Comprehensive Energy Analysis

Arapahoe County

Littleton, Colorado

October 2005

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Prepared by

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Executive Summary

Chevron Energy Solutions ("Chevron ES") is pleased to present this Comprehensive Energy Analysis (CEA) to Arapahoe County. Our proposal is dedicated to the identification and implementation of energy cost savings projects and facility upgrades. There are fifteen building sites included in this CEA. They are listed and described in detail in Section 3 of this report, Data on Present Facilities.

The Chevron ES performance based energy savings program has been developed with the assistance of the County's administrative and site maintenance staff. Coordination with the staff was a crucial factor in allowing us to develop a program that will enhance the working environment and address current and long-range facility planning requirements. We would like to thank Bob Roby, Anne Cecilione, Wayne Cooper, and the rest of the Facilities Staff for their assistance in preparation of this report. The Chevron Energy Solutions proposal was developed based on the following objectives:

- *Improve comfort for the staff and occupants of the County's buildings.*
- *Extend value to the County by upgrading facility infrastructures and increasing the life expectancy of existing building systems.*
- *Implement energy efficiency measures that support the County's operating cost improvement goals.*
- *Provide flexibility in product and vendor selection to meet specific operating requirements for each building.*
- *Support program implementation through a turnkey approach including on-site construction management and follow-up support after installation of proposed energy retrofit measures.*

Chevron ES' philosophy regarding performance contracting is based on determining the most cost-effective solution to a client's needs and then selecting the equipment/manufacturer required to meet each technical application. Additionally, Chevron ES requires review of facilities on a holistic basis, that is, accounting for the interaction of energy conservation measures on the building environment and operating cost. This approach also supports the County's standard for excellence in meeting or exceeding current environmental requirements for facility operation while insuring occupant comfort and safety. The resulting energy services proposal fully describes a list of retrofit opportunities to support these objectives along with firm installation costs and guaranteed energy savings. It takes into account specific site operating requirements, historical energy and operating cost data, and current facility planning studies.

Background

The proposed project contained in this report analyzes energy conservation measures (ECM's) at fifteen individual building sites. These buildings encompass a great variety of usage types and operating parameters. A thorough survey of the buildings and their energy using systems was conducted. Potential measures were analyzed based on their potential to generate energy savings and upon the need for upgraded equipment to improve the operation and environmental control of the facilities.

For the 12-month period of most recent utility data, Arapahoe County spent a total of $2,274,106 in utility costs for the buildings included in this scope of work as follows:

Electricity		$843,134
Natural Gas		$425,902
Water/Sewer		$1,005,070
	Total	$2,274,106

Project Opportunities

The recommended project includes a variety of projects, including the following:

- ✓ Upgrades to all interior lighting systems, where required. In addition to decreasing energy consumption, the types of lamps and ballasts will be standardized so that less replacement inventory need be kept on hand.
- ✓ Upgrades to heating, ventilating, and air conditioning (HVAC) systems to improve efficiency and comfort.
- ✓ Implementation of new and upgrade of existing Energy Management Systems (EMS) with actual occupancy and zone temperature requirements.
- ✓ HVAC improvements at the Administration I facility including a new chilled water plant with a waterside economizer, heating and domestic hot water plants, and improving the airside distribution system.
- ✓ New boilers at Administration I, Altura Plaza, ACJC Courthouse, ACJC Administration II, as well as the ACJC Detention Center.
- ✓ Improve evaporation cooling efficiency in air handling units reducing water usage.
- ✓ End-use fixture replacement. Approximately five million gallons of annual water usage will be avoided with the implementation of low flow toilets and waterless urinals.
- ✓ New cooling tower at the ACJC Courthouse.
- ✓ Programmable flush valve controls to eliminate excessive inmate usage.
- ✓ Ozone laundry system that will reduce detergent and water consumption.
- ✓ On-site Energy Resource Conservation Manager to expand, enhance, and assist current energy manager roles.
- ✓ Retro-commissioning of existing EMS systems at Centrepoint Plaza and Sheriff's/Coroners Facility to optimize control and achieve greater efficiencies.
- ✓ Along with the 12-year financing term that the project has a 16 year weighted life.

The detailed descriptions and benefits of these and other improvements are addressed in Section 4 of this report.

The installation costs, including labor, material, engineering design, and construction management for the ECM's proposed in the buildings are guaranteed. The guarantee of the installation cost assures the County that the installation of the ECM's will not exceed the amount presented. The savings guarantee assures the County that utility savings for the ECM's will be realized for the life of the guarantee.

Recommended Project

This CEA has shown that, if implemented, the performance contract set forth by Chevron ES will save $632,694 in the first year.

Table 1.1 provides the cash flow scenario for the recommended project. The total guaranteed cost of the project is $10,093,933. *$5,622,508 of the project will be paid for out of the performance contract as detailed in Table 1.1, the remaining $4,471,425 will be paid for from other means.* Utilizing a 3.54% interest rate, the program pays for itself within 12 years, using funds already available in the current operational and utility budgets. Tables 1.2 through 1.14 provide a building-by-building breakdown of the construction costs and savings for the ECM's included in the recommended package. Table 1.15 provides a total of all recommended ECM's.

Arapahoe County retains all excess savings generated by this Project. These funds could be used to install additional capital improvements in facilities that could not be included in the project.

Report Layout

This report contains, among other items, the Executive Summary (Section 1), Energy Consumption History (Section 2), Data on Present Facilities (Section 3), Energy Conservation Measures (Section 4), proposed Measurement and Verification Program (Section 5); and Section 6, the Appendix, is divided into four (4) separate sections: Appendix A, Appendix B, Appendix C, and Appendix D. Appendix A provides an inventory of all existing light fixtures within the selected buildings at Arapahoe County. Appendix B provides an inventory of the Standards of Control for existing conditions and proposed new conditions on which the energy savings calculations are based. Appendix C provides the points lists per facility for the recommended energy management system. Appendix D provides the weighted average life of each ECM.

Performance Based Energy Savings Program

Chevron ES has detailed the results of the CEA in this report and will assist in selecting energy efficiency measures that would best meet the County's energy efficiency goals. These measures will also be targeted for improving the working environment and comfort for the occupants, and increasing the life expectancy of the building systems.

After Arapahoe County approves the measures for implementation, Chevron ES will then prepare specifications and drawings for the implementation of the selected measures. The specifications and drawings will adhere to the County's design guidelines and will be reviewed by Arapahoe County personnel as well. The installed costs provided in this report include labor and material, engineering design, and construction management.

The Chevron Energy Solutions Team

Chevron ES is highly qualified and uniquely positioned to develop a successful energy savings performance contract that will meet the needs and goals of Arapahoe County. We believe that the technical and financial solutions described in our comprehensive energy audit, together with Chevron ES' unparalleled, no-risk energy savings guarantee, will solidify our selection as your energy service company (ESCO) of choice.

Chevron Energy Solutions Company (Chevron ES) is a division of **Chevron**, the second-largest U.S.-based energy company and the fifth largest publicly traded integrated oil and gas company in the world, based on market capitalization. The corporation engages in all aspects of the energy industry, including exploration, production, refining, equity gas marketing and transportation, power generation and energy conservation services. Chevron ES, already a major energy services company, has become the leader in this services area with the recent acquisitions of Energy Masters International, a major presence at the Federal level and Viron Energy Services, a major presence in the public sector particularly with the education market. With these acquisitions, Chevron ES is positioned to provide the industry's leading vendor-independent energy services to markets throughout North America.

Chevron ES legacy companies have been providing the industry's leading energy performance contract services for 24 years and have been in the energy services business for over 30 years. The following points regarding our unique market position need to be made:

Bowie State University – Prepare for Life

"By having a more engineering based company involved, I think you get a broader spectrum, a broader aspect of involvement on how the total project needs to come together."

Charlie Hargett
Physical Plant Administrator

- Performance contracting has been our only business since 1981.
- Our core competency is custom-engineered solutions.
- We have highly qualified, seasoned professionals on our project team.
- Chevron ES is vendor-independent, yet experienced with all major brands of HVAC equipment and building control systems.
- Chevron ES currently monitors energy consumption for over 1200 buildings.
- We presently manage over $250 million in energy savings guarantees.
- Chevron ES is a single-source energy performance engineering and contracting company.
- Our project values range from $500,000 to $220 million.
- Chevron ES completed the 1st ESPC contract at **Adrian College** in 1981.
- Chevron ES has completed the installation of the largest college/university energy performance contract ever implemented in the U.S -- ***University of Utah $43MM***
- Chevron ES is an EPA Energy Star Partner.

- Chevron ES is a pre-qualified with the Department of Energy/Defense.
- Chevron ES is a founding member of the National Association of Energy Services Companies, the industry's trade association.

CES will provide the County with the services required to make a project of this size successful. Chevron ES' areas of expertise are rooted in our technical team that will be assigned to the project. We take great pride in the fact that we have the largest in-house bench of energy engineers in the industry. The Chevron ES technical in-house staff is experienced in performing in-depth energy evaluations, implementing successful paid from savings programs that are rigorously reviewed with a strong measurement and verification program by our monitoring department.

Our engineers have worked in the industry in a wide variety of capacities and, together, they bring to the County project broad experience and expertise in all areas of energy and water conservation. Our staff's areas of expertise include computer modeling, design and analysis, HVAC, energy management controls, contracting, test and balancing, EMCS commissioning, monitoring and verification, facility operations, finance, and maintenance. On-site construction management and ongoing support are included to minimize disruption to work spaces while maximizing program results.

Once the optimal retrofits have been determined for installation and Chevron ES has developed engineering/specification documents, Arapahoe County staff and Chevron ES will then select the most qualified contractors to install the measures.

We do not have a list of preferred suppliers or subcontractors. Our philosophy is to recommend the most cost effective and appropriate selection of suppliers and subcontractors for the immediate project. By not being tied to a single supplier or manufacturer, we are able to utilize equipment already in place without the added expense of having to replace it. We are able to design the best solution for our customer, rather than specifying the equipment of a parent company.

Efforts will be made to utilize and maximize **local subcontractors as much as possible.** We at Chevron ES recognize the importance of maximizing local subcontractors as a way to contribute to the local economies.

Conclusion

Acceptance of the foregoing proposal will allow Arapahoe County to greatly improve the operation and condition of its facilities with funds that are already identified. Performance contracts are unique among contracting methods because they allow for the creation of "win-win" rather than adversarial relationships between the customer and contractor. Both parties involved in a performance contract share a common goal: *save energy and utility costs in order to improve the facilities.* We genuinely believe that the partnership between the contractor and the on-site personnel that is formed during this process is the key factor in ensuring long-term project success. We appreciate the assistance of all members of the County staff whose input and assistance was essential in the preparation of this report.

In summary, we believe that we have demonstrated through our proposal that the Chevron ES team has the technical resources and expertise on staff to handle the full range of technologies that will be required in this program.

We are extremely excited about the opportunity to partner with Arapahoe County in realizing the benefits that will be obtained through program implementation.

Table 1.1
Financial Aspects of Performance Based Energy Program for
Arapahoe County
Littleton, CO

Implementation Cost	$10,042,594
CEA Fee	$51,339
Total Project Fee	$10,093,933
Construction Period Savings	$0
Client Buydown	$0
Cash Contribution to Project	**$0**
Financed amount of Project	**$10,093,933**
Construction Period Interest	$ 434,838
Financing Fees	$ -
Total Financing Costs during Construction	**$ 434,838**
Total Amount Financed	**$10,528,771**

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Year	**Total Energy Savings**	**Maintenance Reallocation**	**Other Funds**	**Total Program Contributions / Savings**	**Payment to Lessor**	**Monitoring and Verification**	**Laundry Ozone Service Contract**	**EMS Service Contract**	**Irrigation Service Contract**	**Water Softener Maintenance / Material Costs**	**Third Party Review**	**Total Program Costs**	**Net Savings**
1	$542,694	$90,000	$456,500	$1,089,194	$1,045,571	$13,500	$0	$7,000	$945	$19,365	$2,713	$1,089,095	$99
2	$556,261	$92,250	$456,500	$1,105,011	$1,056,733	$13,905	$3,500	$7,175	$969	$19,849	$2,781	$1,104,912	$99
3	$570,168	$94,556	$456,500	$1,121,224	$1,071,672	$14,322	$3,588	$7,354	$993	$20,345	$2,851	$1,121,125	$99
4	$584,422	$96,920	$456,500	$1,137,842	$1,104,656	$0	$3,677	$7,538	$1,018	$20,854	$0	$1,137,743	$99
5	$599,033	$99,343	$456,500	$1,154,876	$1,120,862	$0	$3,769	$7,727	$1,043	$21,375	$0	$1,154,776	$99
6	$511,380	$101,827	$456,500	$1,069,706	$1,034,845	$0	$3,863	$7,920	$1,069	$21,910	$0	$1,069,607	$99
7	$524,164	$104,372	$456,500	$1,085,036	$1,049,306	$0	$3,960	$8,118	$1,096	$22,457	$0	$1,084,937	$99
8	$537,268	$106,982	$456,500	$1,100,750	$1,064,129	$0	$4,059	$8,321	$1,123	$23,019	$0	$1,100,651	$99
9	$550,700	$109,656	$456,500	$1,116,856	$1,079,322	$0	$4,160	$8,529	$1,151	$23,594	$0	$1,116,757	$99
10	$564,467	$112,398	$456,500	$1,133,365	$1,094,895	$0	$4,264	$8,742	$1,180	$24,184	$0	$1,133,266	$99
11	$578,579	$115,208	$456,500	$1,150,287	$1,110,857	$0	$4,371	$8,961	$1,210	$24,789	$0	$1,150,187	$99
12	$593,043	$118,088	$456,500	$1,167,631	$1,127,219	$0	$4,480	$9,185	$1,240	$25,409	$0	$1,167,532	$99
Totals	$6,712,179	$1,241,600	$5,478,000	$13,431,779	$12,960,065	$41,727	$43,692	$96,569	$13,037	$267,151	$8,346	$13,430,587	$1,192

Notes By Column:

(1) Years after implementing retrofit changes
(2) Energy Savings are escalated by 2.5% to account for inflation. Energy Savings at Altura Plaza and Peoria Shops eliminated after Year 5.
(3) Maintnance funds reallocated with implementation of Performance Contract escalated at 2.5% per year. Estimated that 1/3 of maintenance costs will be reduced.
(4) Other funds provided annually for program to cash flow.
(5) Total Program Savings is the sum of Columns (2), (3), and (4)
(6) Payment to Lessor is based on an annual interest rate of 3.54%, 12 year term. Actual rate will be determined at closing
(7) Monitoring Services are included for the entire term of the project as listed in Column 1 and are required for guaranteed programs. Monitoring and Verification services are escalated by 3% to account for inflation.
(8) Service contract escalated 2.5% per year. Year 1 is included in the base contract.
(9) Service contract escalated 2.5% per year.
(10) Service contract escalated 2.5% per year.
(11) Water Softener Material & Maintenance Costs Escalated at 2.5% per year.
(12) 1/2% of Column 1 "Total Energy Savings" for third party review.
(13) Total Program Costs are the sum of Columns (6) thru (12)
(14) Net Savings equals Total Program Savings less Total Program Costs, Columns (5) - (13).

Table 1.2
ECM Summary Table – 01 Administration

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
								Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
01 - ADMINISTRATION BUILDING														
1	Lighting Energy Efficiency Improvements	172,101	54.5	125,062	(1,322)	0	0	16,593	(838)	0	0	2,760	18,515	9.3
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	62,182	0.0	0	0	669	0.0	0	0	3,588	0	0	3,588	17.3
3	Install New/Upgrade the Existing EMCS	189,038	0.0	218,866	11,548	0.0	0.0	12,845	7,331	0	0	0	20,176	9.4
5a	Replace the Existing Chillers and Cooling Tower - Performance Cont	173,888	54.1	79,870	0	0.0	0.0	10,052	0	0	0	0	10,052	17.3
5b	Replace the Existing Chillers and Cooling Tower - GC Contract	998,944	0.0	0	0	0.0	0.0	0	0	0	0	0	0	
6a	Replace the Existing Natural Gas Fired Boilers - Performance Contra	24,747	(1.7)	(5,038)	1,851	0.0	0.0	(464)	1,175	0	0	0	711	34.8
6b	Replace the Existing Natural Gas Fired Boilers - GC Contract	142,167	0.0	0	0	0.0	0.0	0	0	0	0	0	0	
7	Install a New VFD on Existing Exhaust Fan	31,006	0.0	18,915	0	0.0	0.0	1,110	0	0	0	0	1,110	27.9
13	Waterside Economizer	81,635	52.2	46,637	0	0.0	0.0	6,433	0	0	0	0	6,433	12.7
16	Irrigation Control System Upgrade	9,988	0.0	0	0	0.0	126.9	0	0	0	680	(120)	560	17.8
20	Replace DHW HX with new DHW Heater	25,810	0.0	0	2,158	0.0	0.0	0	1,370	0	0	0	1,370	18.8
23	Energy Resource Conservation Management Program	9,229	0.0	22,742	701	0.0	0.0	1,335	445	0	0	0	1,780	5.2
26	Replace Existing Moduline Boxes w/ VAV Terminal Units	2,015,547	0.0	0	0	0.0	0.0	0	0	0	0	0	0	
TOTAL OF RECOMMENDED ECMs		3,936,281	159.1	507,055	14,936	669.410	127	47,904	9,483	3,588	680	2,640	64,295	61.2

Table 1.3
ECM Summary Table – 12 Arapahoe Plaza East

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
								Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
12 - ARAPAHOE PLAZA EAST BUILDING														
1	Lighting Energy Efficiency Improvements	19,519	6.1	16,471	-165	0.0	0.0	1,998	-105	0	0	10	1,903	10.3
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	8,108	0.0	0	0	118.9	0.0	0	0	637	0	0	637	12.7
3	Install New/Upgrade the Existing EMCS	73,176	0.0	76,871	2,516	0.0	0.0	4,512	1,597	0	0	0	6,109	12.0
23	Energy Resource Conservation Management Program	1,379	0.0	3,398	89	0.0	0.0	199	56	0	0	0	255	5.4
TOTAL OF RECOMMENDED ECMs		102,182	6.1	96,740	2,439	119	0	6,709	1,548	637	0	20	8,914	11.5

Table 1.4
ECM Summary Table – 13 Arapahoe Human Services

Building and ECM Number & Name	Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
							Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
13 - ARAPAHOE HUMAN SERVICES													
1 Lighting Energy Efficiency Improvements	44,031	13.1	35,863	(379)	0	0	4,324	(241)	0	0	59	4,142	10.6
2a Water Conservation Measures w/ Waterless Urinal Retrofit	13,657	0.0	0	0	279.1	0.0	0	0	1,496	0	0	1,496	9.1
3 Install New/Upgrade the Existing EMCS	192,336	0.0	132,023	4,300	0.0	0.0	7,748	2,730	0	0	0	10,478	18.4
21 Change Natural Gas Utility Provider	0	0.0	0	0	0.0	0.0	0	3,619	0	0	0	3,619	0.0
23 Energy Resource Conservation Management Program	3,598	0.0	8,865	231	0.0	0.0	520	147	0	0	0	667	5.4
TOTAL OF RECOMMENDED ECMs	253,622	13	176,752	4,152	279	0	12,592	6,255	1,496	0	59	20,403	12.4

Table 1.5
ECM Summary Table – 14 Arapahoe Plaza West

Building and ECM Number & Name	Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
							Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
14 - ARAPAHOE PLAZA WEST BUILDING (COUNTY COURT)													
1 Lighting Energy Efficiency Improvements	17,823	5.9	12,783	-128	0.0	0.0	1,751	-81	0	0	213	1,883	9.5
2a Water Conservation Measures w/ Waterless Urinal Retrofit	15,109	0.0	0	0	305.1	0.0	0	0	1,635	0	0	1,635	9.2
3 Install New/Upgrade the Existing EMCS	58,216	0.0	71,285	5,076	0.0	0.0	4,184	3,222	0	0	0	7,406	7.9
23 Energy Resource Conservation Management Program	1,374	0.0	3,385	88	0.0	0.0	199	56	0	0	0	255	5.4
TOTAL OF RECOMMENDED ECMs	92,522	5.9	87,453	5,036	305	0	6,133	3,197	1,635	0	213	11,178	8.3

Table 1.6
ECM Summary Table – 15 Federal Warehouse

Building and ECM Number & Name	Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
							Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
15 - FEDERAL WAREHOUSE													
1 Lighting Energy Efficiency Improvements	18,056	7.0	15,823	-159	0.0	0.0	2,125	-119	0	0	129	2,135	8.5
2a Water Conservation Measures w/ Waterless Urinal Retrofit	6,552	0.0	0	0	18.5	0.0	0	0	99	0	0	99	66.2
4 Install Programmable Thermostats	550	0.0	13,513	1,662	0.0	0.0	793	1,246	0	0	0	2,039	0.3
16 Irrigation Control System Upgrade	0	0.0	0	0	0.0	0.0	0	0	0	0	0	0	
23 Energy Resource Conservation Management Program	4,940	0.0	12,172	318	0.0	0.0	714	238	0	0	0	952	5.2
TOTAL OF RECOMMENDED ECMs	30,097	7.0	41,508	1,821	19	0	3,632	1,365	99	0	129	5,225	5.8

Table 1.7
ECM Summary Table – 20 Tri County Health

Building and ECM Number & Name	Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
							Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
20 - TRI COUNTY HEALTH													
1 Lighting Energy Efficiency Improvements	11,012	4.2	10,584	-106	0.0	0.0	1,337	-80	0	0	342	1,599	6.9
4 Install Programmable Thermostats	2,477	0.0	6,828	1,166	0.0	0.0	401	874	0	0	0	1,275	1.9
23 Energy Resource Conservation Management Program	553	0.0	1,362	36	0.0	0.0	80	27	0	0	0	107	5.2
TOTAL OF RECOMMENDED ECMs	14,042	4.2	18,774	1,095	0	0	1,817	821	0	0	342	2,980	4.7

Table 1.8
ECM Summary Table – 23 Altura Plaza

Building and ECM Number & Name	Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
							Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
23 - ALTURA PLAZA BUILDING													
1 Lighting Energy Efficiency Improvements	89,736	61.5	159,641	0	0	0	19,820	0	0	0	2,821	22,641	4.0
2a Water Conservation Measures w/ Waterless Urinal Retrofit	41,333	0.0	0	0	515.4	0.0	0	0	2,572	0	0	2,572	16.1
3 Install New/Upgrade the Existing EMCS	162,874	0.0	262,098	55,360	0.0	0.0	15,383	35,143	0	0	0	50,526	3.2
6a Replace the Existing Natural Gas Fired Boilers - Performance Contra	30,938	0.0	(1,402)	1,729	0.0	0.0	(82)	1,098	0	0	0	1,016	30.5
6b Replace the Existing Natural Gas Fired Boilers - GC Contract	177,734	0.0	0	0	0.0	0.0	0	0	0	0	0	0	
23 Energy Resource Conservation Management Program	4,914	0.0	12,108	373	0.0	0.0	711	237	0	0	0	948	5.2
TOTAL OF RECOMMENDED ECMs	507,529	61.5	432,444	57,462	515	0	35,831	36,478	2,572	0	2,821	77,702	6.5

Table 1.9
ECM Summary Table – 24 Cetrepoint Plaza

Building and ECM Number & Name	Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
							Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
24 - CENTREPOINT PLAZA													
1 Lighting Energy Efficiency Improvements	35,152	10.2	35,183	(353)	0	0	3,954	(285)	0	0	0	3,669	9.6
2a Water Conservation Measures w/ Waterless Urinal Retrofit	17,979	0.0	0	0	397	0.0	0	0	1,981	0	0	1,981	9.1
23 Energy Resource Conservation Management Program	6,953	0.0	15,907	415	0	0.0	1,005	335	0	0	0	1,340	5.2
25 Retro Commissioning	29,723	0.0	237,292	(4,540)	0.0	0.0	14,999	(3,664)	0	0	0	11,335	2.6
TOTAL OF RECOMMENDED ECMs	89,807	10.2	288,382	(4,478)	397	0	19,958	(3,614)	1,981	0	0	18,325	4.9

Table 1.10
ECM Summary Table – 29 Peoria Shops

Building and ECM Number & Name	Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
							Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
29 - PEORIA SHOPS													
1 Lighting Energy Efficiency Improvements	16,715	5.4	16,327	-164	0.0000	0.0	1,867	-104	0	0	349	2,112	7.9
2 Water Conservation Measures	5,878	0.0	0	0	59.6560	0.0	0	0	780	0	0	780	7.5
4 Install Programmable Thermostats	2,477	0.0	6,053	8,615	0.0	0.0	355	5,469	0	0	0	5,824	0.4
18 Water Reclaim	52,181	-6.6	-2,793	0	576.0	0.0	-1,277	0	7,528	0	-1,280	4,971	10.5
23 Energy Resource Conservation Management Program	1,646	0.0	4,055	125	0.0	0.0	238	79	0	0	0	317	5.2
TOTAL OF RECOMMENDED ECMs	78,897	-1.2	23,642	8,576	636	0	1,183	5,444	8,308	0	-931	14,004	5.6

Table 1.11
ECM Summary Table – 35 ACJC Courthouse

Building and ECM Number & Name	Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
							Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
35 - ACJC COURTHOUSE													
1 Lighting Energy Efficiency Improvements	160,935	69.8	220,825	0	0	0	24,825	0	0	0	5,114	29,938	5.4
2a Water Conservation Measures w/ Waterless Urinal Retrofit	66,175	0.0	0	0	508	0.0	0	0	6,644	0	0	6,644	10.0
3 Install New/Upgrade the Existing EMCS	368,278	0.0	74,515	4,922	0	0.0	4,373	3,125	0	0	0	7,498	49.1
6a Replace the Existing Natural Gas Fired Boilers - Performance Contra	28,053	0.0	-8,023	7,294	0	0.0	(471)	4,630	0	0	0	4,159	6.7
6b Replace the Existing Natural Gas Fired Boilers - GC Contract	161,154	0.0	0	0	0	0.0	0	0	0	0	0	0	
8 Install a New VFD on Existing Vane Axial Fan	117,393	0.0	226,190	0	0	0.0	13,275	0	0	0	0	13,275	8.8
12 Water Softener	35,093	0.0	0	0	2,624	0.0	0	0	34,295	0	-5,805	28,490	1.2
23 Energy Resource Conservation Management Program	9,773	0.0	24,081	742	0	0.0	1,413	471	0	0	0	1,884	5.2
24 New Cooling Tower	216,088	3.9	6,587	0	0	0.0	1,048	0	0	0	0	1,048	206.1
TOTAL OF RECOMMENDED ECMs	1,162,942	74	544,175	12,959	3,132	0	44,464	8,226	40,939	0	-691	92,938	12.5

Table 1.12
ECM Summary Table – 36 ACJC Detention Center

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
								Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
36 - ACJC DETENTION CENTER														
1	Lighting Energy Efficiency Improvements	158,033	55.1	277,890	-2,790	0	0	25,677	-1,771	0	0	3,148	27,054	5.8
2	Water Conservation Measures	151,960	0.0	0	1,261	1,582	0	0	800	24,769	0	0	25,569	5.9
3	Install New/Upgrade the Existing EMCS	548,787	0.0	0	0	0	0	0	0	0	0	0	0	
6a	Replace the Existing Natural Gas Fired Boilers - Performance Contra	149,938	0.0	0	23,459	0	0	0	14,892	0	0	0	14,892	10.1
6b	Replace the Existing Natural Gas Fired Boilers - GC Contract	861,356	0.0	0	0	0	0	0	0	0	0	0	0	
12	Water Softener	344,359	0.0	0	0	3,094	0	0	0	48,459	0	-9,080	39,379	8.7
16	Irrigation Control System Upgrade	19,519	0.0	0	0	0	306	0	0	0	2,395	-825	1,570	12.4
17	Programmable Flush Valve Controls	739,681	0.0	0	0	3,615	0	0	0	56,616	0	0	56,616	13.1
19	Laundry Conservation	52,492	0.0	0	1,276	440	0	0	810	6,888	0	0	7,698	6.8
23	Energy Resource Conservation Management Program	19,211	0.0	47,337	1,459	0.0	0.0	2,778	926	0	0	0	3,704	5.2
TOTAL OF RECOMMENDED ECMs		3,045,336	55.1	325,227	24,665	8,731	306	28,455	15,657	136,732	2,395	(6,757)	176,482	17.3

Table 1.13
ECM Summary Table – 37 ACJC Administrative II

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
								Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
37 - ACJC ADMINISTRATIVE II														
1	Lighting Energy Efficiency Improvements	196,219	62.2	210,550	(2,225)	0	0	22,933	(1,666)	0	0	3,638	24,905	7.9
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	34,298	0.0	0	0	220.5	0.0	0	0	2,882	0	0	2,882	11.9
3	Install New/Upgrade the Existing EMCS	216,659	0.0	18,671	1,970	0.0	0.0	1,096	1,477	0	0	0	2,573	84.2
6a	Replace the Existing Natural Gas Fired Boilers - Performance Contra	19,935	-0.7	-6,467	1,783	0.0	0.0	-504	1,337	0	0	0	833	23.9
6b	Replace the Existing Natural Gas Fired Boilers - GC Contract	114,524	0.0	0	0	0.0	0.0	0	0	0	0	0	0	
10	Install A/C Units to Serve Computer Equipment Rooms	83,981	0.0	37,602	2,356	0.0	0.0	2,207	1,766	0	0	0	3,973	21.1
12	Water Softener	19,016	0.0	0	0	0.0	0.0	0	0	0	0	(2,720)	(2,720)	
23	Energy Resource Conservation Management Program	5995.1	0.0	14,772	386	0.0	0.0	867	289	0	0	0	1,156	5.2
TOTAL OF RECOMMENDED ECMs		690,626	62	275,128	4,270	221	0	26,600	3,203	2,882	0	918	33,603	20.6

Table 1.14
ECM Summary Table – 38 Sheriff/Coroner Facility

Building and ECM Number & Name	Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
							Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
38 - SHERIFF/CORONER FACILITY													
1 Lighting Energy Efficiency Improvements	42,927	12.9	39,353	(395)	0	0	4,498	(287)	0	0	0	4,211	10.2
2a Water Conservation Measures w/ Waterless Urinal Retrofit	17,979	0.0	0	0	180.0	0.0	0	0	1,175	0	0	1,175	15.3
23 Energy Resource Conservation Management Program	8,229	0.0	20,276	545	0.0	0.0	1,190	397	0	0	0	1,587	5.2
25 Retro Commissioning	20,916	0.0	227,590	(6,766)	0.0	0.0	13,357	(4,923)	0	0	0	8,434	2.5
TOTAL OF RECOMMENDED ECMs	90,049	12.9	287,219	(6,616)	180	0	19,045	(4,813)	1,175	0	0	15,407	5.8

Table 1.15
ECM Summary Table – All Buildings Combined

	SUMMARY OF ECMs	Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
								Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
1	Lighting Energy Efficiency Improvements	982,260	367.8	1,176,356	(8,187)	0	0	131,702	(5,577)	0	0	18,583	144,708	6.8
2	Water Conservation Measures	157,838	0.0	0	1,261	1,641	0	0	800	25,549	0	0	26,349	6.0
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	283,370	0.0	0	0	3,212	0	0	0	22,709	0	0	22,709	12.5
3	Install New/Upgrade the Existing EMCS	1,809,364	0.0	854,329	85,692	0	0	50,141	54,625	0	0	0	104,766	17.3
4	Install Programmable Thermostats	5,504	0.0	26,394	11,443	0	0	1,549	7,589	0	0	0	9,138	0.6
5a	Replace the Existing Chillers and Cooling Tower - Performance Cont	173,888	54.1	79,870	0	0	0	10,052	0	0	0	0	10,052	17.3
5b	Replace the Existing Chillers and Cooling Tower - GC Contract	998,944	0.0	0	0	0	0	0	0	0	0	0	0	
6a	Replace the Existing Natural Gas Fired Boilers - Performance Contra	253,611	-2.4	-20,930	36,117	0	0	-1,521	23,132	0	0	0	21,611	11.7
6b	Replace the Existing Natural Gas Fired Boilers - GC Contract	1,456,935	0.0	0	0	0	0	0	0	0	0	0	0	
7	Install a New VFD on Existing Exhaust Fan	31,006	0.0	18,915.0	0	0	0	1,110	0	0	0	0	1,110	27.9
8	Install a New VFD on Existing Vane Axial Fan	117,393	0.0	226,190	0	0	0	13,275	0	0	0	0	13,275	8.8
9	Replace Air-Cooled Chiller with Water Cooled Chillers	0	0.0	0	0	0	0	0	0	0	0	0	0	
10	Install A/C Units to Serve Computer Equipment Rooms	83,981	0.0	37,602	2,356	0	0	2,207	1,766	0	0	0	3,973	21.1
11	Variable Flow Water Source Heat Pump Circulation Loop	0	0.0	0	0	0	0	0	0	0	0	0	0	
12	Water Softener	398,467	0.0	0	0	5,718	0	0	0	82,754	0	(17,605)	65,149	6.1
13	Waterside Economizer	81,635	52.2	46,637	0	0	0	6,433	0	0	0	0	6,433	12.7
14	Chilled Water Storage	0	0.0	0	0	0	0	0	0	0	0	0	0	
15	Install a Cogeneration Plant	0	0.0	0	0	0	0	0	0	0	0	0	0	
16	Irrigation Control System Upgrade	29,507	0.0	0	0	0	433	0	0	0	3,075	(945)	2,130	13.9
17	Programmable Flush Valve Controls	739,681	0.0	0	0	3,615	0	0	0	56,616	0	0	56,616	13.1
18	Water Reclaim	52,181	-6.6	-2,793	0	576	0	-1,277	0	7,528	0	(1,280)	4,971	10.5
19	Laundry Conservation	52,492	0.0	0	1,276	440	0	0	810	6,888	0	0	7,698	6.8
20	Replace DHW HX with new DHW Heater	25,810	0.0	0	2,158	0	0	0	1,370	0	0	0	1,370	18.8
21	Change Natural Gas Utility Provider	0.0	0.0	0	0	0	0	0	3,619	0	0	0	3,619	0.0
22	Remove Existing Fire Pumps	0	0.0	0	0	0	0	0	0	0	0	0	0	
23	Energy Resource Conservation Management Program	77,792	0.0	190,460	5,508	0	0	11,250	3,703.0	0	0	0	14,953	5.2
24	New Cooling Tower	216,088	3.9	6,587	0	0	0	1,048	0	0	0	0	1,048	206.1
25	Retro Commissioning	50,639	0.0	464,882	-11,306	0	0	28,357	-8,587	0	0	0	19,770	2.6
26	Replace Existing Moduline Boxes w/ VAV Terminal Units	2,015,547	0.0	0	0	0	0	0	0	0	0	0	0	
TOTAL OF ALL RECOMMENDED ECMs		**10,093,933**	**469**	**3,104,500**	**126,317**	**15,203**	**433**	**254,325**	**83,250**	**202,044**	**3,075**	**(1,247)**	**541,448**	**18.6**

2
Energy Consumption History

This section of the report contains the electric, natural gas, steam, and water usage history for each of the Arapahoe County facilities. Tables 2-1, 2-2, and 2-3 summarize all electric, natural gas, and water meters serving the sites. These tables also provide the applicable account number, meter number, utility company, and the rate type, where applicable.

For each utility type, a history of the energy usage has been established. The purpose of the energy consumption history is to represent the utility usage that is currently being used under the existing site conditions and schedules. Pages 2-14 through 2-38 show the energy consumption history for each site.

Table 2-4 summarizes the utility usage and costs that occurred generally during the latest 12 months of bills available. Referring to Table 2-4, Arapahoe County spent $2,249,990 in electric, natural gas, and water costs for the sites included in this study. Of this amount, 36% of the costs are related to electricity usage, 19% of the costs are related to natural gas usage, and 45% are related to water usage. The costs included in this table are based on existing utility rates.

The utility dollar savings in this report are calculated by multiplying the unit savings by the cost per unit determined from the most recent applicable energy rate. The cost per unit of electric demand (kW), electrical energy (kWh), natural gas (Therm), and water (Kgal) for each rate is given below.

Electricity

There are two major electricity utility rate structures applied to the Arapahoe County facilities. Both rates have escalated as a result of the recent rate change June 1, 2005. These changes are reflected below. Table 2-1 lists the rate type associated with each building. Descriptions of the electrical rates are included in the appendix. The unit costs for savings, as shown in the tabulation on page 2-9, are derived for each site from the rates shown below:

Electric Rate SG: Secondary General Service (Xcel Energy)

The portions of this rate that are related to energy savings are the Energy Charge, Demand Charge, General Rate Schedule Adjustments (GRSA), Electric Commodity Adjustment, Air Quality Improvement Rider, the Franchise Fee, and Sales Tax. The Service and Facility Charge of $25.00 remains fixed each month.

The Energy Charge: The Energy Charge is $0.0288/kWh.

The Demand Charge: The Demand Charge is $13.75/kW.

The General Rate Schedule Adjustments (GRSA): The General Rate Schedule Adjustments (GRSA) has been eliminated.

The Electric Commodity Adjustment: The Electric Commodity Adjustment is $0.02703/kWh.

The Air Quality Improvement Rider: The Air Quality Improvement Rider is $0.00115/kWh.

The Franchise Fee: The Franchise Fee is a percentage of the total charges listed above. The Franchise Fee is 3% for each of the buildings except for the Peoria Shops, ACJC Courthouse, and the Sheriff/Coroner Facility, all of which are not charged a Franchise Fee.

PCCA (Purchase Capacity Cost Adjustment): There is a 2.6193% charge applied to the sum of the previous items.

DSMCA (Demand Side Management Cost Adjustment): There is a 0.83% charge applied to the sum of the previous items.

Fort St. Vrain Decommissioning: There is a 1.19% charge applied to the sum of the previous items.

Sales Tax: Local Sales Tax is applied to each of the charges at the Centrepoint Plaza building only.

Electric Rate C: Commercial Service (Xcel Energy)

The portions of this rate that are related to energy savings are the Energy Charge, General Rate Schedule Adjustments (GRSA), Electric Commodity Adjustment, Air Quality Improvement Rider, and the Franchise Fee. The Service and Facility Charge of $6.25 remains fixed each month.

The Energy Charge (Summer): The Energy Charge is $0.04852/kWh. Summer is identified as the period between June 1 and September 30.
The Energy Charge (Winter): The Energy Charge is $0.04475/kWh. Winter is identified as the period between October 1 and May 31.

The General Rate Schedule Adjustments (GRSA): The General Rate Schedule Adjustments (GRSA) has been eliminated.

The Electric Commodity Adjustment: The Electric Commodity Adjustment is $0.02703/kWh.

The Air Quality Improvement Rider: The Air Quality Improvement Rider is $0.00115/kWh.

PCCA (Purchase Capacity Cost Adjustment): There is a 2.6193% charge applied to the sum of the previous items.

DSMCA (Demand Side Management Cost Adjustment): There is a 0.83% charge applied to the sum of the previous items.

Fort St. Vrain Decommissioning: There is a 1.19% charge applied to the sum of the previous items.

The Franchise Fee: The Franchise Fee is a percentage of the total charges listed above. The Franchise Fee is 3% for each of the buildings except for the Peoria Shops, which is not charged a Franchise Fee.

Natural Gas

There are two major natural gas utility rate structures applied to the Arapahoe County facilities. Table 2-2 lists the rate type associated with each building. Descriptions of the natural gas rates are included in the appendix. The unit costs for savings, as shown in the tabulation on page 2-9, are derived for each site from the rates shown below:

Natural Gas Rate CG-T: Commercial Gas Service (Xcel Energy)

The portions of this rate that are related to energy savings are the Distribution System Charge, Natural Gas Charge, Interstate Pipeline Charge, the Franchise Fee, and Sales Tax. The Metering and Billing Charge of $15.38 remains fixed each month.

The Distribution System Charge: The Distribution System Charge is $0.08703/Therm.

The Natural Gas Charge: The Natural Gas Charge is $0.572/Therm. This is the average cost per Therm over the last twelve months of data collected (June 2004 thru May 2005). A copy of the historical rate data can be found in the Appendix.

The Interstate Pipeline Charge: The Interstate Pipeline Charge is $0.06860/Therm.

The Franchise Fee: The Franchise Fee is a percentage of the total charges listed above. The Franchise Fee is 3% for each of the buildings except for the Sheriff/Coroner Facility, which is not charged a Franchise Fee.

Sales Tax: Local Sales Tax is applied to each of the charges at the Centrepoint Plaza building only.

Natural Gas Rate (Seminole Energy Services)

The portions of this rate that are related to energy savings are the Gas Usage Charge, Pipeline Transport Fee, Supply Cost, and the Franchise Fee. The Pipeline Meter Fee of $56.95 remains fixed each month. The Pipeline Reservation Charge differs for each facility and typically remains fixed each month but it can change if the customer's Peak Daily Quantity (PDQ) increases.

The Gas Usage Charge: The Gas Usage Charge is the current Colorado Interstate Gas Co. charge of $0.5785/Therm. This is the average cost per Therm over the last twelve months of data collected (May 2004 thru April 2005). A copy of the historical rate data can be found in the Appendix. Add $0.03/Therm for a total charge of $0.658/Therm.

The Pipeline Transport Fee: The Pipeline Transport Fee is $0.0304/Therm.

The Supply Cost: The Supply Cost is $0.025/Therm.

The Pipeline Reservation Charge: The current Pipeline Reservation Charge for each facility is listed in the table below.

Building:	Meter #:	Current PDQ:	Pipeline Reservation Charge:
01-Administration Building	67268001	43	$165.98
23-Altura Plaza Building	67399201	77	$297.22
29-Peoria Shops	153320301	45	$173.70
35-ACJC Courthouse	67892701	51	$196.86
36-ACJC Detention Center	67271401	87	$335.82
36-ACJC Detention Center	67893101	96	$370.56

Note: The Pipeline Reservation Charge is calculated by multiplying the PDQ by $3.86.

The Franchise Fee: The Franchise Fee is 3% of the Pipeline Meter Fee, the Pipeline Reservation Charge, and Pipeline Transport Fee.

Water

There are four major water utility rate structures applied to the Arapahoe County facilities. Table 2-2 lists the rate type associated with each building. Descriptions of the water rates are included in the appendix. The unit costs for savings, as shown in the tabulation on page 2-9, are derived for each site from the rates shown below:

Denver Water – Rate Schedule No. 2 – Outside City – Total Service:

The portions of this rate that are related to energy savings are the winter consumption rate of $2.14/Kgal (1,000 Gallons), the summer consumption rate of $2.57/Kgal, and the sewer rate of $3.00/Kgal. The winter consumption rate is applied during the months of January through April, November and December. The summer consumption rate is applied during the months of May through October. The sewer charge is billed annually by the City of Littleton. The sewer charge is applied to the previous year's lowest billed consumption, as measured by Denver Water. The bi-monthly service charge and fire protection charge (if applicable) remain the same each billing period. The storm water charge remains the same each billing period too. Each of the fixed charges is listed for each building in the table below.

Building:	Bi-Monthly Service Charge:	Bi-Monthly Fire Protection Charge:	Annual Storm Water Charge:
01-Administration Building	$85.20	$15.03	$2,460
12-Arapahoe Plaza East Building	$14.60	None	$623.38
13-Arapahoe Human Services	$32.19	$15.03	Incl. w/ Bldg. 12
14-Arapahoe Plaza West Building (County Court)	$14.60	None	Incl. w/ Bldg. 12
15-Federal Warehouse	$32.19	$26.30	$812.50
16-CSU Extension Office	$8.51	None	$74.16
17-CSU Warehouse	$8.51	None	$135.62

City of Englewood – Water & Sewer Charges:

The portions of this rate that are related to water savings are the consumption rate of $2.15/Kgal (1,000 Gallons), and the sewer rate of $1.3291/Kgal. The consumption rate and sewer rate are only applied if the facility consumes more than 45 Kgals each billing period (three months), otherwise a minimum consumption charge of $104.83 and a minimum sewer charge of $176.56 are charged to the customer each billing period. The consumption and sewer charges shall increase 15% every January through January 2008. The Storm Water Charge of $22.00 remains the same each billing period.

NOTE: Building 20 – Tri County Health is the only facility that utilizes this rate. Since their consumption has always been much less than 45 Kgals each billing period than they have been billed the minimum consumption and sewer charges each month. So, water dollar savings cannot be achieved at this facility.

City of Aurora - Commercial:

The portions of this rate that are related to water savings are the consumption rate of $3.34/Kgal, and the sewer rate of $1.65/Kgal. The sewer consumption value remains the same each month and is calculated by taking the average consumption of the three winter months of December, January, and February. The Fire Protection Charge, the Storm Drain Component, the Meter Charge, the Sewer Service Charge, and the Water Service Charge remain the same each month. The table below lists each of these charges for each building.

Building:	Fire Protection Charge:	Storm Drain Component:	Meter Charge:	Sewer Service Charge:	Water Service Charge:
23-Altura Plaza Building	N/A	$3.83	$90.90	$14.33	$12.13
24-Centrepoint Plaza	$20.44	$3.83	$160.59	$31.37	$24.04

N/A – Not Applicable

Arapahoe County Water and Wastewater Authority:

The portions of this rate that are related to water savings are the tiered consumption rate and the tiered sewer rate - which is 80% of the consumption rate. A minimum usage charge is billed each month depending on the water meter's size. Once the minimum usage is met, the tiered rates are then used to bill the remaining water usage. The irrigation water usage is metered separately. Irrigation water is billed in the same manner that's described above but, it does not have a sewer charge. A Stormwater Fee and a Fire Line Charge (if applicable) remain the same each billing period. Also, some of the facilities are billed a Capitol Finance (CF) Fee. The CF Fee is calculated by adding up each of the aforementioned charges and fees, except for the Stormwater Fee.

The tiered consumption and sewer rates are listed in the table below.

Usage (Gallons):	Consumption Rate ($/Kgal):	Sewer Rate ($/Kgal):
Less Than or Equal to 25,000	$2.90	$2.32
25,001 to 200,000	$3.63	$2.90
Greater Than 200,001	$4.35	$3.48

The water meter data for each facility is listed in the table below.

Building:	Meter Size (in.):	Min. Usage (Kgals):	Stormwater Fee:	Fire Line Charge:	CF Fee:
29-Peoria Shops	2	12	$117.45	N/A	Yes
35-ACJC Courthouse	3	24	Incl. w/ 36	$95.18	Yes
36-ACJC Detention Center (Main Building)	6	144	$232.00	$1,142.04	Yes
36-ACJC Detention Center (Warehouse)	2	12	Incl. w/ 36	N/A	Yes
37-ACJC Administrative II	3	24	Incl. w/ 36	$190.34	Yes
38-Sheriff/Coroner Facility	3	24	$100.56	$380.68	No

The irrigation meter data for each facility is listed in the table below.

