Investment Grade Energy Audit- Final Report

Buncombe County General Services Department

11/08/2013

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1.0 EXECUTIVE SUMMARY

1.1 Introduction

Buncombe County Government (Buncombe) contracted Shaw Environmental and Infrastructure, Inc. (Shaw) to support Buncombe with engineering services for energy audits of county buildings for Energy and Water Efficiency. The comprehensive professional services executed by Shaw to support Buncombe in its energy and water efficiency objectives include:

- Energy audits and recommendations for improving energy efficiency at Buncombe owned facilities.
- Water usage audits for improving water efficiency at Buncombe owned facilities
- Utility audits and analysis for improving cost effectiveness

The following report details the findings of these services specific for the Buncombe ten (10) selected facilities further detailed in the table below. This report provides Buncombe with a base of information to achieve the organizations long term energy and water efficiency and energy independence objectives.

Table 1.1 Buncombe County Buildings for Energy Audits

Building	Address	Area (S.F.)
Courthouse	60 Court Plaza, 28801	215,818
Detention Center	Valley St., 28801	149,160
Detention Addition	Valley St., 28801	92,453
35 Woodfin St.	35 Woodfin St., 28801	85,892
Social Services	40 Coxe Avenue., 28801	74,978
County Administration	200 College St.	54,545
Sheriff's Department	Haywood St., 28801	28,408
Animal Shelter	14 Forever Friend Lane, 28806	27,800
911 Center	164 Erwin Hills Road, 28806	23,500
Interchange Building	59 Woodfin Place, 28801	28,448

1.2 Executive Summary

Ever more increasingly, government entities and leading facility operators are taking a focused assessment of their building's energy performance and its affect on operations financial bottom line, building occupants and the surrounding environment. Rising energy prices and uncertainty in the commodity markets have been significant drivers for increasing energy costs thereby driving the focus on energy efficiency performance. Energy efficiency is a proven tool for reducing a building's energy usage and resulting operating costs. Most facilities use 10 to 20 percent more energy than necessary and have abundant opportunities for energy conservation. Past history indicates that the majority of facilities can significantly reduce energy usage through the implementation of low-cost / no-cost measures and capital improvements. Often, identified capital improvements can provide an attractive return on investment from the resultant energy cost savings.

As part of the Buncombe facilities assessment portion of this project Shaw identified 26 potential Energy and Water Cost Reduction Measures (ECRMs) that can be implemented to improve energy efficiency and reduce operational costs. Annual potential energy cost savings for these measures range from $500 to $55,600. Based on Shaw's energy and water audit assessment, the total identified potential energy and water cost savings is estimated at $250,400 per year. The estimated total potential energy cost savings for all of the recommended measures represent an approximate 18.1%, 15.0% and 26.4% reduction in electricity, natural gas and water costs respectively. While additional energy and water savings opportunities may exist beyond those identified within this report, Shaw's recommended energy reduction strategies target proven technologies with attractive return on investments.

The capital improvement opportunities were prioritized based on Return on Investment (ROI), ease of implementation, impact on operations, and the general availability of supporting grant and incentive dollars. This prioritization was then utilized to develop short-, mid- and long-term energy efficiency strategies focusing on quick financial return projects that support Buncombe's overall organization goals.

It should be noted that while some of the identified capital project opportunities have a small return on investment and in some cases a negative net present value, the reduced maintenance and increased operational efficiency benefits may outweigh the less attractive returns. In certain cases, the energy savings from capital investments help justify the cost for replacing equipment that should already be replaced, but allow Buncombe to do so at an earlier date.

All energy cost savings are calculated utilizing the average energy costs identified in Section 2 – Utility Rates. Further detailed descriptions of the recommendations and icon descriptions have been included within the "Energy Cost Reduction Measures" Section 4.0. It should be noted that energy savings may be interactive between individual measures and therefore total energy savings may vary dependent on the implementation of a combination of measures.

A list of the recommended energy and water efficiency cost reduction measures are provided in Table 1.2 below. The recommended opportunities have been organized in ascending order based on return on investment.

1.3 Energy Cost Reduction Recommendations Summary

The following metrics are provided for each measure to convey the financial implications as well as the general impact on the building staff and ease of project implementation. These metrics are used as a quick reference guide for assessing the applicability of an energy efficiency opportunity.

Simple Payback Legend

	1 to 3 year payback
	3 to 7 year payback
	7+ year payback

Impact of Staff Operations

	No effect on operations
	Will have minor affect on operations
	Will have major affect on operations

Available Grant/Incentive Dollars Legend

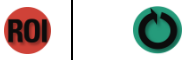
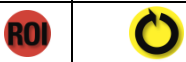
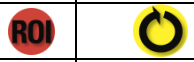
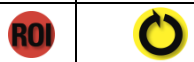
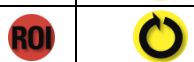
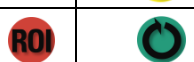
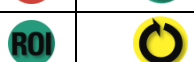
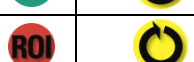
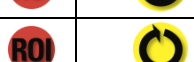
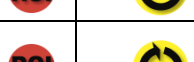
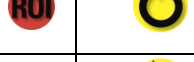
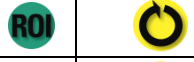
	Grant funds available at a state or national level
	Grant funds available as a federal tax incentive
	No identified funding available

Ease of Implementation Legend

	Can be implemented using internal staff
	May require outside contractor work
	Will require design and installation services

Table 1.2 Energy Cost Recommendation Summary Table*

Energy Cost Reduction Measure	ID	ROI	Impact on Operations	Available Incentive Funding	Ease of Implementation	Implementation Cost w/ Incentive ($)	Annual Energy Cost Savings ($)	Simple Payback (yrs)
Interior Lighting Retrofit	4.2.1	ROI		$		$6,500	$500	13.0
Exterior Lighting	4.2.2	ROI		$		$45,100	$3,500	12.9
Delamp Fixtures	4.2.3	ROI		$		$8,200	$3,300	2.5
Add Occupancy Sensors	4.2.4	ROI		$		$155,600	$9,000	17.4
DDC Scheduling / Temperature Setback	4.2.5	ROI		$		$28,800	$19,000	1.5
Thermostat Addition	4.2.6	ROI		$		$76,700	$20,100	3.8
Demand Control Ventilation	4.2.7	ROI		$		$56,800	$7,600	7.5
Optimize Economizers	4.2.8	ROI		$		$28,700	$10,300	2.8
Duct Static Reset	4.2.9	ROI		$		$25,200	$25,100	1.0
Higher Efficiency Condensing Unit	4.2.10	ROI		$		$103,500	$2,600	39.1
Variable Frequency Drives (VFDs)	4.2.11	ROI		$		$9,600	$1,600	12.6
Vending Miser	4.2.12	ROI		$		$2,000	$1,200	1.7
Computer Controls	4.2.13	ROI		$		$47,200	$17,400	2.7

Energy Cost Reduction Measure	ID	ROI	Impact on Operations	Available Incentive Funding	Ease of Implementation	Implementation Cost w/ Incentive ($)	Annual Energy Cost Savings ($)	Simple Payback (yrs)
Energy Efficient Transformers	4.2.14					$122,700	$12,000	10.2
Sheriff Offices DDC Retrofit	4.2.15					$203,100	$10,300	19.7
Filter Replacement	4.2.16					$27,300	$2,600	10.5
High SEER RTU Replacement	4.2.17					$41,200	$1,000	41.2
Replace Chiller Pipe Insulation	4.2.18					$2,600	$500	5.2
High Efficiency Heating Boilers	4.2.19					$656,800	$16,600	39.6
High Efficiency Domestic Boilers	4.2.20					$54,700	$1,400	39.1
Water Conservation (Fixtures/Control)	4.2.21					$410,900	$55,600	7.4
Energy Star Clothes Washers- Residential	4.2.22					$6,000	$2,000	3.0
Commercial Tray Washer	4.2.23					$77,200	$10,900	7.1
Hot Water Reset Control	4.2.24					$53,100	$2,900	11.4
Convert Chilled & Heating Water Sys to Variable w/ DP Reset	4.2.25					$640,900	$12,400	51.7
DHW Heating System ReCx	4.2.26					$1,000	$500	2.0
Energy Star Clothes Washers- Commercial	4.2.27					$45,000	$1,300	34.6
TOTAL						**$2,916,100**	**$250,400**	**11.6**

* Table does not include the Solar PV ECRM

2.0 Energy Baseline and Utility Analysis

2.1 Overview

Shaw performed an energy baseline and utility bill analysis of the ten (10) Buncombe County facilities. Information was analyzed from Buncombe County provided electric, natural gas and water utility bills from June 2011 through May 2013.

The energy usage and rate information was used to define the facility's current baseline energy performance and to identify the energy rate structures that are in place. This data allows the Shaw audit team to identify high energy users, determine the cost impacts of specific energy reduction measures and assess the energy reduction potential for the facility.

2.2 Utility Rates

Shaw compiled twenty-four months of energy bills for electricity, natural gas and water for each Buncombe County building. Each Buncombe County building is billed using a separate electricity, natural gas, and water meter.

The Buncombe County Courthouse building located at 60 Court Plaza purchases their electricity through Duke Energy and natural gas through PSNC Energy. The water, including fireline, is provided by the City of Asheville with sewer treatment and maintenance provided by the Metropolitan Sewage District of Buncombe County. A summary of utility provider and rate schedule information for the Courthouse is presented in Table 2.1 below.

Table 2.1 Energy and Water Utility Providers – Courthouse

Utility	Service Provider	Rate
Electricity	Duke Energy	SGS-TOU
Natural Gas	PSNC Energy	125 – Small General Service
Water	City of Asheville	
Sewer	Metropolitan Sewage District of Buncombe County	20000/25000

The Buncombe County Detention Center building located at 20 Davidson Drive purchases their electricity through Duke Energy. Natural gas is supplied by Transco with distribution provided by PSNC Energy. The water, including fireline, is provided by the City of Asheville. Sewer treatment and maintenance is billed separately by the Metropolitan Sewage District of Buncombe County after applying a monthly adjustment for water used in the Detention Center cooling towers. A summary of utility provider and rate schedule information for Detention Center is presented in Table 2.2 below.

Table 2.2 Energy and Water Utility Providers – Detention Center

Utility	Service Provider	Delivery Provider	Rate
Electricity	Duke Energy	Duke Energy	SGS-TOU
Natural Gas	Transco	PSNC Energy	175 – Firm Transportation
Water	City of Asheville	City of Asheville	
Sewer	Metropolitan Sewage District of Buncombe County	Metropolitan Sewage District of Buncombe County	20000/25000 with monthly cooling tower adjustment

The Detention Addition building purchases their electricity through Duke Energy. Natural gas is supplied by Transco with distribution provided by PSNC Energy. The water, including fireline, is provided by the City of Asheville. Sewer treatment and maintenance is billed separately by the Metropolitan Sewage District of Buncombe County after applying a monthly adjustment for water used in the Detention Addition cooling towers. A summary of utility provider and rate schedule information for Detention Addition is presented in Table 2.3 below.

Table 2.3 Energy and Water Utility Providers – Detention Addition

Utility	Service Provider	Delivery Provider	Rate
Electricity	Duke Energy	Duke Energy	SGS-TOU
Natural Gas	Transco	PSNC Energy	175 – Firm Transportation
Water	City of Asheville	City of Asheville	
Sewer	Metropolitan Sewage District of Buncombe County	Metropolitan Sewage District of Buncombe County	20000/25000 with monthly cooling tower adjustment

The Department of Health and Human Services building located at 35 Woodfin Street purchases their electricity through Duke Energy (Progress) and natural gas through PSNC Energy. The water is provided by the City of Asheville with sewer treatment and maintenance provided by the Metropolitan Sewage District of Buncombe County. A summary of utility provider and rate schedule information for 35 Woodfin Street is presented in Table 2.4 below.

Table 2.4 Energy and Water Utility Providers – 35 Woodfin Street

Utility	Service Provider	Rate
Electricity	Duke Energy	SGS-TOU
Natural Gas	PSNC Energy	125 – Small General Service
Water	City of Asheville	
Sewer	Metropolitan Sewage District of Buncombe County	20000/25000

The Social Services building located at 40 Coxe Avenue purchases their electricity through Duke Energy and their gas from PSNC Energy. Water, including fireline and stormwater, for Social Services is also provided by the City of Asheville with sewer treatment and maintenance provided by the Metropolitan Sewage District of Buncombe County. A summary of utility provider and rate schedule information for Social Services is presented in Table 2.5 below.

Table 2.5 Energy and Water Utility Providers – Social Services

Utility	Delivery Provider	Rate
Electricity	Duke Energy	SGS-TOU
Natural Gas	PSNC Energy	125 – Small General Service
Water	City of Asheville	
Sewer	Metropolitan Sewage District of Buncombe County	20000/25000

The County Administration building located at 200 College Street purchases their electricity through Duke Energy and their gas from PSNC Energy. Water, including fireline and stormwater, for County Administration is also provided by the City of Asheville with sewer treatment and maintenance provided by the Metropolitan Sewage District of Buncombe County. A summary of utility provider and rate schedule information for County Administration is presented in Table 2.6 below.

Table 2.6 Energy and Water Utility Providers – County Administration

Utility	Delivery Provider	Rate
Electricity	Duke Energy	SGS-TOU
Natural Gas	PSNC Energy	125 – Small General Service
Water	City of Asheville	
Sewer	Metropolitan Sewage District of Buncombe County	20000/25000

The Buncombe County Sheriff building located at 202 Haywood Street purchases their electricity through Duke Energy and their gas from PSNC Energy. Water, including stormwater, for County Administration is also provided by the City of Asheville with sewer treatment and maintenance provided by the Metropolitan Sewage District of Buncombe County. A summary of utility provider and rate schedule information for the Sheriff's building is presented in Table 2.7 below.

