
Civic Center	$0.84	$0.16	$1.00
Senior Center	$1.62	$0.36	$1.98
FunPlex	$3.52	$1.24	$4.76
Lincoln Park Annex	$1.36	$0.39	$1.75
Police HQ	$1.39	$0.39	$1.79
Police Secondary Building	$0.75	$0.73	$1.48
Overall	$1.40	$0.52	$1.92

Benchmarking City of Greeley's Facilities

A benchmarking analysis was performed for five of the seven facilities. The Recreation Center and Family FunPlex were excluded because no reliable benchmarking data exists for recreational center facility types.

A benchmarking analysis compares a facility's overall energy performance characterized by its energy use index (EUI) to a database* of similar facilities. This practice is valuable in that it provides context to a building's current energy performance based on how efficiently similar buildings in the area and country are operating, and gives insight to the maximum achievable savings potential from the implementation of a comprehensive Energy Performance Contract. However, reliable benchmarking data exists for only a limited number of facility types, for example office buildings, retail facilities, and lodging facilities. In this case, there is no available benchmarking data for recreation-center-type facilities.

Overall, the City's facilities tend to use a greater amount of energy than is typical for these facility types. This means there is likely substantial opportunity to implement energy conservation measures and reduce the costs to operate the buildings.

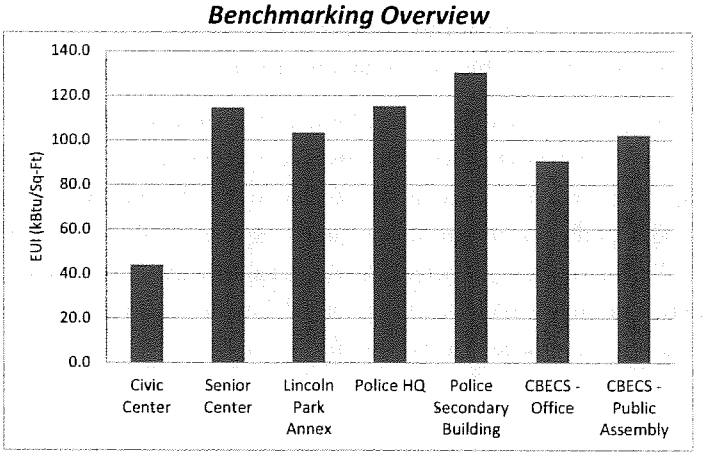
There are limits to the accuracy of benchmarking analyses. For example, facilities such as the Lincoln Park Annex and Civic Center are difficult to categorize due to their unique occupancies and varied uses, and are therefore difficult to compare to standard building types. The Civic Center, for example, has very low occupancy hours throughout the year. While the figures below give the appearance that the Civic Center is operating very efficiently, the relatively low EUI is caused in most part by the building's low hours of use rather than efficient equipment, necessarily. The Civic Center still presents opportunities for energy savings measures to be implemented, despite having relatively low energy use metrics.

*Note – The Commercial Building Energy Consumption Survey (CBECS) database is maintained by the Energy Information Administration (EIA). The EIA provides official energy statistics for all U.S. energy sources by sector. The Commercial Buildings Energy Consumption Survey (CBECS) is a national sample survey that collects information on the stock of U.S. buildings, by sector (including commercial buildings), their energy-related building characteristics, and their energy consumption and expenditures. The United States has five climate zones which are defined by the number of heating and cooling degree days. The north and west portions of Colorado fall within Climate Zone 1, defined as having less than 2,000 cooling degree days and more than 7,000 heating degree days annually.

Benchmarking Overview

City Building	Facility EUI (kBtu/SF)
Civic Center	44.0
Senior Center	114.6
Lincoln Park Annex	103.3
Police HQ	115.3
Police Secondary Building	130.4
CBECS Building Type	**ASHRAE Climate Zone 1 Average EUI (kBtu/SF)**
CBECS - Office	90.7
CBECS - Public Assembly	102.2

Benchmarking Overview



Greenhouse Gas Emissions

A greenhouse gas (GHG) emissions analysis was performed to quantify the GHG emissions reduction that would be realized if the proposed energy conservation measures were implemented by Ameresco under an Energy Savings Performance Contract. A summary of the absolute emissions reductions and of the environmental impact of various equivalent measures is provided on the next page.

Emissions Overview, City of Greeley

GHG Emissions	Current Emissions Per Year		Proposed Emissions Reductions Per Year	
Carbon dioxide (CO_2)	14,228,348	lbs	2,579,382	lbs
Methane (CH_4)	34	lbs	7	lbs
Nitrous oxide (N_2O)	85	lbs	10	lbs
Nitrogen Oxides (NOx)	26,264	lbs	5,003	lbs
Sulfur Dioxide (SO_2)	32,834	lbs	6,937	lbs
Particulate Matter (PM10)	61	lbs	6	lbs
Volatile Organic Compounds (VOC)	177	lbs	18	lbs
Carbon Monoxide (CO)	787	lbs	79	lbs

Energy Reduction Equivalent to:		
Taking	177	cars off the road
Planting	3,829	trees
CO2 emissions from	109,423	gallons of gasoline consumed
CO2 emissions from the electricity use of	134	homes for one year
Carbon sequestered annually by	219	acres of pine or fir forests
CO2 emissions from burning	5	railcars' worth of coal