Building:	Meter Size (in.):	Min. Usage (Kgals):	CF Fee:
35-ACJC Courthouse	1-1/2	8	Yes
36-ACJC Detention Center (Main Building)	1-1/2	8	Yes
36-ACJC Detention Center (Warehouse)	1-1/2	8	Yes
37-ACJC Administrative II	1-1/2	8	Yes
38-Sheriff/Coroner Facility	1-1/2	8	No

NOTE: The water consumption at Building 36 – ACJC Detention Center (Warehouse) has always been much less than the 12 Kgals minimum that they are billed for each month for water and sewer. So, water dollar savings cannot be achieved at this facility.

Unit Costs for the Dollar Savings Calculations

Building:	Electric		Natural Gas	Water & Sewer
	$/kW:	$/kWh:	$/Therm:	$/Kgal:
01 – Administration Building	$14.16	$0.05869	$0.63481	$5.36
12 – Arapahoe Plaza East Building	$14.16	$0.05869	$0.63481	$5.36
13 – Arapahoe Human Services	$14.16	$0.05869	$0.63481	$5.36
14 – Arapahoe Plaza West Building (County Court)	$14.16	$0.05869	$0.63481	$5.36
15 – Federal Warehouse	$14.16	$0.05869	$0.74946	$5.36
16 – CSU Extension Office	$14.16	$0.05869	$0.74946	$5.36
17 – CSU Warehouse (Summer)	0.00	$0.07900	$0.74946	$5.36
17 – CSU Warehouse (Winter)	0.00	$0.07512	$0.74946	$5.36
20 – Tri County Health	$14.16	$0.05869	$0.74946	(1)
23 – Altura Plaza Building	$14.16	$0.05869	$0.63481	$4.99
24 – Centrepoint Plaza	$14.16	$0.06321	$0.80714	$4.99
29 – Peoria Shops	$14.16	$0.05869	$0.63481	$13.07
35 – ACJC Courthouse	$14.16	$0.05869	$0.63481	$13.07
36 – ACJC Detention Center (Main Building)	$14.16	$0.05869	$0.63481	$15.66
36 – ACJC Detention Center (Warehouse)	$14.16	$0.05869	$0.74946	$13.07
37 – ACJC Administrative II	$14.16	$0.05869	$0.74946	$13.07
38 – Sheriff/Coroner Facility	$14.16	$0.05869	$0.72763	$6.53

(1) Tri County Health is billed as a Commercial Rate. This rate is described earlier in this section.

Table 2-1 ELECTRICAL ACCOUNT SUMMARY

Arapahoe County

Building	*Address*	*Utility Company*	*Account No.*	*Meter No.*	*Rate Type*
01 - Administration Building	5334 S. Prince St. Littleton, CO	Xcel Energy	53-3441672-9	44743T	SG
12 - Arapahoe Plaza East Building	1610 W. Littleton Blvd. Littleton, CO	Xcel Energy	53-3441672-9	28161T	SG
13 - Arapahoe Human Services	1690 W. Littleton Blvd. Littleton, CO	Xcel Energy	53-3441672-9	21739T	SG
14 - Arapahoe Plaza West Building	1790 W. Littleton Blvd. Littleton, CO	Xcel Energy	53-3441672-9	28196T	SG
15 - Federal Warehouse	5251 S. Federal Blvd. Littleton, CO	Xcel Energy	53-3441672-9	32895T	SG
16 - CSU Extension Office	5804 S. Datura St. Littleton, CO	Xcel Energy	53-3441672-9	11579T	SG
17 - CSU Warehouse	5814 S. Datura St. Littleton, CO	Xcel Energy	53-3441672-9	2351236	C
20 - Tri County Health	4857 S. Broadway St. Englewood, CO	Xcel Energy	53-3441672-9	25086T	SG
23 - Altura Plaza Building	15400 E. 14th PL. Aurora, CO	Xcel Energy	53-3441672-9	31141T	SG
24 - Centrepoint Plaza	14980 E. Alameda Ave. Aurora, CO	Xcel Energy	53-3441672-9	22021T	SG
29 - Peoria Shops	7600 S. Peoria St. Englewood, CO	Xcel Energy	53-3441672-9	16228T & 18555T	SG
			53-3441672-9	112586S	C
35 - ACJC Courthouse	7325 S. Potomac St. Englewood, CO	Xcel Energy	53-3441672-9	44203T	SG
36 - ACJC Detention Center (Main Building)	7375 S. Potomac St. Englewood, CO	Xcel Energy	53-3441672-9	29911T	SG
36 - ACJC Detention Center (Warehouse)			53-3441672-9	76942S	C
37 - ACJC Administrative II	7305 S. Potomac St. Englewood, CO	Xcel Energy	53-3441672-9	41435T	SG
38 - Sheriff/Coroner Facility	13101 E. Broncos Pkwy. Englewood, CO	Xcel Energy	53-3441672-9	44403T	SG

1) Rate type SG is Secondary General Service
2) Rate type C is Commercial Service

Table 2-2 NATURAL GAS ACCOUNT SUMMARY

Arapahoe County

Building	*Address*	*Utility Company*	*Account No.*	*Meter No.*	*Rate Type*
01 - Administration Building	5334 S. Prince St. Littleton, CO	Seminole Energy Services	500892	67268001	None
13 - Arapahoe Human Services	1690 W. Littleton Blvd. Littleton, CO	Xcel Energy	53-3441672-9	1015025	CG-T
15 - Federal Warehouse	5251 S. Federal Blvd. Littleton, CO	Xcel Energy	53-3441672-9	1299336	CG-T
16 - CSU Extension Office	5804 S. Datura St. Littleton, CO	Xcel Energy	53-3441672-9	481873	CG-T
17 - CSU Warehouse	5814 S. Datura St. Littleton, CO	Xcel Energy	53-3441672-9	391242	CG-T
20 - Tri County Health	4857 S. Broadway St. Englewood, CO	Xcel Energy	53-3441672-9	298402	CG-T
23 - Altura Plaza Building	15400 E. 14th PL. Aurora, CO	Seminole Energy Services	500059	67399201	None
24 - Centrepoint Plaza	14980 E. Alameda Ave. Aurora, CO	Xcel Energy	53-3441672-9	1309638	CG-T
29 - Peoria Shops	7600 S. Peoria St. Englewood, CO	Seminole Energy Services	500893	153320301	None
35 - ACJC Courthouse	7325 S. Potomac St. Englewood, CO	Seminole Energy Services	500894	67892701	None
36 - ACJC Detention Center (Main Building)	7375 S. Potomac St. Englewood, CO	Seminole Energy Services	500891	67271401 & 67893101	None
36 - ACJC Detention Center (Warehouse)		Xcel Energy	53-3441672-9	1353953	CG-T
37 - ACJC Administrative II	7305 S. Potomac St. Englewood, CO	Xcel Energy	53-3441672-9	FC24679	CG-T
38 - Sheriff/Coroner Facility	13101 E. Broncos Pkwy. Englewood, CO	Xcel Energy	53-3441672-9	1454533	CG-T

Notes:
1. The boilers served by the natural gas meter at building 13-Arapahoe Human Services provide heating to the 12-Arapahoe Plaza East and 14-Arapahoe Plaza West (County Court) Buildings as well.
2. Rate CG-T is Commercial Gas Service

Table 2-3 WATER ACCOUNT SUMMARY

Arapahoe County

Building	*Address*	*Utility Company*	*Account No.*
01 - Administration Building	5334 S. Prince St. Littleton, CO	Denver Water	10407675-01-5
12 - Arapahoe Plaza East Building	1610 W. Littleton Blvd. Littleton, CO	Denver Water	10447924-01-6
13 - Arapahoe Human Services	1690 W. Littleton Blvd. Littleton, CO	Denver Water	10447925-01-7
14 - Arapahoe Plaza West Building (County Court)	1790 W. Littleton Blvd. Littleton, CO	Denver Water	10447928-01-1
15 - Federal Warehouse	5251 S. Federal Blvd. Littleton, CO	Denver Water	10411460-01-1
16 - CSU Extension Office	5804 S. Datura St. Littleton, CO	Denver Water	10403740-01-3
17 - CSU Warehouse	5814 S. Datura St. Littleton, CO	Denver Water	10403741-01-4
20 - Tri County Health	4857 S. Broadway St. Englewood, CO	City of Englewood	01000-04857-0
23 - Altura Plaza Building	15400 E. 14th PL. Aurora, CO	City of Aurora Utilities	20703-16332
24 - Centrepoint Plaza	14980 E. Alameda Ave. Aurora, CO	City of Aurora Utilities	199313-132082
29 - Peoria Shops	7600 S. Peoria St. Englewood, CO	Arapahoe County Water & Wastewater Authority	1041
35 - ACJC Courthouse	7325 S. Potomac St. Englewood, CO	Arapahoe County Water & Wastewater Authority	1124 & 123820
36 - ACJC Detention Center (Main Building)	7375 S. Potomac St. Englewood, CO		
36 - ACJC Detention Center (Warehouse)			
37 - ACJC Administrative II	7305 S. Potomac St. Englewood, CO		
38 - Sheriff/Coroner Facility	13101 E. Broncos Pkwy. Englewood, CO	Arapahoe County Water & Wastewater Authority	125775

Table 2-4 -- ENERGY CONSUMPTION SUMMARY FOR THE MOST RECENT 12 MONTHS OF DATA
Arapahoe County

	ELECTRICITY			NATURAL GAS			WATER		
BUILDING	kWh	Cost	Average Blended $/kWh	Therms	Cost	Average $/Therm	Kgals (1000 gallons)	Sewer (If Applicable) & Water Cost	Average $/Kgal
01 - Administration Building	2,792,459	$109,608	$0.039	39,560	$26,818	$0.68	5,206	$27,603	$5.30
12 - Arapahoe Plaza East Building	339,031	$20,496	$0.060	(1)	(1)	(1)	633	$3,363	$5.31
13 - Arapahoe Human Services	718,155	$44,407	$0.062	43,910	$33,255	$0.76	653	$3,467	$5.31
14 - Arapahoe Plaza West Building (County Court)	398,714	$21,390	$0.054	(1)	(1)	(1)	867	$4,534	$5.23
15 - Federal Warehouse	500,390	$32,097	$0.064	11,490	$9,221	$0.80	460	$2,511	$5.45
16 - CSU Extension Office	76,809	$5,500	$0.072	4,400	$3,087	$0.70	62	$355	$5.73
17 - CSU Warehouse	28,414	$2,095	$0.074	2,290	$1,680	$0.73	11	$94	$8.82
20 - Tri County Health	87,912	$6,535	$0.074	3,850	$2,722	$0.71	24	$761	$31.11
23 - Altura Plaza Building	1,407,102	$79,204	$0.056	107,880	$70,816	$0.66	3,632	$12,419	$3.42
24 - Centrepoint Plaza	2,743,135	$99,750	$0.036	2,240	$2,002	$0.89	4,559	$16,871	$3.70
29 - Peoria Shops	320,958	$17,967	$0.056	32,140	$23,241	$0.72	1,851	$8,167	$4.41
35 - ACJC Courthouse	2,755,414	$115,252	$0.042	72,800	$47,065	$0.65	56,770	$908,737	$16.01
36 - ACJC Detention Center	5,517,976	$220,556	$0.040	285,340	$182,715	$0.64			
37 - ACJC Administrative II	2,017,650	$92,155	$0.046	17,040	$11,077	$0.65			
38 - Sheriff/Coroner Facility	2,472,668	$82,399	$0.033	14,950	$12,203	$0.82	3,428	$16,188	$4.72
TOTALS:	**22,176,787**	**$949,411**	**$0.043**	**637,890**	**$425,902**	**$0.67**	**78,156**	**$1,005,070**	**$12.86**

TOTAL UTILITY COSTS: **$2,380,383**

Notes:

(1) This building is heated by the natural gas-fired boiler plant located in building 13 - Arapahoe Human Services.

Project: Arapahoe County
Building: 01-Administration Building

Electric Usage Baseline

Baseline Units: kWh

Account #(s): 4001284208

Meter #(s): 44743T (old meter 12973T)

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		211,680		205,918	217,183	211,594	211,594	211,551	217,183
Feb		189,674		202,957	189,788	194,140	194,140	196,373	189,788
Mar		229,024		229,311		229,168	229,168	229,311	229,311
Apr		235,576		218,456		227,016	227,016	218,456	218,456
May		248,684		243,374		246,029	246,029	243,374	243,374
Jun		265,610		248,088		256,849	256,849	248,088	248,088
Jul		298,963		270,700		284,832	284,832	270,700	270,700
Aug		283,165	266,959	264,710		271,611	271,611	265,835	264,710
Sep		239,141		243,348		241,245	241,245	243,348	243,348
Oct		227,421		232,915		230,168	230,168	232,915	232,915
Nov				220,561		220,561	220,561	220,561	220,561
Dec			207,428	216,466		211,947	211,947	211,947	216,466
Totals	0	2,428,938	474,387	2,796,804	406,971	2,825,160	2,825,160	2,792,459	2,794,900

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Electric Demand Baseline

Baseline Units: kW

Account #(s): 4001284208

Meter #(s): 44743T (old meter 12973T)

Total Monthly Electric Demand (kW)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		609		451	551	537	537	501	551
Feb		622		451	490	521	521	471	490
Mar		640		544	513	566	566	529	513
Apr		608		548		578	578	548	548
May		572		564		568	568	564	564
Jun		583		595		589	589	595	595
Jul		594		607		601	601	607	607
Aug		618	563	621		601	601	592	621
Sep		589	536	567		564	564	552	567
Oct		568		584		576	576	584	584
Nov		536		585		561	561	585	585
Dec			510	573		542	542	542	573
Totals	0	6,539	1,609	6,690	1,554	6,804	6,804	6,670	6,798

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Natural Gas Usage Baseline

Baseline Units: therms

Account #(s): !Acct No.

Meter #(s): 0067268001 (old meter 35461508), 305461508

Total Monthly Natural Gas Usage (therms)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		4,370	4,050	5,080		5,080	4,500	4,565	5,080
Feb			4,050	4,650		4,650	4,350	4,350	4,650
Mar				3,950		3,950	3,950	3,950	3,950
Apr				3,550		3,550	3,550	3,550	3,550
May		1,270		2,140		2,140	1,705	2,140	2,140
Jun		300		1,740		1,740	1,020	1,740	1,740
Jul		310		1,010		1,010	660	1,010	1,010
Aug		310	590	1,390		1,390	763	990	1,390
Sep		370	1,960	2,220		2,220	1,517	2,090	2,220
Oct		1,960	2,750	4,110		4,110	2,940	3,430	4,110
Nov		3,890	4,090	4,850		4,850	4,277	4,470	4,850
Dec	4,260	4,630	4,810	4,870		4,870	4,643	4,840	4,870
Totals	4,260	17,410	22,300	39,560	0	39,560	33,875	37,125	39,560

The CEA Baseline is the most recent 12 months data collected

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Water Usage Baseline

Baseline Units: gallons

Account #(s): 10407675015

Meter #(s):

Total Monthly Water Usage (gallons)									
Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan			140,532	119,396		129,964	129,964	129,964	119,396
Feb		96,393	142,847	107,644		115,628	115,628	125,246	107,644
Mar		419,651	151,822	228,209		266,561	266,561	190,016	228,209
Apr		624,828	142,500	290,000		352,443	352,443	216,250	290,000
May		859,943		538,714		699,329	699,329	538,714	538,714
Jun		930,952		648,571		789,762	789,762	648,571	648,571
Jul		922,758		833,556		878,157	878,157	833,556	833,556
Aug		897,984	1,014,593	951,542		954,706	954,706	983,068	951,542
Sep		471,973	885,017	608,644		655,211	655,211	746,831	608,644
Oct		250,175	856,579	467,627		524,794	524,794	662,103	467,627
Nov		142,655	286,451			214,553	214,553	214,553	286,451
Dec		116,134	125,388			120,761	120,761	120,761	125,388
Totals	0	5,733,446	3,745,729	4,793,903	0	5,701,869	5,701,869	5,409,633	5,205,742

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 12-Arapahoe Plaza East Building

Electric Usage Baseline

Baseline Units: kWh
Account #(s): 6000900470
Meter #(s): 28161T

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		31,710		28,069	33,024	33,024	30,934	30,547	33,024
Feb		29,837		26,763	28,866	28,866	28,489	27,815	28,866
Mar		31,696		29,277	33,384	33,384	31,452	31,331	33,384
Apr		29,521		28,336		28,336	28,929	28,336	28,336
May		29,887		28,416		28,416	29,152	28,416	28,416
Jun		28,316		28,020		28,020	28,168	28,020	28,020
Jul		29,369		29,354		29,354	29,362	29,354	29,354
Aug		29,436	28,988	31,700		31,700	30,041	30,344	31,700
Sep		27,820	27,571	29,611		29,611	28,334	28,591	29,611
Oct		28,457	28,530	30,668		30,668	29,218	29,599	30,668
Nov		27,995	27,337	27,862		27,862	27,731	27,600	27,862
Dec			28,059	31,304		31,304	29,682	29,682	31,304
Totals	0	324,044	140,485	349,380	95,274	360,545	351,492	349,635	360,545

The CEA Baseline is the most recent 12 months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Electric Demand Baseline

Baseline Units: kW
Account #(s): 6000900470
Meter #(s): 28161T

Total Monthly Electric Demand (kW)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		72		79	78	78	76	79	78
Feb		70		73	79	79	74	76	79
Mar		70		72	80	80	74	76	80
Apr		68		72	80	80	73	76	80
May		68		71		71	70	71	71
Jun		66		76		76	71	76	76
Jul		66		74		74	70	74	74
Aug		60	74	75		75	70	75	75
Sep		60	72	76		76	69	74	76
Oct		64	70	77		77	70	74	77
Nov		65	71	74		74	70	73	74
Dec		67	75	77		77	73	76	77
Totals	0	796	362	896	317	917	860	900	917

The CEA Baseline is the most recent 12 months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Water Usage Baseline

Baseline Units: gallons
Account #(s): 10447924016
Meter #(s):

Total Monthly Water Usage (gallons)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan			21,657	33,275		33,275	27,466	27,466	33,275
Feb		15,607	23,729	33,915		33,915	24,417	28,822	33,915
Mar		14,073	23,317	49,501		49,501	28,964	36,409	49,501
Apr		11,379	20,500	56,000		56,000	29,293	38,250	56,000
May		62,793		63,073		63,073	62,933	63,073	63,073
Jun		84,286		63,810		63,810	74,048	63,810	63,810
Jul		74,206		76,159		76,159	75,183	76,159	76,159
Aug		66,066	77,237	83,542		83,542	75,615	80,390	83,542
Sep		38,776	74,740	57,797		57,797	57,104	66,269	57,797
Oct		25,018	77,228	47,814		47,814	50,020	62,521	47,814
Nov		16,977	39,065			39,065	28,021	28,021	39,065
Dec		15,269	29,149			29,149	22,209	22,209	29,149
Totals	0	424,450	386,622	564,886	0	633,100	555,273	593,399	633,100

The CEA Baseline is the most recent 12 months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 13-Arapahoe Human Services

Electric Usage Baseline

Baseline Units: kWh
Account #(s): 3000900650
Meter #(s): 21739T

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan				56,825		56,825	56,825	56,825	56,825
Feb				53,311		53,311	53,311	53,311	53,311
Mar				57,360		57,360	57,360	57,360	57,360
Apr		57,279		55,422		55,422	56,351	55,422	55,422
May		62,552		57,204		57,204	59,878	57,204	57,204
Jun		64,490		69,488		69,488	66,989	69,488	69,488
Jul		67,237		102,970		102,970	85,104	102,970	102,970
Aug		63,549	77,732	83,302		83,302	74,861	80,517	83,302
Sep		46,798	54,782	80,601		80,601	60,727	67,692	80,601
Oct		40,333	56,687	83,325		83,325	60,115	70,006	83,325
Nov		42,689	54,893	73,482		73,482	57,021	64,188	73,482
Dec			56,864			56,864	56,864	56,864	56,864
Totals	0	444,927	300,958	773,290	0	830,154	745,406	791,847	830,154

The CEA Baseline is the most recent 12 months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Electric Demand Baseline

Baseline Units: kW
Account #(s): 3000900650
Meter #(s): 21739T

Total Monthly Electric Demand (kW)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		156		153		153	155	153	153
Feb				153		153	153	153	153
Mar				154		154	154	154	154
Apr		175		154		154	165	154	154
May		148		154		154	151	154	154
Jun		170		142		142	156	142	142
Jul		170		230		230	200	230	230
Aug		160	245	200		200	202	223	200
Sep		141	152	200		200	164	176	200
Oct		118	152	200		200	157	176	200
Nov		106	152	192		192	150	172	192
Dec		130	153			153	142	142	153
Totals	0	1,474	854	1,932	0	2,085	1,949	2,029	2,085

The CEA Baseline is the most recent 12 months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Natural Gas Usage Baseline

Baseline Units: therms
Account #(s): 53-3441672-9
Meter #(s): 1015025

Total Monthly Natural Gas Usage (therms)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan				7,719	6,316	6,316	7,018	7,018	6,316
Feb				6,785	5,567	5,567	6,176	6,176	5,567
Mar				4,638	5,364	5,364	5,001	5,001	5,364
Apr		2,333		3,074		3,074	2,704	3,074	3,074
May		1,388		2,324		2,324	1,856	2,324	2,324
Jun		587		1,054		1,054	821	1,054	1,054
Jul				605		605	605	605	605
Aug			524	873		873	699	699	873
Sep			1,193	1,523		1,523	1,358	1,358	1,523
Oct		3,702	3,570	4,029		4,029	3,767	3,800	4,029
Nov		5,787	5,918	6,131		6,131	5,945	6,025	6,131
Dec			7,347	6,336		6,336	6,842	6,842	6,336
Totals	0	13,797	18,552	45,091	17,247	43,196	42,792	43,976	43,196

The CEA Baseline is the Most Recent Twelve Months Data Collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Water Usage Baseline

Baseline Units: gallons

Account #(s): 10447925017

Meter #(s):

Total Monthly Water Usage (gallons)									
Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan			87,972	45,365		66,669	66,669	66,669	45,365
Feb		100,066	55,051	46,203		67,107	67,107	50,627	46,203
Mar		96,735	62,159	50,152		69,682	69,682	56,156	50,152
Apr		83,793	61,000	49,000		64,598	64,598	55,000	49,000
May		57,931		56,379		57,155	57,155	56,379	56,379
Jun		42,857		57,619		50,238	50,238	57,619	57,619
Jul		42,061		61,884		51,973	51,973	61,884	61,884
Aug		40,656	36,254	63,576		46,829	46,829	49,915	63,576
Sep		51,093	45,198	67,966		54,752	54,752	56,582	67,966
Oct		59,825	52,754	73,559		62,046	62,046	63,157	73,559
Nov		106,539	41,435			73,987	73,987	73,987	41,435
Dec		125,388	39,791			82,590	82,590	82,590	39,791
Totals	0	806,944	481,614	571,703	0	747,626	747,626	730,565	652,929

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 14-Arapahoe Plaza West Building (County Court)

Electric Usage Baseline

Baseline Units: kWh
Account #(s): 1000900566
Meter #(s): 28196T

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		33,378		34,794	35,850	34,674	34,674	35,322	35,850
Feb		31,610		33,396	33,283	32,763	32,763	33,340	33,283
Mar		35,537		35,611	37,129	36,092	36,092	36,370	37,129
Apr		31,276		33,916		32,596	32,596	33,916	33,916
May		29,858		34,476		32,167	32,167	34,476	34,476
Jun		32,323		33,173		32,748	32,748	33,173	33,173
Jul		33,675		34,438		34,057	34,057	34,438	34,438
Aug		34,548	32,659	36,775		34,661	34,661	34,717	36,775
Sep		33,689	31,629	33,108		32,809	32,809	32,369	33,108
Oct		32,360	33,087	34,251		33,233	33,233	33,669	34,251
Nov		32,013	33,110	33,149		32,757	32,757	33,130	33,149
Dec			34,656	34,637		34,647	34,647	34,647	34,637
Totals	0	360,267	165,141	411,724	106,262	403,204	403,204	409,567	414,185

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Electric Demand Baseline

Baseline Units: kW
Account #(s): 1000900566
Meter #(s): 28196T

Total Monthly Electric Demand (kW)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		72		68	70	70	70	69	70
Feb		74		70	73	72	72	72	73
Mar		71		70	71	71	71	71	71
Apr		75		68	72	72	72	70	72
May		68		68		68	68	68	68
Jun		68		68		68	68	68	68
Jul		68		66		67	67	66	66
Aug		68	64	68		67	67	66	68
Sep		71	63	67		67	67	65	67
Oct		70	66	70		69	69	68	70
Nov		63	65	60		63	63	63	60
Dec		76	66	60		67	67	63	60
Totals	0	844	324	803	286	821	821	809	813

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Water Usage Baseline

Baseline Units: gallons
Account #(s): 10447928011
Meter #(s):

Total Monthly Water Usage (gallons)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan			93,729	84,070		88,900	88,900	88,900	84,070
Feb		127,148	105,356	73,237		101,914	101,914	89,297	73,237
Mar		121,102	82,515	80,338		94,652	94,652	81,427	80,338
Apr		103,448	56,000	79,000		79,483	79,483	67,500	79,000
May		121,149		72,459		96,804	96,804	72,459	72,459
Jun		123,810		65,238		94,524	94,524	65,238	65,238
Jul				67,931		67,931	67,931	67,931	67,931
Aug			70,932	68,305		69,619	69,619	69,619	68,305
Sep			83,169	50,508		66,839	66,839	66,839	50,508
Oct		67,439	94,632	44,136		68,736	68,736	69,384	44,136
Nov		61,228	89,682			75,455	75,455	75,455	89,682
Dec		62,000	92,075			77,038	77,038	77,038	92,075
Totals	0	787,324	768,090	685,222	0	981,895	981,895	891,087	866,979

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 15-Federal Warehouse

Electric Usage Baseline

Baseline Units: kWh
Account #(s): 6000925178
Meter #(s): 32895T

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		36,103		39,654	37,311	37,689	37,689	38,483	37,311
Feb		28,911		42,136	34,722	35,256	35,256	38,429	34,722
Mar		35,167		43,853	36,331	38,450	38,450	40,092	36,331
Apr		36,993		42,014		39,504	39,504	42,014	42,014
May		39,162		47,936		43,549	43,549	47,936	47,936
Jun		47,062		53,937		50,500	50,500	53,937	53,937
Jul		59,580		69,872		64,726	64,726	69,872	69,872
Aug		51,035		63,752		57,394	57,394	63,752	63,752
Sep		45,055	34,726	53,977		44,586	44,586	44,352	53,977
Oct		40,974	38,008	52,079		43,687	43,687	45,044	52,079
Nov		36,655	30,706	41,840		36,400	36,400	36,273	41,840
Dec			32,454	39,374		35,914	35,914	35,914	39,374
Totals	0	456,697	135,894	590,424	108,364	527,655	527,655	556,098	573,145

The CEA Baseline is Average of all data collected

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Electric Demand Baseline

Baseline Units: kW
Account #(s): 6000925178
Meter #(s): 32895T

Total Monthly Electric Demand (kW)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		120		109	106	112	112	108	106
Feb		118		105	96	106	106	101	96
Mar		118		92	105	105	105	99	105
Apr		123		147		135	135	147	147
May		124		158		141	141	158	158
Jun		146		158		152	152	158	158
Jul		178		166		172	172	166	166
Aug		170	153	151		158	158	152	151
Sep		162	132	138		144	144	135	138
Oct		118	124	116		119	119	120	116
Nov		108	78	98		95	95	88	98
Dec	98		89	108		98	98	99	108
Totals	98	1,485	576	1,546	307	1,537	1,537	1,531	1,547

The CEA Baseline is Average of all data collected

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Natural Gas Usage Baseline

Baseline Units: dth
Account #(s): 53-3441672-9
Meter #(s): 1299336

Total Monthly Natural Gas Usage (dth)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		273		293	237	268	268	265	237
Feb		246		325	181	251	251	253	181
Mar		189		139	178	169	169	159	178
Apr		40		106		73	73	106	106
May		16		30		23	23	30	30
Jun		1		6		4	4	6	6
Jul				1		1	1	1	1
Aug				0		0	0	0	0
Sep		3	20	2		8	8	11	2
Oct		101	54	12		56	56	33	12
Nov		254	239	151		215	215	195	151
Dec			332	245		289	289	289	245
Totals	0	1,123	645	1,310	596	1,357	1,357	1,348	1,149

The CEA Baseline is Average of all data collected

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Water Usage Baseline

Baseline Units: gallons

Account #(s): 10411460011

Meter #(s):

Total Monthly Water Usage (gallons)									
Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan			3,133	4,853		3,993	3,993	3,993	4,853
Feb		2,295	949	6,881		3,375	3,375	3,915	6,881
Mar		59,721	3,141	18,364		27,075	27,075	10,753	18,364
Apr		97,759	4,500	24,500		42,253	42,253	14,500	24,500
May		135,920		45,809		90,865	90,865	45,809	45,809
Jun		147,619		55,238		101,429	101,429	55,238	55,238
Jul		131,933		79,157		105,545	105,545	79,157	79,157
Aug		118,918	99,831	95,102		104,617	104,617	97,467	95,102
Sep		52,863	88,757	61,186		67,602	67,602	74,972	61,186
Oct		17,404	87,018	47,288		50,570	50,570	67,153	47,288
Nov		8,393	20,679			14,536	14,536	14,536	20,679
Dec		6,015	1,388			3,702	3,702	3,702	1,388
Totals	0	778,840	309,396	438,378	0	615,562	615,562	471,195	460,445

The CEA Baseline is Average of all data collected

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 16-CSU Extension Office

Electric Usage Baseline

Baseline Units: kWh
Account #(s): 3000856826
Meter #(s): 11579T

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		5,343		4,865	5,793	5,334	5,334	5,329	5,793
Feb		5,274		4,893	4,542	4,903	4,903	4,718	4,542
Mar		6,089		4,954	5,016	5,353	5,353	4,985	5,016
Apr		6,383		5,364		5,874	5,874	5,364	5,364
May		7,765		6,076		6,921	6,921	6,076	6,076
Jun		9,602		7,280		8,441	8,441	7,280	7,280
Jul		10,109		9,041		9,575	9,575	9,041	9,041
Aug		9,304	8,067	4,774		7,382	7,382	6,421	4,774
Sep		6,937	5,394	6,437		6,256	6,256	5,916	6,437
Oct		5,298	5,462	6,301		5,687	5,687	5,882	6,301
Nov		5,249	5,340	6,681		5,757	5,757	6,011	6,681
Dec			4,994	5,911		5,453	5,453	5,453	5,911
Totals	0	77,353	29,257	72,577	15,351	76,936	76,936	72,476	73,216

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Electric Demand Baseline

Baseline Units: kW
Account #(s): 3000856826
Meter #(s): 11579T

Total Monthly Electric Demand (kW)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		22		18	21	20	20	20	21
Feb		23		18	19	20	20	19	19
Mar		24		18	18	20	20	18	18
Apr		22		20	22	21	21	21	22
May		22		26		24	24	26	26
Jun		26		27		27	27	27	27
Jul		27		30		29	29	30	30
Aug		32	28	29		30	30	29	29
Sep		28	23	26		26	26	25	26
Oct		24	19	22		22	22	21	22
Nov		21	18	20		20	20	19	20
Dec		22	19	18		20	20	19	18
Totals	0	293	107	272	80	279	279	274	278

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Natural Gas Usage Baseline

Baseline Units: dth
Account #(s): 53-3441672-9
Meter #(s): 481873

Total Monthly Natural Gas Usage (dth)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		71		77	60	69	69	69	60
Feb		61		71	43	58	58	57	43
Mar		55		51	35	47	47	43	35
Apr		31		40		36	36	40	40
May		23		32		28	28	32	32
Jun		8		19		14	14	19	19
Jul		3		11		7	7	11	11
Aug		7	1	17		8	8	9	17
Sep		17	3	20		13	13	12	20
Oct		42	27	30		33	33	29	30
Nov		55	60	61		59	59	61	61
Dec			76	66		71	71	71	66
Totals	0	373	167	495	138	443	443	453	434

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Water Usage Baseline

Baseline Units: gallons

Account #(s): 10403740013

Meter #(s):

Total Monthly Water Usage (gallons)									
Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan			6,683	4,381		5,532	5,532	5,532	4,381
Feb		3,672	6,169	3,932		4,591	4,591	5,051	3,932
Mar		3,877	6,464	4,794		5,045	5,045	5,629	4,794
Apr		3,621	6,000	5,000		4,874	4,874	5,500	5,000
May		5,540		5,325		5,433	5,433	5,325	5,325
Jun		6,190		5,238		5,714	5,714	5,238	5,238
Jul		9,640		5,626		7,633	7,633	5,626	5,626
Aug		11,689		5,780		8,735	8,735	5,780	5,780
Sep		8,814		6,271		7,543	7,543	6,271	6,271
Oct		7,614	3,263	6,831		5,903	5,903	5,047	6,831
Nov		6,525	4,170			5,348	5,348	5,348	4,170
Dec		6,478	4,627			5,553	5,553	5,553	4,627
Totals	0	73,660	37,376	53,178	0	71,904	71,904	65,900	61,975

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 17-CSU Warehouse

Electric Usage Baseline

Baseline Units: kWh

Account #(s): 8000856838

Meter #(s): 2351236

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		2,465		2,567	1,790	2,274	2,274	2,179	1,790
Feb		2,241		2,335	1,832	2,136	2,136	2,084	1,832
Mar		2,566		2,250	2,090	2,302	2,302	2,170	2,090
Apr		2,160		1,966		2,063	2,063	1,966	1,966
May		2,200		1,946		2,073	2,073	1,946	1,946
Jun		2,258		1,840		2,049	2,049	1,840	1,840
Jul		2,691		2,203		2,447	2,447	2,203	2,203
Aug		2,430		2,362		2,396	2,396	2,362	2,362
Sep		2,342	2,214	2,109		2,222	2,222	2,162	2,109
Oct		2,627	2,428	2,005		2,353	2,353	2,217	2,005
Nov		2,623	2,531	2,231		2,462	2,462	2,381	2,231
Dec			2,544	2,143		2,344	2,344	2,344	2,143
Totals	0	26,603	9,717	25,957	5,712	27,121	27,121	25,854	24,517

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Natural Gas Usage Baseline

Baseline Units: dth

Account #(s): 53-3441672-9

Meter #(s): 391242

Total Monthly Natural Gas Usage (dth)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		55		48	43	49	49	46	43
Feb		46		40	36	41	41	38	36
Mar		43		25	38	35	35	32	38
Apr		17		12		15	15	12	12
May		9		7		8	8	7	7
Jun		5		3		4	4	3	3
Jul		5		3		4	4	3	3
Aug		4		3		4	4	3	3
Sep		5	4	3		4	4	4	3
Oct		20	5	12		12	12	9	12
Nov		41	29	32		34	34	31	32
Dec			43	43		43	43	43	43
Totals	0	250	81	231	117	253	253	231	235

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Water Usage Baseline

Baseline Units: gallons

Account #(s): 10403741014

Meter #(s):

Total Monthly Water Usage (gallons)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan			804	998		901	901	901	998
Feb		2,754	949	983		1,562	1,562	966	983
Mar		1,899	741	723		1,121	1,121	732	723
Apr		1,034	500	500		678	678	500	500
May		678		501		590	590	501	501
Jun		476		476		476	476	476	476
Jul		502		511		507	507	511	511
Aug		508	525	525		519	519	525	525
Sep		514	520	847		627	627	684	847
Oct		544	544	1,051		713	713	798	1,051
Nov		466	809	1,625		967	967	1,217	1,625
Dec		463	925	1,908		1,099	1,099	1,417	1,908
Totals	0	9,838	6,317	10,648	0	9,760	9,760	9,228	10,648

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 20-Tri County Health

Electric Usage Baseline

Baseline Units: kWh
Account #(s): 4000225125
Meter #(s): 25086T

Total Monthly Electric Usage (kWh)									
Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		5,731		5,684	5,817	5,744	5,744	5,751	5,817
Feb		5,597		5,125	4,981	5,234	5,234	5,053	4,981
Mar		6,181		5,637	5,382	5,733	5,733	5,510	5,382
Apr		6,516		6,202		6,359	6,359	6,202	6,202
May		8,182		7,566		7,874	7,874	7,566	7,566
Jun		9,584		8,398		8,991	8,991	8,398	8,398
Jul		10,986		9,260		10,123	10,123	9,260	9,260
Aug		10,491		9,024		9,758	9,758	9,024	9,024
Sep		8,621	8,130	7,348		8,033	8,033	7,739	7,348
Oct		7,017	6,705	6,369		6,697	6,697	6,537	6,369
Nov		6,041	5,563	5,976		5,860	5,860	5,770	5,976
Dec			5,623	6,057		5,840	5,840	5,840	6,057
Totals	0	84,947	26,021	82,646	16,180	86,246	86,246	82,650	82,380

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Electric Demand Baseline

Baseline Units: kW
Account #(s): 4000225125
Meter #(s): 25086T

Total Monthly Electric Demand (kW)									
Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		20		23	19	21	21	21	19
Feb		20		20	19	20	20	20	19
Mar		20		20	19	20	20	20	19
Apr		26		26	20	24	24	23	20
May		31		35		33	33	35	35
Jun		34		35		35	35	35	35
Jul		34		28		31	31	28	28
Aug		34		32		33	33	32	32
Sep		34	31	32		32	32	32	32
Oct		19	22	27		23	23	25	27
Nov		20	20	22		21	21	21	22
Dec		20	20	19		20	20	20	19
Totals	0	312	93	319	77	313	313	312	307

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Natural Gas Usage Baseline

Baseline Units: dth
Account #(s): 53-3441672-9
Meter #(s): 298402

Total Monthly Natural Gas Usage (dth)									
Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		88		83	75	82	82	79	75
Feb		71		66	50	62	62	58	50
Mar		59		34	45	46	46	40	45
Apr		25		19		22	22	19	19
May		11		14		13	13	14	14
Jun		6		6		6	6	6	6
Jul		7		5		6	6	5	5
Aug		7		4		6	6	4	4
Sep		10	7	6		8	8	7	6
Oct		36	20	20		25	25	20	20
Nov		59	49	49		52	52	49	49
Dec			76	76		76	76	76	76
Totals	0	379	152	382	170	404	404	377	369

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Water Usage Baseline

Baseline Units: gallons

Account #(s): 01000048570, 01000048570

Meter #(s):

Total Monthly Water Usage (gallons)									
Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan			3,386	2,752	1,722	2,620	2,620	2,237	1,722
Feb			3,339	1,198	1,556	2,031	2,031	1,377	1,556
Mar		1,000	1,802	1,703		1,502	1,502	1,753	1,703
Apr		968	3,049	1,974		1,997	1,997	2,512	1,974
May		1,508	2,271	2,040		1,940	1,940	2,156	2,040
Jun		1,630	645	1,648		1,308	1,308	1,147	1,648
Jul		2,707	2,351	3,388		2,815	2,815	2,870	3,388
Aug		2,957	3,570	3,388		3,305	3,305	3,479	3,388
Sep		1,957	2,234	1,648		1,946	1,946	1,941	1,648
Oct		3,725	2,990	3,407		3,374	3,374	3,199	3,407
Nov		3,106	1,624	1,648		2,126	2,126	1,636	1,648
Dec		1,319	341			830	830	830	341
Totals	0	20,877	27,602	24,794	3,278	25,794	25,794	25,137	24,463

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 23-Altura Plaza Building

Electric Usage Baseline

Baseline Units: kWh
Account #(s): 9002393124
Meter #(s): 31141T

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		136,358		121,640	121,594	121,594	126,531	121,617	121,594
Feb		121,328		112,652	103,244	103,244	112,408	107,948	103,244
Mar		120,842		115,320	112,618	112,618	116,260	113,969	112,618
Apr		108,257		112,883		112,883	110,570	112,883	112,883
May		117,060		120,411		120,411	118,736	120,411	120,411
Jun		121,281		122,653		122,653	121,967	122,653	122,653
Jul		134,723		139,482		139,482	137,103	139,482	139,482
Aug		125,370		138,135		138,135	131,753	138,135	138,135
Sep		109,073	113,074	126,767		126,767	116,305	119,921	126,767
Oct		99,878	107,998	120,855		120,855	109,577	114,427	120,855
Nov		98,443	108,126	119,468		119,468	108,679	113,797	119,468
Dec			116,975	126,428		126,428	121,702	121,702	126,428
Totals	0	1,292,613	446,173	1,476,694	337,456	1,464,538	1,431,591	1,446,945	1,464,538

The CEA Baseline is the most recent twelve months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Electric Demand Baseline

Baseline Units: kW
Account #(s): 9002393124
Meter #(s): 31141T

Total Monthly Electric Demand (kW)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		280		272	272	272	275	272	272
Feb		260		276	272	272	269	274	272
Mar		264		272	228	228	255	250	228
Apr		288		272	276	276	279	274	276
May		288		288		288	288	288	288
Jun		280		324		324	302	324	324
Jul		296		344		344	320	344	344
Aug		292		312		312	302	312	312
Sep		276	304	308		308	296	306	308
Oct		252	268	320		320	280	294	320
Nov		252	272	320		320	281	296	320
Dec		252	252	272		272	259	262	272
Totals	0	3,280	1,096	3,580	1,048	3,536	3,406	3,496	3,536

The CEA Baseline is the most recent twelve months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Natural Gas Usage Baseline

Baseline Units: dth
Account #(s): !Acct No.
Meter #(s): 601275967

Total Monthly Natural Gas Usage (dth)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		489	495	1,816		1,816	933	1,156	1,816
Feb			1,083	1,167		1,167	1,125	1,125	1,167
Mar		477		516		516	497	516	516
Apr		269		501		501	385	501	501
May		194		415		415	305	415	415
Jun		134		370		370	252	370	370
Jul		156		453		453	305	453	453
Aug		190	477	630		630	432	554	630
Sep		124	809	753		753	562	781	753
Oct		301	923	1,490		1,490	905	1,207	1,490
Nov		492	1,094	1,833		1,833	1,140	1,464	1,833
Dec	476	501	1,301			1,301	759	901	1,301
Totals	476	3,327	6,182	9,944	0	11,245	7,600	9,443	11,245

The CEA Baseline is the most recent twelve months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Water Usage Baseline

Baseline Units: gallons
Account #(s): 20703-16332
Meter #(s): 40390840

Total Monthly Water Usage (gallons)									
Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan			110,310	231,312		231,312	170,811	170,811	231,312
Feb		93,803	159,457	188,690		188,690	147,317	174,074	188,690
Mar		111,548	244,963	157,555		157,555	171,355	201,259	157,555
Apr		137,177	240,402	247,231		247,231	208,270	243,817	247,231
May		170,500	244,036	322,300		322,300	245,612	283,168	322,300
Jun		219,529		347,233		347,233	283,381	347,233	347,233
Jul		283,367		387,367		387,367	335,367	387,367	387,367
Aug		300,303	259,742	459,150		459,150	339,732	359,446	459,150
Sep		235,831	224,684	414,267		414,267	291,594	319,476	414,267
Oct		156,452	212,109	361,683		361,683	243,415	286,896	361,683
Nov		114,888	215,586	318,155		318,155	216,210	266,871	318,155
Dec		108,463	196,791			196,791	152,627	152,627	196,791
Totals	0	1,931,861	2,108,080	3,434,943	0	3,631,734	2,805,691	3,193,045	3,631,734

The CEA Baseline is the most recent twelve months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 24-Centrepoint Plaza

Electric Usage Baseline

Baseline Units: kWh
Account #(s): 1503487587
Meter #(s): 22021T

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan					260,048	260,048	260,048	260,048	260,048
Feb				571,192	230,963	401,078	401,078	401,078	230,963
Mar				270,714	252,724	261,719	261,719	261,719	252,724
Apr				215,531		215,531	215,531	215,531	215,531
May				211,119		211,119	211,119	211,119	211,119
Jun		194,897		213,078		203,988	203,988	213,078	213,078
Jul		223,186		224,479		223,833	223,833	224,479	224,479
Aug		215,876		222,248		219,062	219,062	222,248	222,248
Sep		195,671		210,752		203,212	203,212	210,752	210,752
Oct		232,614		215,706		224,160	224,160	215,706	215,706
Nov				230,257		230,257	230,257	230,257	230,257
Dec				256,230		256,230	256,230	256,230	256,230
Totals	0	1,062,244	0	2,841,306	743,735	2,910,237	2,910,237	2,922,245	2,743,135

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Electric Demand Baseline

Baseline Units: kW
Account #(s): 1503487587
Meter #(s): 22021T

Total Monthly Electric Demand (kW)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan				645	641	643	643	643	641
Feb				615	605	610	610	610	605
Mar				578	580	579	579	579	580
Apr				578		578	578	578	578
May		495		578		537	537	578	578
Jun		670		617		644	644	617	617
Jul		573		625		599	599	625	625
Aug		673		581		627	627	581	581
Sep		526		578		552	552	578	578
Oct		542		532		537	537	532	532
Nov		552		627		590	590	627	627
Dec				654		654	654	654	654
Totals	0	4,031	0	7,208	1,826	7,150	7,150	7,202	7,196

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Natural Gas Usage Baseline

Baseline Units: dth
Account #(s): 53-3441672-9
Meter #(s): 1309638

Total Monthly Natural Gas Usage (dth)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan					34	34	34	34	34
Feb				23	29	26	26	26	29
Mar				17	29	23	23	23	29
Apr				15		15	15	15	15
May				16		16	16	16	16
Jun		12		12		12	12	12	12
Jul		13		13		13	13	13	13
Aug		18		14		16	16	14	14
Sep		29		14		22	22	14	14
Oct		61		15		38	38	15	15
Nov				16		16	16	16	16
Dec				17		17	17	17	17
Totals	0	133	0	172	92	248	248	215	224

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Water Usage Baseline

Baseline Units: gallons

Account #(s): 199313-132082

Meter #(s):

Total Monthly Water Usage (gallons)									
Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan			68,683	116,409		116,409	92,546	92,546	116,409
Feb			74,489	121,020		121,020	97,755	97,755	121,020
Mar			83,309	127,429		127,429	105,369	105,369	127,429
Apr			113,574	217,067		217,067	165,321	165,321	217,067
May			189,084	450,652		450,652	319,868	319,868	450,652
Jun			309,858	608,281		608,281	459,070	459,070	608,281
Jul			560,076	767,500		767,500	663,788	663,788	767,500
Aug			734,000	847,328		847,328	790,664	790,664	847,328
Sep		318,644	760,397	677,306		677,306	585,449	718,852	677,306
Oct		166,536	589,437	354,273		354,273	370,082	471,855	354,273
Nov		70,656	225,037	156,870		156,870	150,854	190,954	156,870
Dec		63,393	114,772			114,772	89,083	89,083	114,772
Totals	0	619,229	3,822,716	4,444,135	0	4,558,907	3,889,849	4,165,125	4,558,907