Table 2.7 Energy and Water Utility Providers – Sheriff's building

Utility	Delivery Provider	Rate
Electricity	Duke Energy	SGS-TOU
Natural Gas	PSNC Energy	125 – Small General Service
Water	City of Asheville	
Sewer	Metropolitan Sewage District of Buncombe County	20000/25000

The Animal Shelter building located at 16 Forever Friend Lane purchases their electricity through Duke Energy and their gas from PSNC Energy. Water, including fireline and stormwater, for the Animal Shelter is also provided by the City of Asheville with sewer treatment and maintenance provided by the Metropolitan Sewage District of Buncombe County. A summary of utility provider and rate schedule information for the Animal Shelter is presented in Table 2.8 below.

Table 2.8 Energy and Water Utility Providers – Animal Shelter

Utility	Delivery Provider	Rate
Electricity	Duke Energy	SGS-TOU
Natural Gas	PSNC Energy	125 – Small General Service
Water	City of Asheville	
Sewer	Metropolitan Sewage District of Buncombe County	20000/25000

The Emergency Management Services/911 Center building located at 164 Erwin Hills Road purchases their electricity through Duke Energy and natural gas through PSNC Energy. The water is provided by the City of Asheville with sewer treatment and maintenance provided by the Metropolitan Sewage District of Buncombe County. A summary of utility provider and rate schedule information for the 911 Center is presented in Table 2.9 below.

Table 2.9 Energy and Water Utility Providers – 911 Center

Utility	Service Provider	Rate
Electricity	Duke Energy	SGS-TOU
Natural Gas	PSNC Energy	125 – Small General Service
Water	City of Asheville	
Sewer	Metropolitan Sewage District of Buncombe County	20000/25000

The Interchange building located at 59 Woodfin Place purchases their electricity through Duke Energy and natural gas through PSNC Energy. The water, including stormwater, is provided by the City of Asheville with sewer treatment and maintenance provided by the Metropolitan Sewage District of Buncombe County. A summary of utility provider and rate schedule information for Interchange is presented in Table 2.10 below.

Table 2.10 Energy and Water Utility Providers – Interchange

Utility	Service Provider	Rate
Electricity	Duke Energy	SGS-TOU
Natural Gas	PSNC Energy	125 – Small General Service
Water	City of Asheville	
Sewer	Metropolitan Sewage District of Buncombe County	20000/25000

Based on the utility bill information provided, Shaw developed marginal cost estimates for each commodity type. Marginal cost estimates are the average cost per unit of each commodity. Within this report, the marginal energy consumption rates were used when calculating energy savings.

It appears electricity and natural gas is currently purchased through a market rate price contract. The market rate fluctuates with current variable market prices and therefore the cost per unit of electricity ($/kWh) and natural gas ($/Therm) changes on a monthly basis. Table 2.11 below shows the average

electricity, natural gas and water rates for the 10 Buncombe County buildings for June 2012 through May 2013. The average marginal rate of the 10 locations is also included in table 2.11 below.

Table 2.11 Commodity Rate Structures

Energy Costs	Electricity ($/kWh)	Natural Gas ($/Therm)	Water ($/Thousand Gallons)
Rate for Courthouse	0.0741	0.8070	12.0161
Rate for Detention Center	0.0698	0.221*	8.3458
Rate for Detention Addition	0.0678	0.7958	9.1900
Rate for 35 Woodfin	0.0786	0.7928	9.7813
Rate for Social Services	0.0767	1.1360	9.3682
Rate for County Admin	0.0758	0.7665	12.3028
Rate for Sheriff	0.0769	4.1072	12.0407
Rate for Animal Shelter	0.0830	0.7832	8.9783
Rate for 911 Center	0.0699	0.9414	9.3093
Rate for Interchange	0.0709	2.0708	11.7953

*Rate for natural gas at the Detention Center excludes supply cost

2.3 Total Energy Usage and Expenditure

In the twenty-four month period analyzed, the combined consumption for the 10 Buncombe County buildings was as follows: total natural gas used was 758,087 therms, the total electricity used was 24,349,740 kWh, and the total water consumed was 46,435,000 gallons. This equates to an expenditure of approximately $1,759,990 in electricity, $389,814 in natural gas and $472,038 in water over the two year period. The total energy and water costs for the facility over this twenty –four month period are $2,621,842, or an average annual cost of approximately $1,300,000. Approximately 67% of the total costs are from electricity with 15% from natural gas and 18% from water and 28% of all utility usage and cost is associated with the Detention Center.

The following subsections provide an overview of the annual usage and cost for electricity, natural gas and water for the facility.

2.3.1 Electricity Usage and Costs

The monthly electric energy consumption, supply and distribution cost for the period of June 2011 through May 2012 is summarized in Table 2.4. The same information for the period of June 2012 through May 2013is summarized in Table 2.5. The electric energy usage for both fiscal years follows a fairly flat usage pattern from month to month with an as expected increase during the summer cooling months.

Table 2.12 June 2011 through May 2012 Total Monthly Electric Usage and Costs

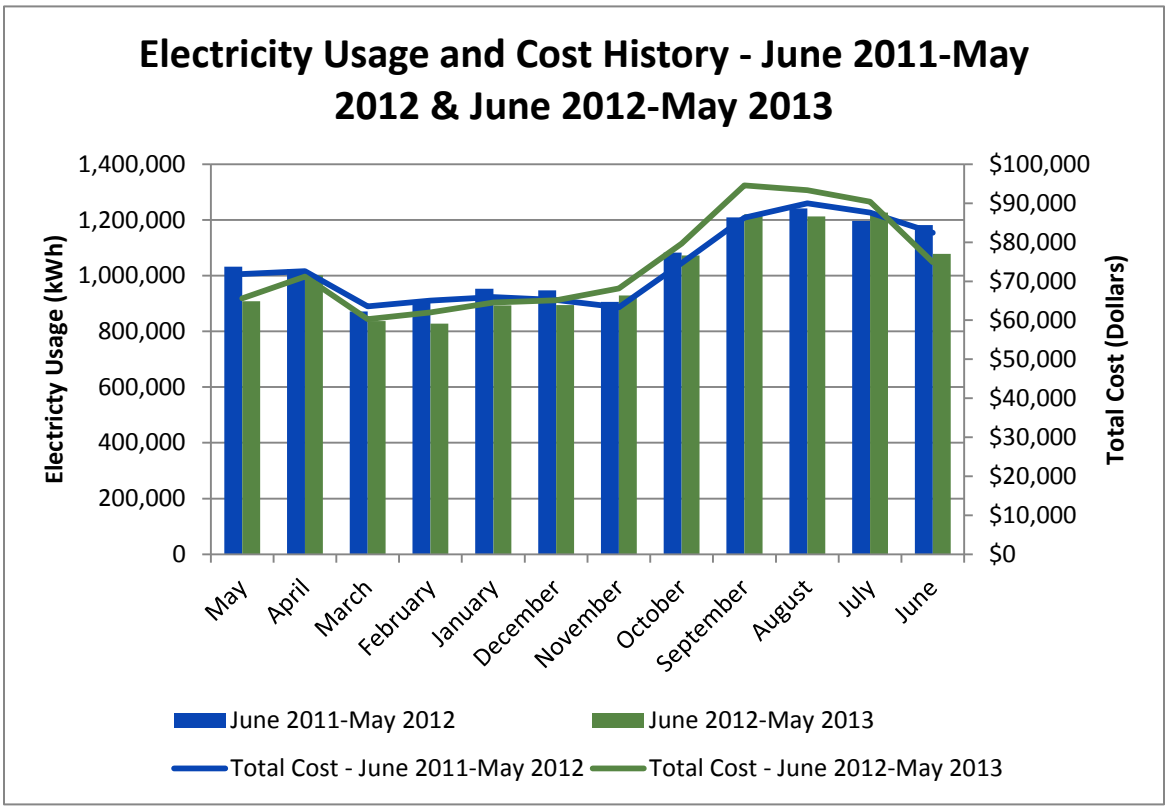
Month	Use (kWh)	Total Cost
June 2011	1,181,340	$82,407
July 2011	1,197,000	$87,603
August 2011	1,241,260	$89,998
September 2011	1,208,980	$86,272
October 2011	1,082,760	$74,639
November 2011	906,300	$63,287
December 2011	947,440	$65,222
January 2012	952,700	$65,908
February 2012	908,220	$65,024
March 2012	871,960	$63,602
April 2012	1,022,840	$72,571
May 2012	1,032,300	$71,869

Table 2.13 June 2012 through May 2013 Total Monthly Electric Usage and Costs

Start	Use (kWh)	Total Cost
June 2012	1,078,840	$74,928
July 2012	1,226,280	$90,382
August 2012	1,213,020	$93,343
September 2012	1,220,580	$94,605
October 2012	1,072,480	$79,635
November 2012	929,440	$68,129
December 2012	894,540	$65,126
January 2013	893,830	$64,540
February 2013	827,600	$62,039
March 2013	836,620	$60,277
April 2013	1,001,120	$71,218
May 2013	908,540	$65,623

Figure 2.1 below presents a graphical representation of the June 2011-May 2012 and June 2012-May 2013 electricity usage and expenditure. The bar graph shows the usage for June 2011-May 2012(green) and June 2012-May 2013 (blue). The trend lines show the total associated costs for these years. The usage and cost follow a similar pattern for both periods.

Figure 2.1 Electricity Usage and Cost History June 2011-May 2012/June 2012-May 2013



2.3.2 Natural Gas Usage and Costs

The monthly natural gas consumption, supply and distribution cost for the period of June 2011 through May 2012 is summarized in Table 2.14. The same information for the period of June 2012 through May 2013is summarized in Table 2.15. The usage pattern follows fluctuations that are typically expected from a facility that uses natural gas primary for space heating with peaks during the winter months and lower usage values during the summer.

Table 2.14 June 2011-May 2012 Total Monthly Natural Gas Usage and Costs

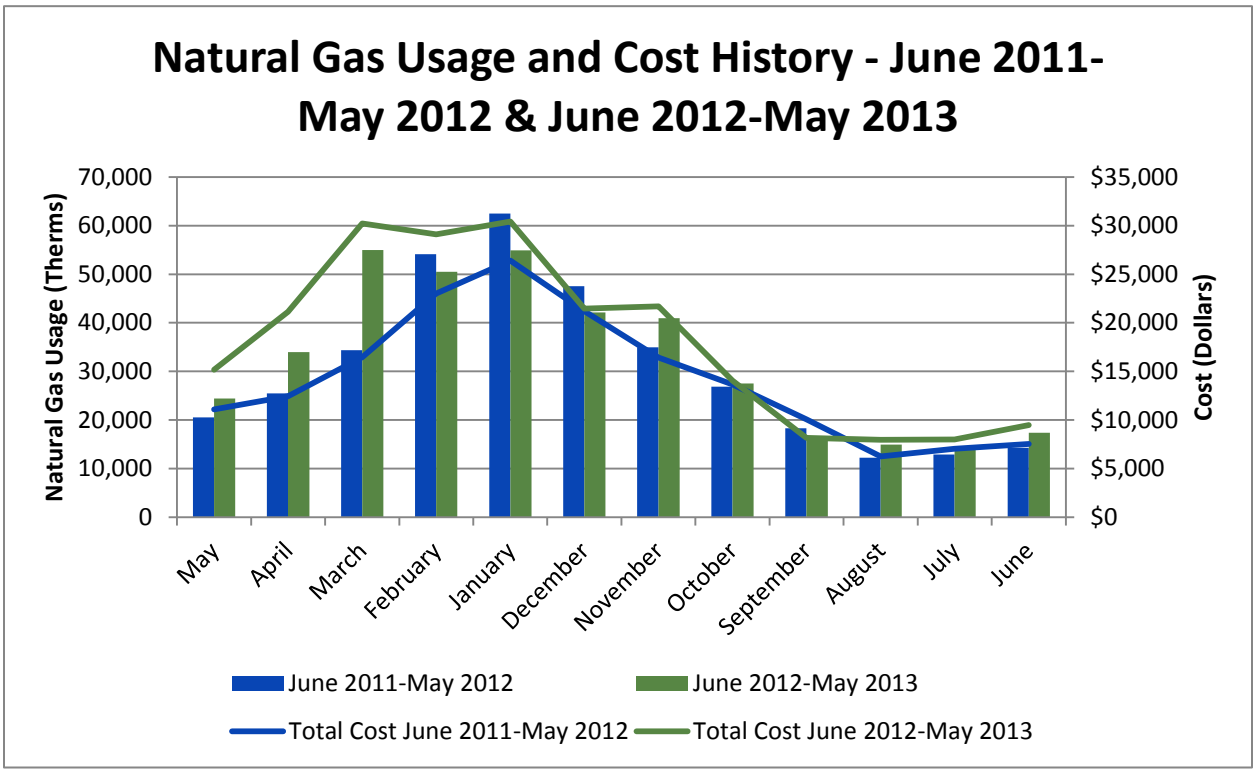
Month	Use (Therms)	Total Cost
June 2011	14,305	$7,544
July 2011	12,872	$7,050
August 2011	12,255	$6,261
September 2011	18,282	$10,076
October 2011	26,876	$13,646
November 2011	34,933	$16,411
December 2011	47,543	$21,202
January 2012	62,506	$26,409
February 2012	54,090	$23,023
March 2012	34,382	$16,461
April 2012	25,457	$12,444
May 2012	20,568	$11,095

Table 2.15 June 2012-May 2013 Total Monthly Natural Gas Usage and Costs

Start	Use (Therms)	Total Cost
June 2012	17,380	$9,473
July 2012	14,542	$7,984
August 2012	14,929	$7,953
September 2012	16,035	$8,158
October 2012	27,503	$14,056
November 2012	40,964	$21,700
December 2012	42,103	$21,464
January 2013	54,902	$30,407
February 2013	50,499	$29,092
March 2013	54,957	$30,207
April 2013	33,971	$21,130
May 2013	24,402	$15,187

Figure 2.2 below presents a graphical representation of the June 2011-May 2012 and June 2012-May 2013 natural gas usage and expenditure. The bar graph shows the usage for June 2011-May 2012 (green) and June 2012-May 2013 (blue). The trend lines show the total associated costs for those years.

