ECM 2a – Water Conservation Measures with Waterless Urinals

Arapahoe County Domestic Water
Administration Building

Assumptions	
Staff Population	358.00
Pop Ratio Female	50.00%
Visitor Population	1000
Pop Ratio Female	0.5
Length of Stay (hrs)	0.50
Inmate Population	0
Pop Ratio Female	0.7
Length of Stay (hrs)	4.00
Staff Absentee rate	10.00%
Days/year	236
Site Type (Res Comm)	comm
Laundry Population	0

Water Temperature		
Street		54
DHW supply		130
Boiler Efficiency		100%
Laundry		
Cycle/person/day		0
Gallons/load Pre		37.5
Gallons/load Post		25

Ice Machine Calc.		
Lbs/ Day	0	lbs
lbs/Year	0	lbs
Gallons / year	0	gal
Gallons of water/100 lbs of ice	16	gal
Process waste	0	gal
Est. Storage Waste	0	gal
Number of Ice Machines	1	gal
Total Storage Waste	24	gal
Total Ice Machine Usage (Gallons)	0	gal

Energy Inputs		Billing units	$/unit
DHW heating source	NG	Therm	$0.8900
Fuel conversion source	GG	kWh	$0.1000
Nat. Gas System Efficiency		100.00%	

	lbs/Year	5200
	Gallons / year	624
	Gallons of water/100 lbs of ice	16
	Process waste	208
	Est. Storage Waste	8000
8000	Number of Ice Machines	1
		8000
	Total Ice Machine Usage (Gallons)	8832

Arapahoe County Domestic Water
Administration Building

Building Area 140,263

General	
Diversity	1

Fixture Diversity	GPF	Quantity	Weighted Average
Toilet	1.6	0	3.00
Toilet	3	44	
Combv	1.6	0	-
Combv	1.6	0	
Urinal	1	0.00	1.50
Urinal	1.5	21	

Inmates		
Population:	50%	4.00 hour
Inmates total per day	0	
Inmates Women conv to person days	0	0.7
Inmates Men conv to person days	0	0.3
Inmates: Total	0	
Absent	0.00%	

Staff		
Population:	358.00	Pop ratio
Staff: Women	161.1	0.5
Staff: Men	161.1	0.5
Staff: Total	322.2	
Absent	10.00%	

Visitors		
Length of stay Not 8 hour day	30%	0.50 hour
Visitors Total per day	1000	
Visitors Women conv to person days	150	0.5
Visitors Men conv to person days	150	0.5
Total (visitor days)	300	

Schedule	Inmates	Staff	Visitors
Occupied Days	260	260	260
Holidays	10	10	10
Vacation	14	14	14
Total	236	236	236

Water Temperature		
Supply	130	Hot Water
Street	54	Fraction
Tap	100	612

Fixtures	Inmates		Staff		Visitors	
	Present	Proposed	Present	Proposed	Present	Proposed
GPF toilet	0	0	3.00	1.6	3.00	1.6
GPF urinal	0	1	1.50	1	1.50	1
Low Faucet GPM	1.5	1.5	2.21	2	2.21	2
Shower GPM	0	0	0	0	0	0

Uses per day	Inmates		Staff		Visitors		
	Male	Female	Male	Female	Male	Female	Units
Toilet	5	5	1	4	1	4	Flushes
Urinal	0		1		1		Flushes
Low Faucet	1		1	0.7	0.7	0.7	Minutes
Shower (M F)		10					Minutes

	Inmates						Staff					Visitors				
	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Shower	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men
Days/year	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236
Population	0	0	0	0	0	322.2	161	161	161	161	161	150	150	150	150	150
Minutes				1	1	10				0.666666667	0.666666667				0.666666667	0.666666667
Use per day	5	5	0				4	1	5			4	1	3		
Uses or minutes	0	0	0	0	0	760,392	152,078	38,020	114,059	25,346	25,346	141,600	35,400	106,200	23,600	23,600
Diversity (account for absentee)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GPU present	0.00	0.00	0.00				3.00	3.00	1.50			3.00	3.00	1.50		
GPM present				1.5	1.5	0				2.21	2.21				2.21	2.21
GPU Proposed	0	0	1				1.6	1.6	1			1.6	1.6	1		
GPM Proposed				1.5	1.5	0				2	2				2	2
Total Usage Pre (Gals)	0	0	0	0	0	0	456,235	114,059	171,088	56,016	56,016	424,800	106,200	159,300	52,156	52,156
Total Usage Post (Gals)	0	0	0	0	0	0	243,325	60,831	114,059	30,693	30,693	226,560	56,640	106,200	47,200	47,200
Savings	0	0	0	0	0	0	212,910	53,227	57,029	5,323	5,323	198,240	49,560	53,100	4,956	4,956
Hot Water GalSavs PRE				0	0	0				33,904	33,904	257,116				31,568
Hot Water GalSavs POST				0	0	0				30,682	30,682	137,128				28,568
Hot Water Energy Pre (mmbtus)				0	0	0				21	21	163				20
Hot Water Energy Post (mmbtus)				0	0	0				19	19	87				18
Hot Water Energy Savings (mmbtus)				0	0	0				2	2	76				2

Sanitary Water Use Summary	Gallons	Gals / person/yr	Gals / SF/ Year	Gals / person / day
Inmate Usage Pre	0	0	0	0
Inmate Usage Post	0	0	0	0
Staff Usage Pre	853,413	2649	8	7
Staff Usage Post	519,601	1613	4	4
Visitor Usage Pre	924,672	2466		7
Visitor Usage Post	483,800	1502		4
Total Usage Pre	1,648,025		12	
Total Usage Post	1,003,401		7	
Savings (Gals.) Domestic Water	644,624			
% Savings Domestic Water	39%			
Hot Water Usage PRE no laundry	67,508	210		
Hot Water Usage POST	61,365	190		
Savings gals	6,143	20		
% Savings (Hot Water)	9.5%			

Benchmarks	Admin 1	Typical Range
Total Usage / SF	41	25-35
Usage/SF less irrigation		
	712	4,053,844

	(Mmbtu)	Therms	kWh
Energy Pre (Mmbtu)	43	429	12,578
Kitchen	0	0	0
total	43	429	12,578
Energy Post (Mmbtu)	39	388	11,383
Energy Savings	4	41	1,195
% Savings (Hot Water	9.5%		

0

Model/Billing
-7%

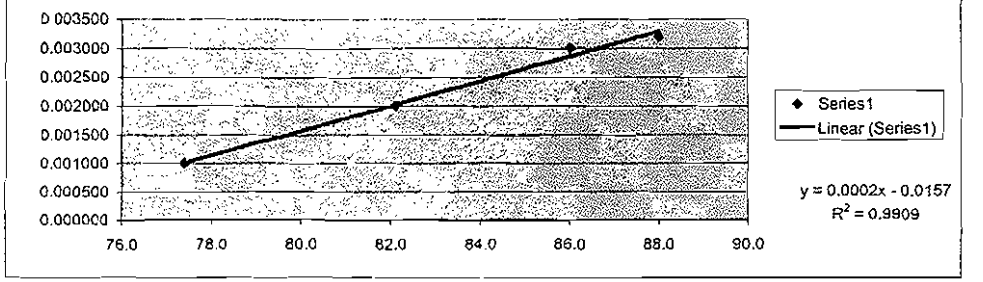
Arapahoe County Domestic Water
Administration Building

2.4	gallons/minu /100 tons of cooling	3	Rule of thumb CFM/SF
248	Chiller size	0.075	lb/cf density of air
1	Number of Chillers	122,833	SF of conditioned space
248	Design Load	368,499	CFM total
50%	Turn down		
124	minimum load		

http://qaweather.com/ccd/nrmcdd.htm

Month	CCD	% of CCD in this Month	Gallons/ month
jan	0	0%	0
feb	0	0%	0
mar	0	0%	0
apr	2	0%	3,795
may	23	3%	43,638
jun	135	19%	256,137
jul	261	38%	495,199
aug	217	31%	411,717
sep	57	8%	108,147
oct	0	0%	0
nov	0	0%	0
dec	0	0%	0
	695	1	1,318,634

Month	DENVER Wet Bulb	DENVER RH	DENVER Mean Dry Bulb	DENVER High Temps Dry Bulb	Average, high and mean	Psychometric Chart Humidity Ratio (#moisture / # of dry air	gallons / month
jan	24	49	36.4	43.2	39.8		
feb	27	44	36.5	47.2	41.9		
mar	31	40	43.1	53.7	48.4		
apr	38	35	50.9	60.9	55.9		
may	46	38	61.0	70.5	65.8		
jun	54	35	69.2	82.1	75.7	0.002000	286,659
jul	58	34	78.2	88.0	83.1	0.003200	458,655
aug	57	35	74.8	86.0	80.4	0.003000	429,989
sep	50	34	65.9	77.4	71.7	0.001000	143,330
oct	41	36	53.2	66.0	59.6		
nov	31	49	41.0	51.5	46.3		
dec	25	52	35.2	44.1	39.7		
0	40	40	53.8	64.2	59.0		
							1,318,634

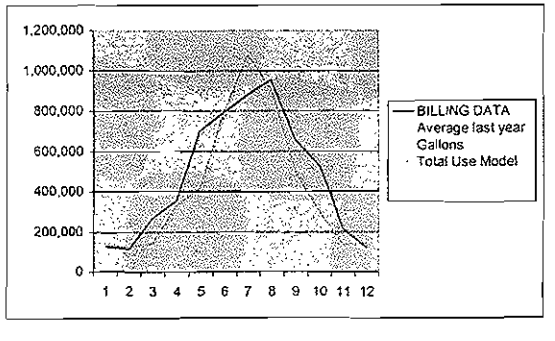


Arapahoe County Domestic Water
Administration Building

									Water Rate	Sewer Rate	0	0
								Summer rate	$2.52000	$1.05000		
								Winter rate	$2.14000	$0.00000	$0.00000	$0.00000
								$0.00000	$0.00000	$0.00000	$0.00000	$0.00000
	BILLING DATA Average last year Gallons	Staff days per month	Visitors days per month	Population days	Sanitary Water Use Model	Balance	Gallons Saved	Water Dollars Saved	Sewer Dollars Saved	Total Dollars Saved	
Jan	179,964	22	22	13,777	139,969	-10,005	54,749	$0	$0	$0	-7%
Feb	115,678	20	20	12,444	126,424	-10,796	49,451	$0	$0	$0	-9%
Mar	266,561	22	22	13,777	139,969	126,592	54,749	$0	$0	$0	90%
Apr	357,443	21	21	13,333	135,454	215,989	52,985	$0	$0	$0	160%
May	699,238	22	22	13,777	139,969	559,269	54,749	$0	$0	$0	400%
June	785,762	21	21	13,333	135,454	650,308	52,985	$0	$0	$0	483%
Jul	878,137	22	22	13,777	139,969	738,168	54,749	$0	$0	$0	527%
Aug	954,786	22	22	13,777	139,969	814,817	54,749	$0	$0	$0	582%
Sep	655,211	21	21	13,333	135,454	519,757	52,985	$0	$0	$0	384%
Oct	524,794	22	22	13,777	139,969	384,825	54,749	$0	$0	$0	275%
Nov	214,553	21	21	13,333	135,454	79,099	52,985	$0	$0	$0	58%
Dec	120,761	22	22	13,777	139,969	-19,208	54,749	$0	$0	$0	-14%
	5,701,869	251		162,716	1,648,025	4,053,844	644,574	0	$0	$0	

	Non Sanitary Use	Non Sanitary Use Kool	Ice machine	Evaporative coolers	Irrigation	Laundry	Kitchen	Total Modeled non sanitary use	Balance	Total Use Model	Total Model / billing
Jan	-10,005	-101	736	0	0	0	0	736	-10,741	140,705	-8%
Feb	-10,796	-111	736	0	0	0	0	736	-11,532	127,160	-10%
Mar	126,592	127	736	0	0	0	0	736	125,856	140,705	47%
Apr	216,989	217	736	5,795	189,077	0	0	193,607	23,381	329,062	7%
May	559,269	559	736	41,538	230,163	0	0	274,536	284,827	414,507	41%
June	654,308	654	736	256,197	391,145	0	0	648,078	6,289	783,470	1%
Jul	738,168	738	736	495,199	441,701	0	0	937,636	-199,468	1,077,805	-23%
Aug	814,737	815	736	411,717	355,223	0	0	767,677	47,060	907,645	5%
Sep	519,757	520	736	108,147	747,459	0	0	856,342	163,415	491,796	25%
Oct	384,825	385	736	0	154,329	0	0	155,065	229,759	295,035	44%
Nov	79,099	79	736	0	0	0	0	736	78,363	136,150	37%
Dec	-19,208	-191	736	0	0	0	0	736	-19,944	140,705	-17%
	4,053,844	4,054	8,832	1,318,634	2,509,098	0	0	4,336,564	717,280	4,984,589	0

Cost Analysis	Non Sanitary Use	Non Sanitary Use Kool	Ice machine	Evaporative coolers	Irrigation	Laundry	Kitchen	Total Modeled non sanitary use			
Jan	-$21		$2	$0	$0			$2			
Feb	-$23		$2	$0	$0			$2			
Mar	$271		$2	$0	$0			$2			
Apr	$464		$2	$0	$409			$414			
May	$1,436		$2	$332	$492			$826			
June	$1,680		$2	$658	$1,005			$1,665			
Jul	$1,897		$2	$1,271	$1,145			$2,410			
Aug	$2,044		$2	$1,058	$913			$1,973			
Sep	$1,356		$2	$278	$636			$916			
Oct	$989		$2	$0	$397			$399			
Nov	$169		$2	$0	$0			$2			
Dec	-$41		$2	$0	$0			$2			
			$19	$3,387	$5,082			$8,490			



Arapahoe County Domestic Water
Administration Building

Code	Units
1	Gal
2	Kgal
3	CF
4	CCF
5	MCF
2	<<< enter unit code

	Water Rate	Sewer Rate		
Summer rate	$2.57000	$3.00000	per	Kgal
Winter rate	$2.14000	$0.00000	per	Kgal
			per	Kgal

Service Charge $85.20 bi monthly
Storm water fee $2,460.00 annual
FireLineCharge $15.03 bi monthly

Read Date	Month	Kgal/day	Usage		Gallons	Billing days	Water Charges	Sewer Charges	Total Metered Charges	Total Water Charges	Total Charges
1/31/2004	Jan	5	130	Kgal	129,964	25	$278	$368	$647	$643	$992
2/25/2004	Feb	4	116	Kgal	115,628	30	$247	$368	$615	$609	$977
3/26/2004	Mar	8	267	Kgal	266,561	30	$570	$368	$939	$826	$1,194
4/30/2004	Apr	13	352	Kgal	352,443	27	$754	$368	$1,123	$1,009	$1,378
5/27/2004	May	21	699	Kgal	699,329	34	$1,797	$368	$2,166	$2,052	$2,421
6/30/2004	Jun	26	790	Kgal	789,762	30	$2,030	$368	$2,398	$2,285	$2,653
7/30/2004	Jul	28	878	Kgal	878,157	31	$2,257	$368	$2,625	$2,512	$2,880
8/30/2004	Aug	31	955	Kgal	954,706	31	$2,454	$368	$2,822	$2,709	$3,077
9/30/2004	Sep	23	655	Kgal	655,211	28	$1,684	$368	$2,052	$1,939	$2,307
10/28/2004	Oct	16	525	Kgal	524,794	33	$1,349	$368	$1,717	$1,604	$1,972
11/30/2004	Nov	7	215	Kgal	214,553	31	$459	$368	$828	$714	$1,083
12/31/2004	Dec	4	121	Kgal	120,761	30	$258	$368	$627	$514	$882
1/30/2005	Jan						14137.84203			17199.22203	21619.87803

$/gal Water charge	$/gal Sewer charge	$/gallon Total	$/gallon Total
$0.0021	$0.0028	$0.0050	$0.0050
$0.0021	$0.0032	$0.0053	$0.0053
$0.0021	$0.0014	$0.0035	$0.0035
$0.0021	$0.0010	$0.0032	$0.0032
$0.0026	$0.0005	$0.0031	$0.0031
$0.0026	$0.0005	$0.0030	$0.0030
$0.0026	$0.0004	$0.0030	$0.0030
$0.0026	$0.0004	$0.0030	$0.0030
$0.0026	$0.0005	$0.0031	$0.0031
$0.0026	$0.0007	$0.0033	$0.0033
$0.0021	$0.0017	$0.0039	$0.0039
$0.0021	$0.0031	$0.0052	$0.0052

129,964	130
115,628	116
266,561	267
352,443	352
699,329	699
789,762	790
878,157	878
954,706	955
655,211	655
524,794	525
214,553	215
120,761	121

Arapahoe County Domestic Water
Arapahoe Plaza East

Assumptions	
Staff Population	60.00
Pop Ratio Female	50.00%
Visitor Population	200
Pop Ratio Female	0.5
Length of Stay (hrs)	1.00
Inmate Population	0
Pop Ratio Female	0.7
Length of Stay (hrs)	4.00
Staff Absentee rate	0.00%
Days/year	236
Site Type (Res Comm)	comm
Laundry Population	0

Water Temperature		
Street		54
DHW supply		130
Boiler Efficiency		100%
Laundry		
Cycle/person/day		0
Gallons/load Pre		37.5
Gallons/load Post		25

Ice Machine Calc.		
Lbs/ Day	0	lbs
lbs/Year	0	lbs
Gallons / year	0	gal
Gallons of water/100 lbs of ice	16	gal
Process waste	0	gal
Est. Storage Waste	0	gal
Number of Ice Machines	1	gal
Total Storage Waste	24	gal
Total Ice Machine Usage (Gallons)	0	gal

Energy Inputs		Billing units	$/unit
DHW heating source	NG	Therm	$0.8900
Fuel conversion source	GG	kWh	$0.1000
Nat. Gas System Efficiency		100.00%	

	lbs/Year	5200
	Gallons / year	624
	Gallons of water/100 lbs of ice	16
	Process waste	832
	Est. Storage Waste	8000
8000	Number of Ice Machines	1
		8000
	Total Ice Machine Usage (Gallons)	8832

Arapahoe County Domestic Water
Arapahoe Plaza East

Building Area: 20,957

General	
Diversity	1

Fixture Diversity			
	GPF	Quantity	Weighted Average
Toilet	1.6	4	2.81
Toilet	3.5	71	
Urinal	1.5	0	-
Urinal	3.5	0	
Lavatory	1	0.00	2.00
Urinal	2	21	

Inmates		
Population:	50%	4.00 hour
Inmates total per day	0	
Inmates Women carry to person days	0	0.7
Inmates Men carry to person days	0	0.3
Inmates: Total	0	
Absent	0.00%	

Staff		
Population:	60.00	Pop ratio
Staff: Women	15	0.5
Staff: Men	30	0.5
Staff: Total	60	
Absent	0.00%	

Visitors		
Length of stay Not 8 hour day	50%	1.00 hour
Visitors Toilet per day	200	
Visitors Women carry to person days	30	0.5
Visitors Men carry to person days	30	0.5
Total (visitor days)	60	

Model/ASHRAE 50%

Schedule	Inmates	Staff	Visitors
Occupied Days	250	250	250
Holidays	10	10	10
Vacation	14	14	14
Total	236	236	226

Water Temperature		
Supply	130	Hot Water
Street	54	Fraction
Tap	100	61.5

Fixtures	Inmates		Staff		Visitors	
	Present	Proposed	Present	Proposed	Present	Proposed
GPF Toilet	0	0	2.81	1.6	2.81	1.6
GPF Urinal	0	1	2.00	1	2.00	1
Lav Faucet GPM	1.5	1.5	2	2	2	2
Shower GPM	0	0	0	0	0	0

Uses per day	Inmates		Staff		Visitors		
	Male	Female	Male	Female	Male	Female	Units
Toilet	5	5	4	4	4	4	Flushes
Urinal	0	0	3		3		Flushes
Lav Faucet	15	15	0.7	0.7	0.7	0.7	Minutes
Shower (M F)	10						Minutes

	Inmates						Staff				Visitors				
	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Shower	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men
Days/year	236	236	236	236	236	236	236	236	236	30	30	226	226	226	226	226
Population:	0	0	0	0	0	60	15	30	30	15	30	30	30	30	30	30
Minutes				1	1	10				0.666666667	0.666666667				0.666666667	0.666666667
Use per day	5	5	0				4	1	3			4	1	3		
Uses or minutes	0	0	0	0	0	141,600	14,160	7,080	21,240	2,360	4,720	26,320	6,580	19,740	4,720	4,720
Diversity (account for absentee)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GPU present	0.00	0.00	0.00				2.81	2.81	2.00			2.81	2.81	2.00		
GPM present				1.5	1.5	0				2	2				2	2
GPU Proposed	0	0	1				1.6	1.6	1			1.6	1.6	1		
GPM Proposed				1.5	1.5	0				2	2				2	2
Total Usage Pre (Gals)	0	0	0	0	0	0	59,777	19,888	42,480	4,720	9,440	79,553	19,888	42,480	9,440	9,440
Total Usage Post (Gals)	0	0	0	0	0	0	22,655	11,328	21,240	4,720	9,440	45,312	11,328	21,240	9,440	9,440
Savings	0	0	0	0	0	0	17,121	8,560	21,240	0	0	34,241	8,560	21,240	0	0
Hot Water Gallons PRE				0	0	0				2,857	5,714	48,151				5,714
Hot Water Gallons POST				0	0	0				2,857	5,714	27,426				5,714
Hot Water Energy Pre (mmbtus)				0	0	0				2	4	30				4
Hot Water Energy Post (mmbtus)				0	0	0				2	4	17				4
Hot Water Energy Savings (mmbtus)				0	0	0				0	0	13				0

Sanitary Water Use Summary	Gallons	Gals / person/yr	Gals / SF/ Year	Gals / person / day
Inmate Usage Pre	0	0	0	0
Inmate Usage Post	0	0	0	0
Staff Usage Pre	116,305	1938	6	5
Staff Usage Post	69,384	1156	3	3
Visitor Usage Pre	160,802	2680		7
Visitor Usage Post	98,760	1613		4
Total Usage Pre	277,107		13	
Total Usage Post	168,144		8	
Savings (Gals.) Domestic Water	110,963			
% Savings Domestic Water	40%			
Hot Water Usage PRE no laundry	8,571	143		
Hot Water Usage POST	8,571	143		
Savings gals	0	0		
% Savings (Hot Water)	0.0%			

Benchmarks	Admin 1	Typical Range
Total Usage / SF	26	25-35
Usage/SF Ext. Irrigation		
	50%	278,165

	(Mmbtu)	Therms	kWh
Energy Pre (Mmbtu)	5	54	1,590
Kitchen	0	0	0
Total	5	54	1,590
Energy Post (Mmbtu)	5	54	1,590
Energy Savings	0	0	0
% Savings (Hot Water	0.0%		

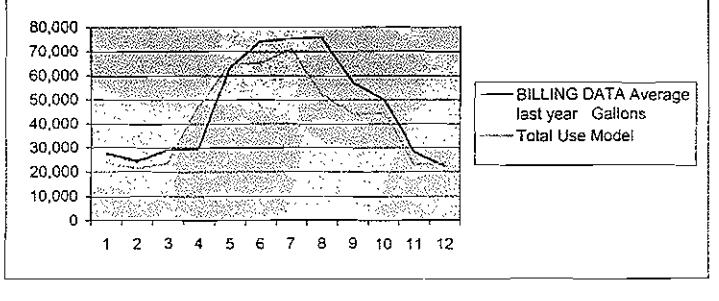
0

Arapahoe County Domestic Water
Arapahoe Plaza East

		Water Rate	Sewer Rate	0	0
	Summer rate	$2.57000	$3.00000		
	Winter rate	$2.14000	$0.00000	$0.00000	$0.00000
	$0.00000	$0.00000	$0.00000	$0.00000	$0.00000

	BILLING DATA Average last year Gallons	Staff days per month	Visitors days per month	Population days	Sanitary Water Use Model	Balance	Gallons Saved	Water Dollars Saved	Sewer Dollars Saved	Total Dollars Saved	
Jan	27,466	22	22	2,657	23,535	3,931	9,424	$0	$0	$0	17%
Feb	24,417	20	20	2,400	21,258	3,159	8,512	$0	$0	$0	15%
Mar	28,964	22	22	2,657	23,535	5,429	9,424	$0	$0	$0	23%
Apr	29,293	21	21	2,571	22,776	6,517	9,120	$0	$0	$0	29%
May	62,933	22	22	2,657	23,535	39,398	9,424	$0	$0	$0	167%
June	74,048	21	21	2,571	22,776	51,272	9,120	$0	$0	$0	225%
Jul	75,183	22	22	2,657	23,535	51,648	9,424	$0	$0	$0	219%
Aug	75,615	22	22	2,657	23,535	52,080	9,424	$0	$0	$0	221%
Sep	57,104	21	21	2,571	22,776	34,328	9,120	$0	$0	$0	151%
Oct	50,020	22	22	2,657	23,535	26,485	9,424	$0	$0	$0	113%
Nov	28,021	21	21	2,571	22,776	5,245	9,120	$0	$0	$0	23%
Dec	22,209	22	22	2,657	23,535	-1,326	9,424	$0	$0	$0	-6%
	555,273	261		31,286	277,107	278,166	110,963	0	$0	$0	20%

	Non Sanitary Use	Non Sanitary Use Kgal	Ice machine	Evaporative coolers	Irrigation	Laundry	Kitchen	Total	Balance	Total Use Model	Total Model / billing
Jan	3,931	4	0	0	0	0	0	0	3,931	23,535	86%
Feb	3,159	3	0	0	0	0	0	0	3,159	21,258	87%
Mar	5,429	5	0	0	0	0	0	0	5,429	23,535	81%
Apr	6,517	7	0	0	24,166	0	0	24,166	-17,649	46,942	160%
May	39,398	39	0	0	41,154	0	0	41,154	-1,756	64,689	103%
June	51,272	51	0	0	42,290	0	0	42,290	8,982	65,066	88%
Jul	51,648	52	0	0	47,508	0	0	47,508	4,140	71,043	94%
Aug	52,080	52	0	0	28,512	0	0	28,512	23,568	52,047	69%
Sep	34,328	34	0	0	21,515	0	0	21,515	12,813	44,291	78%
Oct	26,485	26	0	0	20,709	0	0	20,709	5,776	44,244	88%
Nov	5,245	5	0	0	0	0	0	0	5,245	22,776	81%
Dec	-1,326	-1	0	0	0	0	0	0	-1,326	23,535	106%
	278,166	278	0	0	225,854	0	0	225,854	52,312	502,961	432%



Arapahoe County Domestic Water
Arapahoe Plaza East

Code	Units
1	Gal
2	Kgal
3	CF
4	CCF
5	MCF
2	<<< enter unit code

	Water Rate	Sewer Rate		
Summer rate	$2.57000	$3.00000	per	Kgal
Winter rate	$2.14000	$0.00000	per	Kgal
			per	Kgal

Service Charge	$14.60	bi monthly
Storm water fee	$207.79	annual
FireLineCharge	$0.00	bi monthly

Read Date	Month	Kgal/day	Usage		Gallons	Billing days	Water Charges	Sewer Charges	Total Metered Charges	Total Water Charges	Total Charges
1/31/2004	Jan	1	27	Kgal	27,466	25	$69	$78	$162	$83	$162
2/25/2004	Feb	1	24	Kgal	24,417	30	$62	$78	$155	$77	$156
3/26/2004	Mar	1	29	Kgal	28,964	29	$74	$78	$167	$89	$166
4/30/2004	Apr	1	29	Kgal	29,293	27	$75	$78	$168	$90	$168
5/27/2004	May	2	63	Kgal	62,933	34	$162	$78	$240	$186	$264
6/30/2004	Jun	2	74	Kgal	74,048	30	$190	$78	$268	$215	$293
7/30/2004	Jul	2	75	Kgal	75,183	31	$193	$78	$271	$218	$296
8/30/2004	Aug	2	76	Kgal	75,615	31	$194	$78	$272	$219	$297
9/30/2004	Sep	2	57	Kgal	57,104	28	$147	$78	$225	$171	$249
10/28/2004	Oct	2	50	Kgal	50,020	33	$129	$78	$206	$153	$231
11/30/2004	Nov	1	28	Kgal	28,021	31	$60	$78	$138	$85	$162
12/31/2004	Dec	1	22	Kgal	22,209	30	$48	$78	$126	$74	$130
1/30/2005	Jan						1358.09251		1653.485843	2587.379843	

$/gal Water charge	$/gal Sewer charge	$/gallon Total	$/gallon Total
$0.0021	$0.0028	$0.0050	$0.0050
$0.0021	$0.0032	$0.0053	$0.0053
$0.0021	$0.0027	$0.0048	$0.0048
$0.0021	$0.0027	$0.0048	$0.0048
$0.0026	$0.0012	$0.0038	$0.0038
$0.0026	$0.0011	$0.0036	$0.0036
$0.0026	$0.0010	$0.0036	$0.0036
$0.0026	$0.0010	$0.0036	$0.0036
$0.0026	$0.0014	$0.0039	$0.0039
$0.0026	$0.0016	$0.0041	$0.0041
$0.0021	$0.0028	$0.0049	$0.0049
$0.0021	$0.0035	$0.0056	$0.0056

27,466	27
24,417	24
28,964	29
29,293	29
62,933	63
74,048	74
75,183	75
75,615	76
57,104	57
50,020	50
28,021	28
22,209	22

Arapahoe County Domestic Water
Arapahoe Plaza Human Services

Assumptions	
Staff Population	90.00
Pop Ratio Female	60.00%
Visitor Population	500
Pop Ratio Female	0.5
Length of Stay (hrs)	0.50
Inmate Population	0
Pop Ratio Female	0.7
Length of Stay (hrs)	4.00
Staff Absentee rate	0.00%
Days/year	236
Site Type (Res Comm)	comm
Laundry Population	0

Water Temperature		
Street		54
DHW supply		130
Boiler Efficiency		100%
Laundry		
Cycle/person/day		0
Gallons/load Pre		37.5
Gallons/load Post		25

Ice Machine Calc.		
Lbs/ Day	0	lbs
lbs/Year	0	lbs
Gallons / year	0	gal
Gallons of water/100 lbs of ice	16	gal
Process waste	0	gal
Est. Storage Waste	0	gal
Number of Ice Machines	1	gal
Total Storage Waste	24	gal
Total Ice Machine Usage (Gallons)	0	gal

Energy Inputs		Billing units	$/unit
DHW heating source	NG	Therm	$0.8900
Fuel conversion source	GG	kWh	$0.1000
Nat. Gas System Efficiency		100.00%	

	lbs/Year	5200
	Gallons / year	624
	Gallons of water/100 lbs of ice	16
	Process waste	832
	Est. Storage Waste	8000
8000	Number of Ice Machines	1
		8000
	Total Ice Machine Usage (Gallons)	8832

Arapahoe County Domestic Water
Arapahoe Plaza Human Services

Building Area 54,285

General

Diversity	1

Inmates

Population:	50%	4.00 hour
Inmates total per day	0	
Inmates Women conv to person days	0	0.7
Inmates Men conv to person days	0	0.3
Inmates Total	0	
Absent	0.00%	

Staff

Population:	90.00	Pop ratio
Staff: Women	54	0.6
Staff: Men	36	0.4
Staff: Total	90	
Absent	0.00%	

Visitors

Length of stay (for 8 hour day	50%	0.50 hour
Visitors Total per day	300	
Visitors Women conv to person days	75	0.5
Visitors Men conv to person days	75	0.5
Total (visitor days)	150	

Fixture Diversity

	GPF	Quantity	Weighted Average
Toilet	1.6	10	2.74
Toilet	4.1	9	
Combo	1.6	0	-
Combo	3.5	0	
Urinal	1	0.00	2.50
Urinal	2.5	5	

Schedule

	Inmates	Staff	Visitors	Water Temperature		
Occupied Days	260	260	260	Supply	130	Hot Water
Holidays	10	10	10	Street	54	Fraction
Vacation	14	14	14	Tap	100	61%
Total	236	236	236			

Fixtures

	Inmates		Staff		Visitors	
	Present	Proposed	Present	Proposed	Present	Proposed
GPF toilet	0	0	2.74	1.6	2.74	1.6
GPF urinal	0	1	2.50	1	2.50	1
Lav Faucet GPM	1.5	1.5	2	2	2	2
Shower GPM	0	0	2.5	2.5	0	0

Use Per day

	Inmates		Staff		Visitors		
	Male	Female	Male	Female	Male	Female	Units
Toilet	5	5	4	4	4	4	Flushes
Urinal	0		3		3		Flushes
Lav Faucet	1	1	0.5	0.5	0.5	0.5	Minutes
Shower (M F)	10						Minutes

	Inmates						Staff					Visitors				
	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Shower	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men
Days/year	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236
Population:	0	0	0	0	0	90	54	36	36	54	36	75	75	75	75	75
Minutes				1	1	10				0.5	0.5				0.5	0.5
Use per day	5	5	0			4		1	3			4	1	3		
Uses or minutes	0	0	0	0	0	212,400	55,296	8,496	25,488	6,372	4,248	70,800	17,700	53,100	8,850	8,850
Diversity (account for assenlee)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GPU present	0.00	0.00	0.00				2.74	2.74	2.50			2.74	2.74	2.50		
GPM present				1.5	1.5	0				2	2				2	2
GPU Proposed	0	0	1				1.6	1.6	1			1.6	1.6	1		
GPM Proposed				1.5	1.5	0				2	2				2	2
Total Usage Pre (Gals)	0	0	0	0	0	0	139,513	23,752	63,720	12,744	8,496	193,768	48,442	132,750	17,700	17,700
Total Usage Post (Gals)	0	0	0	0	0	0	81,562	13,594	25,488	12,744	8,496	113,280	28,320	53,100	17,700	17,700
Savings	0	0	0	0	0	0	57,952	9,858	38,232	0	0	80,488	20,122	79,650	0	0
Hot Water Gallons PRE				0	0	0				7,713	5,142	117,281				10,713
Hot Water Gallons POST				0	0	0				7,713	5,142	68,564				10,713
Hot Water Energy Pre (mmbtus)				0	0	0				5	3	74				7
Hot Water Energy Post (mmbtus)				0	0	0				5	3	43				7
Hot Water Energy Savings (mmbtus)				0	0	0				0	0	31				0

Sanitary Water Use Summary	Gallons	Gals / person/yr	Gals / SF/ Year	Gals / person / day
Inmate Usage Pre	0	0	0	0
Inmate Usage Post	0	0	0	0
Staff Usage Pre	247,775	2753	5	8
Staff Usage Post	141,883	1576	3	4
Visitor Usage Pre	410,361	4560		12
Visitor Usage Post	230,100	2557		7
Total Usage Pre	658,086		12	
Total Usage Post	371,983		7	
Savings (Gals) Domestic Water	286,103			
% Savings Domestic Water	43%			
Hot Water Usage PRE no laundry	12,855	143		
Hot Water Usage POST	12,855	143		
Savings gals	0	0		
% Savings (Hot Water)	0.0%			

Benchmarks	Admin 1	Typical Range
Total Usage / SF	16	25-36
Usage/SF less Irrigation		
	24%	208,593

	(Mmbtu)	Therms	kWh
Energy Pre (Mmbtu)	8	81	2,385
Kitchen	0	0	0
Total	8	81	2,385
Energy Post (Mmbtu)	8	81	2,385
Energy Savings	0	0	0
% Savings (Hot Water	0.0%		

0

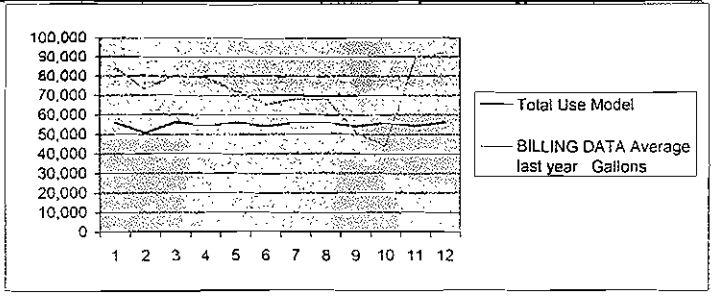
Arapahoe County Domestic Water
Arapahoe Plaza Human Services

		Water Rate	Sewer Rate	0	0
	Summer rate	$2.57000	$3.00000		
	Winter rate	$2.14000	$0.00000	$0.00000	$0.00000
	$0.00000	$0.00000	$0.00000	$0.00000	$0.00000

	BILLING DATA Average last year Gallons	Staff days per month	Visitors days per month	Population days	Sanitary Water Use Model	Balance	Gallons Saved	Water Dollars Saved	Sewer Dollars Saved	Total Dollars Saved	
Jan	84,070	22	22	5,314	55,892	28,178	24,299	$0	$0	$0	50%
Feb	73,237	20	20	4,800	50,483	22,754	21,948	$0	$0	$0	45%
Mar	80,338	22	22	5,314	55,892	24,446	24,299	$0	$0	$0	44%
Apr	79,000	21	21	5,143	54,089	24,911	23,515	$0	$0	$0	46%
May	72,459	22	22	5,314	55,892	16,567	24,299	$0	$0	$0	30%
June	65,238	21	21	5,143	54,089	11,149	23,515	$0	$0	$0	21%
Jul	67,931	22	22	5,314	55,892	12,039	24,299	$0	$0	$0	22%
Aug	68,305	22	22	5,314	55,892	12,413	24,299	$0	$0	$0	22%
Sep	50,508	21	21	5,143	54,089	-3,581	23,515	$0	$0	$0	-7%
Oct	44,136	22	22	5,314	55,892	-11,756	24,299	$0	$0	$0	-21%
Nov	89,682	21	21	5,143	54,089	35,593	23,515	$0	$0	$0	66%
Dec	92,075	22	22	5,314	55,892	36,183	24,299	$0	$0	$0	65%
	866,979	261		62,571	658,086	208,893	286,103	0	$0	$0	

33%

	Non Sanitary Use	Non Sanitary Use Kgal	Ice machine	Evaporative coolers	Irrigation	Laundry	Kitchen	Total	Balance	Total Use Model	Total Model / billing
Jan	28,178	28	0	0	0	0	0	28	28,150	55,920	33%
Feb	22,754	23	0	0	0	0	0	23	22,731	50,506	31%
Mar	24,446	24	0	0	0	0	0	24	24,421	55,917	30%
Apr	24,911	25	0	0	0	0	0	25	24,886	54,114	32%
May	16,567	17	0	0	0	0	0	17	16,550	55,909	23%
June	11,149	11	0	0	0	0	0	11	11,138	54,100	17%
Jul	12,039	12	0	0	0	0	0	12	12,027	55,904	18%
Aug	12,413	12	0	0	0	0	0	12	12,400	55,905	18%
Sep	-3,581	-4	0	0	0	0	0	-4	-3,578	54,086	-7%
Oct	-11,756	-12	0	0	0	0	0	-12	-11,744	55,880	-27%
Nov	35,593	36	0	0	0	0	0	36	35,557	54,125	40%
Dec	36,183	36	0	0	0	0	0	36	36,147	55,928	39%
	208,893	209	0	0	0	0	0	209	208,684	658,295	32%



Arapahoe County Domestic Water
Arapahoe Plaza Human Services

Code	Units
1	Gal
2	Kgal
3	CF
4	CCF
5	MCF
2	<<< enter unit code

	Water Rate	Sewer Rate		
Summer rate	$2.57000	$3.00000	per	Kgal
Winter rate	$2.14000	$0.00000	per	Kgal
			per	Kgal

Service Charge	$32.19	bimonthly
Storm water fee	$207.79	
FireLineCharge	$15.03	bimonthly

Read Date	Month	Kgal/day	Usage		Gallons	Billing days	Water Charges	Sewer Charges	Total Metered Charges	Total Water Charges	Total Charges		$/gal Water charge	$/gal Sewer charge	$/gallon Total
1/31/2004	Jan	3	84	Kgal	84,070	25	$180	$204	$384	$411	$616		$0.0021	$0.0024	$0.0045
2/25/2004	Feb	3	73	Kgal	73,237	30	$157	$204	$361	$388	$592		$0.0021	$0.0028	$0.0049
3/26/2004	Mar	3	80	Kgal	80,338	30	$172	$204	$376	$403	$607		$0.0021	$0.0025	$0.0046
4/30/2004	Apr	3	79	Kgal	79,000	34	$169	$204	$373	$400	$604		$0.0021	$0.0026	$0.0047
5/27/2004	May	2	72	Kgal	72,459	34	$186	$204	$391	$418	$622		$0.0026	$0.0028	$0.0054
6/30/2004	Jun	2	65	Kgal	65,238	30	$168	$204	$372	$399	$603		$0.0026	$0.0031	$0.0057
7/30/2004	Jul	2	68	Kgal	67,931	31	$175	$204	$379	$406	$610		$0.0026	$0.0030	$0.0056
8/30/2004	Aug	2	68	Kgal	68,305	31	$176	$204	$380	$407	$611		$0.0026	$0.0030	$0.0056
9/30/2004	Sep	2	51	Kgal	50,508	28	$130	$204	$334	$361	$566		$0.0026	$0.0040	$0.0066
10/28/2004	Oct	1	44	Kgal	44,136	33	$113	$204	$318	$345	$549		$0.0026	$0.0046	$0.0072
11/30/2004	Nov	3	90	Kgal	89,682	31	$192	$204	$396	$423	$628		$0.0021	$0.0023	$0.0044
12/31/2004	Dec	3	92	Kgal	92,075	30	$197	$204	$401	$428	$633		$0.0021	$0.0022	$0.0044
1/30/2005	Jan						$2,014			$4,791					

84,070	84
73,237	73
80,338	80
79,000	79
72,459	72
65,238	65
67,931	68
68,305	68
50,508	51
44,136	44
89,682	90
92,075	92

Arapahoe County Domestic Water
Arapahoe Plaza West Building (County Court)

Assumptions	
Staff Population	30.00
Pop Ratio Female	60.00%
Visitor Population	500
Pop Ratio Female	0.5
Length of Stay (hrs)	2.50
Inmate Population	0
Pop Ratio Female	0.7
Length of Stay (hrs)	4.00
Staff Absentee rate	0.00%
Days/year	236
Site Type (Res Comm)	comm
Laundry Population	0

Water Temperature		
Street		54
DHW supply		130
Boiler Efficiency		100%
Laundry		
Cycle/person/day		0
Gallons/load Pre		37.5
Gallons/load Post		25

Ice Machine Calc.		
Lbs/ Day	0	lbs
lbs/Year	0	lbs
Gallons / year	0	gal
Gallons of water/100 lbs of ice	16	gal
Process waste	0	gal
Est. Storage Waste	0	gal
Number of Ice Machines	1	gal
Total Storage Waste	24	gal
Total Ice Machine Usage (Gallons)	0	gal

Energy Inputs		Billing units	$/unit
DHW heating source	NG	Therm	$0.8900
Fuel conversion source	GG	kWh	$0.1000
Nat. Gas System Efficiency		100.00%	

	lbs/Year	5200
	Gallons / year	624
	Gallons of water/100 lbs of ice	16
	Process waste	832
	Est. Storage Waste	8000
8000	Number of Ice Machines	1
		8000
	Total Ice Machine Usage (Gallons)	8832

Arapahoe County Domestic Water
Arapahoe Plaza West Building (County Court)

Building Area: 70,960

General	
Diversity	1

Fixture Diversity			
	GPF	Quantity	Weighted Average
Toilet	1.6	11	3.87
Toilet	4	18	
Combo	1.6	0	-
Combo	3.5	0	
Urinal	1	0.50	2.50
Urinal	2.5	21	

Model/Billing 63%

Inmates			
Population:	50%	4.00	hour
Inmates total per day	0		
Inmates Women comv to person days	0	0.7	
Inmates Men comv to person days	0	0.3	
Inmates: Total	0		
Absent	0.00%		

Staff		
Population:	30.00	Poo ratio
Staff: Women	18	0.6
Staff: Men	12	0.4
Staff: Total	30	
Absent	0.00%	

Visitors			
Length of stay (of 8 hour day	30%	2.50	hour
Visitors total per day	500		
Visitors Women comv to person days	75	0.5	
Visitors Men comv to person days	75	0.5	
Total (visitor days)	150		

Schedule	Inmates	Staff	Visitors
Occupied Days	250	250	250
Holidays	10	10	10
Vacation	14	14	14
Total	236	236	236

Water Temperature		
Supply	130	Hot water
Street	54	Fraction
Tap	100	612

Fixtures	Inmates		Staff		Visitors	
	Present	Proposed	Present	Proposed	Present	Proposed
GPF toilet	0	0	3.87	1.6	3.87	1.6
GPF urinal	0	0	2.50	1	2.50	1
Low Faucet GPM	1.5	1.5	2	2	2	2
Shower GPM	0	0	3.5	2.5	0	0

Uses per day	Inmates		Staff		Visitors		
	Male	Female	Male	Female	Male	Female	Units
Toilet	5	5	3	4	1	4	Flushes
Urinal	0		3		3		Flushes
Low Faucet	1	1	0.3	0.5	0.5	0.5	Minutes
Shower (if 2)		10					Minutes

	Inmates						Staff					Visitors				
	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Shower	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men
Days/year	236	236	236	236	236	236	250	250	250	250	250	250	250	250	250	250
Population:	0	0	0	0	0	30	18	12	12	18	12	75	75	75	75	75
Minutes				1	1	10				0.5	0.5				0.5	0.5
Use per day	5	5	0				4	3				4	1		1	
Uses or minutes	0	0	0	0	0	70,800	18,992	2,837	8,496	2,124	1,416	70,800	17,700	53,100	8,850	8,850
Diversity (account for absentee)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GPU present	0.00	0.00	0.00				3.87	3.87	2.50			3.87	3.87	2.50		
GPM present				1.5	1.5	0				2	2				2	2
GPU Proposed	0	0	1				1.6	1.6	1			1.6	1.6	1		
GPM Proposed				1.5	1.5	0				2	2				2	2
Total Usage Pre (Gals)	0	0	0	0	0	0	65,822	10,970	21,240	4,248	2,832	274,257	68,564	132,750	17,700	17,700
Total Usage Post (Gals)	0	0	0	0	0	0	27,187	4,531	8,496	4,248	2,832	113,280	28,320	53,100	17,700	17,700
Savings	0	0	0	0	0	0	38,634	6,439	12,744	0	0	160,977	40,244	79,650	0	0
Hot Water Gallons PRE				0	0	0				2,571	1,714	165,488				10,713
Hot Water Gallons POST				0	0	0				2,571	1,714	68,564				10,713
Hot Water Energy Pre (mmbtus)				0	0	0				7	1	105				7
Hot Water Energy Post (mmbtus)				0	0	0				7	1	43				7
Hot Water Energy Savings (mmbtus)				0	0	0				0	0	62				0

Sanitary Water Use Summary	Gallons	Gals / person/yr	Gals / SF/ Year	Gals / person / day
Inmate Usage Pre	0	0	0	0
Inmate Usage Post	0	0	0	0
Staff Usage Pre	105,112	3504	5	10
Staff Usage Post	47,294	1576	2	4
Visitor Usage Pre	510,971	1703		47
Visitor Usage Post	230,100	767		21
Total Usage Pre	616,083			29
Total Usage Post	277,394			13
Savings (Gals.) Domestic Water	338,689			
% Savings Domestic Water	55%			
Hot Water Usage PRE no laundry	4,285	143		
Hot Water Usage POST	4,285	143		
Savings gals	0	0		
% Savings (Hot Water)	0.0%			

Benchmarks	Admin 1	Typical Range
Total Usage / SF	47	25-56
Usage/SF less Irrigation		
		565,812

	(Mmbtu)	Therms	kWh
Energy Pre (Mmbtu)	3	27	795
Kitchen	0	0	0
total	3	27	795
Energy Post (Mmbtu)	3	27	795
Energy Savings	0	0	0
% Savings (Hot Water	0.0%		

0

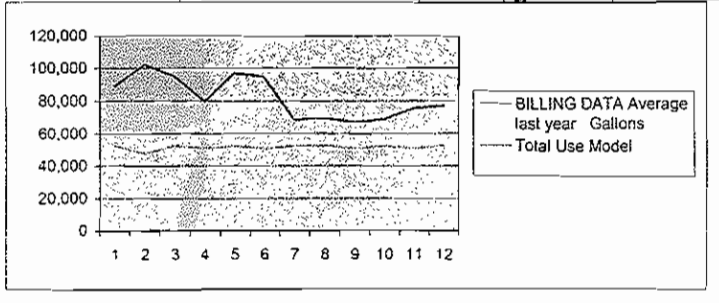
Arapahoe County Domestic Water
Arapahoe Plaza West Building (County Court)

		Water Rate	Sewer Rate	0	0
	Summer rate	$2.57000	$3.00000		
	Winter rate	$2.14000	$0.00000	$0.00000	$0.00000
	average	$2.35500	$0.00000	$0.00000	$0.00000

	BILLING DATA Average last year Gallons	Staff days per month	Visitors days per month	Population days	Sanitary Water Use Model	Balance	Gallons Saved	Water Dollars Saved	Sewer Dollars Saved	Total Dollars Saved	
Jan	88,900	22	22	3,986	52,325	36,575	28,765	$67,742	$0	$67,742	70%
Feb	101,914	20	20	3,600	47,261	54,653	25,982	$61,187	$0	$61,187	116%
Mar	94,652	22	22	3,986	52,325	42,327	28,765	$67,742	$0	$67,742	81%
Apr	79,483	21	21	3,857	50,637	28,846	27,837	$65,557	$0	$65,557	57%
May	96,804	22	22	3,986	52,325	44,479	28,765	$67,742	$0	$67,742	85%
June	94,524	21	21	3,857	50,637	43,887	27,837	$65,557	$0	$65,557	87%
Jul	67,931	22	22	3,986	52,325	15,606	28,765	$67,742	$0	$67,742	30%
Aug	69,619	22	22	3,986	52,325	17,294	28,765	$67,742	$0	$67,742	33%
Sep	66,839	21	21	3,857	50,637	16,202	27,837	$65,557	$0	$65,557	32%
Oct	68,736	22	22	3,986	52,325	16,411	28,765	$67,742	$0	$67,742	31%
Nov	75,455	21	21	3,857	50,637	24,818	27,837	$65,557	$0	$65,557	49%
Dec	77,038	22	22	3,986	52,325	24,713	28,765	$67,742	$0	$67,742	47%
	981,895	261		46,929	616,083	365,812	338,689	797,612	$0	$797,612	

34%

	Non Sanitary Use	Non Sanitary Use Kgal	Ice machine	Evaporative coolers	Irrigation	Laundry	Kitchen	Total	Balance	Total Use Model	Total Model / Billing
Jan	36,575	37	0	0	0	0	0	0	36,575	52,325	41%
Feb	54,653	55	0	0	0	0	0	0	54,653	47,261	54%
Mar	42,327	42	0	0	0	0	0	0	42,327	52,325	45%
Apr	28,846	29	0	0	0	0	0	0	28,846	50,637	36%
May	44,479	44	0	0	0	0	0	0	44,479	52,325	46%
June	43,887	44	0	0	0	0	0	0	43,887	50,637	46%
Jul	15,606	16	0	0	0	0	0	0	15,606	52,325	23%
Aug	17,294	17	0	0	0	0	0	0	17,294	52,325	25%
Sep	16,202	16	0	0	0	0	0	0	16,202	50,637	24%
Oct	16,411	16	0	0	0	0	0	0	16,411	52,325	24%
Nov	24,818	25	0	0	0	0	0	0	24,818	50,637	33%
Dec	24,713	25	0	0	0	0	0	0	24,713	52,325	32%
	365,812	366	0	0	0	0	0	366	365,812	616,083	37%



Arapahoe County Domestic Water
Arapahoe Plaza West Building (Co

Code	Units
1	Gal
2	Kgal
3	CF
4	CCF
5	MCF
2	<<< enter unit code

	Water Rate	Sewer Rate		
Summer rate	$2.57000	$3.00000	per	Kgal
Winter rate	$2.14000	$0.00000	per	Kgal
average	$2.35500		per	Kgal
Service Charge	$14.60	bimonthly		
Storm water fee	$207.79	annual		
FireLineCharge	$0.00	bimonthly		

Read Date	Month	Kgal/day	Usage		Gallons	Billing days	Water Charges	Sewer Charges	Total Metered Charges	Total Water Charges	Total Charges
1/31/2004	Jan	4	89	Kgal	88,900	25	$190	$206	$396	$215	$421
2/25/2004	Feb	3	102	Kgal	101,914	30	$218	$206	$424	$243	$449
3/26/2004	Mar	3	95	Kgal	94,652	30	$203	$206	$409	$227	$433
4/30/2004	Apr	3	79	Kgal	79,483	27	$170	$206	$376	$189	$395
5/27/2004	May	3	97	Kgal	96,804	34	$249	$206	$455	$273	$480
6/30/2004	Jun	3	95	Kgal	94,524	30	$243	$206	$449	$268	$474
7/30/2004	Jul	2	68	Kgal	67,931	31	$175	$206	$381	$199	$406
8/30/2004	Aug	2	70	Kgal	69,619	31	$179	$206	$385	$204	$410
9/30/2004	Sep	2	67	Kgal	66,839	28	$172	$206	$378	$196	$403
10/28/2004	Oct	2	69	Kgal	68,736	33	$177	$206	$383	$201	$408
11/30/2004	Nov	2	75	Kgal	75,455	31	$161	$206	$368	$186	$392
12/31/2004	Dec	3	77	Kgal	77,038	30	$165	$206	$371	$190	$396
1/30/2005	Jan						$2,301			$2,596	

$/gal Water charge	$/gal Sewer charge	$/gallon Total	$/gallon Total
$0.0021	$0.0023	$0.0045	$0.0045
$0.0021	$0.0020	$0.0042	$0.0042
$0.0023	$0.0022	$0.0045	$0.0043
$0.0021	$0.0026	$0.0047	$0.0047
$0.0026	$0.0021	$0.0047	$0.0047
$0.0026	$0.0022	$0.0048	$0.0048
$0.0026	$0.0030	$0.0056	$0.0056
$0.0026	$0.0030	$0.0055	$0.0055
$0.0026	$0.0031	$0.0057	$0.0057
$0.0026	$0.0030	$0.0056	$0.0056
$0.0021	$0.0027	$0.0049	$0.0049
$0.0021	$0.0027	$0.0048	$0.0048

88,900	89
101,914	102
94,652	95
79,483	79
96,804	97
94,524	95
67,931	68
69,619	70
66,839	67
68,736	69
75,455	75
77,038	77

Arapahoe County Domestic Water
Federal Warehouse

Assumptions	
Staff Population	13.00
Pop Ratio Female	0.00%
Visitor Population	15
Pop Ratio Female	0.5
Length of Stay (hrs)	2.40
Inmate Population	0
Pop Ratio Female	0.7
Length of Stay (hrs)	4.00
Staff Absentee rate	0.00%
Days/year	236
Site Type (Res Comm)	comm
Laundry Population	0

Water Temperature		
Street		54
DHW supply		130
Boiler Efficiency		100%
Laundry		
Cycle/person/day		0
Gallons/load Pre		37.5
Gallons/load Post		25

Ice Machine Calc.		
Lbs/ Day	0	lbs
lbs/Year	0	lbs
Gallons / year	0	gal
Gallons of water/100 lbs of ice	16	gal
Process waste	0	gal
Est. Storage Waste	0	gal
Number of Ice Machines	1	gal
Total Storage Waste	24	gal
Total Ice Machine Usage (Gallons)	0	gal

Energy Inputs		Billing units	$/unit
DHW heating source	NG	Therm	$0.8900
Fuel conversion source	CG	kWh	$0.1000
Nat. Gas System Efficiency		100.00%	

	lbs/Year	5200
	Gallons / year	624
	Gallons of water/100 lbs of ice	16
	Process waste	832
	Est. Storage Waste	8000
8000	Number of Ice Machines	1
		8000
	Total Ice Machine Usage (Gallons)	8832

Arapahoe County Domestic Water
Federal Warehouse

Building Area: 75,700

General	
Diversity	1

Fixture Diversity	GPF	Quantity	Weighted Average
Toilet	1.61	15	2.08
Toilet	5.51	5	
Combv	1.6	0	-
Combv	3.5	0	
Urinal	1	1.00	1.50
Urinal	2	1	

model/billing
5.40%

Inmates		
Population	50%	4.00 hour
Inmates total per day	0	
Inmates Women conv to person days	0	0.7
Inmates Men conv to person days	0	0.3
Inmates: Total	0	
Absent	0.00%	