The CEA Baseline is most recent 12 Months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Water Usage Baseline

Baseline Units: gallons
Account #(s): 1041
Meter #(s):

Total Monthly Water Usage (gallons)									
Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		124,000	116,194	99,923		99,923	113,372	108,059	99,923
Feb		102,933	61,419	147,319		147,319	103,890	104,369	147,319
Mar		213,352	118,887	187,883		187,883	173,374	153,385	187,883
Apr		176,442	108,357	181,875		181,875	155,558	145,116	181,875
May		136,273	128,820			128,820	132,547	132,547	128,820
Jun		210,771	110,323	123,600		123,600	148,231	116,962	123,600
Jul		122,229	144,000	137,541		137,541	134,590	140,771	137,541
Aug		140,357	130,250	206,059		206,059	158,889	168,155	206,059
Sep		126,043	123,750	135,714		135,714	128,502	129,732	135,714
Oct		86,800	142,000	200,571		200,571	143,124	171,286	200,571
Nov		94,800	122,667	133,714		133,714	117,060	128,191	133,714
Dec			72,333	168,000		168,000	120,167	120,167	168,000
Totals	0	1,534,000	1,379,000	1,722,199	0	1,851,019	1,629,304	1,618,740	1,851,019

The CEA Baseline is the most recent twelve months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 35-ACJC Courthouse

Electric Usage Baseline

Baseline Units: kWh
Account #(s): 3002636248
Meter #(s): 44203T (old meter 12368T)

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		179,898		200,878	202,551	202,551	194,442	201,715	202,551
Feb		164,296		202,969	172,659	172,659	179,975	187,814	172,659
Mar				234,751		234,751	234,751	234,751	234,751
Apr				234,674		234,674	234,674	234,674	234,674
May		197,796		248,888		248,888	223,342	248,888	248,888
Jun		209,448		247,557		247,557	228,503	247,557	247,557
Jul		231,635		293,663		293,663	262,649	293,663	293,663
Aug		239,517	314,971	276,365		276,365	276,951	295,668	276,365
Sep		227,389		228,143		228,143	227,766	228,143	228,143
Oct		205,013		214,985		214,985	209,999	214,985	214,985
Nov		183,400	202,782	201,979		201,979	196,054	202,381	201,979
Dec			193,783	199,199		199,199	196,491	196,491	199,199
Totals	0	1,838,392	711,536	2,784,051	375,210	2,755,414	2,665,597	2,786,730	2,755,414

The CEA Baseline is the most recent 12 months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Electric Demand Baseline

Baseline Units: kW
Account #(s): 3002636248
Meter #(s): 44203T (old meter 12368T)

Total Monthly Electric Demand (kW)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		411		509	514	514	478	512	514
Feb		430		489	513	513	477	501	513
Mar		432		492	532	532	485	512	532
Apr		422		491		491	457	491	491
May		509		504		504	507	504	504
Jun		478		540		540	509	540	540
Jul		564		569		569	567	569	569
Aug		551	580	544		544	558	562	544
Sep		553	522	539		539	538	531	539
Oct		517		479		479	498	479	479
Nov		532	504	526		526	521	515	526
Dec		532	435	489		489	485	462	489
Totals	0	5,931	2,041	6,171	1,559	6,240	6,080	6,178	6,240

The CEA Baseline is the most recent 12 months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Natural Gas Usage Baseline

Baseline Units: dth
Account #(s): !Acct No.
Meter #(s): 405046133

Total Monthly Natural Gas Usage (dth)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		691	677	968		968	779	823	968
Feb			762	887		887	825	825	887
Mar				754		754	754	754	754
Apr		374		671		671	523	671	671
May		340		456		456	398	456	456
Jun		90		402		402	246	402	402
Jul		44		273		273	159	273	273
Aug		164	194	371		371	243	283	371
Sep		366	525	387		387	426	456	387
Oct		574	659	602		602	612	631	602
Nov		609	816	677		677	701	747	677
Dec	655	702	952	832		832	785	892	832
Totals	655	3,954	4,585	7,280	0	7,280	6,451	7,213	7,280

The CEA Baseline is the most recent 12 months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 13500 E. Fremont

Water Usage Baseline

Baseline Units: gallons
Account #(s): 1124
Meter #(s):

Total Monthly Water Usage (gallons)								
Month	2001	2002	2003	2004	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		325,615		425,622	425,622	375,619	425,622	425,622
Feb		295,965		514,533	514,533	405,249	514,533	514,533
Mar		317,197		565,324	565,324	441,261	565,324	565,324
Apr		312,337		563,143	563,143	437,740	563,143	563,143
May		302,100		383,824	383,824	342,962	383,824	383,824
Jun		317,550		486,176	486,176	401,863	486,176	486,176
Jul		325,342		667,161	667,161	496,252	667,161	667,161
Aug		388,134	1,008,665	537,484	773,075	644,761	773,075	537,484
Sep		428,044	838,190	679,355	758,773	648,530	758,773	679,355
Oct		280,975	840,217	538,909	689,563	553,367	689,563	538,909
Nov		203,950	825,881	409,091	617,486	479,641	617,486	409,091
Dec			783,212		783,212	783,212	783,212	783,212
Totals	0	3,497,209	4,296,165	5,770,622	7,227,892	6,010,457	7,227,892	6,553,834

The CEA Baseline is the Average of the last two years data received.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 36-ACJC Detention Center

Electric Usage Baseline

Baseline Units: kWh

Account #(s): 4002636224, 8002636236

Meter #(s): 14207T, 76942S

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		452,856		452,687	453,980	453,980	453,174	453,334	453,980
Feb		401,573		426,998	411,708	411,708	413,426	419,353	411,708
Mar				464,851		464,851	464,851	464,851	464,851
Apr				449,165		449,165	449,165	449,165	449,165
May		445,283		468,214		468,214	456,749	468,214	468,214
Jun		456,242		466,091		466,091	461,167	466,091	466,091
Jul		520,313		503,173		503,173	511,743	503,173	503,173
Aug		503,902	481,523	513,825		513,825	499,750	497,674	513,825
Sep		461,274		468,494		468,494	464,884	468,494	468,494
Oct		445,775		462,990		462,990	454,383	462,990	462,990
Nov		415,968	448,554	433,440		433,440	432,654	440,997	433,440
Dec			448,503	422,045		422,045	435,274	435,274	422,045
Totals	0	4,103,186	1,378,580	5,531,973	865,688	5,517,976	5,497,220	5,529,610	5,517,976

The CEA Baseline is the most recent 12 months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Electric Demand Baseline

Baseline Units: kW

Account #(s): 4002636224, 8002636236

Meter #(s): 14207T, 76942S

Total Monthly Electric Demand (kW)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		726		722	728	728	725	725	728
Feb		708		716	731	731	718	724	731
Mar		737		773	747	747	752	760	747
Apr		754		779		779	767	779	779
May		762		833		833	798	833	833
Jun		856		888		888	872	888	888
Jul		898		906		906	902	906	906
Aug		924	909	857		857	897	883	857
Sep		865	851	874		874	863	863	874
Oct		779		769		769	774	769	769
Nov		698	786	757		757	747	772	757
Dec		698	715	726		726	713	721	726
Totals	0	9,405	3,261	9,600	2,206	9,595	9,528	9,623	9,595

The CEA Baseline is the most recent 12 months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Natural Gas Usage Baseline

Baseline Units: dth

Account #(s): 54-3441672-9

Meter #(s): 1353953, 0067271401 (old meter 304832582), 0067893101 (old meter 903992823)

Total Monthly Natural Gas Usage (dth)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		3,792	3,119	3,420	2,216	3,137	3,137	2,818	2,978
Feb			3,166	3,310	1,714	2,730	2,730	2,512	2,621
Mar		3,807		2,765	1,846	2,806	2,806	2,306	2,556
Apr		2,324		2,617		2,471	2,471	2,617	2,617
May		1,999		1,928		1,964	1,964	1,928	1,928
Jun				1,768		1,768	1,768	1,768	1,768
Jul				1,359		1,359	1,359	1,359	1,359
Aug			1,059	1,595		1,327	1,327	1,327	1,595
Sep		1,506	1,734	1,760		1,667	1,667	1,747	1,760
Oct		3,100	2,090	2,218		2,469	2,469	2,154	2,218
Nov		3,180	2,635	2,918		2,911	2,911	2,777	2,918
Dec	3,194	3,404	3,197	3,360		3,289	3,289	3,279	3,360
Totals	3,194	23,112	17,000	29,018	5,776	27,898	27,898	26,592	27,678

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 13500 E. Fremont

Water Usage Baseline

Baseline Units: gallons
Account #(s): 1124
Meter #(s):

Total Monthly Water Usage (gallons)

Month	2001	2002	2003	2004	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		2,630,600		2,756,486	2,756,486	2,693,543	2,756,486	2,756,486
Feb		2,492,029		4,021,000	4,021,000	3,256,515	4,021,000	4,021,000
Mar		2,700,215		4,314,714	4,314,714	3,507,465	4,314,714	4,314,714
Apr		3,092,762		4,984,286	4,984,286	4,038,524	4,984,286	4,984,286
May		3,345,929		3,368,529	3,368,529	3,357,229	3,368,529	3,368,529
Jun		3,838,466		4,151,471	4,151,471	3,994,969	4,151,471	4,151,471
Jul		4,008,319		4,564,677	4,564,677	4,286,498	4,564,677	4,564,677
Aug		3,534,581	4,057,744	4,210,161	4,210,161	3,934,162	4,133,953	4,210,161
Sep		2,793,990	3,908,260	5,095,161	5,095,161	3,932,470	4,501,711	5,095,161
Oct		2,916,460	3,440,068	4,572,727	4,572,727	3,643,085	4,006,398	4,572,727
Nov			3,143,869	3,977,273	3,977,273	3,560,571	3,560,571	3,977,273
Dec			3,462,680	3,475,000	3,475,000	3,468,840	3,468,840	3,475,000
Totals	0	31,353,351	18,012,621	49,491,485	49,491,485	43,673,871	47,832,636	49,491,485

The CEA Baseline is the Most Recent 12 Months data received.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 37-ACJC Administrative II

Electric Usage Baseline

Baseline Units: kWh
Account #(s): 7002636152
Meter #(s): 41435T (old meter 74910A)

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		157,715		152,791	149,668	153,391	153,391	151,230	149,668
Feb		125,628		145,204	123,955	131,596	131,596	134,580	123,955
Mar		143,495		163,857	137,823	148,392	148,392	150,840	137,823
Apr		164,500		166,962		165,731	165,731	166,962	166,962
May		178,334		183,024		180,679	180,679	183,024	183,024
Jun		194,898		185,588		190,243	190,243	185,588	185,588
Jul		213,389		204,313		208,851	208,851	204,313	204,313
Aug		202,560	211,383	202,649		205,531	205,531	207,016	202,649
Sep		188,637	182,508	187,481		186,209	186,209	184,995	187,481
Oct		164,921	172,601	170,057		169,193	169,193	171,329	170,057
Nov		147,778	151,850	153,399		151,009	151,009	152,625	153,399
Dec			154,078	152,731		153,405	153,405	153,405	152,731
Totals	0	1,881,855	872,420	2,068,056	411,446	2,044,230	2,044,230	2,045,907	2,017,650

The CEA Baseline is Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Electric Demand Baseline

Baseline Units: kW
Account #(s): 7002636152
Meter #(s): 41435T

Total Monthly Electric Demand (kW)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		398		322	406	375	375	364	406
Feb		384		336	403	374	374	370	403
Mar		341		358	403	367	367	381	403
Apr		348		362	403	371	371	383	403
May		350		382		366	366	382	382
Jun		451		396		424	424	396	396
Jul		451		403		427	427	403	403
Aug		396	463	398		419	419	431	398
Sep		451	466	389		435	435	428	389
Oct		451	374	389		405	405	382	389
Nov		451	370	389		403	403	380	389
Dec		451	334	389		391	391	362	389
Totals	0	4,923	2,007	4,513	1,615	4,757	4,757	4,662	4,750

The CEA Baseline is Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Natural Gas Usage Baseline

Baseline Units: therms
Account #(s): 53-3441672-9
Meter #(s): FC24679

Total Monthly Natural Gas Usage (therms)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		3,340		2,472	3,292	3,292	3,035	2,882	3,292
Feb		2,957		2,029	2,623	2,623	2,536	2,326	2,623
Mar		2,939		1,907	2,661	2,661	2,502	2,284	2,661
Apr		1,835		1,611		1,611	1,723	1,611	1,611
May		1,365		1,342		1,342	1,354	1,342	1,342
Jun		541		773		773	657	773	773
Jul		163		650		650	407	650	650
Aug		214	422	841		841	492	632	841
Sep		161	932	897		897	663	915	897
Oct		1,114	1,500	977		977	1,197	1,239	977
Nov		2,623	1,734	2,320		2,320	2,226	2,027	2,320
Dec			2,366	3,238		3,238	2,802	2,802	3,238
Totals	0	17,252	6,954	19,057	8,576	21,225	19,594	19,483	21,225

The CEA Baseline is the most recent 12 months data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: Administration II

Water Usage Baseline

Baseline Units: gallons
Account #(s): 1124
Meter #(s):

Total Monthly Water Usage (gallons)								
Month	2001	2002	2003	2004	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan		61,118		40,216	50,667	50,667	40,216	40,216
Feb		56,581		68,267	62,424	62,424	68,267	68,267
Mar		69,308		66,305	67,807	67,807	66,305	66,305
Apr		73,568		75,429	74,499	74,499	75,429	75,429
May		54,900		50,706	52,803	52,803	50,706	50,706
Jun		63,702		65,294	64,498	64,498	65,294	65,294
Jul		54,977		58,839	56,908	56,908	58,839	58,839
Aug		62,413	67,422	57,290	62,375	62,375	62,356	57,290
Sep		55,695	57,329	63,871	58,965	58,965	60,600	63,871
Oct		57,031	61,356	64,182	60,856	60,856	62,769	64,182
Nov			61,679	61,818	61,749	61,749	61,749	61,818
Dec			52,784	52,000	52,392	52,392	52,392	52,000
Totals	0	609,293	300,570	724,217	725,943	725,943	724,922	724,217

The CEA Baseline is Average All data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: ACJC Irrigation

Water Usage Baseline

Baseline Units: gallons
Account #(s): 1124
Meter #(s):

Total Monthly Water Usage (gallons)									
Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan				838		838	838	838	838
Feb				3,667		3,667	3,667	3,667	3,667
Mar				42,333		42,333	42,333	42,333	42,333
Apr				150,000		150,000	150,000	150,000	150,000
May				390,471		390,471	390,471	390,471	390,471
Jun				723,529		723,529	723,529	723,529	723,529
Jul		628,397		865,000		746,699	746,699	865,000	865,000
Aug		778,422	709,277	624,258		703,986	703,986	666,768	624,258
Sep		558,542	547,565	727,742		611,283	611,283	637,654	727,742
Oct		232,329	543,693	186,364		320,795	320,795	365,029	186,364
Nov		1,167	1,060	23,636		8,621	8,621	12,348	23,636
Dec			995	16,000		8,498	8,498	8,498	16,000
Totals	0	2,198,857	1,802,590	3,753,838	0	3,710,720	3,710,720	3,866,135	3,753,838

The CEA Baseline is the Average of All Data Collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Project: Arapahoe County
Building: 38-Sheriff/Coroner Facility

Electric Usage Baseline

Baseline Units: kWh
Account #(s): 7901224416
Meter #(s): 41579T

Total Monthly Electric Usage (kWh)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan					233,435	233,435	233,435	233,435	233,435
Feb				224,985	205,024	215,005	215,005	215,005	205,024
Mar				209,333	222,636	215,985	215,985	215,985	222,636
Apr				199,959		199,959	199,959	199,959	199,959
May				202,483		202,483	202,483	202,483	202,483
Jun				194,728		194,728	194,728	194,728	194,728
Jul				204,941		204,941	204,941	204,941	204,941
Aug				203,837		203,837	203,837	203,837	203,837
Sep			191,878	191,029		191,454	191,454	191,454	191,029
Oct				190,813		190,813	190,813	190,813	190,813
Nov				185,731		185,731	185,731	185,731	185,731
Dec				238,052		238,052	238,052	238,052	238,052
Totals	0	0	191,878	2,245,891	661,095	2,476,423	2,476,423	2,476,423	2,472,668

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Natural Gas Usage Baseline

Baseline Units: dth
Account #(s): 53-3441672-9
Meter #(s): 1454533

Total Monthly Natural Gas Usage (dth)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan				235	197	216	216	216	197
Feb				276	176	226	226	226	176
Mar				144	141	143	143	143	141
Apr				169	105	137	137	137	105
May				77		77	77	77	77
Jun				63		63	63	63	63
Jul				76		76	76	76	76
Aug		26		58		42	42	58	58
Sep		27	45	67		46	46	56	67
Oct			62	93		78	78	78	93
Nov		180		164		172	172	164	164
Dec		300	212	278		263	263	245	278
Totals	0	533	319	1,700	619	1,539	1,539	1,539	1,495

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

Water Usage Baseline

Baseline Units: gallons
Account #(s): 125775
Meter #(s):

Total Monthly Water Usage (gallons)

Month	2001	2002	2003	2004	2005	CEA Baseline	Average All Data	Average Last 2 Years	Most Recent 12 Months
Jan				93,314		93,314	93,314	93,314	93,314
Feb				121,580		121,580	121,580	121,580	121,580
Mar				97,456		97,456	97,456	97,456	97,456
Apr				131,250		131,250	131,250	131,250	131,250
May		593,982		406,200		500,091	500,091	406,200	406,200
Jun		574,821		540,733		557,777	557,777	540,733	540,733
Jul		593,982		669,949		631,966	631,966	669,949	669,949
Aug		593,982	610,438	567,118		590,513	590,513	588,778	567,118
Sep		558,054	486,563	365,571		470,063	470,063	426,067	365,571
Oct		420,714	218,000	199,571		279,428	279,428	208,786	199,571
Nov		98,314	112,258	138,857		116,476	116,476	125,558	138,857
Dec		83,257	96,142			89,700	89,700	89,700	96,142
Totals	0	3,517,106	1,523,401	3,331,599	0	3,679,614	3,679,614	3,499,371	3,427,741

The CEA Baseline is the Average of all data collected.

The initial Monitoring Baseline will be reviewed and determined before the start of monitoring.

3

Data on Present Facilities

Data important to energy use at Arapahoe County is covered in this section of the report. The data was collected on a building-by-building basis. Each building was visited by a survey team to collect data and to identify potential opportunities for energy cost reduction. Areas of concern encompassed factors that impact the usage of thermal energy and electrical energy. The survey considered building envelopes, heating, ventilation, and air conditioning (HVAC) equipment, lighting, miscellaneous equipment, process equipment, etc. Information was collected on building use schedules as well as HVAC equipment usage and lighting schedules. Available plans and HVAC control drawings for each building were reviewed to augment data collected during the survey work. In addition, energy usage information was assembled from a tabulation of utility bills. Table 3-1 shows the list of buildings involved in the report, the square feet of each building, as well as that building's page number in this section.

A complete inventory of the lighting fixtures is located in the Appendix. All of the EMCS' existing and proposed new operating schedules and temperature setpoints may be found in the Standards of Control located in the Appendix. All other information regarding building control, equipment, and operation is presented on the following pages.

Table 3-1

List of Buildings

Building Name	***Square Feet***	***Pg. #***
01 – Administration Building	140,263	3-3
12 – Arapahoe Plaza East Building	20,957	3-10
13 – Arapahoe Human Services	54,678	3-13
14 – Arapahoe Plaza West Building (County Court)	20,880	3-17
15 – Federal Warehouse	75,073	3-20
16 – CSU Extension Office	5,309	3-23
17 – CSU Warehouse	9,476	3-25
20 – Tri County Health	8,398	3-27
23 – Altura Plaza Building	74,675	3-29

Building Name	*Square Feet*	*Pg. #*
24 – Centrepoint Plaza	105,662	3-34
29 – Peoria Shops	25,008	3-36
35 – ACJC Courthouse	148,522	3-39
36 – ACJC Detention Center	291,955	3-44
37 – ACJC Administrative II	91,110	3-50
38 – Sheriff/Coroner Facility	125,055	3-54

01 - ADMINISTRATION BUILDING

I. General Description

A. Gross Square Footage: 140,263 Sq. Ft.

B. Year of Original Construction: 1977

C. General Construction Information: This four story building has exterior walls constructed of architectural concrete, batt insulation, and a 5/8" gypsum board interior. The exterior glass is typically single pane. The windows on the east side of the building have recently been retrofitted to double pane tinted windows. The roof is constructed of built-up roofing on top of 4 ½" rigid insulation, and pre-cast concrete.

D. Building Schedules: The building is occupied by the County staff and visitors between 6:00 am to 6:00 pm, Monday through Friday.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the Administration Building is general office equipment, which includes personal computers, printers, faxes, etc.

IV. Heating, Ventilation, and Air Conditioning

A. Heating System: The Administration Building produces heating hot water from three boilers located in the first floor mechanical room. The heating hot water is distributed to the heating coils located in the reheat boxes via two hot water pumps. The hot water system is piped so that the hot water return may be preheated by two heat recovery condensers located in the building's two water-cooled chillers. The heat recovery is achieved by taking the heat from the compressor and transferring it to the hot water loop via the chiller's condenser. Additionally, the heating plant provides hot water to a non-operational snow melting system that contains a heat exchanger with two circulating pumps, and a domestic hot water heat exchanger.

1. Hot Water Boilers: B-1 and B-2 are natural gas fired, atmospheric, hot water boilers. B-3 is an electric hot water boiler. The boilers supply hot water to the heating coils in the variable air volume reheat boxes, the snow melt system, and the domestic hot water heat exchanger. B-1 and B-2 operate throughout the entire year in order to provide hot water to the domestic hot water heat exchanger. B-3 is not used. Additional information about the hot water boilers is listed in the table below.

01 - Administration Building - Hot Water Boilers

Equip ID	Mfgr	Model	Fuel	Input MBH	Output MBH	Pressure (psig)	kW
B-1	Peerless	211-8-WTG	NG	1470	1178	N/A	N/A
B-2	Peerless	211-8-WTG	NG	1470	1178	N/A	N/A
B-3	Indeeco	56UWC-375-U-A	Elect.	N/A	N/A	160	375

N/A – The nameplate data was not available during the time of the survey.

2. Hot Water Pumps: The two hot water pumps (P-3 and P-4) are centrifugal, constant volume pumps located in mechanical room G90.1. Each pump circulates water through its own heat recovery condenser, the boilers, and the hot water coils. The pumps operate in parallel. The first pump comes on whenever the outside air temperature falls below 66ºF. The second pump comes on when the outside air temperature falls below 50ºF. Additional information about the hot water pumps is listed in the table below.

01 - Administration Building - Hot Water Pumps

	Pump Data				Motor Data				
Equip ID	Mfgr.	Model	GPM	Head (Ft.)	Mfgr.	Model	HP	Amps	Volts
P-3	Armstrong	2E 4030	160	N/A	Lincoln	N/A	7.5	20.4/10.2	230/460
P-4	Armstrong	2E 4030	160	N/A	Lincoln	N/A	7.5	20.4/10.2	230/460

N/A – The nameplate data was not available during the time of the survey.

B. Cooling System: The Administration Building utilizes two water-cooled, heat recovery chillers to cool the building. The chilled water is distributed to the chilled water coils, located in the air handling units, via two chilled water pumps.

1. Water-Cooled, Heat Recovery Chillers: Both chillers (CH-1 and CH-2) contain two sets of condensers, one for the cooling tower, and one for the heat recovery system. The condenser for the cooling tower rejects heat from the compressor through the cooling tower. During the heating season, the condenser for the heat recovery system preheats the hot water return by transferring the heat from the compressor to the hot water return. Both chillers operate when the chilled water pumps are turned on via a digital time clock. Additional information about the chillers is listed in the table below.

01 - Administration Building - Chillers

			Output Clg.		Compressor Data				
Equip ID	Mfgr	Model	Capacity (tons)	Refrigerant	Qty	Mfgr	Model	LRA	Volts
CH-1	Carrier	09RP0702B9-1	130	R-22	4	Totaline	6E275TL360	506	208/230
CH-2	Carrier	09RP0702B9-1	130	R-22	4	Totaline	6E275TL360	506	208/230

N/A – The nameplate data was not available during the time of the survey.

2. Chilled Water Pumps: The chilled water pumps (P-1 and P-2) are constant volume, centrifugal pumps located in Mechanical Room G90.1. Both pumps are scheduled to operate from 7:30am to 10pm, Monday through Friday, as governed by a digital time clock. Both pumps were on during the time of the survey. Additional information about the chilled water pumps is listed in the table below.

01 - Administration Building - Chilled Water Pumps

	Pump Data				Motor Data					
Equip ID	Mfgr	Model	GPM	Head (Ft.)	Mfgr	Model	HP	Amps	Volts	Location
P-1	Armstrong	AE 4030	420	80	Baldor	EN2333T	15	37/18.5	230/460	Mech. Rm G90.1
P-2	Armstrong	819359-002	420	80	Lincoln	N/A	15	40/20	230/460	Mech. Rm G90.1

N/A – The nameplate data was not available during the time of the survey.

3. Cooling Tower:

CT-1 is a single cell cooling tower with a propeller fan. This is an older unit, small due to the low wet bulb temperatures typical of Denver. The fill did not have a large amount of solids deposition. There is a water-treatment metering pump in place that administers biocides to control algae and bacteria growth. Also, an acid cleaner is used to control scaling resulting from the deposition to dissolved solids. The tower is mounted in a concrete walled courtyard that shields the tower from wind driven drift. The cooling tower is located outside while the tower basin is located in the basement. The cooling tower was found to be in very poor, decayed condition during the time of the survey. Water was flowing out the top of the tower onto the ground and into a drain. Additional information about the cooling tower is listed in the table below.

01 - Administration Building - Cooling Tower

Equip ID	Mfgr.	Model	Fan HP
CT-1	Marley	NC-8605	10

4. Condenser Water Pumps: The condenser water pumps (P-5 and P-6) are constant volume, centrifugal pumps located in Mechanical Room G90.1. Additional information about the condenser water pumps is listed in the table below.

01 - Administration Building - Condenser Water Pumps

	Pump Data				Motor Data					
Equip ID	Mfgr	Model	GPM	Head (Ft.)	Mfgr	Model	HP	Amps	Volts	Location
P-5	Armstrong	4E 4030	420	80	Lincoln	N/A	15	40/20	230/460	Mech. Rm G90.1
P-6	Armstrong	4E 4030	420	80	Lincoln	N/A	15	40/20	230/460	Mech. Rm G90.1

N/A – The nameplate data was not available during the time of the survey.

C. Distribution Systems:

1. AH-1 and AH-2: These are constant volume, single zone systems located in storage closets on the second floor. They condition the small hearing room (AH-1) and the large hearing room (AH-2) on the second floor. Each unit is equipped with a supply air fan, a chilled/hot water cooling/heating coil, and mixed air dampers. The cooling/heating coil has one supply line and one return line. The supply line is connected to both the building's hot water supply header and the chilled water supply header. The return line is connected to both the building's hot water return header and the chilled water return header. All four lines are controlled by two-way pneumatic valves which modulate to maintain the space temperature setpoint as governed by the space thermostat. The supply air fan on each unit is scheduled to operate from 7:30 am to 10 pm, Monday through Friday, as governed by the same digital time clock that controls the chilled water pumps. The mixed air dampers are controlled by electric actuators. Additional information that was obtained from the drawings is listed in the table below.

01 - Administration Building - Air Handling Units

			Supply Fan			
Equip ID	**Area Served**	**Mfgr**	**CFM**	**HP**	**Amps**	**Volts**
AH-1	Meeting Room	Trane	2,250	1.5	N/A	N/A
AH-2	Hearing Room	Trane	9,600	5	N/A	N/A

N/A – The nameplate data was not available during the time of the survey.

2. AH-3 and AH-4: These are variable air volume reheat systems that serve the majority of the building. Each unit is equipped with a supply air fan, chilled water cooling coil, mixed air dampers, and a return/exhaust air fan. The supply air fans have inlet guide vanes that have been locked to the 100% open position. Each supply fan is controlled by a variable frequency drive, which modulates to maintain the supply air duct static pressure setpoint. The conditioned air is distributed to the spaces via system and fan powered VAV boxes. The cooling coils are not equipped with control valves. The mixed air dampers are controlled by pneumatic actuators, which modulate to maintain the mixed air temperature setpoint. Each unit is equipped with an electric unit heater that is used to preheat the outside air. The electric unit heater on AH-3 was not working during the time of the survey. The supply air fan on each unit is scheduled to operate from 7:30 am to 10 pm, Monday through Friday, as governed by the same digital time clock that controls the chilled water pumps. The return/exhaust air fan does not have a variable frequency drive and runs constantly at full load during occupied periods.

01 - Administration Building - Air Handling Units

			Supply Fan				Return Fan			
Equip ID	Mfgr.	Model	CFM	HP	Amps	Volts	CFM	HP	Amps	Volts
AH-3	Carrier	39EH90	65000	75	184/92	230/460	N/A	10	N/A	N/A
AH-4	Carrier	39EH90	65000	75	184/92	230/460	N/A	10	N/A	N/A

N/A – The nameplate data was not available during the time of the survey.

3. Liebert Units: These units are direct expansion split systems, with electric heat, which serve the computer areas. These units operate 24 hours a day, seven days a week. The condensing units are located outside by the docking area. Additional information about these units is listed in the table below.

01 - Administration Building - Liebert Units

			Supply Fan				Compressor Fans				
Equip ID	Mfgr.	Model	CFM	HP	Amps	Volts	Qty	RLA	LRA	Volts	Location
Liebert-1	Liebert	FH245A-A00	N/A	7.5	11	460	2	17.8	99	N/A	G80.16
Liebert-2	Liebert	FH245A-A00	N/A	7.5	11	460	2	17.8	99	N/A	G80.16

N/A – The nameplate data was not available during the time of the survey.

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water:

1. The domestic hot water system utilizes a hot water heat exchanger to supply the building with domestic hot water. The heat exchanger is embedded in a domestic hot water storage tank. The heat exchanger has a pump that circulates hot water from the heating hot water system, as well as another pump to deliver the domestic hot water from the storage tank to the building. Additional information on these pumps is listed in the table below.

01 - Administration Building - DHW Pumps

	Pump Data				Motor Data					
Equip ID	Mfgr	Model	GPM	Head (Ft.)	Mfgr	Model	HP	Amps	Volts	Location
DHWP-1	Armstrong	N/A	N/A	N/A	N/A	N/A	1/6	3.6/1.75	115	Mech. Rm G90.1
HX Pump	B&G	M10532K10	N/A	N/A	N/A	N/A	1/4	3.6	115	Mech. Rm G90.1

N/A – The nameplate data was not available during the time of the survey.

B. Snow Melt System:

1. The snow melt system, which is currently non-operational, contains a heat exchanger, two circulation pumps, a three-way pneumatic valve that controls the flow to the snow melt areas, and a two-way pneumatic valve, which modulates the hot water flow from the boiler to maintain the hot water supply temperature to the snow melt zones.

VI. Water Usage

A. Overview: There are three primary modes of water use: sanitary, cooling tower makeup, and irrigation. Other minor uses include an ice machine, drinking water fountains, janitorial use, and boiler makeup water. All services share one meter which is read monthly. The owner installed a water meter to monitor irrigation usage before the 2005 irrigation season commenced.

There is significant public use (up to 1500 visitors per day per facilities staff) of this building as there is a motor vehicle license bureau that serves the public. The assumed length of each visit is less than ½ hour.

B. Plumbing Fixtures, general

The commodes are all flush-valve actuated, wall-mounted models with no markings to indicate gallons per flush. No leaks or maintenance problems were observed during the survey. The urinals are all flush-valve actuated, wall-mounted models with no markings to indicate gallons per flush. These units had a large, deep bowl with a large water spot, suggestive of a high usage fixture.

Lavatory faucets are primarily Chicago brand units in good condition. Measured flow rates through these faucets ranged from 1.75 to 2.5 gallons per minute (GPM), average: 2.2 GPM.

Each floor had two small kitchenettes with small stainless steel sinks and gooseneck faucets. There is a small residential type kitchen on the ground floor with a faucet and the Scotsman Ice Machine

Each floor has two janitorial closets with utility faucets.

01 – Administration Building– Plumbing Fixtures

Commodes:		Urinals	Faucets			
Flush Valve 1.6 GPF	Flush Valve 3.5 GPF	2.0 GPF	GPM average	Total Lavatory	Metered	Kitchen (break)
0	44	21	2.2	32	0	9

C. Modeling Notes: The commode and urinal flush rates are the expected flush rates given the apparent age of the units and the lack of identifying labels on the bowls and the fixtures. Given the staffing and visitor levels and normal frequency of use, and comparing the model to the bills, the actual water usage does not support the flush rates listed above. The billing reflects the use of 1.6 GPF commodes and 1 GPF urinals.

D. Cooling Tower Water Use:

General: Water usage in cooling towers results from evaporation, drift, and sump purging. Evaporative losses are necessary to the function of the tower: evaporation cools the water that is pumped from the condenser and this is how the heat from the building is pumped outside. Drift is the carrying of water droplets away from the tower by the action of the cooling tower fan and wind. Sump purging is necessary to reduce the accumulation of salts in the cooling tower

water system. Evaporation results in the concentration of salts (dissolved solids) in the water medium, reducing the ability of water to evaporate and resulting in the deposition of salts in the tower fill reducing the efficacy of the tower. The sump is purged periodically to reduce the total dissolved solids to maintain optimal water quality in the system.

E. Irrigation:

General: There are two large lawn areas served by impact rotor popup sprayers spaced 50 to 60 feet on center, staggered in a diamond pattern. Smaller areas are served with smaller rotor popup sprinklers and shrubs are served with popup sprinklers and/or a drip system. There are two Rainmaster brand digital timers that control the frequency, duration, and sequencing of the various zones. There are no automatic controls for sensing wind, soil moisture, or rainfall. Schedule is altered by the staff if rainfall occurs that is sufficient to moisten the lawn and irrigation is not needed and if the staff is present to do so. According to facilities staff there is little or no problem with vandalism.

Area Served: The grounds include 135,191 square feet (3.10 acres) total area, consisting primarily of temperate climate grass lawn area and shrubbery areas bordering walkways and parking lots and with several larger deciduous and evergreen trees.

Notes: The lawns are boarded by sloped areas, varying the exposure to sunlight. The irrigation system appears to be installed with inadequate regard to the variation in sun exposure resulting in south facing slopes showing drought stress before others areas.

12 - ARAPAHOE PLAZA EAST BUILDING

I. General Description

A. Gross Square Footage: 20,957 Sq. Ft.

B. Year of Original Construction: Unknown; Most recently remodeled 2001

C. General Construction Information: This one story building has exterior walls constructed of brick veneer, ¾" plywood, 4" R-11 batt insulation, and a 5/8" gypsum board interior. The windows are aluminum frame, double-paned with a tinted finish. No information is available for the roof.

D. Building Schedules: The building is occupied from 7:30 am to 5:00 pm, Monday through Friday. The custodial staff works from 4:00 pm to 12:30 am, Monday through Friday.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the Arapahoe Plaza East Building is general office equipment, which includes personal computers, printers, faxes, etc.

IV. Heating, Ventilation, and Air Conditioning

A. Heating System: The Arapahoe Plaza East Building receives heating hot water from the boiler system located in the Arapahoe Human Services Building. The heating hot water is distributed to the hot water heating coils located in the variable volume reheat boxes via two hot water pumps that are also located in the Arapahoe Human Services Building. Information about the boilers and hot water system is located in the Arapahoe Human Services Building section of this document.

B. Cooling System: The Arapahoe Plaza East Building receives chilled water from the Arapahoe Human Services Building. The chilled water is distributed to the chilled water cooling coils located in the air handling units. Information about the chillers and chilled water pumps is located in the Arapahoe Human Services Building section of this document.

C. Distributions Systems:

1. AHU-E1 and AHU-E2: These are variable air volume reheat systems that serve the entire East building. Each unit is equipped with a supply air fan, a chilled water cooling coil, mixed air dampers, and inlet guide vanes. The supply air volume is controlled by the inlet guide vanes, which modulate to maintain the supply air duct static pressure setpoint. The conditioned air is distributed to the spaces via fan powered VAV boxes. The chilled water cooling coil is controlled by either a two-way or three-

way pneumatic valve which modulates to control the discharge air temperature setpoint. The mixed air dampers are controlled by pneumatic actuators, which modulate to maintain mixed air temperature setpoint. There is also a hot water unit heater located in the mechanical room that preheats the mixed air. The supply air fan on each unit is scheduled to operate from 6 am to 10 pm on Monday through Friday, and 8 am to 4:30 pm on Saturday and Sunday as governed by a digital time clock and confirmed using run time loggers. Additional information about the air handling units is listed in the table below.

12 - Arapahoe Plaza East Building - Air Handling Units

			Supply Fan			
Equip ID	**Area Served**	**Mfgr**	**CFM**	**HP**	**Amps**	**Volts**
AHU-E1	E. Bldg-Level 1	Trane	14,000	15	40.5-38/19	208-230/460
AHU-E2	E. Bldg-Level 2	Trane	15,000	15	40.5-38/19	208-230/460

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water:

1. Domestic hot water is produced by an electric hot water heater that is located in the Arapahoe Plaza East Building. Additional information about the electric hot water heater is listed in the table below.

12 - Arapahoe Plaza East Building - DHW Heaters

Equip ID	Mfgr	Gallons	kW	Volts
DHW-E1	N/A	20	15	208

N/A – The nameplate data was not available during the time of the survey.

B. Exhaust Fans:

1. There are multiple exhaust fans located on the roof which serve the restrooms.

VI. Water Use

A. Overview: The two modes of water use are sanitary service for the Arapahoe Plaza East Building and irrigation service for all three buildings on Arapahoe Plaza. Other minor uses include janitorial use and boiler makeup water. All services share one meter, and the meter is read monthly.

The services provided by the offices in this building draw visitors at a rate of 100 per day and it is assumed that the length of stay is ½ hour.

B. Plumbing Fixtures, general

There are a variety of commodes: flush gravity tank type and pressure assisted type (Sloan Flushmate ®) floor-mounted models with varying gallons per flush. No leaks or maintenance problems were observed during the survey. The urinals are all flush-valve actuated wall-mounted models with no markings to indicate

gallons per flush. Lavatory faucets are in good condition and have a metering valve that limit the amount of time of flow. The flow rates averaged 2 GPM. Each floor has a small kitchenette with stainless steel sinks and gooseneck faucets. Each floor has two janitorial closets with utility faucets.

12 - Arapahoe Plaza East– Plumbing Fixtures

Commodes:			Urinals	Faucets			
Tank 1.6 GPF	Tank 3.5 GPF	Flush Mate 1.6 GPF	2.0 GPFM	GPM average	Total Lavatory	Metered	Kitchen (break)
1	7	3	2	2	9	9	2

C. Irrigation:

General: There are several lawn areas served by popup sprinklers. There are two Rainmaster brand digital timers that control the frequency, duration, and sequencing of the various zones. There are no automatic controls for sensing wind, soil moisture, or rainfall. The schedule is altered by the staff if rainfall occurs that is sufficient to moisten the lawn and irrigation is not needed and if the staff is present to do so. There is little or no problem with vandalism.

Sidewalks intersect the irrigation areas, and many of these areas are narrow strips between the street and sidewalks. This configuration increases the potential for waste due to over-spray onto sidewalks and roadways. There is a 2-foot wide strip of grass between the north edge of the parking lot and the sidewalk that is difficult to water with out wasting water on to the parking lot.

13 - ARAPAHOE HUMAN SERVICES

I. General Description

A. Gross Square Footage: 54,678 Sq. Ft.

B. Year of Original Construction: Unknown

C. General Construction Information: This three story building has exterior walls constructed of brick veneer, ¾" plywood, 4" R-11 batt insulation, and a 5/8" gypsum board interior. The windows are aluminum frame, double-paned with a tinted finish. No information is available for the roof.

D. Building Schedules: The majority of the building is occupied from 7:30 am to 5:00 pm, Monday through Friday. The sheriff substation is occupied 24 hours a day, seven days a week. The custodial staff works from 4:30 pm to 1:00 am, Monday through Friday.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the Arapahoe Human Services Building is general office equipment, which includes personal computers, printers, faxes, etc.

IV. Heating, Ventilation, and Air Conditioning

A. Heating Plant: The Arapahoe Human Services Building produces heating hot water from two boilers located in the basement mechanical room. The heating hot water is distributed to the heating coils located in the reheat boxes via two hot water pumps.

1. Hot Water Boilers: B-1 and B-2 are natural gas fired, atmospheric, hot water boilers that are located in the basement mechanical room. The boilers supply hot water to the heating coils in the variable air volume reheat boxes throughout the three Arapahoe Plaza buildings. Additional information about the boilers is listed in the table below.

13 - Arapahoe Human Services - Hot Water Boilers

Equip ID	Mfgr	Model	Fuel	Input MBH	Output MBH
B-1	Weil Mclain	LGB-1B	NG	2,210	1,790
B-2	Weil Mclain	LGB-1B	NG	2,210	1,790

2. Hot Water Pumps: The two hot water pumps (HWP-1 and HWP-1A) are constant volume, centrifugal pumps located in the basement mechanical room. HWP-1 and HWP-1A operate in parallel. Both pumps were off during the time of the survey. Additional information about the pumps is listed in the table below.

13 - Arapahoe Human Services - Hot Water Pumps

	Pump Data				Motor Data				
Equip ID	Mfgr	Model	GPM	Head (Ft.)	Mfgr	Model	HP	Amps	Volts
HWP-1	N/A	FE2510E2F1F2L6	300	76	Magnetek	LF1-841000	10	24/12	208-230/460
HWP-1A	N/A	FE2510E2F1F2L6	300	76	Magnetek	LF1-841000	10	24/12	208-230/460

N/A – The nameplate data was not available during the time of the survey.

B. Central Cooling Plant: The Arapahoe Human Services Building uses two chillers to cool the building. The chilled water is distributed to the chilled water coils, located in the air handling units, via two chilled water pumps per chiller.

1. Chillers: CH-E1 and CH-W1 are air-cooled chillers with 4 reciprocating compressors each. They are located on the east (CH-E1) and west (CH-W1) side of the Arapahoe Human Services Building above the parking garage. The chillers supply chilled water to all three Arapahoe Plaza buildings via four chilled water pumps. Additional information about the chillers is listed in the table below.

13 - Arapahoe Human Services - Chillers

Equip ID	Mfgr	Model	EWT (F)	LWT (F)	EAT (F)	Capacity (tons)	Max kW	Volts
CH-E1	Carrier	30GB150	60	40	105	140	190	460
CH-W1	Carrier	30GB175	60	40	105	160	220	460

2. Chilled Water Pumps: CWP-1, CWP-1A, CWP-2, and CWP-2A are constant volume, centrifugal chilled water pumps located in the parking garage. CWP-1 and CWP-1A circulate chilled water from chiller CH-W1 to the chilled water cooling coils in the west side of the Arapahoe Human Services building, and in the entire Arapahoe Plaza West Building. CWP-2 and CWP-2A circulate chilled water from chiller CH-E1 to the chilled water cooling coils in the east side of the Arapahoe Human Services Building, and the entire Arapahoe Plaza East Building. Additional information on these pumps is listed in the table below.

13 - Arapahoe Human Services - Chilled Water Pumps

	Pump Data				Motor Data				
Equip ID	Mfgr	Model	GPM	Head (Ft.)	Mfgr	Model	HP	Amps	Volts
CWP-1	N/A	N/A	205	45	N/A	N/A	7.5	19.2/9.6	230/460
CWP-1A	N/A	N/A	205	45	N/A	N/A	7.5	19.2/9.6	230/460
CWP-2	N/A	N/A	230	40	Magnetek	LF1-84050C	5	13/6.5	208-230/460
CWP-2A	N/A	N/A	230	40	Magnetek	LF1-84050C	5	13/6.5	208-230/460

N/A – The nameplate data was not available during the time of the survey.

C. Distributions Systems:

1. AHU-SE1, AHU-SE2, AHU-SW1, and AHU-SW2: These are variable air volume, reheat systems that serve the entire Arapahoe Human Services

Building. Each unit is equipped with a supply air fan, a chilled water cooling coil, mixed air dampers, and inlet guide vanes. The supply air volume is controlled by the inlet guide vanes, which modulate to maintain the supply air duct static pressure setpoint. The conditioned air is distributed to the spaces via fan powered VAV boxes. The chilled water cooling coil is controlled by either a two-way or three-way pneumatic valve which modulates to control the discharge air temperature setpoint. The mixed air dampers are controlled by pneumatic actuators, which modulate to maintain the mixed air temperature setpoint. There is also a hot water unit heater located in the mechanical room that preheats the mixed air. The supply air fan on each unit is governed by a stand-alone Johnson Controls System. The operating schedules programmed into the Johnson Controls System were inaccessible during the time of the survey. Additional information about the air handling units is listed in the table below.

13 - Arapahoe Human Services - Air Handling Units

			Supply Fan			
Equip ID	**Area Served**	**Mfgr**	**CFM**	**HP**	**Amps**	**Volts**
AHU-SE1	S. Bldg - E. 1st	Trane	12,000	15	40.5-38/19	208-230/460
AHU-SE2	S. Bldg - E. 2nd	Trane	15,000	15	40.5-38/19	208-230/460
AHU-SW1	S. Bldg - W. 1st	Trane	12,000	15	40.5-38/19	208-230/460
AHU-SW2	S. Bldg - W. 2nd	Trane	24,500	30	78/37	208-230/460

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water:

1. Domestic hot water is produced by electric hot water heaters that are located in the Arapahoe Human Services Building. Additional information about the electric hot water heaters is listed in the table below.

13 - Arapahoe Human Services - DHW Heaters

Equip ID	**Mfgr**	**Gallons**	**kW**	**Volts**
DHW-SW-1	N/A	20	15	208
DHW-SW-2	N/A	20	15	208

N/A – The nameplate data was not available during the time of the survey.

B. Air Compressor:

1. There is an air compressor located in the basement mechanical room. The compressor provides compressed air to the pneumatic controls located throughout the three Arapahoe Plaza buildings. Additional information about the air compressor is listed in the table below.

13 - Arapahoe Human Services - Air Compressor

Equip ID	Mfgr	No. of Motors	HP	Amps	Volts
Air Comp-1	N/A	2	2	5.6/2.8	230/460

N/A – The nameplate data was not available during the time of the survey.

C. Exhaust Fans:

1. There are multiple exhaust fans located on the roof which serve the restrooms.

VI. Water Usage

A. Overview: The primary mode of water use in the Human Service Building is for sanitary services. Other minor uses include janitorial uses and boiler makeup water. All services share one meter which is read monthly.

The services provided by the offices in this building draw visitors at a rate of 500 per day and it is assumed that the length of stay is ½ hour.