Figure 2.2 Natural Gas Usage and Cost History June 2011-May 2012/June 2012-May 2013



2.3.3 Water Usage and Costs

The monthly water consumption and cost for the period of June 2011 through May 2012 is summarized in Table 2.16. The same information for the period of June 2012 through May 2013 is summarized in Table 2.17. Data was taken directly from utility bill data provided by Buncombe County. Each building is billed separately for water use, with the billing period varying by building. The County Administration, 911 Center, Animal Shelter, Social Services, Interchange, and Sheriff's buildings are billed for water use and sewer treatment on a bi-monthly basis. The 35 Woodfin, Courthouse, Detention Center, and Detention Addition are billed on a monthly basis. Total cost includes cost of water consumption and sewer treatment.

Table 2.16 June 2011-May 2012 Total Water Usage and Costs

Month	Use (CCF)	Total Cost
June 2011	2,244	$27,209
July 2011	1,790	$21,906
August 2011	2,860	$29,494
September 2011	1,944	$23,505
October 2011	2,319	$28,585
November 2011	2,176	$25,446
December 2011	1,961	$25,452
January 2011	1,745	$16,479
February 2011	2,112	$20,775
March 2011	1,696	$12,603
April 2011	2,328	$21,698
May 2011	1,696	$15,860

Table 2.17 June 2012-May 2013 Total Water Usage and Costs

Month	Use (CCF)	Total Cost
June 2012	2,290	$23,859
July 2012	1,806	$16,258
August 2012	2,483	$22,811
September 2012	1,856	$16,067
October 2012	2,073	$21,139
November 2012	1,608	$15,015
December 2012	1,795	$19,439
January 2013	1,234	$12,350
February 2013	1,988	$20,812
March 2013	1,330	$12,855
April 2013	1,956	$20,053
May 2013	1,926	$16,442

Figure 2.2 below presents a graphical representation of the June 2011-May 2012 and June 2012-May 2013 water usage and expenditure. The bar graph shows the usage for June 2011-May 2012 (green) and June 2012-May 2013 (blue). The trend lines show the total associated costs for those years.

Figure 2.3 Water Usage and Cost History June 2011-May 2012 & June 2012-May 2013

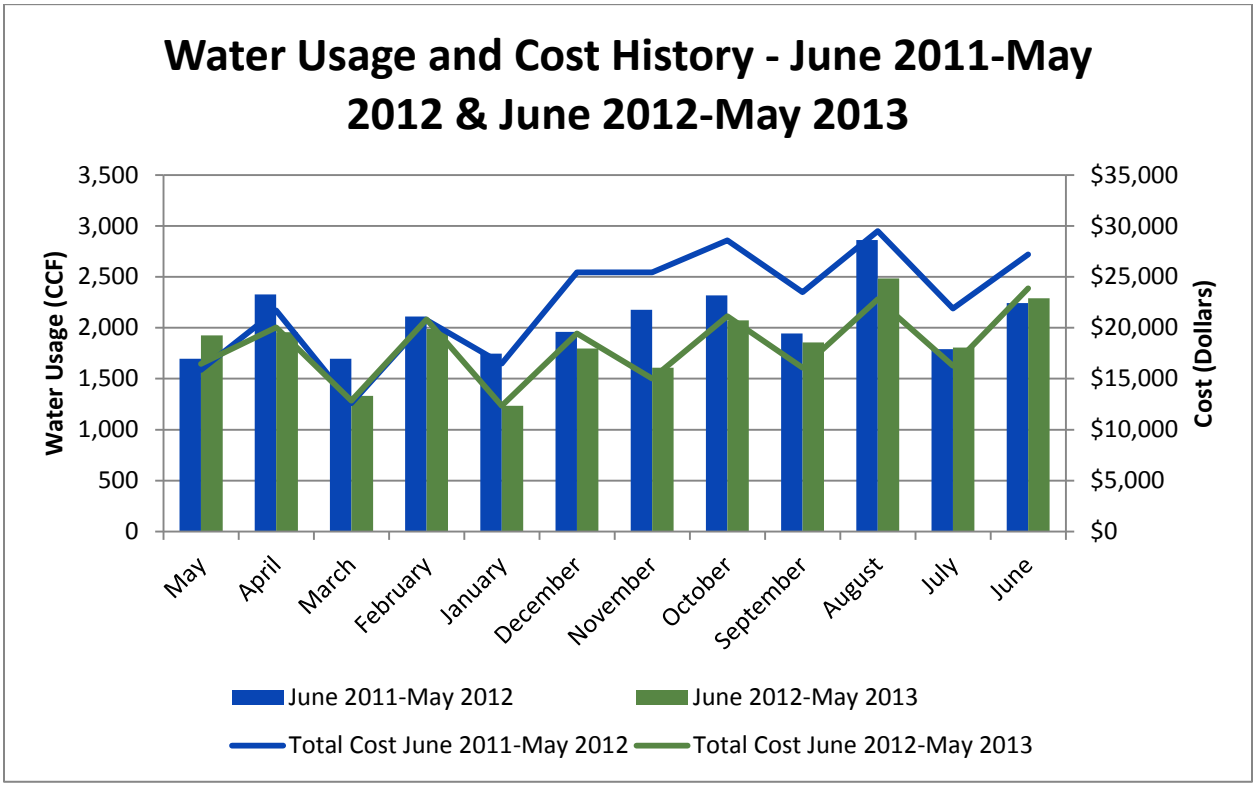
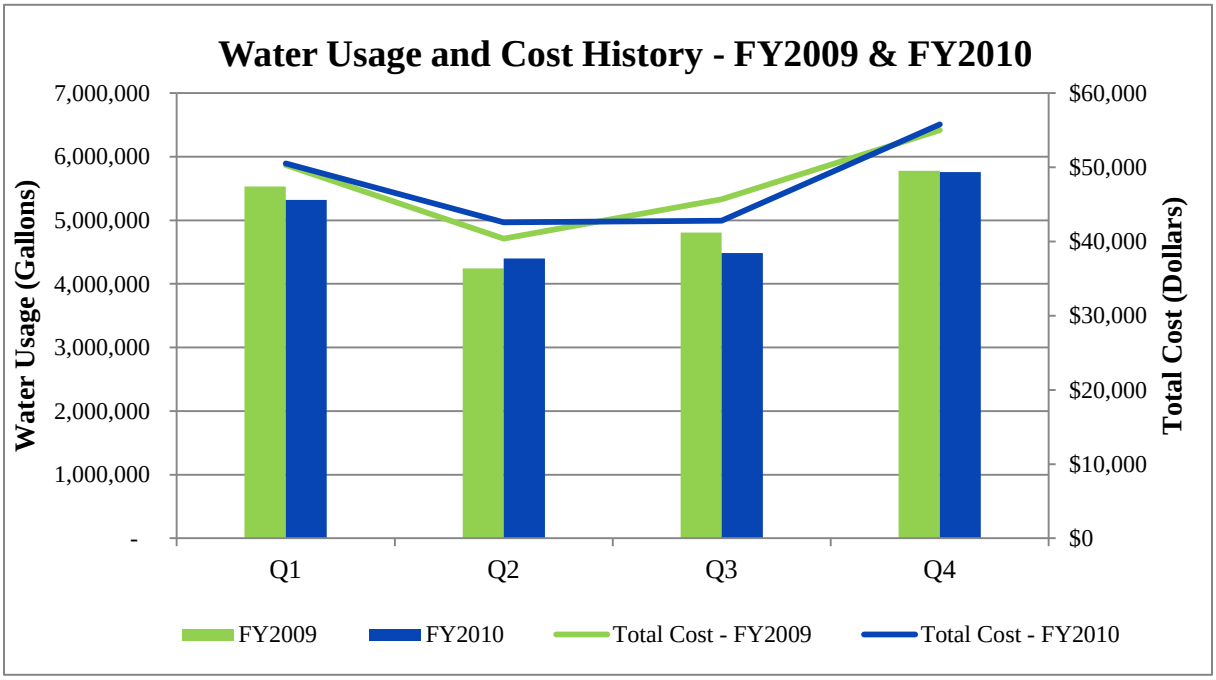


Figure 2.3 below presents a graphical representation of the FY2009 and FY2010 water usage and expenditure. The bar graph shows the usage for FY2009 (green) and FY2010 (blue). The trend lines show the total associated costs for those years. The usage and cost follow a similar pattern for FY2009 and FY2010.

Figure 2.4 Water Usage and Cost History FY2009/FY2010



3.0 Building Asset Description

3.1 General Description

This investment grade energy assessment included a walkthrough of the ten buildings with an emphasis on mechanical, electrical, lighting, and water systems. During this study, building construction and operating schedules were documented through observations and interviews with the on-site personnel. The paragraphs below give an overview of each building, followed by further HVAC and lighting details.

Courthouse

The County Admin was built in 1928 and is approximately 216,000 SF. The building is comprised of offices and courtrooms. The building is occupied from 8 AM to 5 PM Monday to Friday. The building is cooled by hydronic fan coil units (FCU's) and heated by steam radiators. The building controls are a combination of Novar and Johnson Controls Metasys.

Detention Center

The County Admin was built in 1996 and is approximately 150,000 SF. The building is used as a jail and offices. This facility holds prisoners and therefore operates 24/7. In addition, the facility has a laundry and kitchen area. The building is cooled hydronically and is heated with steam.

Detention Addition

The County Admin was built in 2004 and is approximately 92,000 SF. The building is used as a jail and offices. This facility holds prisoners and therefore operates 24/7. The building is cooled and heated hydronically and is controlled by Metasys.

35 Woodfin

The 35 Woodfin building was built in 1969 as an office building and is approximately 86,000 SF. The building is occupied from 8 AM to 5 PM Monday to Friday; however, there is a garage area where a couple of Ambulances are stored. This area operates 24/7. The building is cooled by several air handling units (AHU's) that are variable air volume systems (VAV) and is heated by a boiler. The building control system is Metasys.

Social Services

The County Admin was built in 1947 and is approximately 75,000 SF. The building is primarily used as office space. In addition this building is used for minor doctor check up's and license renewals. The building is occupied from 7 AM to 5:30 PM Monday to Friday. It is cooled with AHU's that are VAV systems and heated hydronically. The control system is Metasys.

County Admin

The County Admin was built in 2008 and is approximately 55,000 SF. The building is used as an office and is occupied from 8 AM to 5 PM Monday to Friday. The building is cooled by two DX RTU's located

on the roof and is heated by a boiler system. The controls are Carrier, but Buncombe County is in the process of converting the controls to Metasys.

Sheriff

The County Admin was built in 1980 and is approximately 28,000 SF. The building is used as office space and is occupied from 7 AM to 7 PM Monday to Friday. The building is cooled with AHU's that are VAV systems and heated electrically. The control system is pneumatic and does not function properly.

Animal Shelter

The Animal Shelter was built in 2010 and is approximately 28,000 SF. The building is used to house homeless dogs and cats and is therefore occupied 24/7. The building is cooled by AHU's with associated energy recovery units (ERV's) interlocked to an air cooled chiller. The building is heated with a boiler. The building control system is Metasys.

911 Center

The 911 Center was built in 2006 and is approximately 24,000 SF. The majority of the building is used as an office; however, there is a call center that operates 24/7. The office portion of the building is occupied from 8 AM to 5 PM. The building is cooled by a combination of roof top units (RTU's) and a variable refrigerant system (VRS). The building is heated by a boiler. The building control system is Metasys; however the Metasys system is having trouble communicating with the VRS.

Interchange

The County Admin was built in 1923 and is approximately 28,000 SF. The primary use of this building is for offices. The building is occupied from 8 AM to 5 PM Monday to Friday. The building is cooled with an air cooled chiller and heated electrically. The IT room's cooling system is controlled by Metasys.

3.2 HVAC System Description

Cooling for the majority of the buildings at Buncombe County is provided by air cooled chillers except for a few exceptions; Detention Center and New Detention Center are provided by hydronic chillers. These chillers provide cold water to VAV systems utilizing a combination of VAV boxes and fan powered VAV boxes. For the 911 Center and Courthouse Life Safety Addition, cooling and heating is provided by a Variable Refrigerant System (VRS). In addition, for the 911 Center cooling is provided by DX RTU's with natural gas heat. Throughout the entire site spot cooling is provided by residential size split systems. Heating is provided by hydronic boilers utilizing reheat coils in VAV boxes. At the Courthouse and Detention Center heat is provided by steam boilers. The steam at the Detention Center is converted to hot water via heat exchangers located in the mechanical rooms. Finally the Interchange building and Sheriff's building uses electric heating utilizing duct heaters downstream of the fan.

The Detention Center's air system is comprised of three VAV systems with ducted return. The plans show return is ducted from the VAV box. The New Addition air system is comprised of five multi-zone units with a common ERU that distributes the OA to each multi-zone unit. The return is also ducted for this building.

Specifically, for the Sheriff's Facility, the usage of the facility has changed from what was designed as a basic 1980 vintage office building to a modern law enforcement facility with much higher occupancy and tremendous amount of technology, which taxes the existing system. Cooling for this building may be undersized and additional cooling should be considered.