Staff		
Population:	13.00	Pop ratio
Staff: Women	0	0
Staff: Men	13	1
Staff: Total	13	
Absent	0.00%	

Visitors		
Length of stay Tot 8 hour day	302	2.40 hour
Visitors total per day	12	
Visitors Women conv to person days	7	0.5
Visitors Men conv to person days	7	0.5
Total (visitor days)	5	

Schedule	Inmates	Staff	Visitors	Water Temperature		
Occupied Days	250	250	250	Supply	130	Hot Water
Holidays	10	10	10	Street	54	Fraction
Vacation	14	14	14	Tap	100	61%
Total	236	236	236			

Fixtures	Inmates		Staff		Visitors		
	Present	Proposed	Present	Proposed	Present	Proposed	
GPF Toilet	0	0	2.08	1.6	2.08	1.6	
GPF Urinal	0	0	1.50	1	1.50	1	
Lav Faucet GPM	1.5	1.5	2.5	2	2.5	2	
Shower GPM	0	0	2.5	2.5	0	0	

Uses Per day	Inmates		Staff		Visitors		
	Male	Female	Male	Female	Male	Female	Units
Toilet	5	5	1	4	1	4	Flushes
Urinal	0	0	3	0	3	0	Flushes
Lav Faucet	1	1	0.5	0.5	0.5	0.5	Minutes
Shower (M F)		10					Minutes

	Inmates						Staff					Visitors				
	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Shower	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men
Days/year	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236
Population:	0	0	0	0	0	13	0	13	13	0	13	7	7	7	7	7
Minutes				1	1	10				0.5	0.5				0.5	0.5
Use per day	5	5	0				4	1	3			4	1	3		
Uses or minutes	0	0	0	0	0	30,680	0	3,068	9,204	0	1,534	2,124	531	1,593	266	266
Diversity (account for absentee)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GPU present	0.00	0.00	0.00				2.08	2.08	1.50			2.08	2.08	1.50		
GPM present				1.5	1.5	0				2.5	2.5				2.5	2.5
GPU Proposed	0	0	0				1.6	1.6	1			1.6	1.6	1		
GPM Proposed				1.5	1.5	0				2	2				2	2
Total Usage Pre (Gals)	0	0	0	0	0	0	0	6,366	13,806	0	3,835	4,407	1,102	2,390	664	664
Total Usage Post (Gals)	0	0	0	0	0	0	0	4,909	9,204	0	3,068	3,398	850	1,593	531	531
Savings	0	0	0	0	0	0	0	1,457	4,602	0	767	1,009	252	797	133	133
Hot Water Gallons PRE				0	0	0				0	2,321	2,668				402
Hot Water Gallons POST				0	0	0				0	1,857	2,057				321
Hot Water Energy Pre (mmbtus)				0	0	0				0	1	2				0
Hot Water Energy Post (mmbtus)				0	0	0				0	1	1				0
Hot Water Energy Savings (mmbtus)				0	0	0				0	0	0				0

Sanitary Water Use Summary	Gallons	Gals / person/yr	Gals / SF/ Year	Gals / person / day
Inmate Usage Pre	0	0	0	0
Inmate Usage Post	0	0	0	0
Staff Usage Pre	24,007	1847	0	5
Staff Usage Post	17,181	1322	0	4
Visitor Usage Pre	9,226	710		7
Visitor Usage Post	6,905	531		1
Total Usage Pre	33,233		0	
Total Usage Post	24,086		0	
Savings (Gals.) Domestic Water	9,149			
% Savings Domestic Water	28%			
Hot Water Usage PRE no laundry	2,321	179		
Hot Water Usage POST	1,857	143		
Savings gals	464	36		
% Savings (Hot Water)	20.0%			

Benchmarks	Admin 1	Typical Range
Total Usage / SF	14	25-36
Usage/SF less Irrigation		
	95%	$52,328

	(Mmbtu)	Therms	kWh
Energy Pre (Mmbtu)	1	15	431
Kitchen	0	0	0
Total	1	15	431
Energy Post (Mmbtu)	1	12	344
Energy Savings	0	3	86
% Savings (Hot Water	20.0%		

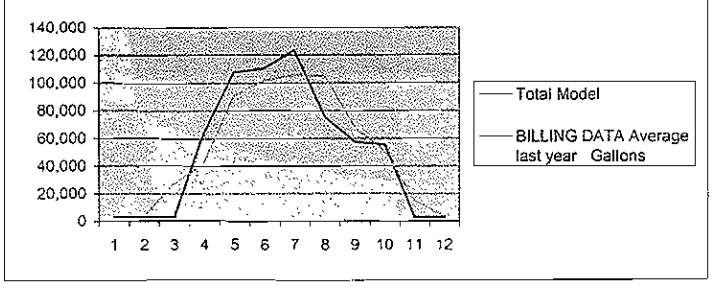
0

Arapahoe County Domestic Water
Federal Warehouse

		Water Rate	Sewer Rate	0	0
	Summer rate	$2.57000	$3.00000		
	Winter rate	$2.14000	$0.00000	$0.00000	$0.00000
	$0.00000	$0.00000	$0.00000	$0.00000	$0.00000

	BILLING DATA Average last year Gallons	Staff days per month	Visitors days per month	Population days	Sanitary Water Use Model	Balance	Gallons Saved	Water Dollars Saved	Sewer Dollars Saved	Total Dollars Saved	
Jan	3,993	22	22	399	2,823	1,170	762	$2	$2	$4	
Feb	3,375	20	20	360	2,549	826	762	$2	$2	$4	
Mar	27,075	22	22	399	2,823	24,252	762	$2	$2	$4	
Apr	42,253	21	21	386	2,731	39,522	762	$2	$2	$4	
May	90,865	22	22	399	2,823	88,042	762	$2	$2	$4	
June	101,429	21	21	386	2,731	98,698	762	$2	$2	$4	
Jul	105,545	22	22	399	2,823	102,722	762	$2	$2	$4	
Aug	104,617	22	22	399	2,823	101,794	762	$2	$2	$4	
Sep	67,602	21	21	386	2,731	64,871	762	$2	$2	$4	
Oct	50,570	22	22	399	2,823	47,747	762	$2	$2	$4	
Nov	14,536	21	21	386	2,731	11,805	762	$2	$2	$4	
Dec	3,702	22	22	399	2,823	879	762	$2	$2	$4	
	615,562	261		4,693	33,233	582,329	9,149	$21	$27	$49	

	Non Sanitary Use	Non Sanitary Use Kgal	Ice machine	Evaporative coolers	Irrigation	Laundry	Kitchen	Total	Balance	Total Model	
Jan	1,170	1	0	0	0	0	0	1	1,169	2,824	29%
Feb	826	1	0	0	0	0	0	1	825	2,550	24%
Mar	24,252	24	0	0	0	0	0	24	24,228	2,647	89%
Apr	39,522	40	0	0	61,391	0	0	61,430	-21,909	64,162	-52%
May	88,042	88	0	0	104,549	0	0	104,637	-16,594	107,459	-18%
June	98,698	99	0	0	107,434	0	0	107,533	-8,835	110,264	-9%
Jul	102,722	103	0	0	120,691	0	0	120,794	-18,071	123,616	-17%
Aug	101,794	102	0	0	72,431	0	0	72,533	29,261	75,356	28%
Sep	64,871	65	0	0	54,658	0	0	54,723	10,148	57,454	15%
Oct	47,747	48	0	0	52,609	0	0	52,657	-4,909	55,479	-10%
Nov	11,805	12	0	0	0	0	0	12	11,793	2,743	81%
Dec	879	1	0	0	0	0	0	1	879	2,823	24%
	582,329	582	0	0	573,762	0	0	574,345	7,984	607,578	1%



Arapahoe County Domestic Water
Federal Warehouse

Code	Units
1	Gal
2	Kgal
3	CF
4	CCF
5	MCF
2	<<< enter unit code

	Water Rate	Sewer Rate		
Summer rate	$2.57000	$3.00000	per	Kgal
Winter rate	$2.14000	$0.00000	per	Kgal

Service Charge	$32.19	bimonthly
Storm water fee	$812.62	annual
FireLineCharge	$26.30	bimonthly

Read Date	Month	Kgal/day	Usage		Gallons	Billing days	Water Charges	Sewer Charges	Total Metered Charges	Total Water Charges	Total Charges		$/gal Water charge	$/gal Sewer charge	$/gallon Total
1/31/2004	Jan	0	4	Kgal	3,993	25	$9	$315	$324	$106	$420		$0.0021	[illegible]	$0.0811
2/25/2004	Feb	0	3	Kgal	3,375	30	$7	$315	$322	$104	$419		$0.0021	[illegible]	$0.0955
3/26/2004	Mar	1	27	Kgal	27,075	35	$58	$315	[illegible]	$155	$470		$0.0021	[illegible]	$0.0138
4/30/2004	Apr	2	42	Kgal	42,253	27	$90	$315	[illegible]	[illegible]	[illegible]		$0.0021	$0.0076	$0.0096
5/27/2004	May	3	91	Kgal	90,865	34	$234	$315	$549	$330	$646		$0.0026	$0.0035	$0.0060
6/30/2004	Jun	3	101	Kgal	101,429	30	$261	$315	$576	$358	$673		$0.0026	$0.0031	$0.0057
7/30/2004	Jul	3	106	Kgal	105,545	31	$271	$315	$586	$368	$683		$0.0026	$0.0030	$0.0056
8/30/2004	Aug	3	105	Kgal	104,617	31	$269	$315	$584	$366	$681		$0.0026	$0.0030	$0.0056
9/30/2004	Sep	2	68	Kgal	67,602	28	$174	$315	$489	$271	$586		$0.0026	$0.0047	$0.0072
10/28/2004	Oct	2	51	Kgal	50,570	33	$130	$315	$445	$227	$542		$0.0026	$0.0062	$0.0088
11/30/2004	Nov	0	15	Kgal	14,536	31	$31	$315	$346	$128	$443		$0.0021	$0.0217	$0.0238
12/31/2004	Dec	0	4	Kgal	3,702	30	$8	$315	$323	$105	$420		$0.0021	$0.0852	$0.0873
1/30/2005	Jan						$1,541			$2,705					

3,993	4
3,375	3
27,075	27
42,253	42
90,865	91
101,429	101
105,545	106
104,617	105
67,602	68
50,570	51
14,536	15
3,702	4

Arapahoe County Domestic Water
Altura Plaza

Assumptions	
Staff Population	145.00
Pop Ratio Female	60.00%
Visitor Population	1600
Pop Ratio Female	0.5
Length of Stay (hrs)	2.50
Inmate Population	0
Pop Ratio Female	0.7
Length of Stay (hrs)	4.00
Staff Absentee rate	0.00%
Days/year	236
Site Type (Res Comm)	comm
Laundry Population	0

Energy Inputs		Billing units	$/unit
DHW heating source	NG	Therm	$0.8900
Fuel conversion source	GG	kWh	$0.1000
Nat. Gas System Efficiency		100.00%	

Water Temperature		
Street		54
DHW supply		130
Boiler Efficiency		100%
Laundry		
Cycle/person/day		0
Gallons/load Pre		37.5
Gallons/load Post		25

Ice Machine Calc.		
Lbs/ Day	0	lbs
lbs/Year	0	lbs
Gallons / year	0	gal
Gallons of water/100 lbs of ice	16	gal
Process waste	0	gal
Est. Storage Waste	0	gal
Number of Ice Machines	1	gal
Total Storage Waste	24	gal
Total Ice Machine Usage (Gallons)	0	gal

	lbs/Year	5200
	Gallons / year	624
	Gallons of water/100 lbs of ice	16
	Process waste	832
	Est. Storage Waste	8000
8000	Number of Ice Machines	1
		8000
	Total Ice Machine Usage (Gallons)	8832

Arapahoe County Domestic Water
Altura Plaza

Building Area	74,675		
General			
Diversity	1		
Inmates			
Population:	50%	4.00	hour
Inmates total per day	0		
Inmates Women conv to person days	0	0.7	
Inmates Men conv to person days	0	0.3	
Inmates Total	0		
Absent	0.00%		
Staff			
Population:	145.00	Pop ratio	
Staff: Women	87	0.6	
Staff: Men	58	0.4	
Staff, Total	145		
Absent	0.00%		
Visitors			
Length of stay % of 8 hour day	30%	2.50	hour
Visitors Total per day	1600		
Visitors Women conv to person days	240	0.5	
Visitors Men conv to person days	240	0.5	
Total (visitor days)	480		

Schedule	**Inmates**	**Staff**	**Visitors**	**Water Temperature**		
Occupied Days	260	260	260	Supply	130	Hot Water
Holidays	10	10	10	Street	54	Fraction
Vacation	14	14	14	Tap	100	61%
Total	236	236	236			

Fixtures	**Inmates**		**Staff**		**Visitors**	
	Present	Proposed	Present	Proposed	Present	Proposed
GPF toilet	1.60	0	2.66	1.6	2.66	1.6
GPF urinal	0	1	1.38	1	1.38	1
Lav Faucet GPM	1.5	1.5	2	2	2	2
Shower GPM	0	0	3.5	2.5	0	0

Uses per day	**Inmates**		**Staff**		**Visitors**		
	Male	Female	Male	Female	Male	Female	Units
Toilet	5	5	1	4	1	4	Flushes
Urinal	0	[redacted]	3	[redacted]	3	[redacted]	Flushes
Lav Faucet	1	1	0.5	0.5	0.5	0.5	Minutes
Shower (M F)		10	[redacted]				Minutes

Fixture Diversity	GPF	Quantity	Weighted Average
Toilet	1.6	28	2.66
Toilet	3.76	27	
Comby	1.6	3	1.60
Comby	3.5	0	
Urinal	1	8.00	1.38
Urinal	2	5	

	Inmates Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Shower	**Staff** Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	**Visitors** Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men
Days/year	236	236	236	236	236	236	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Population:	0	0	0	0	0	145	87	58	58	57	58	240	240	240	240	240
Minutes				1	1	10				0.5	0.5				0.5	0.5
Use per day	5	5	0				4	1	3			4	1	3		
Uses or minutes	0	0	0	0	0	342,200	[illegible]	13,688	41,064	10,266	6,844	226,560	56,640	169,920	28,320	28,320
Diversity (account for absentee)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GPU present	1.60	1.60	0.00				2.66	2.65	1.38			2.66	2.66	1.38		
GPM present				1.5	1.5	0				2	2				2	2
GPU Proposed	0	0	1				1.6	1.6	1			1.6	1.6	1		
GPM Proposed				1.5	1.5	0				2	2				2	2
Total Usage Pre (Gals)	0	0	0	0	0	0	218,490	36,415	56,856	20,532	13,688	602,732	150,683	235,274	56,640	56,640
Total Usage Post (Gals)	0	0	0	0	0	0	131,405	21,901	41,064	20,532	13,688	362,496	90,624	169,920	56,640	56,640
Savings	0	0	0	0	0	0	87,086	14,514	15,794	0	0	240,236	60,059	65,354	0	0
Hot Water Gallons PRE				0	0	0				12,427	8,285	364,811				34,282
Hot Water Gallons POST				0	0	0				12,427	8,285	219,405				34,282
Hot Water Energy Pre (mmbtus)				0	0	0				8	5	231				22
Hot Water Energy Post (mmbtus)				0	0	0				8	5	139				22
Hot Water Energy Savings (mmbtus)				0	0	0				0	0	92				0

Sanitary Water Use Summary	Gallons	Gals / person/yr	Gals / SF/ Year	Gals / person / day
Inmate Usage Pre	0	0	0	0
Inmate Usage Post	0	0	0	0
Staff Usage Pre	345,983	2386	5	7
Staff Usage Post	278,590	1576	3	4
Visitor Usage Pre	1,101,969	7600		21
Visitor Usage Post	736,320	5078		14
Total Usage Pre	1,447,952		19	
Total Usage Post	964,910		13	
Savings (Gals.) Domestic Water	483,042			
% Savings Domestic Water	33%			
Hot Water Usage PRE no laundry	20,712	143		
Hot Water Usage POST	20,712	143		
Savings gals	0	0		
% Savings (Hot Water)	0.0%			

	(Mmbtu)	Therms	KWh
Energy Pre (Mmbtu)	13	131	3,842
Kitchen	0	0	0
Total	13	131	3,842
Energy Post (Mmbtu)	13	131	3,842
Energy Savings	0	0	0
% Savings (Hot Water	0.0%		

0	

Benchmarks	Admin 1	Typical Range
Total Usage / SF	49	25-36
Usage/SF less irrigation		
		2,163,752

Arapahoe County Domestic Water
Altura Plaza

132,453	SF	24	gallons/minu / 100 tons of cooling	1	Rule of thumb CFM/SF
550	Rule of thumb SF/ton	248	Chiller size	0.075	lb/ct density of air
378.151429	tons loading	1	Number of Chillers	78,512	SF of conditioned space
55	Balance point	248	Design load	20,522	CFM total
		50%	Turn down	32,757	Moisture (lbs)
		124	minimum load	3,874	Moisture (gals)

Bin Temps

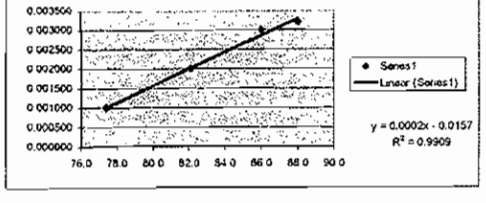
	hi	lo	average	Total hoursGriffiths AFB New York	Total Hours Denver	Hours of cooling	Water varies with load	tons load	Variable Water Use Rate gallons	Humidity Ratio (lbs moisture per lbs dry air)	gallons of water used
	95	99	97	3	4	4	378	378	2,178	0.004100	625
	90	94	92	28	42	42	340	340	20,584	0.003100	4,960
	85	89	87	120	168	168	303	303	73,186	0.002100	13,439
	80	84	82	265	280	280	265	265	106,729	0.001100	11,732
	75	79	77	441	397	397	227	227	129,709	0.000100	1,512
	70	74	72	628	498	498	189	189	135,590		
	65	69	67	731	634	634	151	151	138,095		
	60	64	62	718	798	798	113	124	142,491		
	55	59	57	709	799	799	76	124	142,669		
balance point	50	54	52	666	769	0	38	124	137,313		
	45	49	47	628	737	0			1,028,544		32,267
	40	44	42	633	710	0					
	35	39	37	723	672	0					
	30	34	32	812	678	0					
	25	29	27	554	582	0					
	20	24	22	400	438	0					
	15	19	17	292	242	0					
	10	14	12	200	137	0					
	5	9	7	113	80	0					
	0	4	2	58	46	0					
	-5	-1	-3	25	20	0					
	-10	-6	-8	6	11	0					
	-15	-11	-13	1	3	0					
	-20	-16	-18		2	0					
					0	3620					

http://coweather.com/cod/nrmcdd.htm

Month	CCD	% of CCD in this Month	Gallons/ month
jan	0	0%	0
feb	0	0%	0
mar	0	0%	0
apr	2	0%	726
may	73	3%	8,350
jun	1351	19%	48,012
jul	2611	36%	94,756
aug	717	31%	78,782
sep	57	8%	20,694
oct	0	0%	0
nov	0	0%	0
dec	0	0%	0
	695	1	752,320

Weith of air #/cf 0.075

Month	DENVER Wet Bulb	DENVER RH	DENVER Mean Dry Bulb	DENVER High Temps Dry Bulb	Average, high and mean	Psychometric Chart Humidity Ratio (#moisture / # of dry air	gallons / month
jan	24	49	36.4	43.2	39.8		
feb	27	44	36.5	47.2	41.9		
mar	31	40	43.1	53.7	48.4		
apr	38	35	50.9	60.9	55.9		
may	46	38	61.0	70.5	65.8		
jun	54	35	69.2	82.1	75.7	0.0020000	54,852
jul	59	34	78.7	88.5	83.1	0.0032000	87,763
aug	57	35	74.8	86.0	80.4	0.0030000	82,278
sep	50	34	65.9	77.4	71.7	0.0010000	27,426
oct	41	36	51.2	65.0	58.1		
nov	31	49	41.0	51.5	46.3		
dec	25	52	35.2	44.1	39.7		
	40	40	51.8	64.2	58.01		252,320

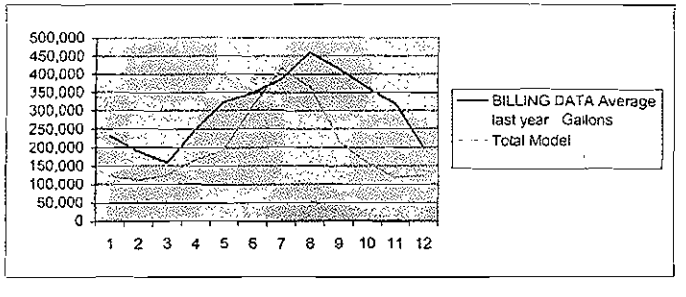


Arapahoe County Domestic Water
Altura Plaza

		Water Rate	Sewer Rate	Water Differential	Sewer Differential
	Flat rate	$3.34000	$1.64000		
	$0.00000	$0.00000	$0.00000	$3.34000	$1.64000
	$0.00000	$0.00000	$0.00000	$3.34000	$1.64000

	BILLING DATA Average last year Gallons	Staff days per month	Visitors days per month	Population days	Sanitary Water Use Model	Balance	Gallons Saved	Water Dollars Saved	Sewer Dollars Saved	Total Dollars Saved	
Jan	231,312	22	22	13,839	122,977	108,335	41,026	$0	$0	$0	88%
Feb	188,690	20	20	12,500	111,076	77,614	37,055	$0	$0	$0	70%
Mar	157,555	22	22	13,839	122,977	34,578	41,026	$0	$0	$0	28%
Apr	247,231	21	21	13,393	119,010	128,221	39,702	$0	$0	$0	108%
May	322,300	22	22	13,839	122,977	199,323	41,026	$0	$0	$0	162%
June	347,233	21	21	13,393	119,010	228,223	39,702	$0	$0	$0	192%
Jul	387,367	22	22	13,839	122,977	264,390	41,026	$0	$0	$0	215%
Aug	459,150	22	22	13,839	122,977	336,173	41,026	$0	$0	$0	273%
Sep	414,267	21	21	13,393	119,010	295,257	39,702	$0	$0	$0	248%
Oct	361,683	22	22	13,839	122,977	238,706	41,026	$0	$0	$0	194%
Nov	318,155	21	21	13,393	119,010	199,145	39,702	$0	$0	$0	167%
Dec	196,791	22	22	13,839	122,977	73,814	41,026	$0	$0	$0	60%
	3,631,734	261		162,946	1,447,952	2,183,782	483,042	0	$0	$0	13%

	Non Sanitary Use	Non Sanitary Use Kgal	Ice machine	Evaporative coolers	Irrigation	Laundry	Kitchen	Total	Balance	Total Model	
Jan	108,335	108	0	0	0	0	0	0	108,335	122,977	100%
Feb	77,614	78	0	0	0	0	0	0	77,614	111,076	100%
Mar	34,578	35	0	0	0	0	0	0	34,578	122,977	100%
Apr	128,221	128	0	726	22,342	0	0	23,068	105,153	165,145	82%
May	199,323	199	0	8,350	27,197	0	0	35,547	163,776	194,070	82%
June	228,223	228	0	49,012	46,219	0	0	95,230	132,993	309,470	58%
Jul	264,390	264	0	94,756	52,192	0	0	146,948	117,442	416,873	44%
Aug	336,173	336	0	78,782	41,974	0	0	120,756	215,417	354,488	64%
Sep	295,257	295	0	20,694	29,240	0	0	49,934	245,323	218,878	83%
Oct	238,706	239	0	0	18,236	0	0	18,236	220,470	159,449	92%
Nov	199,145	199	0	0	0	0	0	0	199,145	119,010	100%
Dec	73,814	74	0	0	0	0	0	0	73,814	122,977	100%
	2,183,782	2,184	0	252,320	237,400	0	0	491,903	1,694,063	2,427,390	29%



Arapahoe County Domestic Water
Altura Plaza

Code	Units
1	Gal
2	Kgal
3	CF
4	CCF
5	MCF
2	<<< enter unit code

		Water Rate	Sewer Rate			Water Differential	Sewer Differential
Flat rate	1000000	$3.34000	$1.64000	per	Kgal		
		$0.00000	$0.00000	per	Kgal	$3.34000	$1.64000
		$0.00000	$0.00000	per	Kgal	$3.34000	$1.64000
Water Service Charge		$12.13	qals				
Sewer Service Charge		$14.33					
Storm water fee		$3.83					
SD COM component		$90.90					

Read Date	Month	Kgal/day	Usage		Gallons	Billing days	Water Charges	Sewer Charges	Total Metered Charges	Total Charges	$/gal Water charge	$/gal Sewer charge	$/gallon Total	$/gallon Total
1/31/2004	Jan	9	231	Kgal	231,312	25	$773	$337	$2,220	$2,341	$0.0033	$0.0015	$0.0048	$0.0096
2/25/2004	Feb	6	189	Kgal	188,690	30	$630	$337	$1,935	$2,056	$0.0033	$0.0018	$0.0051	$0.0103
3/26/2004	Mar	5	158	Kgal	157,555	35	$526	$337	$1,727	$1,848	$0.0033	$0.0021	$0.0055	$0.0110
4/30/2004	Apr	9	247	Kgal	247,231	27	$826	$337	$2,326	$2,447	$0.0033	$0.0014	$0.0047	$0.0094
5/27/2004	May	9	322	Kgal	322,300	34	$1,076	$337	$2,827	$2,949	$0.0033	$0.0010	$0.0044	$0.0088
6/30/2004	Jun	12	347	Kgal	347,233	30	$1,160	$337	$2,994	$3,115	$0.0033	$0.0010	$0.0043	$0.0086
7/30/2004	Jul	12	387	Kgal	387,367	31	$1,294	$337	$3,262	$3,383	$0.0033	$0.0009	$0.0042	$0.0084
8/30/2004	Aug	15	459	Kgal	459,150	31	$1,534	$337	$3,741	$3,863	$0.0033	$0.0007	$0.0041	$0.0081
9/30/2004	Sep	15	414	Kgal	414,267	28	$1,384	$337	$3,442	$3,563	$0.0033	$0.0008	$0.0042	$0.0083
10/28/2004	Oct	11	362	Kgal	361,683	33	$1,208	$337	$3,090	$3,212	$0.0033	$0.0009	$0.0043	$0.0085
11/30/2004	Nov	10	318	Kgal	318,155	31	$1,063	$337	$2,800	$2,921	$0.0033	$0.0011	$0.0044	$0.0088
12/31/2004	Dec	7	197	Kgal	196,791	30	$657	$337	$1,989	$2,110	$0.0033	$0.0017	$0.0051	$0.0101
1/30/2005	Jan													

231,312	231
188,690	189
157,555	158
247,231	247
322,300	322
347,233	347
387,367	387
459,150	459
414,267	414
361,683	362
318,155	318
196,791	197

Arapahoe County Domestic Water
Peoria Shops

Assumptions	
Staff Population	56.00
Pop Ratio Female	30.00%
Visitor Population	0
Pop Ratio Female	0.5
Length of Stay (hrs)	2.40
Inmate Population	0
Pop Ratio Female	0.7
Length of Stay (hrs)	4.00
Staff Absentee rate	50.00%
Days/year	341
Site Type (Res Comm)	comm
Laundry Population	0

Energy Inputs		Billing units	$/unit
DHW heating source	NG	Therm	$0.8900
Fuel conversion source	GG	kWh	$0.1000
Nat. Gas System Efficiency		100.00%	

Water Temperature		
Street		54
DHW supply		130
Boiler Efficiency		100%
Laundry		
Cycle/person/day		0
Gallons/load Pre		37.5
Gallons/load Post		25

Ice Machine Calc.		
Lbs/ Day	0	lbs
lbs/Year	0	lbs
Gallons / year	0	gal
Gallons of water/100 lbs of ice	16	gal
Process waste	0	gal
Est. Storage Waste	0	gal
Number of Ice Machines	1	gal
Total Storage Waste	24	gal
Total Ice Machine Usage (Gallons)	0	gal

	lbs/Year	5200
	Gallons / year	624
	Gallons of water/100 lbs of ice	16
	Process waste	832
	Est. Storage Waste	8000
8000	Number of Ice Machines	1
		8000
	Total Ice Machine Usage (Gallons)	8832

Arapahoe County Domestic Water
Peoria Shops

Building Area 25,008

General

Diversity	1

Fixture Diversity

	GPF	Quantity	Weighted Average
Toilet	1.6	0	3.50
Urinal	1.0	6	
Combo	1.6	0	-
Combo	3.5	0	
Urinal	1.1	0.00	2.50
Urinal	2	2	

Inmates

Population:	50%	4.00	hour
Inmates total per day	0		
Inmates Women conv to person days	0	0.7	
Inmates Men conv to person days	0	0.3	
Inmates: Total	0		
Absent	0.00%		

Model/Sizing
7.1

Staff

Population:	56.00	Pop ratio
Staff: Women	8.4	0.3
Staff: Men	19.6	0.7
Staff: Total	28	
Absent	50.00%	

Visitors

Length of stay (for 8 hour day	30%	2.40 hour
Visitors Total per day	0	
Visitors Women conv to person days	0	0.5
Visitors Men conv to person days	0	0.5
Total (visitor days)	0	

Schedule

	Inmates	Staff	Visitors
Occupied Days	365	365	365
Holidays	10	10	10
Vacation	14	14	14
Total	341	341	341

Water Temperature

Summer	130	Hot Water
Winter	54	Fraction
Avg	100	61.5

Fixtures

	Inmates		Staff		Visitors	
	Present	Proposed	Present	Proposed	Present	Proposed
GPF Toilet	0	1	3.50	1.6	3.50	1.6
GPF urinal	0	1	2.00	1	2.00	1
Lav Faucet GPM	1.5	1.5	2	2	2	2
Shower GPM	0	0	2.5	2.5	0	0

Uses per day

	Inmates		Staff		Visitors		
	Male	Female	Male	Female	Male	Female	Units
Toilet	5	5	1	4	1	1	Flushes
Urinal	0		3		1		Flushes
Lav Faucet	1	1	0.5	0.5	0.5	0.5	Minutes
Shower (M F)		10					Minutes

	Inmates						Staff					Visitors				
	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Shower	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men
Days/year	341	341	341	341	341	341	341	341	341	341	341	341	341	341	341	341
Population:	0	0	0	0	0	28	8	20	20	8	20	0	0	0	0	0
Minutes			1		1	10				0.5	0.5				0.5	0.5
Use per day	5	5	0				4	1	3			1	1	1		
Uses or minutes	0	0	0	0	0	95,480	11,536	6,884	20,051	1,432	3,342	0	0	0	0	0
Diversity (account for absences)	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
GPU present	0.00	0.00	0.00				3.50	3.50	2.00			3.50	3.50	2.00		
GPM present				1.5	1.5	0				2	2				2	2
GPU Proposed	0	0	1				1.6	1.6	1			1.6	1.6	1		
GPM Proposed				1.5	1.5	0				2	2				2	2
Total Usage Pre (Gals)	0	0	0	0	0	0	40,102	23,393	40,102	2,864	6,684	0	0	0	0	0
Total Usage Post (Gals)	0	0	0	0	0	0	18,332	10,694	20,051	2,864	6,684	0	0	0	0	0
Savings	0	0	0	0	0	0	21,769	12,699	20,051	0	0	0	0	0	0	0
Hot Water Gallons PRE				0	0	0				1,734	4,045	0				0
Hot Water Gallons POST				0	0	0				1,734	4,045	0				0
Hot Water Energy Pre (mmbtus)				0	0	0				1	3	0				0
Hot Water Energy Post (mmbtus)				0	0	0				1	3	0				0
Hot Water Energy Savings (mmbtus)				0	0	0				0	0	0				0

Sanitary Water Use Summary	Gallons	Gals / person/yr	Gals / SF/ Year	Gals / person / day
Inmate Usage Pre	0	0	0	0
Inmate Usage Post	0	0	0	0
Staff Usage Pre	113,144	4043	5	11
Staff Usage Post	58,625	2094	2	6
Visitor Usage Pre	0	0		0
Visitor Usage Post	0	0		0
Total Usage Pre	113,144		5	
Total Usage Post	58,625		2	
Savings (Gals) Domestic Water	54,519			
% Savings Domestic Water	48%			
Hot Water Usage PRE no laundry	5,779	206		
Hot Water Usage POST	5,779	206		
Savings gals	0	0		
% Savings (Hot Water)	0.0%			

Benchmarks	Admin 1	Typical Range
Total Usage / SF	65	25-55
Usage/SF less irrigation		
		1,516,199

	(Mmbtu)	Therms	kWh
Energy Pre (Mmbtu)	4	37	1,072
Kitchen	0	0	0
Total	4	37	1,072
Energy Post (Mmbtu)	4	37	1,072
Energy Savings	0	0	0
% Savings (Hot Water	0.0%		

0

Arapahoe County Domestic Water
Peoria Shops
Road Maintenance

Street Sweepers		
Capacity	250	gallons
Quantity	4	
Frequency	237	
Total Usage	59,365	
Patch Trucks		
Capacity	50	
Quantity	3	
Frequency	150	
Total Usage	22,500	
Tankers		
Capacity	0	
Quantity	2	
Frequency	150	
Total Usage	0	
Grand Total	81,865	

Recycle factor	0.5
Total recycle savings	640000
Estimated cost savings	9600

Street sweepers are deployed when Temps are above 20 °F

	Total Hours	
average	Denver	20
97	4	0
92	42	0
87	168	0
82	280	0
77	397	0
72	498	0
67	634	0
62	798	0
57	799	0
52	769	0
47	737	0
42	710	0
37	672	0
32	678	0
27	582	0
22	438	0
17	242	242
12	137	137
7	80	80
2	46	46
-3	20	20
-8	11	11
-13	3	3
-18	2	2
		541
		23

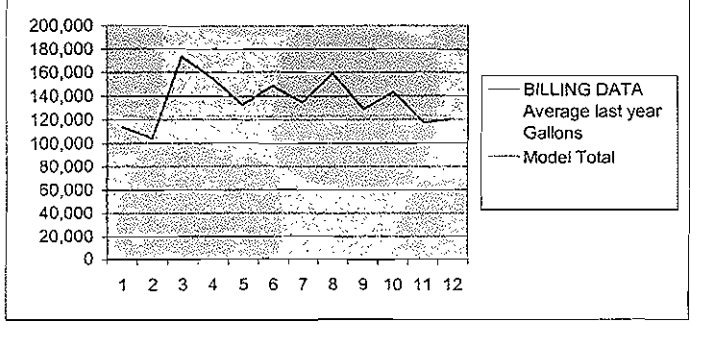
Arapahoe County Domestic Water
Peoria Shops

	Water Rate	Sewer Rate	Water Differential	Sewer Differential
< 25,000g gal	$0.00290	$0.00232		
25,001-200,000	$0.00363	$0.00290	$0.00073	$0.00058
>200,000	$0.00435	$0.00348	$0.00145	$0.00116

	BILLING DATA Average last year Gallons	Staff days per month	Visitors days per month	Population days	Sanitary Water Use Model	Balance	Gallons Saved	Water Dollars Saved	Sewer Dollars Saved	Total Dollars Saved	
Jan	113,372	22	22	620	9,609	103,763	4,630	$17	$11	$28	1080%
Feb	103,890	20	20	560	8,680	95,210	4,182	$15	$10	$25	1097%
Mar	173,374	22	22	620	9,609	163,765	4,630	$17	$11	$28	1704%
Apr	155,558	21	21	600	9,299	146,259	4,481	$16	$10	$27	1573%
May	132,547	22	22	620	9,609	122,938	4,630	$13	$11	$24	1279%
June	148,231	21	21	600	9,299	138,932	4,481	$13	$10	$23	1494%
Jul	134,590	22	22	620	9,609	124,981	4,630	$13	$11	$24	1301%
Aug	158,889	22	22	620	9,609	149,280	4,630	$13	$11	$24	1553%
Sep	128,502	21	21	600	9,299	119,203	4,481	$13	$10	$23	1282%
Oct	143,124	22	22	620	9,609	133,515	4,630	$13	$11	$24	1389%
Nov	117,060	21	21	600	9,299	107,761	4,481	$16	$10	$27	1159%
Dec	120,167	22	22	620	9,609	110,558	4,630	$17	$11	$28	1151%
	1,629,304	261		7,300	113,144	1,516,160	54,519	178	$126	$304	

3%

	Non Sanitary Use	Non Sanitary Use Kgal	Ice maching	Evaporative coolers	Irrigation	Car Wash	Round Maintenance	Total	Balance	Model Total	
Jan	103,763	104	0	0	0	106,667	6,822	113,489	-9,726	123,098	109%
Feb	95,210	95	0	0	0	106,667	6,822	113,489	-18,278	122,168	118%
Mar	163,765	164	0	0	0	106,667	6,822	113,489	50,276	123,098	71%
Apr	146,259	146	0	0	0	106,667	6,822	113,489	32,770	122,788	79%
May	122,938	123	0	0	0	106,667	6,822	113,489	9,449	123,098	93%
June	138,932	139	0	0	0	106,667	6,822	113,489	25,443	122,788	83%
Jul	124,981	125	0	0	0	106,667	6,822	113,489	11,492	123,098	91%
Aug	149,280	149	0	0	0	106,667	6,822	113,489	35,791	123,098	77%
Sep	119,203	119	0	0	0	106,667	6,822	113,489	5,714	122,788	96%
Oct	133,515	134	0	0	0	106,667	6,822	113,489	20,026	123,098	86%
Nov	107,761	108	0	0	0	106,667	6,822	113,489	-5,728	122,788	105%
Dec	110,558	111	0	0	0	106,667	6,822	113,489	-2,931	123,098	102%
	1,516,160	1,516	0	0	0	1,280,000	81,865	1,363,381	154,296	1,475,008	91%
										1,629,304	



Recycle factor	0.5
Total recycle savings	640,000
	9600

Arapahoe County Domestic Water
Peoria Shops

Code	Units
1	Gal
2	Kgal
3	CF
4	CCF
5	MCF
2	<<< enter unit code

		Water Rate	Sewer Rate			Water Differential	Sewer Differential
< 25,000g ga	25,000	$0.00290	$0.00232	per	Kgal		
25,001–200,000	200,000	$0.00363	$0.00290	per	Kgal	$0.00073	$0.00058
>200,000	200,000	$0.00435	$0.00348	per	Kgal	$0.00145	$0.00116
Minimum Usage		12,000	cals				
Storm water fee		$117.45					
FireLineCharge		$0.00					
Capital Fund Factor		$2.00					

Read Date	Month	Kgal/day	Usage		Gallons	Billing days	Water Charges	Sewer Charges	Total Charges		$/gal Water charge
1/31/2004	Jan	5	113	Kgal	113,372	28	$397	$317	$1,418		$0
2/29/2004	Feb	3	104	Kgal	103,890	30	$425	$339	$1,527		$0
3/26/2004	Mar	5	173	Kgal	173,374	35	$623	$178	$802		$0
4/30/2004	Apr	6	156	Kgal	155,558	27	$675	$219	$988		$0
5/27/2004	May	4	133	Kgal	132,547	34	$342	$272	$1,228		$0
6/30/2004	Jun	5	148	Kgal	148,231	30	$296	$236	$1,064		$0
7/30/2004	Jul	4	135	Kgal	134,590	31	$336	$268	$1,207		$0
8/30/2004	Aug	5	159	Kgal	158,889	31	$265	$211	$953		$0
9/30/2004	Sep	5	129	Kgal	128,502	28	$353	$282	$1,270		$0
10/28/2004	Oct	4	143	Kgal	143,124	33	$311	$248	$1,118		$0
11/30/2004	Nov	4	117	Kgal	117,060	31	$367	$308	$1,390		$0
12/31/2004	Dec	4	120	Kgal	120,167	30	$378	$301	$1,357		$0
1/30/2005	Jan							$3,180	$14,334		

$/gal Water charge	$/gal Sewer charge	$/gallon Total	$/gallon Total
$0.0035	$0.0028	$0.0063	$0.0126
$0.0041	$0.0033	$0.0074	$0.0147
$0.0013	$0.0010	$0.0023	$0.0046
$0.0018	$0.0014	$0.0032	$0.0064
$0.0026	$0.0021	$0.0046	$0.0093
$0.0020	$0.0016	$0.0036	$0.0072
$0.0025	$0.0020	$0.0045	$0.0090
$0.0017	$0.0013	$0.0030	$0.0060
$0.0027	$0.0022	$0.0049	$0.0099
$0.0022	$0.0017	$0.0039	$0.0078
$0.0033	$0.0026	$0.0059	$0.0119
$0.0031	$0.0025	$0.0056	$0.0113

113,372	113
103,890	104
173,374	173
155,558	156
132,547	133
148,231	148
134,590	135
158,889	159
128,502	129
143,124	143
117,060	117
120,167	120

Arapahoe County Domestic Water
ACJC Courthouse

Assumptions	
Staff Population	109.00
Pop Ratio Female	60.00%
Visitor Population	1500
Pop Ratio Female	0.6
Length of Stay (hrs)	1.00
Inmate Population	50
Pop Ratio Female	0.7
Length of Stay (hrs)	4.00
Staff Absentee rate	0.00%
Days/year	355
Site Type (Res Comm)	comm
Laundry Population	0

Water Temperature		
Street		54
DHW supply		130
Boiler Efficiency		100%
Laundry		
Cycle/person/day		0
Gallons/load Pre		37.5
Gallons/load Post		25

Ice Machine Calc.		
Lbs/ Day	50	lbs
lbs/Year	18250	lbs
Gallons / year	2191	gal
Gallons of water/100 lbs of ice	16	gal
Process waste	2920	gal
Est. Storage Waste	8000	gal
Number of Ice Machines	1	gal
Total Storage Waste	24	gal
Total Ice Machine Usage (Gallons)	10920	gal

Energy Inputs		Billing units	$/unit
DHW heating source	NG	Therm	$0.8900
Fuel conversion source	GG	kWh	$0.1000
Nat. Gas System Efficiency		100.00%	

lbs/Year	5200
Gallons / year	624
Gallons of water/100 lbs of ice	16
Process waste	832
Est. Storage Waste	8000
Number of Ice Machines	1
	8000
Total Ice Machine Usage (Gallons)	8832

Arapahoe County Domestic Water
ACJC Courthouse

Building Area: 146,522

General

Diversity	1

Inmates

Population:	50%	4.00	hour
Inmates total per day	50		
Inmates Women conv to person days	16	0.7	
Inmates Men conv to person days	16	0.3	
Inmates: Total	25		
Absent	0.00%		

Staff

Population:	109.00	Pop ratio
Staff: Women	65.4	0.6
Staff: Men	43.6	0.4
Staff: Total	109	
Absent	0.00%	

Visitors

Length of stay Not 8 hour day	1.5%	1.00	hour
Visitors Total per day	1500		
Visitors Women conv to person days	113	0.6	
Visitors Men conv to person days	75	0.4	
Total (visitor days)	188		

Fixture Diversity

	GPF	Quantity	Weighted Average
Toilet	1.6	5	2.91
Toilet	3	74	
Combo	1.6	10	1.60
Combo	3.5	0	
Urinal	1	9	1.00
Urinal	2	0	

model/billing
100.46%

Schedule	**Inmates**	**Staff**	**Visitors**	**Water Temperature**		
Occupied Days	365	365	365	Supply	130	Hot Water
Holidays	10	10	10	Street	54	Fraction
Vacation	0	14	0	Tap	100	61%
Total	355	341	355			

Fixtures	**Inmates**		**Staff**		**Visitors**	
	Present	Proposed	Present	Proposed	Present	Proposed
GPF Toilet	1.60	0	2.91	1.6	2.91	1.6
GPF urinal	0	0	1	1	1	1
Lav Faucet GPM	1.5	1.5	2	2	2	2
Shower GPM	0	0	2.5	2.5	0	0

Uses per day	**Inmates**		**Staff**		**Visitors**		
	Male	Female	Male	Female	Male	Female	Units
Toilet	5	5	1	1	5	5	Flushes
Urinal	0		2		2		Flushes
Lav Faucet	1	1	1	1	1	1	Minutes
Shower (M F)	10						Minutes

	Inmates						**Staff**					**Visitors**				
	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Shower	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men
Days/year	355	355	355	355	355	355	341	341	341	341	341	355	355	355	355	355
Population:	18	7.5	7.5	17.5	7.5	109	65	44	44	65	44	113	75	75	113	75
Minutes				1	1	10				1	1				1	1
Use per day	5	5	0				5	1	7			5	1	2		
Uses or minutes	31,063	13,313	0	6,213	2,663	386,950	111,507	14,866	29,735	22,301	14,868	199,608	26,625	53,250	39,938	26,625
Diversity (account for absenteeism)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GPU present	1.60	1.60	0.00				2.91	2.91	1.00			2.91	2.91	1.00		
GPM present				1.5	1.5	0				2	2				2	2
GPU Proposed	0	0	0				1.6	1.6	1			1.6	1.6	1		
GPM Proposed				1.5	1.5	0				2	2				2	2
Total Usage Pre (Gals)	49,700	21,300	0	9,319	3,994	0	324,641	43,285	29,735	44,603	29,735	581,369	77,516	53,250	79,875	53,250
Total Usage Post (Gals)	0	0	0	9,319	3,994	0	178,411	23,788	29,735	44,603	29,735	319,500	42,600	53,250	79,875	53,250
Savings	49,700	21,300	0	0	0	0	146,229	19,497	0	0	0	261,869	34,916	0	0	0
Hot Water Gallons PRE				5,642	2,417	0				26,996	17,998	351,881			32,250	0
Hot Water Gallons POST				5,642	2,417	0				26,996	17,998	193,387			32,250	0
Hot Water Energy Pre (mmbtu)				4	2	0				17	11	223			20	0
Hot Water Energy Post (mmbtu)				4	2	0				17	11	122			20	0
Hot Water Energy Savings (mmbtu)				0	0	0				0	0	100			0	0

Sanitary Water Use Summary	Gallons	Gals / person/yr	Gals / SF/ Year	Gals / person / day
Inmate Usage Pre	84,313	774	1	2
Inmate Usage Post	13,313	122	0	0
Staff Usage Pre	471,999	4330	3	12
Staff Usage Post	365,273	2810	2	8
Visitor Usage Pre	845,269	7755		21
Visitor Usage Post	548,475	5037		14
Total Usage Pre	1,401,572		9	
Total Usage Post	868,060		6	
Savings (Gals.) Domestic Water	533,511			
% Savings Domestic Water	38%			
Hot Water Usage PRE no laundry	53,052	487		
Hot Water Usage POST	53,052	487		
Savings gals	0	0		
% Savings (Hot Water)	0.0%			

Benchmarks	Admin 1	Typical Range
Total Usage / SF	29	25-36
Usage/SF less irrigation		

	(Mmbtu)	Therms	kWh
Energy Pre (Mmbtu)	34	336	9,841
Kitchen	69	692	20,311
Total	103	1,028	30,152
Energy Post (Mmbtu)	34	336	9,841
Energy Savings	0	0	0
% Savings (Hot Water	0.0%		

109500

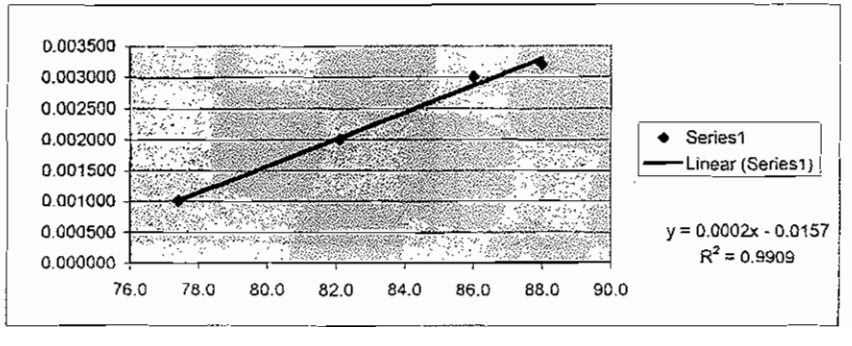
Arapahoe County Domestic Water
ACJC Courthouse

3	Rule of thumb CFM/SF
0.075	lb/cf density of air
148,000	SF of conditoned space
444,000	CFM total

http://qqweather.com/ccd/nrmcdd.htm

Month	CCD	% of CCD in this Month	Gallons/ month
jan	0	0%	0
feb	0	0%	0
mar	0	0%	0
apr	2	0%	4,572
may	23	3%	52,579
jun	135	19%	308,617
jul	261	38%	596,659
aug	217	31%	496,073
sep	57	8%	130,305
oct	0	0%	0
nov	0	0%	0
dec	0	0%	0
	695		1,588,806

Month	DENVER Wet Bulb	DENVER RH	DENVER Mean Dry Bulb	DENVER High Temps Dry Bulb	Average, high and mean	Psychometric Chart Humidity Ratio (#moisture / # of dry air	gallons / month
jan	24	49	36.4	43.2	39.8		
feb	27	44	36.5	47.2	41.9		
mar	31	40	43.1	53.7	48.4		
apr	38	35	50.9	60.9	55.9		
may	46	38	61.0	70.5	65.8		
jun	54	35	69.2	82.1	75.7	0.002000	345,393
jul	58	34	78.2	88.0	83.1	0.003200	552,628
aug	57	35	74.8	86.0	80.4	0.003000	518,089
sep	50	34	65.9	77.4	71.7	0.001000	172,696
oct	41	36	53.2	66.0	59.6		
nov	31	49	41.0	51.5	46.3		
dec	25	52	35.2	44.1	39.7		
0	40	40	53.8	64.2	59.0		
							1,588,806



Arapahoe County Domestic Water
ACJC Courthouse

	BILLING DATA Average last year Gallons	Work days per month	Sanitary Water Use Model	Kitchen	Non Weather related total	Baseline	Balance	Gallons Saved		New Baseline
Jan	126,154	22	119,038	9,125	128,163	116,266	7,116	45,312		80,842
Feb	107,992	20	107,518	9,125	116,643	116,266	474	40,927		67,065
Mar	124,901	22	119,038	9,125	128,163	116,266	5,863	45,312		79,589
Apr	175,622	21	115,198	9,125	124,323	116,266	60,424	43,850		131,772
May	383,824	22	119,038	9,125	128,163	116,266	264,786	45,312		338,512
June	486,176	21	115,198	9,125	124,323	116,266	370,978	43,850		442,326
Jul	667,151	22	119,038	9,125	128,163	116,266	548,123	45,312		621,849
Aug	537,484	22	119,038	9,125	128,163	116,266	418,446	45,312		492,172
Sep	679,355	21	115,198	9,125	124,323	116,266	564,157	43,850		635,505
Oct	538,909	22	119,038	9,125	128,163	116,266	419,871	45,312		495,597
Nov	409,107	21	115,198	9,125	124,323	116,266	293,909	43,850		385,257
Dec	106,017	22	119,038	9,125	128,163	116,266	-13,021	45,312		60,705
	4,342,702	261	1,401,571	73,000	1,013,781	1,395,192	2,941,131	533,511		3,809,191

	Non Sanitary Use	Non Sanitary Use Kagl	Ice machine	Evaporative coolers	Laundry	Total	Model Total	Balance (agl)	Model total to billing
Jan	7,116	7	0	0	0	0	128,163	-2,009	102%
Feb	474	0	0	0	0	0	116,643	-8,651	108%
Mar	5,863	6	0	0	0	0	128,163	-3,252	103%
Apr	60,424	60	0	4,572	0	4,572	128,895	46,727	73%
May	264,786	265	0	52,579	0	52,579	180,742	203,082	47%
June	370,978	371	0	308,617	0	308,617	432,940	53,236	89%
Jul	548,123	548	0	596,659	0	596,659	724,822	-57,661	109%
Aug	418,446	418	0	496,073	0	496,073	624,236	-86,752	116%
Sep	564,157	564	0	130,305	0	130,305	254,628	424,727	37%
Oct	419,871	420	0	0	0	0	128,163	410,746	24%
Nov	293,909	294	0	0	0	0	124,323	284,784	30%
Dec	-13,021	-13	0	0	0	0	128,163	-22,146	121%
	2,941,131	2,941	0	1,588,805	0	1,591,747	3,039,877	1,242,825	71%

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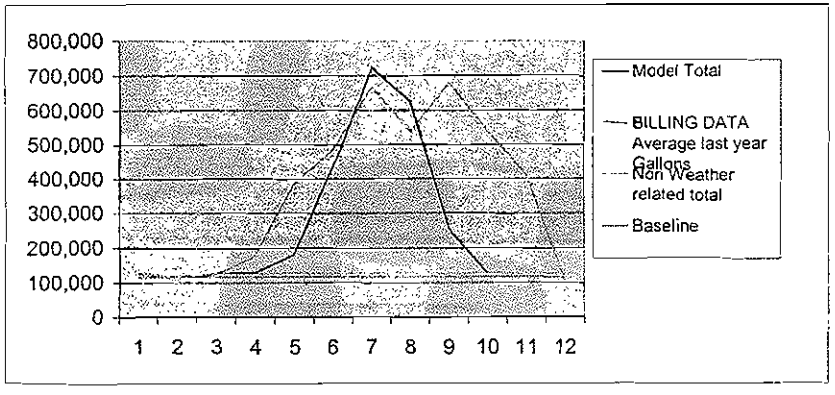


Arapahoe County Domestic Water
ACJC Courthouse

Code	Units
1	Gal
2	Kgal
3	CF
4	CCF
5	MCF
2	<<< enter unit code

		Water Rate	Sewer Rate			Water Differential	Sewer Differential
< 25,000g gal	25000	$0.00290	$0.00232	per	Kgal		
25,001-200,000	200000	$0.00363	$0.00290	per	Kgal	$0.00073	$0.00058
>200,000	200000	$0.00435	$0.00348	per	Kgal	$0.00145	$0.00116
Minimun Usage		144,000	gals				
Storm water fee		$15.30					
FireLineCharge		$1,142.04					
Capitol Fund		$317.50					

Read Date	Month	Kgal/day	Usage		Gallons	Billing days	Water Charges	Sewer Charges	Total Charges	Total Charges	$/gal Water charge	$/gal Sewer charge	$/gallon Total	$/gallon Total
1/31/2004	Jan	5	126	Kgal	126,154	25	$360	$287	$1,295		$0.00285	0.0022776	0.0051324	0.0102649
2/25/2004	Feb	4	108	Kgal	107,992	30	$413	$329	$1,485		$0.00382	0.0030508	0.0068735	0.0137470
3/26/2004	Mar	4	125	Kgal	124,901	35	$364	$290	$1,308		$0.00291	0.0023237	0.0052363	0.0104726
4/30/2004	Apr	7	176	Kgal	175,622	27	$217	$173	$779		$0.00123	0.0009825	0.0022164	0.0044329
5/27/2004	May	11	384	Kgal	383,824	34	$1,526	$1,220	$5,491		$0.00397	0.0031778	0.0071526	0.0143052
6/30/2004	Jun	16	486	Kgal	486,176	30	$1,971	$1,576	$7,094		$0.00405	0.0032414	0.0072952	0.0145904
7/30/2004	Jul	22	667	Kgal	667,161	31	$2,758	$2,206	$9,928		$0.00413	0.0033061	0.0074403	0.0148806
8/30/2004	Aug	17	537	Kgal	537,484	31	$2,194	$1,754	$7,897		$0.00408	0.0032642	0.0073463	0.0146925
9/30/2004	Sep	24	679	Kgal	679,355	28	$2,811	$2,248	$10,119		$0.00414	0.0033092	0.0074473	0.0148946
10/28/2004	Oct	16	539	Kgal	538,909	33	$2,200	$1,759	$7,919		$0.00408	0.0032648	0.0073475	0.0146951
11/30/2004	Nov	13	409	Kgal	409,107	31	$1,636	$1,308	$5,887		$0.00400	0.0031965	0.0071945	0.0143889
12/31/2004	Dec	4	106	Kgal	106,017	30	$419	$334	$1,505		$0.00395	0.0031508	0.0070988	0.0141976
1/30/2005	Jan													

126,154	126.154
107,992	107.992
124,901	124.901
175,622	175.622
383,824	383.824
486,176	486.176
667,161	667.161
537,484	537.484
679,355	679.355
538,909	538.909
409,107	409.107
106,017	106.017