B. Plumbing Fixtures, general

There are a variety of commodes: flush gravity tank type and pressure assisted type (Sloan Flushmate ®) floor-mounted models with varying gallons per flush. No leaks or maintenance problems were observed. The urinals are all flush-valve actuated wall-mounted models with no markings to indicate gallons per flush. Lavatory faucets are good condition and have a metering valve that limit the amount of time of flow. The flow rates measured averaged approximately 2 GPM. There are several small kitchenettes with stainless steel sinks and gooseneck faucets. Each floor has two janitorial closets with utility faucets.

13 - Arapahoe Plaza Human Services – Plumbing Fixtures

Commodes:			Urinals	Faucets			
Tank 1.6 GPF	Tank 3.5 GPF	Flush Mate 1.6 GPF	2.0 GPF	GPM average	Total Lavatory	Metered	Kitchen (break)
0	9	10	5	2	11	11	5

14 - ARAPAHOE PLAZA WEST BUILDING (COUNTY COURT)

I. General Description

A. Gross Square Footage: 20,880 Sq. Ft.

B. Year of Original Construction: Unknown

C. General Construction Information: This one story building has exterior walls constructed of brick veneer, ¾" plywood, 4" R-11 batt insulation, and a 5/8" gypsum board interior. The windows are aluminum frame, double-paned with a tinted finish. No information is available for the roof.

D. Building Schedules: The building is occupied from 8:00 am to 5:00 pm, Monday through Friday. The custodial staff works from 4:00 pm to 12:30 am, Monday through Friday.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the Arapahoe Plaza West Building is general office equipment, which includes personal computers, printers, faxes, etc.

IV. Heating, Ventilation, and Air Conditioning

A. Heating System: The Arapahoe Plaza West Building receives heating hot water from the boilers in the Arapahoe Human Services Building. The heating hot water is distributed to the hot water heating coils located in the variable volume reheat boxes. Information about the boilers and hot water pumps is located in the Arapahoe Human Services Building section of this document.

B. Cooling System: The Arapahoe Plaza West Building receives chilled water from the Chiller (CH-W1) located by the Arapahoe Human Services Building. The chilled water is distributed to the chilled water cooling coils located in the air handling units via two chilled water pumps that are located in the parking garage. Information about the chillers and chilled water pumps is located in the Arapahoe Human Services section of this document.

C. Distributions Systems:

1. AHU-W1 and AHU-W2: These are variable air volume, reheat systems that serve the entire West building. Each unit is equipped with a supply air fan, a chilled water cooling coil, mixed air dampers, and inlet guide vanes. The supply air volume is controlled by the inlet guide vanes, which modulate to maintain the supply air duct static pressure setpoint. The conditioned air is distributed to the spaces via fan powered VAV boxes. The chilled water cooling coil is controlled by either a two-way or three-

way pneumatic valve which modulates to control the discharge air temperature setpoint. The mixed air dampers are controlled by pneumatic actuators, which modulate to maintain the mixed air temperature setpoint. There is also a hot water unit heater located in the mechanical room that preheats the mixed air. The supply air fan on each unit is scheduled to operate 24 hours a day on Monday through Friday, and 4 am to 6 pm on Saturday and Sunday, as governed by a digital time clock and confirmed using run time loggers. Additional information about the air handling units is listed in the table below.

14 - Arapahoe Plaza West Building - Air Handling Units

			Supply Fan			
Equip ID	**Area Served**	**Mfgr**	**CFM**	**HP**	**Amps**	**Volts**
AHU-W1	W. Bldg-Level 1	Trane	14,000	15	40.5-38/19	208-230/460
AHU-W2	W. Bldg-Level 2	Trane	14,000	15	40.6/20.3	230/460

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water:

1. Domestic hot water is produced by an electric hot water heater that is located in the Arapahoe Plaza West Building. Additional information about the electric hot water heater is listed in the table below.

14 - Arapahoe Plaza West Building - DHW Heaters

Equip ID	**Mfgr**	**Gallons**	**kW**	**Volts**
DHW-W1	N/A	20	15	208

N/A – The nameplate data was not available during the time of the survey.

B. Exhaust Fans:

1. There are multiple exhaust fans located on the roof which serve the restrooms.

VI. Water Use

A. Overview: The primary mode of water use in the Human Service Building is for sanitary services. Other minor uses include janitorial uses and boiler makeup water. All services share one meter which is read monthly.

The services provided by the offices in this building draw visitors at a rate of 500 per day, and it is assumed that the length of stay is ½ hour.

B. Plumbing Fixtures, general

There are a variety of commodes: flush gravity tank type and pressure assisted type (Sloan Flushmate ®) floor-mounted models with varying gallons per flush. No leaks or maintenance problems were observed. The urinals are all flush-valve actuated wall-mounted models with no markings to indicate gallons per flush. Lavatory faucets are good condition. The faucets for public use have metering valves that limit the amount of time of flow. The flow rates measured averaged

less than 2 GPM. There are several small kitchenettes with stainless steel sinks and gooseneck faucets. Each floor has two janitorial closets with utility faucets.

14 - Arapahoe Plaza West Building – Plumbing Fixtures

Commodes:			Urinals	Faucets			
Tank 1.6 GPF	Tank 3.5 GPF	Flush Mate 1.6 GPF	2.0 GPF	GPM average	Total Lavatory	Metered	Kitchen (break)
0	18	1	2	2	17	7	0

15 - FEDERAL WAREHOUSE

I. General Description

A. Gross Square Footage: 75,073 Sq. Ft.

B. Year of Original Construction: Unknown

C. General Construction Information: This one story building was an existing retail hardware store. No drawings are available for a detailed shell description; however, from the site visit, the exterior walls are constructed of brick veneer. The few windows are double-paned with a tinted finish. The roof appears to be constructed of built-up roofing on top of rigid insulation and pre-cast concrete.

D. Building Schedules: The building is occupied from 7:00 am to 4:30 pm, Monday through Friday.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the Federal Warehouse is voting poll equipment that is rarely used.

IV. Heating, Ventilation, and Air Conditioning

A. Heating System: The Federal Warehouse receives heating from natural gas fired rooftop units.

B. Cooling System: The Federal Warehouse receives cooling from direct expansion cooling coils in rooftop units.

C. Distribution Systems:

1. Rooftop Units: There are ten rooftop units that serve the Federal Warehouse. Each unit is equipped with a supply fan, a natural gas fired heating burner, a direct expansion cooling coil, and manual outside air dampers. Each rooftop unit, except for RTU-10, is controlled by a programmable thermostat. RTU-10 is controlled by a non-programmable thermostat. Additional information about the rooftop units is listed in the table below.

15 - Federal Warehouse – Rooftop Units

				Supply Fan				Compressor		
Equip ID	**Location**	**Mfgr**	**Model**	**CFM**	**HP**	**Amps**	**Volts**	**Qty**	**Amps**	**Volts**
RTU-1	SE Roof	Rheem	N/A	N/A	3	8.4/4.2	230/460	2	50	N/A
RTU-2	NE Roof	Rheem	N/A	N/A	3	8.4/4.2	230/460	2	50	N/A
RTU-3	NE Roof	Rheem	N/A	N/A	3	8.4/4.2	230/460	2	50	N/A
RTU-4	S Roof	Rheem	N/A	N/A	3	8.4/4.2	230/460	2	50	N/A
RTU-5	E Roof	Rheem	N/A	N/A	3	8.4/4.2	230/460	2	50	N/A

15 - Federal Warehouse – Rooftop Units

				Supply Fan				Compressor		
Equip ID	**Location**	**Mfgr**	**Model**	**CFM**	**HP**	**Amps**	**Volts**	**Qty**	**Amps**	**Volts**
RTU-6	N Roof	Rheem	N/A	N/A	3	8.4/4.2	230/460	2	50	N/A
RTU-7	SW Roof	Rheem	N/A	N/A	3	8.4/4.2	230/460	2	50	N/A
RTU-8	W Roof	Rheem	N/A	N/A	3	8.4/4.2	230/460	2	50	N/A
RTU-9	NW Roof	Rheem	N/A	N/A	3	8.4/4.2	230/460	2	50	N/A
RTU-10	SW Roof	Trane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A – The nameplate data was not available during the time of the survey.

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water:

1. There are two small domestic hot water heaters that serve the faucets in the restrooms which were inaccessible during the survey.

B. Dust Collector:

1. The dust collector was used for the shop area. It is currently not being used.

C. Exhaust Fans:

1. There are several exhaust fans located on the roof which serve the restrooms and shop areas.

VI. Water Use

A. Overview: Water uses in the Federal Warehouse Plaza are for irrigation and sanitary services. All services share one meter. The meter is read monthly.

This building is used as a venue for training staff and election workers so the sanitary water use in not easily determined.

B. Plumbing Fixtures, general

The restrooms used by trainees and voting management staff are outfitted with up-to-date water conserving fixtures.

Lavatory faucets are good condition and are hand operated fixtures running 2.5 GPM.

15 – Federal Warehouse – Plumbing Fixtures

Commodes:		Urinals		Faucets		
Tank 3.5	Flush Valve 1.6 GPF	1.0 GPF	2.0 GPF	GPM average	Total Lavatory	Metered
5	5	1	1	2.5	4	2

C. Irrigation:

General: There is one Rainmaster brand digital timer that controls the frequency, duration, and sequencing of the various zones. There are no automatic controls for sensing wind, soil moisture, or rainfall. Schedule is altered by the staff if rainfall occurs that is sufficient to moisten the lawn and irrigation is not needed, and if the staff is present to do so. There is little or no problem with vandalism.

Area Served: The grounds include 67,000 square feet (1.54 acres) total area, consisting primarily of temperate climate grass lawn area and shrubbery areas bordering walkways and parking lots and with several larger deciduous and evergreen trees. The lawn area is long and narrow, bordered by parking lots, roadways, and walkways, increasing the potential for waste from wind driven drift and misaligned spray heads.

16 - CSU EXTENSION OFFICE

I. General Description

A. Gross Square Footage: 5,309 Sq. Ft.

B. Year of Original Construction: 1960

C. General Construction Information: This is a one story office facility. No original drawings were recovered to determine building shell make up. Exterior walls have brick veneer and windows are single pane.

D. Building Schedules: The building is occupied from 8:00 am to 4:30 pm, Monday through Friday.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the CSU Extension Office is general office equipment, which includes personal computers, printers, faxes, etc.

IV. Heating, Ventilation, and Air Conditioning

A. Heating System: The CSU Extension Office receives heating from two natural gas fired air handling units.

B. Cooling System: The CSU Extension Office receives cooling from two direct expansion cooling air handling units.

C. Distribution Systems:

1. Air Handling Units: There are two air handling units that serve the CSU Extension Office. Each unit is equipped with a supply fan, a natural gas fired burner, a direct expansion cooling coil, and manual outside air dampers. Each unit operates from 7 am to 5:30 pm, seven days a week, as governed by a programmable thermostat. Additional information about the air handling units is listed in the table below.

16 - CSU Extension Office – Air Handling Units

			Supply Fan				Compressor			Heating	
Equip ID	**Mfgr**	**Model**	**CFM**	**HP**	**Amps**	**Volts**	**Qty**	**Amps**	**Volts**	**Input MBH**	**Output MBH**
RTU-1	Carrier	48TFE014-A-511	4700	5	15	208	2	146	N/A	160	260
RTU-2	Carrier	48TFE008-A-511	2800	3	5.8	208	2	91	N/A	143	143

N/A – The nameplate data was not available during the time of the survey.

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water:

1. There is one natural gas fired domestic hot water heater that serves the CSU Extension Office.

17 - CSU WAREHOUSE

I. General Description

A. Gross Square Footage: 9,476 Sq. Ft.

B. Year of Original Construction: 1974

C. General Construction Information: This is a one story facility that is seldom used. No original drawings were recovered to determine building shell make up. Exterior walls are concrete block veneer, and the roof appears to be built-up.

D. Building Schedules: The building is rarely occupied. It is used to host small events a few times per year. It is mostly used for storage.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The only miscellaneous equipment found at the CSU Warehouse was two vending machines and a popcorn maker.

IV. Heating, Ventilation, and Air Conditioning

A. Heating System: The CSU Warehouse receives heating from ten natural gas fired unit heaters and one rooftop unit.

B. Cooling System: The CSU Warehouse receives cooling from one rooftop unit.

C. Distribution Systems:

1. Rooftop Unit: The rooftop unit serves the office. It contains a supply fan, a natural gas fired burner, a direct expansion cooling coil, and manual outside air dampers. The rooftop unit is controlled by a non-programmable thermostat that was found to be in the off position during the time of the survey. Additional information about the rooftop unit is listed in the table below.

17 - CSU Warehouse - Rooftop Unit

			Supply Fan				Compressor			Heating	
Equip ID	Mfgr	Model	CFM	HP	Amps	Volts	Qty	Amps	Volts	Input MBH	Output MBH
RTU-1	Rheem	N/A	N/A	0.25	2.4	N/A	1	71	208/230	75	N/A

N/A – The nameplate data was not available during the time of the survey.

2. Unit Heaters: There are ten natural gas fired unit heaters which serve the large open areas. Each unit is controlled by its own non-programmable thermostat that was set at 50ºF during the time of the survey. Additional information about the unit heaters is listed in the table below.

17 - CSU Warehouse – Unit Heaters

Equip ID	Mfgr	Model	Input MBH	Output MBH
UH-1 thru 10	Modine	N/A	75	60

N/A – The nameplate data was not available during the time of the survey.

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water

1. The CSU Warehouse has one small electric hot water heater which serves the restroom faucets.

20 - TRI COUNTY HEALTH

I. General Description

A. Gross Square Footage: 8,398 Sq. Ft.

B. Year of Original Construction: 1980

C. General Construction Information: This three story building has exterior walls constructed of brick veneer, ¾" plywood, 4" R-11 batt insulation, and a 5/8" gypsum board interior. The windows are double-paned and have mechanical shading louvers that appear to be inoperable but are fixed in a position that provides a good amount of shading. The roof is constructed of built-up roofing on top of 4 ½" rigid insulation and pre-cast concrete.

D. Building Schedules: The building is occupied from 8:00 am to 5:00 pm, Monday through Friday.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the Tri County Health building is general hospital equipment and general office equipment, which includes personal computers, printers, faxes, etc.

IV. Heating, Ventilation, and Air Conditioning

A. Heating System: The Tri County Health building receives heating from furnaces and rooftop units.

B. Cooling System: The Tri County Health building receives cooling from furnaces and rooftop units.

C. Distribution Systems:

1. Furnaces: There are five furnaces that serve the Tri County Health building. Four units (AC-1, F-3, F-4, and F-6) are located in room 17 in the basement, and one unit (F-5) is located in room 113 on the first floor. Each furnace is equipped with a supply fan, a natural gas fired burner, a direct expansion cooling coil, and manual outside air dampers. The condensing units for each of the direct expansion cooling coils are located on the roof. The furnaces are controlled by non-programmable thermostats. Additional information about the furnaces is listed in the table below.

20 - Tri County Health - Furnaces

				Outdoor Motor				Compressor		
Equip ID	Mfgr	Model	Area Served	CFM	HP	Amps	Volts	Qty	Amps	Volts
AC-1	Carrier	28AC048000	3rd Floor NW	N/A	N/A	N/A	N/A	1	N/A	N/A
F-3	Trane	TXC060CJHPCO	1st Floor Center Core	N/A	0.25	1.3	200/230	1	14.7	200/230
F-4	Trane	TXC061C5HPCO	1st Floor SW	N/A	0.25	1.3	200/230	1	14.7	200/230
F-5	Trane	TXC037C4HPCO	N/A	N/A	0.25	1.3	200/230	1	14.7	200/230
F-6	Trane	TXC050C4HPDO	3rd Floor NE	N/A	0.25	1.3	200/230	1	14.7	200/230

N/A – The nameplate data was not available during the time of the survey.

2. Rooftop Units: These four units are constant volume rooftop units with direct expansion cooling, natural gas fired heating, except RTU-4 which has electric heating and manual outside air dampers. The units are controlled by non-programmable thermostats. Additional information about the rooftop units is listed in the table below.

20 - Tri County Health - Rooftop Units

				Condenser			Compressor			Heating	
Equip ID	Location	Mfgr	Model	Qty	HP	Amps	Qty	HP	Amps	Input MBH	Output MBH
RTU-1	North Side	Carrier	48GL036300BA	1	0.2	1	1	N/A	18	75	N/A
RTU-2	SE Corner	Carrier	48TFF006-A-511	1	N/A	0.6	1	N/A	114	120	150
RTU-3	SE Corner	York	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RTU-4	Upper Roof	Day & Night	559EJ030	1	N/A	N/A	1	N/A	72	N/A	N/A

N/A – The nameplate data was not available during the time of the survey.

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water

1. Domestic hot water is produced by a natural gas fired hot water heater. It has a ¼ hp circulation pump plugged into a wall outlet. Additional information on the domestic hot water heater is listed in the table below.

20 - Tri County Health - DHW Heater

Equip ID	Mfgr	Gal	Gal/Hr	Input MBH	Volts
DHWH	AMS	75	N/A	75.1	N/A

N/A – The nameplate data was not available during the time of the survey.

B. Exhaust Fans:

1. There are two exhaust fans located on the roof which serve the restrooms.

23 - ALTURA PLAZA BUILDING

I. General Description

A. Gross Square Footage: 74,675 Sq. Ft.

B. Year of Original Construction: 1972

C. General Construction Information: This six story building has exterior walls constructed of brick veneer, ¾" plywood, 4" R-11 batt insulation, and a 5/8" gypsum board interior. The windows are double-paned with a tinted finish. The roof is constructed of built-up roofing on top of 2" rigid insulation, and pre-cast concrete.

D. Building Schedules: The majority of the building is occupied from 7:00 am to 6:00 pm, Monday through Friday. The District Attorney's office and the Juvenile Diversion office are occupied from 7:00 am to 9:00 pm, Monday through Friday.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the Altura Plaza Building is general office equipment, which includes personal computers, printers, faxes, etc.

IV. Heating, Ventilation, and Air Conditioning

A. Heating Plant: Heating is provided to most of the building by two hot water boilers (B-1 and B-2). The boilers provide hot water to water source heat pumps which are located throughout the entire building.

1. Hot Water Boilers: B-1 and B-2 are natural gas fired, atmospheric, hot water boilers which provide heating water to the water source heat pumps (WSHP's), the penthouse unit heaters, the basement fan coil unit, and the hot water preheat coils in the basement heat pumps.

23 - Altura Plaza Building - Hot Water Boilers

Equip ID	Mfgr	Model	Fuel	Input MBH	Output MBH
B-1	Ajax	WGH-3000	NG	3,000	2,400
B-2	Ajax	WGH-1375	NG	3,000	2,400

N/A – The nameplate data was not available during the time of the survey.

2. WSHP Circulation Pumps: There are two WSHP circulation pumps (P-1 and P-2) which circulate water from the boiler and the evaporative cooler to the water source heat pumps located throughout the building. The two pumps operate in parallel and run 24 hours a day, seven days a week. Hot water is circulated to the penthouse unit heaters and the heating coils located in the basement units by two smaller circulating pumps.

23 - Altura Plaza Building – Hot Water Pumps

	Pump Data				Motor Data				
Equip ID	Mfgr	Model	GPM	Head (Ft.)	Mfgr	Model	HP	Amps	Volts
P-1	N/A	N/A	590	60	N/A	N/A	15	41/20.5	460
P-2	N/A	N/A	590	60	N/A	N/A	15	41/20.5	460

N/A – The nameplate data was not available during the time of the survey.

B. Central Cooling Plant: The Altura Plaza Building receives cooling from an evaporative cooler. The evaporative cooler provides condenser water to the water source heat pumps.

1. Evaporative Cooler: The evaporative cooler is equipped with two fans which cycle to maintain the WSHP loop water supply temperature setpoint of 82ºF-85ºF. It is located in the penthouse. Nameplate data was not available during the time of the survey. Mechanical drawings indicate that the unit is a Singer #1850 with two 15 hp fan motors.

C. Distribution Systems

1. Water Source Heat Pumps: There are 54 water source heat pumps located throughout the building. Each water source heat pump is equipped with a compressor and a supply fan. The compressor on each unit cycles to maintain the space temperature setpoint as governed by the non-programmable thermostat. The building receives ventilation from the makeup air unit described later in this section. Additional information about the WSHP's is listed in the table below.

23 - Altura Plaza Building - Water Source Heat Pumps

Equip ID	Quantity	CFM	Clg. Tons
CC520	17	1,600	4
CC400	26	1,200	3
VWS-1028	8	4,000	10
VWS-818	3	3,000	8

N/A – The nameplate data was not available during the time of the survey.

2. Fan Coil Unit: FCU-1 is a constant volume unit located in the basement mechanical room that serves the fitness center. FCU-1 is equipped with a supply fan and a hot water heating coil. The supply fan on this units runs 24 hours a day, seven days a week. The hot water heating coil is controlled by a two-way valve which modulates to maintain the space temperature setpoint as governed by the space thermostat. Additional information about the fan coil unit is listed in the table below.

23 - Altura Plaza Building – Fan Coil Unit

				Supply Fan				Compressor		
Equip ID	Location	Mfgr	Model	CFM	HP	Amps	Volts	Qty	Amps	Volts
FCU-1	Bsmt Mech Rm	N/A	N/A	N/A	1.5	4.8/2.4	208-230/460	X	X	X

N/A – The nameplate data was not available during the time of the survey.

3. HW Preheat Heat Pumps: AHU-B3 and AHU-B5 are constant volume units located in the basement mechanical rooms. AHU-B3 serves a conference room in the basement. AHU-B5 serves the Sheriff's area in the basement. They are water source heat pumps with hot water preheat coils. Additional information about these units is listed in the table below.

23 - Altura Plaza Building – HW Preheat Units

				Supply Fan				Compressor		
Equip ID	Location	Mfgr	Model	CFM	HP	Amps	Volts	Qty	Amps	Volts
AHU-B3	Bsmt Mech Rm	Westinghouse	N/A	N/A	1	1.8	440/480	1	78	N/A
AHU-B5	Bsmt Mech Rm	Westinghouse	N/A	N/A	1	1.8	440/480	1	78	N/A

N/A – The nameplate data was not available during the time of the survey.

4. Makeup Air Unit: MAU-1 is located on the roof. It is equipped with a supply air fan and a natural gas fired burner. This unit provides ventilation air to the water source heat pumps located throughout the building. This unit operates 24 hours a day, seven days a week. The natural gas fired burner is not controlled and was observed to be on at outside air temperatures above 80ºF. Additional information about the makeup air unit is listed in the table below.

23 - Altura Plaza Building - Makeup Air Unit

				Supply Fan			
Equip ID	Location	Mfgr	Model	CFM	HP	Amps	Volts
MAU-1	Roof	Hastings	N/A	7,950	5	14.4	N/A

N/A – The nameplate data was not available during the time of the survey.

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water:

1. Domestic hot water for the faucets in the restrooms is produced by a natural gas fired hot water heater that is located in the penthouse boiler room. Additional information on the domestic hot water heater is listed in the table below.

23 – Altura Plaza Building - DHW Heater

Equip ID	Mfgr	Gal	Gal/Hr	Input MBH	Volts
DHWH	State	82	N/A	N/A	N/A

N/A – The nameplate data was not available during the time of the survey.

B. Exhaust Fans:

1. There are multiple exhaust fans located throughout the building which serve the restrooms.

VI. Water Use

A. Overview: The primary mode of water use in the Altura Plaza is for sanitary services, indirect evaporative cooling tower makeup water, and irrigation cooling. Other minor uses include janitorial uses and boiler makeup water. All services share one meter which is read monthly.

In addition to the normal staffing levels (145), there are an average of 1600 visitors per day, some of whom (jurors) stay for 8 hours. For the purposes of modeling the building, there are 1600 visitors per day with an average stay of 2 hours.

B. Plumbing Fixtures, general

The commodes are a variety of units — tank flush, flush-valve actuated, china, and stainless steel "comby" units in the holding cells. No leaks or maintenance problems were observed during the survey. The urinals are all flush-valve actuated, wall-mounted 1.0 and 2 GPF models. Lavatory faucets are in good condition. The flow rates measured averaged 2 GPM. There are 4 small kitchenettes with stainless steel sinks and gooseneck faucets in the break and jury rooms. Each floor has one janitorial closet with utility faucets. There are 14 lab sinks in dental and medical clinics on the upper floors. There are two shower rooms with two showers each for staff use of the ground floor. These are rarely used.

Commodes:					Urinals		Faucets				
Tank 1.6 GPF	Tank 3.5 GPF	Flush Valve 1.6 GPF	Flush Valve 3.5 GPF	Comby 3.6 GPF	1.0 GPF	1.0 GPF	GPM average	Total Lavatory	Showers (<2.5 GPM)	Lab Sinks	Kitchen (break)
1	15	24	12	3	5	8	2	55	2	17	4

Note: Lavatory count does not include comby units.

C. Cooling Tower Water Use: This is an indirect evaporative cooler; the water in the cooling tower does not go to the chiller. There is a closed loop circulating water from the tower to the heat pumps distributed through the building and back. An open-loop water circulation system sprays water over fill; a fan enhances the evaporative effect. The evaporation, brought about by the open loop, cools the

water in the closed loop to the heat pumps. There is a water-treatment metering pump in place that administers biocides to controls algae and bacteria growth. Also, an acid cleaner may be used to control scaling resulting form the deposition to dissolved solids. The tower is enclosed in a sheet metal plenum within the building and, therefore, wind driven drift is not a factor.

D. Irrigation:

General: There are relatively small lawn areas served by popup sprinklers. There is a Rainmaster brand digital timer that controls the frequency, duration, and sequencing of the various zones. There are no automatic controls for sensing wind, soil moisture, or rainfall. Schedule is altered by the staff if rainfall occurs that is sufficient to moisten the lawn and irrigation is not needed and if the staff is present to do so. There are occasional problems with vandalism. Sidewalks intersect the irrigation areas, and many of the areas are narrow strips between the street and sidewalks. This configuration increases the potential for waste due to over-spray onto sidewalk and roadways.

24 – CENTREPOINT PLAZA

I. General Description

A. Gross Square Footage: 105,662 Sq. Ft.

B. Year of Original Construction: 2002

C. General Construction Information: No architectural drawings were recovered for this facility.

D. Building Schedules: The building is occupied from approximately 6:00 am to 7:00 pm, Monday through Friday. A few areas are occupied for longer periods in the evenings; some areas as late as 10:00 pm. There are also some areas that are occupied on the weekends.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the Centrepoint Plaza building is general office equipment, which includes personal computers, printers, faxes, etc.

IV. Heating, Ventilation, and Air Conditioning

A. Heating System: The Centrepoint Plaza building receives heating from electric reheat boxes.

B. Cooling System: The Centrepoint Plaza building receives cooling from rooftop units.

C. Distribution Systems:

1. RTU-1 to RTU-4: These units are variable air volume reheat systems. They are equipped with a supply fan, a return fan, a direct expansion cooling coil, a natural gas fired burner, mixed air dampers, and electric reheat VAV boxes. The supply air volume is controlled by a variable frequency drive, which modulates to maintain the supply air duct static pressure setpoint. The direct expansion cooling coil maintains the cooling discharge air temperature setpoint. The natural gas fired heating coil maintains the discharge air temperature setpoint. The conditioned air is distributed to the spaces via fan powered, electric reheat VAV boxes. The mixed air dampers are controlled by electric actuators, which modulate to maintain the mixed air temperature setpoint. These units are controlled through the Invensys energy management system. The rooftop units are scheduled to operate from 5 am to 11 pm on Monday through Friday, and from 8 am to 4:30 pm on Saturday and Sunday. Also, only two of the units run at a time. Two units serve one supply air duct header in order to achieve 100% redundancy. Additional information on the rooftop units is listed in the table below.

24 – Centrepoint Plaza - Rooftop Units

			Condenser			Compressor			Supply Fan	Return Fan
Equip ID	Mfgr	Model	Qty	HP	Amps	Qty	HP	Amps	HP	HP
RTU-1	McQuay	RPS105CLA	9	1	2	4	25	214	60	30
RTU-2	McQuay	RPS105CLA	9	1	2	4	25	214	60	30
RTU-3	McQuay	RPS105CLA	9	1	2	4	25	214	60	30
RTU-4	McQuay	RPS105CLA	9	1	2	4	25	214	60	30

VII. Miscellaneous HVAC Equipment

A. Domestic Hot Water:

1. Domestic hot water is produced by a natural gas fired hot water heater. Additional information about the natural gas fired hot water heater is listed in the table below.

24 – Centrepoint Plaza - DHW Heater

Equip ID	Mfgr	Gallons	Input MBH
DHWH-1	N/A	125	208

N/A – The nameplate data was not available during the time of the survey.

B. Exhaust Fans:

1. There are multiple exhaust fans located throughout the building which serve the restrooms.

29 - PEORIA SHOPS

I. General Description

A. Gross Square Footage: 25,008 Sq. Ft.

B. Year of Original Construction: 1973

C. General Construction Information: This facility is used primarily for county vehicle repair and washing. There were no drawings recovered for this facility. The exterior walls appear to be pre-cast concrete, and windows are single pane with reflective coating. Ten large garage doors are utilized often as vehicles are pulled in and out frequently.

D. Building Schedules: The building is open from 6:00 am to 4:30 pm, Monday through Friday. Crews work on a 4/10 schedule during the Summer and 5/8 during the Winter. This building is occupied 24 hours a day when it snows.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the Peoria Shops is automotive repair equipment.

IV. Heating, Ventilation, and Air Conditioning

A. Heating System: The Peoria Shops receives heating from rooftop units, unit heaters, and makeup air units.

B. Cooling System: The Peoria Shops receives cooling from the rooftop units.

C. Distribution Systems:

1. Rooftop Units: RTU-1 and RTU-2 are constant volume rooftop units with direct expansion cooling, natural gas fired heating, and manual outside air dampers. RTU-3 is natural gas heating only. Each unit is controlled by a non-programmable thermostat. RTU-1 serves the second floor offices. RTU-2 and RTU-3 serve the first floor offices. Additional information on the rooftop units is listed in the table below.

29 - Peoria Shops - Rooftop Units

				Condenser			Compressor			Heating	
Equip ID	**Location**	**Mfgr**	**Model**	**Qty**	**HP**	**Amps**	**Qty**	**HP**	**Amps**	**Input MBH**	**Output MBH**
RTU-1	West Unit	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RTU-2	South Unit	Lennox	GCS16-513-125-1Y	1	0.25	2	1	N/A	90	125	N/A
RTU-3	North Unit	Carrier	48EG008D	X	X	X	X	X	X	112.5	22.5

N/A – The nameplate data was not available during the time of the survey.

2. Makeup Air Units: MAU-1, MAU-2, MAU-4 are constant volume systems with natural gas heating. During the survey, MAU-2's heating looked to be disabled. The units provide makeup air to the shop areas. MAU-1 is controlled by a non-programmable thermostat. MAU-2 is controlled by an on/off switch. MAU-4 is controlled by a twist timer and thermostat. Additional information about the makeup air units is listed in the table below.

29 - Peoria Shops - Makeup Air Units

				Supply Fan			Heating	
Equip ID	**Location**	**Mfgr**	**Model**	**CFM**	**HP**	**Amps**	**Input MBH**	**Output MBH**
MAU-1	SE Corner	Reznor	PCB-175	21,950	15	N/A	2,190	1,401
MAU-2	NE Corner	Reznor	PEB250-6-20E	4,000	2	N/A	N/A	N/A
MAU-4	NE Corner	Reznor	RGB-350	3,000	2	7	350	213

N/A – The nameplate data was not available during the time of the survey.

3. Unit Heaters: There are six, natural gas fired, unit heaters that provide additional heat to the shop areas. Each unit is controlled by a non-programmable thermostat.

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water:

1. Domestic hot water is produced by a natural gas fired hot water heater that is located in the second floor locker room. Additional information on the domestic hot water heater is listed in the table below.

29 - Peoria Shops - DHW Heater

Equip ID	**Mfgr**	**Gal**	**Gal/Hr**	**Input MBH**	**Volts**
DHWH-1	Rheem	75	N/A	125	N/A

N/A – The nameplate data was not available during the time of the survey.

2. Vehicle Washer: There is a vehicle washer that utilizes a natural gas fired heater to produce hot water to power wash the maintenance vehicles and police vehicles.

B. Exhaust Fans:

1. There are eight exhaust fans that serve the restrooms, locker rooms, and shop areas at Peoria Shops.

VI. Water Use

A. Overview: The primary mode of water use is for road maintenance, vehicle washing services, and sanitary services. All services share one meter which is read monthly.

Staffing levels are at 56 with many of the staff off site during much of the day.

B. Plumbing Fixtures, general

The commodes are flush-valve actuated, china units in the ground floor restroom and second floor locker rooms. No leaks or maintenance problems were observed during the survey. The urinals are all flush-valve actuated, wall-mounted 2 GPF models. Lavatory faucets are good condition. One lavatory is a gang spigot foot operated hand-washing station operating at 4 GPM (measured). The other faucets are hand operated fixtures running 2 GPM (measured). There is a utility sink in the shop. There are two shower rooms with two showers each for staff use in the locker room floor.

29 – Peoria Shop – Plumbing Fixtures

Commodes:	Urinals	Faucets			
Flush Valve 3.5 GPF	2.0 GPF	GPM avg	Total Lavatory	Metered	Showers (<2.5 GPM)
6	2	2	4	0	2

Note: Lavatory count does not include gang hand wash station.

C. Maintenance Water Use:

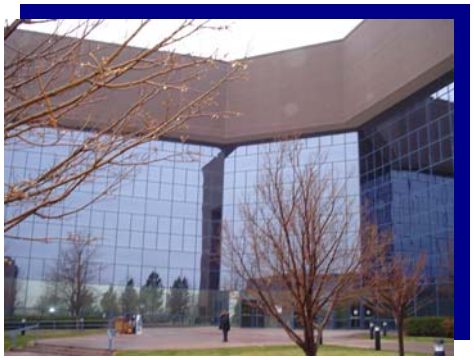
Vehicle washing: There is an outdoor truck/car washing area on a concrete pad adjacent to the truck maintenance bays. There is a filtration system installed to catch wash water and remove sediments and organics from the wastewater before it is drained to the storm sewer. All of the county vehicles are washed here — police cars, road maintenance trucks, road strip painting trucks, construction equipment, and county staff vehicles.

Road maintenance: There are four mobile sweep sweepers that go out once a day with 250 gallons of water on board. If subsequent fills are needed, they are filled from a hydrant; 150 working days per year.

There are three 4000-gallon tankers that are topped off daily that are used at construction sites (i.e. to wet down construction sites for dust control). It was assumed that each truck goes out once a day, four day per week with an average of 1000 gallons used each trip, 150 working days per year.

There are 3 road patch trucks with 50-gallons tanks that fill up once a day.

35 - ACJC COURTHOUSE



I. General Description

A. Gross Square Footage: 148,522 Sq. Ft.

B. Year of Original Construction: 1986

C. General Construction Information: This four story building has exterior walls constructed of face brick with through-wall flashing, 4" batt insulation, vapor barrier, and a 5/8" gypsum board interior. The windows are double-paned with a tinted finish. The roof is constructed of elastic sheet roofing on rigid insulation over steel deck.

D. Building Schedules: The building is occupied from 6:00 am to 8:00 pm, Monday through Friday. Also, some of the judges work in their offices on the weekends as well. The custodial staff works from 4:30 pm to 1:00 am, Monday through Friday.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the ACJC District Courthouse building is general office equipment, which includes personal computers, printers, faxes, etc.

IV. Heating, Ventilation, and Air Conditioning

A. Heating Plant: The ACJC District Courthouse produces heating hot water from two natural gas boilers located in the basement mechanical room. The heating hot water is distributed to the heating coils located in the reheat boxes via two hot water pumps. The heating plant is controlled by the Siemens Apogee control system.

1. Hot Water Boilers: B-1 and B-2 are natural gas fired hot water, atmospheric boilers that are located in the basement boiler room. The boilers supply hot water to the heating coils in the variable air volume reheat boxes located throughout ACJC Courthouse building. The boilers are enabled when the outside air temperature falls below 68ºF, and are disabled when the outside air temperature rises above 72ºF. Additional information about the boilers is listed in the table below.

35 - ACJC Courthouse - Hot Water Boilers

Equip ID	Mfgr	Model	Fuel	Input MBH	Output MBH
B-1	Ajax	2000	NG	2000	N/A
B-2	Ajax	2000	NG	2000	N/A

N/A – The nameplate data was not available during the time of the survey.

2. Hot Water Pumps: P-1 and P-2 are constant volume, centrifugal pumps, which are located in the boiler room. The pumps operate in parallel. Additional information about the hot water pumps is listed in the table below.

35 - ACJC Courthouse - Hot Water Pumps

	Pump Data				Motor Data				
Equip ID	**Mfgr**	**Model**	**GPM**	**Head (Ft.)**	**Mfgr**	**Model**	**HP**	**Amps**	**Volts**
P-1	Alias Chalmers	N/A	250	N/A	N/A	N/A	15	42/21	230/460
P-2	Alias Chalmers	N/A	250	N/A	N/A	N/A	15	42/21	230/460

N/A – The nameplate data was not available during the time of the survey.

B. Central Cooling Plant: The ACJC Courthouse utilizes one chiller and an evaporative cooling system to cool the entire building. The chilled water is distributed to the chilled water coils, located in the air handling units, via two chilled water pumps. The cooling plant is controlled by the Siemens Apogee control system.

1. Chiller: CH-1 is a water-cooled, screw chiller with two compressors located in the chiller room in the basement. Each compressor has its own water cooled condenser. The chiller provides chilled water to cooling coils located in the air handling units. Additional information about the chiller is listed in the table below.

35 - ACJC Courthouse - Chiller

Equip ID	**Mfgr**	**Model**	**Capacity (tons)**	**Refrigerant**	**Mfgr**	**Model**	**HP**	**Amps**	**Volts**
CH-1	Bohn	HWSC135A	135	R-22	Hitachi	6001SC-H	75	95	460
					Bohn	060ASC10	60	78	460

N/A – The nameplate data was not available during the time of the survey.

2. Chilled Water Pumps: P-3 and P-4 are constant volume, centrifugal pumps, which are located in the chiller room in the basement. The pumps operate in parallel and circulate chilled water from the chiller to the cooling coils. Additional information about the chilled water pumps is listed in the table below.

35 - ACJC Courthouse - Chilled Water Pumps

	Pump Data				Motor Data				
Equip ID	**Mfgr**	**Model**	**GPM**	**Head (Ft.)**	**Mfgr**	**Model**	**HP**	**Amps**	**Volts**
P-3	Alias Chalmers	N/A	330	N/A	US Elect	N/A	15	42/21	230/460
P-4	Alias Chalmers	N/A	330	N/A	US Elect	N/A	15	42/21	230/460

N/A – The nameplate data was not available during the time of the survey.

3. Evaporative Cooler: EC-1 is an evaporative cooler located in the penthouse mechanical room. The evaporative cooler serves the condensers in CH-1. Additional information about the evaporative cooler is listed in the table below.

35 - ACJC Courthouse – Evaporative Cooler

			Fan Motor			Spray Pump		
Equip ID	**Mfgr**	**Model**	**HP**	**Amps**	**Volts**	**Hp**	**Amps**	**Volts**
EC-1	Evapco	N/A	20	58/29	230/460	1.5	5-5.6/2.8	230/460

N/A – The nameplate data was not available during the time of the survey.

4. Condenser Water Pumps: P-8 and P-9 are constant volume, centrifugal pumps, which are located in the chiller room in the basement. The pumps operate in parallel and circulate condenser water from the evaporative cooler to the chiller. Additional information about the condenser water pumps is listed in the table below.

35 - ACJC Courthouse - Condenser Water Pumps

	Pump Data				Motor Data				
Equip ID	**Mfgr**	**Model**	**GPM**	**Head (Ft.)**	**Mfgr**	**Model**	**HP**	**Amps**	**Volts**
P-8	Allis Chalmers	N/A	390	N/A	US Elect	N/A	15	42/21	230/460
P-9	Allis Chalmers	N/A	390	N/A	US Elect	N/A	15	42/21	230/460

N/A – The nameplate data was not available during the time of the survey.

C. Distribution Systems:

1. AH-1: This is a constant volume, single zone unit located in the basement that serves the parking garage. The unit is equipped with a supply fan, a hot water heating coil, and outside air dampers. The hot water heating coil is equipped with coil bypass dampers and a three-way valve that modulate to maintain the space temperature setpoint. The unit is 100% outside air and is rarely used. AH-1 is controlled by the Siemens Apogee control system. Additional information about this unit is listed in the table below.

35 - ACJC Courthouse - Air Handling Unit

				Supply Fan			
Equip ID	**Location**	**Mfgr**	**Model**	**CFM**	**HP**	**Amps**	**Volts**
AH-1	Basement	McQuay	LHD-114D	12,000	7.5	24-21.6/10.3	230/460

N/A – The nameplate data was not available during the time of the survey.

2. AHU-1 and AHU-2: These units are variable air volume reheat systems located in the penthouse mechanical room that serve the majority of the building. Each unit is equipped with a vane axial supply fan, a vane axial return fan, and a chilled water cooling coil. The vane axial supply and return fans vary the air flow to maintain static pressure. A heat recovery

system is utilized to pre-cool the outside air stream using evaporative cooling coils. The heat recovery system has caused major scaling on the interior walls and coils of the air handlers. The heat recovery system has currently been turned off and abandoned in place so that the maintenance staff can clean up the air handlers and their coils. AHU-1 and AHU-2 are controlled by the Siemens Apogee control system. Additional information about the air handling units is listed in the table below.

35 - ACJC Courthouse - Air Handling Units

				Supply Fan				Return Fan			
Equip ID	**Location**	**Mfgr**	**Model**	**CFM**	**HP**	**Amps**	**Volts**	**CFM**	**HP**	**Amps**	**Volts**
AHU-1	Penthouse	Joy	54-26-1770-CP	90,000	100	240/120	230/460	70,000	30	39	N/A
AHU-2	Penthouse	Joy	54-26-1770-CP	90,000	100	240/120	230/460	70,000	30	39	N/A

N/A – The nameplate data was not available during the time of the survey.

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water:

1. Domestic hot water is produced by a natural gas fired hot water heater that is located in the basement boiler room. The domestic hot water heater is equipped with two circulation pumps and a storage tank. Additional information on the domestic hot water heater is listed in the table below.

35 - ACJC Courthouse - DHW Heater

Equip ID	Mfgr	Gal/Hr	Input MBH	Volts	Circ Pump HP
HWB-1	Jarco	636.4	700	208	1/3

B. Exhaust Fans:

1. There are multiple exhaust fans located throughout the building which serve the restrooms.

VI. Water Use

A. Overview: The primary mode of water use in the ACJC is for sanitary services, cooling tower makeup water, and evaporative cooling. Other minor uses include janitorial use and boiler makeup water. All services share one meter which is read monthly.

There are an average of 1500 visitors per day, some of whom (jurors) stay for 8 hours. For the purposes of modeling the building, there are 1500 visitors per day with an average stay of 2 hours.

B. Plumbing Fixtures, general

The commodes include a variety of units, tank flush, flush-valve actuated, china, and stainless steel “comby” units in the holding cells. No leaks or maintenance problems were observed during the survey. The urinals are all flush-valve actuated, wall-mounted 1.0 GPF models, with a number of units with infrared sensor activated automatic flushometers. Lavatory faucets are in good condition.

The flow rates averaged more than 3 GPM (measured). There are 14 small kitchenettes with stainless steel sinks and gooseneck faucets in the jury rooms. Each floor has one janitorial closet with utility faucets.

Commodes:					Urinals		Faucets			
Tank 1.6 GPF	Tank 3.5 GPF	Flush Valve 1.6 GPF	Flush Valve 3.5 GPF	Comby 3.6 GPF	1.0 GPF	2.0 GPF Auto	GPM average	Total Lavatory	Metered	Kitchen (break)
3	39	2	35	10	6	8	3.	77	0	14

C. Cooling Tower Water Use: This is an indirect evaporative cooler; the water in the cooling tower does not go to the chiller. There is a water-treatment metering pump in place that administers biocides to controls algae and bacteria growth. Also, an acid cleaner may be used to control scaling resulting form the deposition to dissolved solids. The tower is enclosed in a sheet metal plenum within the building; and, therefore, wind driven drift is not a factor.

Water Quality: The water supply for the cooling tower is very hard. This results in a large amount of water being wasted to maintain acceptable levels of dissolved solids and to preserve the efficacy of the tower fill. The existing chemical representative stated the tower is currently set up at 1.7 cycles. The bleed line from the tower was measured at approximately 4 GPM and was observed at various times to be dumping water at this rate during the occupied period.

36 - ACJC DETENTION CENTER

I. General Description

A. Gross Square Footage: 291,955 Sq. Ft.

B. Year of Original Construction: 1986

C. General Construction Information: This two story building has exterior walls constructed of pre-cast concrete, 4" batt insulation, vapor barrier, and a 5/8" gypsum board interior. The windows are double-paned with a tinted finish. The roof is constructed of elastic sheet roofing on rigid insulation over steel deck.

D. Building Schedules: The building is occupied 24 hours a day, seven days a week for the entire year.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the ACJC Detention Center is general office equipment and Audio/Video equipment, which includes personal computers, printers, faxes, etc. Audio/Video equipment includes TVs, VCRs, monitoring equipment, etc.

IV. Heating, Ventilation, and Air Conditioning

A. Heating Plant: The ACJC Detention Center produces heating hot water from three natural gas boilers located in the basement mechanical room. The heating hot water is distributed to the heating coils located in the rooftop units via three hot water pumps. The heating plant is controlled by the Siemens Apogee control system.

1. Hot Water Boilers: B-1A, B-1B, and B-1C are natural gas fired, forced draft, hot water boilers. The boilers are staged to satisfy the hot water temperature setpoint temperature. The boilers are enabled when the outside air temperature falls below 68ºF, and are disabled when the outside air temperature rises above 72ºF. Additional information about the boilers is listed in the table below.

36 - ACJC Detention Center - Hot Water Boilers

Equip ID	Mfgr	Model	Fuel	Max Input MBH	Max Output MBH	Blower HP
B-1A	Cleaver Brooks	M4-700-4000	NG	6,000	3,200	3
B-1B	Cleaver Brooks	M4-700-4000	NG	6,000	3,200	3
B-1C	Cleaver Brooks	M4-700-4000	NG	6,000	3,200	3

N/A – The nameplate data was not available during the time of the survey.

2. Hot Water Pumps: The hot water pumps (P-1A, P-1B, and P-1C) are constant volume, centrifugal pumps, which are located in the basement mechanical room. P-1A is the primary, P-1B is the secondary, and P-1C is the standby. Additional information about the pumps is listed in the table below.