Natural gas domestic hot water heaters provide domestic hot water, except for a couple buildings. For the Interchange and 35 Woodfin buildings domestic hot water is provided by electric water heaters.

The primary building control system is Metasys but Novar is also used at the Courthouse. Carrier is also present at County Admin but is in the process of changing to Metasys. For the buildings that are not connected to Metasys, individual unit control is provided by wall or unit mounted thermostats that control heating and cooling valves or electric heaters. Since most of the fan coil units are more than 20 years old, control is provided by a 3 speed dial. These thermostats and dial controls do not have any set back or scheduling capabilities. In addition, it was determined that the buildings with Metasys are implementing some energy saving control sequencing, but still can be optimized even more. For example, Buncombe County has programmed dry bulb economizers, but can be optimized to enthalpy based economizers. Finally it was determined that no reset sequencing was installed or DCV.

Heating, ventilation and cooling is provided by a combination of chillers, boilers, Roof Top Units (RTUs), Air Handling Units (AHUs), and ancillary distribution devices.

Table 3.1 Air Handling Equipment List

Building	Tag #	Manufacturer	Model #
35 Woodfin	AHU-1	Built-up	Built-up
	AHU-2	Built-up	Built-up
	AHU-3	Built-up	Built-up
911 Center	RTU-1	Trane	YCH120A3RMA
	RTU-2	Trane	4TCC3036A1
	RTU-3	Trane	2YCC3048A1096
	RTU-4	Trane	4TCC3024A1
	RTU-5	Trane	THC072A3R0A
Animal Shelter	ERU-1	York	XTI048X063
	ERU-2	York	XTI048X066
	ERU-3	York	XTI033X048
	ERU-4	York	XTI039X051
County Building	RTU-1	Carrier	48ZNE060NHK
	RTU-2	Carrier	48ZWE105NM
Courthouse	OAU-1	Munters	HTD-TF HE150
	PAHU	Carrier	40RUAA12A2A

Detention Addition	AHU-1	Trane	4FWCA036A
	MZU-1	Carrier	39MN25B0059BW11XXS
	MZU-2	Carrier	39MN17B0059BV11XXS
	MZU-3	Carrier	39MN25B0059BZ11XXS
	MZU-4	Carrier	39MN14B0059BX11XXS
	MZU-5	Carrier	39MN25B0059BY11XXS
Detention Center	AHU-1	York	YCM-12-E
	AHU-2	York	YCM-12-E
	AHU-3	York	YCM-12-E
	MAHU-1	York	YCP45LP
	MAHU-2	York	YCP25-AF
Interchange		Carrier	39M1STD02JK
		Carrier	39MN17B0057MG
Sheriff	1	Carrier	39B
	2	Carrier	39E
	3	Carrier	39B
	4	Carrier	39E
	5	Carrier	39E
Social Services	AHU-1	Built-up	Built-up
	AHU-2	Carrier	39LF2121CA1036

Table 3.2 Boiler Equipment List

Building	Tag #	Make	Model
35 Woodfin	B-1	Patterson Kelley	N2500-MFD
	B-2	Patterson Kelley	N2500-MFD
911 Center		Weil-McLain	688
Animal Shelter	B-1	RBI Dominator	DB750
	B-2	RBI Dominator	DB750
County Building	B-1	RBI Dominator	DB1350
	B-2	RBI Dominator	DB1350
Courthouse		Weil-McLain	BL-1592SN
		Weil-McLain	BL-1529SN
Detention Addition	B-1	Lochinvar	PBN1001PM
	B-2	Lochinvar	PBN1001
Detention Center		Superior	4-5-75-1L-GP
		Superior	4-5-75-1L-GP
Social Services		Raypak, Inc.	H-2100A

Table 3.3 Chiller Equipment List

Building	Tag #	Make	Model	Type	Tonnage
35 Woodfin		Trane	RTAA2404XR	Helical Rotary Air-Cooled	240
Animal Shelter	C-1	York	YLAA0070SE46XCA	Air-Cooled Screw	72
Courthouse		Carrier	30GT-040-510KA	Flotronic Air-Cooled	36
		Carrier	30GT-040-510KA	Flotronic Air-Cooled	36
		Carrier	30GT-040-510KA	Flotronic Air-Cooled	36
		Carrier	30GT-040-510KA	Flotronic Air-Cooled	36
		McQuay	AGZ065DHHNN	Air-Cooled Water Chiller	65
Detention Addition	CH-1	Carrier	30HXC161	Centrifugal	157
Detention Center	CH-1	York	YSBBBBDSICGA		185
	CH-2	York	YSBBBBDSICGA		185
Interchange		Carrier	38AH054-510		50
Sheriff		Trane	CGAFC404AMA		40
Social Services		York	YCAV0157SA28	Air-Cooled Screw	154

3.3 Lighting System Description

Lighting at the Buncombe County facilities consists of a combination of linear fluorescent, compact fluorescents (CFLs), Light Emitting Diodes (LEDs), and LED exit signs. The majority of the offices, open areas, corridors, and restrooms utilize 28 Watt (2'x4') T8 fluorescent fixtures with two, three, or four lamps, depending on lighting requirements. These fixtures contain electronic ballasts. Similarly, some offices and corridors utilize 17 Watt (2'x2') T8 fluorescent fixtures with two lamps. Open office work areas in some buildings utilize cable suspended direct/indirect fluorescent fixtures with 4' three lamp sections combined to total lengths of 8', 12' or 16'. Lobby areas and some corridors utilize down (can) lights with either one or two CFL lamps or LEDs. Few areas utilize 36 or 40 Watt incandescent decorative fixtures. The Sheriff's building is the only building utilizing 40 Watt (2'x4') T12 fluorescent one, two or three lamp fixtures and 75 Wall (2'x8') T12 fluorescent one or two lamp fixtures. These fixtures are in the process of being retrofitted as the T12 lamps expire.

Exterior lighting primarily consists of pole or wall mounted Metal Halides with numerous wattages ranging from 50 to 400 Watt lamps.

Most interior lighting is controlled through individual space switches which impose On / Off control by space occupants when needed. At 35 Woodfin, lighting in cube areas, open offices, and work areas is controlled using ceiling mounted dual technology occupancy sensors and daylighting sensors. The occupancy sensors control the lighting to activate when motion is sensed in the area and deactivate when a given amount of time has passed since motion was last detected. The daylighting sensors control the lighting to reduce lighting levels when sufficient lighting is provided through exterior windows. Three switching sequences are programmed into the controls to reduce the lighting by three levels, depending on the lighting provided through exterior windows. Through staff interviews, it was determined that most of the daylighting controls at 35 Woodfin are currently overridden.

In the Social Services building, lighting in open offices, lobbies, waiting areas and corridors is controlled using ceiling mounted dual technology occupancy sensors. These sensors control lighting levels similar to 35 Woodfin. At the Animal Shelter, lighting in offices, labs, and lobbies is controlled using ceiling mounted dual technology occupancy sensors, with controls similar to 35 Woodfin and Social Services. At the Courthouse, renovated areas including the Life Safety Addition (LSA), third, 10th, 11th, 12th, 13th, and 14th floors have lighting in restrooms, stairwells, corridors, offices, lobbies, and waiting areas controlled using ceiling mounted dual technology occupancy sensors similar to buildings described above. At the Interchange, lighting in restrooms is controlled using switch mounted occupancy sensors. The following table summarizes lighting controls currently used and general building occupancy.

Exterior lighting for each building is controlled through a time clock with On/Off control capabilities for night lighting. The site visit was conducted during daylight hours and most exterior lights were found to be off. The exception to this was found at the County Administration, which was found to have exterior pole lights on at one point during the site visit. Each building's exterior lighting time clock was found and checked for operating schedule.

Table 3.4 Interior Lighting Controls

Building	Occ. Sensor controls?	Daylight Sensor controls?	Days Occupied	Active	Inactive
35 Woodfin	Y	Y	Monday – Friday	8:00am	5:00pm
Social Services	Y	N	Monday – Friday	7:00am	6:30pm
County Administration	N	N	Monday – Friday	8:00am	5:00pm
Animal Shelter	Y	N	Monday – Sunday	8:00am	5:00pm
911 Center	N	N	Monday – Friday	8:00am	5:00pm
Detention Center	N	N	Monday - Sunday	24 hrs	-
Detention Addition	N	N	Monday – Sunday	24 hrs	-
Courthouse	Y	N	Monday – Friday	8:00am	5:30pm
Interchange	Y	N	Monday – Friday	7:30am	5:30pm
Sheriff	N	N	Monday – Friday	7:00am	7:00pm

4.0 Energy Cost Reduction Measures

4.1 Overview of Energy Cost Reduction Measures (ECRMs)

As a portion of Shaw's Comprehensive Energy Service activities, a team of energy engineers performed a detail energy audit of the Buncombe County facilities. As a result of this energy audit, Shaw has developed a comprehensive list of potential ECRMs.

The following sections present the findings and results of this energy audit and the recommended strategies for reducing Buncombe's total energy usage.

Energy savings and cost estimates have been provided for each measure to allow Buncombe the ability to determine which, if not all, measures should be implemented. In general, associated costs have been determined utilizing RS-Means pricing data or general contractor quotes. Energy consumption savings are based on engineering calculations and/or computer simulation modeling. All energy cost savings are calculated utilizing the average energy costs identified in Section 2 – Utility Rates.

4.1 Assessment Metrics

The following metrics are provided for each measure to convey the financial implications as well as the general impact on the building staff and ease of project implementation. These metrics are used as a quick reference guide for assessing the applicability of an energy efficiency opportunity.

Simple Payback Legend

	1 to 3 year payback
	3 to 7 year payback
	7+ year payback

Impact of Staff Operations

	No effect on operations
	Will have minor affect on operations
	Will have major affect on operations

Available Grant/Incentive Dollars Legend

	Grant funds available at a state or national level
	Grant funds available as a federal tax incentive
	No identified funding available

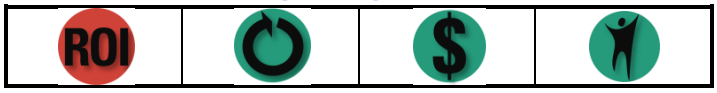
Ease of Implementation Legend

	Can be implemented using internal staff
	May require outside contractor work
	Will require design and installation services

4.2 Energy Efficiency Opportunities

The following subsections provide descriptions of energy efficiency measures that have been order based on simple payback and include no-cost / low-cost, medium and long term opportunities.

4.2.1 Interior Lighting Retrofit



Issues and Observations:

Through staff interviews it was determined that Buncombe County has a maintenance policy to replace any expired 32 Watt T8 lamps with more efficient second generation 28W T8 lamps on all linear fluorescent fixtures. The back stock of these replacement lamps was also observed during the site visit. A combination of 32 Watt and 28 Watt lamps was found in the linear fluorescent fixtures in each building.

Some buildings featured decorative fixtures that were found to utilize 36 Watt and 60 Watt incandescent lamps. At the Sheriff building, some linear fluorescent fixtures serving corridors, lobbies, restrooms, and stairwells still utilized 4 foot 40 Watt T12 and 8 foot 75 Watt T12 lamps.

Recommendations:

Shaw recommends expediting the current maintenance policy to replace all existing 32 Watt T8 lamps with more efficient second generation 28 Watt T8 lamps right away. This will require maintenance staff to walk each building to check all linear fluorescent fixtures for any remaining 32 Watt T8 lamps and immediately replace said lamp with the 28 Watt T8. This will only require replacement of the lamp, as the existing ballast will operate the lower wattage lamp.

For the buildings with decorative fixtures, Shaw recommends removing any 36 Watt and 60 Watt incandescent lamps and replacing them with 26 Watt Compact Fluorescent Lamps (CFLs).

For the Sheriff's building, Shaw recommends replacing each fixture utilizing T12 lamps with a new ballast and T8 lamps, with length depending on the existing fixture length. This replacement will require removal of the existing magnetic ballast. More efficient electronic ballasts will be installed in place in order to utilize the T8 lamps. Once the ballast is installed, a 4 foot 28 Watt T8 or 8 foot 60 Watt T8 lamp will be installed, depending on the existing fixture length.

Costs and Benefits:

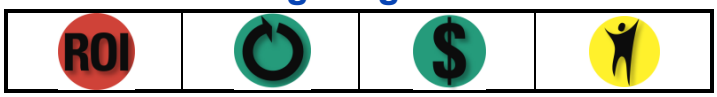
Costs for replacing first generation 32 Watt T8 lamps with second generation 28 Watt T8 lamps will be incurred for the disposal of the old lamps and the cost of the new lamps. The same costs will be incurred for the CFL replacements. Replacement of the fixtures utilizing T12 lamps will incur costs for the replacement ballasts and T8 lamps, as well as the lighting retrofit kit to be installed within the fixture.

All replacement and fixture retrofit labor can be completed in house by Buncombe County maintenance staff. Savings will be achieved through reduced lighting demand and consumption from the more efficient lamps and ballasts to be installed.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	6,700
Demand Reduction (kW)	1
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	7,500
Annual Energy Cost Savings ($)	500
Available Rebates ($)	-
Simple Payback (yrs)	13.0

4.2.2 Exterior Lighting Retrofit



Issues and Observations:

During the site visit it was observed that each Buncombe County building, with the exception of the Sheriff's building, had exterior lighting operating on the building's electricity meter. These exterior lighting fixtures include pole or wall mounted Metal Halide fixtures with wattages including 50, 100, 150, 175, 250, and 400 Watts. The wall mounted fixtures were generally found to be wall packs, while the pole mounted fixtures included one or two lamp fixtures.