Arapahoe County Domestic Water
Administrative II

Assumptions	
Staff Population	250.00
Pop Ratio Female	60.00%
Visitor Population	150
Pop Ratio Female	0.5
Length of Stay (hrs)	0.50
Inmate Population	0
Pop Ratio Female	0.7
Length of Stay (hrs)	4.00
Staff Absentee rate	0.00%
Days/year	236
Site Type (Res Comm)	comm
Laundry Population	0

Energy Inputs		Billing units	$/unit
DHW heating source	NG	Therm	$0.8900
Fuel conversion source	GG	kWh	$0.1000
Nat. Gas System Efficiency		100.00%	

Water Temperature		
Street		54
DHW supply		130
Boiler Efficiency		100%
Laundry		
Cycle/person/day		0
Gallons/load Pre		37.5
Gallons/load Post		25

Ice Machine Calc.		
Lbs/ Day	50	lbs
lbs/Year	18250	lbs
Gallons / year	2191	gal
Gallons of water/100 lbs of ice	16	gal
Process waste	2920	gal
Est. Storage Waste	8000	gal
Number of Ice Machines	1	gal
Total Storage Waste	24	gal
Total Ice Machine Usage (Gallons)	10920	gal

lbs/Year	5200
Gallons / year	624
Gallons of water/100 lbs of ice	16
Process waste	832
Est. Storage Waste	8000
Number of Ice Machines	1
	8000
Total Ice Machine Usage (Gallons)	8832

Arapahoe County Domestic Water
Administrative II

Building Area	91,000		
General			
Diversity			
Inmates			
Population:	50%	4.00	hour
Inmates total per day	0		
Inmates Women conv to person days	0	0.7	
Inmates Men conv to person days	0	0.3	
Inmates: Total	0		
Absent	0.00%		
Staff			
Population:	250.00	Pop ratio	
Staff: Women	150	0.6	
Staff: Men	100	0.4	
Staff, Total	250		
Absent	0.00%		
Visitors			
Length of stay %of 8 hour day	30%	0.50	hour
Visitors Total per day	150		
Visitors Women conv to person days	23	0.5	
Visitors Men conv to person days	23	0.5	
Total (visitor days)	45		

Schedule	**Inmates**	**Staff**	**Visitors**	**Water Temperature**			
Occupied Days	260	260	260	Supply	130	Hot Water	
Holidays	10	10	10	Street	54	Fraction	
Vacation	14	14	14	Too	100		61%
Total	236	236	236				

Fixtures	**Inmates**		**Staff**		**Visitors**	
	Present	Proposed	Present	Proposed	Present	Proposed
GPF toilet		0	2.50	1.6	2.50	1.6
GPF urinal	0	1	1	1	1	1
Lav Faucet GPM	1.5	1.5	3	2	3	2
Shower GPM	0	0	3.5	2.5	0	0

Uses per day	**Inmates**		**Staff**		**Visitors**		
	Male	Female	Male	Female	Male	Female	Units
Toilet	5	5	1	4	1	4	Flushes
Urinal	0		3		3		Flushes
Lav Faucet	1	1	0.5	0.5	0.5	0.5	Minutes
Shower (M F)		10					Minutes

Fixture Diversity	GPF	Quantity	Weighted Average
Toilet	1.6	0	2.50
Toilet	2.5	32	
Comby	1.6	0	–
Comby	3.5	0	
Urinal	1	0.00	1.00
Urinal	1	6	

model/billing
92.37%

	Inmates						**Staff**					**Visitors**										
	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Shower	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men						
Days/year	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236						
Population	0	0	0	0	0	750	150	100	100	150	100	23	23	23	23	23						
Minutes				1	1	10				0.5	0.5				0.5	0.5						
Use per day	5	5	0				4	1	3			4	1	3								
Uses or minutes	0	0	0	0	0	590,000	147,600	23,600	70,800	17,700	11,800	21,240	5,310	15,930	2,655	2,655						
Diversity (account for absentee)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
GPU present	0.00	0.00	0.00				2.50	2.50	1.00			2.50	2.50	1.00								
GPM present				1.5	1.5	0				3	3				3	3						
GPU Proposed	0	0	1				1.6	1.6	1			1.6	1.6	1								
GPM Proposed				1.5	1.5	0				2	2				2	2						
Total Usage Pre (Gals)	0	0	0	0	0	0	354,000	59,000	70,800	53,100	35,400	53,100	13,275	15,930	7,965	7,965						
Total Usage Post (Gals)	0	0	0	0	0	0	226,560	37,760	70,800	35,400	23,600	33,984	8,496	15,930	5,310	5,310						
Savings	0	0	0	0	0	0	127,440	21,240	0	17,700	11,800	19,116	4,779	0	2,655	2,655						
Hot Water Gallons PRE				0	0	0				32,139	21,426	32,139				4,821	0				0	0
Hot Water Gallons POST				0	0	0				21,426	14,284	20,569				3,214	0				0	0
Hot Water Energy Pre (mmbtus)				0	0	0				20	14	20				3	0				0	0
Hot Water Energy Post (mmbtus)				0	0	0				14	9	13				2	0				0	0
Hot Water Energy Savings (mmbtus)				0	0	0				7	5	7				1	0				0	0

Sanitary Water Use Summary	Gallons	Gals / person/yr	Gals / SF/ Year	Gals / person / day
Inmate Usage Pre	0	0	0	0
Inmate Usage Post	0	0	0	0
Staff Usage Pre	572,300	2289	6	5
Staff Usage Post	394,120	1576	4	4
Visitor Usage Pre	95,235	393		1
Visitor Usage Post	61,030	276		1
Total Usage Pre	670,535		7	
Total Usage Post	463,150		5	
Savings (Gals.) Domestic Water	207,385			
% Savings Domestic Water	31%			
Hot Water Usage PRE no laundry	53,566	214		
Hot Water Usage POST	35,711	143		
Savings gals	17,855	71		
% Savings (Hot Water)	33.3%			

Benchmarks	Admin 1	Typical Range
Total Usage / SF	8	25-35
Usage/SF less irrigation		
		55,408

	(Mmbtu)	Therms	kWh
Energy Pre (Mmbtu)	34	339	9,936
Kitchen	0	0	0
Total	34	339	9,936
Energy Post (Mmbtu)	23	226	6,624
Energy Savings	11	113	3,312
% Savings (Hot Water	33.3%		

0		

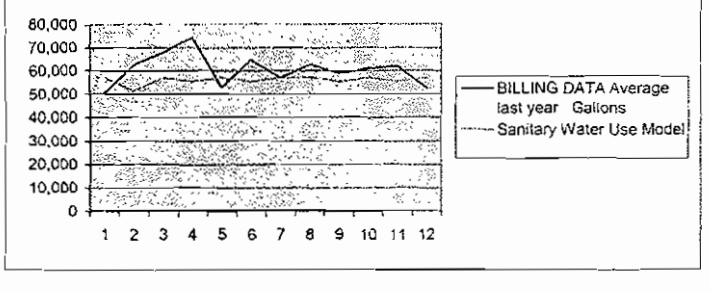
Arapahoe County Domestic Water
Administrative II

	Water Rate	Sewer Rate	Water Differential	Sewer Differential
< 25,000g gal	$0.00290	$0.00232		
25,001-200,000	$0.00363	$0.00290	$0.00073	$0.00058
>200,000	$0.00435	$0.00348	$0.00145	$0.00116

	BILLING DATA Average last year Gallons	Staff days per month	Visitors days per month	Population days	Sanitary Water Use Model	Balance	Gallons Saved	Water Dollars Saved	Sewer Dollars Saved	Total Dollars Saved	
Jan	50,667	22	22	6,532	56,950	-6,283	17,614	$77	$61	$138	-11%
Feb	62,424	20	20	5,900	51,438	10,986	15,909	$69	$55	$125	21%
Mar	67,807	22	22	6,532	56,950	10,857	17,614	$77	$61	$138	19%
Apr	74,499	21	21	6,321	55,112	19,387	17,045	$74	$59	$133	35%
May	52,803	22	22	6,532	56,950	-4,147	17,614	$77	$61	$138	-7%
June	64,498	21	21	6,321	55,112	9,386	17,045	$74	$59	$133	17%
Jul	56,908	22	22	6,532	56,950	-42	17,614	$77	$61	$138	0%
Aug	62,375	22	22	6,532	56,950	5,425	17,614	$77	$61	$138	10%
Sep	58,965	21	21	6,321	55,112	3,853	17,045	$74	$59	$133	7%
Oct	60,856	22	22	6,532	56,950	3,906	17,614	$77	$61	$138	7%
Nov	61,749	21	21	6,321	55,112	6,637	17,045	$74	$59	$133	12%
Dec	52,392	22	22	6,532	56,950	-4,558	17,614	$77	$61	$138	-8%
	725,943	261		76,911	670,535	55,408	207,385	902	$722	$1,624	

29%

	Non Sanitary Use	Non Sanitary Use Kgal	Ice machine	Evaporative coolers	Laundry	Kitchen	Total Modeled non sanitary use	Balance	Total Use Model	
Jan	-6,283	-6	910	0	0	0	910	-7,193	57,860	113%
Feb	10,986	11	910	0	0	0	910	10,076	52,348	80%
Mar	10,857	11	910	0	0	0	910	9,947	57,860	83%
Apr	19,387	19	910	0	0	0	910	18,477	56,022	66%
May	-4,147	-4	910	0	0	0	910	-5,057	57,860	109%
June	9,386	9	910	0	0	0	910	8,476	56,022	85%
Jul	-42	0	910	0	0	0	910	-952	57,860	102%
Aug	5,425	5	910	0	0	0	910	4,515	57,860	92%
Sep	3,853	4	910	0	0	0	910	2,943	56,022	95%
Oct	3,906	4	910	0	0	0	910	2,996	57,860	95%
Nov	6,637	7	910	0	0	0	910	5,727	56,022	90%
Dec	-4,558	-5	910	0	0	0	910	-5,468	57,860	110%
	55,408	55	10,920	0	0	0	10,975	44,488	681,455	94%



Arapahoe County Domestic Water
Administrative II

Code	Units
1	Gal
2	Kgal
3	CF
4	CCF
5	MCF
2	<<< enter unit code

		Water Rate	Sewer Rate			Water Differential	Sewer Differential
< 25,000g gal	25000	$0.00280	$0.00232	per	Kgal		
25,001-200,000	200000	$0.00363	$0.00290	per	Kgal	$0.00073	$0.00058
>200,000	200000	$0.00435	$0.00348	per	Kgal	$0.00145	$0.00116
Minimun Usage		144,000 gals					
Storm water fee		$15.30					
FireLineCharge		$1,142.04					
Capitol Fund		$317.50					

Read Date	Month	Kgal/day	Usage		Gallons	Billing days	Water Charges	Sewer Charges	Total Charges	Total Charges	$/gal Water charge	$/gal Sewer charge	$/gallon Total	$/gallon Total
1/31/2004	Jan	2	51	Kgal	50,667	25	$579	$462	$2,083		$0.0114	$0.0091	$0.0205	$0.0411
2/25/2004	Feb	2	62	Kgal	62,424	30	$545	$435	$1,960		$0.0087	$0.0070	$0.0157	$0.0314
3/26/2004	Mar	2	68	Kgal	67,807	35	$529	$423	$1,904		$0.0078	$0.0062	$0.0140	$0.0281
4/30/2004	Apr	3	74	Kgal	74,499	27	$510	$407	$1,834		$0.0068	$0.0055	$0.0123	$0.0246
5/27/2004	May	2	53	Kgal	52,803	34	$573	$457	$2,061		$0.0108	$0.0087	$0.0195	$0.0390
6/30/2004	Jun	2	64	Kgal	64,498	30	$539	$430	$1,939		$0.0084	$0.0067	$0.0150	$0.0301
7/30/2004	Jul	2	57	Kgal	56,908	31	$561	$448	$2,018		$0.0099	$0.0079	$0.0177	$0.0355
8/30/2004	Aug	2	62	Kgal	62,375	31	$545	$435	$1,961		$0.0087	$0.0070	$0.0157	$0.0314
9/30/2004	Sep	2	59	Kgal	58,965	28	$555	$443	$1,996		$0.0094	$0.0075	$0.0169	$0.0339
10/28/2004	Oct	2	61	Kgal	60,856	33	$550	$439	$1,977		$0.0090	$0.0072	$0.0162	$0.0325
11/30/2004	Nov	2	62	Kgal	61,749	31	$547	$437	$1,967		$0.0089	$0.0071	$0.0159	$0.0319
12/31/2004	Dec	2	52	Kgal	52,392	30	$574	$458	$2,065		$0.0110	$0.0088	$0.0197	$0.0394
1/30/2005	Jan													

50,667	50.667
62,424	62.424
67,807	67.807
74,499	74.499
52,803	52.803
64,498	64.498
56,908	56.908
62,375	62.375
58,965	58.965
60,856	60.856
61,749	61.749
52,392	52.392

ECM 3 – Install New/Upgrade Energy Management System

Please refer to the Energy Conservation Measure (ECM) section of this report for additional information.

Existing Condition to Warrant an ECM Opportunity:
Some of the facilities within Arapahoe County currently have an energy management control system (EMCS). In most cases, the equipment in these facilities operates during periods of the little or no occupancy. So, some of the existing operating schedules programmed into the EMCS can be modified to better match the actual occupancy schedules.

Many facilities within Arapahoe County are currently without an EMCS. These facilities utilize time clocks, programmable thermostats, and non-programmable thermostats for control of their equipment. In most cases, the equipment operates during periods of little or no occupancy. The installation of a new EMCS will allow the maintenance staff to easily modify the equipment operating schedules to better match the actual occupancy schedules.

Savings Calculation Methodolgy:
The implementation of this ECM shall result in both natural gas and electrical savings. The savings for this ECM were calculated utilizing two Trane Trace building energy simulation models. The first model included the existing operating schedules for each piece of equipment. The second model was modified to include the new operating schedules for each piece of equipment. The annual energy consumption calculated from each model was subtracted from one another to produce the annual energy savings.

Spreadsheet calculations were performed on the buildings that were not modeled. The spreadsheet calculations used the same methodology described above.

Figure 1

Arapahoe County - Admin I Building
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	217,183	160,605	26%
Feb	189,788	145,184	24%
Mar	229,311	168,223	27%
Apr	218,456	194,211	11%
May	243,374	236,417	3%
Jun	248,088	246,541	1%
Jul	270,700	246,323	9%
Aug	264,710	258,730	2%
Sep	243,348	223,995	8%
Oct	232,915	230,945	1%
Nov	220,561	174,307	21%
Dec	216,466	156,768	28%
	2,794,900	2,442,249	13%

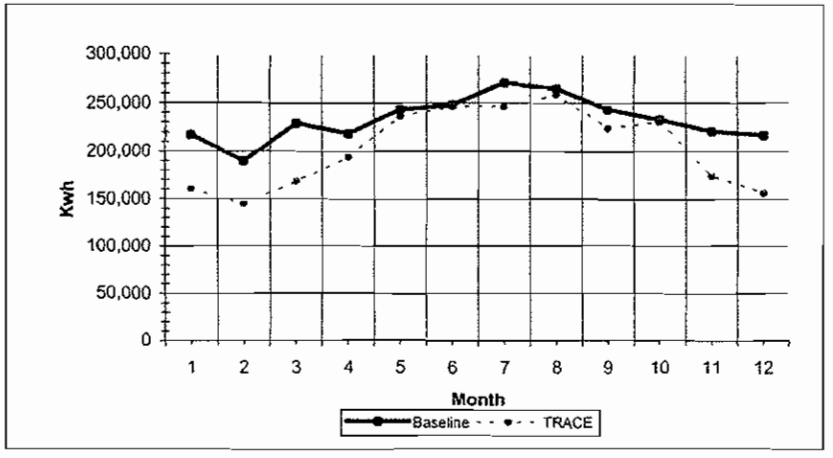
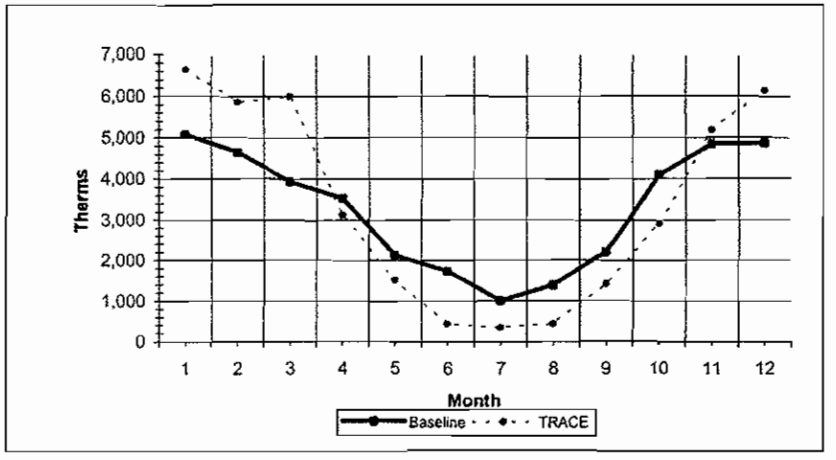


Figure 2

Arapahoe County - Admin I Building
Computer Model Calibration for Natural Gas

NATURAL GAS USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	5,080	6,648	-31%
Feb	4,650	5,870	-26%
Mar	3,950	6,011	-52%
Apr	3,550	3,128	12%
May	2,140	1,521	29%
Jun	1,740	449	74%
Jul	1,010	353	65%
Aug	1,390	443	68%
Sep	2,220	1,421	36%
Oct	4,110	2,921	29%
Nov	4,850	5,181	-7%
Dec	4,870	6,142	-26%
	39,560	40,089	-1%



MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - Match

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	160,605	145,184	168,223	194,211	236,417	246,541	246,323	258,730	223,995	230,945	174,307	156,768	2,442,249
On-Pk Demand (kW)	410	410	410	648	665	673	684	676	665	664	575	410	684
Gas													
On-Pk Cons. (therms)	6,648	5,870	6,011	3,128	1,521	449	353	443	1,421	2,921	5,181	6,142	40,089
On-Pk Demand (therms/hr)	38	39	38	36	35	6	2	3	35	36	37	38	39
Water													
Cons. (1000gal)	0	0	0	104	215	258	298	281	197	155	24	0	1,533

Building Energy Consumption = 110,260 Btu/(ft2-year)
Source Energy Consumption = 261,072 Btu/(ft2-year)
Floor Area = 111,956 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - Lighting Run

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	140,796	127,277	147,458	172,897	212,943	223,527	222,829	233,874	199,514	211,337	138,488	137,436	2,168,375
On-Pk Demand (kW)	358	358	358	586	593	609	619	612	607	600	358	358	619
Gas													
On-Pk Cons. (therms)	6,751	5,968	6,114	3,168	1,499	476	353	465	1,708	2,917	5,907	6,238	41,562
On-Pk Demand (therms/hr)	37	37	37	35	34	6	2	3	35	35	36	37	37
Water													
Cons. (1000gal)	0	0	0	91	197	235	277	260	179	145	0	0	1,385

Building Energy Consumption = 103,227 Btu/(ft2-year)
Source Energy Consumption = 237,407 Btu/(ft2-year)
Floor Area = 111,956 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - EMCS Run

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	130,120	117,639	137,067	149,284	177,616	184,908	184,820	196,456	161,483	176,125	128,253	126,618	1,870,390
On-Pk Demand (kW)	358	358	358	586	616	638	646	636	614	600	358	358	646
Gas													
On-Pk Cons. (therms)	4,845	4,278	3,815	1,265	415	388	353	405	353	1,373	3,805	4,449	25,743
On-Pk Demand (therms/hr)	37	37	36	34	12	2	2	2	2	31	36	37	37
Water													
Cons. (1000gal)	0	0	0	70	145	186	200	210	124	103	0	0	1,037

Building Energy Consumption = 80,013 Btu/(ft2-year)
Source Energy Consumption = 195,278 Btu/(ft2-year)
Floor Area = 111,956 ft2

MODELING NOTES

ARAPAHOE COUNTY - ADMIN I BUILDING

ECM Run: Install New EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
AH-1	Fan Schedule	M-F: 5am-11pm; Sat-Sun: 8am-4pm	M-F: 6am-6:30pm; Sat-Sun: Off
AH-2	Fan Schedule	M-F: 5am-11pm; Sat-Sun: 8am-4pm	M-F: 6am-6:30pm; Sat-Sun: Off
AH-3	Fan Schedule	M-F: 5am-11pm; Sat-Sun: 8am-4pm	M-F: 6am-6:30pm; Sat-Sun: Off
AH-4	Fan Schedule	M-F: 5am-11pm; Sat-Sun: 8am-4pm	M-F: 6am-6:30pm; Sat-Sun: Off

Previous Run (New Lighting Run):

Annual kWh Usage:	2,168,375
Annual kW Usage:	6,016
Annual Therms Usage:	41,562

Current Run (Install New EMCS Run):

Annual kWh Usage:	1,870,390
Annual kW Usage:	6,125
Annual Therms Usage:	25,743

Savings (Install New EMCS Savings):

Annual kWh Savings:	297,985
Annual kW Savings:	-109
Annual Therms Savings:	15,819

Notes:

1. The negative kW savings is the result of the chiller have to work harder in the mornings due to the schedule change. These negative savings shall not be accounted for since the upgraded EMCS shall cool each space down gradually without having to "overload" the chillers in the morning.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

Admin I - DHW Pump EMCS Savings

Pump ID:	HP:	LF:	Efficiency:	kW:	Existing Run Hrs:	New Run Hrs:	kWh Savings:
DHWP-1	0.17	0.75	0.7	0.13	8,760	3,259	733
HX Pump	0.25	0.75	0.7	0.20	8,760	3,259	1,099
						Total kWh Savings:	**1,832**

Note: The existing run hours are 24 h/d, 7 d/w. The new run hours are 12.5 h/d, 5 d/w. These savings shall be added to the EMCS savings that were calculated in the Trane Trace building simulation model.

Figure 1

Arapahoe County - Arapahoe Plaza East Building
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	33,024	29,670	10%
Feb	28,866	26,813	7%
Mar	33,384	30,602	8%
Apr	28,336	28,562	-1%
May	28,416	30,213	-6%
Jun	28,020	29,748	-6%
Jul	29,354	30,148	-3%
Aug	31,700	31,074	2%
Sep	29,611	28,642	3%
Oct	30,668	30,136	2%
Nov	27,862	29,028	-4%
Dec	31,304	29,204	7%
	360,545	353,840	2%

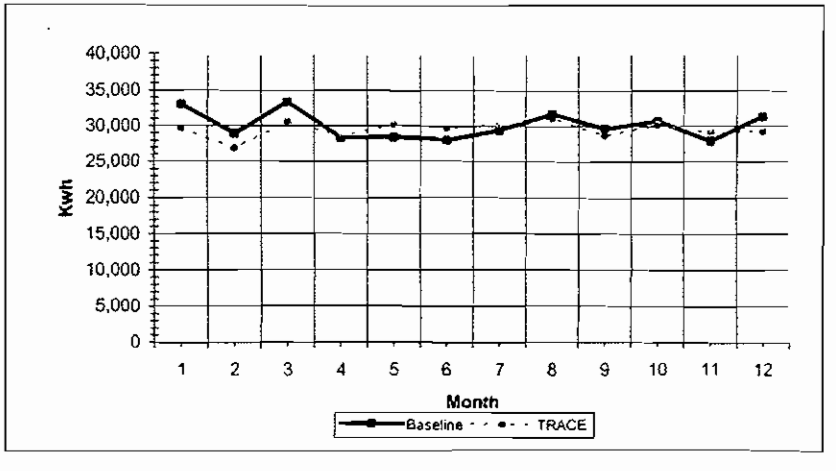


Figure 2

Arapahoe County - Arapahoe Plaza East Building
Computer Model Calibration for Natural Gas

NATURAL GAS USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	0	0	#DIV/0!
Feb	0	0	#DIV/0!
Mar	0	0	#DIV/0!
Apr	0	0	#DIV/0!
May	0	0	#DIV/0!
Jun	0	0	#DIV/0!
Jul	0	0	#DIV/0!
Aug	0	0	#DIV/0!
Sep	0	0	#DIV/0!
Oct	0	0	#DIV/0!
Nov	0	0	#DIV/0!
Dec	0	0	#DIV/0!
	0	0	#DIV/0!

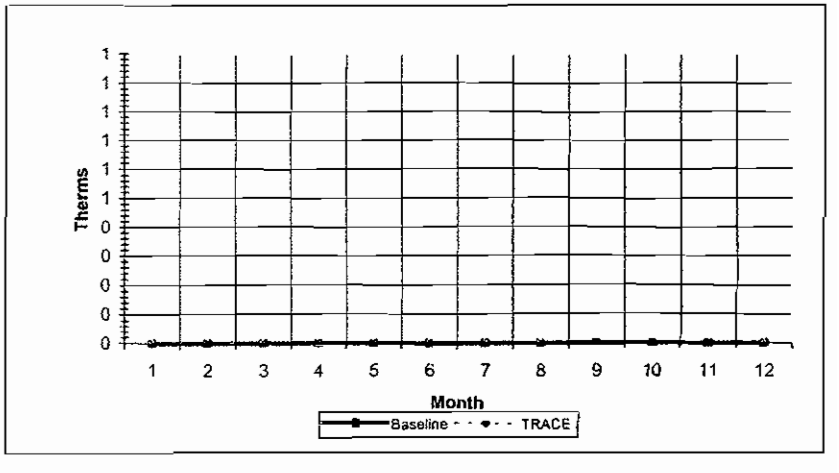


Figure 1

Arapahoe County - Arapahoe Human Services
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	56,825	59,538	-5%
Feb	53,311	53,809	-1%
Mar	57,360	61,379	-7%
Apr	55,422	65,372	-18%
May	57,204	88,176	-54%
Jun	69,488	96,267	-39%
Jul	102,970	112,971	-10%
Aug	83,302	107,725	-29%
Sep	80,601	85,398	-6%
Oct	83,325	78,622	6%
Nov	73,482	58,109	21%
Dec	56,864	58,611	-3%
	830,154	925,977	-12%

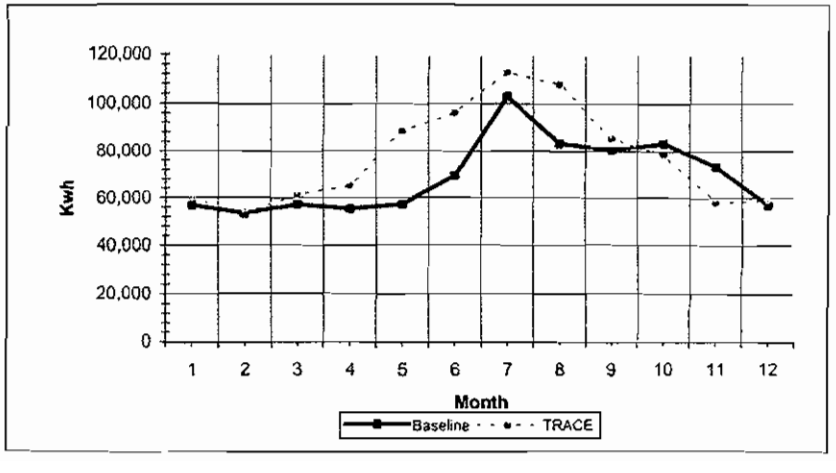


Figure 2

Arapahoe County - Arapahoe Human Services
Computer Model Calibration for Natural Gas

NATURAL GAS USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	6,316	4,401	30%
Feb	5,567	4,013	28%
Mar	5,364	3,706	31%
Apr	3,074	2,406	22%
May	2,324	1,602	31%
Jun	1,054	1,203	-14%
Jul	605	691	-14%
Aug	873	1,129	-29%
Sep	1,523	1,596	-5%
Oct	4,029	2,418	40%
Nov	6,131	3,477	43%
Dec	6,336	4,222	33%
	43,196	30,865	29%

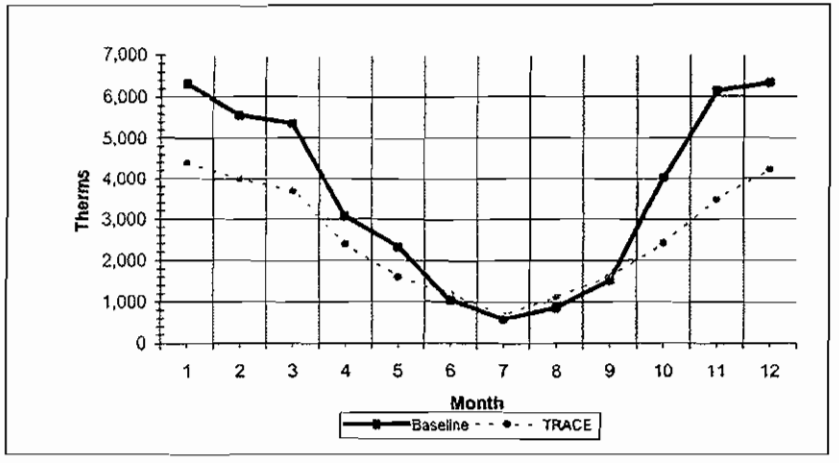


Figure 1

Arapahoe County - Arapahoe Plaza West Building
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	34,674	30,921	11%
Feb	32,763	27,950	15%
Mar	36,092	32,238	11%
Apr	32,596	29,711	9%
May	32,167	31,652	2%
Jun	32,748	31,235	5%
Jul	34,057	30,975	9%
Aug	34,661	32,667	6%
Sep	32,809	29,781	9%
Oct	33,233	31,579	5%
Nov	32,757	30,370	7%
Dec	34,647	30,263	13%
	403,204	369,343	8%

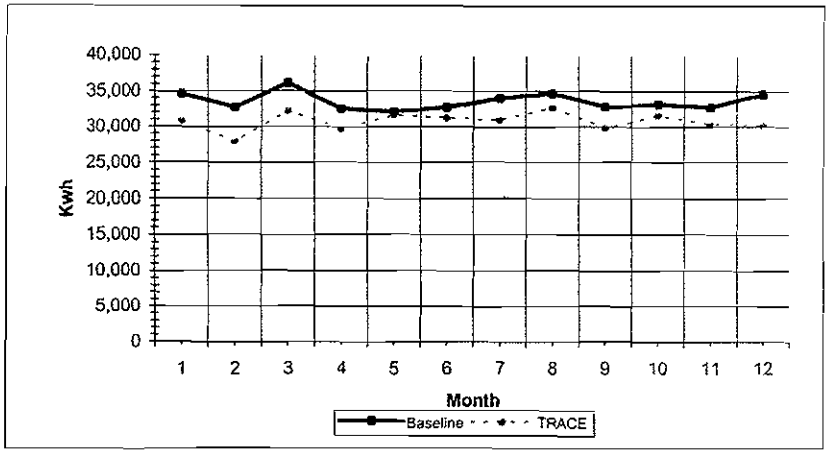
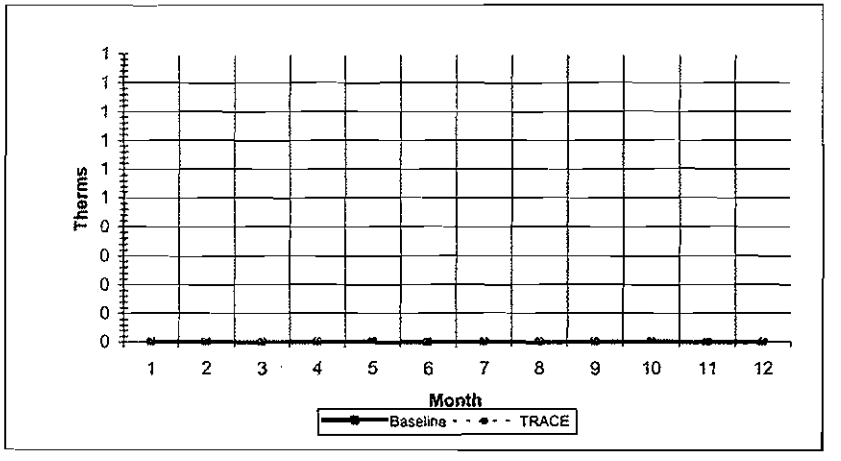


Figure 2

Arapahoe County - Arapahoe Plaza West Building
Computer Model Calibration for Natural Gas

NATURAL GAS USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	0	0	#DIV/0!
Feb	0	0	#DIV/0!
Mar	0	0	#DIV/0!
Apr	0	0	#DIV/0!
May	0	0	#DIV/0!
Jun	0	0	#DIV/0!
Jul	0	0	#DIV/0!
Aug	0	0	#DIV/0!
Sep	0	0	#DIV/0!
Oct	0	0	#DIV/0!
Nov	0	0	#DIV/0!
Dec	0	0	#DIV/0!
	0	0	#DIV/0!



MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe Plaza Bldgs - Match Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	120,129	108,572	124,218	123,646	150,041	157,250	174,094	171,467	143,821	140,337	117,507	118,078	1,649,160
On-Pk Demand (kW)	271	271	271	342	398	416	458	439	413	370	271	271	458
Gas													
On-Pk Cons. (therms)	4,401	4,013	3,706	2,406	1,602	1,203	691	1,129	1,596	2,418	3,477	4,222	30,865
On-Pk Demand (therms/hr)	18	19	11	9	8	7	6	7	8	9	11	18	19

Building Energy Consumption =	91,864	Btu/(ft2-year)
Source Energy Consumption =	212,253	Btu/(ft2-year)
Floor Area =	94,870	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe Plaza Bldgs - East Light Run

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -----												
Electric													
On-Pk Cons. (kWh)	118,071	106,775	122,061	121,729	147,526	154,642	171,372	168,814	141,501	138,154	115,482	116,070	1,622,198
On-Pk Demand (kW)	265	265	265	336	394	408	452	431	405	362	265	265	452
Gas													
On-Pk Cons. (therms)	4,437	4,045	3,743	2,437	1,620	1,218	692	1,143	1,617	2,452	3,511	4,256	31,170
On-Pk Demand (therms/hr)	18	18	11	9	8	7	6	7	8	9	11	18	18

Building Energy Consumption =	91,215	Btu/(ft2-year)
Source Energy Consumption =	209,681	Btu/(ft2-year)
Floor Area =	94,870	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe Plaza Bldgs - East Emcs Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	109,469	99,011	113,863	112,852	137,847	145,741	160,512	161,270	133,531	128,286	107,312	107,201	1,516,895
On-Pk Demand (kW)	265	265	265	336	394	413	457	438	416	362	265	265	457
Gas													
On-Pk Cons. (therms)	3,817	3,482	3,214	1,951	1,287	992	598	941	1,246	1,978	3,000	3,633	26,138
On-Pk Demand (therms/hr)	13	14	10	8	6	5	5	5	6	7	9	13	14

Building Energy Consumption =	82,123	Btu/(ft2-year)
Source Energy Consumption =	192,731	Btu/(ft2-year)
Floor Area =	94,870	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe Plaza Bldgs - South Light Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	93,060	84,184	96,738	95,697	116,059	124,401	133,489	137,225	113,657	109,637	90,976	90,849	1,285,972
On-Pk Demand (kW)	239	239	239	311	366	391	423	410	391	337	239	239	423
Gas													
On-Pk Cons. (therms)	2,926	2,677	2,302	1,148	580	357	129	303	560	1,091	2,135	2,718	16,926
On-Pk Demand (therms/hr)	12	12	10	7	4	3	3	3	4	5	9	11	12

Building Energy Consumption =	64,105	Btu/(ft2-year)
Source Energy Consumption =	157,585	Btu/(ft2-year)
Floor Area =	94,870	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe Plaza Bldgs - South EMCS Run

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	77,494	70,071	82,261	80,380	100,815	110,366	112,393	123,313	101,119	94,994	76,802	75,110	1,105,118
On-Pk Demand (kW)	239	239	239	317	390	405	423	414	402	357	250	239	423
Gas													
On-Pk Cons. (therms)	1,815	1,673	1,403	307	33	0	0	0	0	262	1,220	1,613	8,326
On-Pk Demand (therms/hr)	13	14	10	7	2	0	0	0	0	3	9	12	14

Building Energy Consumption =	48,534	Btu/(ft2-year)
Source Energy Consumption =	128,522	Btu/(ft2-year)
Floor Area =	94,870	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe Plaza Bldgs - West Light Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	106,284	96,069	110,478	109,641	133,731	141,541	155,871	156,690	129,723	124,651	104,109	104,026	1,472,813
On-Pk Demand (kW)	257	257	257	328	382	401	445	427	404	351	257	257	445
Gas													
On-Pk Cons. (therms)	3,843	3,505	3,237	1,968	1,277	980	581	928	1,240	1,995	3,023	3,657	26,234
On-Pk Demand (therms/hr)	12	13	10	8	6	5	4	5	6	7	9	13	13

Building Energy Consumption =	80,638	Btu/(ft2-year)
Source Energy Consumption =	188,080	Btu/(ft2-year)
Floor Area =	94,870	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe Plaza Bldgs - West EMCS Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	99,488	89,995	103,593	102,432	124,422	133,329	142,186	146,650	121,696	117,222	97,033	97,117	1,375,163
On-Pk Demand (kW)	257	257	257	333	390	415	446	432	414	366	257	257	446
Gas													
On-Pk Cons. (therms)	2,792	2,554	2,203	1,065	533	338	126	284	518	1,007	2,043	2,621	16,084
On-Pk Demand (therms/hr)	11	11	10	7	4	3	4	3	4	5	8	11	11

Building Energy Consumption = 66,426 Btu/(ft2-year)
Source Energy Consumption = 166,277 Btu/(ft2-year)
Floor Area = 94,870 ft2

MODELING NOTES

ARAPAHOE COUNTY - ARAPAHOE PLAZA EAST BUILDING

ECM Run: Install New EMCS

Room/Fan System	Item Changed	Previous Run Input	Current Run Input
AHU-E1	Fan Schedule	M-F: 6am-10pm; Sat-Sun: 8am-4:30pm	M-F: 7am-6pm; Sat-Sun: OFF
AHU-E2	Fan Schedule	M-F: 6am-10pm; Sat-Sun: 8am-4:30pm	M-F: 7am-6pm; Sat-Sun: OFF

Previous Run (New Lighting Run):

Annual kWh Usage:	1,622,198
Annual kW Usage:	4,116
Annual Therms Usage:	31,170

Current Run (Install New EMCS Run):

Annual kWh Usage:	1,516,895
Annual kW Usage:	4,142
Annual Therms Usage:	26,138

Savings (Install New EMCS Savings):

Annual kWh Savings:	105,303
Annual kW Savings:	-27
Annual Therms Savings:	5,032

Notes:

1. The negative kW savings is the result of the chiller have to work harder in the mornings due to the schedule change. These negative savings shall not be accounted for since the upgraded EMCS shall cool each space down gradually without having to "overload" the chillers in the morning.

Electric Savings Safety Factor: 0.73
Natural Gas Savings Safety Factor: 0.5

MODELING NOTES

ARAPAHOE COUNTY - ARAPAHOE HUMAN SERVICES BUILDING

ECM Run: Install New EMCS

Room/Fan System	Item Changed	Previous Run Input	Current Run Input
AHU-SW1	Fan Schedule	M-F: 6am-10pm; Sat-Sun: 8am-4:30pm	M-F: 7am-6pm; Sat-Sun: OFF
AHU-SE1	Fan Schedule	M-F: 6am-10pm; Sat-Sun: 8am-4:30pm	M-F: 7am-6pm; Sat-Sun: OFF
AHU-SW2	Fan Schedule	M-F: 6am-10pm; Sat-Sun: 8am-4:30pm	M-F: 7am-6pm; Sat-Sun: OFF
AHU-SE2	Fan Schedule	M-F: 6am-10pm; Sat-Sun: 8am-4:30pm	M-F: 7am-6pm; Sat-Sun: OFF

Previous Run (New Lighting Run):

Annual kWh Usage:	1,285,972
Annual kW Usage:	3,827
Annual Therms Usage:	16,926

Current Run (Install New EMCS Run):

Annual kWh Usage:	1,105,118
Annual kW Usage:	3,916
Annual Therms Usage:	8,326

Savings (Install New EMCS Savings):

Annual kWh Savings:	180,854
Annual kW Savings:	-89
Annual Therms Savings:	8,600

Notes:

1. The negative kW savings is the result of the chiller have to work harder in the mornings due to the schedule change. These negative savings shall not be accounted for since the upgraded EMCS shall cool each space down gradually without having to "overload" the chillers in the morning.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.5

MODELING NOTES

ARAPAHOE COUNTY - ARAPAHOE PLAZA WEST BUILDING

ECM Run: Install New EMCS

Room/Fan System	Item Changed	Previous Run Input	Current Run Input
AHU-W1	Fan Schedule	M-F: 24 h/d; Sat-Sun: 4am-6pm	M-F: 7am-6pm; Sat-Sun: OFF
AHU-W2	Fan Schedule	M-F: 24 h/d; Sat-Sun: 4am-6pm	M-F: 7am-6pm; Sat-Sun: OFF

Previous Run (New Lighting Run):

Annual kWh Usage:	1,472,813
Annual kW Usage:	4,023
Annual Therms Usage:	26,234

Current Run (Install New EMCS Run):

Annual kWh Usage:	1,375,163
Annual kW Usage:	4,081
Annual Therms Usage:	16,084

Savings (Install New EMCS Savings):

Annual kWh Savings:	97,650
Annual kW Savings:	-58
Annual Therms Savings:	10,151

Notes:

1. The negative kW savings is the result of the chiller have to work harder in the mornings due to the schedule change. These negative savings shall not be accounted for since the upgraded EMCS shall cool each space down gradually without having to "overload" the chillers in the morning.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.5

Figure 1

Arapahoe County - Altura Plaza
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	121,594	112,997	7%
Feb	103,244	100,020	3%
Mar	112,618	114,465	-2%
Apr	112,883	107,205	5%
May	120,411	113,295	6%
Jun	122,653	116,146	5%
Jul	139,482	122,622	12%
Aug	138,135	125,874	9%
Sep	126,767	109,882	13%
Oct	120,855	112,745	7%
Nov	119,468	107,850	10%
Dec	126,428	107,003	15%
	1,464,538	1,350,104	8%

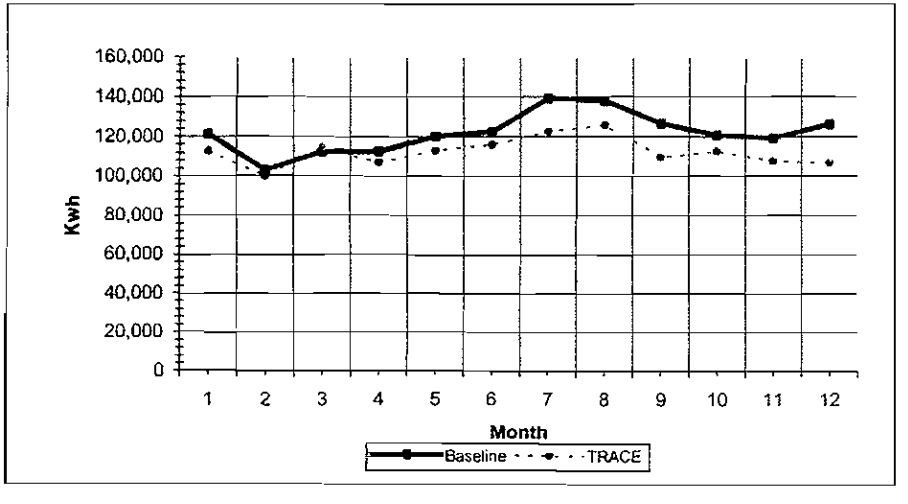
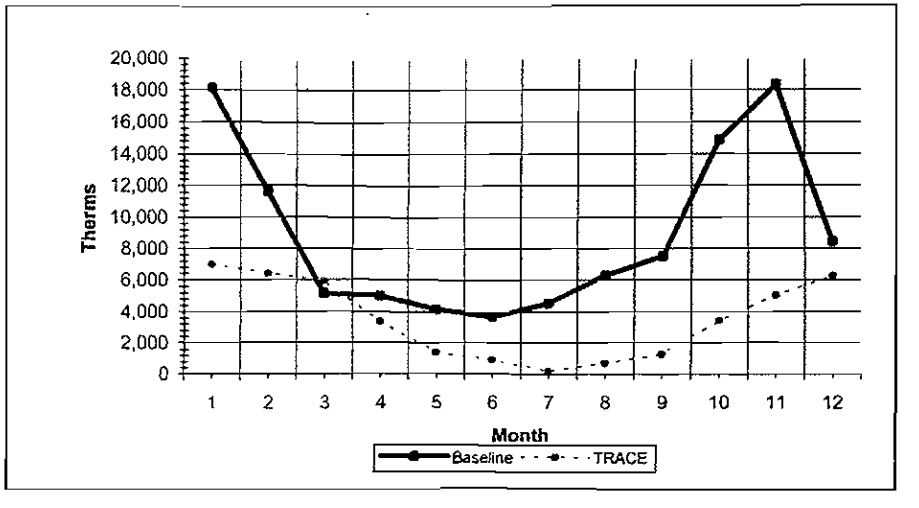


Figure 1

Arapahoe County - Altura Plaza
Computer Model Calibration for NG usage

NG USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	18,160	7,038	61%
Feb	11,670	6,450	45%
Mar	5,160	5,962	-16%
Apr	5,010	3,362	33%
May	4,150	1,450	65%
Jun	3,700	933	75%
Jul	4,530	186	96%
Aug	6,300	682	89%
Sep	7,530	1,276	83%
Oct	14,900	3,421	77%
Nov	18,330	5,074	72%
Dec	8,440	6,277	26%
	107,880	42,111	61%



MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Altura Plaza

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	112,997	100,020	114,465	107,205	113,295	116,146	122,622	125,874	109,882	112,745	107,650	107,003	1,350,106
On-Pk Demand (kW)	445	445	445	445	445	446	446	445	446	445	445	445	446
Gas													
On-Pk Cons. (therms)	7,038	6,450	5,962	3,362	1,450	933	186	682	1,276	3,421	5,074	6,277	42,112
On-Pk Demand (therms/hr)	19	19	17	13	9	7	4	5	8	12	15	18	19
Water													
Cons. (1000gal)	56	43	88	43	92	121	176	152	104	104	72	52	1,081

Building Energy Consumption = 134,046 Btu/(ft2-year)
Source Energy Consumption = 277,511 Btu/(ft2-year)
Floor Area = 65,792 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Altura Plaza

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	----- Monthly Energy Consumption -----												
Electric													
On-Pk Cons. (kWh)	96,256	84,809	95,876	90,994	95,250	97,213	104,972	106,136	93,140	94,296	90,714	90,718	1,140,374
On-Pk Demand (kW)	364	364	364	364	364	365	366	365	365	365	364	364	366
Gas													
On-Pk Cons. (therms)	7,147	6,548	6,042	3,441	1,493	958	186	725	1,301	3,445	5,125	6,373	42,783
On-Pk Demand (therms/hr)	19	19	17	13	9	7	4	5	8	12	15	18	19
Water													
Cons. (1000gal)	44	31	53	30	77	104	159	135	90	88	58	39	909

Building Energy Consumption = 124,186 Btu/(ft2-year)
Source Energy Consumption = 245,941 Btu/(ft2-year)
Floor Area = 65,792 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Altura Plaza

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	---------- Monthly Energy Consumption ----------												
Electric													
On-Pk Cons. (kWh)	67,168	59,744	68,625	56,875	64,113	67,496	71,397	76,143	61,956	65,341	61,442	61,037	781,336
On-Pk Demand (kW)	364	364	364	364	364	365	366	365	365	365	367	364	367
Gas													
On-Pk Cons. (therms)	5,799	5,391	5,185	1,398	667	378	186	332	588	3,242	4,319	5,233	32,717
On-Pk Demand (therms/hr)	24	25	24	18	16	8	0	8	15	22	23	24	25
Water													
Cons. (1000gal)	33	25	44	27	65	86	120	111	72	68	44	30	725

Building Energy Consumption =	90,280	Btu/(ft2-year)
Source Energy Consumption =	173,954	Btu/(ft2-year)
Floor Area =	65,792	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Altura Plaza

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	67,596	60,139	68,831	57,057	64,174	67,546	71,397	76,169	62,010	65,402	61,556	61,378	783,256
On-Pk Demand (kW)	364	364	364	364	364	365	366	365	365	365	368	364	368
Gas													
On-Pk Cons. (therms)	5,381	5,015	4,872	1,105	551	330	186	297	490	3,119	4,094	4,909	30,348
On-Pk Demand (therms/hr)	20	20	20	14	12	6	0	6	11	18	19	20	20
Water													
Cons. (1000gal)	33	25	44	27	65	86	120	111	72	58	44	30	725

Building Energy Consumption =	86,760	Btu/(ft2-year)
Source Energy Consumption =	170,463	Btu/(ft2-year)
Floor Area =	65,792	ft2

MODELING NOTES

ARAPAHOE COUNTY - ALTURA PLAZA

ECM Run: Install New EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
WSHP	Fan Schedule/Cycle with People	Available 100%	M-F: 6am-6:30pm; Sat-Sun: Off
Pre-Heat WSHP	Fan Schedule/Cycle with People	Available 100%	M-F: 7am-6:30pm; Sat-Sun: Off
Fan Coil	Fan Schedule/Cycle with People	Available 100%	M-F: 7am-6:30pm; Sat-Sun: Off

Previous Run (New Lighting Run):

Annual kWh Usage:	1,140,374
Annual kW Usage:	4,374
Annual Therm Usage:	42,784

Current Run (Install New EMCS Run):

Annual kWh Usage:	781,336
Annual kW Usage:	4,377
Annual Therm Usage:	32,718

Savings (Install New EMCS Savings):

Annual kWh Savings:	359,038
Annual kW Savings:	-3
Annual Therm Savings:	10,066

Notes:

1. An additional 65,769 Therms were added to the 10,066 Therms savings shown above. This is a result of the building's existing natural gas usage being way out of line, so much so that we were unable to force our computer model to reflect the building's actual natural gas usage. So, the 65,769 Therms is the difference in the building's actual usage and the computer model's "match usage." Refer to the attached spreadsheet.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

Figure 1

Arapahoe County - Altura Plaza
Computer Model Calibration for NG usage

Month	NG USAGE (Therms) BASELINE	MODEL		Adjusted Baseline Savings
Jan	18,160	7,038	61%	11,122
Feb	11,670	6,450	45%	5,220
Mar	5,160	5,962	-16%	-802
Apr	5,010	3,362	33%	1,648
May	4,150	1,450	65%	2,700
Jun	3,700	933	75%	2,767
Jul	4,530	186	96%	4,344
Aug	6,300	682	89%	5,618
Sep	7,530	1,276	83%	6,254
Oct	14,900	3,421	77%	11,479
Nov	18,330	5,074	72%	13,256
Dec	8,440	6,277	26%	2,163
	107,880	42,111	61%	65,769

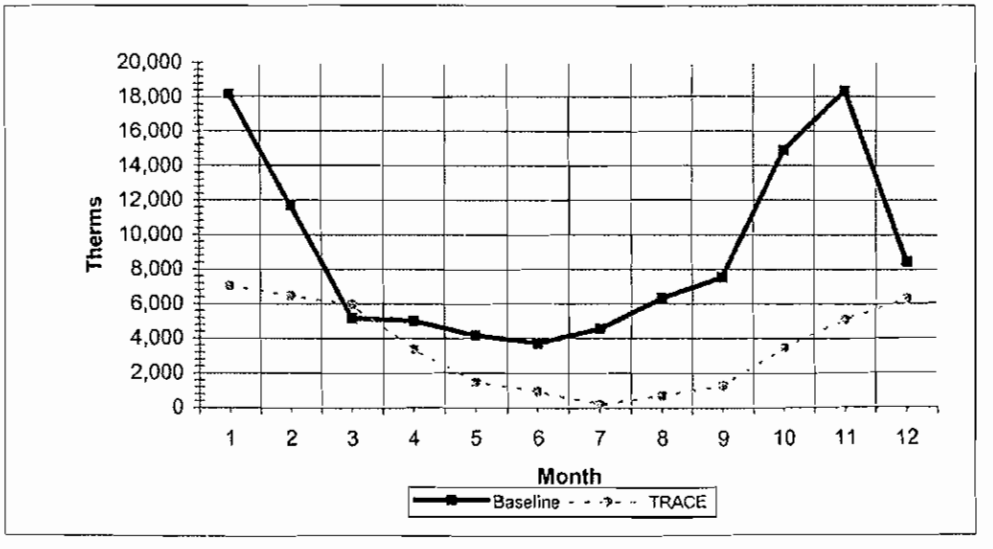


Figure 1

Arapahoe County - ACJC Courthouse
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	202,551	197,435	3%
Feb	172,659	178,589	-3%
Mar	234,751	203,151	13%
Apr	234,674	190,309	19%
May	248,888	221,458	11%
Jun	247,557	224,685	9%
Jul	293,663	238,057	19%
Aug	276,365	238,231	14%
Sep	228,143	211,261	7%
Oct	214,985	213,383	1%
Nov	201,979	192,946	4%
Dec	199,199	194,492	2%
	2,755,414	2,503,997	9%

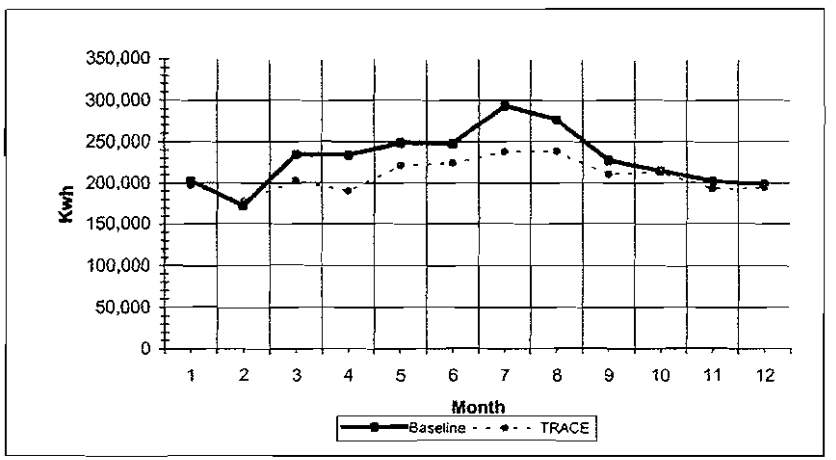
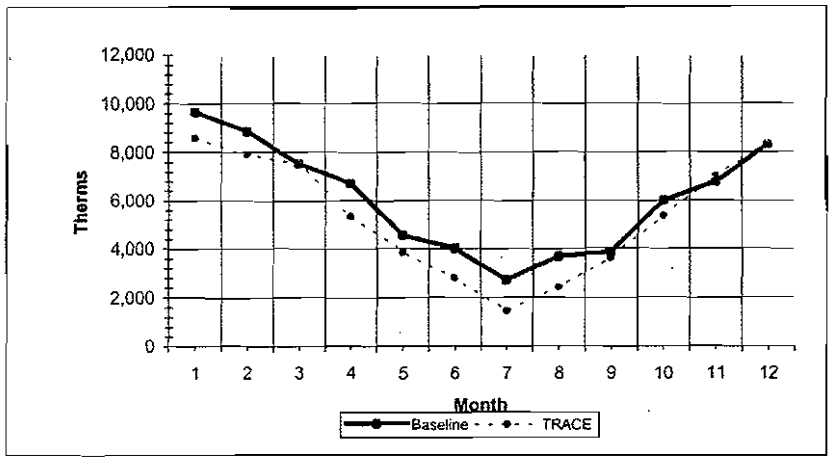


Figure 1

Arapahoe County - ACJC Courthouse
Computer Model Calibration for NG usage

NG USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	9,680	8,570	11%
Feb	8,870	7,938	11%
Mar	7,540	7,540	0%
Apr	6,710	5,356	20%
May	4,560	3,860	15%
Jun	4,020	2,835	29%
Jul	2,730	1,484	46%
Aug	3,710	2,446	34%
Sep	3,870	3,639	6%
Oct	6,020	5,366	11%
Nov	6,770	7,029	-4%
Dec	8,320	8,374	-1%
	72,800	64,437	11%



MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 ACJC Courthouse

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	197,435	178,589	203,151	190,309	221,458	224,685	235,057	238,231	211,261	213,383	192,946	194,492	2,503,995
On-Pk Demand (kW)	409	409	409	430	496	563	561	574	516	490	409	409	581
Gas													
On-Pk Cons. (therms)	8,570	7,938	7,540	5,356	3,860	2,835	1,484	2,446	3,639	5,366	7,029	6,374	64,439
On-Pk Demand (therms/hr)	45	44	44	44	44	44	44	44	44	44	44	44	45
Water													
Cons. (1000gal)	0	0	0	0	82	109	155	132	81	56	0	0	615

Building Energy Consumption =	142,485	Btu/(ft2-year)
Source Energy Consumption =	308,201	Btu/(ft2-year)
Floor Area =	105,204	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 ACJC Courthouse

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	172,576	155,952	177,035	166,190	194,011	196,562	208,965	208,391	185,310	186,583	166,343	169,990	2,189,927
On-Pk Demand (kW)	346	346	346	350	415	488	501	491	443	417	346	346	501
Gas													
On-Pk Cons. (therms)	8,696	8,063	7,873	5,455	3,915	2,859	1,436	2,445	3,694	5,460	7,149	8,475	65,319
On-Pk Demand (therms/hr)	42	42	42	42	42	42	42	42	42	42	42	42	42
Water													
Cons. (1000gal)	0	0	0	0	67	90	129	108	66	46	0	0	506

Building Energy Consumption =	133,133	Btu/(ft2-year)
Source Energy Consumption =	278,513	Btu/(ft2-year)
Floor Area =	105,204	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 ACJC Courthouse

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	164,194	148,361	168,067	158,423	184,583	186,552	203,494	197,971	175,808	178,072	160,172	182,176	2,087,862
On-Pk Demand (kW)	346	346	346	350	415	488	501	491	443	417	346	346	501
Gas													
On-Pk Cons. (therms)	8,519	7,900	7,409	4,930	3,084	1,916	600	1,394	2,877	4,630	6,839	8,276	58,575
On-Pk Demand (therms/hr)	42	42	42	42	33	13	7	10	31	42	42	42	42
Water													
Cons. (1000gal)	0	0	0	0	65	85	133	104	62	46	0	0	496

Building Energy Consumption = 123,411 Btu/(ft2-year)
Source Energy Consumption = 261,829 Btu/(ft2-year)
Floor Area = 105,204 ft2

MODELING NOTES

ARAPAHOE COUNTY - ACJC COURTHOUSE

ECM Run: Upgrade Existing EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
AH-1	Fan Schedule Changed	M-F - 4am-11pm, Sat-Sun: 8am-17pm	M-F: 5:30am-9:30pm; Sat-Sun: 8am-17pm
AHU-1	Fan Schedule Changed	M-F - 4am-11pm, Sat-Sun: 8am-17pm	M-F: 5:30am-9:30pm; Sat-Sun: 8am-17pm
AHIU-2	Fan Schedule Changed	M-F - 4am-11pm, Sat-Sun: 8am-17pm	M-F: 5:30am-9:30pm; Sat-Sun: 8am-17pm

Previous Run (New Lighting Run):

Annual kWh Usage:	2,189,928
Annual kW Usage:	4,835
Annual Therm Usage:	65,319

Current Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	2,087,853
Annual kW Usage:	4,835
Annual Therm Usage:	58,576

Savings (Upgrade Existing EMCS Savings):

Annual kWh Savings:	102,075
Annual kW Savings:	0
Annual Therm Savings:	6,743

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

Figure 1

Arapahoe County - ACJC Admin II Building
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	149,668	117,519	21%
Feb	123,955	106,449	14%
Mar	137,823	125,967	9%
Apr	166,962	120,398	28%
May	183,024	150,964	18%
Jun	185,588	161,275	13%
Jul	204,313	170,641	16%
Aug	202,649	178,772	12%
Sep	187,481	141,905	24%
Oct	170,057	141,498	17%
Nov	153,399	115,011	25%
Dec	152,731	111,523	27%
	2,017,650	1,641,920	19%

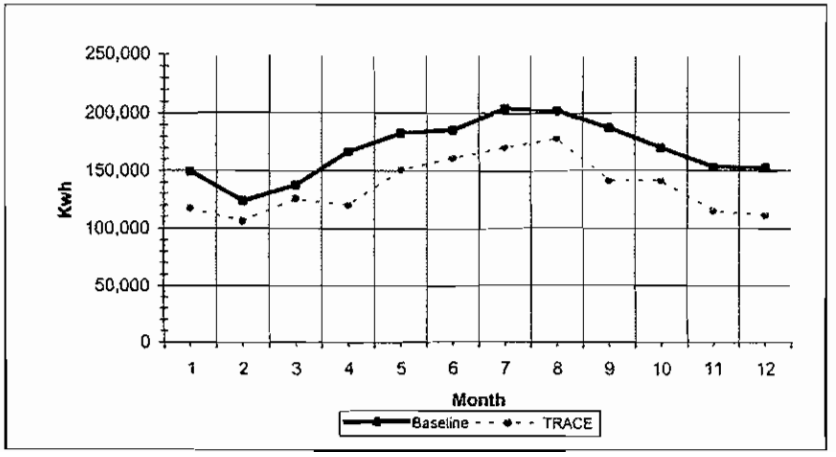
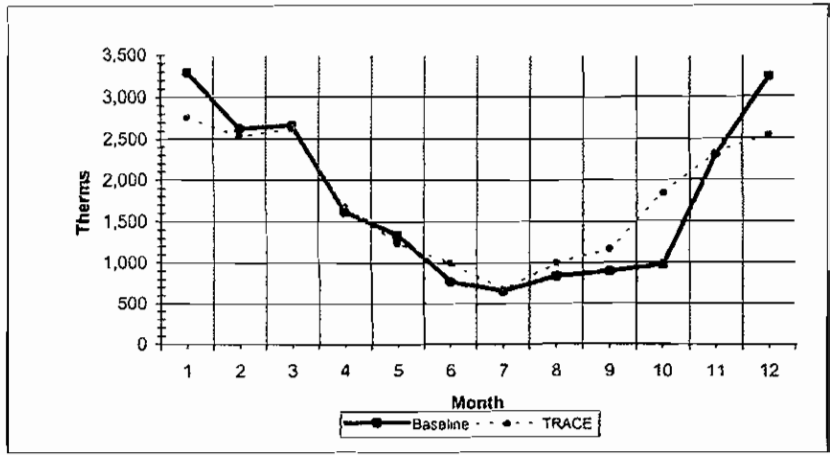


Figure 2

Arapahoe County - ACJC Admin II Building
Computer Model Calibration for Natural Gas

NATURAL GAS USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	3,292	2,762	16%
Feb	2,623	2,527	4%
Mar	2,661	2,629	1%
Apr	1,611	1,677	-4%
May	1,342	1,242	7%
Jun	773	1,001	-30%
Jul	650	672	-3%
Aug	841	999	-19%
Sep	897	1,175	-31%
Oct	977	1,842	-89%
Nov	2,320	2,343	-1%
Dec	3,238	2,547	21%
	21,225	21,417	-1%



MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 ACJC Admin II - Match Run

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	117,519	106,449	125,967	120,398	150,964	161,275	170,641	178,772	141,905	141,498	115,011	111,523	1,641,920
On-Pk Demand (kW)	370	371	363	420	455	470	530	508	478	446	349	349	530
Gas													
On-Pk Cons. (therms)	2,762	2,527	2,629	1,677	1,242	1,001	672	999	1,175	1,842	2,343	2,547	21,417
On-Pk Demand (therms/hr)	12	12	11	10	9	9	7	9	9	10	10	12	12

Building Energy Consumption =	95,541	Btu/(ft2-year)
Source Energy Consumption =	235,198	Btu/(ft2-year)
Floor Area =	81,071	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 ACJC Admin II - Lighting Run

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	103,095	93,293	110,380	103,857	132,054	140,854	152,364	156,782	124,987	123,969	100,353	97,688	1,439,677
On-Pk Demand (kW)	330	331	330	369	404	418	477	455	427	391	309	323	477
Gas													
On-Pk Cons. (therms)	2,888	2,646	2,781	1,803	1,335	1,077	724	1,079	1,261	1,963	2,476	2,675	22,709
On-Pk Demand (therms/hr)	13	13	12	10	10	9	9	9	9	10	11	12	13

Building Energy Consumption =	88,621	Btu/(ft2-year)
Source Energy Consumption =	211,331	Btu/(ft2-year)
Floor Area =	81,071	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 ACJC Admin II - EMCS Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	101,636	91,993	108,591	102,210	128,575	137,751	150,090	154,105	121,916	122,297	98,669	96,267	1,414,100
On-Pk Demand (kW)	330	331	330	370	404	426	476	458	427	396	309	323	476
Gas													
On-Pk Cons. (therms)	2,685	2,462	2,516	1,558	1,087	852	580	841	1,041	1,696	2,227	2,465	20,011
On-Pk Demand (therms/hr)	12	13	12	10	7	6	5	6	8	10	11	12	13

Building Energy Consumption =	84,215	Btu/(ft2-year)
Source Energy Consumption =	204,596	Btu/(ft2-year)
Floor Area =	81,071	ft2

MODELING NOTES

ARAPAHOE COUNTY - ACJC ADMIN II BUILDING

ECM Run: Upgrade Existing EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
AHU-1	Fan Schedule	M-F: 7am-10:30pm; Sat-Sun: OFF	M-F: 7am-8:30pm; Sat-Sun: OFF
AHU-2	Fan Schedule	M-F: 5:30am-10:30pm; Sat-Sun: OFF	M-F: 5:30am-8:30pm; Sat-Sun: OFF
AHU-4	Fan Schedule	M-F: 7am-10:45pm; Sat-Sun: OFF	M-F: 7am-8:30pm; Sat-Sun: OFF
AHU-6	Fan Schedule	M-F: 7am-11pm; Sat-Sun: 8am-5pm	M-F: 7am-8:30pm; Sat-Sun: 8am-5pm

Previous Run (New Lighting Run):

Annual kWh Usage:	1,439,677
Annual kW Usage:	4,563
Annual Therms Usage:	22,709

Current Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	1,414,100
Annual kW Usage:	4,581
Annual Therms Usage:	20,011

Savings (Upgrade Existing EMCS Savings):

Annual kWh Savings:	25,577
Annual kW Savings:	-18
Annual Therms Savings:	2,699

Notes:

1. The negative kW savings is the result of the chiller have to work harder in the mornings due to the schedule change. These negative savings shall not be accounted for since the upgraded EMCS shall cool each space down gradually without having to "overload" the chillers in the morning.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

ECM 4 – Install Programmable Thermostats

Please refer to the Energy Conservation Measure (ECM) section of this report for additional information.

Existing Condition to Warrant an ECM Opportunity:
Many of the facilities within Arapahoe County currently don't have an energy management control system (EMCS). These facilities utilize non-programmable thermostats for control of their equipment. In most cases, the equipment operates during periods of little or no occupancy. The installation of programmable thermostats will allow the maintenance staff to easily modify the equipment operating schedules to better match the actual occupancy schedules.

Savings Calculation Methodolgy:
The implementation of this ECM shall result in both natural gas and electrical savings. The majority of the savings for this ECM were calculated utilizing two Trane Trace building energy simulation models. The first model included the existing operating schedules for each piece of equipment. The second model was modified to include the new operating schedules for each piece of equipment. The annual energy consumption calculated from each model was subtracted from one another to produce the annual energy savings.

Spreadsheet calculations were performed on the buildings that were not modeled. The spreadsheet calculations used the same methodology described above.

Federal Warehouse EMCS & Programmable Thermostats Savings Summary

Building	Unit ID:	Fan Motor Savings (kWh)	Cooling Savings (kWh):	Heating Savings (Therms):	Total Savings (kWh):
Federal Warehouse	RTU-2,3,5,6,8,9	3,320	5,705	935	9,025
Federal Warehouse	RTU-7	552	861	169	1,413
Federal Warehouse	RTU-10	2,056	2,520	743	4,576
	TOTALS	**5,928**	**9,086**	**1,847**	**15,014**

Date: 6/30/05
Building: Federal Warehouse
Equip. Name: RTU-2,3,5,6,8,9 (10 Tons)

NOTE: Highlighted Cells are user inputs

Current Occupancy Schedule:

	From:	To:	Hours:	
EXAMPLE (6:00am to 6 pm)	6	18	12	
SMTWRFS			0	Note: Enter Half Hours as .5, for example 6.5 not 6:30
Mon	6	18	12	
Tues	6	18	12	
Wed	6	18	12	
Thu	6	18	12	
Fri	6	18	12	
Sat	6	18	12	
Sun	6	18	12	
			84	

Proposed Occupancy Schedule:

	From	To:	Hours:	
EXAMPLE (6:00am to 6 pm)	6	18	12	
SMTWRFS			0	Note: Enter Half Hours as .5, for example 6.5 not 6:30
Mon	6	17	11	
Tues	6	17	11	
Wed	6	17	11	
Thu	6	17	11	
Fri	6	17	11	
Sat			0	
Sun			0	
			55	

Supply Fan Motor Savings:

Inputs:

HP:	3
Efficiency:	0.8
Load Factor:	0.75
# of Fans	6
Existing Yearly Hrs:	773
Proposed Yearly Hrs:	510

kWh_savings: 3,320

Date 6/30/05
Building Federal Warehouse
Equip. Name. RTU-2,3,5,6,8,9 (10 Tons)

NOTE: Highlighted Cells are user inputs

CURRENT CONDITIONS		PROPOSED CONDITIONS	
Heating Discharge Air Temp (DAT)	85 F	Heating Discharge Air Temp (DAT)	85 F
Cooling Discharge Air Temp (DAT)	55 F	Cooling Discharge Air Temp (DAT)	55 F
Heating Return Air Temp (RAT)	74 F	Heating Return Air Temp (RAT)	74 F
Cooling Return Air Temp (RAT)	76 F	Cooling Return Air Temp (RAT)	76 F
OA%	10%	OA%	10%
RA%	90%	RA%	90%
kW/ton rating of air-cooled A/C Unit	1.1	kW/ton rating of air-cooled A/C Unit	1.1
Supply Fan CFM	4000 cfm	Supply Fan CFM	4000 cfm
Min OA CFM	400		
Cooling Minimum Mixed Air Temp	55 F	Cooling Minimum Mixed Air Temp	55 F
Furnace Efficiency (0.75=75%)	0.8	Furnace Efficiency (0.75=75%)	0.8

Current Occupancy Schedule:

	From	To
EXAMPLE (6:00am to 6 pm)	6	18
SMTWRFS	0	0
Mon	6	18
Tues	6	18
Wed	6	18
Thu	6	18
Fri	6	18
Sat	6	18
Sun	6	18

Proposed Occupancy Schedule:

	From	To
EXAMPLE (6:00am to 6 pm)	6	18
SMTWRFS	0	0
Mon	6	17
Tues	6	17
Wed	6	17
Thu	6	17
Fri	6	17
Sat	0	0
Sun	0	0

CFM 4000
Correction Factor 0.9432

Existing Cooling Usage (kWh): 19,420
Existing Heating Usage (Therms): 2,420

Cooling Savings (kWh): 5,705

Heating Savings (Therms): 935

		Existing Hours									Proposed Hours								
DAT	Cycling Factor	OAT BIN	CFM To Be Htd. Or Cld.	Outside Air CFM	Mixed Air Temp	BTU/Hr	kW/Ton & Htr Eff	kW & Therms/Hr	Run Hours	Energy kWh/Yr & Therms/Yr	OAT BIN	SF CFM	Outside Air CFM	Mixed Air Temp	BTU/Hr	kW/Ton & Htr Eff.	kW & Therms/Hr	Run Hours	Energy kWh/Yr & Therms/Yr
55.00	0.75	97	4,000	400	76.10	90,924	1.1	8.33	5	44	107	4,000	400	78.10	84,897	1.1	8.68	4	33
55.00	0.50	92	4,000	400	77.60	89,038	1.1	8.16	32	259	102	4,000	400	78.60	82,611	1.1	8.57	22	188
55.00	0.40	87	4,000	400	77.10	87,153	1.1	7.98	60	480	97	4,000	400	78.10	80,724	1.1	8.39	42	350
55.00	0.30	82	4,000	400	76.60	85,265	1.1	7.82	71	554	92	4,000	400	77.60	78,838	1.1	8.14	48	390
55.00	0.25	77	4,000	400	76.10	83,379	1.1	7.64	71	543	87	4,000	400	77.10	76,952	1.1	7.95	45	358
55.00	0.20	72	4,000	400	75.60	81,492	1.1	7.47	82	612	82	4,000	400	76.60	75,065	1.1	7.65	41	313
55.00	0.15	67	4,000	400	75.10	79,606	1.1	7.30	55	401	77	4,000	400	76.10	73,179	1.1	7.84	25	196
55.00	0.10	62	4,000	400	74.60	77,720	1.1	7.12	38	272	72	4,000	400	75.60	71,293	1.1	7.47	28	209
55.00	0.05	57	4,000	400	74.10	75,833	1.1	6.95	19	128	67	4,000	400	75.10	69,406	1.1	7.30	12	87
55.00	0.05	52	4,000	400	73.60	73,947	1.1	6.78	18	123	62	4,000	400	74.60	67,520	1.1	7.12	12	85
95.00	0.05	47	4,000	400	73.10	75,852	0.8	0.99	18	17	57	4,000	400	74.10	75,079	0.8	0.94	12	11
95.00	0.10	42	4,000	400	70.60	87,529	0.8	1.09	33	36	52	4,000	400	71.60	83,756	0.8	1.05	21	22
95.00	0.15	37	4,000	400	70.30	89,415	0.8	1.12	46	51	47	4,000	400	71.30	85,643	0.8	1.07	29	31
95.00	0.20	32	4,000	400	69.80	91,302	0.8	1.14	59	67	42	4,000	400	70.80	87,529	0.8	1.09	38	41
95.00	0.25	27	4,000	400	69.30	93,188	0.8	1.16	57	67	37	4,000	400	70.30	89,415	0.8	1.12	37	41
95.00	0.30	22	4,000	400	68.80	95,075	0.8	1.19	46	55	32	4,000	400	69.80	91,302	0.8	1.14	29	33
95.00	0.35	17	4,000	400	68.30	96,961	0.8	1.21	32	38	27	4,000	400	69.30	93,188	0.8	1.16	20	23
95.00	0.40	12	4,000	400	67.80	98,847	0.8	1.24	21	26	22	4,000	400	68.80	95,075	0.8	1.19	13	16
95.00	0.45	7	4,000	400	67.30	100,734	0.8	1.26	15	19	17	4,000	400	68.30	96,961	0.8	1.21	10	12
95.00	0.50	2	4,000	400	66.80	102,620	0.8	1.28	11	13	12	4,000	400	67.80	98,847	0.8	1.24	7	8
95.00	0.55	-3	4,000	400	66.30	104,507	0.8	1.31	5	7	7	4,000	400	67.30	100,734	0.8	1.26	3	4
95.00	0.60	-8	4,000	400	65.80	106,393	0.8	1.33	2	3	2	4,000	400	66.80	102,620	0.8	1.28	1	2
95.00	0.65	-13	4,000	400	65.30	108,279	0.8	1.35	1	1	-3	4,000	400	66.30	104,507	0.8	1.31	0	1
95.00	0.75	-18	4,000	400	64.80	110,166	0.8	1.38	1	2	-8	4,000	400	65.80	106,393	0.8	1.33	1	1
95.00	1.00	-23	4,000	400	64.30	112,052	0.8	1.40	0	0	-13	4,000	400	65.30	108,279	0.8	1.35	0	0
95.00	1.00	-28	4,000	400	63.80	113,939	0.8	1.42	0	0	-18	4,000	400	64.80	110,166	0.8	1.38	0	0
										773									510

EMC C1 - Fan Motor Savings

Date: 6/30/05
Building: Federal Warehouse
Equip. Name: RTU-7 (10 Tons)

NOTE: Highlighted Cells are user inputs

Current Occupancy Schedule:

	From:	To:	Hours:
EXAMPLE (6:00am to 6 pm)	6	18	12
SMTWRFS			0
Mon	5	17	12
Tues	5	17	12
Wed	5	17	12
Thu	5	17	12
Fri	5	17	12
Sat	5	17	12
Sun	5	17	12
			84

Note: Enter Half Hours as .5, for example 6.5 not 6:30

Proposed Occupancy Schedule:

	From:	To:	Hours:
EXAMPLE (6:00am to 6 pm)	6	18	12
SMTWRFS			0
Mon	6	17	11
Tues	6	17	11
Wed	6	17	11
Thu	6	17	11
Fri	6	17	11
Sat			0
Sun			0
			55

Note: Enter Half Hours as .5, for example 6.5 not 6:30

Supply Fan Motor Savings:

Inputs

HP:	3
Efficiency:	0.8
Load Factor:	0.75
# of Fans:	1
Existing Yearly Hrs:	773
Proposed Yearly Hrs:	510

kWh_savings: 552

Date: 6/30/05
Building: Federal Warehouse
Equip. Name: RTU-7 (10 Tons)

NOTE: Highlighted Cells are User Inputs

CURRENT CONDITIONS		PROPOSED CONDITIONS	
Heating Discharge Air Temp (DAT):	95 F	Heating Discharge Air Temp (DAT):	95 F
Cooling Discharge Air Temp (DAT):	55 F	Cooling Discharge Air Temp (DAT):	55 F
Heating Return Air Temp (RAT):	74 F	Heating Return Air Temp (RAT):	74 F
Cooling Return Air Temp (RAT):	78 F	Cooling Return Air Temp (RAT):	76 F
OA%:	10%	OA%	10%
RA%:	90%	RA%	90%
kW/ton rating of air-cooled A/C Unit:	1.1	kW/ton rating of air-cooled A/C Unit:	1.1
Supply Fan CFM:	4000 cfm	Supply Fan CFM	4000 cfm
Min. OA CFM	400		
Cooling Minimum Mixed Air Temp	55 F	Cooling Minimum Mixed Air Temp	55 F
Furnace Efficiency (0.75=75%)	0.8	Furnace Efficiency (0.75=75%)	0.8

Current Occupancy Schedule

	From	To
EXAMPLE (6:00am to 6 pm)	6	18
SMTWRFS	0	0
Mon	5	17
Tues	5	17
Wed	5	17
Thu	5	17
Fri	5	17
Sat	5	17
Sun	5	17

Proposed Occupancy Schedule

	From	To
EXAMPLE (6:00am to 6 pm)	6	18
SMTWRFS	0	0
Mon	6	17
Tues	6	17
Wed	6	17
Thu	6	17
Fri	6	17
Sat	0	0
Sun	0	0

CFM: 4000
Correction Factor: 0.9432

Existing Cooling Usage (kWh): 3,146
Existing Heating Usage (Therms): 417

Cooling Savings (kWh):
861

Heating Savings (Therms):
169

		Existing Hours									Proposed Hours								
DAT	Cycling Factor	OAT BIN	CFM To Be Htd Or Cld	Outside Air CFM	Mixed Air Temp	BTU/Hr	kW/Ton & Htr Eff	kW & Therms/Hr	Run Hours	Energy kWh/Yr & Therms/Yr	OAT BIN	SF CFM	Outside Air CFM	Mixed Air Temp	BTU/Hr	kW/Ton & Htr Eff	kW & Therms/Hr	Run Hours	Energy kWh/Yr & Therms/Yr
55.00	0.75	97	4,000	400	78.10	90,924	1.1	8.33	5	44	107	4,000	400	78.10	94,697	1.1	8.68	6	53
55.00	0.50	92	4,000	400	77.80	89,036	1.1	8.16	31	253	102	4,000	400	77.80	92,811	1.1	8.67	32	278
55.00	0.40	87	4,000	400	77.10	87,152	1.1	7.99	59	472	97	4,000	400	78.10	90,924	1.1	8.33	45	375
55.00	0.30	82	4,000	400	76.60	85,265	1.1	7.82	68	532	92	4,000	400	77.80	89,036	1.1	8.16	48	392
55.00	0.25	77	4,000	400	76.10	83,378	1.1	7.64	69	528	87	4,000	400	77.10	87,152	1.1	7.99	51	408
55.00	0.20	72	4,000	400	75.80	81,492	1.1	7.47	69	516	82	4,000	400	76.60	85,265	1.1	7.82	51	399
55.00	0.15	67	4,000	400	75.10	79,605	1.1	7.30	48	349	77	4,000	400	76.10	83,378	1.1	7.64	51	390
55.00	0.10	62	4,000	400	74.80	77,720	1.1	7.12	38	271	72	4,000	400	75.80	81,492	1.1	7.47	51	381
55.00	0.05	57	4,000	400	74.10	75,833	1.1	6.95	19	131	67	4,000	400	75.10	79,605	1.1	7.30	51	372
55.00	0.05	52	4,000	400	73.80	73,947	1.1	6.78	19	128	62	4,000	400	74.80	77,720	1.1	7.12	51	363
95.00	0.05	47	4,000	400	73.10	78,852	0.8	0.99	18	17	57	4,000	400	74.10	75,079	0.8	0.94	12	11
95.00	0.10	42	4,000	400	70.80	87,529	0.8	1.09	34	37	52	4,000	400	71.80	83,756	0.8	1.05	21	22
95.00	0.15	37	4,000	400	70.30	89,415	0.8	1.12	47	52	47	4,000	400	71.30	85,643	0.8	1.07	29	31
95.00	0.20	32	4,000	400	69.80	91,302	0.8	1.14	60	69	42	4,000	400	70.80	87,529	0.8	1.09	38	41
95.00	0.25	27	4,000	400	69.30	93,188	0.8	1.16	59	69	37	4,000	400	70.30	89,415	0.8	1.12	37	41
95.00	0.30	22	4,000	400	68.80	95,075	0.8	1.19	48	57	32	4,000	400	69.80	91,302	0.8	1.14	29	33
95.00	0.35	17	4,000	400	68.30	96,961	0.8	1.21	33	40	27	4,000	400	69.30	93,188	0.8	1.16	20	23
95.00	0.40	12	4,000	400	67.80	98,847	0.8	1.24	22	28	22	4,000	400	68.80	95,075	0.8	1.19	13	16
95.00	0.45	7	4,000	400	67.30	100,734	0.8	1.28	16	20	17	4,000	400	68.30	96,961	0.8	1.21	10	12
95.00	0.50	2	4,000	400	66.80	102,620	0.8	1.28	11	14	12	4,000	400	67.80	98,847	0.8	1.24	7	8
95.00	0.55	-3	4,000	400	66.30	104,507	0.8	1.31	5	7	7	4,000	400	67.30	100,734	0.8	1.26	3	4
95.00	0.60	-8	4,000	400	65.80	106,393	0.8	1.33	3	3	2	4,000	400	66.80	102,620	0.8	1.28	1	2
95.00	0.65	-13	4,000	400	65.30	108,279	0.8	1.35	1	1	-3	4,000	400	66.30	104,507	0.8	1.31	0	1
95.00	0.75	-18	4,000	400	64.80	110,166	0.8	1.38	1	2	-8	4,000	400	65.80	106,393	0.8	1.33	1	1
95.00	1.00	-23	4,000	400	64.30	112,052	0.8	1.40	0	1	-13	4,000	400	65.30	108,279	0.8	1.35	0	0
95.00	1.00	-28	4,000	400	63.80	113,939	0.8	1.42	0	0	-18	4,000	400	64.80	110,166	0.8	1.38	0	0
										773									510

EMC C1 - Fan Motor Savings

Date: 6/30/05
Building: Federal Warehouse
Equip. Name: RTU-10 (10 Tons)

NOTE: Highlighted Cells are user inputs

Current Occupancy Schedule:

	From:	To:	Hours:
EXAMPLE (6:00am to 6 pm)	6	18	12
SMTWRFS			0
Mon	0.0001	24	24
Tues	0.0001	24	24
Wed	0.0001	24	24
Thu	0.0001	24	24
Fri	0.0001	24	24
Sat	0.0001	24	24
Sun	0.0001	24	24
			168

Note: Enter Half hours as .5, for example 6.5 not 6:30

Proposed Occupancy Schedule:

	From:	To:	Hours:
EXAMPLE (6:00am to 6 pm)	6	18	12
SMTWRFS			0
Mon	6	17	11
Tues	6	17	11
Wed	6	17	11
Thu	6	17	11
Fri	6	17	11
Sat			0
Sun			0
			55

Note: Enter Half hours as .5, for example 6.5 not 6:30

Supply Fan Motor Savings:

Inputs:

HP:	3
Efficiency:	0.8
Load Factor:	0.75
# of Fans:	1
Existing Yearly Hrs:	1,489
Proposed Yearly Hrs:	510

kWh_savings: 2,056

Date: 6/30/05
Building: Federal Warehouse
Equip Name: RTU-10 (10 Tons)

NOTE: Highlighted Cells are user inputs

CURRENT CONDITIONS		PROPOSED CONDITIONS	
Heating Discharge Air Temp (DAT):	95 F	Heating Discharge Air Temp (DAT):	95 F
Cooling Discharge Air Temp (DAT):	55 F	Cooling Discharge Air Temp (DAT):	55 F
Heating Return Air Temp (RAT):	74 F	Heating Return Air Temp (RAT):	74 F
Cooling Return Air Temp (RAT):	78 F	Cooling Return Air Temp (RAT):	78 F
OA%:	10%	OA%:	10%
RA%:	90%	RA%:	90%
kW/ton rating of air-cooled A/C Unit:	1.1	kW/ton rating of air-cooled A/C Unit:	1.1
Supply Fan CFM:	4000 cfm	Supply Fan CFM:	4000 cfm
Min. OA CFM:	400		
Cooling Minimum Mixed Air Temp:	55 F	Cooling Minimum Mixed Air Temp:	55 F
Furnace Efficiency (0.75=75%):	0.8	Furnace Efficiency (0.75=75%):	0.8

Current Occupancy Schedule

	From:	To:
EXAMPLE (6:00am to 6 pm)	6	18
SMTWRFS	0	0
Mon	0.0001	24
Tues	0.0001	24
Wed	0.0001	24
Thu	0.0001	24
Fri	0.0001	24
Sat	0.0001	24
Sun	0.0001	24

Proposed Occupancy Schedule

	From	To:
EXAMPLE (5:00am to 6 pm)	6	18
SMTWRFS	0	0
Mon	6	17
Tues	6	17
Wed	6	17
Thu	6	17
Fri	6	17
Sat	0	0
Sun	0	0

CFM: 4000
Correction Factor: 0.9432

Existing Cooling Usage (kWh): 4,806
Existing Heating Usage (Therms): 990

Cooling Savings (kWh): 2,520

Heating Savings (Therms): 743

		Existing Hours										Proposed Hours									
DAT	Cycling Factor	OAT BIN	CFM To Be Htd Or Cld	Outside Air CFM	Mixed Air Temp	BTU/Hr	kW/Ton & Btr Eff	kW & Therms/Hr	Run Hours	Energy kWh/Yr & Therms/Yr		OAT BIN	SF CFM	Outside Air CFM	Mixed Air Temp	BTU/Hr	kW/Ton & Btr. Eff	kW & Therms/Hr	Run Hours	Energy kWh/Yr & Therms/Yr	
55.00	0.75	97	4,000	400	78.10	90,024	1.1	8.33	6	44		107	4,000	400	78.10	94,697	1.1	8.68	4	33	
55.00	0.50	92	4,000	400	77.60	89,038	1.1	8.16	38	290		102	4,000	400	78.10	92,611	1.1	8.54	22	181	
55.00	0.40	87	4,000	400	77.10	87,152	1.1	7.99	70	538		97	4,000	400	78.10	90,524	1.1	8.33	42	330	
55.00	0.30	82	4,000	400	76.60	85,266	1.1	7.82	87	662		92	4,000	400	77.60	89,038	1.1	8.16	49	371	
55.00	0.25	77	4,000	400	78.10	83,378	1.1	7.64	96	734		87	4,000	400	77.10	87,152	1.1	7.99	48	368	
55.00	0.20	72	4,000	400	75.60	81,492	1.1	7.47	98	736		82	4,000	400	76.60	85,266	1.1	7.82	41	322	
55.00	0.15	67	4,000	400	75.10	79,606	1.1	7.30	83	606		77	4,000	400	75.10	83,378	1.1	7.64	32	246	
55.00	0.10	62	4,000	400	74.60	77,720	1.1	7.12	79	565		72	4,000	400	74.60	81,492	1.1	7.47	25	186	
55.00	0.05	57	4,000	400	74.10	75,833	1.1	6.95	39	270		67	4,000	400	74.10	79,606	1.1	7.30	12	89	
55.00	0.05	52	4,000	400	73.60	73,947	1.1	6.78	37	250		62	4,000	400	73.60	77,720	1.1	7.12	12	86	
95.00	0.05	47	4,000	400	73.10	78,852	0.8	0.99	36	36		57	4,000	400	74.10	75,079	0.8	0.94	12	11	
95.00	0.10	42	4,000	400	70.80	87,529	0.8	1.09	75	82		52	4,000	400	71.80	83,756	0.8	1.05	21	22	
95.00	0.15	37	4,000	400	70.30	89,415	0.8	1.12	109	121		47	4,000	400	71.30	85,643	0.8	1.07	29	31	
95.00	0.20	32	4,000	400	69.80	91,302	0.8	1.14	141	161		42	4,000	400	70.80	87,529	0.8	1.09	38	41	
95.00	0.25	27	4,000	400	69.30	93,188	0.8	1.16	139	162		37	4,000	400	70.30	89,415	0.8	1.12	37	41	
95.00	0.30	22	4,000	400	68.80	95,075	0.8	1.19	118	140		32	4,000	400	69.80	91,302	0.8	1.14	29	33	
95.00	0.35	17	4,000	400	68.30	96,961	0.8	1.21	85	103		27	4,000	400	69.30	93,188	0.8	1.16	20	23	
95.00	0.40	12	4,000	400	67.80	98,847	0.8	1.24	55	68		22	4,000	400	68.80	95,075	0.8	1.19	13	16	
95.00	0.45	7	4,000	400	67.30	100,734	0.8	1.26	38	48		17	4,000	400	68.30	96,961	0.8	1.21	10	12	
95.00	0.50	2	4,000	400	66.80	102,620	0.8	1.28	27	35		12	4,000	400	67.80	98,847	0.8	1.24	7	8	
95.00	0.55	-3	4,000	400	66.30	104,507	0.8	1.31	12	16		7	4,000	400	67.30	100,734	0.8	1.26	3	4	
95.00	0.60	-8	4,000	400	65.80	106,393	0.8	1.33	8	10		2	4,000	400	66.80	102,620	0.8	1.28	1	2	
95.00	0.65	-13	4,000	400	65.30	108,279	0.8	1.35	3	4		-3	4,000	400	66.30	104,507	0.8	1.31	0	1	
95.00	0.75	-18	4,000	400	64.80	110,166	0.8	1.38	2	3		-8	4,000	400	65.80	106,393	0.8	1.33	1	1	
95.00	1.00	-23	4,000	400	64.30	112,052	0.8	1.40	1	1		-13	4,000	400	65.30	108,279	0.8	1.35	0	0	
95.00	1.00	-28	4,000	400	63.80	113,939	0.8	1.42	0	0		-18	4,000	400	64.80	110,166	0.8	1.38	0	0	
										1,489											510

Tri County Health EMCS & Programmable Thermostats Savings Summary

Building	Unit ID:	Fan Motor Savings (kWh)	Cooling Savings (kWh):	Heating Savings (Therms):	Total Savings (kWh):
Tri County Health	RTU-1 & RTU-3	391	1,472	451	1,863
Tri County Health	AC-1, F-3 to F-6	979	4,906	1,505	5,884
Tri County Health	RTU-2	381	1,226	376	1,607
	TOTALS	**1,750**	**7,604**	**2,332**	**9,354**

Date: 6/30/05
Building: Tri County Health
Equip. Name: RTU-1 & RTU-3 (3 Tons)

NOTE: Highlighted Cells are user inputs

Current Occupancy Schedule:

	From:	To:	Hours:
EXAMPLE (6:00am to 6 pm)	6	18	12
SMTWRFS			0
Mon	0.0001	24	24
Tues	0.0001	24	24
Wed	0.0001	24	24
Thu	0.0001	24	24
Fri	0.0001	24	24
Sat	0.0001	24	24
Sun	0.0001	24	24
			168

Note: Enter Half hours as .5, for example 6:30 not 6.30

Proposed Occupancy Schedule:

	From:	To:	Hours:
EXAMPLE (6:00am to 6 pm)	6	18	12
SMTWRFS			0
Mon	7	18	11
Tues	7	18	11
Wed	7	18	11
Thu	7	18	11
Fri	7	18	11
Sat			0
Sun			0
			55

Note: Enter Half hours as .5, for example 6:30 not 6.30

Supply Fan Motor Savings:

Inputs:

HP:	0.25
Efficiency:	0.7
Load Factor:	0.75
# of Fans:	2
Existing Yearly Hrs:	1,489
Proposed Yearly Hrs:	510

kWh_savings: 391

Date: 5/30/05
Building: Tri County Health
Equip. Name: RTU-1 & RTU-3 (3 Tons)

NOTE: Highlighted Cells are user inputs

CURRENT CONDITIONS		PROPOSED CONDITIONS	
Heating Discharge Air Temp (DAT):	85 F	Heating Discharge Air Temp (DAT)	95 F
Cooling Discharge Air Temp (DAT):	55 F	Cooling Discharge Air Temp (DAT)	55 F
Heating Return Air Temp (RAT):	74 F	Heating Return Air Temp (RAT):	74 F
Cooling Return Air Temp (RAT):	78 F	Cooling Return Air Temp (RAT):	78 F
OA%	10%	OA%	10%
RA%	90%	RA%	90%
kW/ton rating of air-cooled A/C Unit	1.1	kW/ton rating of air-cooled A/C Unit	1.1
Supply Fan CFM:	1200 cfm	Supply Fan CFM	1200 cfm
Min OA CFM	120		
Cooling Minimum Mixed Air Temp	55 F	Cooling Minimum Mixed Air Temp	55 F
Furnace Efficiency (0.75=75%)	0.8	Furnace Efficiency (0.75=75%)	0.8

Current Occupancy Schedule

EXAMPLE (6:00am to 6 pm)	From: 6	To: 18
SMTWRFS	0	0
Mon	0.0001	24
Tues	0.0001	24
Wed	0.0001	24
Thu	0.0001	24
Fri	0.0001	24
Sat	0.0001	24
Sun	0.0001	24

Proposed Occupancy Schedule

EXAMPLE (6:00am to 6 pm)	From: 6	To: 18
SMTWRFS	0	0
Mon	7	18
Tues	7	18
Wed	7	18
Thu	7	18
Fri	7	18
Sat	0	0
Sun	0	0

CFM: 1200
Correction Factor: 0.9432

Existing Cooling Usage (kWh): 2,884
Existing Heating Usage (Therms): 594

Cooling Savings (kWh):
1,472

Heating Savings (Therms):
451

		Existing Hours									Proposed Hours								
DAT	Cycling Factor	OAT BIN	CFM To Bc Htd Or Cld	Outside Air CFM	Mixed Air Temp	BTU/Hr	kW/Ton & Btr Eff	kW & Therms/Hr	Run Hours	Energy kWh/Yr & Therms/Yr	OAT BIN	SF CFM	Outside Air CFM	Mixed Air Temp	BTU/Hr	kW/Ton & Btr. Eff	kW & Therms/Hr	Run Hours	Energy kWh/Yr & Therms/Yr
55.00	0.75	97	1,200	120	78.10	27,277	1.1	2.50	5	13	107	1,200	120	79.10	28,409	1.1	2.60	4	10
55.00	0.50	92	1,200	120	77.60	26,711	1.1	2.45	35	87	102	1,200	120	78.60	27,843	1.1	2.55	21	56
55.00	0.40	87	1,200	120	77.10	26,146	1.1	2.40	70	167	97	1,200	120	78.10	27,277	1.1	2.50	43	109
55.00	0.30	82	1,200	120	76.60	25,580	1.1	2.34	97	205	92	1,200	120	77.60	26,711	1.1	2.45	51	124
55.00	0.25	77	1,200	120	76.10	25,014	1.1	2.29	98	220	87	1,200	120	77.10	26,146	1.1	2.40	60	134
55.00	0.20	72	1,200	120	75.60	24,449	1.1	2.24	98	215	82	1,200	120	76.60	25,580	1.1	2.34	64	137
55.00	0.15	67	1,200	120	75.10	23,882	1.1	2.19	80	204	77	1,200	120	75.10	25,014	1.1	2.29	60	137
55.00	0.10	62	1,200	120	74.60	23,316	1.1	2.14	70	170	72	1,200	120	74.60	24,449	1.1	2.24	55	123
55.00	0.05	57	1,200	120	74.10	22,750	1.1	2.09	30	81	67	1,200	120	74.10	23,882	1.1	2.19	17	38
55.00	0.05	52	1,200	120	73.60	22,184	1.1	2.03	37	75	62	1,200	120	73.60	23,316	1.1	2.14	17	36
95.00	0.05	47	1,200	120	73.10	23,655	0.8	0.30	36	11	57	1,200	120	74.10	22,524	0.8	0.28	11	3
95.00	0.10	42	1,200	120	70.80	26,259	0.8	0.33	75	25	52	1,200	120	71.80	25,127	0.8	0.31	21	7
95.00	0.15	37	1,200	120	70.30	26,825	0.8	0.34	109	38	47	1,200	120	71.30	25,693	0.8	0.32	29	9
95.00	0.20	32	1,200	120	69.80	27,391	0.8	0.34	141	48	42	1,200	120	70.80	26,259	0.8	0.33	37	12
95.00	0.25	27	1,200	120	69.30	27,956	0.8	0.35	139	48	37	1,200	120	70.30	26,825	0.8	0.34	35	12
95.00	0.30	22	1,200	120	68.80	28,522	0.8	0.36	118	42	32	1,200	120	69.80	27,391	0.8	0.34	28	10
95.00	0.35	17	1,200	120	68.30	29,088	0.8	0.36	85	31	27	1,200	120	69.30	27,958	0.8	0.35	19	7
95.00	0.40	12	1,200	120	67.80	29,654	0.8	0.37	55	20	22	1,200	120	68.80	28,522	0.8	0.36	12	4
95.00	0.45	7	1,200	120	67.30	30,220	0.8	0.38	38	14	17	1,200	120	68.30	29,088	0.8	0.36	9	3
95.00	0.50	2	1,200	120	66.80	30,786	0.8	0.38	27	10	12	1,200	120	67.80	29,654	0.8	0.37	6	2
95.00	0.55	-3	1,200	120	66.30	31,352	0.8	0.39	12	5	7	1,200	120	67.30	30,220	0.8	0.38	3	1
95.00	0.60	-8	1,200	120	65.80	31,918	0.8	0.40	8	3	2	1,200	120	66.80	30,786	0.8	0.38	1	1
95.00	0.65	-13	1,200	120	65.30	32,484	0.8	0.41	3	1	-3	1,200	120	66.30	31,352	0.8	0.39	0	0
95.00	0.75	-18	1,200	120	64.80	33,050	0.8	0.41	2	1	-8	1,200	120	65.80	31,918	0.8	0.40	1	0
95.00	1.00	-23	1,200	120	64.30	33,616	0.8	0.42	1	0	-13	1,200	120	65.30	32,484	0.8	0.41	0	0
95.00	1.00	-28	1,200	120	63.80	34,182	0.8	0.43	0	0	-18	1,200	120	64.80	33,050	0.8	0.41	0	0
										1,489									510

Date: 6/30/05
Building: Tri County Health
Equip. Name: AC-1 & F-3 to F-6 (4 Tons)

NOTE: Highlighted Cells are user inputs

Current Occupancy Schedule

	From:	To	Hours
EXAMPLE (6:00am to 6 pm)	6	18	12
SMTWRFS			0
Mon	0.0001	24	24
Tues	0.0001	24	24
Wed	0.0001	24	24
Thu	0.0001	24	24
Fri	0.0001	24	24
Sat	0.0001	24	24
Sun	0.0001	24	24
			168

Note: Enter Half hours as .5, for example 6.5 not 6:30

Proposed Occupancy Schedule:

	From:	To:	Hours:
EXAMPLE (6:00am to 6 pm)	6	18	12
SMTWRFS			0
Mon	7	18	11
Tues	7	18	11
Wed	7	18	11
Thu	7	18	11
Fri	7	18	11
Sat			0
Sun			0
			55

Note: Enter Half hours as .5, for example 6.5 not 6:30

Supply Fan Motor Savings.

Inputs.

HP:	0.25
Efficiency:	0.7
Load Factor:	0.75
# of Fans:	5
Existing Yearly Hrs:	1,489
Proposed Yearly Hrs	510

kWh_savings: 979

Date: 6/30/05
Building: Tri County Health
Equip. Name: AC-1 & F-3 to F-6 (4 Tons)

NOTE: Highlighted Cells are user inputs

CURRENT CONDITIONS			PROPOSED CONDITIONS		
Heating Discharge Air Temp (DAT)	95	F	Heating Discharge Air Temp (DAT)	95	F
Cooling Discharge Air Temp (DAT)	55	F	Cooling Discharge Air Temp (DAT)	55	F
Heating Return Air Temp (RAT)	74	F	Heating Return Air Temp (RAT)	74	F
Cooling Return Air Temp (RAT)	76	F	Cooling Return Air Temp (RAT)	76	F
OA%	10%		OA%	10%	
RA%	90%		RA%	90%	
kW/ton rating of air-cooled A/C Unit:	1.1		kW/ton rating of air-cooled A/C Unit:	1.1	
Supply Fan CFM:	1600	cfm	Supply Fan CFM	1600	cfm
Min. OA CFM:	160				
Cooling Minimum Mixed Air Temp	55	F	Cooling Minimum Mixed Air Temp	55	F
Furnace Efficiency (0.75=75%):	0.8		Furnace Efficiency (0.75=75%)	0.8	

Current Occupancy Schedule:

EXAMPLE (6:00am to 6 pm)	From 6	To 18
SMTWRFS	0	0
Mon	0.0001	24
Tues	0.0001	24
Wed	0.0001	24
Thu	0.0001	24
Fri	0.0001	24
Sat	0.0001	24
Sun	0.0001	24

Proposed Occupancy Schedule

EXAMPLE (6:00am to 6 pm)	From 6	To 18
SMTWRFS	0	0
Mon	7	18
Tues	7	18
Wed	7	18
Thu	7	18
Fri	7	18
Sat	0	0
Sun	0	0

CFM: 1600
Correction Factor: 0.9432

Existing Cooling Usage (kWh): 9,612
Existing Heating Usage (Therms): 1,981

Cooling Savings (kWh):
4,906

Heating Savings (Therms):
1,505

		Existing Hours									Proposed Hours								
DAT	Cycling Factor	OAT BIN	CFM To Be Htd. Or Cld	Outside Air CFM	Mixed Air Temp	BTU/Hr	kW/Ton & Blr Eff	kW & Therms/Hr	Run Hours	Energy kWh/Yr & Therms/Yr	OAT BIN	SF CFM	Outside Air CFM	Mixed Air Temp	BTU/Hr	kW/Ton & Blr. Eff.	kW & Therms/Hr	Run Hours	Energy kWh/Yr & Therms/Yr
55.00	0.75	97	1,600	160	78.10	36,370	1.1	3.33	5	18	107	1,600	160	79.10	37,879	1.1	3.47	4	13
55.00	0.50	92	1,600	160	77.60	35,615	1.1	3.26	36	116	102	1,600	160	78.60	37,129	1.1	3.40	23	77
55.00	0.40	87	1,600	160	77.10	34,861	1.1	3.20	70	222	97	1,600	160	78.10	36,370	1.1	3.33	43	144
55.00	0.30	82	1,600	160	76.60	34,106	1.1	3.13	87	273	92	1,600	160	77.60	35,615	1.1	3.26	51	166
55.00	0.25	77	1,600	160	76.10	33,352	1.1	3.06	96	293	87	1,600	160	77.10	34,861	1.1	3.20	60	181
55.00	0.20	72	1,600	160	75.60	32,597	1.1	2.99	98	295	82	1,600	160	76.60	34,106	1.1	3.13	44	138
55.00	0.15	67	1,600	160	75.10	31,842	1.1	2.92	93	271	77	1,600	160	76.10	33,352	1.1	3.06	33	102
55.00	0.10	62	1,600	160	74.60	31,088	1.1	2.85	79	226	72	1,600	160	75.60	32,597	1.1	2.99	29	74
55.00	0.05	57	1,600	160	74.10	30,333	1.1	2.78	39	108	67	1,600	160	75.10	31,842	1.1	2.92	12	35
55.00	0.05	52	1,600	160	73.60	29,579	1.1	2.71	37	100	62	1,600	160	74.60	31,088	1.1	2.85	12	34
95.00	0.05	47	1,600	160	73.10	31,541	0.8	0.39	38	14	57	1,600	160	74.10	30,031	0.8	0.38	11	4
95.00	0.10	42	1,600	160	70.80	35,012	0.8	0.44	75	33	52	1,600	160	71.80	33,502	0.8	0.42	21	9
95.00	0.15	37	1,600	160	70.30	35,766	0.8	0.45	109	49	47	1,600	160	71.30	34,257	0.8	0.43	29	12
95.00	0.20	32	1,600	160	69.80	36,521	0.8	0.46	141	64	42	1,600	160	70.80	35,012	0.8	0.44	37	16
95.00	0.25	27	1,600	160	69.30	37,275	0.8	0.47	139	65	37	1,600	160	70.30	35,766	0.8	0.45	35	15
95.00	0.30	22	1,600	160	68.80	38,030	0.8	0.48	118	56	32	1,600	160	69.80	36,521	0.8	0.46	28	13
95.00	0.35	17	1,600	160	68.30	38,784	0.8	0.48	85	41	27	1,600	160	69.30	37,275	0.8	0.47	19	9
95.00	0.40	12	1,600	160	67.80	39,539	0.8	0.49	55	27	22	1,600	160	68.80	38,030	0.8	0.48	12	6
95.00	0.45	7	1,600	160	67.30	40,294	0.8	0.50	38	19	17	1,600	160	68.30	38,784	0.8	0.48	9	4
95.00	0.50	2	1,600	160	66.80	41,048	0.8	0.51	27	14	12	1,600	160	67.80	39,539	0.8	0.49	6	3
95.00	0.55	-3	1,600	160	66.30	41,803	0.8	0.52	12	6	7	1,600	160	67.30	40,294	0.8	0.50	3	2
95.00	0.60	-8	1,600	160	65.80	42,557	0.8	0.53	8	4	2	1,600	160	66.80	41,048	0.8	0.51	1	1
95.00	0.65	-13	1,600	160	65.30	43,312	0.8	0.54	3	2	-3	1,600	160	66.30	41,803	0.8	0.52	0	0
95.00	0.75	-18	1,600	160	64.80	44,066	0.8	0.55	2	1	-8	1,600	160	65.80	42,557	0.8	0.53	1	0
95.00	1.00	-23	1,600	160	64.30	44,821	0.8	0.56	1	1	-13	1,600	160	65.30	43,312	0.8	0.54	0	0
95.00	1.00	-28	1,600	160	63.80	45,575	0.8	0.57	0	0	-18	1,600	160	64.80	44,066	0.8	0.55	0	0
										1,489									510

Date: 6/30/05
Building: Tri County Health
Equip Name: RTU-2 (5 Tons)

NOTE: Highlighted Cells are user inputs

Current Occupancy Schedule:

	From:	To:	Hours:	
EXAMPLE (6:00am to 6 pm)	6	18	12	
SMTWRFS			0	Note: Enter Half hours as .5, for example 6.5 not 6:30
Mon	0.0001	24	24	
Tues	0.0001	24	24	
Wed	0.0001	24	24	
Thu	0.0001	24	24	
Fri	0.0001	24	24	
Sat	0.0001	24	24	
Sun	0.0001	24	24	
			168	

Proposed Occupancy Schedule:

	From:	To:	Hours:	
EXAMPLE (6:00am to 6 pm)	6	18	12	
SMTWRFS			0	Note: Enter Half hours as .5, for example 6.5 not 6:30
Mon	7	18	11	
Tues	7	18	11	
Wed	7	18	11	
Thu	7	18	11	
Fri	7	18	11	
Sat			0	
Sun			0	
			55	

Supply Fan Motor Savings:

Inputs:

HP:	0.5
Efficiency:	0.72
Load Factor:	0.75
# of Fans	1
Existing Yearly Hrs:	1,489
Proposed Yearly Hrs:	510

kWh_savings: 381

Date: 6/30/05
Building: Tri County Health
Equip. Name: RTU-2 (5 Tons)

NOTE: Highlighted Cells are user inputs

CURRENT CONDITIONS		PROPOSED CONDITIONS	
Heating Discharge Air Temp (DAT):	95 F	Heating Discharge Air Temp (DAT):	95 F
Cooling Discharge Air Temp (DAT):	55 F	Cooling Discharge Air Temp (DAT):	55 F
Heating Return Air Temp (RAT):	74 F	Heating Return Air Temp (RAT):	74 F
Cooling Return Air Temp (RAT):	76 F	Cooling Return Air Temp (RAT):	76 F
OA%	10%	OA%	10%
RA%	90%	RA%	90%
kW/ton rating of air-cooled A/C Unit:	1.1	kW/ton rating of air-cooled A/C Unit:	1.1
Supply Fan CFM:	2000 cfm	Supply Fan CFM	2000 cfm
Min OA CFM	200		
Cooling Minimum Mixed Air Temp	55 F	Cooling Minimum Mixed Air Temp.	55 F
Furnace Efficiency (0.75=75%):	0.8	Furnace Efficiency (0.75=75%):	0.8

Current Occupancy Schedule

	From:	To
EXAMPLE (6.00am to 6 pm)	6	18
SMTWRFS	0	0
Mon	0.0001	24
Tues	0.0001	24
Wed	0.0001	24
Thu	0.0001	24
Fri	0.0001	24
Sat	0.0001	24
Sun	0.0001	24

Proposed Occupancy Schedule

	From	To
EXAMPLE (6.00am to 6 pm)	6	18
SMTWRFS	0	0
Mon	7	18
Tues	7	18
Wed	7	18
Thu	7	18
Fri	7	18
Sat	0	0
Sun	0	0

CFM: 2000
Correction Factor: 0.9432

Existing Cooling Usage (kWh): 2,403
Existing Heating Usage (Therms): 495

Cooling Savings (kWh):
1,226

Heating Savings (Therms):
376

		Existing Hours									Proposed Hours								
DAT	Cycling Factor	OAT BIN	CFM To Be Htd Or Cld	Outside Air CFM	Mixed Air Temp	BTU/Hr	kW/Ton & Btr Eff	kW & Therms/Hr	Run Hours	Energy kWh/Yr & Therms/Yr	OAT BIN	SF CFM	Outside Air CFM	Mixed Air Temp	BTU/Hr	kW/Ton & Btr. Eff.	kW & Therms/Hr	Run Hours	Energy kWh/Yr & Therms/Yr
95.00	0.75	97	2,000	200	78.10	45,462	1.1	4.17	5	22	107	2,000	200	79.10	47,349	1.1	4.34	4	19
95.00	0.50	92	2,000	200	77.60	44,518	1.1	4.08	38	156	102	2,000	200	78.60	46,405	1.1	4.25	23	94
95.00	0.40	87	2,000	200	77.10	43,578	1.1	3.99	70	278	97	2,000	200	78.10	45,462	1.1	4.17	43	178
95.00	0.30	82	2,000	200	76.60	42,633	1.1	3.91	97	381	92	2,000	200	77.60	44,518	1.1	4.08	61	247
95.00	0.25	77	2,000	200	76.10	41,689	1.1	3.82	88	337	87	2,000	200	77.10	43,578	1.1	3.99	59	231
95.00	0.20	72	2,000	200	75.60	40,746	1.1	3.74	99	369	82	2,000	200	76.60	42,633	1.1	3.91	74	276
95.00	0.15	67	2,000	200	75.10	39,803	1.1	3.65	83	303	77	2,000	200	76.10	41,689	1.1	3.82	63	230
95.00	0.10	62	2,000	200	74.60	38,860	1.1	3.56	79	282	72	2,000	200	75.60	40,746	1.1	3.74	75	267
95.00	0.05	57	2,000	200	74.10	37,917	1.1	3.48	39	135	67	2,000	200	75.10	39,803	1.1	3.65	37	127
95.00	0.05	52	2,000	200	73.60	36,973	1.1	3.39	37	125	62	2,000	200	74.60	38,860	1.1	3.56	12	41
95.00	0.05	47	2,000	200	73.10	36,428	0.8	0.49	36	18	57	2,000	200	74.10	37,539	0.8	0.47	11	5
95.00	0.10	42	2,000	200	72.60	43,784	0.8	0.55	75	41	52	2,000	200	71.80	41,678	0.8	0.52	21	11
95.00	0.15	37	2,000	200	70.30	44,708	0.8	0.58	109	61	47	2,000	200	71.30	42,821	0.8	0.54	29	15
95.00	0.20	32	2,000	200	69.80	45,651	0.8	0.57	141	80	42	2,000	200	70.80	43,764	0.8	0.55	37	20
95.00	0.25	27	2,000	200	69.30	46,594	0.8	0.58	139	81	37	2,000	200	70.30	44,708	0.8	0.56	35	20
95.00	0.30	22	2,000	200	68.80	47,537	0.8	0.59	118	70	32	2,000	200	69.80	45,651	0.8	0.57	28	16
95.00	0.35	17	2,000	200	68.30	48,480	0.8	0.61	85	52	27	2,000	200	69.30	46,594	0.8	0.58	19	11
95.00	0.40	12	2,000	200	67.80	49,424	0.8	0.62	55	34	22	2,000	200	68.80	47,537	0.8	0.59	12	7
95.00	0.45	7	2,000	200	67.30	50,367	0.8	0.63	38	24	17	2,000	200	68.30	48,480	0.8	0.61	9	6
95.00	0.50	2	2,000	200	66.80	51,310	0.8	0.64	27	17	12	2,000	200	67.80	49,424	0.8	0.62	6	4
95.00	0.55	-3	2,000	200	66.30	52,253	0.8	0.65	12	8	7	2,000	200	67.30	50,367	0.8	0.63	3	2
95.00	0.60	-8	2,000	200	65.80	53,196	0.8	0.66	8	5	2	2,000	200	66.80	51,310	0.8	0.64	1	1
95.00	0.65	-13	2,000	200	65.30	54,140	0.8	0.68	3	2	-3	2,000	200	66.30	52,253	0.8	0.65	0	0
95.00	0.75	-18	2,000	200	64.80	55,083	0.8	0.69	2	2	-8	2,000	200	65.80	53,196	0.8	0.66	1	0
95.00	1.00	-23	2,000	200	64.30	56,026	0.8	0.70	1	1	-13	2,000	200	65.30	54,140	0.8	0.68	0	0
95.00	1.00	-28	2,000	200	63.80	56,969	0.8	0.71	0	0	-18	2,000	200	64.80	55,083	0.8	0.69	0	0
										1,489									510

MODELING NOTES

ARAPAHOE COUNTY - PEORIA SHOPS

ECM Run: Install a New EMCS/Programmable Thermostats

Fan System	Item Changed	Previous Run Input	Current Run Input
Rm 1 (UHs & MAUs)	Heating Driftpoint	70F	55F
Rm 2 (RTU-3)	Heating Driftpoint	70F	55F
Rm 3 (RTU-1 & RTU-2)	Cooling Driftpoint Heating Driftpoint	75F 70F	95F 55F

NOTE: The units above shall cylce on during the occupied period to maintain the space temperature setpoint as governed by the existing space thermostat. The units above shall cycle on during the unoccupied period to maintain the night setback temperatures above as governed by the new EMCS or programmable thermostat.