36 - ACJC Detention Center - Hot Water Pumps

	Pump Data				Motor Data				
Equip ID	Mfgr	Model	GPM	Head (Ft.)	Mfgr	Model	HP	Amps	Volts
P-1A	Alias Chalmers	N/A	500	75	US Elec	N/A	15	39.2/19.6	230/460
P-1B	Alias Chalmers	N/A	500	75	US Elec	N/A	15	39.2/19.6	230/460
P-1C	Alias Chalmers	N/A	500	75	US Elec	N/A	15	39.2/19.6	230/460

N/A – The nameplate data was not available during the time of the survey.

B. Cooling System: The ACJC Detention Center is cooled by evaporative (swamp) coolers and packaged rooftop units. Each of the cooling units is controlled by the Siemens Apogee control system.

C. Distribution Systems

1. Swamp Coolers: These units are constant volume single zone systems that are located on the roof. They contain a supply fan, a return fan, a direct/indirect evaporative cooling coil, two condenser fans, a hot water heating coil, and mixed air dampers. The evaporative cooling coils maintain the cooling space temperature setpoint. The hot water heating coil is controlled by a three-way electric valve which modulates to maintain the space temperature setpoint. The mixed air dampers are controlled by an electric actuator, which modulates to maintain the mixed air temperature setpoint. The units serve Pods 1, 3, 4, and 6. Additional information about the swamp coolers is listed in the table below.

36 - ACJC Detention Center - Swamp Coolers

				Supply Fan				Return Fan		
Equip ID	Location	Mfgr	Model	CFM	HP	Amps	Volts	HP	Amps	Volts
AHU-1	Pod 1	DesChamps	PIDC/H-6	6,000	5	N/A	N/A	3	N/A	N/A
AHU-2	Pod 1	DesChamps	PIDC/H-6	16,000	10	25/12.5	N/A	7.5	N/A	N/A
AHU-3	Pod 1	DesChamps	PIDC/H-6	16,000	10	25/12.5	N/A	7.5	N/A	N/A
AHU-4	Pod 1	DesChamps	PIDC/H-6	16,000	10	25/12.5	N/A	7.5	N/A	N/A
AHU-1	Pod 3	DesChamps	PIDC/H-6	6,000	5	N/A	N/A	3	N/A	N/A
AHU-2	Pod 3	DesChamps	PIDC/H-6	16,000	10	25/12.5	N/A	7.5	N/A	N/A
AHU-3	Pod 3	DesChamps	PIDC/H-6	16,000	10	25/12.5	N/A	7.5	N/A	N/A
AHU-4	Pod 3	DesChamps	PIDC/H-6	16,000	10	25/12.5	N/A	7.5	N/A	N/A
AHU-1	Pod 4	DesChamps	PIDC/H-6	6,000	5	N/A	N/A	3	N/A	N/A
AHU-2	Pod 4	DesChamps	PIDC/H-6	16,000	10	25/12.5	N/A	7.5	N/A	N/A
AHU-3	Pod 4	DesChamps	PIDC/H-6	16,000	10	25/12.5	N/A	7.5	N/A	N/A
AHU-4	Pod 4	DesChamps	PIDC/H-6	16,000	10	25/12.5	N/A	7.5	N/A	N/A

36 - ACJC Detention Center - Swamp Coolers

				Supply Fan				Return Fan		
Equip ID	**Location**	**Mfgr**	**Model**	**CFM**	**HP**	**Amps**	**Volts**	**HP**	**Amps**	**Volts**
AHU-1	Pod 6	DesChamps	PIDC/H-6	6,000	5	N/A	N/A	3	N/A	N/A
AHU-2	Pod 6	DesChamps	PIDC/H-6	16,000	10	25/12.5	N/A	7.5	N/A	N/A
AHU-3	Pod 6	DesChamps	PIDC/H-6	16,000	10	25/12.5	N/A	7.5	N/A	N/A
AHU-4	Pod 6	DesChamps	PIDC/H-6	16,000	10	25/12.5	N/A	7.5	N/A	N/A

N/A – The nameplate data was not available during the time of the survey.

2. VAV Rooftop Units: RTU-1, RTU-2, and RTU-3 are variable air volume reheat systems. They are equipped with a supply fan with inlet guide vanes, a direct expansion cooling coil, mixed air dampers, and fan powered VAV boxes. The supply air volume is controlled by the inlet guide vanes, which modulate to maintain the supply air duct static pressure setpoint. The conditioned air is distributed to the spaces via fan powered VAV boxes. The direct expansion cooling coil maintains the cooling discharge air temperature setpoint. The mixed air dampers are controlled by electric actuators, which modulate to maintain the mixed air temperature setpoint. Additional information about the rooftop units is listed in the table below.

36 - ACJC Detention Center – VAV Rooftop Units

							Condenser			Compressor		
Equip ID	**Location**	**Mfgr**	**Model**	**HP**	**Amps**	**Volts**	**Qty**	**HP**	**Amps**	**Qty**	**HP**	**Amps**
RTU-1	Roof-Medical Area	Alton	AV-522	N/A	N/A	N/A	6	1	2	2	N/A	52.2
RTU-2	Roof-Medical Area	Alton	AU-271	10	25.2/12.6	230/460	4	1	2	1	N/A	59
RTU-3	Roof-Library	Alton	AU-271	10	25.2/12.6	230/460	4	1	2	1	N/A	59

N/A – The nameplate data was not available during the time of the survey.

3. Rooftop Units: These rooftop units (RTU-5, RTU-8A thru 8D, RTU-18, RTU-20A, RTU-20B, RTU-36A, and RTU-36B) are constant volume single zone systems. These units are equipped with a supply fan, a direct expansion cooling coil, a hot water heating coil, and mixed air dampers. The supply fan, economizer, cooling coil, and heating coil modulate in sequence to maintain the space temperature setpoint. Additional information about the rooftop units is listed in the table below.

36 - ACJC Detention Center – Constant Volume Rooftop Units

							Condenser			Compressor		
Equip ID	**Location**	**Mfgr**	**Model**	**HP**	**Amps**	**Volts**	**Qty**	**HP**	**Amps**	**Qty**	**HP**	**Amps**
RTU-5	Roof-JAC	Lennox	LGA060SH1G	1.5	2.8	N/A	1	0.3	1.3	1	N/A	55
RTU-8A	Roof-Computer Rm	Lennox	LGA150SH2G	3	4.8	N/A	2	0.3	1.3	2	N/A	70
RTU-8B	Roof-Multi-Purpose	Lennox	LGA150SH2G	3	4.8	N/A	2	0.3	1.3	2	N/A	70
RTU-8C	Roof-Admin	Lennox	LGA150SH2G	3	4.8	N/A	2	0.3	1.3	2	N/A	70
RTU-8D	Roof-Admin	Lennox	LGA150SH2G	3	4.8	N/A	2	0.3	1.3	2	N/A	70
RTU-18	Roof-Pod 5	McQuay	RPS0180SW	7.5	10.8	460	2	1.5	2.6	1	20	31
RTU-20A	Roof-Pod 5	McQuay	RPS020CSW	10	14	460	2	1.5	2.6	1	25	39
RTU-20B	Roof-Pod 5	McQuay	RPS020CSW	10	14	460	2	1.5	2.6	1	25	39
RTU-36A	Roof-Pod 2	McQuay	RPS036CLW	20	25	460	4	1.5	2.6	1	40	71
RTU-36B	Roof-Pod 2	McQuay	RPS036CLW	20	25	460	4	1.5	2.6	1	40	71

N/A – The nameplate data was not available during the time of the survey.

4. Heat Recovery Unit: This unit is a constant volume heat recovery system that serves the kitchen area. It contains a supply fan, an evaporative cooling coil, hot water heating coil, and an exhaust fan. The evaporative cooling coils maintain the cooling discharge air temperature setpoint. The hot water heating coil is controlled by a three-way electric valve which modulates to maintain the heating discharge air temperature setpoint. The heat recovery part of the unit was inaccessible during the time of the survey. Additional information about the heat recovery unit is listed in the table below.

36 - ACJC Detention Center - Heat Recovery Unit

				Supply Fan				Exhaust Fan		
Equip ID	**Location**	**Mfgr**	**Model**	**CFM**	**HP**	**Amps**	**Volts**	**HP**	**Amps**	**Volts**
HR-1	Roof-Kitchen	DesChamps	N/A	N/A	20	60/30	230/460	N/A	N/A	N/A

N/A – The nameplate data was not available during the time of the survey.

5. Makeup Air Unit: This unit is a constant volume single zone make up air unit that serves the kitchen area. It contains a supply fan, an evaporative cooling coil, and a natural gas burner. The evaporative cooling coil cycles to maintain the cooling space temperature setpoint. The natural gas heating burner cycles to maintain the heating space temperature setpoint. Additional information about the makeup air unit is listed in the table below.

36 - ACJC Detention Center - Makeup Air Unit

				Supply Fan			
Equip ID	Location	Mfgr	Model	CFM	HP	Amps	Volts
MUA-1	Roof-Kitchen	Reznor	RPB400-8	N/A	N/A	N/A	N/A

N/A – The nameplate data was not available during the time of the survey.

6. AC Unit: This is a constant volume unit that serves the classification office. It contains a supply fan, a direct expansion cooling coil, a natural gas fired burner, and manual outside air dampers. Additional information about the condensing unit is listed in the table below.

36 - ACJC Detention Center - AC Unit

				Condenser				Compressor	
Equip ID	Location	Mfgr	Model	CFM	HP	Amps	Volts	Qty	Amps
CU-1	Roof-Classification	Carrier	48GX-03006050	N/A	N/A	2.1	208-230	1	63

N/A – The nameplate data was not available during the time of the survey.

7. BC-1: This unit is a constant volume cooling system that serves the visitation area. The unit provides direct expansion cooling only and has manual outside air dampers. Additional information about the cooling unit is listed in the table below.

36 - ACJC Detention Center - Conditioning Unit

				Motors			
Equip ID	Location	Mfgr	Model	CFM	HP	Amps	Volts
BC-1	Roof-Visitation	MagicAire	60-BVXW/EEA	N/A	1.5	4.6	208

N/A – The nameplate data was not available during the time of the survey.

8. Furnace: This unit is located in the maintenance/warehouse building and serves the office areas. It is equipped with a supply fan, a direct expansion cooling coil, a natural gas fired burner, and manual outside air dampers. It is controlled by a non-programmable thermostat. Additional information about this unit is listed in the table below.

36 - ACJC Detention Center - Furnace

				Heating				Condenser			Compressor	
Equip ID	Location	Mfgr	Model	Input MBH	Output MBH	Amps	Volts	Qty	HP	Amps	Qty	Amps
F-1	Mech-Warehouse	Carrier	58PAV111-20	110	89	14.4	N/A	1	0.25	1.9	1	19.7

N/A – The nameplate data was not available during the time of the survey.

9. Infrared Heaters: There are three natural gas-fired infrared heaters that provide heating to the Maintenance/Warehouse building's bomb bay and generator room. The units cycle to maintain the space temperature

setpoint as governed by the non-programmable thermostats located in each of the spaces.

10. Unit Heaters: There are six gas fired unit heaters located in the Maintenance/Warehouse building. These units serve the storage area of the warehouse and the warehouse mezzanine. They are controlled by non-programmable thermostats. Two units are currently not being used.

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water

1. Domestic hot water for the ACJC Detention Center is produced by five natural gas fired, force draft, hot water boilers, which are located in the ACJC Detention Center's basement mechanical room. Four units produce 140ºF for faucets and showers. One unit is used to produce hot water for the kitchen and laundry facilities which also has a storage tank. The Maintenance/Warehouse building also has a natural gas fired domestic hot water heater. Additional information about the domestic hot water heaters is listed in the table below.

36 - ACJC Detention Center - DHW Heaters

				Motors			
Equip ID	**Mfgr**	**Gal**	**Input MBH**	**Motor 1 HP**	**Motor 2 HP**	**Amps**	**Volts**
B-3	Turbopower Gas	1,750	2,800	5	X	11.5/5.7	230/460
B-4	PVI	1,750	2,800	1.5	1.5	18/9	115/230
B-5	PVI	1,750	2,800	1.5	1.5	18/9	115/230
B-6	Turbopower Gas	1,250	3,200	1.5	1.5	18/9	115/230
Laundry DHWH	Turbopower Gas	1,000	500	0.3	X	10	115
Warehouse	A.O. Smith	30	32	X	X	X	X

B. Generators

1. There are two backup generators that are located in the Maintenance/Warehouse building.

C. Exhaust Fans

1. There are multiple exhaust fans located throughout the building which serve the restroom and kitchen areas.

37 - ACJC ADMINISTRATIVE II

I. General Description

A. Gross Square Footage: 91,110 Sq. Ft.

B. Year of Original Construction: 1989

C. General Construction Information: This three story building has exterior walls constructed of face brick with through-wall flashing, 4" batt insulation, vapor barrier, and a 5/8" gypsum board interior. The windows are double-paned with a tinted finish. The roof is constructed of elastic sheet roofing on rigid insulation over steel deck.

D. Building Schedules: The building is occupied from approximately 5:00 am to 8:00 pm, Monday through Friday. The custodial staff works from 4:30 pm to 1:00 am, Monday through Friday.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the ACJC Administrative II building is general office equipment, which includes personal computers, printers, faxes, etc.

IV. Heating, Ventilation, and Air Conditioning

A. Heating Plant: The ACJC Administrative II building produces heating hot water from two boilers located in the first floor mechanical room. The heating hot water is distributed to the heating coils located in the reheat boxes via two hot water pumps. The heating plant is controlled by the Siemens Apogee control system.

1. Hot Water Boilers: B-1 and B-2 are natural gas fired, atmospheric, hot water boilers. The boilers supply hot water to the heating coils in the variable air volume reheat boxes. The boilers are enabled when the outside air temperature falls below 68ºF, and are disabled when the outside air temperature rises above 72ºF. Additional information is listed in the table below.

37 - ACJC Administrative II - Hot Water Boilers

Equip ID	Mfgr	Model	Fuel	Input MBH	Output MBH
B-A	Ajax	WGH-1375	NG	1,375	1,100
B-B	Ajax	WGH-1375	NG	1,375	1,100

2. Hot Water Pumps: The two hot water pumps (HWP-1 and HWP-2) are constant volume, inline pumps located in the basement mechanical room.

HWP-1 and HWP-2 operate in parallel. Additional information about the pumps is listed in the table below.

37 - ACJC Administrative II - Hot Water Pumps

	Pump Data				Motor Data				
Equip ID	Mfgr	Model	GPM	Head (Ft.)	Mfgr	Model	HP	Amps	Volts
HWP-1	Taco	N/A	120	65	N/A	N/A	5	13.3/6.65	230/460
HWP-2	Taco	N/A	120	65	N/A	N/A	5	13.3/6.65	230/460

N/A – The nameplate data was not available during the time of the survey.

B. Central Cooling Plant: The ACJC Administrative II building uses two chillers to cool the building. The chilled water is distributed to the chilled water coils located in the air handling units via two chilled water pumps. The cooling plant is controlled by the Siemens Apogee control system.

1. Chillers: A-1 and A-2 are air-cooled, reciprocating chillers located outside. Each unit has two compressors and twelve condenser fans. The chillers supply chilled water to the chilled water coils located in the air handling units. Additional information about the chillers is listed in the table below.

37 - ACJC Administrative II - Chillers

			Condenser				Compressor		
Equip ID	Mfgr	Model	Qty	HP	Amps	Volts	Qty	Amps	Volts
A-1	Trane	CGACD121RANLL603RCAGDMH	12	1	1.8	460	2	98	460
A-2	Trane	CGACD121RANLL603RCAGDMH	12	1	1.8	460	2	98	460

2. Chilled Water Pumps: The two chilled water pumps (CHW-1 and CHW-2) are constant volume, inline pumps located in the basement mechanical room. The pumps operate in parallel. Additional information about the chilled water pumps is listed in the table below.

37 - ACJC Administrative II - Chilled Water Pumps

	Pump Data				Motor Data				
Equip ID	Mfgr	Model	GPM	Head (Ft.)	Mfgr	Model	HP	Amps	Volts
CHW-1	Taco	N/A	550	65	Unimount	N/A	15	39.2/19.6	460
CHW-2	Taco	N/A	550	65	Unimount	N/A	15	39.2/19.6	460

N/A – The nameplate data was not available during the time of the survey.

C. Distribution Systems:

1. AHU-1 thru AHU-6: These are variable air volume reheat systems located throughout the building. Each unit is equipped with a supply air fan with inlet guide vanes, a chilled water cooling coil, and mixed air dampers. The inlet guide vanes modulate to maintain the supply air duct

static pressure setpoint. The chilled water cooling coil is controlled by a three-way electric valve which modulates to control the discharge air temperature setpoint. The mixed air dampers are controlled by electric actuators, which modulate to maintain the mixed air temperature setpoint. The conditioned air is distributed to the spaces via fan powered VAV boxes. Each air handling is controlled by the Siemens Apogee control system. AHU-3 and AHU-5 currently operate 24 hours a day, seven days a week in order to condition some computer equipment rooms. Additional information about the air handling units is listed in the table below.

37 - ACJC Administrative II - Air Handling Units

				Supply Fan			
Equip ID	**Location**	**Mfgr**	**Model**	**CFM**	**HP**	**Amps**	**Volts**
AHU-1	West-1st Floor	N/A	N/A	N/A	15	32.4/16.2	230/460
AHU-2	East-1st Floor	N/A	N/A	N/A	15	32.4/16.2	230/460
AHU-3	West-2nd Floor	N/A	N/A	N/A	15	32.4/16.2	230/460
AHU-4	East-2nd Floor	N/A	N/A	N/A	15	32.4/16.2	230/460
AHU-5	West-3rd Floor	N/A	N/A	N/A	15	32.4/16.2	230/460
AHU-6	East-3rd Floor	N/A	N/A	N/A	15	32.4/16.2	230/460

N/A – The nameplate data was not available during the time of the survey.

2. Unit Heaters: These four units are natural gas fired heaters located in the basement mechanical rooms. Additional information about the unit heaters is listed in the table below.

37 - ACJC Administrative II - Unit Heaters

Equip ID	**Mfgr**	**MBH**
UH-1	Trane	50.9
UH-2	Trane	50.9
UH-3	Trane	15
UH-4	Trane	15

3. Garage Unit: This is a constant volume, single zone system that serves the parking garage in the basement. The unit is equipped with a supply fan and an electric heating element. The supply fan and electric heating element cycle to maintain the space temperature setpoint as governed by the non-programmable thermostat.

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water

1. Domestic hot water is produced by a natural gas fired hot water heater that is located in the basement mechanical room. Additional information on the domestic hot water heater is listed in the table below.

37 - ACJC Administrative II - DHW Heaters

Equip ID	Mfgr	Gal	Gal/Hr	Input MBH	Volts
DHWH	A.O. Smith	71	116.4	120	N/A

N/A – The nameplate data was not available during the time of the survey.

B. Exhaust Fans

1. There are multiple exhaust fans located throughout the building which serve the restrooms.

VI. Water Use

A. Overview: The primary mode of water use in the Administration Building 2 is for sanitary services. Other minor uses include janitorial uses and boiler makeup water. All services share one meter which is read monthly.

The services provided by the offices in this building draw visitors at a rate of 150 per day, and it is assumed that the length of stay is ½ hour.

B. Plumbing Fixtures, general

The commodes are all flush-valve actuated, wall-mounted models with no markings to indicate gallons per flush. No leaks or maintenance problems were observed. The urinals are all flush-valve actuated, wall-mounted models with no markings to indicate gallons per flush. Lavatory faucets are in good condition. The flow rates averaged more than 3 GPM (measured). There are two small kitchenettes with stainless steel sinks and gooseneck faucets. Each floor has one janitorial closet with utility faucets.

37 – Administration Building 2 – Plumbing Fixtures

Commodes:			Urinals	Faucets			
Tank 1.6 GPF	Tank 3.5 GPF	Flush Valve 3.5 GPF	2.0 GPF	GPM average	Total Lavatory	Metered	Kitchen (break)
0	0	1	6	3.1	2.8	0	2

38 – SHERIFF/CORONER FACILITY

I. General Description

A. Gross Square Footage: 125,055 Sq. Ft.

B. Year of Original Construction: 2002

C. General Construction Information: No architectural drawings were recovered for this facility.

D. Building Schedules: The building is occupied from approximately 6:00 am to 5:00 pm, Monday through Friday. The building does have areas that are occupied 24 hours a day, seven days a week. The custodial staff works from 4:00 pm to 1:00 am, Monday through Friday.

II. Lighting

A. An inventory of lighting is presented in the Appendix.

III. Miscellaneous Equipment

A. The majority of miscellaneous equipment found in the Sheriff/Coroner Facility is general office equipment, which includes personal computers, printers, faxes, etc.

IV. Heating, Ventilation, and Air Conditioning

A. Heating System: The Sheriff/Coroner Facility receives heating from rooftop units.

B. Cooling System: The Sheriff/Coroner Facility receives cooling from rooftop units.

C. Distribution Systems:

1. VAV Rooftop Units: These units are variable air volume reheat systems. They are equipped with a supply fan, a return fan, a direct expansion cooling coil, a natural gas fired burner, mixed air dampers, and electric VAV reheat boxes. The supply air volume is controlled by a variable frequency drive, which modulates to maintain the supply air duct static pressure setpoint. The direct expansion cooling coil maintains the cooling discharge air temperature setpoint. The natural gas fired heating coil maintains the discharge air temperature setpoint. The conditioned air is distributed to the spaces via fan powered, electric VAV reheat boxes. The mixed air dampers are controlled by electric actuators, which modulate to maintain the mixed air temperature setpoint. These units are controlled through the Trane Tracer Summit energy management system. Also, only two of the units run at a time. Two units serve one supply air duct header in order to achieve 100% redundancy. Additional information on the rooftop units is listed in the table below.

38 – Sheriff/Coroner Facility – VAV Rooftop Units

			Condenser			Compressor			Supply Fans		Return Fan
Equip ID	Mfgr	Model	Qty	HP	Amps	Qty	HP	Amps	Qty	HP	HP
RTU-1	Trane	SFHSC90	8	1	1.8	2	N/A	18.2	2	50	25
RTU-2	Trane	SFHSC90	8	1	1.8	2	N/A	18.2	2	50	25
RTU-3	Trane	SFHSC90	8	1	1.8	2	N/A	18.2	2	50	25
RTU-4	Trane	SFHSC90	8	1	1.8	2	N/A	18.2	2	50	25

N/A – The nameplate data was not available during the time of the survey.

2. Rooftop Units: These units are constant volume single zone systems. They are equipped with a supply fan, a direct expansion cooling coil, a natural gas fired burner, and mixed air dampers. The supply fan maintains the space temperature setpoint. The direct expansion cooling coil maintains the cooling discharge air temperature setpoint. The natural gas fired burner maintains the heating discharge air temperature setpoint. The mixed air dampers are controlled by electric actuators, which modulate to maintain the mixed air temperature setpoint. These units are controlled through the Trane Tracer Summit energy management system. They serve the Northeast corner of the second floor. Additional information on the rooftop units is listed in the table below.

38 – Sheriff/Coroner Facility - Rooftop Units

			Supply Fan		Condenser			Compressor		
Equip ID	Mfgr	Model	CFM	HP	Qty	HP	Amps	Qty	HP	Amps
RTU-5	Trane	YCD-180	6,000	5	2	0.5	1.6	2	N/A	118
RTU-6	Trane	YCD-180	6,000	5	2	0.5	1.6	2	N/A	118

N/A – The nameplate data was not available during the time of the survey.

3. Liebert Units: These units are direct expansion split systems, with electric heat. These units operate 24 hours a day, seven days a week. Additional information on the Liebert units is listed in the table below.

38 – Sheriff/Coroner Facility - Liebert Units

			Supply Fan			
Equip ID	Mfgr.	Model	CFM	HP	Amps	Volts
CRAC-1	Liebert	N/A	N/A	5	N/A	N/A
CRAC-2	Liebert	N/A	N/A	5	N/A	N/A
CRAC-3	Liebert	N/A	N/A	5	N/A	N/A

N/A – The nameplate data was not available during the time of the survey.

4. Makeup Air Unit: This unit is equipped with a supply fan, a direct expansion cooling coil, and a natural gas fired burner. The direct expansion cooling coil cycles to maintain the cooling space temperature setpoint. The natural gas fired burner cycles to maintain the heating space temperature setpoint. This unit serves the autopsy area. Additional information about the makeup air unit is listed in the table below.

38 – Sheriff/Coroner Facility - Makeup Air Unit

			Supply Fan			
Equip ID	**Mfgr.**	**Model**	**CFM**	**HP**	**Amps**	**Volts**
MAU-1	Engineered Air	FW-224/DJ-60	4,800	5	N/A	N/A

N/A – The nameplate data was not available during the time of the survey.

V. Miscellaneous HVAC Equipment

A. Domestic Hot Water:

1. Domestic hot water is produced by a natural gas fired hot water heater. Additional information about the natural gas fired hot water heater is listed in the table below.

38 – Sheriff/Coroner Facility - DHW Heater

Equip ID	**Mfgr**	**Gallons**	**Input MBH**
DHWH-1	AO Smith	400	1500

B. Exhaust Fans:

1. There are multiple exhaust fans located throughout the building which serve the restrooms.

4
Energy Conservation Measures

The following section contains descriptions of the Energy Conservation Measures (ECM's). These ECM's were developed with at least one of three goals in mind. Those goals were: 1) reduce utility and operational costs, 2) resolve existing operational problems, and 3) improve the working environment. Not all of the ECM's analyzed proved to be cost effective and, therefore, are not recommended for the program. However, the ECM's recommended herein proved to be viable and will address and achieve the stated goals.

A list of all ECM's analyzed is shown in Table 4.1. Table 4.1 includes many comprehensive energy conservation measures. Each measure was analyzed in a preliminary fashion. Most ECM's were evaluated in detail. Some were not evaluated in detail, based on preliminary analysis results and feedback from the Arapahoe County staff.

Tables 4.2 through 4.16 show costs and savings of all ECM's investigated. ECM's as part of the recommenced program can be found in the Executive Summary.

The final proposed scope is shown in the Executive Summary, Section 1, of this report.

Table 4.1
Analyzed Energy Conservation Measures for
ARAPAHOE COUNTY

Building	Gross Floor Area	Analyzed ECM's																												
		1 - Lighting Energy Efficiency Upgrades	2 - Water Conservation Measures	2a - Water Conservation Measures with Waterless Urinals	3 - Upgrade/Install New EMCS	4 - Install Programmable Thermostats	5 - Replace the Existing Chillers and Cooling Tower	6 - Replace the Existing Natural Gas-Fired Boilers	7 - Install a New VFD on the Existing Exhaust Fan	8 - Install a VFD on Existing Vane Axial Fan	9 - Replace Air-Cooled Chillers with Water-Cooled Chillers	10 - Install an A/C Unit to Serve Computer Equipment Room	11 - Variable Flow WSHP System	12 - Water Softener	13 - Install Waterside Economizer	14 - Chilled Water Storage	15 - Combined Heat & Power (CHP)	16 - Irrigation Control System Upgrade	17 - Programmable Flush Valve Controls	18 - Install Water Reclaim System	19 - Laundry Conservation	20 - Replace DHW HX with a New DHW Heater	21 - Change Natural Gas Utility Provider	22 - Remove Existing Fire Pumps	23 - Energy Resource Conservation Manager	24 - Replace Cooling Tower	25 - Retro commissioning	26 - Replace Modulines and Install VAV boxes, Diffusers, Controls
01 - Administration Building	140,263	X	X	X	X		X	X	X						X	X		X				X			X			X
12 - Arapahoe Plaza East Building	20,957	X	X	X	X													X							X			
13 - Arapahoe Human Services	54,678	X	X	X	X			X			X							X					X		X			
14 - Arapahoe Plaza West Building (County Court)	20,880	X	X	X	X													X							X			
15 - Federal Warehouse	75,073	X	X	X	X	X																			X			
16 - CSU Extension Office	5,309	X	X	X																					X			
17 - CSU Warehouse	9,476	X	X																						X			
20 - Tri County Health	8,398	X	X		X	X																			X			
23 - Altura Plaza Building	74,675	X	X	X	X			X					X					X							X			
24 - Centrepoint Plaza	105,662	X		X	X																				X		X	
29 - Peoria Shops	25,008	X	X	X	X	X														X					X			
35 - ACJC Courthouse	148,522	X	X	X	X			X		X				X				X						X	X	X		
36 - ACJC Detention Center	291,955	X	X	X	X			X						X			X	X	X		X			X	X			
37 - ACJC Administrative II	91,110	X	X	X	X			X			X	X		X				X					X		X			
38 - Sheriff/Coroner Facility	125,055	X		X	X																				X		X	
Gross Floor Area Total	**1,197,021**																											

SHADED PROJECTS ARE INCLUDED IN THE RECOMMENDED PROGRAM

Table 4.2
ECM Summary Table – 01 Administration

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
								Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
01 - ADMINISTRATION BUILDING														
1	Lighting Energy Efficiency Improvements	172,101	54.5	125,062	(1,322)	0	0	16,593	(838)	0	0	2,760	18,515	9.3
2	Water Conservation Measures	46,934	0.0	0	0	470.6	0.0	0	0	2,522	0	0	2,522	18.6
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	62,182	0.0	0	0	669	0.0	0	0	3,588	0	0	3,588	17.3
3	Install New/Upgrade the Existing EMCS	189,038	0.0	218,866	11,548	0.0	0.0	12,845	7,331	0	0	0	20,176	9.4
5	Replace the Existing Chillers and Cooling Tower	1,172,832	54.1	79,870	0	0.0	0.0	10,052	0	0	0	0	10,052	116.7
6	Replace the Existing Natural Gas Fired Boilers	166,914	(1.7)	(5,038)	1,851	0.0	0.0	(585)	1,175	0	0	0	590	282.9
7	Install a New VFD on Existing Exhaust Fan	31,006	0.0	18,915	0	0.0	0.0	1,110	0	0	0	0	1,110	27.9
13	Waterside Economizer	81,635	52.2	46,637	0	0.0	0.0	6,433	0	0	0	0	6,433	12.7
14	Chilled Water Storage	0	0.0	0	0	0.0	0.0	0	0	0	0	0	0	
16	Irrigation Control System Upgrade	9,988	0.0	0	0	0.0	126.9	0	0	0	680	(120)	560	17.8
20	Replace DHW HX with new DHW Heater	25,810	0.0	0	2,158	0.0	0.0	0	1,370	0	0	0	1,370	18.8
23	Energy Resource Conservation Management Program	9,229	0.0	22,742	701	0.0	0.0	1,335	445	0	0	0	1,780	5.2
26	Replace Existing Moduline Boxes w/ VAV Terminal Units	2,015,547	0.0	0	0	0.0	0.0	0	0	0	0	0	0	
TOTAL OF RECOMMENDED ECMs		3,983,216	159.1	507,055	14,936	1,140	127	47,783	9,483	6,110	680	2,640	66,697	59.7

Table 4.3
ECM Summary Table – 12 Arapahoe Plaza East

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
								Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
12 - ARAPAHOE PLAZA EAST BUILDING														
1	Lighting Energy Efficiency Improvements	19,519	6.1	16,471	(165)	0	0	1,998	(105)	0	0	10	1,903	10.3
2	Water Conservation Measures	6,656	0.0	0	0	81.0	0.0	0	0	434	0	0	434	15.3
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	8,108	0.0	0	0	118.9	0.0	0	0	637	0	0	637	12.7
3	Install New/Upgrade the Existing EMCS	73,176	0.0	76,871	2,516	0.0	0.0	4,512	1,597	0	0	0	6,109	12.0
16	Irrigation Control System Upgrade	9,988	0.0	0	0	0.0	126.9	0	0	0	680	(550)	130	76.7
23	Energy Resource Conservation Management Program	1,379	0.0	3,398	89	0.0	0.0	199	56	0	0	0	255	5.4
TOTAL OF RECOMMENDED ECMs		118,826	6.1	96,740	2,439	200	127	6,709	1,549	1,071	680	(538)	9,471	12.5

Table 4.4
ECM Summary Table – 13 Arapahoe Human Services

Building and ECM Number & Name	Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
							Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
13 - ARAPAHOE HUMAN SERVICES													
1 Lighting Energy Efficiency Improvements	44,031	13.1	35,863	(379)	0	0	4,324	(241)	0	0	59	4,142	10.6
2a Water Conservation Measures w/ Waterless Urinal Retrofit	13,657	0.0	0	0	279.1	0.0	0	0	1,496	0	0	1,496	9.1
3 Install New/Upgrade the Existing EMCS	192,336	0.0	132,023	4,300	0.0	0.0	7,748	2,730	0	0	0	10,478	18.4
6 Replace the Existing Natural Gas Fired Boilers	156,742	0.0	-3,120	769	0.0	0.0	-183	488	0	0	0	305	514.1
21 Change Natural Gas Utility Provider	0	0.0	0	0	0.0	0.0	0	3,540	0	0	0	3,540	0.0
23 Energy Resource Conservation Management Program	3,598	0.0	8,865	231	0.0	0.0	520	147	0	0	0	667	5.4
TOTAL OF RECOMMENDED ECMs	420,390	13	173,632	4,922	488	0	12,409	6,664	2,615	0	59	21,747	19.3

Table 4.5
ECM Summary Table – 14 Arapahoe Plaza West

Building and ECM Number & Name	Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
							Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
14 - ARAPAHOE PLAZA WEST BUILDING (COUNTY COURT)													
1 Lighting Energy Efficiency Improvements	17,823	5.9	12,717	(128)	0	0	1,743	(81)	0	0	213	1,875	9.5
2 Water Conservation Measures	13,657	0.0	0	0	247.2	0.0	0	0	1,325	0	0	1,325	10.3
2a Water Conservation Measures w/ Waterless Urinal Retrofit	15,109	0.0	0	0	305.1	0.0	0	0	1,635	0	0	1,635	9.2
3 Install New/Upgrade the Existing EMCS	58,216	0.0	71,285	5,076	0.0	0.0	4,184	3,222	0	0	0	7,406	7.9
23 Energy Resource Conservation Management Program	1,374	0.0	3,385	88	0.0	0.0	199	56	0	0	0	255	5.4
TOTAL OF RECOMMENDED ECMs	106,179	5.9	87,387	5,036	552	0	6,125	3,197	2,960	0	213	12,495	8.5

Table 4.6
ECM Summary Table – 15 Federal Warehouse

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	Simple Payback (Years)
15 - FEDERAL WAREHOUSE														
1	Lighting Energy Efficiency Improvements	18,056	7.0	15,823	(159)	0	0	2,125	(119)	0	0	129	2,134	8.5
2	Water Conservation Measures	4,495	0.0	0	0	8.2	0.0	0	0	44	0	0	44	102.2
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	6,552	0.0	0	0	18.5	0.0	0	0	99	0	0	99	66.2
3	Install New/Upgrade the Existing EMCS	23,465	0.0	13,513	1,662	0.0	0.0	793	1,246	0	0	0	2,039	11.5
4	Install Programmable Thermostats	550	0.0	13,513	1,662	0.0	0.0	793	1,246	0	0	0	2,039	0.3
23	Energy Resource Conservation Management Program	4,940	0.0	12,172	318	0.0	0.0	714	238	0	0	0	952	5.2
TOTAL OF RECOMMENDED ECMs		58,057	7.0	55,021	3,483	27	0	4,425	2,611	143	0	129	7,308	7.9

Table 4.7
ECM Summary Table – 16 CSU Extension

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	Simple Payback (Years)
16 - CSU EXTENSION OFFICE														
1	Lighting Energy Efficiency Improvements	6,241	2.0	5,784	(61)	0	0	688	(45)	0	0	46	689	9.1
2	Water Conservation Measures	3,717	0.0	0	0	29.7	0.0	0	0	159	0	0	159	23.4
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	4,443	0.0	0	0	34.8	0.0	0	0	187	0	0	187	23.8
TOTAL OF RECOMMENDED ECMs		14,400	2.0	5,784	-61	65	0	688	-45	346	0	46	1,035	13.9

Table 4.8
ECM Summary Table – 17 CSU Warehouse

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	Simple Payback (Years)
17 - CSU WAREHOUSE														
1	Lighting Energy Efficiency Improvements	5,753	0.4	531	(6)	0	0	40	(4)	0	0	6	42	136.3
2	Water Conservation Measures	259	0.0	0	0	0.8	0.0	0	0	4	0	0	4	64.8
TOTAL OF RECOMMENDED ECMs		6,012	0.4	531	-6	1	0	40	-4	4	0	6	46	130.1

Table 4.9
ECM Summary Table – 20 Tri County Health

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
								Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
20 - TRI COUNTY HEALTH														
1	Lighting Energy Efficiency Improvements	11,012	4.2	10,584	(106)	0	0	1,337	(80)	0	0	342	1,598	6.9
2	Water Conservation Measures	0	0.0	0	0	0.0	0.0	0	0	0	0	0	0	
3	Install New/Upgrade the Existing EMCS	21,668	0.0	6,828	1,166	0.0	0.0	401	874	0	0	0	1,275	
4	Install Programmable Thermostats	2,477	0.0	6,828	1,166	0.0	0.0	401	874	0	0	0	1,275	1.9
23	Energy Resource Conservation Management Program	553	0.0	1,362	36	0.0	0.0	80	27	0	0	0	107	5.2
TOTAL OF RECOMMENDED ECMs		35,710	4.2	25,603	2,261	0	0	2,218	1,695	0	0	342	4,255	8.4

Table 4.10
ECM Summary Table – 23 Altura Plaza

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
								Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
23 - ALTURA PLAZA BUILDING														
1	Lighting Energy Efficiency Improvements	89,736	61.5	159,641	0	0	0	19,820	0	0	0	2,821	22,641	4.0
2	Water Conservation Measures	26,622	0.0	0	0	320.0	0.0	0	0	1,597	0	0	1,597	16.7
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	41,333	0.0	0	0	515.4	0.0	0	0	2,572	0	0	2,572	16.1
3	Install New/Upgrade the Existing EMCS	162,874	0.0	262,098	55,360	0.0	0.0	15,383	35,143	0	0	0	50,526	3.2
6	Replace the Existing Natural Gas Fired Boilers	208,672	0.0	(1,402)	1,729	0.0	0.0	(82)	1,098	0	0	0	1,016	205.4
11	Variable Flow Water Source Heat Pump Circulation Loop	49,878	0.0	21,540	0	0.0	0.0	1,264	0	0	0	0	1,264	39.5
16	Irrigation Control System Upgrade	7,471	0.0	0	0	0.0	22.7	0	0	0	113	-119	-6	
23	Energy Resource Conservation Management Program	4,914	0.0	12,108	373	0.0	0.0	711	237	0	0	0	948	5.2
TOTAL OF RECOMMENDED ECMs		591,501	61.5	453,984	57,462	835	23	37,095	36,478	4,169	113	2,702	80,558	7.3

Table 4.11
ECM Summary Table – 24 Cetrepointe Plaza

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
								Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
24 - CENTREPOINT PLAZA														
1	Lighting Energy Efficiency Improvements	35,152	10.2	35,183	(353)	0	0	3,953	(285)	0	0	0	3,668	9.6
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	17,979	0.0	0	0	397	0.0	0	0	1,981	0	0	1,981	9.1
23	Energy Resource Conservation Management Program	6,953	0.0	15,907	415	0	0.0	1,005	335	0	0	0	1,340	5.2
25	Retro Commissioning	29,723	0.0	237,292	(4,540)	0.0	0.0	14,999	(3,664)	0	0	0	11,335	2.6
TOTAL OF RECOMMENDED ECMs		89,807	10.2	288,382	(4,478)	397	0	19,958	(3,614)	1,981	0	0	18,325	4.9

Table 4.12
ECM Summary Table – 29 Peoria Shops

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
								Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
29 - PEORIA SHOPS														
1	Lighting Energy Efficiency Improvements	16,715	5.4	16,327	(164)	0	0	1,868	(104)	0	0	349	2,113	7.9
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	5,878	0.0	0	0	67.1	0.0	0	0	877	0	0	877	6.7
3	Install New/Upgrade the Existing EMCS	20,987	0.0	6,053	8,615	0.0	0.0	355	5,469	0	0	0	5,824	3.6
4	Install Programmable Thermostats	2,477	0.0	6,053	8,615	0.0	0.0	355	5,469	0	0	0	5,824	0.4
18	Water Reclaim	52,181	-6.6	-2,793	0	576.0	0.0	-1,277	0	7,528	0	-1,280	4,971	10.5
23	Energy Resource Conservation Management Program	1,646	0.0	4,055	125	0.0	0.0	238	79	0	0	0	317	5.2
TOTAL OF RECOMMENDED ECMs		99,883	-1.2	29,696	17,190	643	0	1,539	10,913	8,405	0	-931	19,926	5.0

Table 4.13
ECM Summary Table – 35 ACJC Courthouse

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS						Simple Payback (Years)
								Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	
35 - ACJC COURTHOUSE														
1	Lighting Energy Efficiency Improvements	160,935	69.8	220,825	0	0	0	24,825	0	0	0	5,114	29,938	5.4
2	Water Conservation Measures	54,195	0.0	0	0	389	0.0	0	0	5,090	0	0	5,090	10.6
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	66,175	0.0	0	0	508	0.0	0	0	6,644	0	0	6,644	10.0
3	Install New/Upgrade the Existing EMCS	368,278	0.0	74,515	4,922	0	0.0	4,373	3,125	0	0	0	7,498	49.1
6	Replace the Existing Natural Gas Fired Boilers	189,207	0.0	-8,023	7,294	0	0.0	(471)	4,630	0	0	0	4,159	45.5
8	Install a New VFD on Existing Vane Axial Fan	117,393	0.0	226,190	0	0	0.0	13,275	0	0	0	0	13,275	8.8
12	Water Softener	35,093	0.0	0	0	2,624	0.0	0	0	34,295	0	-5,805	28,490	1.2
13	Waterside Economizer	70,123	0.0	0	0	0	0.0	0	0	0	0	0	0	
23	Energy Resource Conservation Management Program	9,773	0.0	24,081	742	0	0.0	1,413	471	0	0	0	1,884	5.2
24	New Cooling Tower	216,088	3.9	6,587	0	0	0.0	1,048	0	0	0	0	1,048	206.1
TOTAL OF RECOMMENDED ECMs		1,287,260	74	544,175	12,959	3,522	0	44,464	8,226	46,029	0	-691	98,028	13.1

Table 4.14
ECM Summary Table – 36 ACJC Detention Center

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	Simple Payback (Years)
36 - ACJC DETENTION CENTER														
1	Lighting Energy Efficiency Improvements	158,033	55.2	278,489	(2,796)	0	0	25,724	(1,775)	0	0	3,148	27,096	5.8
2	Water Conservation Measures	151,960	0.0	0	1,261	1,582	0	0	800	24,769	0	0	25,569	5.9
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	181,245	0.0	0	0	2,771	0	0	0	43,388	0	0	43,388	4.2
3	Install New/Upgrade the Existing EMCS	548,787	0.0	0	0	0	0	0	0	0	0	0	0	
6	Replace the Existing Natural Gas Fired Boilers	1,011,294	0.0	0	23,459	0	0	0	14,892	0	0	0	14,892	67.9
12	Water Softener	344,359	0.0	0	0	3,094	0	0	0	48,459	0	-9,080	39,379	8.7
15	Install a Cogeneration Plant	864,354	146.0	1,278,960	-112,661	0	0	99,870	-71,518	0	0	-26,280	2,072	417.1
16	Irrigation Control System Upgrade	19,519	0.0	0	0	0	306	0	0	0	2,395	-825	1,570	12.4
17	Programmable Flush Valve Controls	739,681	0.0	0	0	3,615	0	0	0	56,616	0	0	56,616	13.1
19	Laundry Conservation	52,492	0.0	0	1,276	440	0	0	810	6,888	0	0	7,698	6.8
23	Energy Resource Conservation Management Program	19,211	0.0	47,337	1,459	0.0	0.0	2,778	926	0	0	0	3,704	5.2
TOTAL OF RECOMMENDED ECMs		4,090,935	201.2	1,604,786	-88,002	11,502	306	128,372	-55,865	180,120	2,395	(33,037)	221,985	18.4

Table 4.15
ECM Summary Table – 37 ACJC Administrative II

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	Simple Payback (Years)
37 - ACJC ADMINISTRATIVE II														
1	Lighting Energy Efficiency Improvements	196,219	62.2	210,550	(2,225)	0	0	22,933	(1,666)	0	0	3,638	24,905	7.9
2	Water Conservation Measures	26,311	0.0	0	0	151	0.0	0	0	1,978	0	0	1,978	13.3
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	34,298	0.0	0	0	220.5	0.0	0	0	2,882	0	0	2,882	11.9
3	Install New/Upgrade the Existing EMCS	216,659	0.0	18,671	1,970	0.0	0.0	1,096	1,477	0	0	0	2,573	84.2
6	Replace the Existing Natural Gas Fired Boilers	134,459	-0.7	-6,467	1,783	0.0	0.0	-504	1,337	0	0	0	833	161.3
10	Install A/C Units to Serve Computer Equipment Rooms	83,981	0.0	37,602	2,356	0.0	0.0	2,207	1,766	0	0	0	3,973	21.1
12	Water Softener	19,016	0.0	0	0	0.0	0.0	0	0	0	0	(2,720)	(2,720)	
13	Waterside Economizer	239,426	60.2	56,236	0	-67.2	0.0	7,564	0	-878	0	-5,000	1,686	142.0
23	Energy Resource Conservation Management Program	5995.1	0.0	14,772	386	0.0	0.0	867	289	0	0	0	1,156	5.2
TOTAL OF RECOMMENDED ECMs		956,363	122	331,364	4,270	305	0	34,164	3,203	3,982	0	(4,082)	37,267	25.7

Table 4.16
ECM Summary Table – 38 Sheriff/Coroner Facility

Building and ECM Number & Name		Installed Cost ($)	Monthly KW Savings	Annual KWH Savings	Annual Gas Savings Therms	Annual Water & Sewer Savings Kgallons	Annual Irrigation Savings Kgallons	COST SAVINGS Electric ($)	Natural Gas ($)	Water & Sewer ($)	Irrigation ($)	Operational ($)	Total ($)	Simple Payback (Years)
38 - SHERIFF/CORONER FACILITY														
1	Lighting Energy Efficiency Improvements	42,927	12.9	39,353	(395)	0	0	4,497	(287)	0	0	0	4,210	10.2
2a	Water Conservation Measures w/ Waterless Urinal Retrofit	17,979	0.0	0	0	180.0	0.0	0	0	1,175	0	0	1,175	15.3
23	Energy Resource Conservation Management Program	8,229	0.0	20,276	545	0.0	0.0	1,190	397	0	0	0	1,587	5.2
25	Retro Commissioning	20,916	0.0	227,590	(6,766)	0.0	0.0	13,357	(4,923)	0	0	0	8,434	2.5
TOTAL OF RECOMMENDED ECMs		90,049	12.9	287,219	(6,616)	180	0	19,045	(4,813)	1,175	0	0	15,407	5.8

ECM Number: 1

ECM Title: Lighting Energy Efficiency Upgrades

ECM 1a: Electronic Ballasts and T8 Lamps

ECM Description:

Arapahoe County utilizes fluorescent fixtures containing a combination of standard and energy saving T12 lamps. Standard magnetic core and coil ballasts are used to operate these lamps. This ECM considers retrofitting the existing fluorescent fixtures with T8 lamps and electronic ballasts at the following facilities:

(01) Administration Building
(13) Human Services
(15) Federal Warehouse
(17) CSU Warehouse
(29) Peoria Shop
(36) Detention Center
(35) Courthouse
(12) Plaza East Building
(14) Plaza West Building
(16) CSU Extension Office
(20) Tri-County Health
(23) Altura Plaza Building
(37) Administrative II

The combination of T8 lamps and electronic ballasts is the most technologically advanced fluorescent lighting system available. It has been proven to be approximately 40% more energy efficient than the conventional T12 lamps and magnetic ballasts. The electronic ballasts operate at high frequencies to reduce the power requirements, while maintaining the appropriate light level. Electronic ballasts also reduce the tendency of fluorescent lamps to flicker or ballasts to hum. T8 lamps also use rare earth phosphor minerals, which provide superior color rendition similar to the familiar energy saver or warm white lamps.