Recommendations:

Shaw recommends retrofitting each existing pole or wall mounted Metal Halide fixture with a pole or wall mounted Lithonia D-Series 36, 45, 47, 68, and 158 Watt LED fixtures that provides equivalent lighting levels.

Costs and Benefits:

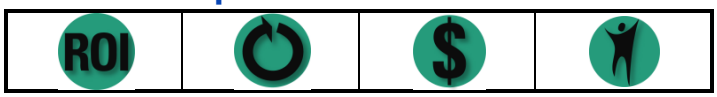
Costs for this measure will be incurred for the materials associated with the purchase of the new exterior lighting fixtures. Installation labor will be performed by a local contractor, which will result in additional costs.

Benefits will be achieved through reduced electricity demand from the new, more efficient lighting fixtures. Because these lights operate only at night, the demand savings will not be realized during the peak demand period, so demand savings are not described below. Electricity consumption savings will also be achieved through use of more efficient exterior lighting fixtures.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	47,000
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	49,600
Annual Energy Cost Savings ($)	3,500
Available Rebates ($)	-
Simple Payback (yrs)	12.9

4.2.3 Delamp Fixtures



Issues and Observations:

During the site walk, it was observed that lighting in some spaces exceeds the adequate lighting level based on the space use. This was also confirmed through staff interviews. Upon further analysis, it was determined that the ASHRAE standard for lighting power demand is exceeded in these spaces. Lighting power demand provides a standard for the amount of lighting wattage per square foot, based on space use.

Recommendations:

Shaw recommends removing a specified number of lamps from numerous fixtures, as determined through the lighting power demand analysis. A reflector kit will be installed in place of the removed lamp (s) in order to ensure even distribution of lighting levels after lamp(s) removal. A brief description of the number of spaces to have lamps removed and the total number of lamps to be removed by building is shown in Table 4.1 below.

Table 4.1 Delamping by building

Building	# of spaces to be delamped	Total # of lamps to be removed
35 Woodfin	11	120
Social Services	8	16
County Building	76	177
911 Center	15	26
Courthouse	81	216

Costs and Benefits:

Lamp removal and reflector kit installation will be completed in house by Buncombe County maintenance staff. Therefore, costs incurred for this measure will only be material costs for the reflector kits. Benefits from this measure will be achieved through reduced lighting demand from fewer lamps being used to provide sufficient lighting to each space.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	42,700
Demand Reduction (kW)	8
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	13,700
Annual Energy Cost Savings ($)	3,300
Available Rebates ($)	-
Simple Payback (yrs)	2.5

4.2.4 Add Lighting Occupancy Sensors

Issues and Observations:

Currently, Buncombe County has lighting occupancy sensors installed in a portion of the spaces within five buildings. 35 Woodfin has dual technology sensors installed in the common cube areas and work areas. Social Services has dual technology sensors installed in lobbies, corridors, waiting rooms, and open work areas. The Animal Shelter has dual technology sensors in all spaces that don't hold animals or in corridors. The Courthouse has dual technology sensors installed in the Life Safety Addition, as well as the 3rd, 10th, 11th, 12th, 13th, and 14th floor renovations. The Interchange building has switch mounted sensors installed in bathrooms.

The remaining Buncombe County buildings, including the County Administration, 911 Center, Detention Center and Addition, and Sheriff's buildings, do not have lighting occupancy sensors installed in any spaces.

Recommendations:

Shaw recommends installing occupancy sensors within any space not currently served by an occupancy sensor. This will include spaces in each of the 10 buildings. Depending on space type and use, it is recommended to install one or more ceiling mounted, wall mounted, or switch mounted dual technology lighting occupancy sensors. The number of occupancy sensors to be installed in each space will be based on the square footage of the space.

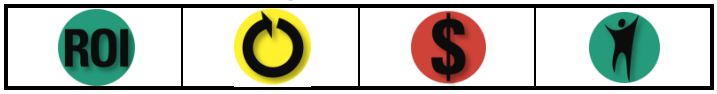
Costs and Benefits:

Occupancy sensor installation with associated wiring will be completed by a local electrical contractor. Material costs for installation will be incurred for the occupancy sensors and necessary wiring. Labor costs for installations will be incurred for the electrician contractor time and labor. Benefits from this measure will be achieved through reduced lighting electricity consumption by turning off any lights left on when a space is not occupied.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	118,600
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	169,100
Annual Energy Cost Savings ($)	9,000
Available Rebates ($)	-
Simple Payback (yrs)	17.4

4.2.5 Scheduling / Temperature setback



Issues and Observations:

Despite 8 out of the 10 Buncombe buildings having schedule and temperature control capabilities through the JCI Metasys BAS, these building HVAC systems currently operate 24/7 off of space temperature demand. This means that the HVAC system operates to meet temperature set points even when the building is not occupied. This leads to excessive use of heating and cooling energy to condition spaces during times when conditioning is not required.

The Courthouse is unique in that only the renovated portion of the building is controlled using Metasys. This portion includes the Life Safety Addition, basement level, ground level, and levels 9, 10, 11, 12, 13, 14 and 14 mezzanine. This portion of the building will be included in this ECRM, while the remaining portion of the building will be included in the following ECRM, Programmable Thermostats/time-clock.

Recommendations:

Shaw recommends implementing an operating schedule for space temperature setpoints for the 8 buildings on the BAS. This schedule will allow temperatures to be setback during unoccupied times. This will reduce electricity and natural gas consumption when space conditioning is not needed. Recommended schedules and setback temperatures are shown in Table 4.1 below. The schedules include one hour for ramp up prior to building occupancy and one and a half to two hours of operation after standard occupancy for conditioning if any occupant stays late.

Because the Detention Center includes inmate cells that require operation 24/7, Shaw only recommends scheduling and setting back the units that serve the Detention Center offices. These spaces do not require 24/7 conditioning, so there is opportunity to reduce excessive energy consumption in the offices. The Detention Addition features only inmate areas, so there will not be opportunity to schedule or setback because these spaces require conditioning 24/7.

Table 4.2 Recommended Setback Schedule

Building	Days Active	Active	Active Set-point	Inactive	Inactive Set-point
35 Woodfin	Monday - Friday	7:00am	Heating = 68F Cooling = 74F	7:00pm	Heating = 66F Cooling = 76F
Social Services	Monday – Friday	6:00am	Heating = 68F Cooling = 72F	8:00pm	Heating = 66F Cooling = 76F
County Building	Monday – Friday	6:00am	Heating = 68F Cooling = 72F	7:00pm	Heating = 66F Cooling = 78F
911 Center	Monday – Friday	7:00am	Heating = 68F Cooling = 72F	7:00pm	Heating = 66F Cooling = 76F
Courthouse*	Monday – Friday	7:00am	Heating = 70F Cooling = 74F	7:00pm	Heating = 70F Cooling = 80F
Detention Center (Offices)	Monday – Sunday	7:00am	Heating = 70F Cooling = 76F	7:00pm	Heating = 66F Cooling = 80F
Detention Addition	Monday – Sunday	0:00am	Heating = 76F Cooling = 76F	-	-
Animal Shelter	Monday – Sunday	7:00am	Heating = 66F Cooling = 72F	7:00pm	Heating = 66F Cooling = 76F

*portion integrated on BAS system

Costs and Benefits:

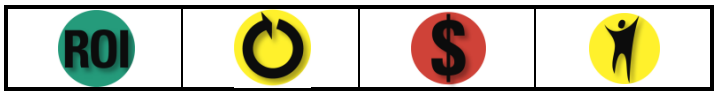
Costs will be incurred for programming the new scheduling time and setback temperatures within the JCI Metasys building automation system. This will require outside consulting by a JCI contractor

Benefits will be achieved through reduced operation of heating and cooling equipment. Scheduling the equipment will reduce hours of operation during times when conditioning is not necessary. Setting back the equipment during unoccupied times will also reduce unnecessary operation by raising/lowering the temperature at which equipment will activate during unoccupied times.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	231,400
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	2,000
Annual Water Savings (CCF)	-
Implementation Cost ($)	28,800
Annual Energy Cost Savings ($)	19,000
Available Rebates ($)	-
Simple Payback (yrs)	1.5

4.2.6 Thermostat Addition



Issues and Observations:

For the Interchange building, heating and cooling is supplied to each space by a wall mounted fan coil unit. These fan coil units are controlled by individual dials with low, medium, and high settings. Unless an occupant turns the dial to low or off when leaving the space, the fan coil unit will condition the space during unoccupied periods. Heating and cooling equipment is electric.

For the Sheriff's building, heating and cooling is supplied to each space by a VAV controlled by a thermostat. The Air Handling Units supplying air to all the VAV boxes do not have a time-clock installed. This leads the VAV boxes to supply air at the thermostat setpoint 24/7, thereby using excessive electricity to heat and cool during unoccupied times. Heating and cooling equipment is electric.

The portion of the Courthouse building not described in the ECRM above, Scheduling/Temperature Setback, has cooling provided by fan coil units in each space. These fan coil units are controlled by individual dials with low, medium and high settings, similar to the Interchange. Heating is provided by steam radiators in each space

Recommendations:

For the Interchange and Courthouse buildings, Shaw recommends installing programmable thermostats connected to the packaged fan coil unit serving each space. This will allow occupants to schedule each individual fan coil unit to serve the unique needs of each space. It is not recommended to connect the thermostats to the steam radiator at the Courthouse due to the excessive cost associated with doing so.

Table 4.3 Recommended Setback Schedule

Building	Days Active	Active	Active Set-point	Inactive	Inactive Set-point
Interchange*	Monday – Friday	6:00am	Heating = 68F Cooling = 72F	7:00pm	Heating = 66F Cooling = 76F
Sheriff*	Monday - Friday	6:00am	Heating = 68F Cooling = 72F	9:00pm	Heating = Off Cooling = Off
Courthouse**	Monday – Friday	7:00am	Heating = 70F Cooling = 74F	7:00pm	Heating = 70F Cooling = 80F

*building not integrated on BAS system
**portion not integrated on BAS system

Costs and Benefits:

Costs will be incurred for the materials required to install each new programmable thermostat at the Interchange and Courthouse buildings. Installation labor will be performed by Buncombe County maintenance staff. Programming of these thermostats can likely be performed by Buncombe County maintenance staff.

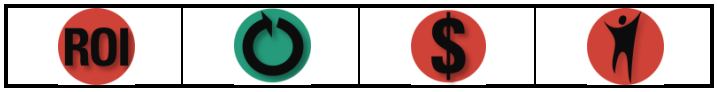
Benefits will be achieved through reduced operation of heating and cooling equipment. At the Interchange, proper programming will enable setback when spaces are unoccupied.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)*	269,300
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)*	76,700
Annual Energy Cost Savings ($)*	20,100
Available Rebates ($)	-
Simple Payback (yrs)	3.8

*savings and cost exclude work done for Sheriff's Office

4.2.7 Demand Control Ventilation (DCV)



Issues and Observations:

Presently, the existing AHU's and RTU's detailed below in Table 4.4 do not utilize DCV.

Table 4.4 Equipment not utilizing DCV

Building	Equipment	Total Existing OA
35 Woodfin	AHU-1, 2, & 3	20,460
Social Services	AHU-1 & 2	9,824
County Administration	RTU-1 & 2	6,900
911 Center	RTU-1, 2, 3, 4, & 5	1,525
Courthouse	DX unit serving courtroom	500
Detention Center	AHU-1, 2, & 3	19,320
Sheriff's Office	AHU-1, 2, 3, 4, 5	13,970

Recommendations:

Shaw recommends installing CO_2 sensors in the main return ductwork for each piece of equipment shown in Table 4.4. Once all CO_2 sensors are installed and calibrated, it is recommended to install Demand Control Ventilation programming to all the units. This will require BAS programming for the equipment in each building. The BAS system will be modified to adjust the outside/return/relief air dampers to specifically meet zone outside air requirements. The Demand Control Ventilation Sequence is as follows: If the CO_2 sensor input reading is less than the setpoint, then the outside air damper shall be at the minimum open position. If the CO_2 sensor input reading is above the setpoint (1,000 ppm), the outside air damper shall modulate open as needed to bring the CO_2 level back down below the setpoint.

General Scope of Work

- Provide appropriate CO2 sensor for mounting in the return duct
- Provide power and controls wiring for each sensor
- Sensor to be interlocked to Buncombe County existing BAS system.
- For MAU units located at County Admin and 911 that serve the large conference room and dispatch room respectively, change CO2 limit to 1000 PPM.

Costs and Benefits:

Costs for this ECRM will be incurred for the CO_2 sensor and wiring material. Installation labor will be completed in-house by Buncombe County maintenance staff. Programming labor will be incurred for the CO_2 sensor integration and outside air damper control sequence programmed into the BAS and in each AHU at the Sheriff's Office.

Table 4.5 AHUs for DCV

Bldg	Unit	# of Sensors
Social Services	AHU-1	1
	AHU-2	1
Courthouse	Pkg AHU	1
Detention Ctr	AHU-1	1
	AHU-2	1
	AHU-3	1
35 Woodfin	AHU-1	1
	AHU-2	1
	AHU-3	1
Sheriff	AHU-1	1
	AHU-2	1
	AHU-3	1
	AHU-4	1
	AHU-5	1
County Admin	RTU-1	1
	RTU-2	1
911	RTU-1	1
	RTU-2	1
	RTU-3	1
	RTU-4	1
	RTU-5	1

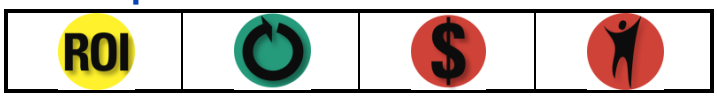
Benefits will be achieved by reduction in the amount of outside air being heated and cooled. By monitoring CO2, the outside air damper modulates to the building occupancy needs. This ensures outside air is not over-supplied while still meeting the minimum code requirements. By reducing the outside air supplied, less energy is needed to heat and cool the air supplied to the zones.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings*
Annual Consumption Savings (kWh)	25,200
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	16,100
Annual Water Savings (CCF)	-
Implementation Cost ($)	56,800
Annual Energy Cost Savings ($)	7,600
Available Rebates ($)	-
Simple Payback (yrs)	7.5

*savings and cost exclude work done for Sheriff's Office. See ECM 15

4.2.8 Optimize Economizers



Issues and Observations:

Presently, the existing AHU's and RTU's detailed below in Table 4.6 have dry bulb economizers installed.