Previous Run (New Lighting Run):

Annual kWh Usage:	194,579
Annual kW Usage:	773
Annual Therms Usage:	24,278

Current Run (Install New EMCS/Prog Tstat Run):

Annual kWh Usage:	186,287
Annual kW Usage:	778
Annual Therms Usage:	12,476

Savings (Install New EMCS/Prog Tstat Savings):

Annual kWh Savings:	8,292
Annual kW Savings:	-5
Annual Therms Savings:	11,801

Notes:

1. The negative kW savings is the result of all of the unit heaters coming on at once in the mornings due to the schedule change. These negative savings shall not be accounted for since the upgraded EMCS shall heat each space up gradually.

ECM 5 – Replace the Existing Chillers and Cooling Tower

Please refer to the Energy Conservation Measure (ECM) section of this report for additional information.

Existing Condition to Warrant an ECM Opportunity:
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 in the building to the outdoors. The second condenser is piped to the building's hot water system which transfers the heat generated in the building 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 cooling tower has reached the end of its useful life too. This ECM concerns replacing the existing chillers and cooling tower. The two new chillers shall be high efficient, water-cooled chillers.

Savings Calculation Methodolgy:
The implementation of this ECM shall result in positive electrical savings and negative natural gas savings. The savings for this ECM were calculated utilizing two Trane Trace building energy simulation models. The first model included the existing heat recovery chillers and the second model was modified to include the new high efficient chillers. The annual energy consumption calculated from each model was subtracted from one another to produce the annual energy savings. The negative natural gas savings reflects the effects of the heat recovery chiller no longer being used to preheat the hot water return.

Figure 1

Arapahoe County - Admin I Building
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	217,183	160,605	26%
Feb	189,788	145,184	24%
Mar	229,311	168,223	27%
Apr	218,456	194,211	11%
May	243,374	236,417	3%
Jun	248,088	246,541	1%
Jul	270,700	246,323	9%
Aug	264,710	258,730	2%
Sep	243,348	223,995	8%
Oct	232,915	230,945	1%
Nov	220,561	174,307	21%
Dec	216,466	156,768	28%
	2,794,900	2,442,249	13%

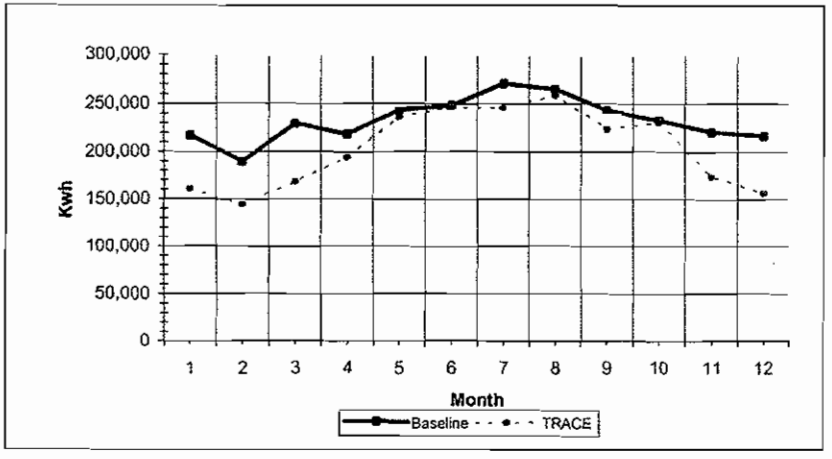
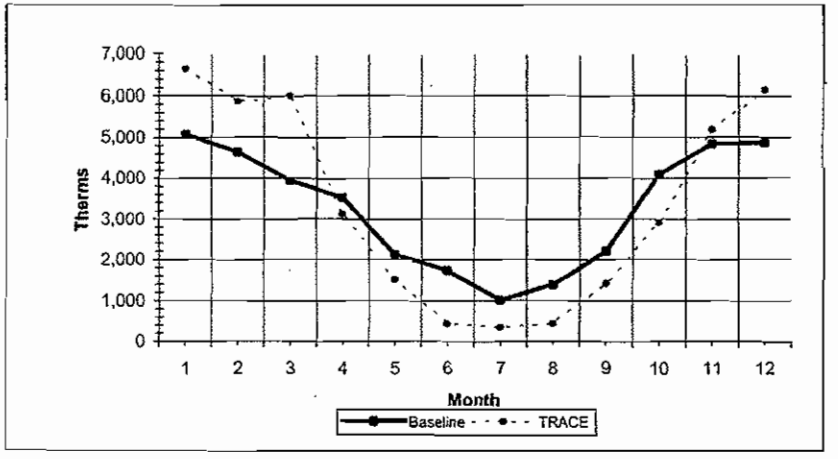


Figure 2

Arapahoe County - Admin I Building
Computer Model Calibration for Natural Gas

NATURAL GAS USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	5,080	6,648	-31%
Feb	4,650	5,870	-26%
Mar	3,950	6,011	-52%
Apr	3,550	3,128	12%
May	2,140	1,521	29%
Jun	1,740	449	74%
Jul	1,010	353	65%
Aug	1,390	443	68%
Sep	2,220	1,421	36%
Oct	4,110	2,921	29%
Nov	4,850	5,181	-7%
Dec	4,870	6,142	-26%
	39,560	40,089	-1%



MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - Match

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	160,605	145,184	168,223	194,211	236,417	246,541	246,323	258,730	223,995	230,945	174,307	156,768	2,442,249
On-Pk Demand (kW)	410	410	410	648	665	673	684	676	665	664	575	410	684
Gas													
On-Pk Cons. (therms)	6,648	5,870	6,011	3,128	1,521	449	353	443	1,421	2,921	5,181	6,142	40,089
On-Pk Demand (therms/hr)	38	39	38	36	35	6	2	3	35	36	37	38	39
Water													
Cons. (1000gal)	0	0	0	104	215	258	298	281	197	155	24	0	1,533

Building Energy Consumption = 110,260 Btu/(ft2-year)
Source Energy Consumption = 261,072 Btu/(ft2-year)
Floor Area = 111,956 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - Lighting Run

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	140,796	127,277	147,458	172,897	212,943	223,527	222,829	233,874	199,514	211,337	138,488	137,436	2,168,375
On-Pk Demand (kW)	358	358	358	586	593	609	619	612	607	600	358	358	619
Gas													
On-Pk Cons. (therms)	6,751	5,968	6,114	3,168	1,499	476	353	465	1,708	2,917	5,907	6,238	41,562
On-Pk Demand (therms/hr)	37	37	37	35	34	6	2	3	35	35	36	37	37
Water													
Cons. (1000gal)	0	0	0	91	197	235	277	260	179	145	0	0	1,385

Building Energy Consumption = 103,227 Btu/(ft2-year)
Source Energy Consumption = 237,407 Btu/(ft2-year)
Floor Area = 111,956 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - EMCS Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	130,120	117,639	137,067	149,284	177,616	184,908	184,820	196,456	161,483	176,125	128,253	126,618	1,870,390
On-Pk Demand (kW)	358	358	358	586	616	638	646	636	614	600	358	358	646
Gas													
On-Pk Cons. (therms)	4,845	4,278	3,815	1,265	415	388	353	405	353	1,373	3,805	4,449	25,743
On-Pk Demand (therms/hr)	37	37	36	34	12	2	2	2	2	31	36	37	37
Water													
Cons. (1000gal)	0	0	0	70	145	186	200	210	124	103	0	0	1,037

Building Energy Consumption = 80,013 Btu/(ft2-year)
Source Energy Consumption = 195,278 Btu/(ft2-year)
Floor Area = 111,956 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - Chiller Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	130,120	117,639	137,067	137,608	162,083	169,765	170,264	180,497	148,025	153,040	128,253	126,618	1,760,979
On-Pk Demand (kW)	358	358	358	457	569	585	588	585	566	465	358	358	588
Gas													
On-Pk Cons. (therms)	4,845	4,278	3,815	1,442	477	388	353	405	419	2,048	3,805	4,449	26,723
On-Pk Demand (therms/hr)	37	37	36	34	12	2	2	2	4	31	36	37	37
Water													
Cons. (1000gal)	0	0	0	61	130	170	184	193	111	92	0	0	940

Building Energy Consumption =	77,553	Btu/(ft2-year)
Source Energy Consumption =	186,192	Btu/(ft2-year)
Floor Area =	111,956	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - Boiler Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	131,144	118,565	138,188	138,242	162,302	169,765	170,264	180,497	148,163	153,880	129,276	127,593	1,767,880
On-Pk Demand (kW)	362	362	362	461	569	585	588	585	566	469	362	362	588
Gas													
On-Pk Cons. (therms)	4,335	3,829	3,426	1,318	467	388	353	405	412	1,858	3,414	3,982	24,186
On-Pk Demand (therms/hr)	33	33	32	30	11	2	2	2	3	27	32	33	33
Water													
Cons. (1000gal)	0	0	0	61	130	170	184	193	111	92	0	0	940

Building Energy Consumption =	75,497	Btu/(ft2-year)
Source Energy Consumption =	184,439	Btu/(ft2-year)
Floor Area =	111,956	ft2

MODELING NOTES

ARAPAHOE COUNTY - ADMIN I BUILDING

ECM Run: Install New EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
AH-1	Fan Schedule	M-F: 5am-11pm; Sat-Sun: 8am-4pm	M-F: 6am-6:30pm; Sat-Sun: Off
AH-2	Fan Schedule	M-F: 5am-11pm; Sat-Sun: 8am-4pm	M-F: 6am-6:30pm; Sat-Sun: Off
AH-3	Fan Schedule	M-F: 5am-11pm; Sat-Sun: 8am-4pm	M-F: 6am-6:30pm; Sat-Sun: Off
AH-4	Fan Schedule	M-F: 5am-11pm; Sat-Sun: 8am-4pm	M-F: 6am-6:30pm; Sat-Sun: Off

Previous Run (New Lighting Run):

Annual kWh Usage:	2,168,375
Annual kW Usage:	6,016
Annual Therms Usage:	41,562

Current Run (Install New EMCS Run):

Annual kWh Usage:	1,870,390
Annual kW Usage:	6,125
Annual Therms Usage:	25,743

Savings (Install New EMCS Savings):

Annual kWh Savings:	297,985
Annual kW Savings:	-109
Annual Therms Savings:	15,819

Notes:

1. The negative kW savings is the result of the chiller have to work harder in the mornings due to the schedule change. These negative savings shall not be accounted for since the upgraded EMCS shall cool each space down gradually without having to "overload" the chillers in the morning.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

Admin I - DHW Pump EMCS Savings

Pump ID:	HP:	LF:	Efficiency:	kW:	Existing Run Hrs:	New Run Hrs:	kWh Savings:
DHWP-1	0.17	0.75	0.7	0.13	8,760	3,259	733
HX Pump	0.25	0.75	0.7	0.20	8,760	3,259	1,099
						Total kWh Savings:	**1,832**

Note: The existing run hours are 24 h/d, 7 d/w. The new run hours are 12.5 h/d, 5 d/w. These savings shall be added to the EMCS savings that were calculated in the Trane Trace building simulation model.

MODELING NOTES

ARAPAHOE COUNTY - ADMIN I BUILDING

ECM Run: Replace the Existing Chillers

Cooling Equipment Tag	Item Changed	Previous Run Input	Current Run Input
Heat Recovery Chillers	Equipment Type	Water-Cooled Recip Chiller w/ Ht. Rec. (Clg.-1 kW/ton @ 260 Tons, Ht. Rec.-1.35 kW/ton @ 220 Tons)	New Admin I Chiller (0.625 kW/ton @ 100% Load)

Previous Run (New EMCS Run):

Annual kWh Usage:	1,870,390
Annual kW Usage:	6,125
Annual Therms Usage:	25,743

Current Run (Replace the Existing Chillers Run):

Annual kWh Usage:	1,760,979
Annual kW Usage:	5,606
Annual Therms Usage:	26,723

Savings (Replace the Existing Chillers Savings):

Annual kWh Savings:	109,411
Annual kW Savings:	519
Annual Therms Savings:	-980

Notes:

1. The negative therms savings is the result of the heat recovery chiller no longer being used to preheat the hot water return. So, now the boiler has to burn more natural gas to account for this. These negative savings shall not be accounted for since the heat recovery system no longer functions properly.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

ECM 6 – Replace the Existing Natural Gas-Fired Boilers

Please refer to the Energy Conservation Measure (ECM) section of this report for additional information.

Existing Condition to Warrant an ECM Opportunity:
The majority of the hot water boilers used for heating in the Arapahoe County facilities are natural gas-fired, atmospheric boilers. Atmospheric boilers aren't the most efficient boilers available. Also, these boilers are beginning to reach the end of their useful lives. This ECM concerns replacing each of the atmospheric boilers with a more efficient natural gas-fired, forced draft boiler.

Savings Calculation Methodolgy:
The implementation of this ECM shall result in positive natural gas savings and negative electrical savings. The savings for this ECM were calculated utilizing two Trane Trace building energy simulation models. The first model included the existing atmospheric boiler and the second model was modified to include the new forced draft boiler. The annual energy consumption calculated from each model was subtracted from one another to produce the annual energy savings. The negative electrical savings reflects the energy usage of the new boiler's forced draft fan.

Figure 1

Arapahoe County - Admin I Building
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	217,183	160,605	26%
Feb	189,788	145,184	24%
Mar	229,311	168,223	27%
Apr	218,456	194,211	11%
May	243,374	236,417	3%
Jun	248,088	246,541	1%
Jul	270,700	246,323	9%
Aug	264,710	258,730	2%
Sep	243,348	223,995	8%
Oct	232,915	230,945	1%
Nov	220,561	174,307	21%
Dec	216,466	156,768	28%
	2,794,900	2,442,249	13%

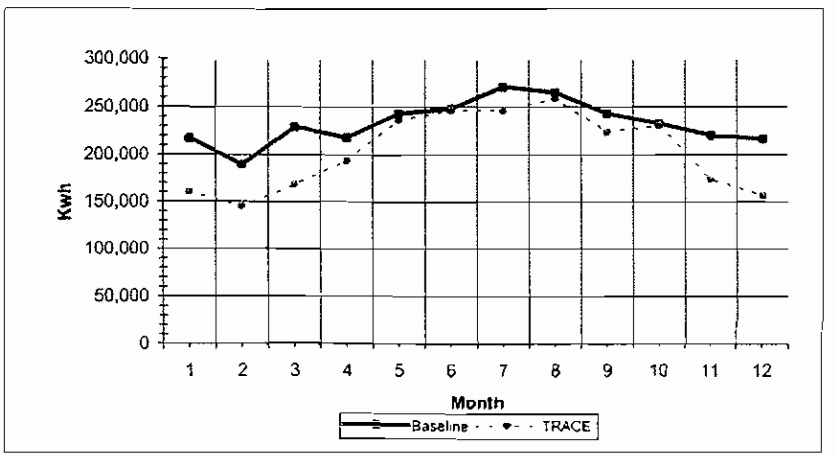
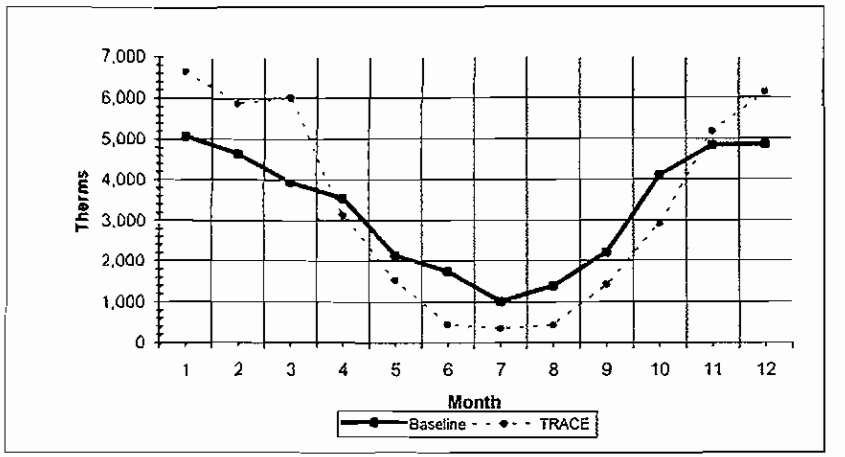


Figure 2

Arapahoe County - Admin I Building
Computer Model Calibration for Natural Gas

NATURAL GAS USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	5,080	6,648	-31%
Feb	4,650	5,870	-26%
Mar	3,950	6,011	-52%
Apr	3,550	3,128	12%
May	2,140	1,521	29%
Jun	1,740	449	74%
Jul	1,010	353	65%
Aug	1,390	443	68%
Sep	2,220	1,421	36%
Oct	4,110	2,921	29%
Nov	4,850	5,181	-7%
Dec	4,870	6,142	-26%
	39,560	40,089	-1%



MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - Match

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	160,605	145,184	168,223	194,211	236,417	246,541	246,323	258,730	223,995	230,945	174,307	156,768	2,442,249
On-Pk Demand (kW)	410	410	410	648	665	673	684	676	665	664	575	410	684
Gas													
On-Pk Cons. (therms)	6,648	5,870	6,011	3,128	1,521	449	353	443	1,421	2,921	5,181	6,142	40,089
On-Pk Demand (therms/hr)	38	39	38	36	35	6	2	3	35	36	37	38	39
Water													
Cons. (1000gal)	0	0	0	104	215	258	298	281	197	155	24	0	1,533

Building Energy Consumption = 110,260 Btu/(ft2-year)
Source Energy Consumption = 261,072 Btu/(ft2-year)
Floor Area = 111,956 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - Lighting Run

------ Monthly Energy Consumption ------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	140,796	127,277	147,458	172,897	212,943	223,527	222,829	233,874	199,514	211,337	138,488	137,436	2,168,375
On-Pk Demand (kW)	358	358	358	586	593	609	619	612	607	600	358	358	619
Gas													
On-Pk Cons. (therms)	6,751	5,968	6,114	3,168	1,499	476	353	465	1,708	2,917	5,907	6,238	41,562
On-Pk Demand (therms/hr)	37	37	37	35	34	6	2	3	35	35	36	37	37
Water													
Cons. (1000gal)	0	0	0	91	197	235	277	260	179	145	0	0	1,385

Building Energy Consumption = 103,227 Btu/(ft2-year)
Source Energy Consumption = 237,407 Btu/(ft2-year)
Floor Area = 111,956 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - EMCS Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	130,120	117,639	137,067	149,284	177,616	184,908	184,820	196,456	161,483	176,125	128,253	126,618	1,870,390
On-Pk Demand (kW)	358	358	358	586	616	638	646	636	614	600	358	358	646
Gas													
On-Pk Cons. (therms)	4,845	4,278	3,815	1,265	415	388	353	405	353	1,373	3,805	4,449	25,743
On-Pk Demand (therms/hr)	37	37	36	34	12	2	2	2	2	31	36	37	37
Water													
Cons. (1000gal)	0	0	0	70	145	186	200	210	124	103	0	0	1,037

Building Energy Consumption = 80,013 Btu/(ft2-year)
Source Energy Consumption = 195,278 Btu/(ft2-year)
Floor Area = 111,956 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - Chiller Run

------- Monthly Energy Consumption ------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	130,120	117,639	137,067	137,608	162,083	169,765	170,264	180,497	148,025	153,040	128,253	126,618	1,760,979
On-Pk Demand (kW)	358	358	358	457	569	585	588	585	566	465	358	358	588
Gas													
On-Pk Cons. (therms)	4,845	4,278	3,815	1,442	477	388	353	405	419	2,048	3,805	4,449	26,723
On-Pk Demand (therms/hr)	37	37	36	34	12	2	2	2	4	31	36	37	37
Water													
Cons. (1000gal)	0	0	0	61	130	170	184	193	111	92	0	0	940

Building Energy Consumption =	77,553	Btu/(ft2-year)
Source Energy Consumption =	186,192	Btu/(ft2-year)
Floor Area =	111,956	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 Arapahoe County - Admin I - Boiler Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	131,144	118,565	138,188	138,242	162,302	169,765	170,264	180,497	148,163	153,880	129,276	127,593	1,767,880
On-Pk Demand (kW)	362	362	362	461	569	585	588	585	566	469	362	362	588
Gas													
On-Pk Cons. (therms)	4,335	3,829	3,426	1,318	467	388	353	405	412	1,858	3,414	3,982	24,186
On-Pk Demand (therms/hr)	33	33	32	30	11	2	2	2	3	27	32	33	33
Water													
Cons. (1000gal)	0	0	0	61	130	170	184	193	111	92	0	0	940

Building Energy Consumption = 75,497 Btu/(ft2-year)
Source Energy Consumption = 184,439 Btu/(ft2-year)
Floor Area = 111,956 ft2

MODELING NOTES

ARAPAHOE COUNTY - ADMIN I BUILDING

ECM Run: Install New EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
AH-1	Fan Schedule	M-F: 5am-11pm; Sat-Sun: 8am-4pm	M-F: 6am-6:30pm; Sat-Sun: Off
AH-2	Fan Schedule	M-F: 5am-11pm; Sat-Sun: 8am-4pm	M-F: 6am-6:30pm; Sat-Sun: Off
AH-3	Fan Schedule	M-F: 5am-11pm; Sat-Sun: 8am-4pm	M-F: 6am-6:30pm; Sat-Sun: Off
AH-4	Fan Schedule	M-F: 5am-11pm; Sat-Sun: 8am-4pm	M-F: 6am-6:30pm; Sat-Sun: Off

Previous Run (New Lighting Run):

Annual kWh Usage:	2,168,375
Annual kW Usage:	6,016
Annual Therms Usage:	41,562

Current Run (Install New EMCS Run):

Annual kWh Usage:	1,870,390
Annual kW Usage:	6,125
Annual Therms Usage:	25,743

Savings (Install New EMCS Savings):

Annual kWh Savings:	297,985
Annual kW Savings:	-109
Annual Therms Savings:	15,819

Notes:

1. The negative kW savings is the result of the chiller have to work harder in the mornings due to the schedule change. These negative savings shall not be accounted for since the upgraded EMCS shall cool each space down gradually without having to "overload" the chillers in the morning.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

Admin I - DHW Pump EMCS Savings

Pump ID:	HP:	LF:	Efficiency:	kW:	Existing Run Hrs:	New Run Hrs:	kWh Savings:
DHWP-1	0.17	0.75	0.7	0.13	8,760	3,259	733
HX Pump	0.25	0.75	0.7	0.20	8,760	3,259	1,099
						Total kWh Savings:	**1,832**

Note: The existing run hours are 24 h/d, 7 d/w. The new run hours are 12.5 h/d, 5 d/w. These savings shall be added to the EMCS savings that were calculated in the Trane Trace building simulation model.

MODELING NOTES

ARAPAHOE COUNTY - ADMIN I BUILDING

ECM Run: Replace the Existing Chillers

Cooling Equipment Tag	Item Changed	Previous Run Input	Current Run Input
Heat Recovery Chillers	Equipment Type	Water-Cooled Recip Chiller w/ Ht. Rec. (Clg.-1 kW/ton @ 260 Tons, Ht. Rec.-1.35 kW/ton @ 220 Tons)	New Admin I Chiller (0.625 kW/ton @ 100% Load)

Previous Run (New EMCS Run):

Annual kWh Usage:	1,870,390
Annual kW Usage:	6,125
Annual Therms Usage:	25,743

Current Run (Replace the Existing Chillers Run):

Annual kWh Usage:	1,760,979
Annual kW Usage:	5,606
Annual Therms Usage:	26,723

Savings (Replace the Existing Chillers Savings):

Annual kWh Savings:	109,411
Annual kW Savings:	519
Annual Therms Savings:	-980

Notes:

1. The negative therms savings is the result of the heat recovery chiller no longer being used to preheat the hot water return. So, now the boiler has to burn more natural gas to account for this. These negative savings shall not be accounted for since the heat recovery system no longer functions properly.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

MODELING NOTES

ARAPAHOE COUNTY - ADMIN I BUILDING

ECM Run: Replace the Existing Boilers

Cooling Equipment Tag	Item Changed	Previous Run Input	Current Run Input
NG Fired HW Boilers	Equipment Type	Atmospheric Boiler (70% Efficient Energy Rate)	Gas Fired Hot Water Boiler (79% Efficient Energy Rate)

Previous Run (Replace the Existing Chillers Run):

Annual kWh Usage:	1,760,979
Annual kW Usage:	5,606
Annual Therms Usage:	26,723

Current Run (Replace the Existing Boilers Run):

Annual kWh Usage:	1,767,880
Annual kW Usage:	5,634
Annual Therms Usage:	24,186

Savings (Replace the Existing Boilers Savings):

Annual kWh Savings:	-6,901
Annual kW Savings:	-28
Annual Therms Savings:	2,536

Notes:

1. The negative kW and kWh savings is the energy used by the forced draft burner on the new boiler.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

Figure 1

Arapahoe County - Altura Plaza
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	121,594	112,997	7%
Feb	103,244	100,020	3%
Mar	112,618	114,465	-2%
Apr	112,883	107,205	5%
May	120,411	113,295	6%
Jun	122,653	116,146	5%
Jul	139,482	122,622	12%
Aug	138,135	125,874	9%
Sep	126,767	109,882	13%
Oct	120,855	112,745	7%
Nov	119,468	107,850	10%
Dec	126,428	107,003	15%
	1,464,538	1,350,104	8%

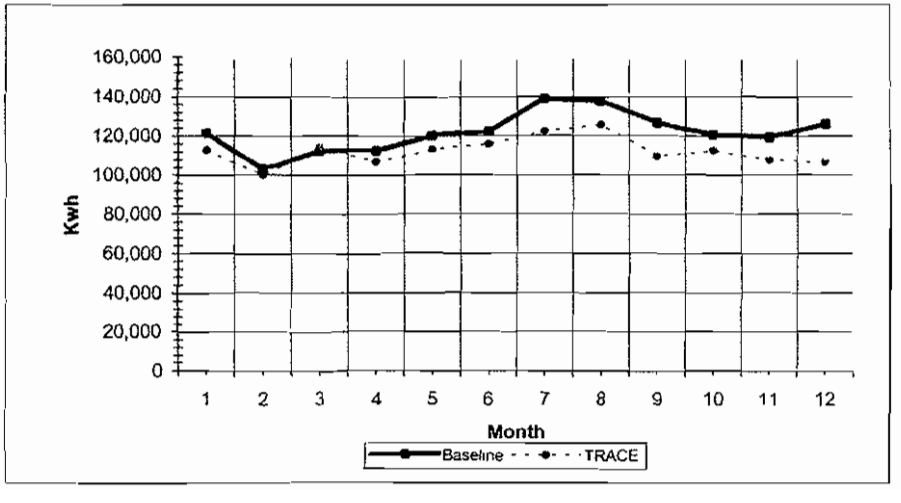
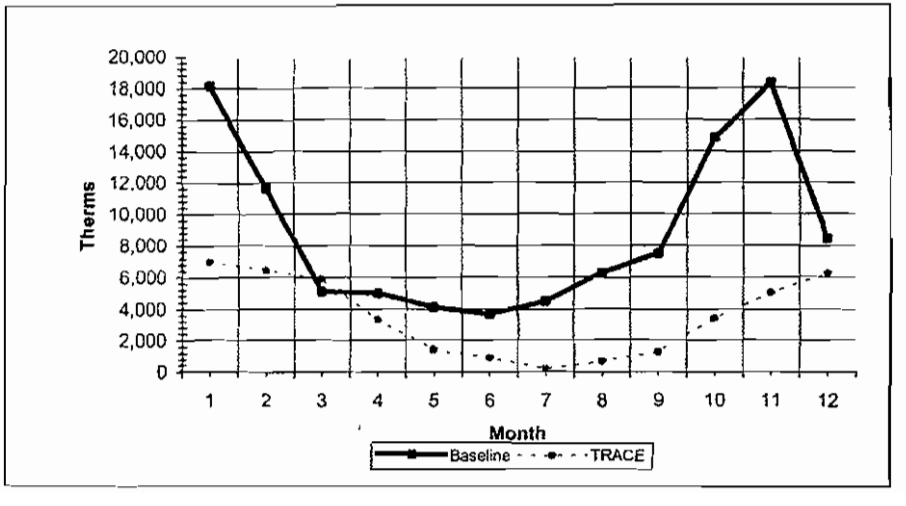


Figure 1

Arapahoe County - Altura Plaza
Computer Model Calibration for NG usage

NG USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	18,160	7,038	61%
Feb	11,670	6,450	45%
Mar	5,160	5,962	-16%
Apr	5,010	3,362	33%
May	4,150	1,450	65%
Jun	3,700	933	75%
Jul	4,530	186	96%
Aug	6,300	682	89%
Sep	7,530	1,276	83%
Oct	14,900	3,421	77%
Nov	18,330	5,074	72%
Dec	8,440	6,277	26%
	107,880	42,111	61%



MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Altura Plaza

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	----- Monthly Energy Consumption -----												
Electric													
On-Pk Cons. (kWh)	112,997	100,020	114,485	107,205	113,295	116,146	122,622	125,874	109,882	112,745	107,850	107,003	1,350,106
On-Pk Demand (kW)	445	445	445	445	445	446	446	446	446	445	445	445	446
Gas													
On-Pk Cons. (therms)	7,038	6,450	5,962	3,362	1,450	933	186	682	1,276	3,421	5,074	6,277	42,112
On-Pk Demand (therms/hr)	19	19	17	13	9	7	4	5	8	12	15	18	19
Water													
Cons. (1000gal)	56	43	68	43	92	121	176	152	104	104	72	52	1,081

Building Energy Consumption = 134,046 Btu/(ft2-year)
Source Energy Consumption = 277,511 Btu/(ft2-year)
Floor Area = 65,792 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Altura Plaza

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	96,256	84,809	95,876	90,994	95,250	97,213	104,972	106,136	93,140	94,296	90,714	90,718	1,140,374
On-Pk Demand (kW)	364	364	364	364	364	365	366	365	365	365	364	364	366
Gas													
On-Pk Cons. (therms)	7,147	6,548	6,042	3,441	1,493	958	166	725	1,301	3,445	5,125	6,373	42,783
On-Pk Demand (therms/hr)	19	19	17	13	9	7	4	5	8	12	15	18	19
Water													
Cons. (1000gal)	44	31	53	30	77	104	159	135	99	88	58	39	909

Building Energy Consumption = 124,186 Btu/(ft2-year)
Source Energy Consumption = 245,941 Btu/(ft2-year)
Floor Area = 65,792 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Altura Plaza

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	----- Monthly Energy Consumption -----												
Electric													
On-Pk Cons. (kWh)	67,168	59,744	68,625	56,875	64,113	67,496	71,397	76,143	61,956	65,341	61,442	61,037	781,338
On-Pk Demand (kW)	364	364	364	364	364	365	366	365	365	365	367	364	367
Gas													
On-Pk Cons. (therms)	5,799	5,391	5,185	1,398	667	378	186	332	588	3,242	4,319	5,233	32,717
On-Pk Demand (therms/hr)	24	25	24	18	16	6	0	8	15	22	23	24	25
Water													
Cons. (1000gal)	33	25	44	27	65	88	120	111	72	68	44	30	725

Building Energy Consumption =	90,260	Btu/(ft2-year)
Source Energy Consumption =	173,954	Btu/(ft2-year)
Floor Area =	85,792	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Altura Plaza

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	67,596	60,139	68,831	57,057	64,174	67,546	71,397	76,169	62,010	65,402	61,558	61,378	783,258
On-Pk Demand (kW)	364	364	364	364	364	365	366	365	365	365	368	364	368
Gas													
On-Pk Cons. (therms)	5,381	5,015	4,872	1,105	551	330	186	297	490	3,119	4,094	4,909	30,348
On-Pk Demand (therms/hr)	20	20	20	14	12	6	0	6	11	18	19	20	20
Water													
Cons. (1000gal)	33	25	44	27	65	88	120	111	72	68	44	30	725

Building Energy Consumption = 86,760 Btu/(ft2-year)
Source Energy Consumption = 170,463 Btu/(ft2-year)
Floor Area = 65,782 ft2

MODELING NOTES

ARAPAHOE COUNTY - ALTURA PLAZA

ECM Run: Install New EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
WSHP	Fan Schedule/Cycle with People	Available 100%	M-F: 6am-6:30pm; Sat-Sun: Off
Pre-Heat WSHP	Fan Schedule/Cycle with People	Available 100%	M-F: 7am-6:30pm; Sat-Sun: Off
Fan Coil	Fan Schedule/Cycle with People	Available 100%	M-F: 7am-6:30pm; Sat-Sun: Off

Previous Run (New Lighting Run):

Annual kWh Usage:	1,140,374
Annual kW Usage:	4,374
Annual Therm Usage:	42,784

Current Run (Install New EMCS Run):

Annual kWh Usage:	781,336
Annual kW Usage:	4,377
Annual Therm Usage:	32,718

Savings (Install New EMCS Savings):

Annual kWh Savings:	359,038
Annual kW Savings:	-3
Annual Therm Savings:	10,066

Notes:

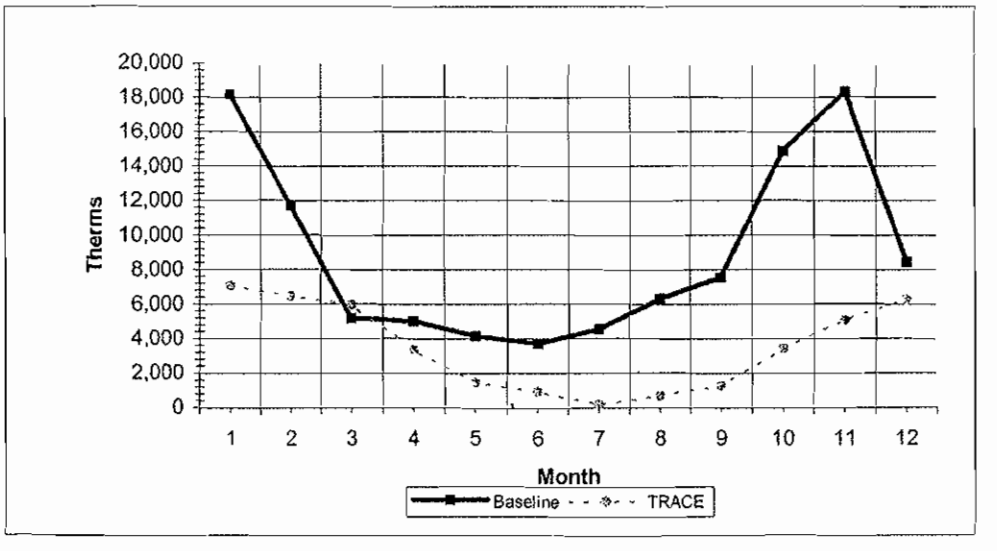
1. An additional 65,769 Therms were added to the 10,066 Therms savings shown above. This is a result of the building's existing natural gas usage being way out of line, so much so that we were unable to force our computer model to reflect the building's actual natural gas usage. So, the 65,769 Therms is the difference in the building's actual usage and the computer model's "match usage." Refer to the attached spreadsheet.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

Figure 1

Arapahoe County - Altura Plaza
Computer Model Calibration for NG usage

	NG USAGE (Therms)			Adjusted
Month	BASELINE	MODEL		Baseline
				Savings
Jan	18,160	7,038	61%	11,122
Feb	11,670	6,450	45%	5,220
Mar	5,160	5,962	-16%	-802
Apr	5,010	3,362	33%	1,648
May	4,150	1,450	65%	2,700
Jun	3,700	933	75%	2,767
Jul	4,530	186	96%	4,344
Aug	6,300	682	89%	5,618
Sep	7,530	1,276	83%	6,254
Oct	14,900	3,421	77%	11,479
Nov	18,330	5,074	72%	13,256
Dec	8,440	6,277	26%	2,163
	107,880	42,111	61%	65,769



MODELING NOTES

ARAPAHOE COUNTY - ALTURA PLAZA

ECM Run: Replace the Existing Boilers

Cooling Equipment Tag	Item Changed	Previous Run Input	Current Run Input
NG Fired HW Boilers	Efficiency	Gas Fired Hot Water Boiler (60% Efficient Energy Rate)	Gas Fired Hot Water Boiler (79% Efficient Energy Rate)

Previous Run (Install New EMCS Run):

Annual kWh Usage:	781,336
Annual kW Usage:	4,377
Annual Therm Usage:	32,718

Current Run (Replace the Existing Boilers Run):

Annual kWh Usage:	783,257
Annual kW Usage:	4,378
Annual Therm Usage:	30,349

Savings (Replace the Existing Boilers Savings):

Annual kWh Savings:	-1,921
Annual kW Savings:	-1
Annual Therm Savings:	2,369

Notes:

1. The negative kW and kWh savings is the energy used by the forced draft burner on the new boiler.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

Figure 1

Arapahoe County - ACJC Courthouse
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	202,551	197,435	3%
Feb	172,659	178,589	-3%
Mar	234,751	203,151	13%
Apr	234,674	190,309	19%
May	248,888	221,458	11%
Jun	247,557	224,685	9%
Jul	293,663	238,057	19%
Aug	276,365	238,231	14%
Sep	228,143	211,261	7%
Oct	214,985	213,383	1%
Nov	201,979	192,946	4%
Dec	199,199	194,492	2%
	2,755,414	2,503,997	9%

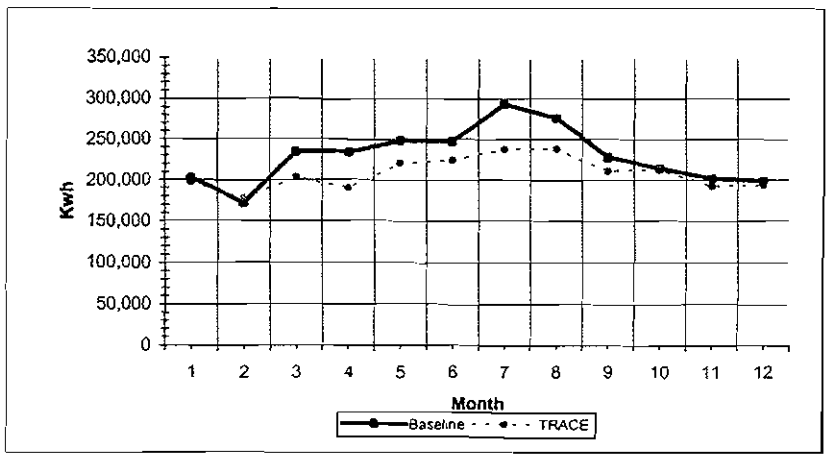
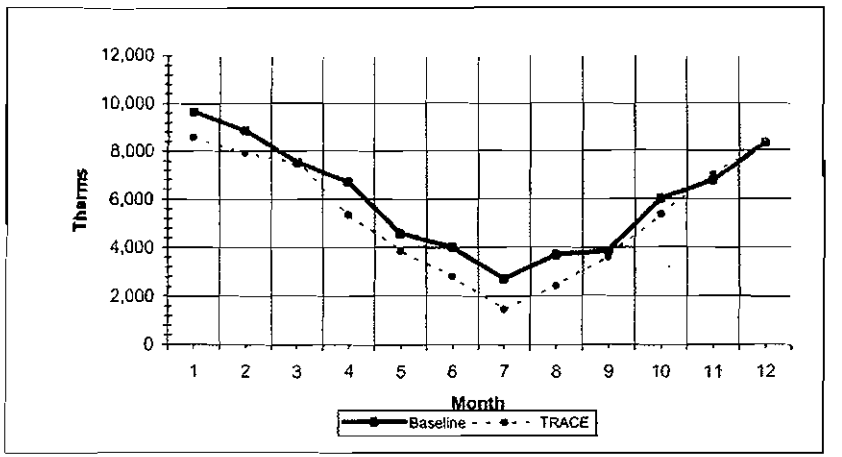


Figure 1

Arapahoe County - ACJC Courthouse
Computer Model Calibration for NG usage

NG USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	9,680	8,570	11%
Feb	8,870	7,938	11%
Mar	7,540	7,540	0%
Apr	6,710	5,356	20%
May	4,560	3,860	15%
Jun	4,020	2,835	29%
Jul	2,730	1,484	46%
Aug	3,710	2,446	34%
Sep	3,870	3,639	6%
Oct	6,020	5,366	11%
Nov	6,770	7,029	-4%
Dec	8,320	8,374	-1%
	72,800	64,437	11%



MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 ACJC Courthouse

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	197,435	178,589	203,151	190,309	221,458	224,685	236,057	238,231	211,261	213,383	192,946	194,492	2,503,995
On-Pk Demand (kW)	409	409	409	430	486	563	581	574	516	490	409	409	581
Gas													
On-Pk Cons. (therms)	8,570	7,938	7,540	5,356	3,860	2,835	1,484	2,446	3,639	5,366	7,029	8,374	64,439
On-Pk Demand (therms/hr)	45	44	44	44	44	44	44	44	44	44	44	44	45
Water													
Cons. (1000gal)	0	0	0	0	82	109	155	132	81	56	0	0	615

Building Energy Consumption = 142,485 Btu/(ft2-year)
Source Energy Consumption = 308,201 Btu/(ft2-year)
Floor Area = 105,204 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 ACJC Courthouse

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	172,576	155,952	177,035	166,190	194,011	196,562	208,965	208,391	185,310	186,583	166,343	169,990	2,189,927
On-Pk Demand (kW)	346	346	346	350	415	488	501	491	443	417	346	346	501
Gas													
On-Pk Cons. (therms)	8,695	8,063	7,673	5,456	3,915	2,859	1,436	2,445	3,694	5,460	7,149	8,475	65,319
On-Pk Demand (therms/hr)	42	42	42	42	42	42	42	42	42	42	42	42	42
Water													
Cons. (1000gal)	0	0	0	0	67	90	129	108	66	46	0	0	506

Building Energy Consumption =	133,133	Btu/(ft2-year)
Source Energy Consumption =	278,513	Btu/(ft2-year)
Floor Area =	105,204	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 ACJC Courthouse

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	164,194	148,361	168,067	158,423	184,563	186,552	203,494	197,971	175,808	178,072	160,172	162,176	2,087,862
On-Pk Demand (kW)	346	346	346	350	415	488	501	491	443	417	346	346	501
Gas													
On-Pk Cons. (therms)	8,519	7,900	7,409	4,930	3,084	1,916	600	1,394	2,877	4,630	6,839	8,278	58,575
On-Pk Demand (therms/hr)	42	42	42	42	33	13	7	10	31	42	42	42	42
Water													
Cons. (1000gal)	0	0	0	0	65	85	133	104	62	46	0	0	496

Building Energy Consumption = 123,411 Btu/(ft2-year)
Source Energy Consumption = 261,829 Btu/(ft2-year)
Floor Area = 105,204 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 ACJC Courthouse

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	165,187	149,258	169,076	159,381	185,535	187,457	204,004	196,853	176,722	179,073	161,138	163,159	2,098,842
On-Pk Demand (kW)	349	349	349	353	417	488	501	491	446	420	349	349	501
Gas													
On-Pk Cons. (therms)	7,042	6,530	6,129	4,089	2,570	1,608	527	1,180	2,399	4,007	5,659	6,844	48,583
On-Pk Demand (therms/hr)	35	34	34	34	27	10	6	6	26	34	34	34	35
Water													
Cons. (1000gal)	0	0	0	0	65	85	133	104	82	46	0	0	496

Building Energy Consumption =	114,269	Btu/(ft2-year)
Source Energy Consumption =	252,900	Btu/(ft2-year)
Floor Area =	105,204	ft2

MODELING NOTES

ARAPAHOE COUNTY - ACJC COURTHOUSE

ECM Run: Upgrade Existing EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
AH-1	Fan Schedule Changed	M-F - 4am-11pm, Sat-Sun: 8am-17pm	M-F: 5:30am-9:30pm; Sat-Sun: 8am-17pm
AHU-1	Fan Schedule Changed	M-F - 4am-11pm, Sat-Sun: 8am-17pm	M-F: 5:30am-9:30pm; Sat-Sun: 8am-17pm
AHIU-2	Fan Schedule Changed	M-F - 4am-11pm, Sat-Sun: 8am-17pm	M-F: 5:30am-9:30pm; Sat-Sun: 8am-17pm

Previous Run (New Lighting Run):

Annual kWh Usage:	2,189,928
Annual kW Usage:	4,835
Annual Therm Usage:	65,319

Current Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	2,087,853
Annual kW Usage:	4,835
Annual Therm Usage:	58,576

Savings (Upgrade Existing EMCS Savings):

Annual kWh Savings:	102,075
Annual kW Savings:	0
Annual Therm Savings:	6,743

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

MODELING NOTES

ARAPAHOE COUNTY - ACJC COURTHOUSE

ECM Run: Replace the Existing Boilers

Cooling Equipment Tag	Item Changed	Previous Run Input	Current Run Input
NG Fired HW Boilers	Efficiency	Atmospheric Boiler (65% Efficient Energy Rate)	Gas Fired Hot Water Boiler (79% Efficient Energy Rate)

Previous Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	2,087,853
Annual kW Usage:	4,835
Annual Therm Usage:	58,576

Current Run (Replace the Existing Boilers Run):

Annual kWh Usage:	2,098,843
Annual kW Usage:	4,861
Annual Therm Usage:	48,584

Savings (Replace the Existing Boilers Savings):

Annual kWh Savings:	-10,990
Annual kW Savings:	-26
Annual Therm Savings:	9,992

Notes:

1. The negative kW and kWh savings is the energy used by the forced draft burner on the new boiler.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

Figure 1

Arapahoe County - ACJC Admin II Building
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	149,668	117,519	21%
Feb	123,955	106,449	14%
Mar	137,823	125,967	9%
Apr	166,962	120,398	28%
May	183,024	150,964	18%
Jun	185,588	161,275	13%
Jul	204,313	170,641	16%
Aug	202,649	178,772	12%
Sep	187,481	141,905	24%
Oct	170,057	141,498	17%
Nov	153,399	115,011	25%
Dec	152,731	111,523	27%
	2,017,650	1,641,920	19%

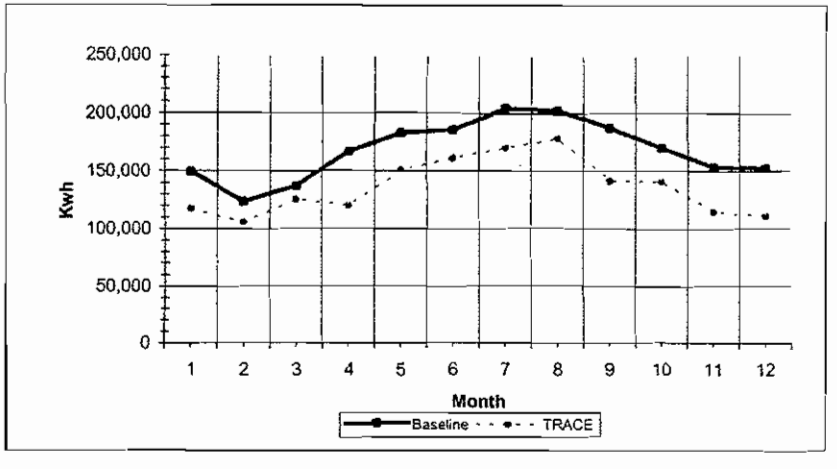
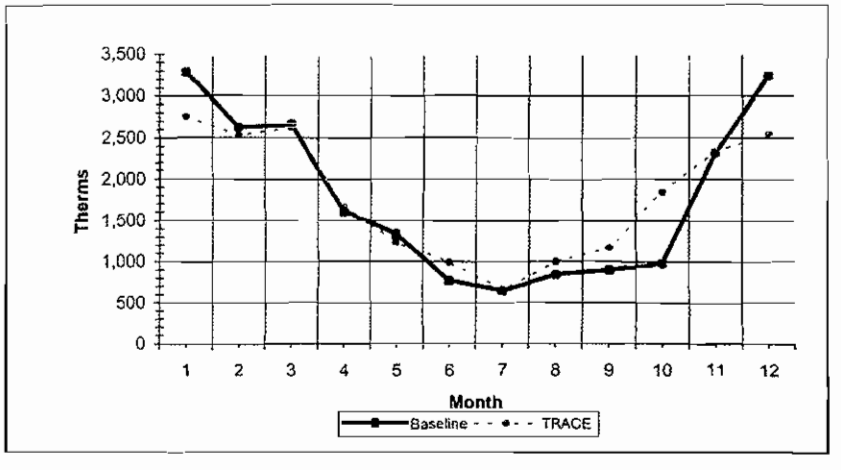


Figure 2

Arapahoe County - ACJC Admin II Building
Computer Model Calibration for Natural Gas

NATURAL GAS USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	3,292	2,762	16%
Feb	2,623	2,527	4%
Mar	2,661	2,629	1%
Apr	1,611	1,677	-4%
May	1,342	1,242	7%
Jun	773	1,001	-30%
Jul	650	672	-3%
Aug	841	999	-19%
Sep	897	1,175	-31%
Oct	977	1,842	-89%
Nov	2,320	2,343	-1%
Dec	3,238	2,547	21%
	21,225	21,417	-1%



MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 ACJC Admin II - Match Run

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	117,519	106,449	125,967	120,398	150,964	161,275	170,641	178,772	141,905	141,498	115,011	111,523	1,641,920
On-Pk Demand (kW)	370	371	363	420	455	470	530	508	478	446	349	349	530
Gas													
On-Pk Cons. (therms)	2,762	2,527	2,629	1,677	1,242	1,001	672	999	1,175	1,842	2,343	2,547	21,417
On-Pk Demand (therms/hr)	12	12	11	10	9	9	7	9	9	10	10	12	12

Building Energy Consumption =	95,541	Btu/(ft2-year)
Source Energy Consumption =	235,198	Btu/(ft2-year)
Floor Area =	81,071	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 ACJC Admin II - Lighting Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	103,095	93,293	110,380	103,857	132,054	140,854	152,364	156,782	124,987	123,969	100,353	97,688	1,439,677
On-Pk Demand (kW)	330	331	330	369	404	418	477	455	427	391	309	323	477
Gas													
On-Pk Cons. (therms)	2,888	2,646	2,781	1,803	1,335	1,077	724	1,079	1,261	1,963	2,476	2,675	22,709
On-Pk Demand (therms/hr)	13	13	12	10	10	9	9	9	9	10	11	12	13

Building Energy Consumption =	88,621	Btu/(ft2-year)
Source Energy Consumption =	211,331	Btu/(ft2-year)
Floor Area =	81,071	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 ACJC Admin II - EMCS Run

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	101,636	91,993	108,591	102,210	128,575	137,751	150,090	154,105	121,916	122,297	98,669	96,267	1,414,100
On-Pk Demand (kW)	330	331	330	370	404	426	476	458	427	396	309	323	476
Gas													
On-Pk Cons. (therms)	2,685	2,462	2,516	1,558	1,087	852	580	841	1,041	1,696	2,227	2,465	20,011
On-Pk Demand (therms/hr)	12	13	12	10	7	6	5	6	8	10	11	12	13

Building Energy Consumption =	84,215	Btu/(ft2-year)
Source Energy Consumption =	204,596	Btu/(ft2-year)
Floor Area =	81,071	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 ACJC Admin II - New Boiler Run

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	102,620	92,871	109,497	102,881	129,228	138,360	150,581	154,695	122,547	123,036	99,480	97,162	1,422,959
On-Pk Demand (kW)	333	333	332	373	406	428	476	458	430	399	311	325	476
Gas													
On-Pk Cons. (therms)	2,353	2,157	2,206	1,368	957	752	514	743	916	1,489	1,953	2,160	17,568
On-Pk Demand (therms/hr)	11	11	10	9	6	5	4	5	7	8	9	11	11

Building Energy Consumption =	81,575	Btu/(ft2-year)
Source Energy Consumption =	202,544	Btu/(ft2-year)
Floor Area =	81,071	ft2

MODELING NOTES

ARAPAHOE COUNTY - ACJC ADMIN II BUILDING

ECM Run: Upgrade Existing EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
AHU-1	Fan Schedule	M-F: 7am-10:30pm; Sat-Sun: OFF	M-F: 7am-8:30pm; Sat-Sun: OFF
AHU-2	Fan Schedule	M-F: 5:30am-10:30pm; Sat-Sun: OFF	M-F: 5:30am-8:30pm; Sat-Sun: OFF
AHU-4	Fan Schedule	M-F: 7am-10:45pm; Sat-Sun: OFF	M-F: 7am-8:30pm; Sat-Sun: OFF
AHU-6	Fan Schedule	M-F: 7am-11pm; Sat-Sun: 8am-5pm	M-F: 7am-8:30pm; Sat-Sun: 8am-5pm

Previous Run (New Lighting Run):

Annual kWh Usage:	1,439,677
Annual kW Usage:	4,563
Annual Therms Usage:	22,709

Current Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	1,414,100
Annual kW Usage:	4,581
Annual Therms Usage:	20,011

Savings (Upgrade Existing EMCS Savings):

Annual kWh Savings:	25,577
Annual kW Savings:	-18
Annual Therms Savings:	2,699

Notes:

1. The negative kW savings is the result of the chiller have to work harder in the mornings due to the schedule change. These negative savings shall not be accounted for since the upgraded EMCS shall cool each space down gradually without having to "overload" the chillers in the morning.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

MODELING NOTES

ARAPAHOE COUNTY - ACJC ADMIN II BUILDING

ECM Run: Replace the Existing Boilers

Cooling Equipment Tag	Item Changed	Previous Run Input	Current Run Input
HW Boilers	Equipment Type	Atmospheric Boiler (69% Efficient Energy Rate)	Gas Fired Hot Water Boiler (79% Efficient Energy Rate)

Previous Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	1,414,100
Annual kW Usage:	4,581
Annual Therms Usage:	20,011

Current Run (Replace the Existing Boilers Run):

Annual kWh Usage:	1,422,959
Annual kW Usage:	4,605
Annual Therms Usage:	17,568

Savings (Replace the Existing Boilers Savings):

Annual kWh Savings:	-8,859
Annual kW Savings:	-24
Annual Therms Savings:	2,443

Notes:

1. The negative kW and kWh savings is the energy used by the forced draft burner on the new boiler.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

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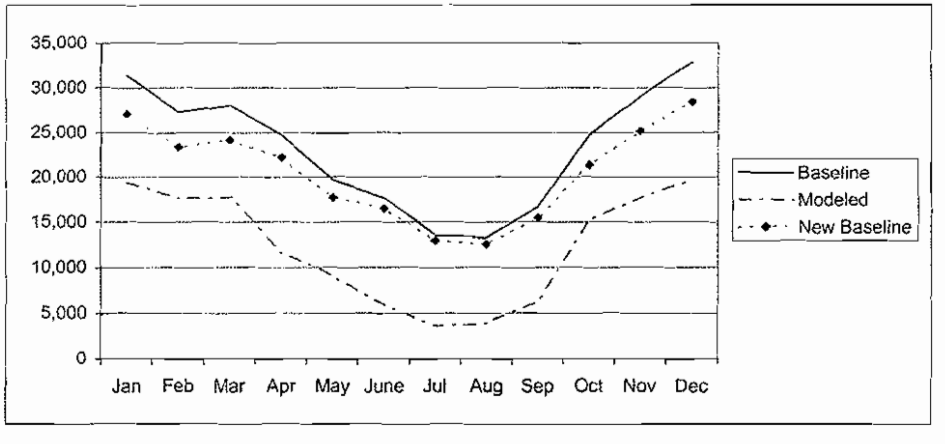
Total Savings HHW	32,135	x Safety Factor of .73 yeilds 23,459 Therms
Total Savings DHW	222	
	32,357	

SF	CFM/SF	OA	Existing Heating Efficiency	New Heating Efficiency
290,000	2	35%		
	580,000	203,000	65%	85%

	CEA Baseline	Domestic Therms	Domestic Therms	LDB	Denver Mean EDB	Heating Btuh	Heating Efficiency	Heating Efficiency	Hours	Days	Existing Total Therms	Baseline % Difference	New Total Therms	Savings	
Jan	31,370	942	721	110	36.4	16,136,064	65%	85%	24	31	19,412	-23.5%	15,066	4,567	27,024
Feb	27,300	942	721	110	36.5	16,114,140	65%	85%	24	28	17,602	-21.6%	13,682	4,142	23,380
Mar	28,060	942	721	110	43.1	14,667,156	65%	85%	24	31	17,731	-22.6%	13,780	4,172	24,110
Apr	24,710	942	721	110	50.9	12,957,084	65%	85%	18	30	11,707	-35.7%	9,174	2,754	22,177
May	19,640	942	721	110	61	10,742,760	65%	85%	16	31	9,140	-36.5%	7,211	2,151	17,711
June	17,680	942	721	110	69.2	8,944,992	65%	85%	12	30	5,896	-50.0%	4,731	1,387	16,514
Jul	13,590	942	721	110	78.2	6,971,832	65%	85%	8	31	3,602	-58.1%	2,976	848	12,964
Aug	13,270	942	721	110	74.8	7,717,248	65%	85%	8	31	3,887	-54.7%	3,194	915	12,577
Sep	16,670	942	721	110	65.9	9,668,484	65%	85%	12	30	6,297	-45.2%	5,037	1,482	15,410
Oct	24,690	942	721	110	53.2	12,452,832	65%	85%	24	31	15,196	-23.8%	11,842	3,576	21,336
Nov	29,110	942	721	110	41	15,127,560	65%	85%	24	30	17,699	-24.4%	13,756	4,164	25,167
Dec	32,890	942	721	110	35.2	16,399,152	65%	85%	24	31	19,713	-25.0%	15,296	4,638	28,473
	278,980	11,307	8,647			147,899,304			218	365	147,881	-31%	115,746	34,795	

Grindrod Calculated		Multiplier 1			LWT	EWT	Existing Boiler Efficiency	New Boiler Efficiency
452,000	Domestic	452,000	434	332	130	55	65%	85%
197,000	Laundry	197,000	316	241	180	55	65%	85%
120,000	Kitchen	120,000	192	147	180	55	65%	85%
		769,000	942	721				

	CEA Baseline	Domestic HW	EVAP & Ice machine	Total	Domestic CW
Jan	2,756,486	769,000	2,920	771,920	1,984,566
Feb	4,021,000	769,000	2,920	771,920	3,249,080
Mar	4,314,714	769,000	2,920	771,920	3,542,794
Apr	4,984,286	769,000	8,414	777,414	4,206,872
May	3,368,529	769,000	66,098	835,098	2,533,431
June	4,151,471	769,000	373,746	1,142,746	3,008,725
Jul	4,564,677	769,000	719,851	1,488,851	3,075,826
Aug	4,210,161	769,000	598,989	1,367,989	2,842,172
Sep	5,095,161	769,000	159,491	928,491	4,166,670
Oct	4,572,727	769,000	2,920	771,920	3,800,807
Nov	3,977,273	769,000	2,920	771,920	3,205,353
Dec	3,475,000	769,000	2,920	771,920	2,703,080
	49,491,485	9,228,000	1,944,112	11,172,112	38,319,373



ECM 7– Install a New VFD on the Existing Exhaust Fan

Please refer to the Energy Conservation Measure (ECM) section of this report for additional information.