Magnetic ballasts can control a maximum of 2 lamps, and electronic ballasts can control up to 4 lamps. This reduces the number of ballasts purchased, by allowing a ballast to operate more than 2 lamps. Some areas that have luminaires mounted end-to-end can be tandem ballasted. Tandem ballasted fixtures house the ballast in one luminaire, while operating lamps in one, or more, of the nearby luminaires.

In addition to energy savings, this lighting ECM creates maintenance savings as well. The proposed T8 lamps and electronic ballasts will replace existing older lamps and ballasts. The new lamps and electronic ballasts have expected lives of approximately 24,000 hours and 25 years, respectively. They are 100% guaranteed by the manufacturer for 3 years (lamps) and 5 years (ballasts).

Chevron Energy Solutions recommends retrofitting T12 fluorescent luminaires with the T8 system. The T8 lamps fit in the existing standard T12 bi-pin sockets without luminaire modification. Recommended replacement lamps are as follows:

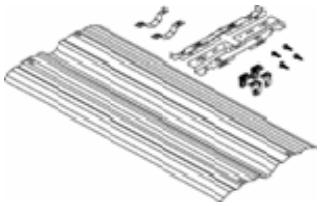
- 20 watt, 2-foot, T12 lamps replaced with 17 watt T8 lamps
- 34 watt and 40 watt, 4-foot, T12 lamps replaced with 32 watt T8 lamps
- 60 watt, 75 watt, 110 watt, 8-foot, T12 lamps with two 32 watt T8 lamps mounted end-to-end.

These retrofits will reduce the energy consumption of these luminaires, while maintaining the appropriate light level and quality.

ECM 1b: Specular Reflectors, Electronic Ballasts, and T8 Lamps

ECM Description:

The buildings listed below utilize recessed luminaires that contain fluorescent T12 lamps, either linear or U-tube. Magnetic core and coil ballasts operate these lamps. The most common recessed luminaire contains 4 standard 4-foot T12 lamps with two magnetic ballasts.



(01) Administration Building
(13) Human Services
(15) Federal Warehouse
(17) CSU Warehouse
(38) Sheriff/Coroner Facility
(24) Centrepoint Plaza
(37) Administrative II
(12) Plaza East Building
(14) Plaza West Building
(16) CSU Extension Office
(29) Peoria Shop
(23) Altura Plaza Building
(36) Detention Center
(35) Courthouse

The lighting industry has seen continued advances in the field of light reflection, which has resulted in the introduction of specular reflectors. With the specular reflector system, up to half of the lamps and ballasts can be removed without reducing the light level at the work surface. A reflective surface is installed in the fixture to make up for the loss of illumination due to lamp removal. This reflects more of the remaining light back into the room.

Each specular reflector is custom designed using sophisticated optical engineering and computer-aided design. The reflector is bent at optimum angles for each fixture type. The enhanced aluminum material optimizes reflectivity and overall performance. The reflector produces uniform lighting that is comfortable and aesthetically pleasing without changing the appearance of existing fixtures. Trapped light is redirected in such a way that the fixture actually appears to still have all bulbs active. Use of this reflector causes almost all of the light energy within a fixture to be transmitted as usable light. Resulting light levels are less diverse because of the reflector's geometric design. This induces even distribution of light and reduces glare.

This ECM considers retrofitting luminaires with specular reflectors, T8 lamps, and electronic ballasts. Experience shows that fixture wattages may be reduced by half with little or no noticeable loss of light intensity at the working level. Listed below are the typical lighting fixtures and the proposed retrofit for each:

- The existing 2' x 4' luminaires containing three to four standard, 4-foot, T12 lamps and two ballasts, will be retrofitted with two 4-foot T8 lamps, an enhanced aluminum reflector, and one 2-lamp electronic ballast.

- The existing 2' x 4' luminaires located in an end-to-end configuration, and containing three to four standard, 4-foot, T12 lamps and two ballasts, will be retrofitted with each fixture

containing two, 4-foot, T8 lamps, and an enhanced aluminum reflector, with one 4-lamp electronic ballast installed in one luminaire and tandem wired to the second luminaire.

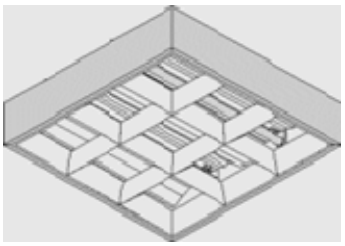
- The existing 2' x 2' luminaires containing two, T12, U-tube lamps and one ballast will be retrofitted with two, 2-foot, T8 lamps, an enhanced aluminum reflector, and one 2-lamp electronic ballast.

ECM 1c: Incandescent to New Fluorescent Fixtures with Electronic Ballasts and T8 Lamps

ECM Description:

The buildings listed below utilize incandescent luminaires in a wide variety of areas.

(01) Administration Building
(15) Federal Warehouse
(17) CSU Warehouse
(29) Peoria Shop
(36) Detention Center
(35) Courthouse
(14) Plaza West Building
(16) CSU Extension Office
(20) Tri-County Health
(23) Altura Plaza Building
(37) Administrative II



This ECM considers replacing selected high wattage incandescent fixtures that have significant operating hours with new fluorescent fixtures containing new T8 lamps and electronic ballasts. This ECM also considers replacing selected luminaires that currently use the less common 8' T12 fluorescent lamps.

While standard incandescent sources provide desirable qualities such as instant light, good color rendition, low replacement cost, and ease of control in dimming situations, they are the least efficient type of light source currently available. The typical life of an incandescent bulb ranges between 750 and 1,000 hours, and the typical efficacy of the incandescent source is 20 lumens per watt. Of the total input power, only 10% emerges as visible light. The typical efficacy of a T8 fluorescent luminaire is 80 to 100 lumens per watt, and lamps have an average life of 20,000 hours, which results in reduced maintenance cost.

With this higher efficacy, a lower wattage fluorescent fixture can provide light levels of the same or greater intensity as a higher wattage incandescent fixture. Due to advanced technology, the new T8 system is an excellent replacement because it is the most efficient fluorescent system available. Electronic ballasts operating at high frequencies reduce the power needed to produce the same or greater amount of light; and more efficient T8 lamps, along with new fixture design, allow more usable light to exit the fixture.

In summary, due to the long life of the fluorescent lamps as compared to the incandescent lamps, the energy maintenance savings, as well as improved lighting quality, this retrofit is highly recommended for all of the buildings analyzed.

ECM 1d: Incandescent to Compact Fluorescent.

ECM Description:

The buildings listed below utilize incandescent luminaires in a wide variety of areas.

(01) Administration Building
(16) CSU Extension Office
(20) Tri-County Health
(23) Altura Plaza Building
(36) Detention Center
(37) Administrative II
(35) Courthouse

Incandescent sources provide such desirable qualities as instant light, good color rendition, low replacement cost, and ease of control in dimming situations. However, they are the least efficient type of light source currently available. The typical life of an incandescent bulb ranges between 750 and 1,000 hours, with an efficacy of 20 lumens per watt. Incandescent lamps only allow 10% of the total input power as visible light.

Compact fluorescent lamps are significantly more efficient. They typically have an efficacy of 50 to 70 lumens per watt, and have an average rated lamp life of 10,000 hours. Long lamp life results in reduced maintenance costs associated with lamp replacements. The more efficient compact fluorescent lamp can provide the same light levels as higher wattage incandescent lamps, without sacrificing lighting quality.

Recommended replacement lamps are as follows:

- 60 watt, 65 watt, 75 watt, incandescent lamp replaced with 15 watt, two piece spiral screw-in compact fluorescent lamp
- 100 watt, incandescent lamp replaced with 23 watt, two piece spiral screw-in compact fluorescent lamps

This ECM considers replacing all incandescent lamps with screw-in compact fluorescent lamps. This requires the installation of new lamps and ballasts into the existing luminaries, and may require the removal of the existing fixture.

ECM 1e: New Fixtures with Hardwire Ballasts and Compact Fluorescent Lamps

ECM Description:

Currently, the buildings listed below utilize high wattage incandescent luminaires in various locations.

(01) Administration Building	(12) Plaza East Building
(14) Plaza West Building	(20) Tri-County Health
(23) Altura Plaza Building	(36) Detention Center

Incandescent lamps provide such desirable qualities as instant light, good color rendition, low replacement cost, and ease of control in dimming situations. However, they are the least efficient, and have the shortest lamp life, of any light source on the market. The typical life of an incandescent lamp ranges between 750 and 1,000 hours, with an efficacy of 20 lumens per watt. Only 10% of the total input power emerges as visible light.

Compact fluorescent lamps are significantly more efficient than standard incandescent lamps. Typically, compact fluorescents have an efficacy of 50 to 70 lumens per watt, and an average rated lamp life of 10,000 hours. A longer lamp life results in reduced maintenance costs associated with lamp replacements. Compact fluorescent lamps can provide the same, if not greater, light levels as higher wattage incandescent lamps.

Recommended replacement lamps and fixtures are as follows:

- 60, 75 watt, incandescent lamp replaced with square fixture, two-2 piece plug in 13 watt compact fluorescent lamps
- 60 watt, incandescent lamp replaced with decorative wall mount fixture, two-13 watt compact fluorescent lamps

This ECM considers replacing selected high wattage incandescent fixtures with new fluorescent fixtures. With the retrofit of new fixtures with compact fluorescent lamps and hardwire ballasts, the same amount of light will be delivered for around one-fourth of the energy.

ECM 1f: Incandescent to Halogen

ECM Description:

Incandescent PAR lamps are currently being used at the Arapahoe County Plaza East Building.

While incandescent sources provide desirable qualities such as instant light, good color rendition, low replacement cost, and ease of control in dimming situations, they are the least efficient and shortest-lived type of light source now on the market. The typical life of an incandescent lamp ranges between 750-1000 hours, with an efficacy of 20 lumens per watt. Of the total input power, only 10% emerges as visible light.

Tungsten halogen PAR lamps are a more efficient light source, with an efficacy as high as 50 lumens per watt. The typical lamp life is from 2,000 to 4,000 hours. With a higher efficacy, a lower wattage tungsten halogen lamp can provide light levels of the same intensity as a higher wattage incandescent lamp, while the increased life span reduces maintenance costs. Another benefit of the tungsten halogen retrofit is that these lamps are available in compatible sizes and shapes as incandescent PAR lamps, reducing installation costs normally associated with retrofitting these fixture types.

This ECM considers retrofitting selected existing incandescent luminaires with tungsten halogen PAR lamps in areas where the desired lighting control or conditions cannot be achieved through current compact fluorescent technology.

ECM 1g: Metal Halide to New Fluorescent Fixtures

Can Fixture – Compact Fluorescent Lamp

ECM Description:

Metal Halide lamps are currently being used at the following Arapahoe County Buildings.

(36) Detention Center
(37) Administrative II
(35) Courthouse

The standard Metal Halide (MH) lamps provide desirable qualities such as 100 lumens per watt, higher light levels with less wattage, and a lamp life of 15,000-20,000 hours. However, the MH fixture generates heat, (which, when located inside a building, can cause air conditioners to run more often; and when used in exterior lighting, can cause lenses to burn out quicker, depending on the fixture type). A typical Metal Halide lamp has a high lumen depreciation of 40 % and a restrike period of approximately 2 to 5 minutes. Metal Halide lamps will be retrofitted with electronic ballasts and either T8 fluorescent lamps or compact fluorescent lamps.

The T8 fluorescent luminaire provides nearly the same efficacy as the Metal Halide at 80 to 100 lumens per watt, and also has a greater average life of 24,000 hours. T8 Fluorescent lamps are instant start on/off, and are the most efficient fluorescent system available. Electronic ballasts operating at high frequencies reduce the power needed to produce the same or greater amount of light; and more efficient T8 lamps, along with new fixture design and reflector additions, allow more usable light to exit the fixture. Use of an aluminum reflector will cause almost all of the light energy within a fixture to be transmitted as usable light. Light levels will be less diverse and, thus, induce even light distribution and reduce glare.

While compact fluorescent lamps have an efficacy of only 50 to 70 lumens per watt, they have an average rated lamp life of 10,000 - 15,000 hours. Metal Halide lamps start to decay rapidly at 12,000-15,000 hours, yet compact fluorescent lamps produce a constant lumen output during an average life cycle. Compact fluorescent lamps are instant on/off and, therefore, do not have a restrike period.

Recommended replacement lamps and fixtures are as follows:

- 150 watt, Metal Halide lamp replaced with new 2'x 2' troffer, two-17 watt T8 lamps with enhanced aluminum reflector
- 150 watt, Metal Halide lamp replaced with new can fixture, two-18 watt compact fluorescent lamps

Due to the quicker restrike period, constant lumen output, and elimination of heat produced by metal halide lamps, this retrofit is highly recommended for the aforementioned buildings.

ECM 1h: New L.E.D. Exit Fixtures

ECM Description:

The buildings listed below utilize exit signs that are illuminated by incandescent lamps, with varying wattages.

(17) CSU Warehouse	(20) Tri-County Health
(29) Peoria Shop	(36) Detention Center
(37) Administrative II	(35) Courthouse

Incandescent sources provide such desirable qualities as instant light, good color rendition, and low replacement cost. However, they are the least efficient types of luminaire on the market. The typical lamp life of an incandescent exit light bulb ranges from 2,000 to 3,000 hours, with an efficacy light source rating of 20 lumens per watt. Only 10% of the total input power emerges as visible light in an incandescent lamp.

Chevron ES recommends replacing these fixtures with a Light Emitting Diode (LED) type exit fixture. LED exit fixtures meet or exceed IES standards for exit lighting levels, while using only 2 watts of energy. The LED exit fixtures have a five-year warranty and a twenty-five year projected life. This will reduce nearly all maintenance labor and material costs associated with replacing bulbs.

ECM 1i: Install Motion Sensors

ECM Description:

The Administrative II building has areas that are unoccupied during portions of the normal workday; and during this unoccupied time, the lights are left on. The 2nd and 3rd floors do not have light switches; thus, each floor is controlled by circuit breakers, and lighting can be only on or off for the entire floor. Office and hallway lights are always on, as long as a single occupant is present on that floor. Weekend periods increase the need for motion sensors because of minimal occupancy. With the addition of motion sensors, any unnecessary lighting in areas not occupied can be eliminated. Motion sensors will also reduce maintenance costs associated with labor and lamp replacement. This ECM considers installing motion or occupancy sensors in these areas to turn off the lights when the area is unoccupied.

Occupancy sensors are devices that detect motion within a space. They automatically turn off or adjust building lighting when a space is unoccupied for time periods typically greater than 6 to 10 minutes. They have the option of being adjustable for any amount of time, such that lighting can be turned off as little as seconds, and as high as hours after an area has been unoccupied. In addition, the sensors can be configured so that they can either turn the systems on manually or automatically depending on the occupant's preference.

The devices being installed will use either ultrasonic, passive infrared, or a combination of both technologies. The selection of the technology is based upon the best application for the space being controlled.

Ultrasonic sensors emit a low intensity, inaudible sound into the area being monitored. Motion is detected when the movements in the coverage area causes a Doppler shift in the reflected sound waves. Ultrasonic sensors are especially sensitive to minor occupant motion, but do not respond to audible sound. Due to the volumetric coverage pattern, these sensors often do not require a fully clear view to detect motion in the area to be controlled. Passive infrared sensors detect the changes in temperature that are created when a person moves within the field of view of the sensor. These sensors read the difference between the heat emitted by a human body and the temperature of the background space. When a person moves into or out of the field of view, the sensor detects motion by the change in the temperature it is sensing. Passive infrared sensors must have a clear view of the area to be controlled to operate effectively.

Sensors are effective in reducing unnecessary energy usage. Often a savings of 30% to 40% in energy usage can be realized in most commercial establishments with the properly designed installation of sensors. CES recommends installing motion sensors in locations wherever room design, primary function, lighting design, and room construction are appropriate.

ECM Number: 2

ECM Title: Water Conservation Measures

ECM Description:

The use of water at correctional institutions, healthcare facilities, office buildings, and other types of facilities has become more of a concern in recent years. In Colorado, this is even more of a concern due to the drought conditions and water restrictions that exist in the area.

Utility charges for potable water and sewage are now increasing at a rate greater than other utilities (electricity and natural gas). Consequently, retrofits have been developed for toilets to reduce the water required for each flush. These devices can reduce water usage by up to 50% per flush. Flush toilets and urinals are a major potable water user at Arapahoe County.

Replace Toilets with Ultra Low Flush Models

This measure replaces the toilets at certain sites that have a high sanitary water use and where water cost saving justifies replacement. Replacement of china and flush valve (or tank) is indicated in order to ensure proper operation. In general, the newer buildings have lower domestic usage due to newer existing equipment. Below is a tabulation of buildings were toilet replacement was evaluated, the total toilet count and recommended replacement.

Analysis indicated that changing all fixtures (toilets, urinals and faucets) was cost prohibitive. (For a discussion of analysis, see below.) Presently, urinal and faucet flow rates are relatively low. Replacing them garners little in the way of savings, and relatively high cost makes replacing them cost prohibitive. Also, half the population uses toilets exclusively and 60% of the toilets are assigned to that half. The return on investment for toilet replacement is enhanced by relatively high water billing rates.

Table 1: Toilet Replace Schedule:

		Style to be replaced			
Building	Total Count	3.5 GPF Tank	3.5 GPF Flush Valve	3.5 GPF Comby	Total Quantity To Be Replaced
Administration #l	44	0	0	0	44
Arapahoe Plaza (A/D works)	11	7	0	0	7
Arapahoe Plaza (Human Services)	19	9	0	0	9
Arapahoe Plaza (County Court)	19	18	0	0	18
CSU Extension Office	4	0	0	0	0
CSU Ware House	1	0	0	0	0
Federal Blvd Warehouse	10	0	0	0	5
Tri County Health	8	0	0	0	0
Administration #2	32	32	0	0	32

		Style to be replaced			
Building	Total Count	3.5 GPF Tank	3.5 GPF Flush Valve	3.5 GPF Comby	Total Quantity To Be Replaced
ACJC District Court	79	39	35	0	74
P.J. Sullivan Detention Center	71	0	71	0	71
P.J. Sullivan Detention Center (Comby)	413	0	0	413	0
County Shops:	6	0	0	0	6
Altura Plaza	55	15	12	0	27
Sheriff Coroner	39	0	0	0	0
Centrepoint	45	0	0	0	0
	856	120	118	413	293

Note: Thirty existing Comby's at the P.J. Sullivan Detention Center have already been replaced with 1.6 GPF Combys.

Administration #l:
This is a modern building with toilets that appear to have older units. The calculations comparing the billing rate to the expected use rate given the staffing levels, visitor demand, and normal frequency of use indicate that the fixtures are probably low usage units. However, low flow units can be installed to achieve savings to justify their installation.

Arapahoe Plaza: (A/D Works):
This building has both 1.6 GPF and 3.5 tank type gravity toilets and ultra low flush (ULF) pressure-assisted toilets. This measure concerns replacing the gravity units with new pressure-assisted toilets.

Arapahoe Plaza (Human Services):
This building has both 3.5 tank type gravity toilets and ultra low flush (ULF) pressure-assisted toilets. This measure concerns replacing the gravity units with new pressure-assisted toilets.

Arapahoe Plaza (County Court):
This building has 3.5 tank type gravity toilets and one ultra low flush (ULF) pressure assisted toilet. This measure concerns replacing the gravity units with new pressure-assisted toilets.

CSU Extension:
There are four 3.5 GPF toilet fixtures in this building. With a low population-to-toilet ratio and low year-round usage, changing the toilet fixtures is not justified based on water cost savings.

CSU Warehouse:
The one toilet in this building is a 1.6 GPF tank, gravity flush unit. With a low flush rate and low/sporadic population levels changing the toilet fixture is not justified based on water cost savings. However, it would be prudent to frequently (monthly) check for leakage using dye tablets designed for that purpose. Flapper valves in the bottom of tanks fail slowly, and "phantom" leaks

resulting from flapper failure can waste a substantial amount of water, especially because the rest room is seldom used.

Federal Warehouse:
The model showed low usage. There are two sets of restrooms, one serving the elections staff and training center and the other serving the maintenance staff. The former set of restrooms has been recently remodeled and requires no upgrades. The maintenance restrooms are seldom used. No change is recommended based on cost savings realized from reduced flush rates. However, it would be prudent to frequently (monthly) check for leakage using dye tablets designed for that purpose. Flapper valves in the bottom of tanks fail slowly, and "phantom" leaks resulting from flapper failure can waste a substantial amount of water, especially because the rest room is seldom used.

Tri-County Health Center:
The toilets in this building are older 3.5 GPF units. Given the high staffing and visitor levels, changing them would save substantial amounts of water. However, the water company classification of this building determines the billing rate with a minimum charge based on a minimum usage. The building never exceeds the minimum usage rate, so changing the toilets is not justified based on water cost savings. However, it would be prudent to frequently (monthly) check for leakage using dye tablets designed for that purpose. Flapper valves in the bottom of tanks fail slowly, and "phantom" leaks resulting from flapper failure can waste a substantial amount of water.

Administration #2:
This building has 3.5 tank type gravity toilets. This measure replaces the gravity units with new pressure-assisted toilets.

ACJC – District Court:
This building has both 3.5 GPF and 1.6 GPF tank type gravity toilets as well as ULF and 3.5 GPF flush valve toilets. This measure considers replacing the 3.5 GPF gravity units with new pressure-assisted toilets and also replacing the 3.5 flush valve units with ULF flush valve units.

P. J. Sullivan Detention Center:
This facility has a large number of fixtures with different population types. The visitors and staff and low security prison population use vitreous china fixtures with 3.5 GPF flush valves. The prison population has stainless steel combination units (combys) rated at 3.5 GPF. This measure replacing the vitreous china units with 1.6 GPF units.

The comby units are relatively expensive and the population-to-fixture is very low. Nevertheless, the inmates are at the facility for most of the day, and there are occasional intentional floods that are disruptive, costly to clean up, and waste water. This measure considers replacing the existing comby units with ULF models that have a flood control feature that mitigates intentional flooding. A detailed description of these units is located in ECM 17.

County Shops:
These fixtures are all low-use flush models, and changing the toilets is not justified based on water cost savings.

Altura Plaza:
This building has both 3.5 GPF and 1.6 GPF tank type gravity toilets, ULF, and 3.5 GPF flush valve toilets. This measure considers replacing the gravity units with new pressure-assisted toilets and also replacing the 3.5 flush valve units with ULF flush valve units.

Sheriff/Coroner:
This building has all ULF fixtures installed.

Centrepoint:
This building has all ULF fixtures installed.

<u>Replace Urinals with Ultra Low Flush Models:</u>

Replacing the urinals that have higher flush rates with ULF urinals can save water. This measure involves replacing or retrofitting the urinal flush valve and the vitreous china bowl with a ULF fixture assembly.

		Style to be replaced			
Building	Total Count	2 GPF	1 GPF	1 GPF Auto Flush	Total Quantity To Be Replaced
Administration #l	21	21	0	0	0
Arapahoe Plaza (A/D works)	2	2	0	0	0
Arapahoe Plaza (Human Services)	5	5	0	0	0
Arapahoe Plaza (County Court)	2	2	0	0	0
CSU Extension Office	1	0	0	0	0
CSU Ware House	0	0	0	0	0
Federal Blvd Warehouse	2	0	0	0	0
Tri County Health	2	0	0	0	0
Administration #2	6	6	0	0	0
ACJC District Court	9	0	0	0	0
P.J. Sullivan Detention Center	22	22	0	0	22
P.J. Sullivan Detention Center (Comby)	0	0	0	0	0
County Shops:	2	0	0	0	0
Altura Plaza	13	0	0	0	0
Sheriff Coroner	10	0	0	0	0
Centrepoint	12	0	0	0	0
	109	58	0	0	22

Replace Urinals with Waterless Models:

Waterless urinals are gaining acceptance among facilities managers, especially in areas where water costs are high. The technology is several years old now, and there is a successful track record that has been established encompassing ease of maintenance, water savings, and user acceptance. The system requires that maintenance staff and management learn how to perform the simple and regular tasks as part of regular cleaning schedule. Cleaning is not any more time consuming than a standard urinal and maintaining trap becomes a regular part of the cleaning routine. Staff and management make this adjustment easily. Patrons will be puzzled by the lack of something to do, but will not notice anything else different, visually or odor-wise, from the standard urinal.

		Style to be replaced			
Building	Total Count	2 GPF	1 GPF	1 GPF Auto Flush	Total Quantity To Be Replaced
Administration #l	21	21	0	0	21
Arapahoe Plaza (A/D works)	2	2	0	0	2
Arapahoe Plaza (Human Services)	5	5	0	0	5
Arapahoe Plaza (County Court)	2	2	0	0	2
CSU Extension Office	1	0	0	0	0
CSU Ware House	0	0	0	0	0
Federal Blvd Warehouse	2	0	0	0	2
Tri County Health	2	0	0	0	0
Administration #2	6	6	0	0	6
ACJC District Court	9	0	1	8	9
P.J. Sullivan Detention Center	22	22	0	0	0
P.J. Sullivan Detention Center (Comby)	0	0	0	0	0
County Shops:	2	0	2	0	0
Altura Plaza	13	5	8	0	13
Sheriff Coroner	10	0	10	0	10
Centrepoint	12	0	12	0	12
	109	57	31	8	80

In determining the savings for this measure, the annual cost for up keep on the special traps used by the system is included in the savings calculation.

The new urinal shall cover the scar left by the old unit. The water supply shall be removed and capped inside the wall cavity and the wall penetration hole covered with an acceptable, removable cover plate. Waste connection is simple change out.

ECM Number: 3

ECM Title: Install New/Upgrade Energy Management System

ECM Description:

This ECM investigates installing an Energy Management Control System (EMCS) to control the heating, ventilation, and air conditioning (HVAC) equipment at specified buildings included in this study for Arapahoe County. Sites included in this study which presently do not have EMCS control are:

Administration Building # 01
Arapahoe Plaza East Building #12
Arapahoe Human Services Building #13
Arapahoe Plaza West Building #14
Federal Warehouse Building #15
Tri-County Health Building #20
Altura Plaza Building #23
Peoria Shops Building #29

Sites included in this study that have EMCS control are:

ACJC Courthouse Building # 35 - Siemens
ACJC Detention Center Building # 36 - Siemens
ACJC Administration II Building #37 - Siemens
Centrepoint Building #24 - Invensys
Sheriff/Coroner Building #38 - Trane Tracer Summit

A listing of the equipment and devices to be controlled by the EMCS is given in the Appendix.

The proposed EMCS will provide supervisory control on some equipment, while providing direct digital control (DDC) on other equipment. For supervisory control equipment, the EMCS will enable the unit during occupied hours; and the existing local controls will control the unit and maintain space temperature. The EMCS will cycle the equipment during unoccupied hours to maintain a setback temperature.

With the DDC system, all existing controllers will be controlled by the EMCS. In most cases, the existing pneumatic actuators and valves will be reused. The EMCS will provide the control logic and signals, while the pneumatics system will provide actual modulation. Any new HVAC equipment installed as part of the energy program will have DDC control with electronic controls (no pneumatics).

Features and criteria associated with the implementation of this ECM are as follows:

- Building Controllers with Ethernet connectivity. Tri-County Health Building #20 does not have Ethernet connectivity; the controller will have a modem installed as well as Ethernet.
- Workstation pc's with the latest controls software version licensed to Arapahoe County (separate licenses for each) will be provided and installed at Administration I Building, Arapahoe Human Services Building and Altura Plaza Building.
- Laptop computer with the latest controls software version licensed to Arapahoe County will be provided.
- AutoCAD floor plans of each site.
- All air handling units (AHU's) will have the capability of being enabled/disabled by the EMCS. Most pumps, heating, cooling, and exhaust systems will be shut off in the buildings when they are not occupied. During unoccupied times the space temperature will be allowed to drop as low as 55ºF in the heating season and remain off in the cooling season. Specific areas of each building should be set back whenever they are not occupied.
- Chilled water pumps will be enabled/disabled by the EMCS, and the chilled water supply and return temperatures monitored. Actual control of the chilled water from chillers will be controlled by the existing chiller controls.
- Loop pumps and hot water pumps will be enabled/disabled by the EMCS, and the water supply and return temperatures monitored.
- The EMCS will provide outside air lockout temperatures for pumps and equipment. The heating hot water pumps should be completely shut off when the outside air temperature is greater than 60ºF. This will save natural gas, steam, and electricity, and can help to minimize overheating in crowded areas of the buildings. This concept also applies to the cooling systems. The chilled water pumps would be off until the outside air temperature reaches 50ºF. These temperature set points will be adjustable and cooling and heating will occur simultaneously on no occasions.
- Existing dampers and valves and their associated operators are assumed functional. The new EMCS will control these valves; and if the DDC system is installed, it will also control all the dampers.
- Each building will utilize an Optimal Start routine that will determine the time to start the equipment in order to bring the building up to the set-point temperature before the occupied period. The software will use the space temperature sensors to "learn" when to start the equipment based on the outside air temperature.
- New low voltage control and communication wire for the EMCS will be plenum rated when installed above drop ceilings. When ceiling access is not possible, wire will be run in conduit. New wire in mechanical rooms below 8 feet AFF shall be in EMT.
- Any asbestos abatement is excluded.
- Smoke detector repair/installation in AHU's is not included.

This system will also allow all equipment controlled in these buildings to be monitored on a PC from different locations.

The HVAC equipment will be scheduled according to the occupancy schedule of the spaces, as listed in the Appendix. It is imperative that facility personnel verify the equipment schedules with

the occupied schedules at least once a year. Failing to maintain these schedules will prevent a large portion of the energy savings from materializing. All of the schedules will be adjustable from the central location. In areas that require 24 hour per day operation, the equipment will operate 24 hours per day.

Another important step related to the implementation of the EMCS is training for the facility staff. Included in the initial cost of the EMCS is scheduled training for the appropriate facility personnel. Basic trouble-shooting and component replacement will be discussed. This will give the maintenance staff the ability to repair most future EMCS problems (i.e., fewer outside contractor service calls and expenses). In addition, the occupants of the building will be informed on the new temperature controls; and a procedure for permanent schedule changes and adjusting temperature set points will be established.

The installation contractor will provide a complete 1-year material and labor warranty for all EMCS components. Chevron Energy Solutions will perform a point-by-point commissioning during the installation to ensure that the EMCS works properly.

Arapahoe County will be responsible for the following items:

1. Maintaining temperatures and operating schedules as detailed in Standards of Control in the Appendix of this CEA Report. If changes in these values are required, Chevron Energy Services will need to be notified so that the impact of energy usage can be accounted for.

2. For maintaining and repairing the EMCS after the 1-year material and labor warranty expires.

3. For installing and maintaining the Ethernet LAN (phone line in Tri-County Health) in and to each building for EMCS communications.

All electrical installations will comply with the National Electric Code, the equipment shall be UL or ETL (or other approved insurance organization) listed, and the overall installation will conform to all Uniform Building Codes.

ECM Number: 4

ECM Title: Install Programmable Thermostats

ECM Description:

Currently, the furnaces, the rooftop units, and unit heaters at building 20-Tri County Health and building 29-Peoria Shops are controlled by manual thermostats which control the units at one set temperature 24 hours per day during the heating and cooling seasons.

Most of the units, except for one at building 15-Federal Warehouse, are already equipped with programmable thermostats. Also, one of the existing programmable thermostats was found to be broken during the time of survey.

Thermostats are available which can be programmed to turn the heating temperatures down to 55°F and turn the cooling systems off during selected times each day of the week. Such devices save energy by not keeping temperatures at the occupied setpoint when the building is unoccupied.

This ECM concerns installing programmable thermostats on the furnaces, rooftop units, and unit heaters located at the facilities listed above. Installing these thermostats will decrease electrical and natural gas energy consumption while maintaining comfort during occupied times in each building. A programmable thermostat will be installed that will allow 7-day scheduling and multiple operating time periods each day.

The schedules and space temperature setpoints that each of the new thermostats shall be set to are shown in the Standards of Control which is located in the Appendix.

ECM Number: 5a

ECM Title: Replace the Existing Chillers and Cooling Tower

ECM Description:

Currently, cooling is provided to building 01-Administration Building by two water-cooled, reciprocating chillers that have heat recovery capabilities. Each chiller is equipped with two different condensers. The first condenser is piped to a cooling tower which transfers the heat generated by the compressors to the outdoors. The second condenser is piped to the building's hot water system which transfers the heat generated by the compressors to the hot water return line, preheating the hot water before it re-enters the boilers. This type of chilled water system works best when there is a need for chilled water throughout the entire winter, which is not the case at this facility. The four main air handling units in this building are equipped with air-side economizers which can be utilized during the winter to provide cooling, instead of the chillers. This type of chilled water system has caused some operational problems due to the complexity of the system. For example, the hot water return water flows through the heat recovery condenser at all times — there are no valves installed to enable the hot water return to bypass the condenser. This causes the chiller to operate in heat recovery mode whenever the hot water pumps are running, which may not always be the ideal time for the heat recovery condenser to be running. The chiller operates at a lower efficiency using the heat recovery condenser since the water temperature entering the condenser is a lot hotter than the water coming from the cooling tower, thus causing the chiller to consume more energy. The chillers have also reached the end of their useful lives and their efficiencies have started to deteriorate.

The picture above shows one of the heat recovery chillers. Beginning from the floor, you can see the cooling tower condenser, the heat recovery condenser, the four reciprocating compressors, and the evaporator on top.

Also, the cooling tower has reached the end of its useful life. The cooling tower is starting to physically fall apart. During the time of survey, it was found that the cooling tower was leaking an extraordinary amount of water. Some clamps have been put in place by the maintenance staff in order to stop the leaking, but the cooling tower still leaks. The continuous leaking not only wastes water, it also wastes all of the chemicals that were purchased to treat the water.

The picture above shows the clamps that are being used to hold the cooling tower together.

The picture above shows the water leaking out of the top of the cooling tower.

This ECM concerns replacing both water-cooled chillers and the cooling tower, which includes the following scope of work:

1. Remove the two existing water-cooled, heat recovery chillers and cooling tower.
2. Furnish and install two new water-cooled chillers and a new cooling tower of similar capacity.

3. The two new chillers shall be installed in a new mechanical room located in the parking garage. The construction of the new 24'x24' mechanical room shall be included. The new mechanical room shall conform to all building and mechanical codes which includes, but is not limited to, a refrigerant monitoring system and two SCBA units.
4. The new cooling tower shall be located outside at the same location of the existing cooling tower.
5. Furnish and install all of the necessary chilled water and condenser water piping for the new chilled water system, including pipe insulation. The existing piping shall be reused to the greatest extent possible. The existing chilled water and condenser water pumps shall remain to be reused.
6. All electrical work necessary for the new chillers and cooling tower installation shall be included.
7. All of the new controls for the new chillers and cooling tower shall be included.
8. The new chilled water system shall be fully commissioned and balanced.

The implementation of this ECM shall produce significant electrical savings since the efficiency of the chillers will be greatly increased. A new cooling tower will also contribute to the efficiency of the chillers since it will be able to produce cooler condenser water temperatures. Also, significant water savings and chemical treatment savings shall be achieved by replacing the cooling tower. The water savings and chemical treatment savings were difficult to accurately calculate, so they are not accounted for in the ECM Summary Table.

The existing heat recovery system shall be eliminated with the installation of the new chillers.

ECM Number: 6

ECM Title: Replace the Existing Natural-Gas Fired Boilers

ECM Description:

The existing boilers listed in the table below are equipped with atmospheric burners, which is not the most efficient type of burner available. Also, these boilers are starting to reach the end of their useful lives.

Building	Existing Boiler Data		
	ID:	MBH In:	MBH Out:
01-Administration Building	B-1	1,470	1,178
01-Administration Building	B-2	1,470	1,178
13-Arapahoe Human Services	B-1	2,210	1,790
13-Arapahoe Human Services	B-2	2,210	1,790
23-Altura Plaza Building	B-1	3,000	2,400
23-Altura Plaza Building	B-2	3,000	2,400
35-ACJC Courthouse	B-1	2,000	N/A
35-ACJC Courthouse	B-2	2,000	N/A
36-ACJC Detention Center	B-1	6,000	3,200
36-ACJC Detention Center	B-2	6,000	3,200
36-ACJC Detention Center	B-3	6,000	3,200
36-ACJC Detention Center	B-4	2,800	N/A
36-ACJC Detention Center	B-5	2,800	N/A
37-ACJC Administrative II	B-1	1,375	1,100
37-ACJC Administrative II	B-2	1,375	1,100

Note: The boiler isolation valves at building 37-ACJC Administrative II are dysfunctional. In order to perform maintenance on these boilers, the entire heating hot water system must be drained.

This ECM concerns replacing each of the existing natural gas-fired boilers with new natural gas fired boilers. The replacement boilers shall be equipped with high efficiency, forced draft burners which will increase the boilers' fuel efficiency by approximately 5% to 10%. The installation of the new boilers shall include the following:

1. The existing boilers shall be removed and replaced with one natural gas fired, forced draft, hot water boiler of similar capacity.
2. Existing natural gas piping and accessories shall be reused to the greatest extent possible.
3. Existing piping and valves shall be reused to the greatest extent possible. The existing boiler isolation valves at building 37-ACJC Administrative II shall be replaced.
4. Existing boiler stack and housekeeping pads shall be reused.
5. Existing hot water system accessories (i.e. pumps, expansion tank, shot feeder, etc.) shall be reused.
6. All of the safeties and controls necessary for the new boiler to operate satisfactorily shall be provided.
7. This ECM also includes the replacement of the domestic hot water heaters at building 23-Altura Plaza Building, building 35-ACJC Courthouse, and building 37-ACJC Administrative II. These heaters need to be replaced in conjunction with the boilers since the heaters share a flue with the boilers. The new heaters shall be equipped with forced draft burners so that they can overcome the flue pressure that shall be induced by the new boilers' forced draft burner.

The replacement of these boilers with new higher efficiency boilers will reduce maintenance costs and natural gas usage.

Also, two of the three heating hot water boilers at building 36 – ACJC Detention Center are being replaced under a separate contract. The natural gas savings that will result from these replacements have been calculated and included in this project.

ECM Number: 7

ECM Title: Install a New VFD on the Existing Exhaust Fan

ECM Description:

The two main air handling units (AH-3 and AH-4) at building 01-Administration Building are variable air volume reheat systems. Each of the air handling units is equipped with a supply fan and a return/exhaust fan. The supply fan's speed is controlled by a variable frequency drive (VFD) which modulates the speed of the supply fan to maintain the supply air duct static pressure setpoint. The return/exhaust fan is a constant volume fan that operates at 100% of its capacity at all times.

This ECM concerns installing a VFD on the return/exhaust fan motor. The new VFD shall modulate the speed of the return/exhaust fan to maintain the building at a slightly positive static pressure. All of the necessary controls for the new VFD are also included in this ECM.

The implementation of this ECM shall result in significant fan motor savings since the return/exhaust fan shall no longer operate at 100% of its capacity when the building's load is less than 100%. Also, with the installation of the VFD, the fan's motor has a built-in "soft-start" system that significantly reduces stress on the motor, bearings, and couplings of the unit.

ECM Number: 8

ECM Title: Install a VFD on Existing Vane Axial Fan

ECM Description:

The two main fan systems (AHU-1 and AHU-2) at building 35-ACJC Courthouse are variable air volume (VAV) reheat systems that utilize vane axial fans to vary the air flow. The vanes, within the supply and return fans, modulate according to static air pressure requirements in the conditioned space. However, the speed of the fans can be better controlled with the installation of variable frequency drives (VFD's).

This ECM concerns installing VFD's on both the supply fan and return fan motors for both AHU-1 and AHU-2. The modulating vanes will be fixed to the full open position to allow the VFD full control of fan speed and corresponding supply air volume. All of the necessary controls and safeties for the new VFD's shall be included.

The installation of this ECM will reduce short term maintenance costs, and over the years will not increase maintenance costs above the current level. The locking of the existing vanes in place will eliminate any future maintenance on them. Also, with the installation of the VFD, the fan's motor has a built-in "soft-start" system that significantly reduces stress on the motor, bearings, and couplings of the unit.

The energy savings associated with this ECM are a result of the maintenance staff cleaning up the existing evaporative cooling, heat recovery systems in each air handling unit. The heat recovery coils and evaporative cooling pads became so "scaled up" from the hard water that the supply fan and return fans had to operate at 100% of their capacities in order to deliver the appropriate amount of conditioned air to the spaces. So, now that the pressure in the system has been reduced by cleaning up the coils and pads, the air flow can be modulated down via the new VFD's.

ECM Number: 9

ECM Title: Replace Air-Cooled Chillers with Water-Cooled Chillers

ECM Description:

The chilled water systems at building 13-Arapahoe Human Services and building 37-ACJC Administrative II utilize two air-cooled chillers to produce chilled water. The arid climate in the Denver, Colorado region results in very low humidity and low outside air wet bulb temperatures. These climate conditions make it ideal for evaporative cooling. Even though the air-cooled chillers are in good condition and were found to be functioning properly during the time of survey, replacing them with water-cooled chillers would create an opportunity to utilize evaporative cooling via a cooling tower.

This ECM concerns replacing the air-cooled chillers at both of the sites above with water-cooled chillers, which includes the following scope of work:

1. The removal of the existing air-cooled chillers. The existing chilled water pumps shall remain to be reused. The existing chilled water piping shall also remain to be reused to the greatest extent possible.
2. The installation of two water-cooled chillers at each site.
3. The installation of a new cooling tower, which includes the construction of an enclosure around the cooling tower.
4. The installation of condenser pumps. There will be two pumps installed at each site in order to achieve 100% redundancy.
5. The installation of all of the new condenser water piping.
6. All of the controls for each piece of new equipment.
7. All electrical work necessary for the new chillers and cooling tower installation shall be included.
8. The new chilled water system shall be fully commissioned and balanced.

The implementation of this ECM shall result in electrical energy savings since a water-cooled chiller operates at a much higher efficiency than an air-cooled chiller.

The savings and payback potential for this ECM do not warrant the implementation of this ECM. The existing chillers do not use enough electrical energy to produce significant energy savings.

ECM Number: 10

ECM Title: Install an A/C Unit to Serve Computer Equipment Room

ECM Description:

There are a total of six computer equipment rooms located throughout building 37-ACJC Administrative II that require cooling 24 hours a day, seven days a week throughout the entire year. Therefore, two (AHU-3 and AHU-5) of the six air handling units that provide cooling to the entire building must operate 24 hours a day, seven days a week in order to condition the six computer equipment rooms.

This ECM includes installing direct expansion cooling, split systems to serve each of the six computer equipment rooms. Each unit shall be controlled by a space thermostat that will cycle the unit on and off to maintain the space cooling temperature setpoint. The condensing units for each of the cooling systems shall be located on the roof.

The implementation of this ECM shall result in both electric savings and natural gas savings. Electric savings will occur by turning off AHU-3 and AHU-5's supply fans at night. Also, the chiller, chilled water pumps, and hot water pumps may be turned off at night too. Natural gas savings shall occur by not having to heat the cold outside air to 55^{o}F at night during the wintertime.

ECM Number: 11

ECM Title: Variable Flow WSHP System

ECM Description:

Building 23-Altura Plaza Building utilizes a water source heat pump (WSHP) system to heat and cool the building. The WSHP circulation pump circulates water throughout the entire building continuously. Much of the time, more water is circulated than is necessary to handle the actual building heating and cooling loads. This ECM considers installing variable frequency drives (VFD's) on the WSHP circulation pumps.

Each of the WSHP's shall be retrofitted with On-Off shut off valves in the circulation lines. When a heat pump zone is not calling for heating or cooling (the WSHP is off), the valve closes. Because less water flow is required, the WSHP loop is transformed into a variable flow system. In a variable flow system, the VFD on the WSHP circulation pump shall modulate to maintain the water pressure setpoint in the WSHP loop. This will ensure that the circulation pump only delivers as much water as is necessary to meet the load at any particular time.

Variable flow systems offer tremendous savings in electrical energy, especially during unoccupied hours. Flow during these times is reduced to a preset minimum (approximately 20 percent) to eliminate wasted horsepower and energy consumption.

The VFD installation shall include start up services and any required control system modifications.