Table 4.6 Equipment with dry bulb economizers installed

Building	Equipment	Existing DB Set Point
35 Woodfin	AHU-1, 2, & 3	60
Social Services	AHU-1 & 2	60
County Administration	RTU-1 & 2	60
Courthouse	DX unit serving courtroom	60
Detention Center	AHU-1, 2, & 3	60
Sheriff's Office	AHU-1, 2, 3, 4, 5	N/A

The economizer setpoint used for each piece of equipment above is significantly lower than the ASHRAE 90.1 recommended economizer setpoint for this geographic region.

Recommendations:

Shaw recommends optimizing the economizer setpoints. This will include changing the programming to include enthalpy economizers. The Metasys BAS will then need to be connected to the local airport weather station to reference humidity.

The economizer control will then be programmed as follows:

When the economizer sequence is enabled by the switchover sequence in Table 4.7 below, the outside air economizer damper, return damper, and relief damper will modulate in sequence to provide outside air to be used for free cooling. The dampers will modulate in sequence with the heating and cooling elements as described in the discharge air temperature control sequence below.

Table 4.7 Economizer control sequence

Sequence	Description
Fixed Enthalpy Economizer Switchover	The economizer sequence shall be enabled whenever the outside air enthalpy is less than **28 Btu/lb of dry air** and **60% RH**. The enthalpy differential setpoint shall be **1 Btu/lb (adj.) of dry air.**

General Scope of Work

- The majority of the work is reprogramming the Metasys system to optimize the existing economizer control.

Courthouse Scope

- The existing OA duct is too small and will need to be resized.
- Contractor to resize outside air duct to handle full economizer mode.
- Reroute ductwork to same exit point and existing OA duct.
- Contractor to provide new OA louver and new wall penetration.
- Contractor to be aware that the building is historic and may require extra time to get permit.

Costs and Benefits:

Costs for this ECRM will be incurred for the programming labor necessary to alter the economizer control sequence.

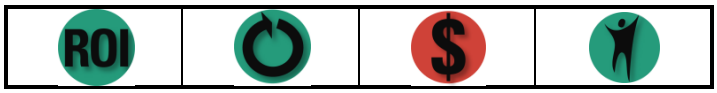
Benefits will be achieved through a reduction in the amount of energy used for cooling. By optimizing the economizer to include enthalpy, a higher temperature economizer setpoint will be used to activate the economizer. This will create more opportunity for free cooling using the economizer.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings*
Annual Consumption Savings (kWh)	139,800
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	28,700
Annual Energy Cost Savings ($)	10,300
Available Rebates ($)	-
Simple Payback (yrs)	2.8

*savings and cost exclude work done for Sheriff's Office. See ECM 15

4.2.9 Duct Static Reset



Issues and Observations:

Currently, the existing equipment shown below in Table 4.8 are VAV systems that do not have Duct Static Reset controls.

Table 4.8 VAV equipment without Duct Static Reset controls

Building	Equipment
35 Woodfin	All AHU's
Social Services	AHU-1 & 2
County Administration	RTU-1 & 2
Detention Center	All AHU's
Detention Addition	All MZU's
Sheriff's Office	All AHU's

Recommendations:

Shaw recommends implementing a Duct Static Reset control strategy, which includes changing the programming to include Duct Static Reset. The maximum duct static will be programmed as the existing setpoint, while the minimum duct static will be reduced to 25% of the existing setpoint. The static pressure reset control sequence is shown in Table 4.9 below.

Table 4.9 Duct Static Reset control sequence

Sequence	Description
Static Pressure Reset Control	Static pressure setpoint shall be reset using Trim & Respond logic within the range **0.35 in. w.c. to existing static pressure set point in. w.c.** When the fan is off, the setpoint shall be reset to **0.8 in. w.c. (adj.)** and this setpoint shall be used on system start up. While the fan is proven on, every two minutes, the setpoint shall be trimmed by **0.04 in. w.c**. if there are two or fewer zone pressure requests. If there are more than two zone pressure requests, the fan shall respond by increasing the setpoint by **0.06 in. w.c.** A zone pressure request is generated when a VAV damper is greater than 95% open until it drops to 80% open. Provide a binary data enable point for each zone to enable/disable the zone damper in the trip and respond algorithm. All setpoints, timers, and zone pressure request threshold for the static pressure reset shall be adjustable. Tune the reset to prevent cycling instability after the space is occupied. Provide a trend graph to show the relative stability of the static pressure setpoint. The final maximum static pressure setpoint shall be determined by the Balancing Contractor to satisfy the worst case zone at maximum design condition.

Scope of Work

The controls contractor shall add the duct static reset sequence to the Metasys system with the parameters listed below.

Table 4.10 VAV equipment without Duct Static Reset controls

Bldg	Unit	Existing Duct Static SP	New Max SP	New Min SP
Social Services	AHU-1	1.5	1.5	0.5
	AHU-2	0.5	0.5	0.15
Detention Center	AHU-1 to 3	1.9	1.9	0.5
Detention Addition	MZU-1 to 5	N/A	1.5	0.5
35 Woodfin	AHU-1	1	1	0.5
Sheriff	AHU-1	N/A	1.5	0.5
County Admin	RTU-1	N/A	1.5	0.5

Costs and Benefits:

Costs for this ECRM will be incurred for the programming and balancing labor.

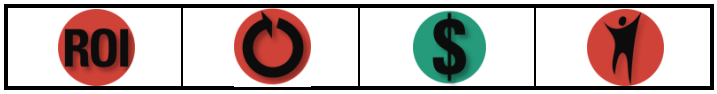
Benefits will be achieved through reduced fan energy consumption. By adding Duct Static Reset control, fan energy consumption will be reduced by modulating the VFD to meet space static pressure needs.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings*
Annual Consumption Savings (kWh)	352,300
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	25,200
Annual Energy Cost Savings ($)	25,100
Available Rebates ($)	-
Simple Payback (yrs)	1.0

*savings and cost exclude work done for Sheriff's Office. See ECM 15

4.2.10 Higher Efficiency Condensing Units



Issues and Observations:

Presently, some of the existing condensing units serving the ground floor of the Courthouse are of low or standard efficiency. During the site visit, a total of 17 condensing units were found to be serving the ground floor. These condensing units were found to be made by various manufacturers, including Carrier, Mitsubishi, Daikin, and more. The average SEER for the 17 condensing units was found to be 9.

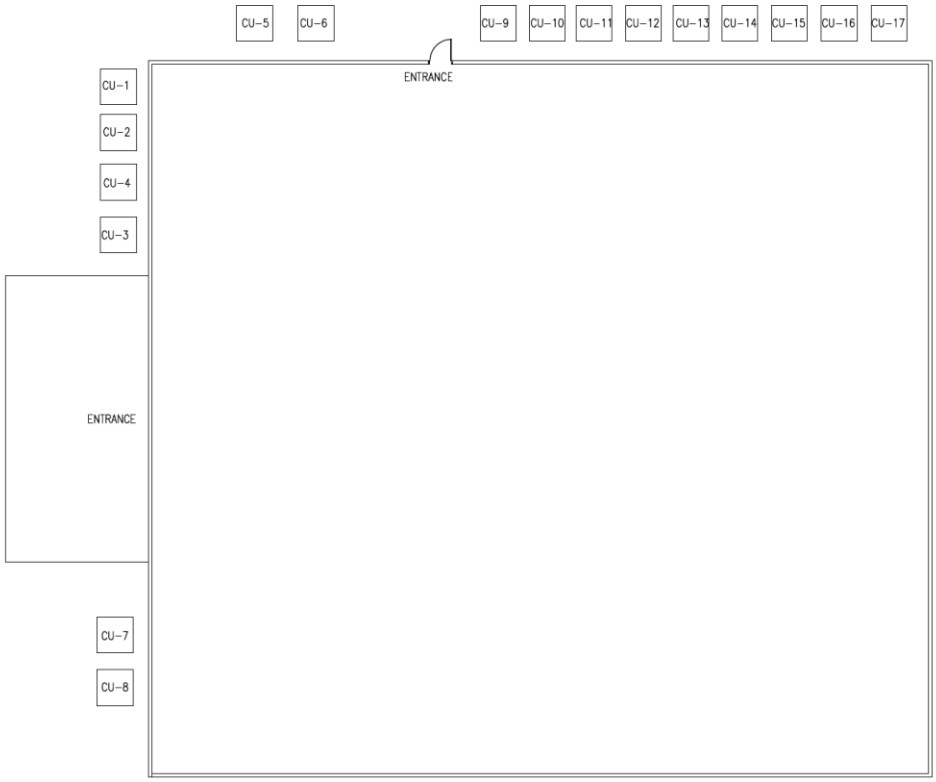
Recommendations:

Shaw recommends replacing the low or standard efficiency condensing units with high efficiency condensing units. It is recommended to replace eight (8) out of the 17 units and associated evaporator with high efficiency 18 SEER units.

Table 4.11 Courthouse CU List

Bldg	Unit	Tons	Included	Manuf	Model	SEER
Courthouse	CU-1	2	Yes	Goodman	CX-24-1B	9
	CU-2	5	No	Carrier	38CK060	10
	CU-3	2	Yes	Unknown		9
	CU-4	5	No	Carrier	38CK060	10
	CU-5	5	Yes	Unknown		9
	CU-6	-	No	Daiken	RXS09	
	CU-7	1.43	Yes	Payne	PA10JA018-C	10
	CU-8	2	Yes	Carrier	38CKC024340	9
	CU-9	2	Yes	Payne	PH10JA024-A	10
	CU-10	2	No	Mit. Mr Slim	PUYA24	17
	CU-11	2	No	Mit. Mr Slim	PUYA24	17
	CU-12	2	No	Mit. Mr Slim	PUYA24	17
	CU-13	2.5	No	Mit. Mr Slim	PUYA30	15.5
	CU-14	2.5	No	Mit. Mr Slim	PUYA30	15.5
	CU-15	2.5	No	Mit. Mr Slim	PUYA30	15.5
	CU-16	6	Yes	GE	TA072L3B	10
	CU-17	7.5	Yes	GE	TA090C3A	10

Figure 1: Courthouse CU Locations



Costs and Benefits:

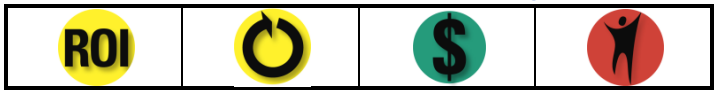
Costs for this ECRM will be incurred for the material and labor necessary to replace the eight (8) condensing units and associated evaporators. Material costs will include the eight (8) high efficiency 18 SEER units. Labor costs will be for the installation of said units.

Benefits will be achieved through reduced energy consumption for cooling. By replacing low and standard efficiency condensing units with high efficiency units, less electricity demand and consumption will be needed to provide the same level of cooling.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	34,100
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	103,500
Annual Energy Cost Savings ($)	2,600
Available Rebates ($)	1,800
Simple Payback (yrs)	39.1

4.2.11 Add Variable Frequency Drives (VFD's)



Issues and Observations:

Currently, the cooling towers at the Detention Center and the air handling units at the Sheriff's Office do not have VFD's. The Detention Center has a two-cell cooling tower with motors that have two stages. The Sheriff's Office has five (5) air handling units each of which supplies a VAV system. The existing control for these air handling units is the outlet damper.

Recommendations:

Shaw recommends installing and interlocking VFD's to the equipment described above. At the Detention Center, it is recommended to interlock the VFD's to the cooling tower motors in order to stage them to maximize chiller efficiency.

Scope of Work: Detention Center

- Provide new VFD's to interlock with existing 10HP cooling tower fan motors
- Place new VFD's in main mechanical room located underneath cooling towers
- Provide new power connections and mounting
- Penetration through roof shall be sealed weather tight
- Interlock to Metasys

Scope of Work: Sheriff Office

- Provide new VFD's to interlock with existing AHU's
- Place new VFD's in same room as AHU's
- Provide new power connections and mounting
- Disable outlet damper
- Provide new static pressure sensor for control of VFD
- Interlock to Metasys

Table 4.12 Motors for VFD

Bldg	Unit	HP
Detention Ctr	CT-1	10
	CT-2	10
Sheriff	AHU-1	3
	AHU-2	5
	AHU-3	3
	AHU-4	5
	AHU-5	5

Costs and Benefits:

Costs for this ECRM will be incurred for the material and labor of installing and interlocking each VFD. A total of seven (7) VFD's will be purchased, installed, and interlocked. Two VFD's will be installed at the Detention Center cooling tower and five VFD's will be installed at the Sheriff's Office, one on each AHU fan motor.