Existing Condition to Warrant an ECM Opportunity:
The two main air handling systems (AH-3 and AH-4) at building 01-Administration Building are variable air volume (VAV) reheat systems. The supply fans on each unit are equipped with variable frequency drives (VFD's) that modulate the speed of the fan in accordance to the building's heating/cooling load. But, the exhaust/return fan on each unit is constant volume – it operates at 100% of it capacity at all times. The installation of a VFD on the exhaust/return fan shall enable the fan to operate in the same manner as the supply fan.

Savings Calculation Methodolgy:
The implementation of this ECM shall result in electrical savings. The first step in the savings calculation was to determine what the heating and cooling loads are for each air handling unit. These loads were calculated utilizing a Trane Trace building simulation model. Once the loads were calculated then the new exhaust/return fan energy (with the VFD installed) required at each load condition was calculated. The new fan energy consumption was then subtracted from the existing fan energy consumption.

Install VFD on AH-3 Return/Exhaust Fan Savings Calculation

Total Run Hours (6am to 6:30pm, M-F): 3,259
% Total Cooling Run Hours: 0.49
% Total Heating Run Hours: 0.51

Cooling Period Electric Savings

Percent Design Load:	Capacity (Tons):	Run Hours (%):	Run Hours:	Exist. Fan kW:	New Fan kW:	kW Savings:	kWh Savings:
0 - 5	5.79	0	0	6.51	0.59	5.92	0
5 - 10	11.58	0	0	6.51	0.59	5.92	0
10 - 15	17.37	0	0	6.51	0.59	5.92	0
15 - 20	23.15	0	0	6.51	0.59	5.92	0
20 - 25	28.94	0	0	6.51	0.59	5.92	0
25 - 30	34.73	0	0	6.51	0.59	5.92	0
30 - 35	40.52	0	0	6.51	0.59	5.92	0
35 - 40	46.31	0	0	6.51	0.59	5.92	0
40 - 45	52.1	0	0	6.51	0.59	5.92	0
45 - 50	57.89	0	0	6.51	0.81	5.70	0
50 - 55	63.67	0	0	6.51	1.08	5.43	0
55 - 60	69.46	2	32	6.51	1.41	5.10	163
60 - 65	75.25	26	416	6.51	1.79	4.72	1,966
65 - 70	81.04	18	288	6.51	2.23	4.28	1,232
70 - 75	86.83	10	160	6.51	2.75	3.76	602
75 - 80	92.62	13	208	6.51	3.33	3.18	661
80 - 85	98.41	3	48	6.51	4.00	2.51	121
85 - 90	104.19	6	96	6.51	4.75	1.76	169
90 - 95	109.98	8	128	6.51	5.58	0.93	119
95 - 100	115.77	15	240	6.51	6.51	0.00	0

Total Cooling Period kWh Savings: 5,034

Heating Period Electric Savings

Percent Design Load:	Capacity (Btu/Hr):	Run Hours (%):	Run Hours:	Exist. Fan kW:	New Fan kW:	kW Savings:	kWh Savings:
0 - 5	-65,602	12	199	6.51	0.59	5.92	1,177
5 - 10	-131,204	7	116	6.51	0.59	5.92	687
10 - 15	-196,806	7	116	6.51	0.59	5.92	687
15 - 20	-262,408	15	249	6.51	0.59	5.92	1,472
20 - 25	-328,010	11	182	6.51	0.59	5.92	1,079
25 - 30	-393,612	10	166	6.51	0.59	5.92	981
30 - 35	-459,214	8	133	6.51	0.59	5.92	785
35 - 40	-524,817	5	83	6.51	0.59	5.92	491
40 - 45	-590,419	3	50	6.51	0.59	5.92	294
45 - 50	-656,021	2	33	6.51	0.81	5.70	189
50 - 55	-721,623	3	50	6.51	1.08	5.43	270
55 - 60	-787,225	0	0	6.51	1.41	5.10	0
60 - 65	-852,827	0	0	6.51	1.79	4.72	0
65 - 70	-918,429	0	0	6.51	2.23	4.28	0
70 - 75	-984,031	0	0	6.51	2.75	3.76	0
75 - 80	-1,049,633	1	17	6.51	3.33	3.18	53
80 - 85	-1,115,235	2	33	6.51	4.00	2.51	83
85 - 90	-1,180,837	0	0	6.51	4.75	1.76	0
90 - 95	-1,246,439	1	17	6.51	5.58	0.93	15
95 - 100	-1,312,041	12	199	6.51	6.51	0.00	0

Total Heating Period kWh Savings: 8,262

TOTAL KWH SAVINGS:	13,296

Install VFD on AH-4 Return/Exhaust Fan Savings Calculation

Total Run Hours (6am to 6:30pm, M-F): 3,259
% Total Cooling Run Hours: 0.49
% Total Heating Run Hours: 0.51

Cooling Period Electric Savings

Percent Design Load:	Capacity (Tons):	Run Hours (%):	Run Hours:	Exist. Fan kW:	New Fan kW:	kW Savings:	kWh Savings:
0 - 5	4.86	0	0	6.51	0.59	5.92	0
5 - 10	9.72	0	0	6.51	0.59	5.92	0
10 - 15	14.57	0	0	6.51	0.59	5.92	0
15 - 20	19.43	0	0	6.51	0.59	5.92	0
20 - 25	24.29	0	0	6.51	0.59	5.92	0
25 - 30	29.15	0	0	6.51	0.59	5.92	0
30 - 35	34.01	0	0	6.51	0.59	5.92	0
35 - 40	38.87	0	0	6.51	0.59	5.92	0
40 - 45	43.72	0	0	6.51	0.59	5.92	0
45 - 50	48.58	0	0	6.51	0.81	5.70	0
50 - 55	53.44	0	0	6.51	1.08	5.43	0
55 - 60	58.3	1	16	6.51	1.41	5.10	82
60 - 65	63.16	23	371	6.51	1.79	4.72	1,750
65 - 70	68.02	12	193	6.51	2.23	4.28	827
70 - 75	72.87	13	209	6.51	2.75	3.76	788
75 - 80	77.73	7	113	6.51	3.33	3.18	358
80 - 85	82.59	9	145	6.51	4.00	2.51	364
85 - 90	87.45	3	48	6.51	4.75	1.76	85
90 - 95	92.31	9	145	6.51	5.58	0.93	134
95 - 100	97.16	23	371	6.51	6.51	0.00	0

Total Cooling Period kWh Savings: 4,389

Heating Period Electric Savings

Percent Design Load:	Capacity (Btu/Hr):	Run Hours (%):	Run Hours:	Exist. Fan kW:	New Fan kW:	kW Savings:	kWh Savings:
0 - 5	-54,819	5	82	6.51	0.59	5.92	487
5 - 10	-109,639	7	115	6.51	0.59	5.92	682
10 - 15	-164,458	11	181	6.51	0.59	5.92	1,072
15 - 20	-219,277	15	247	6.51	0.59	5.92	1,462
20 - 25	-274,096	18	297	6.51	0.59	5.92	1,755
25 - 30	-328,916	12	198	6.51	0.59	5.92	1,170
30 - 35	-383,735	6	99	6.51	0.59	5.92	585
35 - 40	-438,554	3	49	6.51	0.59	5.92	292
40 - 45	-493,374	1	16	6.51	0.59	5.92	97
45 - 50	-548,193	3	49	6.51	0.81	5.70	282
50 - 55	-603,012	0	0	6.51	1.08	5.43	0
55 - 60	-657,831	1	16	6.51	1.41	5.10	84
60 - 65	-712,651	0	0	6.51	1.79	4.72	0
65 - 70	-767,470	2	33	6.51	2.23	4.28	141
70 - 75	-822,289	1	16	6.51	2.75	3.76	62
75 - 80	-877,109	1	16	6.51	3.33	3.18	52
80 - 85	-931,928	0	0	6.51	4.00	2.51	0
85 - 90	-986,747	0	0	6.51	4.75	1.76	0
90 - 95	-1,041,566	0	0	6.51	5.58	0.93	0
95 - 100	-1,096,386	14	231	6.51	6.51	0.00	0

Total Heating Period kWh Savings: 8,226

TOTAL KWH SAVINGS:	12,615

Trane Trace Load Profiles Used to Calculate \ Return/Exhaust Fan VFD Savings at Admin I

AH-3 Htg. & Clg. Load Profile

Percent	---- Cooling Load ----			---- Heating Load ----		---- Cooling Airflow ----				---- Heating Design	Cap.	
0 - 5	5.8	0	0	-65,602.1	14	270	3,070.3	0	0	0.0	0	0
5 - 10	11.6	0	0	-131,204.1	9	171	6,140.6	0	0	0.0	0	0
10 - 15	17.4	0	0	-196,806.2	7	133	9,210.9	0	0	0.0	0	0
15 - 20	23.2	0	0	-262,408.3	14	254	12,281.2	0	0	0.0	0	0
20 - 25	28.9	0	0	-328,010.3	10	187	15,351.4	0	0	0.0	0	0
25 - 30	34.7	0	0	-393,612.4	9	176	18,421.7	0	0	0.0	0	0
30 - 35	40.5	0	0	-459,214.4	3	64	21,492.0	0	0	0.0	0	0
35 - 40	46.3	0	0	-524,816.5	8	154	24,562.3	0	0	0.0	0	0
40 - 45	52.1	0	0	-590,418.6	0	8	27,632.6	0	0	0.0	0	0
45 - 50	57.9	0	0	-656,020.6	2	33	30,702.9	0	0	0.0	0	0
50 - 55	63.7	0	0	-721,622.7	0	4	33,773.2	0	0	0.0	0	0
55 - 60	69.5	4	68	-787,224.8	0	0	36,843.4	0	0	0.0	0	0
60 - 65	75.3	25	401	-852,826.8	1	16	39,913.7	0	0	0.0	0	0
65 - 70	81.0	26	421	-918,428.9	1	17	42,984.0	0	0	0.0	0	0
70 - 75	86.8	13	214	-984,030.9	0	3	46,054.3	0	0	0.0	0	0
75 - 80	92.6	12	190	-1,049,633.0	2	36	49,124.6	90	2,948	0.0	0	0
80 - 85	98.4	3	53	-1,115,235.1	1	20	52,194.9	1	30	0.0	0	0
85 - 90	104.2	1	18	-1,180,837.1	1	24	55,265.2	0	15	0.0	0	0
90 - 95	110.0	4	59	-1,246,439.3	0	0	58,335.5	1	19	0.0	0	0
95 - 100	115.8	12	201	-1,312,041.3	16	305	61,405.7	8	277	0.0	0	0
Hours Off	0.0	0	7,135	0.0	0	6,885	0.0	0	5,471	0.0	0	8,760

AH-4 Htg. & Clg. Load Profile

Percent	---- Cooling Load ----			---- Heating Load ----		---- Cooling Airflow ----				---- Heating Design	Cap.	
0 - 5	4.9	0	0	-54,819.3	7	111	3,042.8	0	0	0.0	0	0
5 - 10	9.7	0	0	-109,638.6	5	89	6,085.5	0	0	0.0	0	0
10 - 15	14.6	0	0	-164,457.8	11	178	9,128.3	0	0	0.0	0	0
15 - 20	19.4	0	0	-219,277.1	14	238	12,171.1	0	0	0.0	0	0
20 - 25	24.3	0	0	-274,096.4	16	269	15,213.8	0	0	0.0	0	0
25 - 30	29.2	0	0	-328,915.7	12	203	18,256.6	0	0	0.0	0	0
30 - 35	34.0	0	0	-383,735.0	5	87	21,299.4	0	0	0.0	0	0
35 - 40	38.9	0	0	-438,554.3	3	44	24,342.1	0	0	0.0	0	0
40 - 45	43.7	0	0	-493,373.5	1	16	27,384.9	0	0	0.0	0	0
45 - 50	48.6	0	0	-548,192.8	1	21	30,427.7	0	0	0.0	0	0
50 - 55	53.4	0	0	-603,012.1	0	3	33,470.4	0	0	0.0	0	0
55 - 60	58.3	1	17	-657,831.4	2	36	36,513.2	0	0	0.0	0	0
60 - 65	63.2	25	384	-712,650.7	1	16	39,556.0	0	0	0.0	0	0
65 - 70	68.0	21	318	-767,469.9	1	21	42,598.7	0	0	0.0	0	0
70 - 75	72.9	11	168	-822,289.3	0	0	45,641.5	0	0	0.0	0	0
75 - 80	77.7	12	190	-877,108.5	0	0	48,684.3	0	0	0.0	0	0
80 - 85	82.6	9	134	-931,927.8	1	24	51,727.0	88	2,889	0.0	0	0
85 - 90	87.5	3	49	-986,747.1	0	0	54,769.8	2	56	0.0	0	0
90 - 95	92.3	6	90	-1,041,566.4	1	17	57,812.5	1	30	0.0	0	0
95 - 100	97.2	12	189	-1,096,385.6	17	289	60,855.3	10	314	0.0	0	0
H Off	0.0	0	7,221	0.0		7,098	0.0	0	5,471	0.0	0	760

ECM 8 – Install a VFD on Existing Vane Axial Fan

Please refer to the Energy Conservation Measure (ECM) section of this report for additional information.

Existing Condition to Warrant an ECM Opportunity:
The two main air handling systems (AHU-1 and AHU-2) at building 35-ACJC Courthouse are variable air volume (VAV) reheat systems. The supply and return fans on each unit are vane axial fans that modulate the airflow in accordance to the building's heating/cooling load. These two air handling systems are also equipped with evaporative heat recovery systems. The coils and evaporative cooling pads in the heat recovery system have "scaled up" so bad that the fans have to operate at nearly 100% of their capacity at all times in order to provide enough air pressure to deliver the appropriate amount of air. The maintenance staff has recently cleaned up the heat recovery system so that the fans don't have to operate at 100% capacity at all times anymore. This ECM concerns recognizing the energy savings that have resulted from the cleaning of the coils and pads. Also, a VFD shall be installed on each fan motor and the existing vanes shall be locked in the 100% open position.

Savings Calculation Methodolgy:
The implementation of this ECM shall result in electrical savings. The first step in the savings calculation was to determine what the heating and cooling loads are for each air handling unit. These loads were calculated utilizing a Trane Trace building simulation model. Once the loads were calculated then the new supply and return fan energy (with the VFD installed) required at each load condition was calculated. The new fan energy consumption was then subtracted from the existing fan energy consumption.

Install VFD on AHU-1 Supply/Return Fan Savings Calculation

Total Run Hours (5am to 9:30pm, M-F, 8am-5pm): 4,849
% Total Cooling Run Hours: 0.34
% Total Heating Run Hours: 0.66

Supply Fan Cooling Period Electric Savings

Percent Design Load:	Capacity (Tons):	Run Hours (%):	Run Hours:	Exist. SF Max kW:	Exist. SF kW:	New SF kW:	SF kW Savings:	Supply Fan kWh Savings:	Exist. RF Max kW:	Exist. RF kW:	RF kW Savings:	RF kW Savings:	Return Fan kWh Savings:
0 - 5	4.67	0	0	61.48	39.35	5.60	33.75	0	18.86	13.62	1.72	11.91	0
5 - 10	9.34	0	0	61.48	39.35	5.60	33.75	0	18.86	13.62	1.72	11.91	0
10 - 15	14	0	0	61.48	39.35	5.60	33.75	0	18.86	13.62	1.72	11.91	0
15 - 20	18.67	0	0	61.48	39.35	5.60	33.75	0	18.86	13.62	1.72	11.91	0
20 - 25	23.34	0	0	61.48	39.35	5.60	33.75	0	18.86	13.62	1.72	11.91	0
25 - 30	28.01	0	0	61.48	39.35	5.60	33.75	0	18.86	13.62	1.72	11.91	0
30 - 35	32.68	0	0	61.48	39.35	5.60	33.75	0	18.86	13.62	1.72	11.91	0
35 - 40	37.34	0	0	61.48	39.35	5.60	33.75	0	18.86	13.62	1.72	11.91	0
40 - 45	42.01	0	0	61.48	39.35	5.60	33.75	0	18.86	13.62	1.72	11.91	0
45 - 50	46.68	0	0	61.48	39.35	7.69	31.66	0	18.86	13.62	2.36	11.27	0
50 - 55	51.35	0	0	61.48	39.35	10.23	29.12	0	18.86	13.62	3.14	10.49	0
55 - 60	56.01	1	16	61.48	39.35	13.28	26.07	425	18.86	13.62	4.07	9.55	156
60 - 65	60.68	5	81	61.48	39.35	16.88	22.47	1,829	18.86	13.62	5.18	8.45	688
65 - 70	65.35	11	179	61.48	39.35	21.09	18.26	3,271	18.86	13.62	6.47	7.16	1,282
70 - 75	70.02	46	749	61.48	39.35	25.94	13.41	10,046	18.86	13.62	7.96	5.67	4,245
75 - 80	74.69	16	261	61.48	39.35	31.48	7.87	2,050	18.86	13.62	9.66	3.97	1,034
80 - 85	79.35	8	130	61.48	44.41	37.75	6.66	868	18.86	13.62	11.58	2.04	266
85 - 90	84.02	3	49	61.48	49.79	44.81	4.98	243	18.86	15.28	13.75	1.53	75
90 - 95	88.69	3	49	61.48	55.48	52.71	2.78	136	18.86	17.02	16.17	0.85	42
95 - 100	93.36	7	114	61.48	61.48	61.48	0.00	0	18.86	18.86	18.86	0.00	0
							Total Cooling Period kWh Savings:	18,868					7,786

Heating Period Electric Savings

Percent Design Load:	Capacity (Btu/Hr):	Run Hours (%):	Run Hours:	Exist. SF Max kW:	Exist. SF kW:	New Fan kW:	kW Savings:	Supply Fan kWh Savings:	Exist. RF Max kW:	Exist. RF kW:	RF kW Savings:	RF kW Savings:	Return Fan kWh Savings:
0 - 5	-68,871	9	290	61.48	39.35	5.60	33.74	9,782	18.86	13.63	1.72	11.91	3,452
5 - 10	-137,743	9	290	61.48	39.35	5.60	33.74	9,782	18.86	13.63	1.72	11.91	3,452
10 - 15	-206,614	10	322	61.48	39.35	5.60	33.74	10,869	18.86	13.63	1.72	11.91	3,836
15 - 20	-275,486	11	354	61.48	39.35	5.60	33.74	11,956	18.86	13.63	1.72	11.91	4,218
20 - 25	-344,357	14	451	61.48	39.35	5.60	33.74	15,217	18.86	13.63	1.72	11.91	5,370
25 - 30	-413,229	9	290	61.48	39.35	5.60	33.74	9,782	18.86	13.63	1.72	11.91	3,452
30 - 35	-482,100	4	129	61.48	39.35	5.60	33.74	4,348	18.86	13.63	1.72	11.91	1,534
35 - 40	-550,971	7	225	61.48	39.35	5.60	33.74	7,608	18.86	13.63	1.72	11.91	2,685
40 - 45	-619,843	5	161	61.48	39.35	5.60	33.74	5,435	18.86	13.63	1.72	11.91	1,918
45 - 50	-688,714	5	161	61.48	39.35	7.69	31.66	5,099	18.86	13.63	2.36	11.27	1,815
50 - 55	-757,586	1	32	61.48	39.35	10.23	29.12	938	18.86	13.63	3.14	10.49	338
55 - 60	-826,457	1	32	61.48	39.35	13.28	26.07	840	18.86	13.63	4.07	9.55	308
60 - 65	-895,328	2	64	61.48	39.35	16.88	22.46	1,447	18.86	13.63	5.18	8.45	544
65 - 70	-964,200	1	32	61.48	39.35	21.09	18.26	588	18.86	13.63	6.47	7.16	231
70 - 75	-1,033,071	0	0	61.48	39.35	25.94	13.41	0	18.86	13.63	7.96	5.67	0
75 - 80	-1,101,943	1	32	61.48	39.35	31.48	7.87	253	18.86	13.63	9.66	3.97	128
80 - 85	-1,170,814	1	32	61.48	44.42	37.76	6.66	215	18.86	13.63	11.58	2.04	66
85 - 90	-1,239,686	0	0	61.48	49.80	44.82	4.98	0	18.86	15.28	13.75	1.53	0
90 - 95	-1,308,557	10	322	61.48	55.49	52.71	2.77	894	18.86	17.02	16.17	0.85	274
95 - 100	-1,377,428	0	0	61.48	61.48	61.48	0.00	0	18.86	18.86	18.86	0.00	0
							Total Heating Period kWh Savings:	95,054					33,620

TOTAL KWH SAVINGS FOR AHU-1:	155,328

Install VFD on AHU-2 Supply/Return Fan Savings Calculation

Total Run Hours (5am to 9:30pm, M-F, 8am-5pm): 4,849
% Total Cooling Run Hours: 0.33
% Total Heating Run Hours: 0.67

Cooling Period Electric Savings

Percent Design Load:	Capacity (Tons):	Run Hours (%):	Run Hours:	Exist. SF Max kW:	Exist. SF kW:	New SF kW:	kW Savings:	Supply Fan kWh Savings:	Exist. RF Max kW:	Exist. RF kW:	RF kW Savings:	RF kW Savings:	Return Fan kWh Savings:
0 - 5	4.94	0	0	61.48	44.41	5.60	38.81	0	18.86	13.62	1.72	11.91	0
5 - 10	9.88	0	0	61.48	44.41	5.60	38.81	0	18.86	13.62	1.72	11.91	0
10 - 15	14.82	0	0	61.48	44.41	5.60	38.81	0	18.86	13.62	1.72	11.91	0
15 - 20	19.75	0	0	61.48	44.41	5.60	38.81	0	18.86	13.62	1.72	11.91	0
20 - 25	24.69	0	0	61.48	44.41	5.60	38.81	0	18.86	13.62	1.72	11.91	0
25 - 30	29.63	0	0	61.48	44.41	5.60	38.81	0	18.86	13.62	1.72	11.91	0
30 - 35	34.57	0	0	61.48	44.41	5.60	38.81	0	18.86	13.62	1.72	11.91	0
35 - 40	39.51	0	0	61.48	44.41	5.60	38.81	0	18.86	13.62	1.72	11.91	0
40 - 45	44.45	0	0	61.48	44.41	5.60	38.81	0	18.86	13.62	1.72	11.91	0
45 - 50	49.39	0	0	61.48	44.41	7.69	36.73	0	18.86	13.62	2.36	11.27	0
50 - 55	54.32	0	0	61.48	44.41	10.23	34.19	0	18.86	13.62	3.14	10.49	0
55 - 60	59.26	0	0	61.48	44.41	13.28	31.14	0	18.86	13.62	4.07	9.55	0
60 - 65	64.2	2	32	61.48	44.41	16.88	27.53	883	18.86	13.62	5.18	8.45	271
65 - 70	69.14	2	32	61.48	44.41	21.09	23.33	748	18.86	13.62	6.47	7.16	230
70 - 75	74.08	7	112	61.48	44.41	25.94	18.48	2,075	18.86	13.62	7.96	5.67	636
75 - 80	79.02	19	305	61.48	44.41	31.48	12.93	3,942	18.86	13.62	9.66	3.97	1,209
80 - 85	83.95	34	545	61.48	44.41	37.75	6.66	3,635	18.86	13.62	11.58	2.04	1,115
85 - 90	88.89	16	257	61.48	49.80	44.81	4.98	1,278	18.86	15.28	13.75	1.53	392
90 - 95	93.83	7	112	61.48	55.48	52.71	2.78	312	18.86	17.02	16.17	0.85	96
95 - 100	98.77	12	192	61.48	61.48	61.48	0.00	0	18.86	18.86	18.86	0.00	0
						Total Cooling Period kWh Savings:		12,873					3,949

Heating Period Electric Savings

Percent Design Load:	Capacity (Tons):	Run Hours (%):	Run Hours:	Exist. SF Max kW:	Exist. SF kW:	New SF kW:	kW Savings:	Supply Fan kWh Savings:	Exist. RF Max kW:	Exist. RF kW:	RF kW Savings:	RF kW Savings:	Return Fan kWh Savings:
0 - 5	-54,819	5	162	61.48	44.42	5.60	38.82	6,298	18.86	13.63	1.72	11.91	1,932
5 - 10	-109,639	7	227	61.48	44.42	5.60	38.82	8,818	18.86	13.63	1.72	11.91	2,705
10 - 15	-164,458	11	357	61.48	44.42	5.60	38.82	13,856	18.86	13.63	1.72	11.91	4,251
15 - 20	-219,277	15	487	61.48	44.42	5.60	38.82	18,895	18.86	13.63	1.72	11.91	5,796
20 - 25	-274,096	18	584	61.48	44.42	5.60	38.82	22,674	18.86	13.63	1.72	11.91	6,956
25 - 30	-328,916	12	389	61.48	44.42	5.60	38.82	15,116	18.86	13.63	1.72	11.91	4,637
30 - 35	-383,735	6	195	61.48	44.42	5.60	38.82	7,558	18.86	13.63	1.72	11.91	2,319
35 - 40	-438,554	3	97	61.48	44.42	5.60	38.82	3,779	18.86	13.63	1.72	11.91	1,159
40 - 45	-493,374	1	32	61.48	44.42	5.60	38.82	1,260	18.86	13.63	1.72	11.91	386
45 - 50	-548,193	3	97	61.48	44.42	7.69	36.73	3,576	18.86	13.63	2.36	11.27	1,097
50 - 55	-603,012	0	0	61.48	44.42	10.23	34.19	0	18.86	13.63	3.14	10.49	0
55 - 60	-657,831	1	32	61.48	44.42	13.28	31.14	1,011	18.86	13.63	4.07	9.55	310
60 - 65	-712,651	0	0	61.48	44.42	16.88	27.54	0	18.86	13.63	5.18	8.45	0
65 - 70	-767,470	2	65	61.48	44.42	21.09	23.33	1,514	18.86	13.63	6.47	7.16	465
70 - 75	-822,289	1	32	61.48	44.42	25.94	18.48	600	18.86	13.63	7.96	5.67	184
75 - 80	-877,109	1	32	61.48	44.42	31.48	12.94	420	18.86	13.63	9.66	3.97	129
80 - 85	-931,928	0	0	61.48	44.42	37.76	6.66	0	18.86	13.63	11.58	2.04	0
85 - 90	-986,747	0	0	61.48	49.80	44.82	4.98	0	18.86	15.28	13.75	1.53	0
90 - 95	-1,041,566	0	0	61.48	55.49	52.71	2.77	0	18.86	17.02	16.17	0.85	0
95 - 100	-1,096,386	13	422	61.48	61.48	61.48	0.00	0	18.86	18.86	18.86	0.00	0
						Total Heating Period kWh Savings:		105,374					32,325

TOTAL KWH SAVINGS FOR AHU-2:	154,521

Trane Trace Load Profiles for AHU-1 & AHU-2 at the ACJC Courthouse

AHU-1 Htg. & Clg. Load Profile

Percent Design Load	---- Cooling Load ---- Cap. (Tons)	Hours (%)	Hours	---- Heating Load ---- Cap. (Btuh)	Hours (%)	Hours	---- Cooling Airflow --- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow---- Cap. (Cfm)	Hours (%)	Hours
0 - 5	4.67	0	0	-68871.42	9	320	4632.72	0	0	1309.43	8	293
5 - 10	9.34	0	0	-137742.84	9	339	9265.45	0	0	2618.87	9	327
10 - 15	14	0	0	-206614.27	10	354	13898.17	0	0	3928.3	10	352
15 - 20	18.67	0	0	-275485.69	11	393	18530.89	0	0	5237.74	7	270
20 - 25	23.34	0	0	-344357.09	14	505	23163.62	0	0	6547.17	12	457
25 - 30	28.01	0	0	-413228.53	9	342	27796.34	0	0	7856.61	11	393
30 - 35	32.68	0	0	-482099.94	4	151	32429.06	0	0	9166.04	8	288
35 - 40	37.34	0	0	-550971.38	7	251	37061.79	0	0	10475.48	5	166
40 - 45	42.01	0	0	-619842.75	5	164	41694.51	0	0	11784.91	6	208
45 - 50	46.68	0	0	-688714.19	5	184	46327.23	0	0	13094.35	5	170
50 - 55	51.35	0	0	-757585.62	1	44	50959.96	0	0	14403.78	3	127
55 - 60	56.01	1	22	-826457.06	1	32	55592.68	0	0	15713.22	1	31
60 - 65	60.68	5	87	-895328.44	2	60	60225.41	0	0	17022.65	1	32
65 - 70	65.35	11	193	-964199.88	1	31	64858.13	0	0	18332.09	2	60
70 - 75	70.02	46	851	-1033071.31	0	12	69490.85	0	0	19641.52	1	31
75 - 80	74.69	16	294	-1101942.75	1	38	74123.58	0	0	20950.96	0	12
80 - 85	79.35	8	154	-1170814.12	1	19	78756.3	93	4483	22260.39	1	38
85 - 90	84.02	3	56	-1239685.5	0	18	83389.02	2	80	23569.83	1	19
90 - 95	88.69	3	49	-1308557	10	365	88021.75	2	81	24879.26	0	8
95 - 100	93.36	7	125	-1377428.37	0	0	92654.47	3	159	26188.7	10	375
Hours Off	0	0	6929	0	0	5138	0	0	3957	0	0	5103
			1,831			3,622						
						5,453						

AHU-2 Htg. & Clg. Load Profile

Percent Design Load	---- Cooling Load ---- Cap. (Tons)	Hours (%)	Hours	---- Heating Load ---- Cap. (Btuh)	Hours (%)	Hours	---- Cooling Airflow --- Cap. (Cfm)	Hours (%)	Hours	---- Heating Airflow---- Cap. (Cfm)	Hours (%)	Hours
0 - 5	4.94	0	0	-74598.27	2	81	5575	0	0	1430.03	3	108
5 - 10	9.88	0	0	-149196.55	7	259	11150.01	0	0	2860.06	6	221
10 - 15	14.82	0	0	-223794.83	8	314	16725.01	0	0	4290.09	7	267
15 - 20	19.75	0	0	-298393.09	10	356	22300.02	0	0	5720.12	9	324
20 - 25	24.69	0	0	-372991.38	9	332	27875.02	0	0	7150.15	8	289
25 - 30	29.63	0	0	-447589.66	9	331	33450.03	0	0	8580.18	8	313
30 - 35	34.57	0	0	-522187.94	8	281	39025.03	0	0	10010.21	9	330
35 - 40	39.51	0	0	-596786.19	11	417	44600.04	0	0	11440.23	6	228
40 - 45	44.45	0	0	-671384.5	6	237	50175.04	0	0	12870.26	10	361
45 - 50	49.39	0	0	-745982.75	5	197	55750.04	0	0	14300.29	7	254
50 - 55	54.32	0	0	-820581.06	8	286	61325.05	0	0	15730.32	6	212
55 - 60	59.26	0	0	-895179.31	4	147	66900.05	0	0	17160.35	7	243
60 - 65	64.2	2	42	-969777.56	2	62	72475.05	0	0	18590.38	3	119
65 - 70	69.14	2	45	-1044375.87	0	3	78050.06	0	0	20020.41	2	58
70 - 75	74.08	7	129	-1118974.12	1	26	83625.06	0	0	21450.44	0	3
75 - 80	79.02	19	357	-1193572.37	0	3	89200.07	91	4373	22880.47	1	26
80 - 85	83.95	34	627	-1268170.75	0	10	94775.08	3	143	24310.5	0	3
85 - 90	88.89	16	295	-1342769	1	25	100350.1	1	48	25740.53	0	10
90 - 95	93.83	7	121	-1417367.25	9	337	105925.1	0	19	27170.56	1	25
95 - 100	98.77	12	215	-1491965.5	0	0	111500.1	5	220	28600.59	9	337
Hours Off	0	0	6929	0	0	5056	0	0	3957	0	0	5029
			1831			3704						
						5535						

ECM 10– Install an A/C Unit to Serve Computer Equipment Room

Please refer to the Energy Conservation Measure (ECM) section of this report for additional information.

Existing Condition to Warrant an ECM Opportunity:
Currently, there are multiple computer equipment rooms located throughout building 37-ACJC Administrative II that require cooling 24 hours a day, seven days a week. So, two of the building's main air handling units (AHU-3 and AHU-5) have to operate at all times in order to provide cooling to these rooms. The installation of individual A/C units to serve each room will eliminate the need to operate the two main air handling systems 24 hours a day, seven days a week.

Savings Calculation Methodolgy:
The implementation of this ECM shall result in both electrical and natural gas savings. Two different Trane Trace building energy simulation models were developed to calculate the energy savings for this ECM. The first model was developed to reflect the existing energy used by AHU-3 and AHU-5 to provide cooling to the computer equipment rooms at all times. The second model was created to reflect the energy used by individual A/C units (air-cooled, split systems) to provide cooling to the computer equipment rooms. The annual energy consumption calculated from each model was subtracted from one another to produce the annual energy savings.

Figure 1

Arapahoe County - ACJC Admin II Building
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	149,668	117,519	21%
Feb	123,955	106,449	14%
Mar	137,823	125,967	9%
Apr	166,962	120,398	28%
May	183,024	150,964	18%
Jun	185,588	161,275	13%
Jul	204,313	170,641	16%
Aug	202,649	178,772	12%
Sep	187,481	141,905	24%
Oct	170,057	141,498	17%
Nov	153,399	115,011	25%
Dec	152,731	111,523	27%
	2,017,650	1,641,920	19%

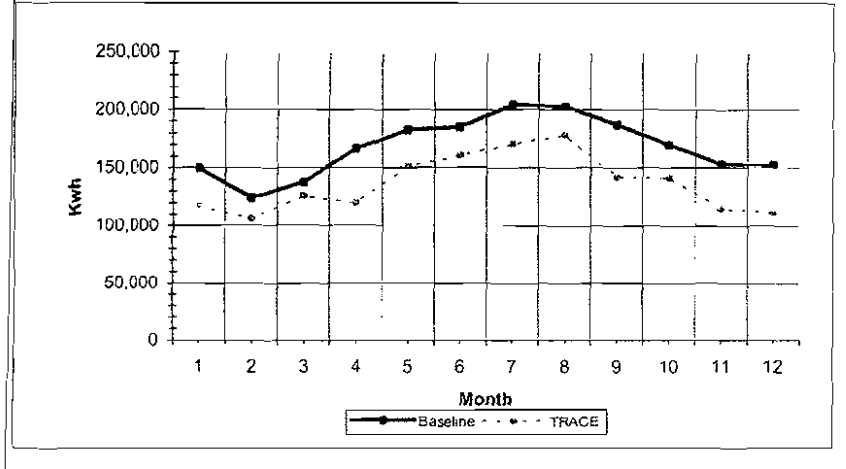
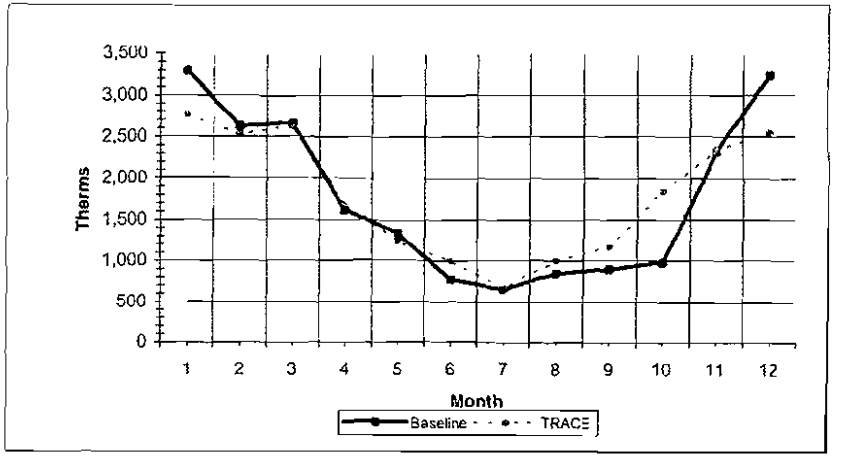


Figure 2

Arapahoe County - ACJC Admin II Building
Computer Model Calibration for Natural Gas

NATURAL GAS USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	3,292	2,762	16%
Feb	2,623	2,527	4%
Mar	2,661	2,629	1%
Apr	1,611	1,677	-4%
May	1,342	1,242	7%
Jun	773	1,001	-30%
Jul	650	672	-3%
Aug	841	999	-19%
Sep	897	1,175	-31%
Oct	977	1,842	-89%
Nov	2,320	2,343	-1%
Dec	3,238	2,547	21%
	21,225	21,417	-1%



MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 ACJC Admin II - Match Run

------ Monthly Energy Consumption ------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	117,519	106,449	125,967	120,398	150,964	161,275	170,641	178,772	141,905	141,498	115,011	111,523	1,641,920
On-Pk Demand (kW)	370	371	363	420	455	470	530	508	478	446	349	349	530
Gas													
On-Pk Cons. (therms)	2,762	2,527	2,629	1,677	1,242	1,001	672	999	1,175	1,842	2,343	2,547	21,417
On-Pk Demand (therms/hr)	12	12	11	10	9	9	7	9	9	10	10	12	12

Building Energy Consumption =	95,541	Btu/(ft2-year)
Source Energy Consumption =	235,198	Btu/(ft2-year)
Floor Area =	81,071	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 ACJC Admin II - Lighting Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	103,095	93,293	110,380	103,857	132,054	140,854	152,364	156,782	124,987	123,969	100,353	97,688	1,439,677
On-Pk Demand (kW)	330	331	330	369	404	418	477	455	427	391	309	323	477
Gas													
On-Pk Cons. (therms)	2,888	2,646	2,781	1,803	1,335	1,077	724	1,079	1,261	1,963	2,476	2,675	22,709
On-Pk Demand (therms/hr)	13	13	12	10	10	9	9	9	9	10	11	12	13

Building Energy Consumption =	88,621	Btu/(ft2-year)
Source Energy Consumption =	211,331	Btu/(ft2-year)
Floor Area =	81,071	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 ACJC Admin II - EMCS Run

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	101,636	91,993	108,591	102,210	128,575	137,751	150,090	154,105	121,916	122,297	98,669	96,267	1,414,100
On-Pk Demand (kW)	330	331	330	370	404	426	476	458	427	396	309	323	476
Gas													
On-Pk Cons. (therms)	2,685	2,462	2,516	1,558	1,087	852	580	841	1,041	1,696	2,227	2,465	20,011
On-Pk Demand (therms/hr)	12	13	12	10	7	6	5	6	8	10	11	12	13

Building Energy Consumption =	84,215	Btu/(ft2-year)
Source Energy Consumption =	204,596	Btu/(ft2-year)
Floor Area =	81,071	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 ACJC Admin II - New Boiler Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	102,620	92,871	109,497	102,881	129,228	138,360	150,581	154,695	122,547	123,036	99,480	97,162	1,422,959
On-Pk Demand (kW)	333	333	332	373	406	428	476	458	430	399	311	325	476
Gas													
On-Pk Cons. (therms)	2,353	2,157	2,206	1,368	957	752	514	743	916	1,489	1,953	2,160	17,568
On-Pk Demand (therms/hr)	11	11	10	9	6	5	4	5	7	8	9	11	11

Building Energy Consumption =	81,575	Btu/(ft2-year)
Source Energy Consumption =	202,544	Btu/(ft2-year)
Floor Area =	81,071	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.007

Alternative: 1 ACJC Admin II - New A/C Unit Run

------- Monthly Energy Consumption -------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	101,970	92,318	109,079	100,610	122,947	131,522	137,542	145,021	114,520	120,309	99,115	96,496	1,371,450
On-Pk Demand (kW)	338	338	337	368	407	441	488	465	425	385	317	330	488
Gas													
On-Pk Cons. (therms)	2,154	1,978	1,989	1,075	590	406	202	389	593	1,188	1,782	1,995	14,341
On-Pk Demand (therms/hr)	10	11	10	9	6	5	3	4	6	8	9	10	11

Building Energy Consumption =	75,427	Btu/(ft2-year)
Source Energy Consumption =	191,848	Btu/(ft2-year)
Floor Area =	81,071	ft2

MODELING NOTES

ARAPAHOE COUNTY - ACJC ADMIN II BUILDING

ECM Run: Upgrade Existing EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
AHU-1	Fan Schedule	M-F: 7am-10:30pm; Sat-Sun: OFF	M-F: 7am-8:30pm; Sat-Sun: OFF
AHU-2	Fan Schedule	M-F: 5:30am-10:30pm; Sat-Sun: OFF	M-F: 5:30am-8:30pm; Sat-Sun: OFF
AHU-4	Fan Schedule	M-F: 7am-10:45pm; Sat-Sun: OFF	M-F: 7am-8:30pm; Sat-Sun: OFF
AHU-6	Fan Schedule	M-F: 7am-11pm; Sat-Sun: 8am-5pm	M-F: 7am-8:30pm; Sat-Sun: 8am-5pm

Previous Run (New Lighting Run):

Annual kWh Usage:	1,439,677
Annual kW Usage:	4,563
Annual Therms Usage:	22,709

Current Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	1,414,100
Annual kW Usage:	4,581
Annual Therms Usage:	20,011

Savings (Upgrade Existing EMCS Savings):

Annual kWh Savings:	25,577
Annual kW Savings:	-18
Annual Therms Savings:	2,699

Notes:

1. The negative kW savings is the result of the chiller have to work harder in the mornings due to the schedule change. These negative savings shall not be accounted for since the upgraded EMCS shall cool each space down gradually without having to "overload" the chillers in the morning.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

MODELING NOTES

ARAPAHOE COUNTY - ACJC ADMIN II BUILDING

ECM Run: Replace the Existing Boilers

Cooling Equipment Tag	Item Changed	Previous Run Input	Current Run Input
HW Boilers	Equipment Type	Atmospheric Boiler (69% Efficient Energy Rate)	Gas Fired Hot Water Boiler (79% Efficient Energy Rate)

Previous Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	1,414,100
Annual kW Usage:	4,581
Annual Therms Usage:	20,011

Current Run (Replace the Existing Boilers Run):

Annual kWh Usage:	1,422,959
Annual kW Usage:	4,605
Annual Therms Usage:	17,568

Savings (Replace the Existing Boilers Savings):

Annual kWh Savings:	-8,859
Annual kW Savings:	-24
Annual Therms Savings:	2,443

Notes:

1. The negative kW and kWh savings is the energy used by the forced draft burner on the new boiler.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

MODELING NOTES

ARAPAHOE COUNTY - ACJC ADMIN II BUILDING

ECM Run: Install an A/C Unit to Serve the Computer Equipment Room

Fan System/Clg. Equip.	Item Changed	Previous Run Input	Current Run Input
Rm 6 - AHU-3	Cooling Driftpoint	72	90
Rm 8 - AHU-5	Cooling Driftpoint	72	90
Create A New Fan System	System Type	None	Computer Room Unit
	Fan Cycling Schedule	None	Cycle With Cooling Loads Only
	Fan Schedule	None	Available (100%)
	ASSIGN ROOMS 2 & 3 TO THE NEW COMPUTER ROOM UNIT FAN SYSTEM		
AHU-3	Fan Schedule	24 Hours/Day, 7 Days/Week	M-F: 5am-8:30pm; Sat-Sun: OFF
AHU-5	Fan Schedule	24 Hours/Day, 7 Days/Week	M-F: 5am-8:30pm; Sat-Sun: OFF
Create A New Clg. Plant	Equip. Type/Category	None	Air-Cooled Unitary
	Energy Rate	None	1.237 kW/Ton
	ASSIGN THE CLG COIL FOR THE NEW COMPUTER ROOM UNIT TO THIS CLG PLANT		

Previous Run (Replace the Existing Boilers Run):

Annual kWh Usage:	1,422,959
Annual kW Usage:	4,605
Annual Therms Usage:	17,568

Current Run (Install New A/C Units Run):

Annual kWh Usage:	1,371,450
Annual kW Usage:	4,638
Annual Therms Usage:	14,341

Savings (Install New A/C Units Savings):

Annual kWh Savings:	51,509
Annual kW Savings:	-34
Annual Therms Savings:	3,227

Notes:

1. The negative kW savings is the energy used by the new A/C units.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

ECM 12 – Install Water Softener

Buildings Included –

- ✓ ACJC Administration II
- ✓ ACJC Detention Center
- ✓ ACJC Courthouse

Spreadsheet savings used (see attached).

For the Justice Center (ACJC Courthouse) the building water usage was modeled. The modeling notes can be seen in the ECM 2 section.

The two penthouse air handlers utilize indirect and direct evaporative heat recovery system as well as a direct evaporative cooling section. Cooling is supplemented with a chilled water cooling system that utilizes a cooling tower. The heat recovery system has never worked correctly in either air handler. The hard water has clogged the direct side media with so much mineral the pads have virtually turned to stone. On the indirect side the nozzles have corroded and leaked over the years making this system use an abundance of water. This recovery coils have so much mineral in them it has restricted air flow through them. The maintenance staff has been forced to open the service doors to allow air pressure to be relieved. The heat recovery system has been disabled as of last fall and water usage has plummeted.

The cooling tower has been operating on a 1.7 cycle or virtually a once through water vessel (as confirmed through the service representative). The bleed line was measured at a rate of 4 gallons per minute to confirm. With the implementation of the water softener the cooling tower will be able to operate in excess of 5 cycles thus saving an immense amount of water.

As both of these cases are relatively difficult to calculate savings a baseline comparison method was used. The baseline water usage (Section 2) for this facility was compared to modeled usage. A .7 safety factor was applied to these savings to be conservative.

For the Detention Center a spreadsheet calculation was also used. There are currently sixteen rooftop units that use direct/indirect evaporative cooling. As the case at the Courthouse the nozzles on the indirect side are constantly calcifying and leaking. The direct side media is also filling with mineral at an alarming rate. The staff has cut the overflow pans to constantly allow water to drain in each air handler. This is a tremendous waste of water. It was estimated that approximately 1 gpm of water was being wasted per unit. With the installation of water softeners for the evaporative cooling units the pans will be fixed and blow down controls will be installed on each unit.

Arapahoe County
Dentention Center
Water Softenner Savings

	BILLING DATA Average last year Gallons	Days per month	GPM per Unit	Number of Untis	Total Water Saved kGals
Jan	2,756,486				
Feb	4,021,000				
Mar	4,314,714				
Apr	4,984,286				
May	3,368,529	31	1.0	16	714
June	4,151,471	30	1.0	16	691
Jul	4,564,677	31	1.0	16	714
Aug	4,210,161	31	1.0	16	714
Sep	5,095,161	30	1.0	16	691
Oct	4,572,727	31	1.0	16	714
Nov	3,977,273				
Dec	3,475,000				
	49,491,485				
					4,239

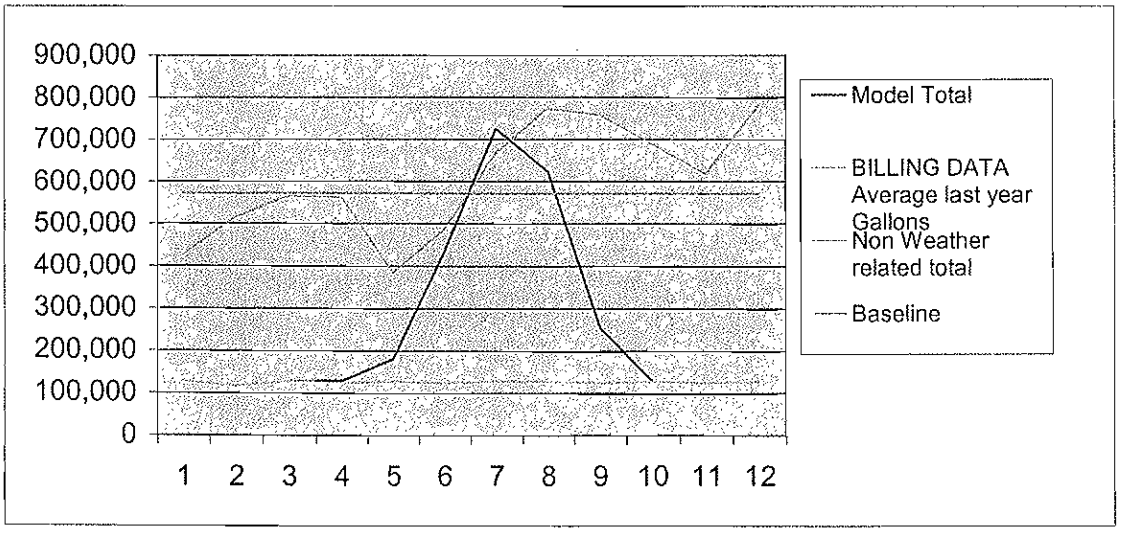
1) Drian pan of each unit was cut to allow water to "bleed" off.
2) Several units were observed to be flowing in excess of 1 gpm.
3) With new water softener the pans will be replaced and water will be able to be re-used.
4) Above does not include water savings for increaded efficiency of evaporative cooling.

ArapahoeCounty Justice Center

	BILLING DATA Average last year Gallons	Work days per month	Sanitary Water Use Model	Kitchen	Non Weather related total	Baseline	Balance	Gallons Saved
Jan	425,622	22	119,038	9,125	128,163	572,173	306,584	45,312
Feb	514,533	20	107,518	9,125	116,643	572,173	407,015	40,927
Mar	565,324	22	119,038	9,125	128,163	572,173	446,286	45,312
Apr	563,143	21	115,198	9,125	124,323	572,173	447,945	43,850
May	383,824	22	119,038	9,125	128,163	572,173	264,786	45,312
June	486,176	21	115,198	9,125	124,323	572,173	370,978	43,850
Jul	667,161	22	119,038	9,125	128,163	572,173	548,123	45,312
Aug	773,075	22	119,038	9,125	128,163	572,173	654,037	45,312
Sep	758,773	21	115,198	9,125	124,323	572,173	643,575	43,850
Oct	689,563	22	119,038	9,125	128,163	572,173	570,525	45,312
Nov	617,494	21	115,198	9,125	124,323	572,173	502,296	43,850
Dec	783,212	22	119,038	9,125	128,163	572,173	664,174	45,312
	7,227,900	261	1,401,571	73,000	1,013,781	6,866,073	5,826,329	533,511

	Non Sanitary Use	Non Sanitary Use Kgal	Ice machine	Evaporative coolers	Laundry	Total	Model Total	Balance (gal)	Model total to billing	Savings From Original Baseline
Jan	306,584	307	0	0	0	0	128,163	297,459	30%	297,459
Feb	407,015	407	0	0	0	0	116,643	397,890	23%	397,890
Mar	446,286	446	0	0	0	0	128,163	437,161	23%	437,161
Apr	447,945	448	0	4,572	0	4,572	128,895	434,248	23%	434,248
May	264,786	265	0	52,579	0	52,579	180,742	203,082	47%	203,082
June	370,978	371	0	308,617	0	308,617	432,940	53,236	89%	53,236
Jul	548,123	548	0	596,659	0	596,659	724,822	-57,661	109%	-57,661
Aug	654,037	654	0	496,073	0	496,073	624,236	148,839	81%	148,839
Sep	643,575	644	0	130,305	0	130,305	254,628	504,145	34%	504,145
Oct	570,525	571	0	0	0	0	128,163	561,400	19%	561,400
Nov	502,296	502	0	0	0	0	124,323	493,171	20%	493,171
Dec	664,174	664	0	0	0	0	128,163	655,049	16%	655,049
	5,826,329	5,826	0	1,588,806	0	1,594,632	3,099,877	4,128,023	43%	4,128,023

1588.805762



ECM 13 – Install Waterside Economizer

Buildings Included –

- ✓ Administration I

Spreadsheet savings used coupled with Bin Data (see attached). The spreadsheets were broken into three parts:

- January through April
- May through October
- November through December

These were broken into three sections as operating variables can change per season in some buildings such as schedule or lock-out temperatures. The intent was to capture all these variables in the most conservative fashion. All variables were received from operations personnel.