ECM Number: 12

ECM Title: Install Water Softener

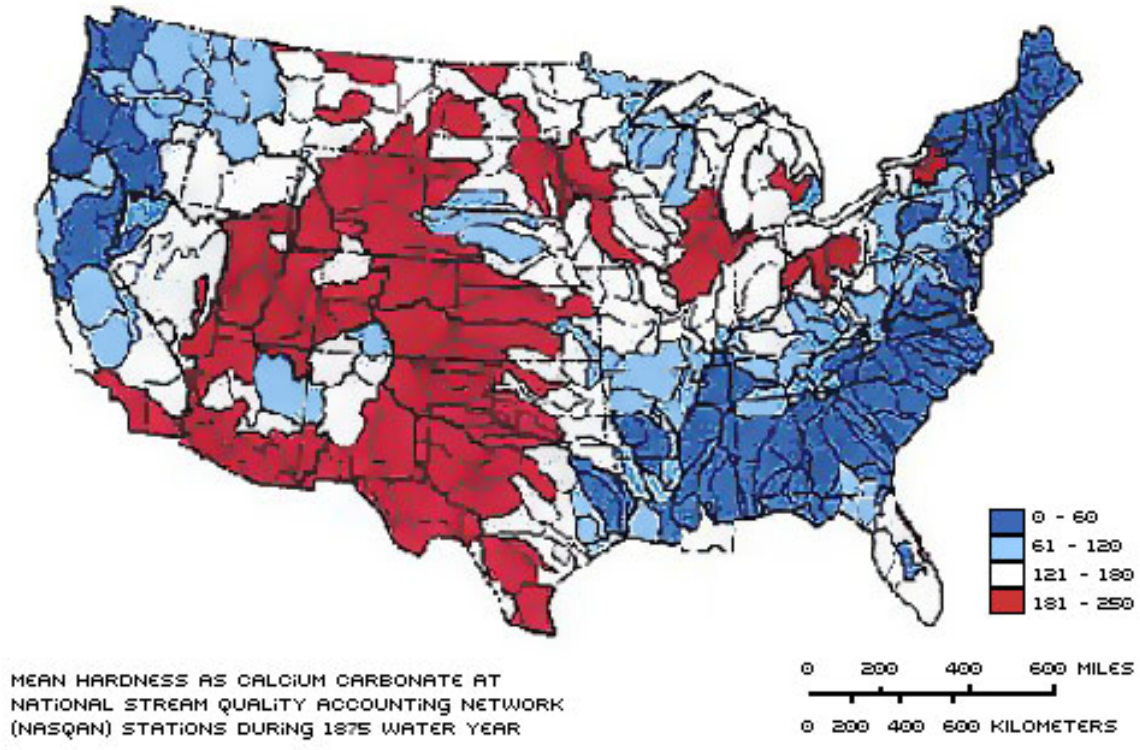
ECM Description:

Water that contains calcium and magnesium is “hard.” While many natural water supplies contain a certain amount of these two elements, most supplies range from 3 grains per gallon (gpg) to 50 gpg (or 51.3 mg/l to 855 mg/l). These substances leave a "film" or scale on surfaces that the water touches. If left untreated, hard water will form lime scaling in pipes, water heaters, boilers, air conditioning systems, etc., causing inefficiency and sometimes even permanent damage. For example, in water heaters just one-sixteenth of an inch of scale can reduce the heater's efficiency by up to 11%, because scale acts as an insulating material and thus lowers heat conduction.

Hard water is probably the most common water quality problem found in the Denver area. According to the Water Quality Association of the United States, hard water is water that contains dissolved hardness minerals above 1 gpg.

Levels of hardness have been established.

Soft Water - less than 1 grain per gallon
Slightly hard - 1 to 3.5 grains per gallon
Moderately hard - 3.5 to 7 grains per gallon
Hard -7 to 10.5 grains per gallon
Very Hard - 10.5 and higher grains per gallon



A recent water sample conducted during this survey indicated that the grains per gallon at the Arapahoe County Justice Center is **12 grains per gallon**.

The evaporative cooling air handlers at the Justice Center are riddled with problems due to the hard water. The coil sections have an abundance of scale which has restricted airflow, allowed spray nozzles to leak excessively, increased water usage, and decreased overall system efficiency. The following pictures illustrate the level of mineral build-up within the typical evaporative cooling section:

As shown in these photos, the scale build up has almost rendered this equipment inoperable. Airflows have been restricted in the coil sections in the Courthouse air handlers that the staff has had to open service doors to allow return air to be released as to relieve air pressure. The 'Munter' pads used in the direct evaporative cooling sections of these air handlers have also historically needed to be replaced much too frequently. The mineral build-up in these pads is dramatic if not changed frequently. The most recent change required at least four inmates to remove each pad as they had collected many pounds of scale.

To reduce scale build-up on the equipment the facilities, the staff has been forced to reduce the amount of cycles of the water to be "recycled". Typically, cooling towers and evaporative cooling sections in air handlers are able to re-use water before it is drained off the system. To reduce the amount of scale build-up in the equipment, water is washed through continuously as if it were almost a once-thru cycle. This not only wastes water but also chemicals induced into the system for biocide control. It was mentioned that approximately 30 gallons of chemical is used every two weeks in the Courthouse cooling tower alone. During the survey, the bleed line of the cooling tower was measured to be dumping an average of 4 gallons per minute. This is excessive waste.

The hard water has not only affected the open loop system, but it has degraded much of the heating water equipment as well. Both the domestic and heating hot water boilers at the Detention Center have been scaling up over the years, and their efficiencies have dropped as is indicated by the excessive stack temperatures recorded to be in excess of 450° F indicating low efficiencies. The zone tempering valves have a failure rate of approximately two years as opposed to the 12 to 15 year life span they should attain.

Not only does the hard water make mechanical equipment inefficient, it does not clean as effectively as soft water either. It may take up to 15 additional pounds of detergent per 1,000 gallons of water that has 10 grains per gallon (gpg) of hardness to clean effectively. Hard water can also result in the formation of soap curd that adheres to linen fibers, glassware, dishes, and other products and leaves an itchy or sticky build-up behind.

There are only two practical ways to treat hard water: Chemical treatment or mechanical treatment. In chemical treatment, various detergents and other substances are used to "cover up" or hide some of the negative effects of hard water. Using mechanical treatment, hardness minerals are physically removed from the water. The most common mechanical way to soften water is through the use of an ion exchange water softener. This device uses an ion exchange process to replace hardness minerals in the water with some other substance. The vast majority of water softening equipment today uses the exchange of hardness minerals for sodium.

The process consists of flowing the hard water over a bed of plastic resin beads. On each bead, slight electric charges hold sodium ions on the surface of the bead. However, these beads also have the ability to attract and hold hardness minerals. As hard water flows through the water softener, it passes around the plastic beads. The hardness minerals (ions) in the water have a greater attraction to the bead than the sodium on the bead. Therefore, they attach themselves to the bead; and in the process, they displace the sodium ions — thus, the name ion exchange. Hardness ions are exchanged for sodium ions.

Eventually, the plastic resin bead will be covered with hardness ions. When this occurs, the removal of hardness will be diminished. The water softener in this condition is known as having "exhausted" resin. In order to remove additional hardness from the water, a means must be found to clean the resin beads of accumulated hardness ions. This is accomplished by a process called regeneration. A brine solution is introduced into the resin tank. The extreme concentration of sodium ions in the brine solution scrub the hardness ions from the resin beads. The resin material is then flushed with clean water and the excess brine and accumulated hardness is flushed away, leaving the beads ready to remove additional hardness.

This ECM considers installing water softeners in the Administration II building, Courthouse, and the Detention Center. In both the Admin and Courthouse buildings, the water softener station will be installed in close proximity of the entry the domestic water entry to the building and will treat all of the mechanical make-up and domestic water with in each facility. There will be two water softener stations installed at the Detention Center. One system will handle the domestic and heating hot water loads, and the other will be installed to soften water to the evaporative cooling air handlers serving the pods 1, 3, 4, & 6.

Efficiency Advantages of Using Soft Water:

- Use less soap and other cleaning products
- Softening the hot water improves heating efficiencies of hot water, which lowers fuel consumption.
- Soft water extends service life of equipment (drinking fountains, dishwashers, shower heads, etc.).
- Maintenance on the various fixtures, which scale up due to high hardness, would be reduced.
- Heating hard water in the water heater forms hardness scale. This scale plugs plumbing and builds up on the inside of water heaters. It can cause increased electric or gas bills, and may lead to early failure of the equipment with costly replacement necessary.
- Soap scum is difficult to remove and stays on your skin after bathing or showering. It clogs skin pores and coats hair. This residue may be a breeding ground for bacteria, and could cause rough, red hands, skin irritation, and skin discomfort.

Hardness minerals may cause unwanted taste in cooked foods such as vegetables and cause cloudy ice cubes.

ECM Number: 13

ECM Title: Install Waterside Economizer

ECM Description:

At present, the chillers and the cooling tower in building 01-Administration Building are operated during low outside ambient air conditions. The chillers are needed for various reasons during these times but specifically because interior loads are greater than what the air-side economizers can handle. The cooling tower can be used to cool the chilled water to cold deck temperatures without operating the chillers. Cooling the chilled water with the cooling tower can be accomplished without contaminating the chilled water with condenser water by using a plate and frame heat exchanger installed in parallel with the existing chillers. Temperature controls will need to be modified to automatically use tower water for cooling whenever outside air conditions permit.

This ECM concerns installing a new waterside plate and frame heat exchanger at building 01-Administration Building. Performance specifications are as follows:

- Plate and frame heat exchanger is to be located in the mechanical room with the chillers.
- Provide new piping to interface with existing condenser water and chilled water piping. Insulate new piping to match existing piping.
- Provide two (2) three-way butterfly valves to isolate the chillers from the plate and frame heat exchanger during the economizer mode of operation.
- Connect valves to the existing control system for automatic operation/switchover from normal chiller cooling mode to tower cooling mode.
- Existing chilled water and condenser water pumps will be used to serve the heat exchanger.

The following table lists the proposed heat exchanger specifications.

Building	CHWS Temp. from HX	CHWR Temp. to HX	Evaporator Flow (GPM)	Condenser Flow (GPM)	Approach Temp.
01-Administration Building	**50F**	**60F**	**840**	**840**	**4F**

*Approximate size only for this study. Final selection upon completion of engineering review.

ECM Number: 14

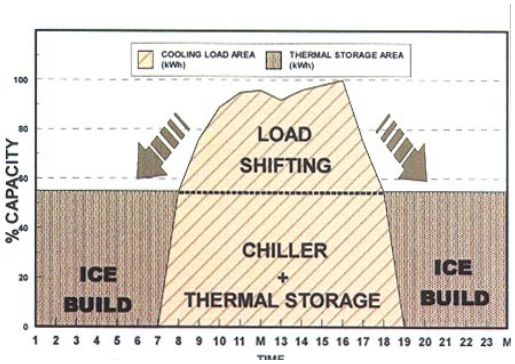
ECM Title: Chilled Water Storage

ECM Description:

Thermal Storage Overview

Thermal storage systems offer the potential for substantial operating cost savings by using off-peak electricity to produce chilled water or ice for use in cooling during peak-hours. The storage systems are most likely to be cost-effective in situations where:

- A facility's maximum cooling load is much greater than the average load
- The utility rate structure has high demand charges, ratchet charges, or a high differential between on- and off-peak energy rates



TES Load Shifting Strategy

Storage Medium

The storage medium determines how large the storage tank will be and the size and configuration of the system and components. The viable options include chilled water and ice storage systems (see **Table 1** on the following page). Overall, ice systems offer the densest storage capacity but the most complex charge and discharge equipment. Water systems offer the lowest storage density, but are the least complex.

Chilled Water

Chilled water storage systems use the sensible heat capacity of water — 1 Btu per pound per degree Fahrenheit (F) — to store cooling capacity. They operate at temperature ranges compatible with standard chiller systems and are most economical for systems greater than 2,000 ton-hours in capacity.

Ice Thermal Storage

Ice thermal storage systems use the latent heat of fusion of water — 144 Btu/lb--to store cooling capacity. To store energy at the temperature of ice requires refrigeration equipment that provides charging fluids at temperatures below the normal operating range of conventional air-conditioning equipment. Special ice-making equipment or standard chillers modified for low-temperature service are used.

With ice as the storage medium, there are several technologies available for charging and discharging storage:

External melt ice-on-coil systems use submerged pipes through which a refrigerant or secondary coolant is circulated. Ice accumulates on the outside of the pipes. Storage is discharged by circulating the warm return water over the pipes, melting the ice from the outside.

Internal melt ice-on-coil systems also feature submerged pipes on which ice is formed. Storage is discharged by circulating warm coolant through the pipes, melting the ice from the inside. The cold coolant is then pumped through the building cooling system or used to cool a secondary coolant that goes through the building's cooling system.

Internal melt ice-on-coil systems are the most commonly used type of ice storage technology in commercial applications. External melt systems are more common in industrial applications, although they can also be applied in commercial buildings and district cooling systems.

Table 1: Comparing storage media

Chilled water systems require the largest tanks, but they can easily interface with existing chiller systems. Ice systems use smaller tanks and offer the potential for the use of low-temperature air systems, but they require more complex chiller systems.

Storage medium	Volume (feet^3/ ton-hour)	Storage temperature (degrees F)	Discharge temperature (degrees F)	Strengths
Chilled water	10.7-21	39-44	41-46	Can use existing chillers; water in storage tank can do double duty for fire protection
Ice	2.4-3.3	32	34-36	High discharge rates; potential for low temperature air system

Source: E Source

Tank Type

Storage tanks must have the strength to withstand the pressure of the storage medium, and they must be watertight and corrosion resistant. Aboveground outdoor tanks must be weather resistant. Buried tanks must withstand the weight of their soil covering and any other loads that might occur above the tank, such as the parking of cars. Tanks may also be insulated to minimize thermal losses — typically 1 to 5 percent per day. Options for tank materials include steel, concrete, and plastic.

Steel: Large steel tanks, holding up to several million gallons capacity, are typically cylindrical in shape and field-erected of welded plate steel. Some kind of corrosion protection, such as an epoxy coating, is usually required to protect the tank interior. Small tanks, with capacities of less than 22,000 gallons, are usually rectangular in shape and typically made of galvanized sheet steel. Cylindrical pressurized tanks are generally used to hold between 3,000 and 56,000 gallons.

Concrete: Concrete tanks may be precast or cast-in-place. Precast tanks are most economical in sizes of one million gallons or more. Cast-in-place tanks can often be integrated with building foundations to reduce costs. However, cast-in-place tanks are more sensitive to thermal shock. Large tanks are usually cylindrical in shape, while smaller tanks may be rectangular or cylindrical.

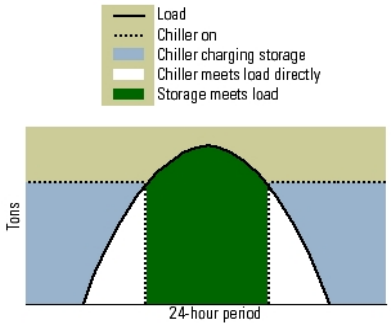
Steel and concrete are the most commonly used types of tanks for chilled water storage. Most external melt ice systems usually use concrete or steel tanks, internal melt systems usually use plastic or steel.

Operating Strategies

Several strategies are available for charging and discharging storage to meet cooling demand during peak hours. These are:

Full storage: A full-storage strategy, also called load shifting, shifts the entire on-peak cooling load to off-peak hours (see **Figure 1**). The system is typically designed to operate at full capacity during all non-peak hours to charge storage on the hottest anticipated days. This strategy is most attractive where on-peak demand charges are high or the on-peak period is short.

Figure 1: Full-storage operating strategy
A full-storage, or load-shifting, strategy shifts the entire on-peak cooling load to off-peak hours. This strategy is most attractive where on-peak demand charges are high or the on-peak period is short.



Source: *ASHRAE Design Guide for Cool Thermal Storage*

Partial storage: In the partial-storage approach, the chiller runs to meet part of the peak period cooling load, and the remainder is met by drawing from storage. The chiller is sized at a smaller capacity than the design load. Partial storage systems may be run as load-leveling or demand-limiting operations.

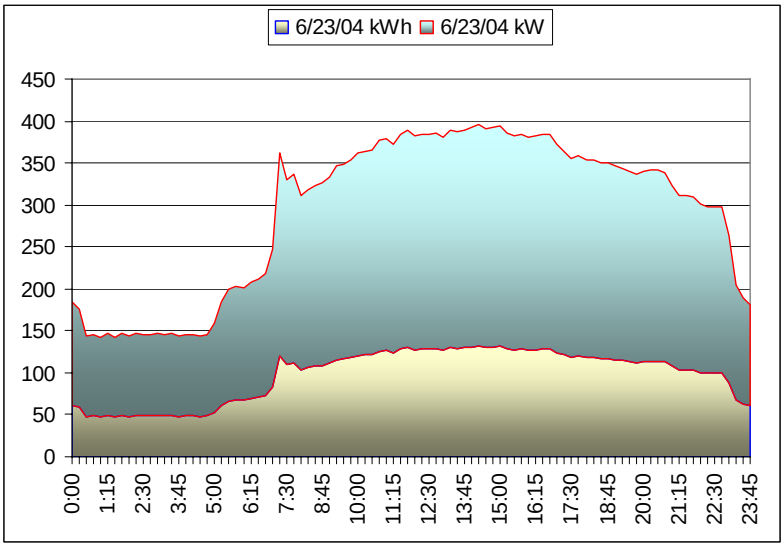
Administration I

Currently, cooling at the Administration I Building is provided by an on-site water-cooled chilled water plant. These chillers are currently proposed to be replaced as described in ECM 5. This ECM can only be implemented in conjunction with ECM 5. The facility experiences high demand costs in large part to the amount of cooling produced via electric chillers. The current demand charge for electricity is $14.16 per kilowatt and the energy charge is $0.059 per kilowatt-hour.

This ECM investigated the installation of Thermal Energy Storage (TES) at the Administration I Building. This facility was chosen specifically because of the existing 10,000 gallon steel water storage tank located in the basement mechanical room. The tank was originally installed as part of a heat reclamation project when the building was built. The solar collecting panels on the roof were never installed due to budget constraints. The tank is currently piped into the heating water system. The facility staff also indicated that the tank has suffered several leaks. To be used in conjunction with a TES system, the existing storage tank would need to be refurbished, re-piped into the chilled water system, and re-used to store and release chilled water during optimal times of the day.

At the Administration Building, the proposed system is designed to offset the peak electrical demand of 50 tons of cooling or approximately 28 kW per billing period. Given its specific heat of 1 Btu/lb F, about 10 cu ft of water are required to absorb 12,000 Btu's and provide one ton-hour of cooling if cooling can be maintained with a 10 degree Delta T. However, the small size of this tank only produces approximately 250 ton-hours of cooling. The proposed chillers in ECM 5 would also need to be modified in order to make cold water (36-39°F).

Typically a summer load profile of a building shows a significant increase during the hotter part of the day (usually between 2 and 6 PM). This is not the case when examining a typical summer load profile as shown in the graph. Looking at the profile, the building demand usage is relatively flat throughout the day. The load fluctuates between 350 and 400 kW between 8:00 AM and 6:00 PM. If the proposed chilled water storage system was installed, the capacity would not be sufficient to limit the peak for this duration. When the stored chilled water runs out, the existing chillers would need to be operated and, thus, eliminate any demand savings.



The cost to install TES at Admin I did not leverage enough energy savings to warrant implementation at this time. Significant demand reduction will be realized with the implementation of the lighting and new chiller plant ECM's (as described in this section) and, therefore, was given priority over TES due to higher capital return.

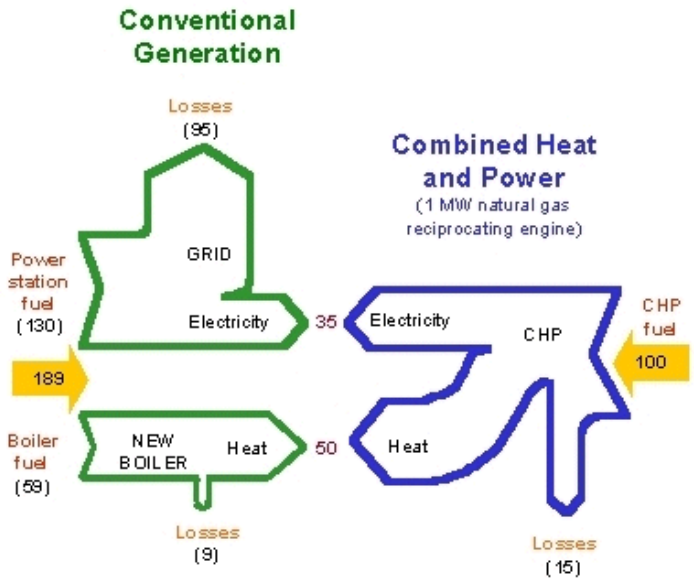
ECM Number: 15

ECM Title: Combined Heat & Power (CHP)

ECM Description:

The Arapahoe County Justice Center has experienced increasingly high utility costs over the past few years. This is becoming a great concern, as budgets to handle utility costs are limited and the need for expansion increases.

CES investigated many different measures such as TES (described in ECM #14) to shave the amount of peak energy used. With the high cost of energy, it became apparent that there was a good opportunity to save on operating costs by offsetting electrical use during high usage periods.



CES reviewed several potential methods of applying on-site electric generation and capturing its waste heat to be applied to other uses (combined heat and power – CHP). The use of combined heat and power was investigated at this site due to the relatively high energy and demand cost of power. The added heat available as a by-product of the electric generation can readily be used to produce heating to be distributed using the existing central plant piping to the majority of the various loads within the Detention Center.

Peak shaving of electric demand was investigated at the Detention Center. This building has a high demand profile coupled with various heating loads which is necessary to utilize the energy produced as a by-product of the electric generation. This analysis is based on existing rates and current surcharges, which have increased as of June 1, 2005 described in the Utility section of this report. There are many potential scenarios for operating the plant — including the option not to operate and revert to purchased power. The installation of this plant offers the County the ultimate in flexibility to optimize the ongoing utility cost, based on current rates as they occur.

Based on existing loads, we have chosen the prime mover in this system to be a single 400 kW natural gas fired reciprocating engine. This power will be transformed and delivered to the existing primary distribution system. The engine will provide waste heat to the existing hot water boilers. This system gives the County the flexibility of choosing how much they would like to buy from which utility. CES will work with the County to optimize the use of each piece of equipment given varying load characteristics.

The hot (900 to 1100°) exhaust from the engines is delivered to a reclaim heat boiler. Throughout the year, the reclaimed heat will be used to supplement the existing heating hot water loop, kitchen and laundry usage, as well as domestic hot water.

A major component of the generation is the use of the exhaust heat. Recovery of this heat and its use is critical for the generation to prove a viable option.

During summer peak, the proposed system eliminates approximately 400 kW of peak demand and produces a kilowatt-hour of energy for an estimated $0.05 per kWh including maintenance. The use of this type of installation gives the District the ultimate in flexibility in controlling what type of energy source they utilize depending on market conditions.

Based on current energy cost, the most attractive control sequence would be to run the system from 5:00 AM to 10:00 PM to cover the extreme heat load times corresponding to kitchen and laundry usage.

Benefits of On-Site Generation

- Peak shaving
- Generates power cheaper than bought from “the grid”
- Lower gas rate opportunities with higher volume
- Waste heat utilized for cooling and heating purposes
- Attractive rebates from the State
- Saves energy costs
- Keeps the County from being subject to the market of just one fuel

With all the benefits of CHP, the program is still moderately attractive in this region. This ECM is not recommended with natural gas prices still high coupled with relatively low electrical demand and energy charges. Costs and savings indicated on the above ECM Summary table are not guaranteed and are only useful for preliminary analysis.

ECM Number: 16

ECM Title: Irrigation Control System Upgrade

ECM Description:

The County uses Rainmaster RME Sentar digital controllers to regulate irrigation at Admin1, Arapahoe Plaza East, Altura Plaza, and the Justice Center. The controllers time the frequency and duration of irrigation cycles according to instructions programmed into the controllers by the Arapahoe County maintenance staff. There are no other sensors or controls on these systems. Therefore, the controllers turn the sprinklers on without regard to the needs of the turf.

The maintenance staff will cancel watering sessions if recent rainfall warrants a change in the schedule. This intervention can be seen in the billing records when compared to rainfall. In August 2004 there was an unusually high amount of rainfall for that month. There was a dip in the water use according to the billing records that month also. The maintenance staff confirmed that the system schedules were altered to account for the extra rainfall. Even with this attention to weather conditions, the water use is greater than what would be expected given the weather data and the type of lawn being served.

Rainmaster offers a controls upgrade (The RME Eagle) that combines all the features of the RME Sentar II with intelligent ET-based scheduling features that will reduce water usage by monitoring local weather conditions on a daily basis and altering the irrigation system accordingly. This is done with a wireless connection to the internet and the integration of recorded local weather data posted on the internet, and alters the schedule based on raw weather data. Specifically, each day, the evapotranspiration rate and rainfall data are downloaded to the controller that then accounts for these inputs when deciding the frequency and duration of watering sessions.

The evapotranspiration (ET) rate is an integration of the evaporation of water from the surface of the soil and the amount of water transpired by a plant growing in that soil. The ET rate assumes a specific plant that is used as a benchmark.

A constant specific to the plant population being served is applied to the rate to make the data relevant to the application. ET rates are affected by humidity, sunlight intensity, and wind. A lawn will need less water after a cloudy day of moderate temperatures and no wind. The proposed system will use the ET data to optimize the application, reducing water use based on real time weather data.

Another feature of the system is the web-based access to the controllers, allowing maintenance staff to monitor the system and alter schedules and sequencing from any computer terminal with a browser connected to the internet.

This Measure includes the installation of the new controllers, the wireless internet connection, setup, and training. The new controller can fit into the existing cases or new cases may be installed.

A minimum acceptable usage will be determined with the County staff and applied at each facility.

ECM Number: 17

ECM Title: Programmable Flush Valve Controls

ECM Description:

The prison population has stainless steel combination units (combys) with an integrated commode served by a remote flush valve (located in an adjacent wall chase) rated at 3.5 GPF. This measure investigates retrofitting the existing combys with stand alone programmable control to limit the amount of uses per inmate.

The existing comby units are expensive, and the population-to-fixture ratio is very low. Nevertheless, the inmates are at the facility for most of the day, and there are occasional intentional floods that are disruptive, costly to clean up, and waste water. This measure will add programmable controls to only allow the inmates to flush their commodes at a pre-determined frequency per hour or per day that mitigates intentional flooding and saves water usage.

The programmable controls have been used in the Pod 6A (23 hour lock down) area with much success. The Deputies especially like the fact that the commodes can be shut down before surprise searches. This control will mitigate the disruption and wasted water caused by intentional flooding as well.

The programmable controls can be added at a fraction of the cost of replacing the entire unit with low flow package. Each flush valve will need to be retrofitted to accommodate the controller. Each controller can receive up to eight inputs/outputs allowing a single controller to supervise up to four Comby units (one each lavatory and closet). This controller can be hard wired into the existing automatic door system for centralized control for each pod. This ECM has budgeted upgrading 380 Willoughby stainless steel combination units with Programmable Water Technologies stand alone controllers to allow the Sheriff's staff to limit the amount of uses per inmate.

ECM Number: 18

ECM Title: Water Reclaim

ECM Description:

Large amounts of water are used at the Peoria Shops for vehicle washing. All of the county vehicles are washed here: police cars, road maintenance trucks, road strip painting trucks, construction equipment, and county staff vehicles. There is a substantial amount of heavy washing that does not require potable water to accomplish. Dump beds, heavy equipment, trucks, and sweeper bins can use recycled water effectively and for a lower cost.

This ECM investigates installing a septic type (1500 gal) tank underground to catch effluent from the existing clarification system and reuse it to do heavy washing. The new system would include a new 10HP 3PH 230V pump in the shop or in a suitable out building and a zero-pressure holding tank within the shop with a 25 GPM sump pump. The underground tank will collect effluent from the existing filtration system. The sump pump pumps the collected water to the holding tank at the shop. A low voltage float switch in the holding tank controls the sump (relay installed in the shop). The high pressure wash pump draws water from the holding tank. The washer motor starts with low voltage controls, manually started from the wash station.

All water from the pad goes to the filtration system. The underground tank will be topped off and "refreshed" when the existing washing station, using potable water, is used to clean staff vehicles.

Collection Tank Maintenance: The County has installed an oil separator to remove oils and grease from the waste stream as required by the water authority so that the contaminants do not enter the water cycle. The oil separator, by design, causes some of the suspended solids to settle out before the water is released to the waste stream. There will be certain amount of suspended solids in the water collected by the recycled water collection tank, necessitating the periodic draining of the tank and removal of the sediment.

ECM Number: 19

ECM Title: Laundry Conservation

ECM Description:

Ozone laundering significantly reduces water-use, detergents, and energy usage in the washing process. Ozone, generated by passing oxygen through a high voltage arc, is used to remove insoluble materials from fabric. Ozone laundering saves resources by operating at lower temperatures, with fewer rinse cycles, less detergent, and less drying time. Ozone must be generated on-site and handled carefully since it is toxic and may cause respiratory irritation.

Ozone is the name given to a construct of the oxygen molecule where three oxygen molecules bond weakly with each other (0_3). The weak bond is broken when an opportunity for a stronger bond presents itself. This releases a free oxygen molecule that is highly reactive and that will destroy the bonds between soil and fabric and bacterial cell walls, aiding in cleaning and sanitizing fabrics in the laundry cleaning process.

Ozone is commonly used in hospital laundry systems to clean and sanitized laundry and to reduce hot water requirements and laundry chemicals. The Arapahoe County P.J. Sullivan Detention Center has a large enough volume of laundry to justify the installation of an ozone laundry system to save laundry water and energy costs.

Water savings are realized by eliminating a high-level rinse and reducing fill levels. Energy savings are gained by using cold water to wash.

The device is a rack-mounted system, 76 inches high with a 25 x 22 inch footprint. There is an oxygen concentrator, two hydraulic metering units, two ozone generators, and a control panel. The oxygen concentrator extracts atmospheric oxygen from ambient air that is supplied to the ozone generators. The metering units inject the ozone into the wash water. The installation includes all electrical and plumbing connections.

The only maintenance necessary is periodic replacement of the oxygen concentrator. A competent maintenance person can troubleshoot and install the concentrator.

Energy Requirements: Ozone generator: 90-250VAC 1.5 – 0.6 AMP (2)
Oxygen Concentrator: 220VAC 2.75 AMP (1).

ECM Number: 20

ECM Title: Replace DHW HX with a New DHW Heater

ECM Description:

Domestic hot water (DHW) for building 01-Administration Building is produced by a DHW heat exchanger (HX). The "hot" side of the DHW HX is piped to the building's heating hot water system. So, the DHW system utilizes the building's two natural gas-fired hot water boilers for its heat source. Even though the building does not require heating hot water in the summer, the two hot water boilers must operate throughout the entire year in order to provide hot water to the DHW HX. This configuration is not very efficient since both boilers have to operate in the summer in order to satisfy the building's DHW load, which is significantly smaller than the building's actual heating load. Also, the two boilers are each equipped with an atmospheric burner which isn't as efficient as a forced draft burner.

The picture above shows the DHW HX, which is inserted into the large storage tank, connected to the building's heating hot water system.

This ECM concerns replacing the existing DHW HX and storage tank with a new natural gas-fired, DHW heater. The scope of work shall include the following:

1. The removal of the existing DHW HX and storage tank. The existing DHW piping and pumps shall remain to be reused to the greatest extent possible.
2. The two heating hot water lines that go in and out of the existing DHW HX shall be capped off.
3. A new "stand alone", natural gas-fired DHW heater shall be installed. The new DHW heater shall be a high efficient unit equipped with a forced draft burner.
4. The installation of new gas piping to serve the new DWH heater. The new gas piping shall tie into the existing gas line that serves the two boilers.
5. The installation of the new DHW heater's outside air vent and flue pipes.

The implementation of this ECM shall produce natural gas savings for two reasons. The first reason is that savings will be achieved during the summer since the two large boilers will no longer have to operate to serve the building's DHW load. The second reason is that savings will be achieved since the DHW will be produced from a higher efficient heating source – i.e., a forced draft burner in the new DHW heater instead of the atmospheric burners in the two boilers.

ECM Number: 21

ECM Title: Change Natural Gas Utility Provider

ECM Description:

There are currently two utility companies that provide natural gas to the Arapahoe County facilities — Xcel Energy and Seminole Energy Services. Seminole Energy Services provides natural gas to the facilities that use a significant amount of natural gas each year (at least 20,000 therms per year), and Xcel Energy provides natural gas to the remaining facilities. The current cost of natural gas purchased from Xcel Energy is $0.74946/therm, and the current cost of natural gas purchased from Seminole Energy Services is $0.63481/therm. But, Seminole Energy Services can only sell natural gas at $0.63481/therm if the facility uses at least 20,000 therms per year. Building 13-Arapahoe Human Services currently purchases natural gas from Xcel Energy even though it has an annual natural gas consumption greater than 20,000 therms.

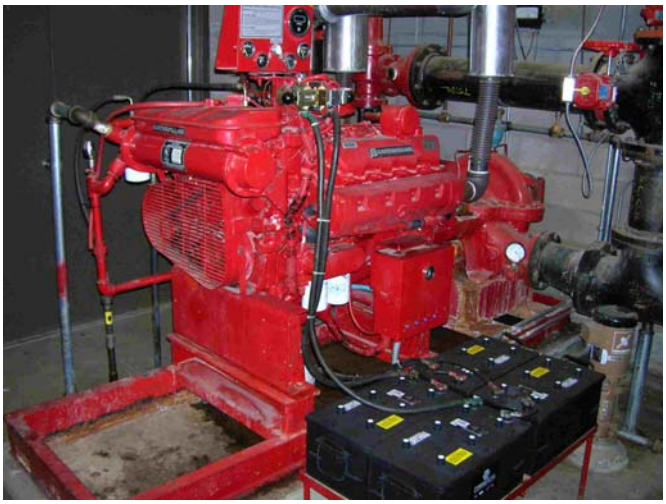
This ECM concerns changing the natural gas utility provider at building 13-Arapahoe Human Services from Xcel Energy to Seminole Energy Services. The changing of natural gas utility providers may occur at zero cost.

Dollar savings shall occur by implementing this ECM since the natural gas purchased from Seminole Energy Services cost less than the natural gas purchased from Xcel Energy.

ECM Number: 22

ECM Title: Remove Existing Fire Pumps

ECM Description:



The existing fire pumps located in the Arapahoe Justice Center Courthouse and Detention Center were originally installed to boost low water pressure in the area in the event of a fire. When the facilities were originally built, the County's water pressure was very poor. Since then, new pumping stations have been installed in the area that have increased the system suction pressure to adequate levels.

The maintenance staff must service these pumps quarterly each year which has become a substantial time and capital expenditure.

In this ECM, a consultant will be hired to produce detailed flow calculations to see if the existing pumps are required. The cost to produce the study and removal of the pumps is included.

ECM Number: 23

ECM Title: Energy Resource Conservation Manager

ECM Description:

As part of the ongoing commitment to our larger customers, Chevron Energy Solutions assists in reducing energy costs by actively monitoring the installed ECM's along with the facilities operations and energy consumption. This objective can be maximized by adding an on-site Energy Resource Conservation Manager (ERCM) dedicated to this program.

The ERCM will work to ensure that the buildings are operating properly and that the energy savings are realized. While the facility staff is usually focused on occupant comfort, the ERCM will also focus on ensuring that equipment is turned off when not needed, and will work with the Customer to investigate and resolve heating and cooling problems.

In addition, the ERCM will have the time, opportunity, and in-depth knowledge of the buildings and systems that will facilitate ongoing recommendation for energy savings opportunities, whether it be additional installed equipment or behavioral modifications.

The ERCM typically has the following duties and responsibilities depending on what the customer's needs are:

- Continually monitoring the ECM's installed to ensure proper operation.
- Identify additional energy savings opportunities. Promote general energy awareness and behavioral modification strategies to generate additional savings.
- Track and quantify changes to the facility energy consumption for baseline maintenance.
- Promote the program within the Customer's staff and to the community.
- Assist Customer's maintenance staff in troubleshooting HVAC and control failures, both from the EMS operator workstations and in the mechanical rooms.
- Optimize operating sequences for energy savings. Field test control points as necessary to verify ongoing proper operation.
- Coordinate training and education for staff relating to the facility improvement measures installed, and to general energy conservative behaviors.

ECM Number: 24

ECM Title: Replace Cooling Tower

ECM Description:

The existing cooling tower at the Arapahoe County Justice Center Courthouse is a single cell, blow-through cooling tower, which uses a single 20 HP motor to drive the fan. The tower was originally installed to serve a 135 ton chiller located in the basement. The tower is an original model and has degraded to the point where it has become a liability. Several problems exist due to the hard water in the area as well as corrosion and a tremendous amount of scale build-up on the fill. Scale formation has its root in the evaporation of water. Evaporated water exits the system as pure vapor leaving the solids behind. The replacement (make-up) water introduces more solids which continually increase the solids concentration in the recirculated water. Left unchecked, the system would reach a point where the water could not hold all of the solids in a dissolved state. They would begin to precipitate out of the solution as scale.

To combat the high concentration of calcium carbonate (200 ppm), the service contractor has the tower set at 1.7 cycles and using approximately 30 gallons of chemical treatment every two weeks. With so few re-usable cycles, the tower, in essence, acts as a once-thru-cooling unit wasting an immense amount of water. During the survey, a 4.5 gallon bucket was filled from the bleed line in approximately one minute.

Many of the future problems will be avoided with the implementation of the building water softener (ECM 12). With the implementation of the water softener ECM, the dissolved solids will drop; and the tower will operate more efficiently, increasing the number of cycles.

Regardless of whether or not the water softener ECM is implemented, the tower needs to be replaced. Considering the amount of corrosion, the current tower is in jeopardy of a sizeable leak that could cause substantial damage to the occupied spaces below.

This ECM concerns replacing the current cooling tower with a unit that meets the existing chiller requirement for condensing water and uses less electrical energy. The benefits of replacing the cooling tower include improved reliability of chiller plant by replacing a tower that has exceeded its average useful life and lower tower operating costs. The existing condenser water pumps shall remain to be reused, and the existing condenser water piping and accessories shall be reused to the greatest extent possible.

ECM Number: 25

ECM Title: Retro Commissioning

ECM Description:

Retroactive commissioning is the systematic process of taking a building's existing assets and making them function properly. It is a program of performance evaluation, troubleshooting, and tune-up. When new, the HVAC equipment and Building Automation Controls were installed to meet existing requirements; but over time, these requirements have changed. Facilities personnel have had to adapt existing HVAC equipment and Building Automation Controls to meet changing performance requirements. Specified or original system performance may not exist, and/or building function or usage may have changed. As opposed to new building commissioning where performance verification of all equipment is executed, retro-commissioning can focus on known trouble spots or performance problems, spending more time on the specific problems and less time on equipment that appears to function properly.

Within Centrepoint Plaza Building #24 and Sheriff/Coroner Building #38, the following is a list of items covered under retro-commissioning:

1. Temperature Sensor Verification & Calibration.
Verify what the sensors are reading and calibrate if needed.

2. Static Pressure sensor Verification & Calibration.
Verify what the sensors are reading and calibrate if needed.

3. Discharge Air Temperature Control.
Verify that the Building Automation System is able to control the heating and or cooling source and maintain the discharge air temperature set point.

4. Mixed Air Damper Control.
Verify that the Building Automation System is able to control the outside/return/relief dampers and maintain the mixed air temperature set point.

5. Supply/Return Fan Operation.
Verify that the Building Automation System has control of the supply and return fans.

6. Fan Static / Pump Differential Control.
Verify that the Building Automation System has control of the variable frequency drive and maintain the static or differential pressure set point.

7. VAV Box Control.
Verify that the Building Automation System is able to control the VAV box and maintain the space temperature set point.

8. Zone Set back Control.

Verify that the Building Automation System is programmed for zone set back.

ECM Number: 26

ECM Title: Replace Modulines, Install VAV boxes, diffusers, and add controls

ECM Description:

This ECM investigates retrofitting the existing Moduline airside distribution system at the Administration I facility with a modernized variable air volume delivery system. The existing Moduline boxes have reached the end of their useful life. The units continuously fail and need repair. Air quality and comfort are compromised in several areas.

Parts for the failed units are increasingly difficult to find as well. The facilities staff is forced to scrap parts off spare units. The spare units are kept in a mechacical penthouse and parts are limited. Once the spare units have been totally scrapped there will not be any more replacement parts available.

This ECM recommends replacing the existing Moduline units and replacing them with a new variable air volume retrofit kit, diffusers, and control. The scope includes re-using as much of the existing duct work as possible, specifically the main trunk lines.

Scope of Work to include:

1. Furnish and install a total of 208 new VAV terminals.
2. Add zone control to proposed Energy Management Control System.
3. Connect the new VAV terminals to the existing supply air trunk lines that meet the requirements of SMACNA.
4. Furnish and install 578 supply air diffusers. The new diffusers shall be 2'x2' square cone diffusers with a white enamel finish.
5. Connect the new diffusers to the new VAV terminals that meet the requirements of SMACNA.
6. Patch and repair all ceiling modifications that shall occur as a result of the new VAV terminal installations, these modifications include but are not limited to the following:
    - Furnish and install a new 2'x2' ceiling tile and 2' long T-Bar next to each of the new supply air diffusers.
    - Furnish and install a new 2'x4' ceiling tile at all locations that had an existing Moduline VAV diffuser and 1'x4' ceiling tile that do not have a new 2'x2' ceiling tile and supply air diffuser.
    - All sheet rock work necessary to install the new VAV terminals and diffusers by the elevator areas.
    - Any necessary steel ceiling modifications.
7. The existing supply air trunk ducts will be checked for leaks and sealed where necessary.
8. Test and balance each of the new VAV terminals to their specified minimum and maximum air flows and shall leave the terminals at the maximum flow setting.

5

Measurement and Verification Plan & Savings Calculation Methods Outline

Measurement and Verification (M&V) Plan and Savings Calculation Methods Outline

1. Executive Summary / M&V Overview & Proposed Savings Calculations

1.1 Proposed Annual Savings Overview

Table 1: Proposed Annual Savings Overview

ECM	Total Energy Savings (MBTU/Yr)	Electric Energy Savings (kWh/Yr)	Electric Demand Savings (kW/Yr)*	Natural Gas Savings (Therms/Yr)	Water Savings (KGal/Yr)	Irrigation Savings (Kgal/Yr)	Total Energy & Water Cost Savings Yr 1 ($/Yr)	Other Energy Related O&M Cost Savings (Year 1 ($/Yr)	Total Cost Savings Yr 1 ($/Yr)
1	3,196	1,176,356	368	-8,187	0	0	126,125	18,583	144,708
2	126	0	0	1,261	1,641	0	26,349	0	26,349
2a	0	0	0	0	3,212	0	22,709	0	22,709
3	11,485	854,329	0	85,692	0	0	104,766	0	104,766
4	1,234	26,394	0	11,443	0	0	9,138	0	9,138
5a	273	79,870	54	0	0	0	10,052	0	10,052
5b	0	0	0	0	0	0	0	0	0
6a	3,540	-20,930	-2	36,117	0	0	21,611	0	21,611
6b	0	0	0	0	0	0	0	0	0
7	65	18,915	0	0	0	0	1,110	0	1,110
8	772	226,190	0	0	0	0	13,275	0	13,275
9	0	0	0	0	0	0	0	0	0
10	364	37,602	0	2,356	0	0	3,973	0	3,973
11	0	0	0	0	0	0	0	0	0
12	0	0	0	0	5,718	0	82,754	-17,605	65,149
13	159	46,637	52	0	0	0	6,433	0	6,433
14	0	0	0	0	0	0	0	0	0

15	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	433	3,075	-945	2,130
17	0	0	0	0	3,615	0	56,616	0	56,616
18	-10	-2,793	-7	0	576	0	6,251	-1,280	4,971
19	128	0	0	1,276	440	0	7,698	0	7,698
20	216	0	0	2,158	0	0	1,370	0	1,370
21	0	0	0	0	0	0	3,619	0	3,619
22	0	0	0	0	0	0	0	0	0
23	1,201	190,460	0	5,508	0	0	14,953	0	14,953
24	22	6,587	4	0	0	0	1,048	0	1,048
25	456	464,882	0	-11,306	0	0	19,770	0	19,770
26	0	0	0	0	0	0	0	0	0
Total Savings	23,227	3,104,500	469	126,317	15,203	433	542,694	-1,247	541,448

1st Year Guaranteed Cost Savings: $541,448

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.

1.1.1 Site Use and Savings Overview (Optional)

Table 1A: Site Use and Savings Overview (Optional)

01 - ADMINISTRATION BUILDING	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	3,224	507,055	159	14,936	669	127
Usage for Entire Site:**	13,495	2,794,900	6,798	39,560	5,206	
% Total Site Usage Saved:	23.89%	18.14%	2.34%	37.76%	12.86%	-
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	140,263	140,263	140,263	140,263	140,263	140,263
% Total Site Area Affected:	11.72%	11.72%	11.72%	11.72%	11.72%	11.72%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

12 - ARAPAHOE PLAZA EAST BUILDING	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	574	96,740	6	2,439	119	0
Usage for Entire Site:**	1,231	360,545	917		633	
% Total Site Usage Saved:	46.65%	26.83%	0.66%	-	18.78%	-
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	20,957	20,957	20,957	20,957	20,957	20,957
% Total Site Area Affected:	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

13 - ARAPAHOE HUMAN SERVICES	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	1,018	176,752	13	4,152	279	0
Usage for Entire Site:**	7,153	830,154	2,085	43,196	653	
% Total Site Usage Saved:	14.24%	21.29%	0.63%	9.61%	42.75%	-
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	54,678	54,678	54,678	54,678	54,678	54,678
% Total Site Area Affected:	4.57%	4.57%	4.57%	4.57%	4.57%	4.57%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

14 - ARAPAHOE PLAZA WEST BUILDING (COUNTY COURT)	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	802	87,453	6	5,036	305	0
Usage for Entire Site:**	1,414	414,185	813		867	
% Total Site Usage Saved:	56.74%	21.11%	0.72%	-	35.19%	-
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	20,880	20,880	20,880	20,880	20,880	20,880
% Total Site Area Affected:	1.74%	1.74%	1.74%	1.74%	1.74%	1.74%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

15 - FEDERAL WAREHOUSE	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	324	41,508	7	1,821	19	0
Usage for Entire Site:**	3,105	573,145	1,547	11,490	460	
% Total Site Usage Saved:	10.43%	7.24%	0.46%	15.85%	4.03%	-
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	75,073	75,073	75,073	75,073	75,073	75,073
% Total Site Area Affected:	6.27%	6.27%	6.27%	6.27%	6.27%	6.27%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

20 - TRI COUNTY HEALTH	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	174	18,774	4	1,095	0	0
Usage for Entire Site:**	650	82,380	307	3,690	24	
% Total Site Usage Saved:	26.70%	22.79%	1.37%	29.68%	0.00%	-
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	8,398	8,398	8,398	8,398	8,398	8,398
% Total Site Area Affected:	0.70%	0.70%	0.70%	0.70%	0.70%	0.70%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

23 - ALTURA PLAZA BUILDING	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	7,222	432,444	62	57,462	515	0
Usage for Entire Site:**	15,786	1,464,538	3,536	107,880	3,632	
% Total Site Usage Saved:	45.75%	29.53%	1.74%	53.26%	14.19%	-
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	74,675	74,675	74,675	74,675	74,675	74,675
% Total Site Area Affected:	6.24%	6.24%	6.24%	6.24%	6.24%	6.24%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

24 - CENTREPOINT PLAZA	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	536	288,382	10	-4,478	397	0
Usage for Entire Site:**	9,586	2,743,135	7,196	2,240	4,559	
% Total Site Usage Saved:	5.60%	10.51%	0.14%	-199.90%	8.71%	-
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	105,662	105,662	105,662	105,662	105,662	105,662
% Total Site Area Affected:	8.83%	8.83%	8.83%	8.83%	8.83%	8.83%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

29 - PEORIA SHOPS	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	938	23,642	-1	8,576	636	0
Usage for Entire Site:**	4,309	320,958	740	32,140	1,851	
% Total Site Usage Saved:	21.77%	7.37%	-0.16%	26.68%	34.34%	-
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	25,008	25,008	25,008	25,008	25,008	25,008
% Total Site Area Affected:	2.09%	2.09%	2.09%	2.09%	2.09%	2.09%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

35 - ACJC COURTHOUSE	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	3,153	544,175	74	12,959	3,132	0
Usage for Entire Site:**	16,684	2,755,414	6,240	72,800	6,554	
% Total Site Usage Saved:	18.90%	19.75%	1.18%	17.80%	47.79%	-
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	148,522	148,522	148,522	148,522	148,522	148,522
% Total Site Area Affected:	12.41%	12.41%	12.41%	12.41%	12.41%	12.41%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

36 - ACJC DETENTION CENTER	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	2,907	47,337	0	27,455	8,731	306
Usage for Entire Site:**	46,510	5,517,976	9,595	276,775	49,491	3,754
% Total Site Usage Saved:	6.25%	0.86%	0.00%	9.92%	17.64%	8.15%
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	291,955	291,955	291,955	291,955	291,955	291,955
% Total Site Area Affected:	24.39%	24.39%	24.39%	24.39%	24.39%	24.39%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

37 - ACJC ADMINISTRATIVE II	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	1,366	275,128	62	4,270	221	0
Usage for Entire Site:**	9,009	2,017,650	4,750	21,225	724	
% Total Site Usage Saved:	15.16%	13.64%	1.30%	20.12%	30.45%	-
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	91,110	91,110	91,110	91,110	91,110	91,110
% Total Site Area Affected:	7.61%	7.61%	7.61%	7.61%	7.61%	7.61%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

SERIFF/CORONER FACILITY	Total Energy (MBTU/Yr)	Electric Energy (kWh)/Yr	Electric Demand (kW/Yr)*	Natural Gas (Therms/Yr)	Water (KGal/Yr)	Irrigation (KGal/Yr)
Proposed Project Savings:	319	287,219	13	-6,616	180	0
Usage for Entire Site:**	9,934	2,472,668		14,950	3,428	
% Total Site Usage Saved:	3.21%	11.62%	-	-44.26%	5.25%	-
Project Square Footage (SF):	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021	1,197,021
Total Site Square Footage (SF):	125,055	125,055	125,055	125,055	125,055	125,055
% Total Site Area Affected:	10.45%	10.45%	10.45%	10.45%	10.45%	10.45%

MBTU=10^6 BTU
.003413 MBTU/kWh
.1 MBTU/therms

* Annual electric demand savings (kW/Yr) is the sum of the monthly demand savings.
** Most Recent 12 Months of Utility Data.