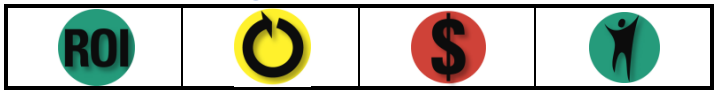
Benefits will be achieved by interlocking the VFD's to stage the Detention Center cooling tower and to modulate the AHU fans. This will reduce the energy used by the motors.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings*
Annual Consumption Savings (kWh)	11,700
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	12,300
Annual Energy Cost Savings ($)	800
Available Rebates ($)	2,200
Simple Payback (yrs)	12.6

*savings and cost exclude work done for Sheriff's Office. See ECM 15

4.2.12 Vending Machine Controls – Miser



Issues and Observations:

Vending machines, both snack and cold drink vending, were found in 7 out of the 10 Buncombe County buildings. These vending machines were generally located in employee breakrooms or kitchens to provide quick snacks or chilled refreshments. Presently, there are no vending machine controls on this equipment. The machines currently operate continuously, including during unoccupied periods. An inventory of the number of vending machines by type and building is shown below in Table 4.13.

Table 4.13 Vending Machine Inventory

Building	Type of Machine	Number of Machines
35 Woodfin	Cold Drink Machine	2
Social Services	Cold Drink Machine	1
County Administration	Cold Drink Machine	1
Detention Addition	Cold Drink Machine	2
Interchange	Cold Drink Machine	1
Sheriff's Office	Cold Drink Machine	1

Recommendations:

Shaw recommends installing vending machine controls on each cold drink machine. A vending machine controller utilizes a custom passive infrared sensor that powers down the vending machine when the surrounding area is unoccupied. The machine automatically repowers when the area is reoccupied. The occupancy sensor can have an intelligent controller that uses fuzzy logic to learn from the habits of the building occupants, and modifies the time-out period accordingly. Due to limited savings, it is not recommended to install vending misers on snack vending machines.

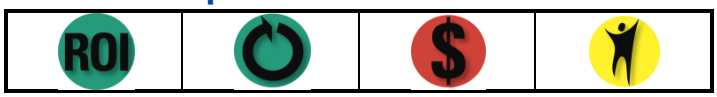
Costs and Benefits:

Energy savings are realized through reduced compressor and lighting usage. The snack machines will have savings from reduced lighting usage while the cold drink machines will have savings from reduced compressor and lighting usage. Savings and costs were calculated using data from a national manufacturer of vending machine occupancy control devices.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	16,400
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	2,000
Annual Energy Cost Savings ($)	1,200
Available Rebates ($)	-
Simple Payback (yrs)	1.7

4.2.13 Computer Controls



Issues and Observations:

Within IT, the largest energy consumer is personal computers. The average existing PC with monitor consumes 588 kWh per year. PCs are voracious consumers of electricity, and their energy use is increasing as faster processors, more memory, and more power-hungry peripherals become commonplace. According to the Department of Energy and Lawrence Berkeley National Laboratories, the average PC can waste up to 400 kilowatt-hours of electricity a year simply by running at full power when no user is present.

Recommendations:

Shaw recommends to installing Verdiem Surveyor computer controls package to all Buncombe County computers. Surveyor measures, manages, and minimizes the energy consumed by the network's PC clients through one centralized interface. It adds new options to the Energy Star settings in your PCs, making this functionality more accessible and dynamic and allowing you to easily implement network-wide best practices that balance user productivity and energy efficiency.

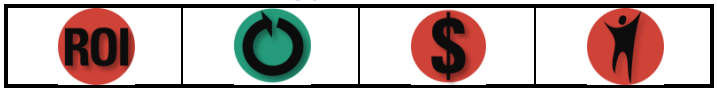
Costs and Benefits:

Surveyor is an easy-to-deploy software utility that addresses network energy waste and reduces operating costs without impacting PC users. Surveyor measures, manages, and minimizes the energy consumed by the network's PC clients through one centralized interface. It provides IT departments with a powerful approach to automate energy-efficient "best practices" throughout their networks, while it adds new control and flexibility to traditional PC power management. This ECM was priced based on 1900 desktops and 77 laptops.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	226,400
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	47,200
Annual Energy Cost Savings ($)	17,400
Available Rebates ($)	-
Simple Payback (yrs)	2.7

4.2.14 Add Energy Efficient Transformers



Issues and Observations:

During the site visit it was observed that each Buncombe County building had numerous aged low voltage transformers throughout the buildings that may be inefficient and near the end of their respective life cycles. Many older and even some new transformers are inefficient. Most of the transformers are dry-type indoor transformers that step-down 480 volt power to 208Y/120 volt power.

Recommendations:

Shaw recommends replacing these small indoor transformers with new, efficient Powersmiths transformers to reduce the no-load losses and load losses associated with the current transformers. Shaw recommends installing Powersmiths' E-SAVER model C3L transformers under this ECM.

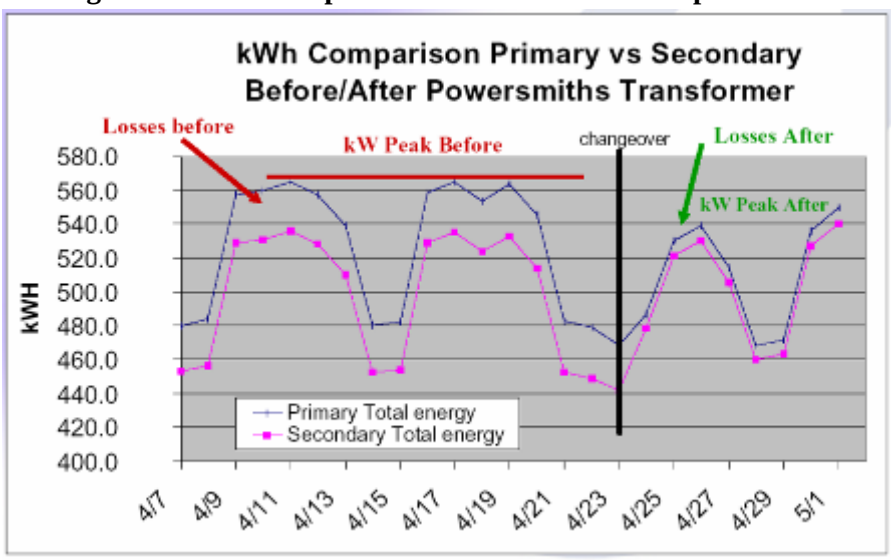
Costs and Benefits:

It is recommended to replace all current transformers that are outside of their effective life spans with newer and more efficient units. Tie-ins to the existing primary and secondary power feeds will be required. Twenty-four (24) transformers are on the list for recommended replacement. Please refer to Table 4.14 below for a list of which transformers are recommended to be replaced.

Table 4.14 List of Transformers for Replacement

#	Building	Location	Designation	Manuf	KVA	Model
1	35 Woodfin	Boiler Rm	TLLLD	Square D	45	EE45T3H
2	35 Woodfin	Boiler Rm		Siemens	75	209.3 series
3	35 Woodfin	Boiler Rm		Square D	45	45T3H
4	35 Woodfin	2nd Floor	T1	Square D	45	EE45T3H
5	35 Woodfin	2nd Floor	T2	Square D	45	EE45T3H
6	35 Woodfin	3rd Floor		Square D	45	EE45T3H
7	Courthouse	Basement	TOSLB	Square D	75	EE75T3H
8	Courthouse	Basement	TNRLBA	Square D	75	EE75T3H
9	Sheriff	Basement		Square D	225	225T3H
10	Animal Shelter	Main Elect	TPP1	Cutler Hammer	150	V48M28F49EE
11	Old Detention	By Kitchen	TX7	Westinghouse	112.5	V48M28T12H
12	Old Detention	By Kitchen	ETX1	Westinghouse	75	V48M28T75J
13	New Detention	Ground	GEX	Cutler Hammer	45	V48M28T45K
14	New Detention	Ground	GNX	Cutler Hammer	45	V48M28T45K
15	New Detention	1st Mezz	1EX	Cutler Hammer	45	V48M28T45K
16	New Detention	1st Mezz	1NX	Cutler Hammer	45	V48M28T45K
17	New Detention	2nd Mezz	2EX	Cutler Hammer	45	V48M28T45K
18	New Detention	2nd Mezz	2NX	Cutler Hammer	45	V48M28T45K
19	New Detention	Roof	3EX	Cutler Hammer	45	V48M28T45K
20	New Detention	Roof	3NX	Cutler Hammer	45	V48M28T45K
21	County Admin	1st Floor	T1	Cutler Hammer	75	V48M28T75EEP1
22	County Admin	2nd Floor	T2	Cutler Hammer	75	V48M28T75EEP2
23	County Admin	3rd Floor	T3	Cutler Hammer	75	V48M28T75EEP3
24	County Admin	4th Floor	T4	Cutler Hammer	75	V48M28T75EEP4

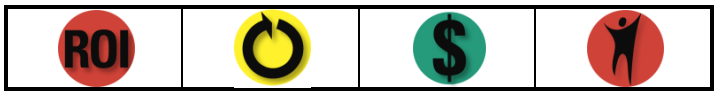
Figure 4.2 kWh Comparison with Transformer Replacement



Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	162,900
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	122,700
Annual Energy Cost Savings ($)	12,000
Available Rebates ($)	-
Simple Payback (yrs)	10.2

4.2.15 Sheriff Office DDC Retrofit



Issues and Observations:

For the Sheriff's office, consists of five AHU's that are VAV systems controlled off an outlet damper. These systems are interlocked to a pneumatic controls system that is currently not functioning. This leads to the AHU's operating 24/7 trying to meet the thermostat setpoint. In addition, since the pneumatic system is not functioning there are no opportunities for economizers, demand control ventilation, and duct static reset.

Recommendations:

Shaw recommends replacing the existing pneumatic system with a new Metasys system. This work would include adding new VFD's to each AHU, providing new thermostats for each VAV box, and optimizing the controls to include DCV, economizer optimization, scheduling / setback and duct static reset. Refer back to previous sections for control and reprogramming sequences.

Scope of Work:

- Complete turnkey DDC controls retrofit with system and floor plan graphics and connected to the county server
- Chiller system integration
- 5 AHU's, include VFD and new motors for AHU supply fan
    - Place new VFD's in same room as AHU's
    - Provide new power connections and mounting
    - Disable outlet damper
    - Provide new static pressure sensor for control of VFD
- 20 VAV box integration
- Install new sequences to include DCV, economizer optimization, scheduling and setback, and duct static reset.

Costs and Benefits:

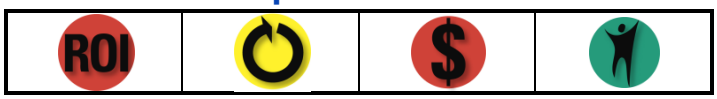
Cost for this ECRM will be incurred for the material and labor of installing a new Metasys system. Cost will also be incurred from new VFD's interlocked to each AHU.

Benefits will be achieved by better control over building heating and cooling systems. This will reduce the heating and cooling energy.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	135,400
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	205,200
Annual Energy Cost Savings ($)	10,300
Available Rebates ($)	2,100
Simple Payback (yrs)	19.7

4.2.16 Filter Replacement



Issues and Observations:

At the Detention Center, AHU-1 uses charcoal filters. These filters have not been replaced since the building was built. It is assumed, based on the age of the filters, that each filter has accumulated enough dust to add an addition 1" of static to AHU-1.

Recommendations:

Shaw recommends replacing the existing dusty charcoal filters with low pressure drop charcoal filters. These replacement filters shall add a maximum of 0.31" of static to AHU-1. It is also recommended to implement a filter maintenance and replacement program every 6 months.

Costs and Benefits:

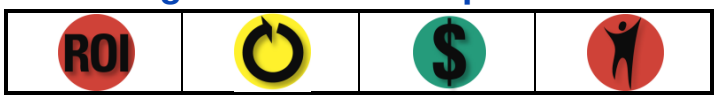
Costs for this ECRM will be incurred for materials for the replacement charcoal filters. Labor will be completed in-house by Buncombe County maintenance staff.

Benefits will be achieved through reduced fan energy consumption. By replacing the existing dirty charcoal filters with low pressure charcoal drop charcoal filters, fans will have to run less to supply adequate air to the building.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	37,800
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	27,300
Annual Energy Cost Savings ($)	2,600
Available Rebates ($)	-
Simple Payback (yrs)	10.5

4.2.17 High SEER RTU Replacement



Issues and Observations:

During the site visit, it was found that four of the five existing RTU's serving the main floor of 911 Center are low or standard efficiency. These existing units are manufactured by Trane and have an average SEER of 12.

Recommendations:

Shaw recommends replacing the low or standard efficiency RTU's with high efficiency RTU's. It is recommended to replace each of the four RTU's with a high efficiency RTU with SEER of 18.

Table 4.15 RTUs for Replacement

Bldg	Unit	Tonnage	Manuf	Model	EER
911	RTU-1	10	Trane	YHC120	11.3
	RTU-2	4	Trane	2YCC3048	11
	RTU-3	4	Trane	2YCC3049	11
	RTU-4	No Work	Trane	4TCC3024	11
	RTU-5	6	Trane	THC072A	11

Costs and Benefits:

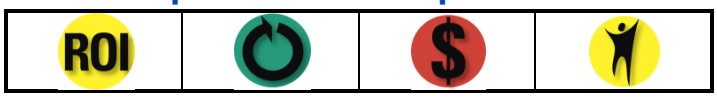
Costs for this ECRM will be incurred for the material and labor required to install the replacement high efficiency RTU's. The material costs will consist mostly of the high efficiency RTU's equipment. Installation of the replacement RTUs will comprise the labor costs associated with this ECRM.