Demand savings was only taken in the winter months when little cooling is needed.

Savings was calculated for reduced run times on the chillers. Currently the staff operates the chillers on the following schedule:

Monday through Friday	5:00 AM to 11:00 PM
Saturday and Sunday	8:00 AM to 4:00 PM

This spreadsheet takes into account the benefit of utilizing the plate & frame heat exchanger during low wet bulb conditions or approximately up to 43°WB under certain conditions.

Arapahoe County
Administration I Building
H2O Economizer

Assumptions:

1) CH-1 & CH-2 operation from 5:00 AM to 7:00 PM and greater than 50 degrees F OA.
2) Uses Trace 700 unloading curve.
3) Assumes load varies directly with OA temperature.
4) Setup load simulated by reduction of OA temp equal to setup differential:
   Setup cfm = MIN((OAT - (Setup T - Space T)-Cooling zero load T),0) / (Cooling full load T - Cooling zero load T)

Basis:

Total Chiller Tonage:	260
Existing Chiller KW/Ton	0.55
Max WB for Economizer	43

Trace 700 Coefficients:

Coefficient A:	0.0005
Coefficient B:	0.5614
Coefficient C:	-1.1412
Coefficient D:	2.2214
Coefficient E:	-0.6455

Occupied Load profile characteristics:

Cooling lockout temperature:	50°	First month of cooling season:	11 November
Min load:	50%	Last month of cooling season:	12 December
Cooling full load at:	90°	Cooling temp. setup ends:	6
Cooling min. load at:	60°	Cooling temp. setup begins:	19
Delta:	30°	Weather data:	Denver Temperature Bins

Load Adjustments:

Occupied space temperature:	74°
Cooling setup temperature:	85°

Bin	Occupied Cooling Nov-Dec: 6:00-19:00					Unoccupied Cooling Hours (Nov thru Feb)					Savings
Average (°F)	Cooling (hrs)	AVG WB	Load Profile	CH-1 kW	kWh	Cooling (hrs)	AVG WB	Load Profile	CH-1 kW	kWh	kWh
107.5°	0.0		100%	0.0			0.0	100%	0.0		0.0
102.5°	0.0		100%	0.0			0.0	100%	0.0		0.0
97.5°	0.0		100%	0.0			0.0	88%	0.0		0.0
92.5°	0.0		100%	0.0			0.0	72%	0.0		0.0
87.5°	0.0		92%	0.0			0.0	55%	0.0		0.0
82.5°	0.0		75%	0.0			0.0	50%	0.0		0.0
77.5°	0.0		58%	0.0		0.0	0.0	50%	0.0		0.0
72.5°	0.0		50%	0.0		1.0	0.0	50%	71.5		0.0
67.5°	0.0		50%	0.0	0.0	5.0	0.0	50%	71.5	357.5	357.5
62.5°	9.0	42.2	50%	71.5	643.5	20.0	44.1	50%	71.5	1430.0	2073.5
57.5°	44.9	40.8	50%	71.5	3208.6	47.0	42.0	50%	71.5	3360.5	6569.1
52.5°	62.5	38.3	50%	71.5	4468.8	84.0	39.8	50%	71.5	6006.0	10474.8
47.5°	79.3	35.7	50%	0.0	0.0	146.0	37.5	50%	0.0	0.0	0.0
42.5°	95.6	33.0	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
37.5°	104.4	30.1	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
32.5°	113.6	27.2	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
27.5°	99.1	23.6	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
22.5°	60.1	19.6	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
17.5°	36.3	15.3	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
	705					303					19,475

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Max DB Bin:											62.5	62.5		
kW Savings:											71.5	71.5	143.0	kW-months
													0.0	kW-months (June-Sept)
													0.0	Peak kW (July - Sept)

Arapahoe County
Administration I Building
H2O Economizer

Assumptions:

1) CH-1 & CH-2 operation from 5:00 AM to 7:00 PM and greater than 50 degrees F OA.
2) Uses Trace 700 unloading curve.
3) Assumes load varies directly with OA temperature.
4) Setup load simulated by reduction of OA temp equal to setup differential:
   Setup cfm = MIN((OAT - (Setup T - Space T)-Cooling zero load T),0) / (Cooling full load T - Cooling zero load T)

Basis:

Total Chiller Tonage:	260
Existing Chiller KW/Ton	0.55
Max WB for Economizer	43

Trace 700 Coefficients:

Coefficient A:	0.0005
Coefficient B:	0.5614
Coefficient C:	-1.1412
Coefficient D:	2.2214
Coefficient E:	-0.6455

Occupied Load profile characteristics:

Cooling lockout temperature:	50°	First month of cooling season:	1 January
Min load:	50%	Last month of cooling season:	4 April
Cooling full load at:	90°	Cooling temp. setup ends:	6
Cooling min. load at:	60°	Cooling temp. setup begins:	19
Delta:	30°	Weather data:	Denver Temperature Bins

Load Adjustments:

Occupied space temperature:	74°
Cooling setup temperature:	85°

Bin	Occupied Cooling Jan-Apr: 6:00-19:00					Unoccupied Cooling Hours (Nov thru Feb)					Savings
Average (°F)	Cooling (hrs)	AVG WB	Load Profile	CH-1 kW	kWh	Cooling (hrs)	AVG WB	Load Profile	CH-1 kW	kWh	kWh
107.5°	0.0		100%	0.0			0.0	100%	0.0		0.0
102.5°	0.0		100%	0.0			0.0	100%	0.0		0.0
97.5°	0.0		100%	0.0			0.0	88%	0.0		0.0
92.5°	0.0		100%	0.0			0.0	72%	0.0		0.0
87.5°	0.0		92%	0.0			0.0	55%	0.0		0.0
82.5°	0.0		75%	0.0			0.0	50%	0.0		0.0
77.5°	0.0		58%	0.0		0.0	0.0	50%	0.0		0.0
72.5°	0.0		50%	0.0		1.0	0.0	50%	71.5		0.0
67.5°	0.0		50%	0.0	0.0	5.0	0.0	50%	71.5	357.5	357.5
62.5°	40.6	42.1	50%	71.5	2904.7	20.0	44.1	50%	71.5	1430.0	4334.7
57.5°	64.9	40.0	50%	71.5	4638.6	47.0	42.0	50%	71.5	3360.5	7999.1
52.5°	147.0	39.1	50%	71.5	10510.5	84.0	39.8	50%	71.5	6006.0	16516.5
47.5°	173.9	36.7	50%	0.0	0.0	146.0	37.5	50%	0.0	0.0	0.0
42.5°	201.3	34.0	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
37.5°	195.1	30.8	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
32.5°	198.9	27.7	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
27.5°	145.0	23.8	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
22.5°	95.9	19.5	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
17.5°	53.5	15.0	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
	1316					303					29,208

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Max DB Bin:	62.5	62.5	62.5										
kW Savings:	71.5	71.5	71.5										214.5 kW-months

0.0 kW-months (June-Sept)
0.0 Peak kW (July - Sept)

Arapahoe County
Administration I Building
H2O Economizer

Assumptions:

1) CH-1 & CH-2 operation from 5:00 AM to 7:00 PM and greater than 50 degrees F OA.
2) Uses Trace 700 unloading curve.
3) Assumes load varies directly with OA temperature.
4) Setup load simulated by reduction of OA temp equal to setup differential:
   Setup cfm = MIN((OAT - (Setup T - Space T)-Cooling zero load T),0) / (Cooling full load T - Cooling zero load T)

Basis:

Total Chiller Tonage:	260
Existing Chiller KW/Ton	0.55
Max WB for Economizer	43

Trace 700 Coefficients:

Coefficient A:	0.0005
Coefficient B:	0.5614
Coefficient C:	-1.1412
Coefficient D:	2.2214
Coefficient E:	-0.6455

Occupied Load profile characteristics:

Cooling lockout temperature:	50°	First month of cooling season:	5 May
Min load:	50%	Last month of cooling season:	10 October
Cooling full load at:	90°	Cooling temp. setup ends:	5
Cooling min. load at:	60°	Cooling temp. setup begins:	19
Delta:	30°	Weather data:	Denver Temperature Bins

Load Adjustments:

Occupied space temperature:	74°
Cooling setup temperature:	85°

Bin	Occupied Cooling May-Oct: 5:00-19:00					Unoccupied Cooling Hours (Nov thru Feb)					Savings
Average (°F)	Cooling (hrs)	AVG WB	Load Profile	CH-1 kW	kWh	Cooling (hrs)	AVG WB	Load Profile	CH-1 kW	kWh	kWh
107.5°	0.0		100%	0.0			0.0	100%	0.0		0.0
102.5°	0.0		100%	0.0			0.0	100%	0.0		0.0
97.5°	0.0		100%	0.0			0.0	88%	0.0		0.0
92.5°	0.0		100%	0.0			0.0	72%	0.0		0.0
87.5°	0.0		92%	0.0			0.0	55%	0.0		0.0
82.5°	0.0		75%	0.0			0.0	50%	0.0		0.0
77.5°	0.0		58%	0.0		0.0	0.0	50%	0.0		0.0
72.5°	0.0		50%	0.0		1.0	0.0	50%	71.5		0.0
67.5°	0.0		50%	0.0	0.0	5.0	0.0	50%	71.5	357.5	357.5
62.5°	0.0		50%	0.0	0.0	20.0	44.1	50%	71.5	1430.0	1430.0
57.5°	0.0		50%	0.0	0.0	47.0	42.0	50%	71.5	3360.5	3360.5
52.5°	56.6	41.0	50%	71.5	4048.7	84.0	39.8	50%	71.5	6006.0	10054.7
47.5°	139.0	40.7	50%	0.0	0.0	146.0	37.5	50%	0.0	0.0	0.0
42.5°	101.6	37.4	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
37.5°	57.4	33.2	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
32.5°	38.5	29.6	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
27.5°	10.3	25.0	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
22.5°	3.3	20.5	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
17.5°	1.8	16.5	50%	0.0	0.0		0.0	50%	0.0	0.0	0.0
	408					303					15,203

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Max DB Bin:													
kW Savings:													0.0 kW-months

0.0 kW-months (June-Sept)
0.0 Peak kW (July - Se

Denver Temperature Bins

Bin	January 01-08 (11)	January 09-16 (12)	January 17-24 (13)	January Total (14)	January MCWB	February 01-08 (11)	February 09-16 (12)	February 17-24 (13)	February Total (14)	February MCWB	March 01-08 (11)	March 09-16 (12)	March 17-24 (13)	March Total (14)	March MCWB	April 01-08 (11)	April 09-16 (12)	April 17-24 (13)	April Total (14)	April MCWB
110/114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105/109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100/104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95/99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90/94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85/89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53
80/84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52
75/79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	0	0	0	0	50
70/74	0	0	0	0	45	0	0	0	0	47	0	0	0	0	46	0	0	0	0	48
65/69	0	0	0	0	44	0	0	0	0	44	0	0	0	0	44	0	0	0	0	47
60/64	0	4	0	4	42	0	10	1	11	42	0	24	6	30	42	0	0	0	0	45
55/59	0	11	1	12	40	0	19	3	22	40	1	29	11	41	40	0	0	0	0	43
50/54	1	21	3	25	37	1	28	9	38	38	5	31	21	57	38	19	35	35	89	41
45/49	4	30	11	45	35	5	32	17	54	35	13	32	30	75	36	36	29	39	104	39
40/44	11	38	25	74	33	15	32	29	76	33	29	32	39	100	34	49	23	41	113	36
35/39	30	31	38	99	30	31	27	40	98	30	49	26	42	117	31	48	15	31	94	33
30/34	41	31	41	113	27	46	24	44	114	27	58	26	44	128	28	45	13	24	82	29
25/29	47	26	38	111	23	46	19	32	97	24	44	17	27	88	24	20	4	9	33	25
20/24	40	20	32	92	19	34	13	21	68	20	24	7	14	45	20	7	3	4	14	20
15/19	25	14	20	59	15	18	7	11	36	15	12	4	6	22	15	2	0	1	3	16
10/14	20	10	16	46	10	12	5	7	24	11	6	2	3	11	11	1	0	0	1	11
5/9	12	6	10	28	5.8	6	3	4	13	5.9	3	1	2	6	5.7	0	0	0	0	6.8
0/4	10	5	7	22	1	4	1	3	8	1.2	2	0	1	3	1.4	0	0	0	0	2.5
-5/-1	4	0	2	6	-3	2	1	1	4	-3.5	1	0	0	1	-2.8	0	0	0	0	0
-10/-6	2	0	1	3	-7.3	1	1	1	3	-7.6	0	0	0	0	-5.7	0	0	0	0	0
-15/-11	0	0	0	0	-12	1	0	1	2	-12	0	0	0	0	0	0	0	0	0	0
-20/-16	0	0	0	0	0	0	0	0	0	-16	0	0	0	0	0	0	0	0	0	0
				739					668					724					533	

Bin	May 01-08 (1)	May 09-16 (2)	May 17-24 (3)	May Total (4)	May MCWB	June 01-08 (1)	June 09-16 (2)	June 17-24 (3)	June Total (4)	June MCWB	July 01-08 (1)	July 09-16 (2)	July 17-24 (3)	July Total (4)	July MCWB	August 01-08 (1)	August 09-16 (2)	August 17-24 (3)	August Total (4)	August MCWB
110/114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105/109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100/104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95/99	0	0	0	0	0	0	0	0	0	60	0	0	0	0	60	0	0	0	0	61
90/94	0	0	0	0	55	0	0	0	0	59	0	0	0	0	60	0	0	0	0	60
85/89	0	0	0	0	55	0	0	0	0	58	0	0	0	0	60	0	0	0	0	59
80/84	0	0	0	0	54	0	0	0	0	58	0	0	0	0	60	0	0	0	0	59
75/79	0	0	0	0	53	0	0	0	0	57	0	0	0	0	59	0	0	0	0	58
70/74	0	0	0	0	52	0	0	0	0	55	0	0	0	0	58	0	0	0	0	57
65/69	0	0	0	0	51	0	0	0	0	54	0	0	0	0	56	0	0	0	0	56
60/64	0	0	0	0	49	0	0	0	0	52	0	0	0	0	55	0	0	0	0	54
55/59	0	0	0	0	47	0	0	0	0	50	0	0	0	0	53	0	0	0	0	52
50/54	0	0	0	0	45	0	0	0	0	47	0	0	0	0	49	0	0	0	0	48
45/49	61	17	39	117	42	0	0	0	0	44	0	0	0	0	44	0	0	0	0	45
40/44	46	11	23	80	39	8	1	3	12	40	0	0	0	0	0	0	0	0	0	0
35/39	21	4	8	33	34	1	0	0	1	36	0	0	0	0	0	0	0	0	0	0
30/34	11	2	4	17	30	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0
25/29	1	0	1	2	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20/24	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15/19	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0/4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-5/-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-10/-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-15/-11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-20/-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				249					13					0					0	

Bin	September 01-08 (1)	September 09-16 (2)	September 17-24 (3)	September Total (4)	September MCWB	October 01-08 (1)	October 09-16 (2)	October 17-24 (3)	October Total (4)	October MCWB	November 01-08 (11)	November 09-16 (12)	November 17-24 (13)	November Total (14)	November MCWB	December 01-08 (11)	December 09-16 (12)	December 17-24 (13)	December Total (14)	December MCWB
110/114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105/109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100/104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95/99	0	0	0	0	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90/94	0	0	0	0	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85/89	0	0	0	0	57	0	0	0	0	54	0	0	0	0	0	0	0	0	0	0
80/84	0	0	0	0	55	0	0	0	0	52	0	0	0	0	0	0	0	0	0	0
75/79	0	0	0	0	54	0	0	0	0	50	0	0	0	0	48	0	0	0	0	0
70/74	0	0	0	0	53	0	0	0	0	49	0	0	0	0	47	0	0	0	0	47
65/69	0	0	0	0	52	0	0	0	0	47	0	0	0	0	45	0	0	0	0	44
60/64	0	0	0	0	50	0	0	0	0	45	0	0	0	0	43	0	9	0	9	42
55/59	0	0	0	0	48	0	0	0	0	43	1	26	6	33	41	0	16	1	17	40
50/54	0	0	0	0	45	34	27	45	106	41	7	30	16	53	39	2	22	6	30	38
45/49	39	6	18	63	42	52	20	47	119	39	18	29	27	74	36	7	29	13	49	35
40/44	18	4	7	29	38	50	14	36	100	36	33	27	39	99	34	19	32	24	75	32
35/39	7	2	3	12	34	42	12	23	77	33	39	24	39	102	31	30	35	36	101	29
30/34	3	1	2	6	30	29	10	19	58	29	45	27	37	109	28	44	34	44	122	27
25/29	1	0	0	1	25	13	2	6	21	25	41	21	36	98	24	46	26	45	117	23
20/24	0	0	0	0	20	4	1	2	7	21	25	9	21	55	20	40	15	32	87	19
15/19	0	0	0	0	16	1	1	1	3	17	18	4	11	33	16	26	10	19	55	15
10/14	0	0	0	0	0	0	0	1	1	12	7	2	4	13	11	14	7	11	32	11
5/9	0	0	0	0	0	1	0	0	1	7	2	1	1	4	6.2	9	4	8	21	5.8
0/4	0	0	0	0	0	0	0	0	0	2.3	1	0	1	2	2	5	1	4	10	1.3
-5/-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-3.3	2	1	1	4	-3.3
-10/-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-6.8	2	1	1	4	-7.6
-15/-11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-12	1	1	1	3	-13
-20/-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	-17
				111					493					675					737	

Bin	Annual Total	Cooling Months May-Oct Day 5:00-19:00	Cooling Months May-Oct Night 19:00-5:00	Cooling Months May-Oct Avg MCWB	Heating Months Nov-Apr Day 5:00-19:00	Heating Months Nov-Apr Night 19:00-5:00	Heating Months Nov-Apr Avg MCWB
110/114	0	0.0	0.0		0.0	0.0	
105/109	0	0.0	0.0		0.0	0.0	
100/104	0	0.0	0.0		0.0	0.0	
95/99	0	0.0	0.0		0.0	0.0	
90/94	0	0.0	0.0		0.0	0.0	
85/89	0	0.0	0.0		0.0	0.0	
80/84	0	0.0	0.0		0.0	0.0	
75/79	0	0.0	0.0		0.0	0.0	
70/74	0	0.0	0.0		0.0	0.0	
65/69	0	0.0	0.0		0.0	0.0	
60/64	54	0.0	0.0		49.6	4.4	
55/59	125	0.0	0.0		110.0	15.0	
50/54	398	56.6	49.4	41°	213.9	78.1	
45/49	700	139.0	160.0	41°	263.5	137.5	
40/44	758	101.6	119.4	37°	316.4	220.6	
35/39	734	57.4	65.6	33°	327.9	283.1	
30/34	749	38.5	42.5	30°	347.4	320.6	
25/29	568	10.3	13.8	25°	274.6	269.4	
20/24	368	3.3	3.8	21°	177.3	183.8	
15/19	211	1.8	1.3	17°	102.4	105.6	
10/14	128				63.9	63.1	
5/9	73				36.4	35.6	
0/4	45				21.3	23.8	
-5/-1	15				6.9	8.1	
-10/-6	10				5.0	5.0	
-15/-11	5				2.5	2.5	
-20/-16	1				0.4	0.6	
	4942	408.4	455.6		2319.1	1756.9 4940	

Bin	January 01-08 (11)	January 09-16 (12)	January 17-24 (13)	January Total (14)	January MCWB	February 01-08 (11)	February 09-16 (12)	February 17-24 (13)	February Total (14)	February MCWB	March 01-08 (11)	March 09-16 (12)	March 17-24 (13)	March Total (14)	March MCWB	April 01-08 (11)	April 09-16 (12)	April 17-24 (13)	April Total (14)	April MCWB
110/114																				
105/109																				
100/104																				
95/99																				
90/94																				
85/89																	0	0	0	53
80/84																	1	0	1	52
75/79												0		0	47		8	1	9	50
70/74				0	45		0		0	47		5	0	5	46	0	20	5	25	48
65/69		1		1	44		3	0	3	44		11	2	13	44	1	27	9	37	47
60/64		4	0	4	42		10	1	11	42	0	24	6	30	42	3	32	16	51	45
55/59	0	11	1	12	40		19	3	22	40	1	29	11	41	40	7	30	25	62	43
50/54	1	21	3	25	37	1	28	9	38	38	5	31	21	57	38	19	35	35	89	41
45/49	4	30	11	45	35	5	32	17	54	35	13	32	30	75	36	36	29	39	104	39
40/44	11	38	25	74	33	15	32	29	76	33	29	32	39	100	34	49	23	41	113	36
35/39	30	31	38	99	30	31	27	40	98	30	49	26	42	117	31	48	15	31	94	33
30/34	41	31	41	113	27	46	24	44	114	27	58	26	44	128	28	45	13	24	82	29
25/29	47	26	38	111	23	46	19	32	97	24	44	17	27	88	24	20	4	9	33	25
20/24	40	20	32	92	19	34	13	21	68	20	24	7	14	45	20	7	3	4	14	20
15/19	25	14	20	59	15	18	7	11	36	15	12	4	6	22	15	2	0	1	3	16
10/14	20	10	16	46	10	12	5	7	24	11	6	2	3	11	11	1	0	0	1	11
5/9	12	6	10	28	5.8	6	3	4	13	5.9	3	1	2	6	5.7	0			0	6.8
0/4	10	5	7	22	1	4	1	3	8	1.2	2		1	3	1.4	0			0	2.5
-5/-1	4	0	2	6	-3	2	1	1	4	-3.5	1			1	-2.8					
-10/-6	2	0	1	3	-7.3	1	1	1	3	-7.6					-5.7					
-15/-11	0	0		0	-12	1	0	1	2	-12										
-20/-16						0				-16										
				740					671					742					718	

Bin	May 01-08 (1)	May 09-16 (2)	May 17-24 (3)	May Total (4)	May MCWB	June 01-08 (1)	June 09-16 (2)	June 17-24 (3)	June Total (4)	June MCWB	July 01-08 (1)	July 09-16 (2)	July 17-24 (3)	July Total (4)	July MCWB	August 01-08 (1)	August 09-16 (2)	August 17-24 (3)	August Total (4)	August MCWB
110/114				0					0					0					0	
105/109				0					0					0					0	
100/104				0					0					0					0	
95/99							2	0	2	60		6	1	7	60		3	0	3	61
90/94		0	0	0	55		12	2	14	59		32	6	38	60		19	3	22	60
85/89		3	0	3	55	0	30	7	37	58	0	55	15	70	60	0	49	10	59	59
80/84		12	2	14	54	1	39	14	54	58	3	60	25	88	60	1	64	21	86	59
75/79	0	28	6	34	53	4	41	23	68	57	10	42	36	88	59	7	49	32	88	58
70/74	2	39	14	55	52	12	39	34	85	55	28	28	53	109	58	21	32	51	104	57
65/69	5	38	22	65	51	26	32	42	100	54	57	15	55	127	56	52	18	59	129	56
60/64	15	39	36	90	49	52	21	48	121	52	89	7	44	140	55	86	9	51	146	54
55/59	30	29	45	104	47	63	10	33	106	50	48	2	13	63	53	60	3	16	79	52
50/54	65	25	48	128	45	48	7	23	78	47	11	1	2	14	49	19	1	4	24	48
45/49	61	17	39	117	42	25	4	9	38	44	1	0	0	1	44	2	0	0	2	45
40/44	46	11	23	80	39	8	1	3	12	40										
35/39	21	4	8	33	34	1	0	0	1	36										
30/34	11	2	4	17	30		0		0	32										
25/29	1	0	1	2	27															
20/24	0			0	22															
15/19	0			0	18															
10/14																				
5/9																				
0/4																				
-5/-1																				
-10/-6																				
-15/-11																				
-20/-16																				
				742					716					745					742	

Bin	September 01-08 (1)	September 09-16 (2)	September 17-24 (3)	September Total (4)	September MCWB	October 01-08 (1)	October 09-16 (2)	October 17-24 (3)	October Total (4)	October MCWB	November 01-08 (11)	November 09-16 (12)	November 17-24 (13)	November Total (14)	November MCWB	December 01-08 (11)	December 09-16 (12)	December 17-24 (13)	December Total (14)	December MCWB
110/114														0					0	
105/109														0					0	
100/104														0					0	
95/99		0		0	58															
90/94	0	4	0	4	59															
85/89	0	19	3	22	57		0		0	54										
80/84	0	39	7	46	55		7	0	7	52										
75/79	1	44	15	60	54		18	2	20	50		1		1	48					
70/74	4	40	26	70	53	0	32	5	37	49		5		5	47		0		0	47
65/69	16	30	38	84	52	1	35	10	46	47		13	0	13	45		3		3	44
60/64	42	23	48	113	50	5	37	20	62	45	0	21	2	23	43		9	0	9	42
55/59	56	15	40	111	48	15	31	32	78	43	1	26	6	33	41	0	16	1	17	40
50/54	52	13	30	95	45	34	27	45	106	41	7	30	16	53	39	2	22	6	30	38
45/49	30	6	18	63	42	52	20	47	119	39	18	29	27	74	36	7	29	13	49	35
40/44	18	4	7	29	38	50	14	36	100	36	33	27	39	99	34	19	32	24	75	32
35/39	7	2	3	12	34	42	12	23	77	33	39	24	39	102	31	30	35	36	101	29
30/34	3	1	2	6	30	29	10	19	58	29	45	27	37	109	28	44	34	44	122	27
25/29	1	0	0	1	25	13	2	6	21	25	41	21	36	98	24	46	26	45	117	23
20/24	0	0	0	0	20	4	1	2	7	21	25	9	21	55	20	40	15	32	87	19
15/19	0			0	16	1	1	1	3	17	18	4	11	33	16	26	10	19	55	15
10/14						0	0	1	1	12	7	2	4	13	11	14	7	11	32	11
5/9						1		0	1	7	2	1	1	4	6.2	9	4	8	21	5.8
0/4						0			0	2.3	1	0	1	2	2	5	1	4	10	1.3
-5/-1											0	0	0	0	-3.3	2	1	1	4	-3.3
-10/-6				0					0		0	0	0	0	-6.8	2	1	1	4	-7.6
-15/-11				0					0		0			0	-12	1	1	1	3	-13
-20/-16				0					0							0	0	1	1	-17
				716					743					717					740	

Bin	Annual Total	Cooling Months -Oct Day 5:00-19:00	Cooling Months -Oct Night 19:00-5:00	Cooling Months -Oct Avg MCWB	Heating Months Nov-Apr Day 5:00-19:00	Heating Months Nov-Apr Night 19:00-5:00	Heating Months Nov-Apr Avg MCWB
110/114	0	0.0	0.0		0.0	0.0	
105/109	0	0.0	0.0		0.0	0.0	
100/104	0	0.0	0.0		0.0	0.0	
95/99	12	11.4	0.6	60.2	0.0	0.0	
90/94	78	71.1	6.9	59.4	0.0	0.0	
85/89	191	169.1	21.9	58.7	0.0	0.0	0.0
80/84	296	248.8	46.3	57.9	1.0	0.0	51.5
75/79	368	273.0	85.0	56.5	9.4	0.6	49.8
70/74	495	303.8	156.3	55.0	31.9	3.1	47.8
65/69	621	311.6	239.4	53.5	62.5	7.5	45.6
60/64	800	337.0	335.0	51.7	110.5	17.5	43.4
55/59	728	259.1	281.9	48.6	152.0	35.0	41.2
50/54	737	213.1	231.9	44.7	213.9	78.1	38.9
45/49	741	156.9	183.1	41.1	263.5	137.5	36.4
40/44	758	101.6	119.4	37.4	316.4	220.6	33.7
35/39	734	57.4	65.6	33.2	327.9	283.1	30.6
30/34	749	38.5	42.5	29.6	347.4	320.6	27.5
25/29	568	10.3	13.8	25.0	274.6	269.4	23.7
20/24	368	3.3	3.8	20.5	177.3	183.8	19.5
15/19	211	1.8	1.3	16.5	102.4	105.6	15.1
10/14	128				63.9	63.1	10.6
5/9	73				36.4	35.6	5.8
0/4	45				21.3	23.8	1.2
-5/-1	15				6.9	8.1	-3.2
-10/-6	10				5.0	5.0	-7.5
-15/-11	5				2.5	2.5	-12.4
-20/-16	1				0.4	0.6	-16.6
	8732	2567.6	1834.4		2526.8	1801.3	

ECM 16 – Irrigation Control System Upgrade
Administration Building 1:

The water economy at the Administration Building 1 is divided between sanitation services, cooling tower make up water, ice machine, irrigation and boiler water make up.

Sanitary water use is calculated based on survey observations of fixture type capacity and condition, population levels integrated with schedules.

Because of seasonal variability in water use rates due to cooling tower and irrigation demand, the year round monthly use rate of sanitary water us is assumed to be at the winter month levels when the only other water use is boiler water makeup (which in normally very low) and the ice machine.

The warm weather increase in water use rates in due to the cooling tower and irrigation usage. The seasonal water use by the cooling tower and irrigation is easily discerned from the water use curve. The cooling tower usage was determined by hand calculations using Denver dry bulb and wet bulb historical data and using a psychometric chart to estimate the evaporative losses. Theses results where compared to water tower water consumption results in the Trane Trace computer model.

The irrigation use was assumed to be the balance of the water consumption:

Irrigation Use = Total Usage – Sanitary – HVAC – Ice Machine.

Administration Building 1 has 3.1 acres of irrigated landscape. The irrigated areas include lawn and landscaped area near and between the buildings and area bordering the parking lots and entry roadways.

Two Rainmaster Sentar ™ RME timers, control the system. The maintenance staff has set up the system so that each zone is set to ensure the lawn area it serves remains green during the summer months. This is a proven method of maintaining turf, but often leads to over watering.

The water use requirements for turf maintenance vary over the summer. For the purposes of this study, precipitation requirements were calculated from the evapotranspiration rates typical to Denver, actual rain data for 2004 with the assumption that turf applied to the lawn is comprised of cool season grasses.

The gallons per day required was calculated by the following formula:

Irrigation required (in) = (ETo x Kc) – Precipitation (in)

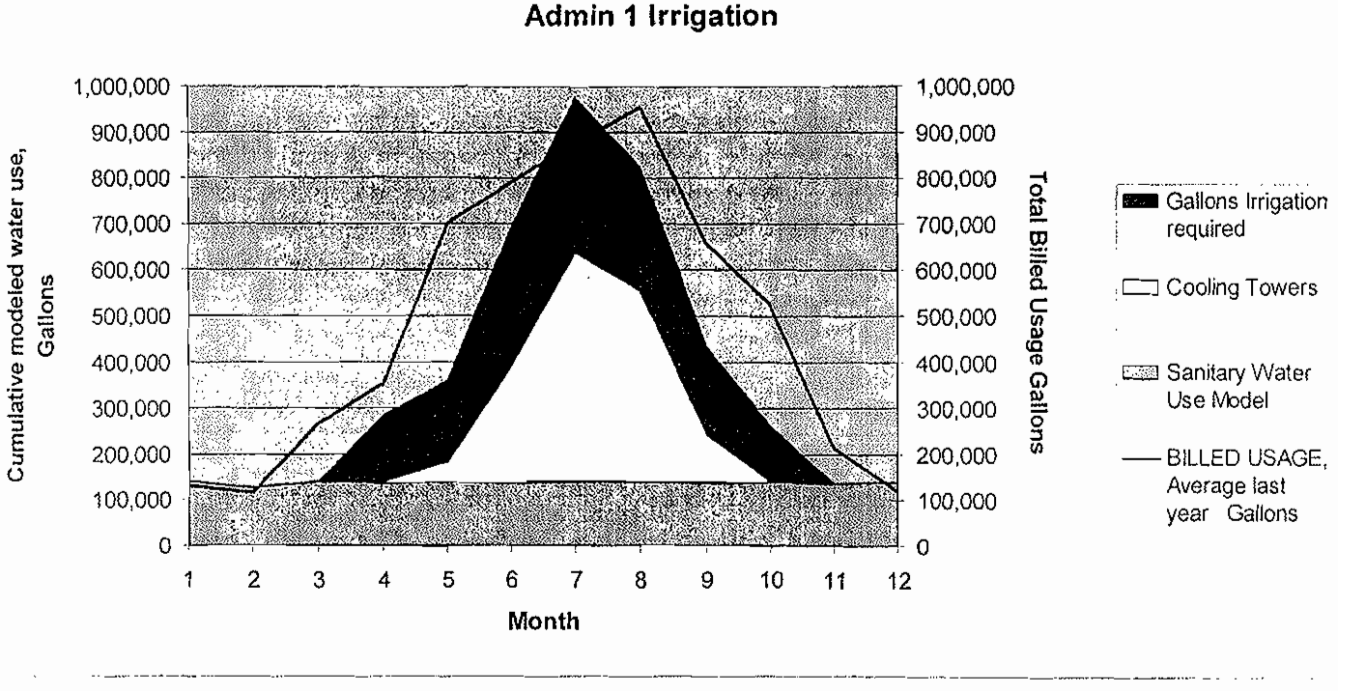
ETo – reference evapotranspiration rate from weather data

Kc - Crop coefficient. A constant applied to correct for the transpiration losses for a particular planting or crop. In this case the "crop" is cool season turf, i.e. eastern bluegrass.

Precipitation – Denver average precipitation

Water savings for this measure is 75% of the difference between the modeled water use and the calculated water requirements of the landscape.

The following chart illustrates the results of the various components of the water model as a stacked area plot; each calculation result is shown as a solid area on the chart and scaled on the left side. The billing data is represented by the solid line and is scaled on the right side. The chart demonstrates that the sum of the models is a well within the billed usage. The ice machine usage was calculated to less than 800 gallons per month and does not show on this chart.



Arapahoe County Domestic Water
Administration Building

Units	
SF/acre	43,650
LF/acre side	209
Gal/CF	7 481

Lawn Area 135,191 SF
3.10 Acres

Northern Front Range % of July

	April	May	June	July	August	September	October
	0 90	1 10	1.40	1 50	1 20	0 90	0 60
	60%	73%	93%	100%	80%	60%	40%

Colorado Springs % of July

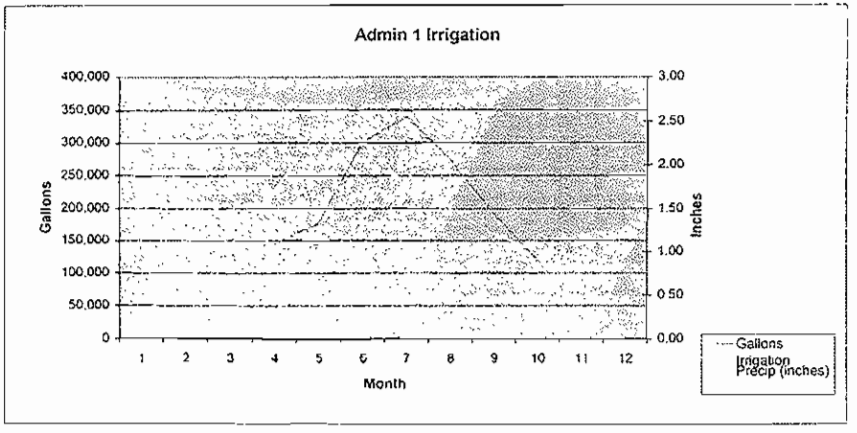
	April	May	June	July	August	September	October
	0 50	0 75	1 25	1 50	1 38	0 83	0 33
	33%	50%	83%	100%	92%	55%	22%

	April	May	June	July	August	September	October
Per month	3 88	4 93	6 04	6 52	5 47	4 01	2 76
Per day	0 13	0 16	0.2	0 21	0 18	0 13	0 09

Predicted Irr use 0 gallons
Estimated Irr billing use 0
0
0

Increase by 30%

Month	Days	ET Required/ week (inches)	ET Required/ month (inches)	Precip (inches)	Kc	Gallons Irrigation	
Jan							
Feb							
Mar							
April	30	0 90	3 86	1.70	0.80	145,444	189077
May	31	1 10	4 87	2 40	0.85	177,049	230163
June	30	1.40	6.00	1.80	0.85	300,881	391145
July	31	1.50	6.64	1.90	0.85	339,770	441701
August	31	1.20	5.31	1.50	0.85	273,249	355223
September	30	0.90	3.86	1.20	0.85	190,353	247459
October	31	0.60	2.66	1.00	0.85	118,715	154329
November							
December							
						1545460	2009098



Denver Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation (inches)	0 5	0 6	1 3	1 7	2 4	1 8	1 9	1 5	1 2	1	0 9	0 6	15 4
Days with Precipitation 0 01 inch or More	6	6	9	9	11	9	9	9	6	5	6	5	89
Monthly Snowfall (inches)	8 1	7.5	12 5	8 9	1 6	0	< 0 05	< 0 05	1 6	3 7	9 1	7 3	60 3

Denver Precipitation	Precip	Days	Monthly Snowfall (inches)
Jan	0 5	6	8 1
Feb	0 6	6	7 5
Mar	1 3	9	12 5
Apr	1 7	9	8.9
May	2 4	11	1 6
Jun	1 8	9	0
Jul	1.9	9	< 0 05
Aug	1 5	9	< 0 05
Sep	1 2	6	1 6
Oct	1	5	3 7
Nov	0 9	6	9 1
Dec	0.6	5	7 3
Annual	15.4	89	60 3

Arapahoe County Domestic Water
Administration Building

Rainmaster "iCentral" Setup:

All prices off web published pricelist RETAIL pricing.

Labor Rate @ $50.00
1 man Day Rep said installation ~ 15 minutes
Trade-in on old panels and discount because we are going to use the old cases not included

Controller

Zones:	36	24	24
Eagle EG	$0.00	$1,619.00	$1,619.00
iCentral	$0.00	$795.00	$795.00
Service Plan	$0.00	$275.00	$275.00
First Year cost	$0.00	$2,689.00	$2,689.00
Grand total	$5,378.00		
Labor	$400.00		
Total	$5,778.00		

Total Estimated Usage (Gals	2,009,098	
Total Required (Gals)	1,545,460	
Gallons of over use	463,638	
Assume 75% over use can be save by tighter control savings:	347,729	
% savings gallons	17%	Rainmaster Rep expects 30% to 40% saviings

Gallons of over use	347,729
Rate	$5.57
Model Overuse:	$1,937
Assume 50% over use can be save by tighter control	$968
Annual Service Cost:	$550

ROI 13.81 years

ECM 16 - Irrigation

Justice Center Irrigation:

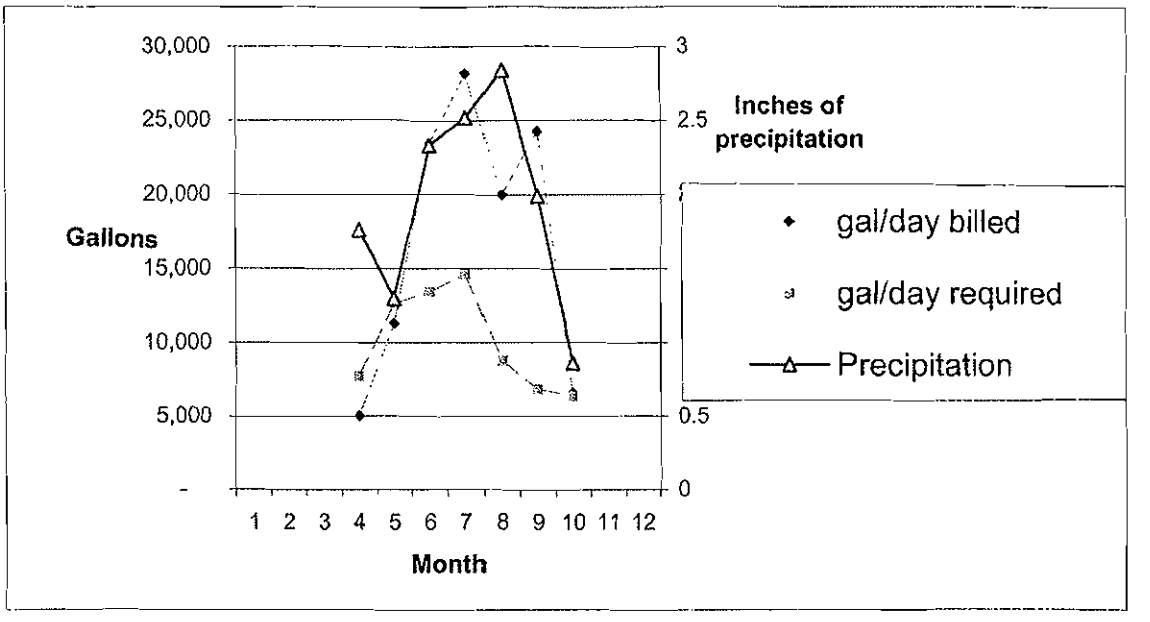
I. General:

A. There are four meters serving the irrigation system at the Justice Center complex. The irrigation system is one network that can be served by any number of four meters feeding the system. As the demand increases, the maintenance staff turns on valves associated with additional meters. All irrigations services share four meters. The meters are read monthly.

B. Justice Center Building has on a 1,944,000 sqft. (45 acre) parcel. The total area not occupied by buildings or covered with pavement is 25 acres. The building maintenance measured the irrigation area to be 176,000 square feet. The irrigated areas include lawn and landscaped area near and between the buildings and area bordering the parking lots and entry roadways. Areas west of the detention center, north of the north parking lot, and certain areas east of the northeast parking lot and north east of the Administration 1 building are not irrigated.

C. Three Rainmaster Sentar ™ RME timers, 2 with 36 zones and one with 24 zones, control the system. The maintenance staff has set up the system so that each zone is set to ensure the lawn area it serves remains green during the summer months. This is a proven method of maintaining turf, but often leads to over watering.

D. The water use requirements for turf maintenance vary over the summer. For the purposes of this study, precipitation were requirements calculated from the evapotranspiration rates typical to Denver, actual rain data for 2004 and assuming turf applied to the lawn is comprised of cool season grasses. The following graph shows the moisture requirements relative to the irrigation applied according to the irrigation billing data.



The Gallons per day required was calculated by the following formula:

Irrigation required (in) = (ETo x Kc) – Precipitation (in)

ETo – reference evapotranspiration rate from weather data

Kc - Crop coefficient. A constant applied to correct for the transpiration losses for a particular planting or crop. In this case the "crop" is cool season turf, i.e. eastern bluegrass.

The second y-axis illustrated rainfall is 2004. There is an indication from the data that some control is being applied to the system in that a drop in the water use rate accompanies the spike in August rainfall. In general, however, there appears to be room for improvement and optimization on the system. The water use rates greatly exceed requirements for most of the season.

E. There is a 3600 square foot area nearby the day program entry way irrigated using water from the detention center meter with its own timer and controls.

ACJC Complex
Irrigation

90 ft =	1 cm		
Irrigated Area			
1	0.7	2	11,340
	0.7	0.7	3,969
2	0.2	3	4,860
3	0.3	2.2	5,346
	0.2	0.9	1,458
4	0.3	2.2	5,346
	0.2	0.9	1,458
5	1.1	0.55	4,901
6	25	0.7	141,750
7	1.9	0.3	4,617
8	1.5	0.7	8,505
9	1.7	0.4	5,508
			0
11	1.2	1.2	11,664
12	0.5	2	8,100
13	0.9	0.9	6,561
	0.7	0.9	5,103
14	0.636173	1	5,153
15	0.2	1.5	2,430
16	0.5	2.5	10,125
	0.7	0.8	4,536
	0.9	0.5	3,645
	1	0.2	1,620
17	0.5	2.5	10,125
	0.7	0.8	4,536
	0.9	0.5	3,645
	1	0.2	1,620
18	5	0.3	12,150
19	3.7	0.3	8,991
20	2.5	0.3	6,075
			305,136

Parking Lot			
7.2	4	233,280	
3.6	7	204,120	437,400
Road			
0.4	48.5	157,140	
1.5	0.7	8,505	
1.5	2	24,300	189,945
Sidewalk			
0.2	27.05	43,821	
			43,821
Patio			
1.2	0.9	8,748	
1	1.2	9,720	
			9,720
			680,886
Buildings:			
Admin1			
1.1	1.1	9,801	
1.1	0.6	5,346	
1.3	1	10,530	
			25,677
Admin2			
1.1	1.1	9,801	
1.1	0.6	5,346	
1.3	1	10,530	
			25,677
Detention			
1.1	4.4	39,204	
0.6	13.2	64,152	
3	0.5	12,150	
0.2	8.7	14,094	
			90,396
			141750

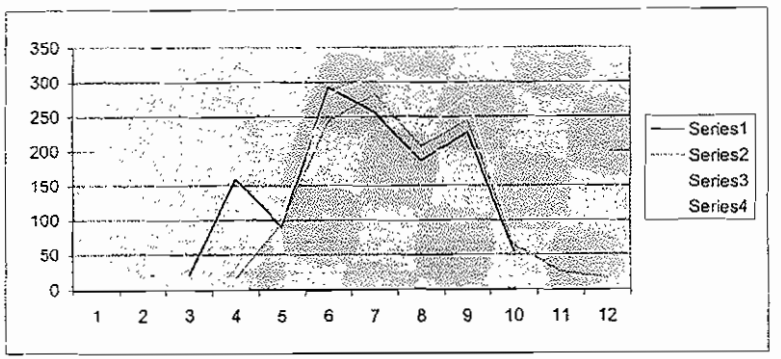
Total Area				
16	15	1,944,000	1,944,000	
Check	1,127,772			
Untreated landscape	816,228			
Total Area	**1,944,000**	**44.54**		

Summary:	**Square feet**	**Acres**			
Untreated landscape	**816,228**	**18.70**	42%	25.69	0.727888
Irrigated Area	**305,136**	**6.99**	16%		0.272112
Parking Lot	**437,400**	**10.02**	23%		
Roadway	**189,945**	**4.35**	10%		
Sidewalk and Patio	**53,541**	**1.23**	3%		
Building footprint	**141,750**	**3.25**	7%		
Total Area	**1,944,000**	**44.54**			

ACJC Complex
Irrigation

Service Charge	26.44 per acct	3.305	Less than 25
Calculated$/gal	per Kgal		25 - 200
			Greater than 200

	Date			1		2		3		4		Total				
				Kgal	$	Kgal	$	Kgal	$	Kgal	$	Kgal	$	kgal/day	$	
1	1/31/2004	12/25/2003	37.00		$ 18.56		$ 26.44		$ 26.44		$ 26.44	0	$ 97.88	-	$ (7.88)	$ -
2	2/25/2004	1/31/2004	25.00		$ 18.56		$ 26.44		$ 26.44		$ 26.44	0	$ 97.88	-	$ (7.88)	$ -
3	3/26/2004	2/25/2004	30.00		$ 18.56	20	$ 61.44		$ 26.44		$ 26.44	20	$ 132.88	0.67	$ 27.12	$ 1.36
4	4/30/2004	3/26/2004	35.00		$ 18.56	159	$ 562.16	16	$ 49.44		$ 26.44	175	$ 656.60	5.00	$ 550.84	$ 3.15
5	5/26/2004	4/30/2004	26.00		$ 18.56	89	$ 308.06	95	$ 329.84	110	$ 384.29	294	$ 1,040.75	11.31	$ 934.99	$ 3.18
6	6/30/2004	5/26/2004	35.00		$ 18.56	293	$ 1,115.54	244	$ 902.39	283	$ 1,072.04	820	$ 3,108.53	23.43	$ 3,002.77	$ 3.66
7	7/30/2004	6/30/2004	30.00		$ 18.56	256	$ 954.59	282	$ 1,067.69	307	$ 1,176.44	845	$ 3,217.28	28.17	$ 3,111.52	$ 3.68
8	8/30/2004	7/30/2004	31.00		$ 18.56	186	$ 660.17	207	$ 741.44	227	$ 828.44	620	$ 2,248.61	20.00	$ 2,142.85	$ 3.46
9	9/30/2004	8/30/2004	31.00		$ 18.56	228	$ 832.79	245	$ 906.74	279	$ 1,054.64	752	$ 2,812.73	24.26	$ 2,706.97	$ 3.60
10	10/28/2004	9/30/2004	28.00		$ 18.56	54	$ 181.01	63	$ 228.20	67	$ 228.20	184	$ 655.97	6.57	$ 550.21	$ 2.99
11	11/30/2004	10/28/2004	33.00		$ 18.56		$ 26.44	26	$ 79.37		$ 26.44	26	$ 150.81	0.79	$ 45.05	$ 1.73
12	12/31/2004	11/30/2004	31.00		$ 18.56		$ 26.44	16	$ 49.64		$ 26.44	16	$ 121.08	0.52	$ 15.32	$ 0.96
												3752	$ 14,341.00			$ 3.39
													$ 5,019.35			$ 6.78



ACJC Complex
Irrigation

Units:
SF/acre 43,650
LF/acre side 209
Gal/CF 7.48

Lawn Area 176,200 SF
4.04 Acres

Northern Front Range % of July

April	May	June	July	August	September	October
0.90	1.10	1.40	1.50	1.20	0.90	0.60
60%	73%	93%	100%	80%	60%	40%

Colorado Springs % of July

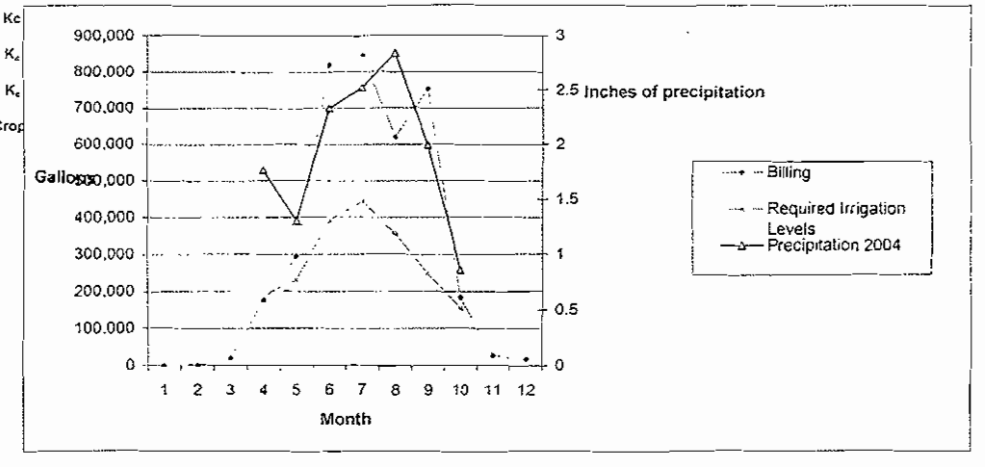
0.50	0.75	1.25	1.50	1.38	0.83	0.33
33%	50%	83%	100%	92%	55%	22%

	April	May	June	July	August	September	October
Per month	3.88	4.93	6.04	6.52	5.47	4.01	2.76
Per day	0.13	0.16	0.2	0.21	0.18	0.13	0.09

Area 2

Month	Days	E.T Required/ week	E.T Required/ month	Kc	Historical Precipitation	Precipitation 2004	Required Irrigation Levels	Billing	differential
January	31							0	0
February	30							0	0
March	31			0.8				20,000	0
April	30	0.90	3.86	0.80	1.7	1.76	189,538	175,000	-14,538
May	31	1.10	4.87	0.85	2.4	1.3	230,724	294,000	63,276
June	30	1.40	6.00	0.85	1.8	2.33	392,098	820,000	427,902
July	31	1.50	6.64	0.85	1.9	2.52	442,777	845,000	402,223
August	31	1.20	5.31	0.85	1.5	2.84	356,089	620,000	263,911
September	30	0.90	3.86	0.85	1.2	1.99	248,062	752,000	503,938
October	31	0.60	2.66	0.85	1	0.86	154,705	184,000	29,295
November	30							26,000	0
December	31							16,000	0
							14 2,013,993	3,690,000	1,676,007

Crop - cool seasc - warm season [15] Reduced Kc with careful management



ACJC Complex
Irrigation

http://www.crh.noaa.gov/cgi-bin-den/showProduct.pl?title=Denver's+2004+Climatological+Summary&product=annsum04.htm&backto=2

MAX

	AVG	AVG I	Mon A	Mon I	HIGH	LOW	PRECIF	Snow	HDD	CCD
JAN	45.5	18.2	31.9	29.2	63	-11	0.23	4.6	1022	0
FEB	41.9	19.8	30.9	33.2	67	-9	0.21	8.9	984	0
MAR	62	30.7	46.4	39.6	79	18	0.14	1.8	569	0
APR	59.6	35.4	47.5	47.6	81	23	1.76	15.3	519	0
MAY	73.9	44.7	59.3	57.2	88	28	1.3	0	192	23
JUN	76.9	50.5	63.7	67.6	98	41	2.33	0	99	67
JUL	85	56.7	70.9	73.4	99	49	2.52	0	17	201
AUG	82.4	54	68.2	71.7	96	42	2.84	0	31	137
SEP	77.6	47.7	62.7	62.4	90	37	1.99	0	131	67
OCT	65.6	36.1	50.9	51	79	24	0.86	1.4	431	0
NOV	49	25.2	37.1	37.5	72	-1	0.45	10	831	0
DEC	48.3	21.4	34.9	30 3	67	-9	0.04	2.6	926	0
ANNUAL	64	36.7	50.3	50.1	99	-11	14.67	44.6	5752	495
SEASON								14	2367	

Denver Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation (inches)	0.5	0.6	1.3	1.7	2.4	1.8	1.9	1.5	1.2	1	0.9	0.6	15.4
Days with Precipitation 0.01 inch or More	6	6	9	9	11	9	9	9	6	5	6	5	89
Monthly Snowfall (inches)	8.1	7.5	12.5	8.9	1.6	0	< 0.05	< 0.05	1.6	3.7	9.1	7.3	60.3

http://www.climate-zone.com/climate/united-states/colorado/denver/
Copied and Transposed from above

Denver Precipitation	Preci	Days	Monthly Snowfall (inches)
Jan	0.5	6	8.1
Feb	0.6	6	7.5
Mar	1.3	9	12.5
Apr	1.7	9	8.9
May	2.4	11	1.6
Jun	1.8	9	0
Jul	1.9	9	< 0.05
Aug	1.5	9	< 0.05
Sep	1.2	6	1.6
Oct	1	5	3.7
Nov	0.9	6	9.1
Dec	0.6	5	7.3
Annual	15.4	89	60.3

ACJC Complex
Irrigation

Rainmaster "iCentral" Setup:

All prices off web published pricelist RETAIL pricing.
http://www.rainmaster.com/PDF/2004TURF-AGPRICELIST.pdf
Labor Rate @ $50.00
1 man Day Rep said installation ~ 15 minutes
Trade-in on old panels and discount because we are going to use the old cases not included

Controller

Zones:	36	36	24
Eagle SCSB	$2,660.00	$2,660.00	$2,265.00
iCentral	$795.00	$795.00	$795.00
Service Plan	$275.00	$275.00	$275.00
First Year cost	$3,766.00	$3,766.00	$3,359.00
Grand total	$10,891.00		
Labor	$400.00		
Total	$11,291.00		

Total Billed Usage (Gals)	3,690,000	
Total Required (Gals)	2,013,993	
Gallons of over use	1,676,007	
Assume 50% over use can be save by tighter control savings:	838,004	
% savings gallons	23%	Rainmaster Rep expects 30% to 40% saviings

Gallons of over use	838,004
Rate	$6.96
Model Overuse:	$5,833
Assume 50% over use can be save by tighter control	$2,916
Annual Service Cost:	$275

ECM 17 – Programmable Flush Valve Controls

General:
Domestic Water usage for the Detention Center was modeled using population figures, staff, inmates, and visitors, occupancy schedules, fixture usage rates as determined in the survey and average estimates of fixture usage. The model is then compared to the metered usage and reasonable adjustments to the model are made to reflect the metered usage. In general, the fixture rates were adjusted to bring the model rates safely below the metered rates. After matching the water model to the building use, various water conservation scenarios were applied to the model to analyze potential savings.