1.2 M&V Approach Summary

Table 2: M&V Plan Summary for each facility

Building	Electric	Gas	Water	Notes
01 - Administration Building	C	C	A	5
12 - Arapahoe Plaza East	A	N/A	A	
13 - Arapahoe Human Services	C	C	A	
14 - Arapahoe Plaza West	A	N/A	A	
15 - Federal Warehouse	A	Calculated	A	1
20 - Tri County Health	A	Calculated	N/A	1
23 - Altura Plaza Building	C	C	A	
24 - Centrepoint Plaza	A	Calculated	A	2
29 - Peoria Shops	A	Calculated	A	1, 3
35 - ACJC Courthouse	C	C	C	
36 - ACJC Detention Center	A	A	C	4, 6
37 - ACJC Administrative II	C	C	A	
38 - Sheriff/Coroner Facility	A	Calculated	A	2

Notes
(1) Lighting to be option A, Programmable Thermostat Savings to be calculated.
(2) Lighting to be option A, Retro Commissioning (ECM 25) to be calculated.
(3) A flow meter will be installed to measure water recovery measure (ECM 18).
(4) Ozone laundry ECM to be calculated (ECM 19).
(5) Water ECM 2 is Option A, ECM 16 is calculated.
(6) Water ECM 2, 12, & 17 are Option C, ECM 16 is calculated.

* M&V Options include A, B, C & D. Guidelines include M&V Guidelines: Measurement & Verification for Federal Energy Projects, Version 2.2 (http://www.eere.energy.gov/financing/superespcs_mvresources.cfm : International Performance Measurement & Verification Protocol (I{MVP) Volume I March 2002 (www.impvp.org).

2. Whole Project Data / Global Assumptions

2.1 Risk & Responsibility

2.1.1 Summarize allocation of responsibility for key items related to M&V

- Refer to contract for details regarding risk allocation.

2.2 Energy, Water, and Operations & Maintenance (O&M) Rate Data

2.2.1 Detail baseline energy & water rates

Building:	Electric		Nat. Gas	Water
	$/kW:	$/kWh:	$/Therm:	$/Kgal:
01 – Administration Building	$14.16	$0.05869	$0.63481	$5.36
12 – Arapahoe Plaza East Building	$14.16	$0.05869	$0.63481	$5.36
13 – Arapahoe Human Services	$14.16	$0.05869	$0.63481	$5.36
14 – Arapahoe Plaza West Building (County Court)	$14.16	$0.05869	$0.63481	$5.36
15 – Federal Warehouse	$14.16	$0.05869	$0.74946	$5.36
16 – CSU Extension Office	$14.16	$0.05869	$0.74946	$5.36
17 – CSU Warehouse (Summer)	0.00	$0.07900	$0.74946	$5.36
17 – CSU Warehouse (Winter)	0.00	$0.07512	$0.74946	$5.36
20 – Tri County Health	$14.16	$0.05869	$0.74946	(1)
23 – Altura Plaza Building	$14.16	$0.05869	$0.63481	$4.99
24 – Centrepoint Plaza	$14.16	$0.06321	$0.80714	$4.99
29 – Peoria Shops	$14.16	$0.05869	$0.63481	$13.07
35 – ACJC Courthouse	$14.16	$0.05869	$0.63481	$13.07
36 – ACJC Detention Center (Main Building)	$14.16	$0.05869	$0.63481	$15.66
36 – ACJC Detention Center (Warehouse)	$14.16	$0.05869	$0.74946	$13.07
37 – ACJC Administrative II	$14.16	$0.05869	$0.74946	$13.07
38 – Sheriff/Coroner Facility	$14.16	$0.05869	$0.72763	$6.53

2.2.2 Provide performance period rate adjustment factors for energy, water, and O&M cost savings, if used.

- Contracted at 2.5% escalated annually

2.3 Schedule & Report for Reporting for Verification Activities

2.3.1 Define requirements for witnessing of measurements during:

- Baseline - Chevron ES will conduct all M&V activities. Facility personnel will be invited to observe and sign-off of all measurement activities. If County declines offer to observe or sign-off measurements data will not be invalidated.
- Post-installation verification activities - Chevron ES will conduct all M&V activities. Facility personnel will be invited to observe and sign-off of all measurement activities. If County declines offer to observe or sign-off measurements data will not be invalidated.

2.3.2 Define schedule of verification reporting activities

Table 3: Schedule of Verification Reporting Activities

Item	Recommended Time of Submission	Owner's review & acceptance period
Final Commissioning Plan	45 days after EMS contractor is under contract	15 days
Post-installation Report	45 days after measurements	15 days
Commissioning Report	45 days after Final Completion of Project	15 days
Annual Report	90 days after years end	15 days

2.3.3 Define content and format of reports:

- Post-installation report

  Use Post-Installation Report Outline[1]

Reports to be Prepared

1. Pre-retrofit measurement report. One report prepared within 30 days of completion of the pre-retrofit measurements. The report will include the names of the measurement team

[1] Electronic copy of Post-Installation Report Outline is available through http://atcam.lbl.gov/mv.

and any observers, the results of all measurements, any exceptions or anomalies associated with the measurements.

2. Post-retrofit measurement report. One report prepared within 30 days of completion of the post-retrofit measurements. The report will include the names of the measurement team and any observers, the results of all measurements, any exceptions or anomalies associated with the measurements.

3. As-built documentation provided by Chevron Energy Solutions' construction team will document the description and location of all retrofits. As-built documentation will be provided as detailed in the Agreement.

4. A preliminary monthly savings report will be generated to communicate the energy (water) savings performance of all ECM's. Each report will include:
   * Baseline consumption for the month
   * Actual consumption for the month
   * Dollar savings for the month
   * Baseline consumption year to date
   * Actual consumption year to date
   * Unit savings year to date
   * Dollar savings year to date
   * Comparison of all ECM savings in aggregate against prorated guaranteed savings
   * Quantification of any known adjustments that impact the reported energy (water) savings. Open-book analysis.

5. Commissioning Report: As each energy conservation measure nears completion of construction, it will be commissioned. All commissioning efforts will be conducted by CES and its subcontractors, and will be witnessed by County personnel. The commissioning plan will confirm proper installation of the equipment as well as confirm proper functional performance of the equipment.

   A Final Commissioning Plan will be submitted and approved by the County before implementation. While CES will execute and submit one commissioning report at completion of construction, it is highly suggested that the County repeat commissioning of the controls and mechanical systems periodically, preferably once per year.

6. A final annual savings report will be generated to communicate the energy (water) savings performance of all ECM's. Each annual report will include:

   * Baseline consumption year to date
   * Actual consumption year to date
   * Unit savings year to date
   * Dollar savings year to date
   * Comparison of all ECM savings in aggregate against a prorated guaranteed savings.

* Quantification of any known adjustments that impact the report energy (water) savings. Open-book analysis.
* Sign-off form asking for County's agreement with the savings calculations including baseline adjustments.
* Computation of an energy savings shortfall payment to be issued by Chevron Energy Solutions if savings fall short of the annual guaranteed energy savings.

2.4 Operations, Preventive Maintenance, Repair, and Replacement Reporting Requirements

2.4.1 Define Government and ESCO reporting requirements

- Operating and maintenance requirements for equipment installed in this project will be included in the O&M Manuals to be provided at the end of the project. There are no ongoing reporting requirements.

2.5 Construction Period Savings

2.5.1 Provide overview of how construction period savings will be calculated, if applicable.

- None

2.6 Status of Rebates

- None

2.7 Dispute Resolution

2.7.1 Describe plan for resolving disputes regarding issues such as baseline, baseline adjustment, energy savings calculation, and the use of periodic measurements.

- Addressed in Section 23 of the Energy Performance Contract.

3. Measurement and Verification General Approach — Detailed Description of Option C M&V

3.1 Standard Energy Management Descriptions & Definitions

3.1.1 **M&V Commencement Date**: "M&V Commencement Date" shall be the first day of the month following both: 1) The signed Certificate of Final Completion, and 2) Chevron ES' receipt of the Contract Amount.

3.1.2 **Construction Period:** The "Construction Period" is the period beginning with the first day of the month that equipment is first installed and continuing until the M&V Commencement Date.

3.1.3 **Measurement Year**: A "Measurement Year" is each one-year period following the M&V Commencement Date.

3.1.4 **EC Savings**: The energy conservation savings, or "EC Savings", having units of dollars ($), are those savings achieved through the reduction in energy consumption, demand, energy rates, maintenance, or materials through the implementation of the Scope of Work.

3.1.5 **Energy Savings Term**: The "Energy Savings Term" shall be the number of Measurement Years shown in Schedule R or until the termination of this Contract.

3.1.6 **Savings Measurement & Verification Plan**: The "Savings Measurement & Verification Plan" is the scope of work defined in this schedule and provides for the quantification of EC Savings for the purpose of meeting the Guaranteed Savings.

3.1.7 **Projected Energy Savings**: "Projected Energy Savings" are those savings expected from the installation and continued operation of the Scope of Work.

3.1.8 **Termination of Guaranteed Savings:** If the Contract is terminated, the Guaranteed Savings shall also be terminated. Should such termination occur on a date other than at the beginning of a Measurement Year, Chevron ES shall have no Guaranteed Savings for a partial year.

3.1.9 **Energy Unit Savings:** The savings in units of energy, power, water, etc., achieved through the reduction in energy consumption, demand, through the implementation of the Scope of Work as defined and calculated in herein.

3.1.10 **Baselines:** In determining Baselines, Chevron ES identified some of the factors which may affect energy use for the Facilities, including but not limited to: hours and levels of occupancy; adjustments in labor force; building use and operational procedures; temperature, humidification, and ventilation levels; installed lighting and scheduled use; building construction and size; general level of repair and efficiency of heating and air conditioning equipment and other energy-using equipment; and amount of heating and air

conditioning and other energy-using equipment. After consideration of those factors and certain other anomalous use of the Facilities, Chevron ES establishes initial Baselines. It is understood that due to changes in factors affecting energy use, the Baselines may be revised from time to time as detailed in this Schedule. In addition, data collected during the period before construction may indicate a change of the energy use pattern at the facility and require a change to the Baselines. Chevron ES shall notify the Customer, in writing, of all such changes.

3.1.11 **Base Energy Rates:** The "Base Energy Rates", having units of dollars per energy unit, are presented herein and shall be used by Chevron ES to calculate the EC Savings.

3.2 Guaranteed Savings Terms and Conditions

3.2.1 The Customer shall maintain all Scope of Work installed under this Contract in a manner consistent with the manufacturer's or Chevron ES' recommended maintenance schedules and procedures from the time of Substantial Completion. Chevron ES shall, if it deems necessary, inspect the Facilities annually.

3.2.2 For the purpose of determining EC Savings, Chevron ES shall prepare reports, take on-site measurements, monitor building automation systems, and/or additional work as required by and detailed in the Savings Measurement & Verification Plan.

3.2.3 The Customer acknowledges and consents to Chevron ES' right to monitor EC Savings and energy management performance by conducting on-site measurements, including, but not limited to, reading meters and installing and observing on-site monitoring equipment. The Customer shall cooperate fully with any such measures instituted by Chevron ES pursuant to this Subsection. Chevron ES shall not institute any measures that unreasonably interfere with the business of Customer conducted at the Facilities. At Chevron ES' request, to facilitate Chevron ES' monitoring of the Scope of Work, the Customer, at its expense, shall cause a dedicated telephone line to be installed at each location of the Customer's Facilities designated by Chevron ES for communication between Scope of Work and Chevron ES. Customer shall pay all monthly service charges and fees for such dedicated telephone line, except that Chevron ES shall pay the monthly fees for long distance service from Chevron ES' office to the Customer's Facilities.

3.2.4 For the purpose of determining EC Savings, Customer shall cooperate with Chevron ES by providing utility information, changes in factors affecting energy use, and/or additional information as requested by Chevron ES personnel.

3.2.5 Savings Guarantee: Subject to changes in factors affecting energy use, Chevron ES guarantees that the Customer will realize total EC Savings during the Energy Savings Term of not less than the Guaranteed Savings.

- Guarantee Payment: Should the Customer's total EC Savings during any Measurement Year be less than the Guaranteed Savings for that year, Chevron ES guarantees that it shall pay to the Customer, within 30 days of the acceptance of

the annual energy savings report, the difference between the Guaranteed Savings for such year and the total EC Savings for that Measurement Year, not to exceed the guarantee amount. If in the judgment of the Customer, Customer would benefit from additional energy services or energy saving retrofits, Customer and Chevron ES may mutually agree upon such services or retrofits in lieu of Guarantee Payment. For the purposes of this Contract, such services or retrofits actually delivered by Chevron ES will be considered a Guarantee Payment for that Measurement Year.

- Excess Savings: For each Measurement Year in which the EC Savings exceed the Guaranteed Savings, the Excess Savings shall be the difference. Excess savings shall be fully retained by Customer and shall not be used to cover shortfalls in other years.

3.2.6 Changes in Factors Affecting Energy Use

- The Customer shall notify Chevron ES in writing within ten (10) business days of any change in any factor that affects the Baselines as set forth. Chevron ES will determine the effect that any such change will have on EC Savings and present to the client a written analysis of the effects of the changes. Changes that are long term or permanent will be reflected in a change to the Baseline. Temporary changes that affect energy use will be calculated and added to the corresponding month's EC savings.
  - If a change in any of the factors involved in the Baseline occurs and results in a reduction of EC Savings, then the level of dollar energy savings to be guaranteed by Chevron ES will be decreased by the same amount.
  - Customer and Chevron ES may from time to time desire to make changes for the express purpose of increasing EC Savings. It is agreed that these changes will only be made with the written consent of both parties, which will not be unreasonably withheld. The Baseline will not be adjusted to reflect any changes agreed to under this subparagraph. If Chevron ES elects to pay for the cost of any such changes that would not unreasonably interfere with the conduct of Customer's business, and the Customer does not consent to the changes, then the Baseline will be adjusted upward by the amount of savings projected from the changes.
  - During the Energy Savings Term when the effect on savings can not be accurately determined due to construction or major changes, Projected Energy Savings for the facility will be used for the period of such changes and until the effect of the changes can be determined by Chevron ES.
  - Chevron ES has the right to charge the Customer for work required to assess the effect on savings for any large scale changes, including, but not limited to, building additions, new buildings, and new or changed HVAC equipment, that require more than forty (40) hours per year to be spent in calculating their effect on the energy savings. Such hours will be billed at current Chevron ES engineering rates. Before initiating such work, Chevron ES will notify the Customer in writing of the intent and cost associated with the work. The Customer will, within 45 days in writing, notify Chevron ES with permission to

proceed or, alternatively at no charge, to stipulate that the Projected Energy Savings for the existing facility in question be used as Energy Use Savings for the purpose of meeting the guarantee. If Chevron ES does not receive written notice within 45 days, the Projected Energy Savings for the existing facility in question will be used as EC Savings until such time that the Customer approves the work, as long as the scope of the work has not changed.

- If the Customer fails to notify Chevron ES of changes in factors affecting energy use or fails to supply Chevron ES with requested information that is required for the calculation of saving in a timely manner, EC Savings for the period will be equal to those Projected Energy Savings for the period. If information for the period in question is supplied at a later date, the EC Savings will be modified only if the calculated savings for the period exceed the Projected Energy Savings for that period of time.
- Any changes made by Chevron ES to the Baselines or savings calculations, as outlined in this contract, shall be presented to the Customer for approval. The Customer shall have 30 days to approve or question the changes in writing. If Chevron ES does not receive notice in writing within 30 days, the changes will be considered contractually valid and implemented as proposed. If the Customer notifies Chevron ES within 30 days of their non-approval of the changes, Chevron ES will work with the client to answer any questions or make any necessary corrections.
- The Customer agrees that Chevron ES shall have the right, with or without prior notice, to inspect the facilities to determine if the Customer is complying and shall have complied with its obligations as set forth above. In the event that any inspection discloses that the Customer has failed on the date of the inspection to be in compliance with any items set forth above, then the Guaranteed Energy Savings shall be assumed to have been achieved for and with respect to the portion of the Energy Savings Period during which such failure shall have existed.

3.3 Calculation of EC Savings

3.31 Energy Savings Report: Annually within 90 days after receipt of all needed information for each Measurement Year during the Energy Savings Term, Chevron ES shall submit an annual energy savings report with a precise calculation of the EC Savings to the Customer, unless additional information is needed to accurately calculate the EC Savings, in which case the Customer shall be notified of such a situation within the 90 day period.

3.32 Four different types of EC Savings are identified under this Contract: (a) Energy Use Savings, (b) Fuel Switch Savings, (c) Energy Rate Reduction Savings, and (d) Stipulated Non-Energy Savings. Total EC Savings will be determined by adding together the Energy Use Savings, Fuel Switch Savings, Energy Rate Reduction Savings, Operational Reduction Savings, and any calculation of an adjustment to the savings due to changes in factors affecting energy use for each period.

- Energy Use Savings are those savings achieved through reductions in energy use, energy demand, water, and other commodities. Chevron ES will calculate the Energy Unit Savings as detailed in the Savings Measurement and Verification

Plan. The Energy Unit Savings will then be multiplied by the applicable Base Energy Rates set forth herein. The dollar amount determined by such calculation shall be the Energy Use Savings for such period.

- Fuel Switch Savings are those savings achieved by switching to a more economical source of energy on a cost per unit of energy basis. The Fuel Switch Rate (dollars saved per unit of new fuel used) will be calculated by Chevron ES and presented herein and shall not be escalated for purposes of calculating savings. Fuel Switch Savings shall be computed for each period by multiplying the Fuel Switch Rate by the number of units of new fuel consumed for that period.
- Energy Rate Reduction (ERR) Savings are those savings achieved through either improving the rate from local utility company, direct purchase of a commodity, or bulk purchase of commodity. An ERR savings rate (dollars saved per unit of applicable energy) will be calculated by Chevron ES and presented herein. ERR Savings shall be computed for each period by multiplying the ERR savings rate by the number of units of energy consumed for that period. There will be no Energy Rate Reduction Savings calculation or penalty if the current energy rate exceeds the Base Energy Rate. There will be no ERR Savings calculation unless an energy rate reduction has been achieved either directly or indirectly by Chevron ES.
- Stipulated Non-energy Savings are achieved through reduction in non-energy cost due to the implementation of the Scope of Work identified by Chevron ES, to be calculated as set forth herein.

3.4 Savings Measurement & Verification Plan

The following details the methodologies and calculations to be used in determining the Energy Unit Savings under this Contract.

3.4.1 M&V Option A: This option allows for the energy savings to be predicted, measured, and agreed upon between the Customer and Chevron ES. One time measurements and stipulated parameters are used to quantify savings that are stipulated for the term of the Contract.

- Chevron ES will supply a one-time report to the Customer detailing the measurements and calculation of savings. If the calculated savings fall short of those expected, Chevron ES will have the opportunity to remedy the short fall and re-measure and calculate the results. Such work will be done at Chevron ES' expense and shall not be unreasonably denied by the Customer, as long as such work does not interfere with the Customer's use of the Facilities. These calculated savings will be defined as Energy Unit Savings and will be agreed to occur each year of the Contract.

3.4.2 M&V Option C: Option C verification techniques calculate savings by comparing the post-retrofit overall energy use in a building or facility with pre-retrofit energy Baselines. This methodology captures all of the savings under a particular meter, and requires ongoing monitoring of the facilities.

- The monthly Energy Unit Savings are calculated by subtracting the monthly post-retrofit consumption from the corresponding monthly Baseline consumption, and presented in ongoing reports. During the Construction Period, Option C Energy Unit Savings will be calculated each month.

- Energy Savings Term
  Except for where Projected Savings are to be utilized as detailed in this contract, for each Facility's Baseline, Energy Unit Savings will be calculated by subtracting the post implementation current month's usage from the Baseline usage for that month. The specific equations for calculating the unit savings are as follows:

  Baseline Usage - Current Usage = Energy Unit Savings

  Current Usage = Total units (i.e. kWh, kW, ccf, therms, gals, etc.) from the current post-implementation utility bills or other calibrated measuring device, for all meters of that type that measure the usage used to derive the Baseline.

  Baseline Usage: The pre-Construction Period usage, as detailed below, revised from time-to-time as detailed in this Contract.

- Baselines and Projected Savings:

01 - Administration

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	211,594	29,716	537	4	5,080	1,586	129,964	0
Feb	194,140	29,716	521	4	4,650	1,586	115,628	0
Mar	229,168	29,716	566	4	3,950	1,586	266,561	0
Apr	227,016	54,793	578	22	3,550	911	352,443	0
May	246,029	54,793	568	22	2,140	911	699,329	0
Jun	256,849	54,793	589	22	1,740	911	789,762	0
Jul	284,832	54,793	601	22	1,010	911	878,157	0
Aug	271,611	54,793	601	22	1,390	911	954,706	0
Sep	241,245	54,793	564	22	2,220	911	655,211	0
Oct	230,168	29,716	576	4	4,110	1,586	524,794	0
Nov	220,561	29,716	561	4	4,850	1,586	214,553	0
Dec	211,947	29,716	542	4	4,870	1,586	120,761	0
Totals	2,825,160	507,055	6,804	159	39,560	14,980	5,701,869	0

13 - Arapahoe Plaza Human Services

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	56,825	14,729	153	1.1	6,316	805	66,669	0
Feb	53,311	14,729	153	1.1	5,567	805	67,107	0
Mar	57,360	14,729	154	1.1	5,364	412	69,682	0
Apr	55,422	14,729	154	1.1	3,074	609	64,598	0
May	57,204	14,729	154	1.1	2,324	19	57,155	0
Jun	69,488	14,729	142	1.1	1,054	19	50,238	0
Jul	102,970	14,729	230	1.1	605	19	51,973	0
Aug	83,302	14,729	200	1.1	873	19	46,829	0
Sep	80,601	14,729	200	1.1	1,523	19	54,752	0
Oct	83,325	14,729	200	1.1	4,029	412	62,046	0
Nov	73,482	14,729	192	1.1	6,131	412	73,987	0
Dec	56,864	14,729	153	1.1	6,336	609	82,590	0
Totals	830,154	176,752	2,085	13.1	43,196	4,160	747,626	0

23 - Altura Plaza

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	121,594	36,037	272	5.1	18,160	11,449	231,312	0
Feb	103,244	36,037	272	5.1	11,670	11,449	188,690	0
Mar	112,618	36,037	228	5.1	5,160	5,740	157,555	0
Apr	112,883	36,037	276	5.1	5,010	8,594	247,231	0
May	120,411	36,037	288	5.1	4,150	31	322,300	0
Jun	122,653	36,037	324	5.1	3,700	31	347,233	0
Jul	139,482	36,037	344	5.1	4,530	31	387,367	0
Aug	138,135	36,037	312	5.1	6,300	31	459,150	0
Sep	126,767	36,037	308	5.1	7,530	31	414,267	0
Oct	120,855	36,037	320	5.1	14,900	5,740	361,683	0
Nov	119,468	36,037	320	5.1	18,330	5,740	318,155	0
Dec	126,428	36,037	272	5.1	13,010	8,594	196,791	0
Totals	1,464,538	432,445	3,536	62	112,450	57,462	3,631,734	0

In the proforma (schedule R) of this contract these savings are eliminated after year 5 as a contingency plan if the County no longer owns this facility. If the County however does continue to own this facility throughout the contract term these savings will continue to be counted toward the generated performance contract savings.

35 - ACJC Courthouse

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	202,551	45,348	514	6.2	9,680	2,505	425,622	156,618
Feb	172,659	45,348	513	6.2	8,870	2,505	514,533	156,618
Mar	234,751	45,348	532	6.2	7,540	1,284	565,324	313,236
Apr	234,674	45,348	491	6.2	6,710	1,894	563,143	156,618
May	248,888	45,348	504	6.2	4,560	62	383,824	313,236
Jun	247,557	45,348	540	6.2	4,020	62	486,176	313,236
Jul	293,663	45,348	569	6.2	2,730	62	667,161	469,854
Aug	276,365	45,348	544	6.2	3,710	62	773,075	469,854
Sep	228,143	45,348	539	6.2	3,870	62	758,773	313,236
Oct	214,985	45,348	479	6.2	6,020	1,284	689,563	156,618
Nov	201,979	45,348	526	6.2	6,770	1,284	617,494	156,618
Dec	199,199	45,348	489	6.2	8,320	1,894	783,212	156,618
Totals	2,755,414	544,175	6,240	74	72,800	12,959	7,227,900	3,132,357

36 - ACJC Detention Center

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	453,980	0	728	0	31,370	0	2,756,486	727,613
Feb	411,708	0	731	0	27,300	0	4,021,000	727,613
Mar	464,851	0	747	0	28,060	0	4,314,714	727,613
Apr	449,165	0	779	0	24,710	0	4,984,286	727,613
May	468,214	0	833	0	19,640	0	3,368,529	727,613
Jun	466,091	0	888	0	17,680	0	4,151,471	727,613
Jul	503,173	0	906	0	13,590	0	4,564,677	727,613
Aug	513,825	0	857	0	13,270	0	4,210,161	727,613
Sep	468,494	0	874	0	16,670	0	5,095,161	727,613
Oct	462,990	0	769	0	24,690	0	4,572,727	727,613
Nov	433,440	0	757	0	29,110	0	3,977,273	727,613
Dec	422,045	0	726	0	32,890	0	3,475,000	727,613
Totals	5,517,976	0	9,595	0	278,980	0	49,491,485	8,731,353

37 - ACJC Administration II

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	153,391	22,927	375	5.2	3,292	809	50,667	0
Feb	131,596	22,927	374	5.2	2,623	809	62,424	0
Mar	148,392	22,927	367	5.2	2,661	421	67,807	0
Apr	165,731	22,927	371	5.2	1,611	615	74,499	0
May	180,679	22,927	366	5.2	1,342	32	52,803	0
Jun	190,243	22,927	424	5.2	773	32	64,498	0
Jul	208,851	22,927	427	5.2	650	32	56,908	0
Aug	205,531	22,927	419	5.2	841	32	62,375	0
Sep	186,209	22,927	435	5.2	897	32	58,965	0
Oct	169,193	22,927	405	5.2	977	421	60,856	0
Nov	151,009	22,927	403	5.2	2,320	421	61,749	0
Dec	153,405	22,927	391	5.2	3,238	615	52,392	0
Totals	2,044,230	275,128	4,757	62	21,225	4,270	725,943	0

3.4.3 Calculated Savings: When the cost, complexity, or uncertainty of savings measurements are high as compared to the projected savings, the Customer and Chevron ES may agree to stipulate the projected Energy Unit Savings as being achieved, without any measurements being taken.

- For the Stipulated Option, the Energy Unit Savings presented in a subsequent section will be agreed to occur each year of the Contract.

3.5 Base Energy Rates

EC Savings shall be calculated using the Base Energy Rates or actual energy rates for that meter, whichever results in greater EC Savings. Actual energy rates will be calculated at the end of each Contract year using utility billing information for that Contract Year and using the same methodology as was employed to determine the Base Energy Rate in the Comprehensive Energy Analysis Report.

The Base Energy Rates listed here are to be increased each year on a cumulative basis by two and one half percent (2.5%) beginning on the first anniversary of the M&V Commencement Date and continuing on the first day of each Contract Year thereafter. The energy rates can be found in Section 2.2.1.

3.6 Stipulated Non-Energy $ Savings

The following dollar savings have been calculated by the Customer from the installation of the EC measures and have been agreed to by the Customer and will not be measured. The sum of these savings each measurement year will be added to the EC savings for that Measurement Year for all facilities.

Measurement Year	Maintenance Reallocation
1	$90,000
2	$92,250
3	$94,556
4	$96,920
5	$99,343
6	$101,827
7	$104,372
8	$106,982
9	$109,656
10	$112,398
11	$115,208
12	$118,088

4. ECM 1 – Lighting Improvements

4.1 Overview of ECM and M&V plan for ECM

This M&V plan applies to the following buildings: Arapahoe Plaza East, Arapahoe Plaza West, Federal Warehouse, Tri County Health, Centrepoint Plaza, Peoria Shops, ACJC Detention Center, Sheriff/Coroner Facility. Lighting retrofits are being implemented in other buildings, but those buildings have Option C electrical and natural gas M&V which will capture the lighting savings and heating penalty.

4.1.1 The Arapahoe County Facilities utilize fluorescent fixtures containing a combination of standard and energy saving T12 lamps with standard magnetic core and coil ballasts and a limited number of electronic T12 ballasts. This ECM considers replacing the existing T12 lamps and ballasts with T8 lamps and electronic ballasts and retrofitting some existing four-lamp and two-lamp U-tube fluorescent fixtures with specular reflectors, electronic ballasts, and T8 straight lamps. Incandescent lamps which have significant operating hours will be retrofitted with screw-in or hard-wired compact fluorescent retrofit kits with lamps and ballasts into the existing luminaire. In some instances new fixtures will replace existing fixtures. Some of the existing mercury vapor (MV) fixtures will be retrofitted with metal halide (MH) pulse-start lamp and ballast retrofit kits. All existing incandescent exit sign fixtures to be replaced with new Light Emitting Diode (LED) exit sign fixtures

Option A Method will be used to measure and verify the electricity savings from this retrofit. This method requires utilizing Xcel Energy standard tables to establish the baseline electricity consumption of the existing lighting systems and the post-retrofit electrical consumption of the new lighting systems. Operating hours for each usage type classification will be measured.

4.1.2 FEMP Method LE-A-02

4.1.3 The intent of this measurement plan is to verify baseline and post retrofit power and operating hours.

4.2 Energy Baseline Development

4.2.1 Variables Affecting Baseline Energy Use

- The only variables affecting baseline energy use will be measured or stipulated. Power consumption of fixtures before and after will be stipulated per XCEL Energy's standard table for the Custom Efficiency Program. Hours of runtime will be measured on a sampling basis using run time data loggers.

4.2.2 Define key system performance factors characterizing the baseline conditions

- A sampling of light level measurements will be taken to confirm pre lighting levels and post compliance with IES standards.

4.2.3 N/A

4.2.4 Baseline Data Collected

- Baseline Period: Lighting fixtures will be grouped according to run-time type and measured on a sampling basis.

- Metering Plan: Industry standard data run time loggers will be used to measure run time hours for a two week period. The hours measured will be averaged by usage group per week and then multiplied by 26 to determine annual hours per usage group.
    - Up to ten usage groups will be defined and 11 different measurements will be taken for each usage group. This will give statistically valid sampling. Usage groups will include: corridors, office bays, individual offices, restrooms, storage areas, conference rooms, lounges, mechanical rooms, stairwells, lobbies, and large meeting rooms. The actual quantity and location of measurements in each facility will be randomly selected by CES and County personnel.

4.2.5 Data Analysis Performed

- Calculations and Adjustments
    - Baseline Period: Annual kW baselines will be developed by applying the XCEL lighting tables to the total fixture population. Annual kWh baselines will be developed by multiplying the power calculations by the annual operating hours.
    - Post-installation Period: Annual post-retrofit kW consumption will be developed by applying the XCEL lighting tables to the total post-retrofit fixture population. Annual kWh consumption will be developed by multiplying the post-retrofit power calculations by the annual operating hours.

4.3 Energy Savings Calculations

4.3.1 The energy savings calculation has two main components: reduced electrical usage and increased natural gas consumption through the heating penalty.

The lighting retrofits will remain installed for the duration of the guarantee term. Retrofits are homogeneous throughout the project's included facilities.

Post-retrofit kWh consumption will be subtracted from the baseline kWh consumption to determine the energy unit savings. Post-retrofit kW consumption per room will be subtracted from the baseline kW. This product will be multiplied by a

diversity factor as shown in the Comprehensive Energy Analysis to determine the on-peak demand savings.

Annual Cost Savings: Annual energy cost savings will be determined by multiplying the energy unit and demand savings by the contractual base energy and demand rates as detailed in the Agreement. To be conservative, no credit will be taken for the air conditioning credit. CES reserves the right to add this credit to the savings calculations, as approved by Arapahoe County, should CES fall short of guaranteed energy savings. For all buildings with natural gas heat, the kWh saved per year shall be multiplied by 0.01004 to arrive at the heating penalty in therms of natural gas. This value was derived per the equation below. This heating penalty will not be applied to the Arapahoe Plaza East and West Buildings, as the heating penalty will be captured in the Option C measurements for the Arapahoe Human Services Building.

3413 btu/kW / .85 heat system efficiency x (1 therm/100,000 btu) x .25 (assumes 1/4 of annual btus get replaced by heating system) = .01004 Therms/kWh

4.3.2 Annual Cost Savings: Annual electrical cost savings will be determined by multiplying each the demand and energy unit by the contractual base demand and energy rates as detailed in the Agreement. The following is an example for the Arapahoe Plaza East Facility:

Total Annual Savings (kWh): 16,471
Total Monthly Savings (kW): 6.07
Total Annual Savings (therms): (165)
Rate (Section 2.2.1): $14.16/kW $0.05869/kWh $0.63481/therm
Total Savings:
(16,471 x .05869) + (12 x 6.07 x 14.16) + ((165) x 0.63481) = $3,588.04

4.4 Operational & Maintenance Cost Savings

No O&M savings were predicted for this retrofit

4.5 Total Annual Measured Savings for ECM

12 - Arapahoe Plaza East

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	33,024	1,373	78	6.1	0	-33	33,275	0
Feb	28,866	1,373	79	6.1	0	-33	33,915	0
Mar	33,384	1,373	80	6.1	0	-17	49,501	0
Apr	28,336	1,373	80	6.1	0	-25	56,000	0
May	28,416	1,373	71	6.1	0	0	63,073	0
Jun	28,020	1,373	76	6.1	0	0	63,810	0
Jul	29,354	1,373	74	6.1	0	0	76,159	0
Aug	31,700	1,373	75	6.1	0	0	83,542	0
Sep	29,611	1,373	76	6.1	0	0	57,797	0
Oct	30,668	1,373	77	6.1	0	-17	47,814	0
Nov	27,862	1,373	74	6.1	0	-17	39,065	0
Dec	31,304	1,373	77	6.1	0	-25	29,149	0
Totals	360,545	16,471	917	72.8	0	-165	633,100	0

14 - Arapahoe Plaza County Court

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	34,674	1,065	70	5.9	0	-26	88,900	0
Feb	32,763	1,065	72	5.9	0	-26	101,914	0
Mar	36,092	1,065	71	5.9	0	-13	94,652	0
Apr	32,596	1,065	72	5.9	0	-19	79,483	0
May	32,167	1,065	68	5.9	0	0	96,804	0
Jun	32,748	1,065	68	5.9	0	0	94,524	0
Jul	34,057	1,065	67	5.9	0	0	67,931	0
Aug	34,661	1,065	67	5.9	0	0	69,619	0
Sep	32,809	1,065	67	5.9	0	0	66,839	0
Oct	33,233	1,065	69	5.9	0	-13	68,736	0
Nov	32,757	1,065	63	5.9	0	-13	75,455	0
Dec	34,647	1,065	67	5.9	0	-19	77,038	0
Totals	403,204	12,783	821	70.7	0	-128	981,895	0

15 - Federal Warehouse

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	37,689	1,319	112	7.0	2,680	-32	3,993	0
Feb	35,256	1,319	106	7.0	2,510	-32	3,375	0
Mar	38,450	1,319	105	7.0	1,690	-16	27,075	0
Apr	39,504	1,319	135	7.0	730	-24	42,253	0
May	43,549	1,319	141	7.0	230	0	90,865	0
Jun	50,500	1,319	152	7.0	40	0	101,429	0
Jul	64,726	1,319	172	7.0	10	0	105,545	0
Aug	57,394	1,319	158	7.0	0	0	104,617	0
Sep	44,586	1,319	144	7.0	80	0	67,602	0
Oct	43,687	1,319	119	7.0	560	-16	50,570	0
Nov	36,400	1,319	95	7.0	2,150	-16	14,536	0
Dec	35,914	1,319	98	7.0	2,890	-24	3,702	0
Totals	527,655	15,823	1,537	84.48	13,570	-159	615,562	0

20 - Tri County Health

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	5,744	882	21	4.2	820	-21	2,620	0
Feb	5,234	882	20	4.2	620	-21	2,031	0
Mar	5,733	882	20	4.2	460	-11	1,502	0
Apr	6,359	882	24	4.2	220	-16	1,997	0
May	7,874	882	33	4.2	130	0	1,940	0
Jun	8,991	882	35	4.2	60	0	1,308	0
Jul	10,123	882	31	4.2	60	0	2,815	0
Aug	9,758	882	33	4.2	60	0	3,305	0
Sep	8,033	882	32	4.2	80	0	1,946	0
Oct	6,697	882	23	4.2	250	-11	3,374	0
Nov	5,860	882	21	4.2	520	-11	2,126	0
Dec	5,840	882	20	4.2	760	-16	830	0
Totals	86,246	10,584	313	50.52	4,040	-106	25,794	0

24 - Centrepointe

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	260,048	2,932	643	10.2	340	-71	116,409	0
Feb	401,078	2,932	610	10.2	260	-71	121,020	0
Mar	261,719	2,932	579	10.2	230	-35	127,429	0
Apr	215,531	2,932	578	10.2	150	-53	217,067	0
May	211,119	2,932	537	10.2	160	0	450,652	0
Jun	203,988	2,932	644	10.2	120	0	608,281	0
Jul	223,833	2,932	599	10.2	130	0	767,500	0
Aug	219,062	2,932	627	10.2	160	0	847,328	0
Sep	203,212	2,932	552	10.2	220	0	677,306	0
Oct	224,160	2,932	537	10.2	380	-35	354,273	0
Nov	230,257	2,932	590	10.2	160	-35	156,870	0
Dec	256,230	2,932	654	10.2	170	-53	114,772	0
Totals	2,910,237	35,183	7,150	122.16	2,480	-353	4,558,907	0

29 - Peoria Shops

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	31,395	1,353	71	5.4	538	-33	99,923	0
Feb	30,020	1,353	73	5.4	527	-33	147,319	0
Mar	29,589	1,353	68	5.4	395	-16	187,883	0
Apr	25,210	1,353	64	5.4	204	-25	181,875	0
May	25,120	1,353	60	5.4	109	0	128,820	0
Jun	25,790	1,353	56	5.4	20	0	123,600	0
Jul	26,147	1,353	59	5.4	10	0	137,541	0
Aug	25,917	1,353	62	5.4	5	0	206,059	0
Sep	23,967	1,353	61	5.4	60	0	135,714	0
Oct	26,448	1,353	65	5.4	206	-16	200,571	0
Nov	29,101	1,353	64	5.4	458	-16	133,714	0
Dec	30,367	1,353	66	5.4	634	-25	168,000	0
Totals	329,071	16,237	769	64.20	3,166	-164	1,851,019	0

36 - ACJC Detention Center

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	453,980	23,158	728	55.1	31,370	-558	2,756,486	0
Feb	411,708	23,158	731	55.1	27,300	-558	4,021,000	0
Mar	464,851	23,158	747	55.1	28,060	-279	4,314,714	0
Apr	449,165	23,158	779	55.1	24,710	-419	4,984,286	0
May	468,214	23,158	833	55.1	19,640	0	3,368,529	0
Jun	466,091	23,158	888	55.1	17,680	0	4,151,471	0
Jul	503,173	23,158	906	55.1	13,590	0	4,564,677	0
Aug	513,825	23,158	857	55.1	13,270	0	4,210,161	0
Sep	468,494	23,158	874	55.1	16,670	0	5,095,161	0
Oct	462,990	23,158	769	55.1	24,690	-279	4,572,727	0
Nov	433,440	23,158	757	55.1	29,110	-279	3,977,273	0
Dec	422,045	23,158	726	55.1	32,890	-419	3,475,000	0
Totals	5,517,976	277,890	9,595	661.56	278,980	-2,790	49,491,485	0

38 - Sheriff/Coroner Facility

Month	Electric Usage Baseline kWh	Electric Usage Projected Savings kWh	Electric Demand Baseline kW	Electric Demand Projected Savings kW	Natural Gas Usage Baseline therms	Natural Gas Usage Projected Savings therms	Water Usage Baseline gallons	Water Usage Projected Savings gallons
Jan	233,435	3,279	0	12.9	2,160	-79	93,314	0
Feb	215,005	3,279	0	12.9	2,260	-79	121,580	0
Mar	215,985	3,279	0	12.9	1,430	-40	97,456	0
Apr	199,959	3,279	0	12.9	1,370	-59	131,250	0
May	202,483	3,279	0	12.9	770	0	500,091	0
Jun	194,728	3,279	0	12.9	630	0	557,777	0
Jul	204,941	3,279	0	12.9	760	0	631,966	0
Aug	203,837	3,279	0	12.9	420	0	590,513	0
Sep	191,454	3,279	0	12.9	460	0	470,063	0
Oct	190,813	3,279	0	12.9	780	-40	279,428	0
Nov	185,731	3,279	0	12.9	1,720	-40	116,476	0
Dec	238,052	3,279	0	12.9	2,630	-59	89,700	0
Totals	2,476,423	39,353	0	154.56	15,390	-395	3,679,614	0

4.6 Post-Installation Verification Activities

Chevron ES will supply a one-time report to the County detailing the measurements and calculation of savings. If the calculated savings fall short of those expected, Chevron ES will have the opportunity to remedy the short fall and re-measure and calculate the results. Such work will be done at Chevron ES' expense and shall not be unreasonably denied by the County, as long as such work does not interfere with the County's use of the Facilities. These calculated savings will be defined as Energy Unit Savings and will be agreed to occur each year of the Contract.

4.6.1 Variables Affecting Post-installation Energy Use

- All variables are being addressed during the baseline development stage.

4.6.2 Define key system performance factors characterizing the post-installation conditions

- A sampling of light level measurements will be taken to confirm compliance with IES recommendations.

4.6.3 Acceptable lighting levels will be verified and included in the post installation report.

4.6.4 N/A

4.6.5 Post-Installation Data To Be Collected

Lighting loggers will be placed in fixtures to confirm the accuracy of the assumed run hours shown in the CEA. The measured hours for each usage group will be averaged to obtain the hours used for savings calculations.

- As-built documentation provided by CES' construction team will document the description and location of all retrofits. As-built documentation will be provided as detailed in the Agreement.
- Post-retrofit report will be completed within 60 days of the post-retrofit measurements. This report will detail the measurements taken and the annual energy unit savings calculated from all of the measurements.

4.6.6 Described in Section 3.3

4.7 Periodic / Interval Verification Activities

- N/A

5. ECM 2 and 2a – Water Consumption Improvements

5.1 Overview of ECM and M&V plan for ECM

This M&V plan applies to the following buildings at Arapahoe County: Administration Building, Arapahoe Plaza East, Arapahoe Human Services, Arapahoe West Building, Federal Warehouse, Altura Plaza, Centrepoint Plaza, Peoria Shops, ACJC Administrative Building, and Sheriff/Coroner Facility. No water measures are being implemented at Tri County Health. At the ACJC Courthouse and Detention Center, water savings are being measured via Option C which will capture water savings from these retrofits.

5.1.1 This ECM concerns replacing selected toilets, urinals and faucets at certain sites that have a high domestic water use and where water cost savings justifies replacement. Replacement of china and flush valve (or tank) is indicated in order to ensure proper operation.

Option A Method will be used to measure and verify the water savings from this retrofit. This method requires measuring the baseline usage per flush of the existing toilets and urinals and the post-retrofit usage per flush of the new toilets and urinals. This method also requires measuring the baseline flow rates of the existing faucets as well as the post-retrofit flow rates. Flushes per year for each toilet will be stipulated initially, and for the duration of the guarantee period, as well as annual usage hours for faucets.

An Option A approach is warranted for this retrofit because usage per flush and flow rates are easily measured using Option A techniques, savings from this ECM are very sustainable, and the cost of this measurement is in line with the projected savings.

5.1.2 Option A will be used to measure savings.

5.1.3 The intent of this measurement plan is to quantify the water and sewer cost savings associated with retrofitting or replacing existing end use fixtures with new low flow end use fixtures.

5.2 Energy Baseline Development

This method requires measuring the baseline consumption of the existing system. In this case, baseline water consumption will be determined by measuring a sampling of the toilet, urinal and faucet water usage before being retrofitted.

5.2.1 Variables Affecting Baseline Energy Use

- The impact of weather, operating hours, and set points will not affect the accuracy of savings measurement since actual water consumption will be measured at the source.