The water usage is determined by:

(Number of People) X (Fixture Rate) X (Uses per Day) X (Days Occupied per Year)

Visitor populations were also included. Visitation period was assumed to be for 2 hours for the detention center, and then the population was normalized to an 8 hr day and added to the given population figure using the following formula:

(Number of Hours Visitation) ÷ (8 hours) X (Visitors/Day) = Normalized Visitor Population

Fixture use rates:

There were some adjustments made to the fixture rates to bring the modeled usage in line with the metered data. Some of the adjustments were downward (lower GPF). Some were adjusted upward; this is justified as long as all water is accounted for. Maladjusted flush valves and leaking tank valves can account for significant losses. Also, where there was a mix of fixtures, a weighted average was applied to the model, which also lowered the modeled fixture rate.

The following table illustrates the uses per day per person used in the models.

Uses per day	Inmates		Staff		Visitors		Units
	Male	Female	Male	Female	Male	Female	
Toilet	12	12	1	5	1	5	Flushes
Urinal	0	0	4	0	4	0	Flushes
Lav Faucet	1	1	2	2	2	2	Minutes
Shower (M F)		10	0	0	0	0	Minutes

*Based on: "A Water Conservation Guide for Commercial Institutional and Industrial Users", Water Use and Conservation Bureau, New Mexico Office of the State Engineer.

Schedules are considered only to the extent that the days that the buildings are open and the building are populated.

Schedules:

	Office (staff and visitors)	Detention Center
Work days	250	365
Holidays	-10	-10
Vacation	-14	-14
Total	226	341

Population assumptions are listed below:

	Population (1)	Visitors / day (2)	Quantity of toilets
P.J. Sullivan Detention Center	195	163	71
P.J. Sullivan Detention Center (Comby)	1215	0	413
Total			484

(1) Population figures are as given by the Maintenance Staff.
(2) Visitor figures as per Arapahoe County Staff.

The ECM recommended placing programmable flush controls on the existing combination penal units. Savings were calculated by adjusting the 'Uses per day' from 12 per inmate to 8.

Savings =

4,952,530 gallons x .73 (Safety Factor) = 3,615,347 gallons per year

Arapahoe County Domestic Water
ACJC Detention Center

Building Area 291,955

General	
Diversity	1

Inmates		
Population:	815	Pop ratio
Inmates: Women	163	0.2
Inmates: Men	652	0.8
Inmates: Total	815	
Absent	0.00%	

Inmates: pods 2&5		
Population:	400	Pop ratio
Inmates: Wor	80	0.2
Inmates: Mer	320	0.8
Inmates: Tot	400	
Absent	0.00%	

Staff		
Population:	195.00	Pop ratio
Staff: Women	117	0.6
Staff: Men	78	0.4
Staff: Total	195	
Absent	0.00%	

Visitors		
Length of stay %of 8 hour day	15%	1.20 hours
Visitors Total per day	163	
Visitors Women conv to person days	20	0.8
Visitors Men conv to person days	5	0.2
Total (visitor days)	25	

Schedule	Inmates	Staff	Visitors
Occupied Days	365	365	365
Holidays		10	
Vacation		14	
Total	365	341	365

Water Temperature		
Supply	130	Hot Water
Street	54	Fraction
Tap	105	57%

Fixture Diversity			
	GPF	Quantity	Weighted Average
Toilet	1.6	0	3.50
Toilet	3.5	71	
Combv	3.5	30	3.96
Combv	4	386	
Urinal	1	0	2.00
Urinal	2	22	

Fixtures	Inmates		Inmates: pods 2&5		Staff		Visitors	
	Present	Proposed	Present	Proposed	Present	Proposed	Present	Proposed
GPF toilet	4.0	4.0	3.5	3.5	3.5	1.6	3.5	1.6
GPF urinal	0.0	0.0	2.0	1.0	2.0	1.0	2.0	1.0
Lav Faucet GPM	1.5	1.5	2.5	1.5	2.5	1.5	2.5	1.5
Shower GPM	2.5	2.5	2.5	2.5	0.0	0.0	0.0	0.0

Uses per day:	Inmates		Inmates: pods 2&5		Staff		Visitors		
	Male	Female	Male	Female	Male	Female	Male	Female	Units
Toilet	12	12	1	6	1	5	1	5	Flushes
Urinal	0	4	6		4		4		Flushes
Lav Faucet	1	1	1	1	2	2	2	2	Minutes
Shower (M F)		10		10					Minutes

	Inmates						Inmates: pods 2&5						Staff						Visitors					
	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Shower	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Shower	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men	Toilet usage women	Toilet usage men	Urinal Usage men	Faucet Usage women	Faucet Usage men
Days/year	365	365	365	365	365	365	365	365	365	365	365	365	341	341	341	341	341	365	365	365	365	365
Population:	163	652	652	163	652	815	80	320	320	80	320	400	117	78	78	117	78	20	5	5	20	5
Minutes	1	1		1	1	10	1	1		1	1	10				2	2				2	2
Use per day	12	12	0	6	1	1	6	1	1	6	1	1	5	1	4	5	1	4	1	4	5	1
Uses or minutes	713,940	2,855,760	0	59,495	237,980	2,974,750	175,200	116,800	700,800	29,200	116,800	1,460,000	199,485	26,598	106,392	79,794	53,196	35,697	1,785	7,139	14,279	3,570
Diversity (account for absentee)	1	1.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GPU present	3.96	3.96	0.00				3.50	3.50	2.00				3.50	3.50	2.00			3.50	3.50	2.00		
GPM present				1.5	1.5	2.5				2.5	2.5	2.5				2.5	2.5				2.5	2.5
GPU Proposed	3.96	3.96	0				3.5	3.5	1.0				1.6	1.6	1			1.6	1.6	1		
GPM Proposed				1.5	1.5	2.5				1.5	1.5	2.5				1.5	1.5				1.5	1.5
Total Usage Pre (Gals)	2,830,017	16,980,102	0	89,243	356,970	7,436,875	613,200	408,800	1,401,600	73,000	292,000	3,650,000	698,198	93,093	212,784	199,485	132,990	124,940	6,247	14,279	35,697	8,924
Total Usage Post (Gals)	2,122,513	12,735,076	0	89,243	356,970	7,436,875	613,200	408,800	700,800	43,800	175,200	3,650,000	319,176	42,557	106,392	119,691	79,794	57,115	2,856	7,139	21,418	5,355
Savings	707,504	4,245,025	0	0	0	0	0	0	700,800	29,200	116,800	0	379,022	50,536	106,392	79,794	53,196	67,824	3,391	7,139	14,279	3,570
Hot Water Gallons PRE				59,886	239,546	4,990,535				48,987	195,947	2,449,342				133,865	89,243				23,955	5,989
Hot Water Gallons POST				59,886	239,546	4,990,535				29,392	117,568	2,449,342				80,319	53,546				14,373	3,593
Hot Water Energy Pre (mmbtus)				38	152	3159				31	124	1551				85	56				15	4
Hot Water Energy Post (mmbtus)				38	152	3159				19	74	1551				51	34				9	2
Hot Water Energy Savings (mmbtus)				0	0	0				12	50	0				34	23				6	2

Sanitary Water Use Summary	Gallons	Gals / person/yr	Gals / SF/ Year	Gals / person / day
Inmate Usage Pre	34,131,806	175035	117	480
Inmate Usage Post	28,332,477	145295	97	398
Staff Usage Pre	1,336,550	6854	5	19
Staff Usage Post	667,610	3424	2	9
Visitor Usage Pre	190,087	975		3
Visitor Usage Post	93,883	481		1
Total Usage Pre	35,658,443		122	
Total Usage Post	29,093,970		100	
Savings (Gals.) Domestic Water	6,564,473			
% Savings Domestic Water	18%			
Hot Water Usage PRE no laundry	5,513,075	28272		
Hot Water Usage POST	5,423,632	27815		
Savings gals	89,243	458		
% Savings (Hot Water)	1.6%			

	(Mmbtu)	Therms	kWh
Energy Pre (Mmbtu)	5,196	51,959	1,522,388
Energy Post (Mmbtu)	5,077	50,774	1,487,661
Energy Savings	119	1,185	34,727
% Savings (Hot Water	2.3%		

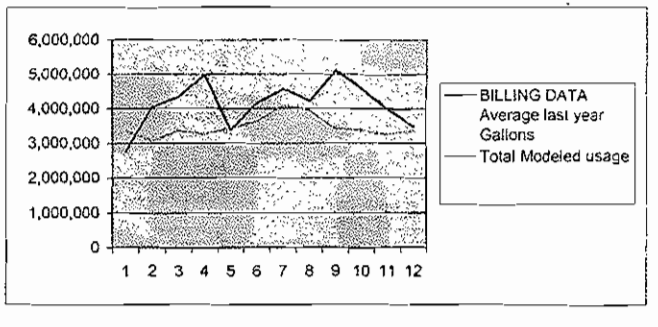
Benchmarks	Admin	Typical Range
Total Usage / SF	170	25-35
Usage/SF less irrigation		

Arapahoe County Domestic Water
ACJC Detention Center

		Water	Sewer	Water Differential	Sewer Differential
< 25,000g gal	$0.00290	$0.00232			
25,001-200,000	$0.00363	$0.00290	0.00073	0.00058	
>200,000	$0.00435	$0.00348	0.00145	0.00116	

	BILLING DATA Average last year Gallons	Staff days per month	Visitors days per month	Population days	Sanitary Water Use Model	Balance	Gallons Saved	Water Dollars Saved	Sewer Dollars Saved	Total Dollars Saved		
Jan	2,756,486	31	31	6,820	3,028,525	-272,039	557,531	$2,425	$1,940	$4,365	-9%	
Feb	4,021,000	28	28	6,160	2,735,442	1,285,558	503,576	$2,191	$1,752	$3,943	47%	
Mar	4,314,714	31	31	6,820	3,028,525	1,286,189	557,531	$2,425	$1,940	$4,365	42%	
Apr	4,984,286	30	30	6,600	2,930,831	2,053,455	539,546	$2,347	$1,878	$4,225	70%	
May	3,368,529	31	31	6,820	3,028,525	340,004	557,531	$2,425	$1,940	$4,365	11%	
June	4,151,471	30	30	6,600	2,930,831	1,220,640	539,546	$2,347	$1,878	$4,225	42%	
Jul	4,564,677	31	31	6,820	3,028,525	1,536,152	557,531	$2,425	$1,940	$4,365	51%	
Aug	4,210,161	31	31	6,820	3,028,525	1,181,636	557,531	$2,425	$1,940	$4,365	39%	
Sep	5,095,161	30	30	6,600	2,930,831	2,164,330	539,546	$2,347	$1,878	$4,225	74%	
Oct	4,572,727	31	31	6,820	3,028,525	1,544,202	557,531	$2,425	$1,940	$4,365	51%	
Nov	3,977,273	30	30	6,600	2,930,831	1,046,442	539,546	$2,347	$1,878	$4,225	36%	
Dec	3,475,000	31	31	6,820	3,028,525	446,475	557,531	$2,425	$1,940	$4,365	15%	
	49,491,485	365		80,300	35,658,442	13,833,043	6,564,473	28,555	$22,844	$51,400		13%
					35,658,442							

	Non Sanitary Use	kgals	Ice machine	Evaporative coolers	Laundry	Kitchen	Irrigation	Total	Balance	Total Modeled usage	Modeled to billing ratio
Jan	-272,039	-272	2,920	0	197,731	120,861	0	321,513	-593,552	3,350,038	-22%
Feb	1,285,558	1,286	2,920	0	197,731	120,861	0	321,513	964,045	3,056,955	24%
Mar	1,286,189	1,286	2,920	0	197,731	120,861	0	321,513	964,676	3,350,038	22%
Apr	2,053,455	2,053	2,920	5,494	197,731	120,861	4,707	327,006	1,726,449	3,257,837	35%
May	340,004	340	2,920	63,178	197,731	120,861	8,015	384,690	-44,686	3,413,215	-1%
June	1,220,640	1,221	2,920	370,826	197,731	120,861	8,237	692,338	528,302	3,623,169	13%
Jul	1,536,152	1,536	2,920	716,930	197,731	120,861	9,253	1,038,443	497,709	4,066,968	11%
Aug	1,181,636	1,182	2,920	596,068	197,731	120,861	5,553	917,581	264,055	3,946,106	6%
Sep	2,164,330	2,164	2,920	156,571	197,731	120,861	4,190	478,083	1,686,247	3,408,914	33%
Oct	1,544,202	1,544	2,920	0	197,731	120,861	4,033	321,513	1,222,689	3,350,038	27%
Nov	1,046,442	1,046	2,920	0	197,731	120,861	0	321,513	724,930	3,252,343	18%
Dec	446,475	446	2,920	0	197,731	120,861	0	321,513	124,962	3,350,038	4%
	13,833,043	13,833	35,045	1,909,067	1,581,852	966,885	39,282	4,506,682	8,065,826	41,425,659	16%



Arapohoe County Domestic Water
ACJC Detention Center

Assumptions	
Staff Population	195
Pop Ratio Female	60.00%
Visitor Population	
Pop Ratio Female	
Inmate Population	
Pop Ratio Female	
Population Inmate	
Staff Absentee rate	0.00%
Visitors/day	163
Visitor ratio Female	0.8
Length of stay(hours)	1.2
Days/year	365
Site Type (Res Comm)	res
Common Laundry?	no
Quantity of Machines	6
Quantity of Apt Units	88
Laundry Population	0
non resident factor	0.01

Energy Inputs		Billing units	$/unit
DHW heating source	NG	kWh	$0.5300
Fuel conversion source	GG	Therm	$0.6500
Nat. Gas System Efficiency		82.00%	

Water Temperature		
Street	54	
DHW supply	130	
DHW Efficiency	0.7	
Laundry		
Cycle/person/day	0	
Gallons/load Pre	37.5	
Gallons/load Post	25	
Ice Machine Calc		
Lbs/ Day	300	lbs
lbs/Year	109500	lbs/year
Gallons / year	13145.3	gallons/year
Gallons of water/100 lbs of ice procees waste	4	gallons/day
Process waste	4380	gallons/year
Storage waste / day	24	gallons/day
Est. Storage Waste	8760	gallons/year
Number of Ice Machines	2	gal
Total Storage Waste	17520	gallons/year
Total Ice Machine Usage (Gallons)	35045	gallons/year

0.020831 29.997

ECM 18 – Water Reclaim

There are three primary uses of water at the Peoria Shops: sanitary, road maintenance and vehicle washing. After estimating the sanitary usage in a manner identical to the methods used to analyze the sanitary water usage at the other buildings, the billing records indicate that the sanitary usage is a minor component of the total usage. The road maintenance water use was estimated and the balance of the water use is assumed to be the vehicle-washing load.

Water usage is determined by:

Sanitary Usage + Road Maintenance Usage + Vehicle Washing Usage

The road maintenance usage was estimated using the following assumptions based on interviews with the road construction staff.

Street Sweepers	
Capacity (gallons)	250
Quantity	4
Frequency (days each unit filled per year)	237
Total Usage (product of above) (gallons)	59,365
Patch Trucks	
Capacity (gallons)	50
Quantity	3
Frequency (days each unit filled per year)	150
Total Usage (product of above) (gallons)	22,500
Tankers	
Capacity (gallons)	3000
Quantity	2
Frequency (days each unit filled per year)	0
Total Usage (product of above) (gallons)	0
Grand Total (Gallons)	81,865

Street sweeper trucks go out every working day when it is above 20 °F. The number of days used accounts for the cold days. The patch trucks work during the summer construction season and fill or top off their tanks once a day.

There are large 3000 + gallon tank trucks used on road repair and road building projects for dust control. These trucks are filled at a remote standpipe and Shop water is not used for this function.

The vehicle-washing component includes washing passenger vehicles and trucks to maintain a presentable appearance and "mucking" out dump truck and cleaning mud and grime from the undercarriage. For the purposes of the estimating savings, it was assumed that the total vehicle wash water usage is divided equally between the vehicle washing and mucking operations and that 100 % of the mucking wash water would be recycled.

Water Savings:

Total Usage – Sanitary Usage – Road Work Usage = Total Vehicle Washing Usage

Washing Recycle Savings = Total Vehicle Washing Usage / 2

The electrical usage for the new system is summarized below:

Electric Calc: Washer pump	Washer Pump	Sump Pump
HP	10	1
kW/HP	0.746	0.746
Load Factor	0.70	0.70
Efficiency	0.80	0.70
kW (HP x .746 hp/kW x load factor / efficiency)	6.53	0.75
GPM	25	25
Gallons used for washing	640,000	640,000
Run Time	427	427
Total kWh	2,785	318
	Total kWh	3,103

Arapahoe County Domestic Water
Peoria Shops
Road Maintenance

Street Sweepers		
Capacity	250	gallons
Quantity	4	
Frequency	237	
Total Usage	59,365	
Patch Trucks		
Capacity	50	
Quantity	3	
Frequency	150	
Total Usage	22,500	
Tankers		
Capacity	0	
Quantity	2	
Frequency	150	
Total Usage	0	
Grand Total	81,865	

Recycle factor	0.5
Total recycle savings	640000
Estimated cost savings	9600

Street sweepers are deployed when Temps are above 20 °F

	Total Hours	
average	Denver	20
97	4	0
92	42	0
87	168	0
82	280	0
77	397	0
72	498	0
67	634	0
62	798	0
57	799	0
52	769	0
47	737	0
42	710	0
37	672	0
32	678	0
27	582	0
22	436	0
17	242	242
12	137	137
7	80	80
2	46	46
-3	20	20
-8	11	11
-13	3	3
-18	2	2
		541
		23

ECM 19 – Laundry Conservation

The savings from the use of an ozone sanitizer comes from water savings produced by reducing the number of fills in a wash cycle and energy savings produced by the reduction of wash and rinse water temperatures. The reductions are based on the track record of ozone units installed at other facilities per manufacturer data and on data gathered from the facility including the quantity and size of loads and the degree of soiling. The reduction in water volume use and the reduction in water temperature are the manufactures estimates.

The following assumptions were used in calculating the savings:

Wash Load	LBS/day
Total Pounds/day	2,289
% Light Soil	90%
% Heavy Soil	10%

Wash Duty	Pre Measure Gallons/ Pound	Ozone Gallons per Pound	Percent Savings
Light Soil	2.8	2.1	26%
Heavy Soil	3.2	2.6	19%

Water Temperature °F	
Street	55.0
DHW supply	170.0

Laundry	Hot Water Fraction	
	Pre measure condition	Ozone Condition
Light Wash	65%	5%
Heavy Wash	73%	14%

Model pre measure	Light Soil			Heavy Soil		
	Cold	Hot	Total	Cold	Hot	Total
Gal/lb	0.98	1.82	2.80	0.86	2.34	3.20
lb/day	2,060	2,060	4,120	229	229	458
Gal/day	2,019	3,749	5,768	198	535	732
total gals/year	736,898	1,368,524	2,105,422	72,186	195,169	267,355
Model Ozone	**Cold**	**Hot**	**Total**	**Cold**	**Hot**	**Total**
Gal/lb	1.96	0.10	2.07	2.27	0.31	2.58
lb/day	2,060	2,060	4,120	229	229	458
Gal/day	4,046	213	4,259	521	71	591
total gals/year	1,476,728	77,676	1,554,404	190,006	25,841	215,846

Total Gallons Saved = (2,105,422-1,554,404) + (267,355-215,846) = 602,527
Hot Water Gallons Saved = (1,368,524 – 77,676) + (195,169 – 25,841) = 1,460,176
Therms Saved = (1460*(8.33*(170-55))/1000/0.8) = 1,748

ECM 20 – Replace DHW HX with a New DHW Heater

Please refer to the Energy Conservation Measure (ECM) section of this report for additional information.

Existing Condition to Warrant an ECM Opportunity:
Currently, the domestic hot water (DHW) for building 01-Administration Building is produced by a heat exchanger (HX) that is served by the building's heating hot water loop. So, the two big natural gas-fired boilers that provide heating hot water must operate throughout the entire year in order to serve the building's DHW system. The replacement of the DHW HX with a stand-alone DHW heater will eliminate the need to operate the two boilers throughout the entire year, and DHW with a higher efficient heating source.

Savings Calculation Methodolgy:
The implementation of this ECM shall result in natural gas savings. The first step in the savings calculation was to determine what the building's DHW load is. Once the actual DHW load was calculated than the amount of natural gas that is currently being consumed by the existing DHW system was calculated utilizing a 70% heating efficiency. Also, the amount of natural gas that will be consumed by the new DHW heater to meet the building's DHW load was calculated using an 85% heating efficiency. These two values were then subtracted from each other to produce a natural gas savings that is the result of a higher efficient heating source. Additional savings were calculated by subtracting the new DHW heater's summer usage from the billed summer usage which reflects the natural gas saved by not having to operate the boilers in the summer months.

Admin1 Bldg. - Ara[illegible]e County

ECM: Replace DHW HX with a New DHW Heater - Fau[illegible]ater Usage

Existing DHW Heater	Staff		Visitor	
	Faucet Usage women	Faucet Usage men	Faucet Usage women	Faucet Usage men
Days/year	237	237	251	251
Population:	231	154	41	41
Minutes	1	1	1	1
Use per day				
Uses or minutes	54,747	36,498	10,291	10,291
Diversity (account for absentee)	0.95	0.95	0.95	0.95
GPU present				
GPM present (PRE)	2.5	2.5	2.5	2.5
GPU Proposed				
GPM Proposed (POST)	1.5	1.5	1.5	1.5
Total Usage Pre (Gals)	**130,024**	**86,683**	**24,441**	**24,441**
Total Usage Post (Gals)	78,014	52,010	14,665	14,665
Savings	52,010	34,673	9,776	9,776

100% Efficiency		70% Efficiency (Existing)
Total (Gals/yr.)	265,589	379,413
Yearly Usage/Annual Therms	**1,681**	**2,402**
% HW	0.67	
Total HW (Gals/yr.) PRE	178,237	254,624
Yearly Usage/Annual Therms HW	**1,128**	**1,612**

Monthly Therms / DHW	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	
Days	31	28	31	30	31	30	31	31	30	31	30	31	
Monthly Usage/Therms (100%)	143	129	143	138	143	138	143	143	138	143	138	143	1,680
					Total Therms in Summer		**424**						
Monthly Usage/Therms (100%) HW	96	87	96	93	96	93	96	96	93	96	93	96	1,128
					Total Therms in Summer HW		**284**						
Existing DHW Heater													
Monthly Usage/Therms (70%)	204	184	204	197	204	197	204	204	197	204	197	204	2,400
					Boiler Total	1,010	1,010	1,010					
					Total Therms in Summer		**3,030**						
Monthly Usage/Therms (70%) HW	137	124	137	132	137	132	137	137	132	137	132	137	1,611
					Total Therms in Summer HW		**406**						
New DHW Heater													
Monthly Usage/Therms (85%)	168	152	168	162	168	162	168	168	162	168	162	168	1,977
					Total Therms in Summer		**498**						
Monthly Usage/Therms (85%) HW	113	102	113	109	113	109	113	113	109	113	109	113	1,327
					Total Therms in Summer HW		**334**						

85% Efficiency	
Total (Gals/yr.)	312,458
Yearly Usage/Annual Therms	**1,978**
% HW	0.67
Total HW (Gals/yr.) PRE	209,690
Yearly Usage/Annual Therms HW	**1,328**

Savings			
Savings by Efficiency (12 mo.)	70% Efficiency	85% Efficiency	Savings (therms)
Yearly Usage	2,402	1,978	424
Savings by Summer (boilers off)			
Summer Usage	3,030	498	2,532

Total Savings	
Yearly Usage (therms)	**2,956**

Admin I - DHW Pump EMCS Savings

Pump ID:	HP:	LF:	Efficiency:	kW:	Existing Run Hrs:	New Run Hrs:	kWh Savings:
DHWP-1	0.17	0.75	0.7	0.13	8,760	3,259	733
HX Pump	0.25	0.75	0.7	0.20	8,760	3,259	1,099
						Total kWh Savings:	**1,832**

Note: The existing run hours are 24 h/d, 7 d/w. The new run hours are 12.5 h/d, 5 d/w. These savings shall be added to the EMCS savings that were calculated in the Trane Trace building simulation model.

ECM 21 - Change Natural Gas Utility Provider

Savings Calculation Description:

The savings for this ECM result from using a cheaper gas rate. The current natural gas utility provider, Xcel Energy, at Building 13-Arapahoe Human Services charges $0.74946/therm. The new natural gas utility provider, Seminole Energy Services, shall charge $0.63481/therm.

The dollar savings for this ECM were calculated by taking the difference in the two utility rates ($0.11465/therm) and multiplying it the target natural gas usage of the facility. The target natural gas usage was calculated with the following equation:

Target Natural Gas Usage = Baseline Natural Gas Usage - Total Natural Gas Saved

where,

Total Natural Gas Saved = Total Natural Gas Saved at Building 12-Arapahoe Plaza Building + Total Natural Gas Saved at Building 13-Arapahoe Human Services + Total Natural Gas Saved at Building 14-Arapahoe Plaza West Building

Note: The natural gas-fired boilers at Building 13-Arapahoe Human Services provide heating to Buildings 12 and 14, that is why these two buildings are included in the calculation above.

Project: Arapahoe County
Building: 13-Arapahoe Human Services

Natural Gas Usage Baseline

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

Total Monthly Natural Gas Usage (therms)

Month	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	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.

Performance Contract Savings:		16280
New Baseline:		26,916
	0.11465 $	3,086

ECM 23 – Energy Resource Conservation Manager

Savings will be achieved through behavioral modifications of occupants (convincing them to turn their lights off, don't mess with thermostats, etc.). See ECM write-up #23 in Section 4 of this Report for more information. The savings for this ECM are stipulated.

Arapahoe County's utility budget over the past twelve months was $2,274,106 including water, electrical, and natural gas usage. Table 2-4 in Volume I of this report illustrates this.

- The current recommended program estimates that $431,264 in energy savings thus reducing the energy budget to $1,842,842.
- A conservative estimate of savings for this program is 1% of budget or $18,428.
- $15,000 is used in the program.

ECM 24 – Replace Cooling Tower

Figure 1

Arapahoe County - ACJC Courthouse
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	202,551	197,435	3%
Feb	172,659	178,589	-3%
Mar	234,751	203,151	13%
Apr	234,674	190,309	19%
May	248,888	221,458	11%
Jun	247,557	224,685	9%
Jul	293,663	238,057	19%
Aug	276,365	238,231	14%
Sep	228,143	211,261	7%
Oct	214,985	213,383	1%
Nov	201,979	192,946	4%
Dec	199,199	194,492	2%
	2,755,414	2,503,997	9%

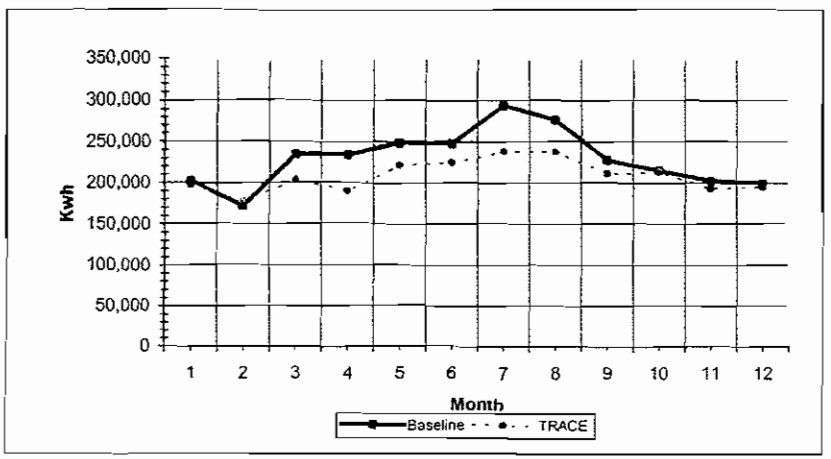
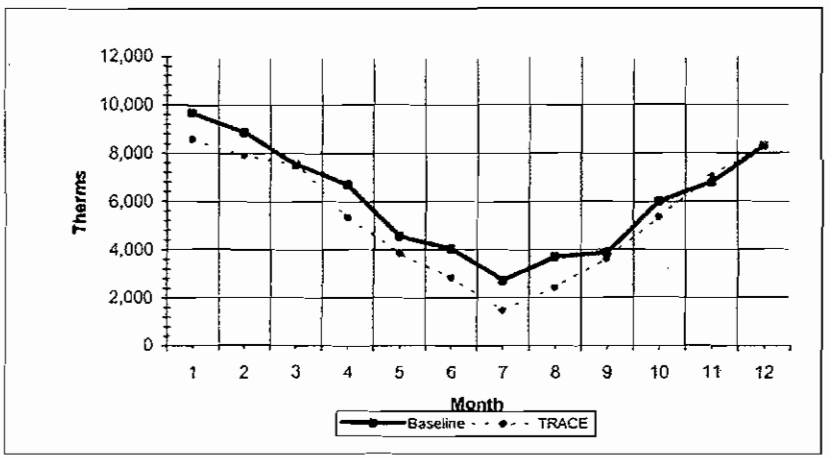


Figure 1

Arapahoe County - ACJC Courthouse
Computer Model Calibration for NG usage

NG USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	9,680	8,570	11%
Feb	8,870	7,938	11%
Mar	7,540	7,540	0%
Apr	6,710	5,356	20%
May	4,560	3,860	15%
Jun	4,020	2,835	29%
Jul	2,730	1,484	46%
Aug	3,710	2,446	34%
Sep	3,870	3,639	6%
Oct	6,020	5,366	11%
Nov	6,770	7,029	-4%
Dec	8,320	8,374	-1%
	72,800	64,437	11%



MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 ACJC Courthouse

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	197,435	178,589	203,151	190,309	221,458	224,685	238,057	238,231	211,261	213,383	192,946	194,492	2,603,995
On-Pk Demand (kW)	409	409	409	430	486	563	581	574	516	490	409	409	581
Gas													
On-Pk Cons. (therms)	8,570	7,938	7,540	5,356	3,860	2,835	1,484	2,446	3,639	5,366	7,029	8,374	64,439
On-Pk Demand (therms/hr)	45	44	44	44	44	44	44	44	44	44	44	44	45
Water													
Cons. (1000gal)	0	0	0	0	82	109	155	132	81	56	0	0	615

Building Energy Consumption =	142,485	Btu/(ft2-year)
Source Energy Consumption =	308,201	Btu/(ft2-year)
Floor Area =	105,204	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 ACJC Courthouse

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	---- Monthly Energy Consumption ----												
Electric													
On-Pk Cons. (kWh)	172,576	155,952	177,035	166,190	194,011	196,562	208,986	208,391	185,310	186,583	168,343	169,990	2,189,927
On-Pk Demand (kW)	346	346	346	350	415	488	501	491	443	417	346	346	501
Gas													
On-Pk Cons. (therms)	8,695	8,063	7,673	5,455	3,915	2,859	1,436	2,445	3,694	5,460	7,149	8,475	65,319
On-Pk Demand (therms/hr)	42	42	42	42	42	42	42	42	42	42	42	42	42
Water													
Cons. (1000gal)	0	0	0	0	67	90	129	108	66	46	0	0	506

Building Energy Consumption =	133,133	Btu/(ft2-year)
Source Energy Consumption =	278,513	Btu/(ft2-year)
Floor Area =	105,204	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 ACJC Courthouse

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	164,194	148,361	168,067	158,423	184,583	186,552	203,494	197,971	175,806	178,072	160,172	162,176	2,087,862
On-Pk Demand (kW)	346	346	346	350	415	488	501	491	443	417	346	346	501
Gas													
On-Pk Cons. (therms)	8,519	7,900	7,409	4,930	3,084	1,916	600	1,394	2,877	4,830	6,839	8,278	58,575
On-Pk Demand (therms/hr)	42	42	42	42	33	13	7	10	31	42	42	42	42
Water													
Cons. (1000gal)	0	0	0	0	65	85	133	104	62	46	0	0	496

Building Energy Consumption = 123,411 Btu/(ft2-year)
Source Energy Consumption = 261,829 Btu/(ft2-year)
Floor Area = 105,204 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 ACJC Courthouse

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	165,187	149,258	169,076	159,381	185,535	187,457	204,004	198,853	176,722	179,073	161,138	163,159	2,098,842
On-Pk Demand (kW)	349	349	349	353	417	488	501	491	446	420	349	349	501
Gas													
On-Pk Cons. (therms)	7,042	6,530	6,129	4,089	2,570	1,608	527	1,180	2,399	4,007	5,659	6,844	48,583
On-Pk Demand (therms/hr)	35	34	34	34	27	10	6	8	26	34	34	34	35
Water													
Cons. (1000gal)	0	0	0	0	65	85	133	104	82	46	0	0	496

Building Energy Consumption =	114,269	Btu/(ft2-year)
Source Energy Consumption =	252,900	Btu/(ft2-year)
Floor Area =	105,204	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 ACJC Courthouse

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	165,187	149,258	169,076	159,381	184,637	186,273	202,080	197,420	175,861	178,439	161,138	169,159	2,091,909
On-Pk Demand (kW)	349	349	348	353	414	483	494	485	442	416	349	349	494
Gas													
On-Pk Cons. (therms)	7,042	6,530	6,129	4,089	2,570	1,606	527	1,180	2,399	4,007	5,659	6,844	48,583
On-Pk Demand (therms/hr)	35	34	34	34	27	10	6	8	26	34	34	34	35
Water													
Cons. (1000gal)	0	0	0	0	64	84	132	103	62	45	0	0	490

Building Energy Consumption = 114,045 Btu/(ft2-year)
Source Energy Consumption = 252,226 Btu/(ft2-year)
Floor Area = 105,204 ft2

MODELING NOTES

ARAPAHOE COUNTY - ACJC COURTHOUSE

ECM Run: Upgrade Existing EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
AH-1	Fan Schedule Changed	M-F - 4am-11pm, Sat-Sun: 8am-17pm	M-F: 5:30am-9:30pm; Sat-Sun: 8am-17pm
AHU-1	Fan Schedule Changed	M-F - 4am-11pm, Sat-Sun: 8am-17pm	M-F: 5:30am-9:30pm; Sat-Sun: 8am-17pm
AHIU-2	Fan Schedule Changed	M-F - 4am-11pm, Sat-Sun: 8am-17pm	M-F: 5:30am-9:30pm; Sat-Sun: 8am-17pm

Previous Run (New Lighting Run):

Annual kWh Usage:	2,189,928
Annual kW Usage:	4,835
Annual Therm Usage:	65,319

Current Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	2,087,853
Annual kW Usage:	4,835
Annual Therm Usage:	58,576

Savings (Upgrade Existing EMCS Savings):

Annual kWh Savings:	102,075
Annual kW Savings:	0
Annual Therm Savings:	6,743

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

MODELING NOTES

ARAPAHOE COUNTY - ACJC COURTHOUSE

ECM Run: Replace the Existing Boilers

Cooling Equipment Tag	Item Changed	Previous Run Input	Current Run Input
NG Fired HW Boilers	Efficiency	Atmospheric Boiler (65% Efficient Energy Rate)	Gas Fired Hot Water Boiler (79% Efficient Energy Rate)

Previous Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	2,087,853
Annual kW Usage:	4,835
Annual Therm Usage:	58,576

Current Run (Replace the Existing Boilers Run):

Annual kWh Usage:	2,098,843
Annual kW Usage:	4,861
Annual Therm Usage:	48,584

Savings (Replace the Existing Boilers Savings):

Annual kWh Savings:	-10,990
Annual kW Savings:	-26
Annual Therm Savings:	9,992

Notes:
1. The negative kW and kWh savings is the energy used by the forced draft burner on the new boiler.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

MODELING NOTES

ARAPAHOE COUNTY - ACJC COURTHOUSE

ECM Run: Replace Cooling Tower

Cooling Equipment Tag	Item Changed	Previous Run Input	Current Run Input
Water Cooled Chiller	Energy Rate	0.8536 kW/ton	0.776 kW/ton

Previous Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	2,098,843
Annual kW Usage:	4,861
Annual Therm Usage:	48,584

Current Run (Replace the Cooling Tower Run):

Annual kWh Usage:	2,091,909
Annual kW Usage:	4,832
Annual Therm Usage:	48,584

Savings (Replace Cooling Tower Savings):

Annual kWh Savings:	6,934
Annual kW Savings:	29
Annual Therm Savings:	0

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

ECM 25 – Retro-commissioning

Details of Retro-commissioning services can be found in ECM write-up #25, located in Volume 1 of 2 of this Comprehensive Energy Analysis.

Existing Condition to Warrant an ECM Opportunity:
The Sheriff's Coroners and Centrepoint Facilities are two recently built buildings that currently have an energy management control system (EMCS). In both cases, the equipment in these facilities operates during periods of the little or no occupancy. So, some of the existing operating schedules programmed into the EMCS can be modified to better match the actual occupancy schedules. Also much of the HVAC equipment has fallen out of calibration and is not operating very efficiently.

Savings Calculation Methodolgy:
The savings for this ECM were calculated utilizing two Trane Trace building energy simulation models. The first model included the existing operating schedules for each piece of equipment. The second model was modified to include the new operating schedules to set back areas within the facilities during unoccupied periods. As each facility utilizes electric reheat the models were also programmed to allow the natural gas preheat to operate in lieu of the electric reheat during morning warm-up as this is a more efficient way to operate the equipment. This made gas usage increase but saved considerable amount of electric energy. The annual energy consumption calculated from each model was subtracted from one another to produce the annual energy savings.

Spreadsheet calculations were performed on the buildings that were not modeled. The spreadsheet calculations used the same methodology described above.

Figure 1

Arapahoe County - Centrepoint Plaza
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	260,048	165,144	36%
Feb	230,963	151,316	34%
Mar	252,724	169,175	33%
Apr	215,531	151,954	29%
May	211,119	199,585	5%
Jun	213,078	216,752	-2%
Jul	224,479	245,758	-9%
Aug	222,248	240,887	-8%
Sep	210,752	190,230	10%
Oct	215,706	171,451	21%
Nov	230,257	153,726	33%
Dec	256,230	156,570	39%
	2,743,135	2,212,548	19%

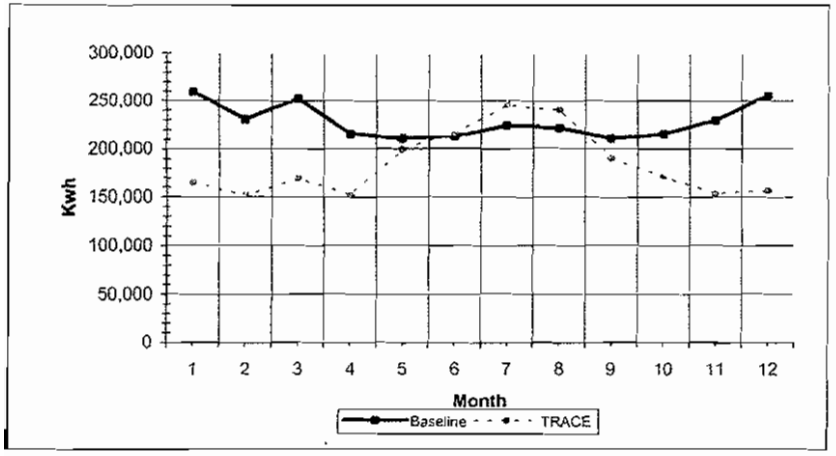
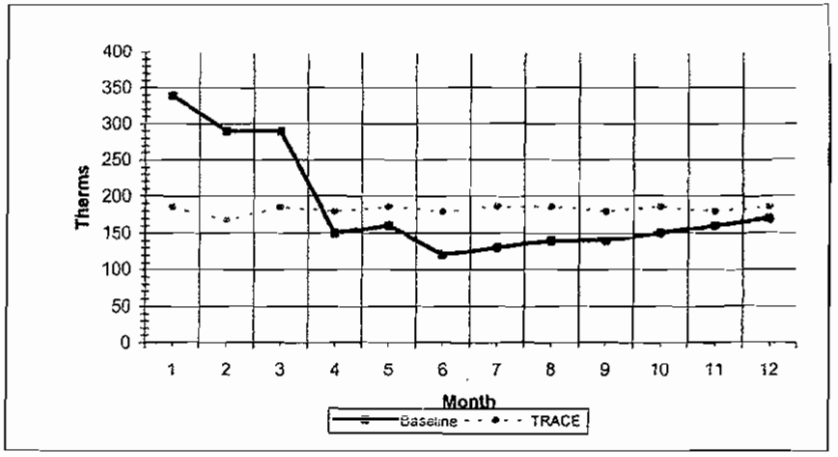


Figure 1

Arapahoe County - Centrepoint Plaza
Computer Model Calibration for NG usage

NG USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	340	186	45%
Feb	290	168	42%
Mar	290	186	36%
Apr	150	180	-20%
May	160	186	-16%
Jun	120	180	-50%
Jul	130	186	-43%
Aug	140	186	-33%
Sep	140	180	-29%
Oct	150	186	-24%
Nov	160	180	-13%
Dec	170	186	-9%
	2,240	2,190	2%



MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Centrepoint Plaza

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	---- Monthly Energy Consumption ----												
Electric													
On-Pk Cons. (kWh)	165,144	151,316	169,175	151,954	199,585	216,752	245,758	240,887	190,230	171,451	153,726	156,570	2,212,549
On-Pk Demand (kW)	560	569	548	509	606	657	797	715	647	560	514	589	797
Gas													
On-Pk Cons. (therms)	186	168	186	180	186	180	186	186	180	186	180	186	2,190
On-Pk Demand (therms/hr)	0	0	0	0	0	0	0	0	0	0	0	0	0

Building Energy Consumption =	57,380	Btu/(ft2-year)
Source Energy Consumption =	169,007	Btu/(ft2-year)
Floor Area =	135,421	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Centrepoint Plaza

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	---- Monthly Energy Consumption ----												
Electric													
On-Pk Cons. (kWh)	161,443	147,960	165,165	147,758	194,701	211,758	240,844	235,560	185,659	166,738	149,436	152,822	2,159,865
On-Pk Demand (kW)	547	557	539	494	590	841	774	698	630	545	506	557	774
Gas													
On-Pk Cons. (therms)	186	168	186	180	186	180	186	186	180	186	180	186	2,190
On-Pk Demand (therms/hr)	0	0	0	0	0	0	0	0	0	0	0	0	0

Building Energy Consumption = 56,052 Btu/(ft2-year)
Source Energy Consumption = 165,023 Btu/(ft2-year)
Floor Area = 135,421 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Centrepoint Plaza

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	144,780	132,997	149,824	134,020	180,345	196,001	221,271	217,640	171,107	152,455	136,386	137,996	1,973,823
On-Pk Demand (kW)	547	557	553	494	591	642	788	701	635	545	509	557	788
Gas													
On-Pk Cons. (therms)	186	168	186	180	186	180	186	186	180	186	180	186	2,190
On-Pk Demand (therms/hr)	0	0	0	0	0	0	0	0	0	0	0	0	0

Building Energy Consumption = 51,363 Btu/(ft2-year)
Source Energy Consumption = 150,955 Btu/(ft2-year)
Floor Area = 135,421 ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Centrepoint Plaza

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	---- Monthly Energy Consumption ----												
Electric													
On-Pk Cons. (kWh)	111,991	98,612	125,980	131,506	180,345	196,001	221,271	217,840	171,107	150,770	120,902	108,691	1,834,807
On-Pk Demand (kW)	448	447	458	494	591	642	786	701	635	545	457	446	788
Gas													
On-Pk Cons. (therms)	1,655	1,706	1,248	294	186	180	186	186	180	261	827	1,500	8,406
On-Pk Demand (therms/hr)	11	11	11	9	0	0	0	0	0	3	11	11	11

Building Energy Consumption =	52,451	Btu/(ft2-year)
Source Energy Consumption =	145,277	Btu/(ft2-year)
Floor Area =	135,421	ft2

MODELING NOTES

ARAPAHOE COUNTY - CENTREPOINT PLAZA

ECM Run: Upgrade Existing EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
Rm-1	Fan Schedule Changed	M-F - 5am-11pm, Sat-Sun: 8am-5pm	M-F: 6am-10pm; Sat-Sun: 8am-5pm
Rm-2	Fan Schedule Changed	M-F - 5am-11pm, Sat-Sun: 8am-5pm	M-F: 6:30am-9pm; Sat-Sun: 8am-5pm
Rm-3	Fan Schedule Changed	M-F - 5am-11pm, Sat-Sun: 8am-5pm	M-F: 7am-7pm

Previous Run (New Lighting Run):

Annual kWh Usage:	2,159,864
Annual kW Usage:	7,078
Annual Therm Usage:	2,190

Current Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	1,973,822
Annual kW Usage:	7,119
Annual Therm Usage:	2,190

Savings (Upgrade Existing EMCS Savings):

Annual kWh Savings:	186,042
Annual kW Savings:	-41
Annual Therm Savings:	0

Notes:

1. The negative kW savings is the result of the electric reheat coils all coming 100% on in the morning to bring the space temperature up from 55F in the morning. These negative savings shall not be accounted for since the EMCS shall warm each space up gradually without having to energize each reheat coil to 100% of its capacity.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

MODELING NOTES

ARAPAHOE COUNTY - CENTREPOINT PLAZA

ECM Run: Utilize Natural Gas Preheat

Cooling Equipment Tag	Item Changed	Previous Run Input	Current Run Input
Heating System 01	Preheat Coil Plant Type	No Preheat Coil	NG Preheat Coil
Heating System 02	Preheat Coil Plant Type	No Preheat Coil	NG Preheat Coil
Heating System 03	Preheat Coil Plant Type	No Preheat Coil	NG Preheat Coil

Previous Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	1,973,822
Annual kW Usage:	7,119
Annual Therm Usage:	2,190

Current Run (Utilize Natural Gas Preheat Run):

Annual kWh Usage:	1,834,806
Annual kW Usage:	6,652
Annual Therm Usage:	8,409

Savings (Utilize Natural Gas Preheat Savings):

Annual kWh Savings:	139,016
Annual kW Savings:	467
Annual Therm Savings:	-6,219

Notes:

1. The air handling units are equipped with natural gas burners that can be utillized to preheat the mixed air stream before it enters the electric reheat VAV boxes. Currently they are not being utilized to do this, the electric reheat coils are handling the entire heating load. So this ECM, which is included with the Uprade Existing EMCS ECM, includes utilizing the existing natural gas fired burners to preheat the mixed air stream.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

Figure 1

Arapahoe County - Sheriff/Coroner Facility
Computer Model Calibration for Electric Energy Use

ELECTRIC ENERGY USAGE (kWh)			
Month	BASELINE	MODEL	
Jan	233,435	165,528	29%
Feb	205,024	154,600	25%
Mar	222,636	161,209	28%
Apr	199,959	138,039	31%
May	202,483	177,411	12%
Jun	194,728	193,133	1%
Jul	204,941	222,406	-9%
Aug	203,837	218,283	-7%
Sep	191,029	170,089	11%
Oct	190,813	159,069	17%
Nov	185,731	140,385	24%
Dec	238,052	154,695	35%
	2,472,668	2,054,847	17%

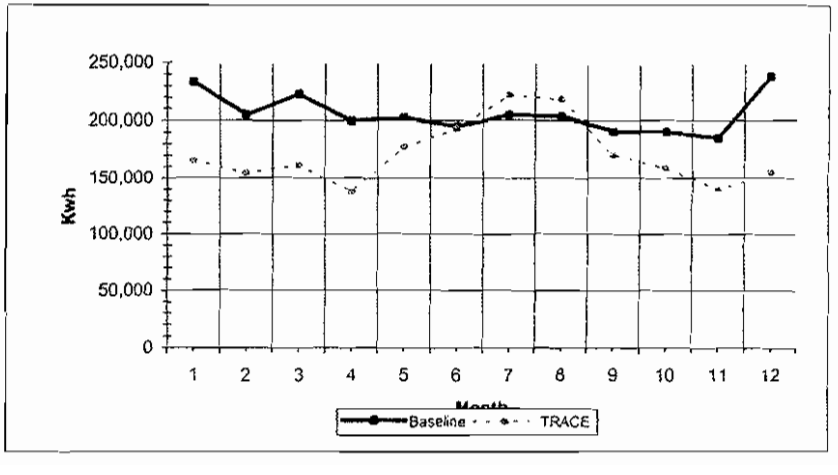
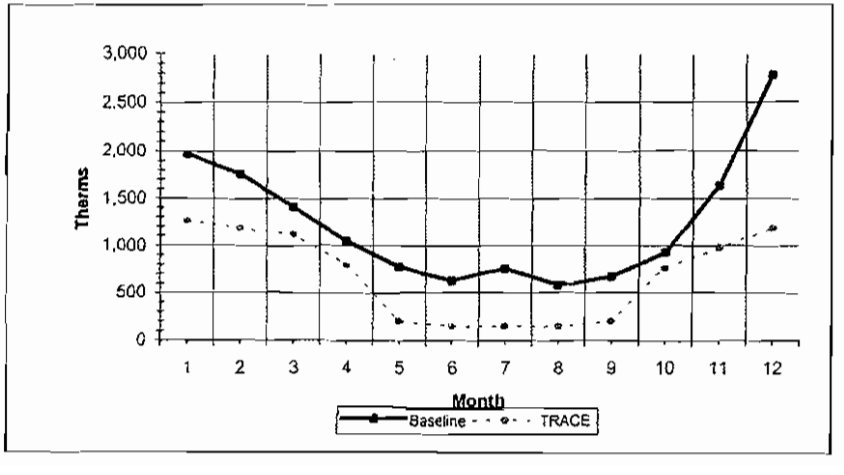


Figure 1

Arapahoe County - Sheriff/Coroner Facility
Computer Model Calibration for NG usage

NG USAGE (Therms)			
Month	BASELINE	MODEL	
Jan	1,970	1,262	36%
Feb	1,760	1,187	33%
Mar	1,410	1,122	20%
Apr	1,050	796	24%
May	770	205	73%
Jun	630	150	76%
Jul	760	149	80%
Aug	580	149	74%
Sep	670	207	69%
Oct	930	764	18%
Nov	1,640	978	40%
Dec	2,780	1,191	57%
	14,950	8,160	45%



MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Sheriffs Coroners

------ Monthly Energy Consumption ------

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Electric													
On-Pk Cons. (kWh)	165,528	154,609	161,209	138,039	177,411	199,133	222,406	218,283	170,089	159,069	140,385	154,695	2,064,846
On-Pk Demand (kW)	541	550	550	485	567	603	681	643	593	528	472	550	681
Gas													
On-Pk Cons. (therms)	1,262	1,187	1,122	796	205	150	149	149	207	764	978	1,191	8,160
On-Pk Demand (therms/hr)	3	3	3	3	2	1	0	0	2	3	3	3	3

Building Energy Consumption =	67,883	Btu/(ft2-year)
Source Energy Consumption =	189,887	Btu/(ft2-year)
Floor Area =	115,335	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Sheriffs Coroners

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	163,364	152,857	158,758	135,413	174,026	189,585	218,813	214,423	166,914	155,669	138,032	152,680	2,020,714
On-Pk Demand (kW)	530	538	538	471	552	588	665	627	577	514	463	538	665
Gas													
On-Pk Cons. (therms)	1,265	1,189	1,125	797	206	151	149	149	208	765	980	1,194	8,178
On-Pk Demand (therms/hr)	3	3	3	3	2	1	0	0	2	3	3	3	3

Building Energy Consumption =	66,888	Btu/(ft2-year)
Source Energy Consumption =	186,873	Btu/(ft2-year)
Floor Area =	115,335	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Sheriffs Coroners

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	151,251	142,104	147,564	129,359	167,510	182,224	210,760	205,749	180,183	149,444	128,938	142,606	1,917,713
On-Pk Demand (kW)	530	538	538	470	552	589	668	628	578	514	463	538	668
Gas													
On-Pk Cons. (therms)	1,265	1,189	1,125	797	206	151	149	149	208	765	980	1,194	8,178
On-Pk Demand (therms/hr)	3	3	3	3	2	1	0	0	2	3	3	3	3

Building Energy Consumption =	63,840	Btu/(ft2-year)
Source Energy Consumption =	177,726	Btu/(ft2-year)
Floor Area =	115,335	ft2

MONTHLY ENERGY CONSUMPTION

By Release 2.006

Alternative: 1 Sheriffs Coroners

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------ Monthly Energy Consumption ------												
Electric													
On-Pk Cons. (kWh)	105,678	95,450	112,233	120,052	167,510	182,224	210,760	205,749	160,183	142,626	104,390	102,092	1,708,948
On-Pk Demand (kW)	427	427	426	470	552	589	666	628	578	514	427	427	666
Gas													
On-Pk Cons. (therms)	3,288	3,257	2,692	1,212	206	151	149	149	208	1,070	2,071	2,994	17,446
On-Pk Demand (therms/hr)	12	12	12	9	2	1	0	0	2	7	12	12	12

Building Energy Consumption =	65,698	Btu/(ft2-year)
Source Energy Consumption =	167,652	Btu/(ft2-year)
Floor Area =	115,335	ft2

MODELING NOTES

ARAPAHOE COUNTY - SHERIFF/CORONER FACILITY

ECM Run: Upgrade Existing EMCS

Fan System	Item Changed	Previous Run Input	Current Run Input
Rm-4	Fan Schedule Changed	M-F - 4am-1am, Sat-Sun: 8am-5pm	M-F: 5am-10pm; Sat-Sun: 8am-5pm
Rm-5	Fan Schedule Changed	M-F - 4am-1am, Sat-Sun: 8am-5pm	M-F: 6am-10pm; Sat-Sun: 8am-5pm

Previous Run (New Lighting Run):

Annual kWh Usage:	2,020,714
Annual kW Usage:	6,601
Annual Therm Usage:	8,178

Current Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	1,917,714
Annual kW Usage:	6,604
Annual Therm Usage:	8,178

Savings (Upgrade Existing EMCS Savings):

Annual kWh Savings:	103,000
Annual kW Savings:	-3
Annual Therm Savings:	0

Notes:

1. The negative kW savings is the result of the electric reheat coils all coming 100% on in the morning to bring the space temperature up from 55F in the morning. These negative savings shall not be accounted for since the EMCS shall warm each space up gradually without having to energize each reheat coil to 100% of its capacity.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

MODELING NOTES

ARAPAHOE COUNTY - SHERIFF/CORONER FACILITY

ECM Run: Utilize Natural Gas Preheat

Cooling Equipment Tag	Item Changed	Previous Run Input	Current Run Input
Heating System 01	Preheat Coil Plant Type	No Preheat Coil	NG Preheat Coil
Heating System 02	Preheat Coil Plant Type	No Preheat Coil	NG Preheat Coil
Heating System 03	Preheat Coil Plant Type	No Preheat Coil	NG Preheat Coil

Previous Run (Upgrade Existing EMCS Run):

Annual kWh Usage:	1,917,714
Annual kW Usage:	6,604
Annual Therm Usage:	8,178

Current Run (Utilize Natural Gas Preheat Run):

Annual kWh Usage:	1,708,947
Annual kW Usage:	6,131
Annual Therm Usage:	17,447

Savings (Utilize Natural Gas Preheat Savings):

Annual kWh Savings:	208,767
Annual kW Savings:	473
Annual Therm Savings:	-9,269

Notes:

1. The air handling units are equipped with natural gas burners that can be utillized to preheat the mixed air stream before it enters the electric reheat VAV boxes. Currently they are not being utilized to do this, the electric reheat coils are handling the entire heating load. So this ECM, which is included with the Uprade Existing EMCS ECM, includes utilizing the existing natural gas fired burners to preheat the mixed air stream.

Electric Savings Safety Factor:	0.73
Natural Gas Savings Safety Factor:	0.73

ECM 26 – Replace Modulines, Install VAV Boxes, Diffusers,and Add Controls

There are no savings associated with the ECM.