Benefits will be achieved through increased efficiency of the new RTU's. These RTU's will provide the same level of cooling to the building, while requiring less cooling energy input to do so. Savings will come from reduced cooling energy use.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	14,200
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	42,400
Annual Energy Cost Savings ($)	1,000
Available Rebates ($)	1,200
Simple Payback (yrs)	41.2

4.2.18 Replace Chiller Pipe Insulation



Issues and Observations:

At the Interchange building and Detention Center the wrapped insulation on the chilled water supply pipes has deteriorated extensively. The insulation presently installed was found to be a closed cell, fiber-free elastometric thermal insulation at a thickness of about one inch. When newly installed, this insulation has high condensation control and significant capacity to retard heat gain. It was found that a considerable amount of time has passed since the installation of the insulation, which has lead to weather and time related deterioration. Currently, the insulation thickness has been reduced through compaction and some has fallen off, which exposes some surface area of the pipe to outside ambient air. The exposed area of the pipe will experience heat gain from the ambient air, which causes the chiller to run more to overcome the heat gain.

Recommendations:

Shaw recommends removing the existing deteriorated chiller piping insulation and replacing it with rigid phenolic, closed cell wrapped piping insulation covering the entire surface area of the chilled water supply pipes at the Interchange building and Detention Center. This insulation material has a lower thermal conductivity rating, which increases the capacity to retard heat gain. It is also recommended to increase the thickness of the piping insulation to two inches.

Costs and Benefits:

Replacing the insulation on the entire surface area of the chilled water supply pipes will reduce the amount of heat gain from the areas of the pipe currently exposed to ambient air. This will reduce the amount the chiller has to run to overcome this heat gain to maintain the chilled water supply temperature for the entire length of the pipes. Increasing the thickness of the insulation will increase the capacity of the insulation material to retard heat gain. Increased thickness will also hinder the effects of weather and time related deterioration.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	6,700
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	2,600
Annual Energy Cost Savings ($)	500
Available Rebates ($)	-
Simple Payback (yrs)	5.2

4.2.19 High Efficiency Heating Boilers

Issues and Observations:

Presently, the existing boilers in several of the Buncombe County buildings are standard to high efficiency natural gas boilers. These existing boilers have efficiencies ranging from 80% to 88%.

At the Courthouse and the Detention Center, the existing steam boilers are also standard efficiency. The burner in each of the boilers used in these buildings was found to be fairly inefficient. These boilers do not make use of stack economizers nor O_2 trim. In addition, it was found that steam produced by these boilers is used to preheat the domestic water make-up in both of these buildings.

Recommendations:

Shaw recommends replacing the standard to high efficiency natural gas boilers with ultra-efficient natural gas boilers. Ultra-efficient natural gas boilers can have efficiencies up to 96%.

It is also recommended to make improvements to the existing steam boilers at the Courthouse and the Detention Center. The first improvement will be replacement of the standard efficiency burner in each boiler with a high efficiency burner. A VFD will be installed on each burner to allow staging capabilities for each boiler. The second improvement will be to add a stack economizer to each boiler to preheat the steam boiler make-up with the domestic water make-up. The last improvement will be to add O_2 trim to each boiler to increase the burn efficiency.

Scope of Work: Natural Gas Boilers

- Reuse existing concrete pad
- Provide new stainless steel flue vent and reuse existing vent penetration if possible
- Reconnect to existing gas pipe
- Insulate piping where necessary
- Provide new electrical connections
- Include new condensate neutralization kit.
- Provide Lochinvar Series Condensing Boiler or similar efficiency.
- Boiler To have a minimum of 5:1 turndown ration

Scope of Work: Steam Boilers

Courthouse Scope:

- Remove existing steam boilers
- Reuse existing deaerator and associated piping
- Reuse existing flue
- Reuse existing gas piping and connection
- Provide (2) each Weishaupt model # WM-G-20/2-A-ZM-W-FM-200-VSD-UL-CSD-1-FM-STS-RA complete with project / boiler specific refractory mounting plate (final model # / selection bill of materials and pricing subject to change pending receipt of information on the existing boilers and system)
- Provide project specific high performance burners with variable speed drive and linkage-less fuel / air ratio control all mounted / wired and factory tested complete with pre-piped and wired gas train assembly.
- Lot package to include (2) each GBT / Sellers project specific heat recovery / stack economizer assemblies shipped loose for field installation (final model # / selection bill of materials and pricing subject to change pending receipt of information on the existing boilers and system) complete with anticipated freight / shipping costs to Buncombe, North Carolina and with anticipated startup / commissioning and owner training:

Detention Center Scope

- Remove existing steam boilers
- Reuse existing deaerator and associated piping
- Reuse existing flue
- Reuse existing gas piping and connection
- Provide (2) each Weishaupt model # WM-G-20/2-A-ZM-W-FM-200-VSD-UL-CSD-1-FM-STS-RA complete with project / boiler specific refractory mounting plate (final model # / selection bill of materials and pricing subject to change pending receipt of information on the existing boilers and system)
- Provide project specific high performance burners with variable speed drive and linkage-less fuel / air ratio control all mounted / wired and factory tested complete with pre-piped and wired gas train assembly.
- Lot package to include (2) each GBT / Sellers project specific heat recovery / stack economizer assemblies shipped loose for field installation (final model # / selection bill of materials and pricing subject to change pending receipt of information on the existing boilers and system) complete with anticipated freight / shipping costs to Buncombe, North Carolina and with anticipated startup / commissioning and owner training.

Table 4.16 Boilers for Replacement

BLDG	(E) System	Min Eff
Social Services	NG	96%
Courthouse	Steam	84%
Detention Ctr	Steam	84%

Costs and Benefits:

Costs for this ECRM will be incurred for the material and labor required to replace each natural gas boiler with the ultra-efficiency boiler. Material and labor costs will also be necessary for each improvement made to the steam boilers at the Courthouse and Detention Center.

Benefits will be achieved through the improved efficiency of the ultra-efficient boilers. This significant increase in efficiency will result in less natural gas being consumed at each building. For the steam boilers at the Courthouse and Detention Center, similar benefits will be attained from the improvements recommended above. The high efficiency burners will require less natural gas to fire, leading to reduced natural gas consumption. Staging the burners with the installation of the VFD's will further improve the burners' efficiency. Adding stack economizers will reduce natural gas consumed to preheat the steam boiler make-up. Finally, adding O_2 trim will increase burn efficiency by optimizing the amount of oxygen provided to each burner.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	4,300
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	31,700
Annual Water Savings (CCF)	-
Implementation Cost ($)	716,500
Annual Energy Cost Savings ($)	16,600
Available Rebates ($)	-
Simple Payback (yrs)	43.2

4.2.20 High Efficiency Domestic Water Heater

Issues and Observations:

During the site walk, it was observed that the existing domestic water heaters are standard to high efficiency natural gas domestic water heaters. Currently, the efficiency of these domestic water heaters ranges from 80% to 88%.

At the Animal Shelter, the domestic water system makes use of a side arm application. A side arm application uses a single boiler for both the heating system and the domestic water used in the building. This system uses a heat exchanger to separate the heating side from the domestic water side.

Recommendations:

Shaw recommends replacing the low to standard efficiency natural gas domestic water heaters with ultra-efficient natural gas domestic water heaters. These domestic water heaters have an efficiency ranging from 90% to 96%

Scope of Work

- Reuse existing concrete pad
- Provide new stainless steel flue vent and reuse existing vent penetration if possible
- Reconnect to existing gas pipe
- Insulate piping where necessary
- Provide new electrical connections
- Include new condensate neutralization kit.

Table 4.17 DHW Boilers for Replacement

BLDG	Min Thermal Eff
Social Services	90%
Courthouse	96%
Detention Addition	96%
911	90%

Costs and Benefits:

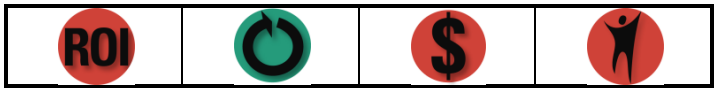
Costs for this ECRM will be incurred for the material associated with the replacement of each domestic water heater. The material costs will come from the replacement ultra-efficient natural gas domestic water heaters. Installation labor will be completed in-house by Buncombe County maintenance staff.

Benefits will be achieved through improved efficiency of the ultra-efficient domestic water heaters. The replacement equipment will require less natural gas to raise the temperature of the water to the desired setpoint. This will reduce the amount of natural gas consumed for domestic hot water.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	-
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	1,800
Annual Water Savings (CCF)	-
Implementation Cost ($)	54,700
Annual Energy Cost Savings ($)	1,400
Available Rebates ($)	-
Simple Payback (yrs)	39.1

4.2.21 Water Conservation (Fixtures/Control)



Issues and Observations:

During our audit we determined that the Detention Center Addition, County Administration, Animal Shelter and 911 Center have existing low consumption fixtures. These have been left out of the proposal because we determined there will not be enough savings to warrant upgrades.

This ECRM includes ways to reduce water/energy consumption and operational expenditures through various water conservation measures. These evaluations included examination of all water-using equipment, measurement and verification of water consumption used by the existing equipment, analysis of the available historical water use, and a breakdown of facility demographics.

Toilets

There are a total of 501 toilet fixtures at the facilities included in the scope of work. Of these, 27 are existing low flow 1.6gpf fixtures. The majority of the fixtures (68%) are found within the Detention Center. Within the Detention Center, there are 305 stainless steel combination toilets with concealed 3.5gpf flush valves operating at 3.0gpf or greater.

Additionally, there are 166 high flow commercial 3.5gpf toilets, 35 of which have sensor actuated flush handles. The Courthouse, 35 Woodfin and Interchange each have one tank type toilet found to be using over 1.6gpf.

Urinals

There are a total of 48 urinals located throughout the men's bathrooms. Fifteen of the urinals are existing 1.0/1.5gpf models and 4 urinals are high consumption, blowout fixtures. The Courthouse has 23 wash down floor outlet models which cannot accept a standard urinal valve. The pictures below are an example of the urinals found at the Courthouse. Lastly, there are 6 existing Pint 0.125gpf urinals in the renovated floors of the Courthouse.

Faucets and Showers

During the audit, a total of 202 lavatory, common, and kitchen style faucets were identified. It is estimated that the lavatory and common area faucets are flowing at 2.4 gallons per minute and the kitchen faucets are flowing at an average rate of 2.1gpm. Thirty one of these sinks have non-threaded, separate hot and cold faucets with an average flow rate of 2.9 gpm which cannot accept flow controls.

There are a total of 6 showerheads between 35 Woodfin and the Sheriff's Department. The showers will be replaced with low flow heads. There are 49 Metcraft institutional shower heads in the old detention center flowing at 2.5 gpm.

Recommendations:

Toilets

Shaw recommends replacing the high flow commercial fixtures with new 1.28gpf American Standard china and 1.28gpf Sloan diaphragm valves. All toilets with sensor actuated flush handles will receive new over handle sensors. For those fixtures in which the vacuum breaker tube is less than 6" above the flood plain, WMI will bring the vacuum breaker up to code height. All ADA compliant fixtures will be replaced with like height units.

The residential style tank toilets will be replaced with 0.8 gpf vacuum-assist gravity style toilets. As pressure tests indicated there was low pressure within several buildings, lower flow pressure assist fixtures are not recommended as these require a minimum of 35 PSI.

Lastly, the 305 stainless steel combination units in the Detention Center will be retrofitted with new ICON electronic valves. These electronic controls will allow the existing fixtures to flush near 1.6 gpf. Not only will the flow rate per flush be reduced, but because of the lockout feature, the number of post project flushes will be reduced by about 20%. It should be noted that WMI has used a conservative 15% in our savings calculations.

Urinals

Shaw recommends replacing all wall mount urinals with new Pint (0. 125 gpf) urinal china and valves. This will reduce the gallons per flush by approximately 90% while ensuring complete washing and evacuation of the urinal china.

Faucets and Showers

Faucets that can accept flow controls will be retrofitted with the following controls matched to the end use: bathroom and common area sinks will be fitted with 0.5gpm flow controls and kitchen faucets will be retrofitted with 1.5gpm aerators. All non-threaded faucets will be replaced with a single Delta self-metering faucet with a mixing valve for tempered water and a 0.5gpm aerator.

The showers in the old detention center are Metcraft Showers; we have had good success retrofitting the institutional showers with High Sierra 1.5 gpm air injected shower heads on showers with blended water. The existing nozzles will be replaced with the High Sierra nozzles. There are 9 standard shower heads that will be replaced.

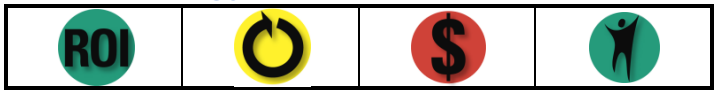
Costs and Benefits:

Reducing water consumption in water fixtures can have triple savings. These savings include 1) Water cost savings 2) Sewage disposal savings and 3) Hot water heating savings (for faucets and showers). A spreadsheet based program was utilized for calculating the savings of this ECM. Hot water usage was assumed to be roughly 50 percent of the total water usage. Assumptions were based upon site observations, interviews with the engineering staff, and general engineering experience.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	4,300
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	2,600
Annual Water Savings (CCF)	5,200
Implementation Cost ($)	410,900
Annual Energy Cost Savings ($)	55,600
Available Rebates ($)	-
Simple Payback (yrs)	7.4

4.2.22 Energy Star Clothes Washer - Residential



Issues and Observations:

The Detention Center features a stacked washer-dryer laundry machine in each cell block on the 4th, 5th, and 6th floors. A total of 6 of these conventional stacked washer-dryer machines were found in the whole Detention Center.

Recommendations:

Shaw recommends replacing each conventional stacked clothes washer-dryer machine with the equivalent Energy Star qualified model. The Energy Star models are more efficient than conventional units with use of electricity, natural gas, and water. More efficient equipment will reduce consumption of all three utilities

Costs and Benefits:

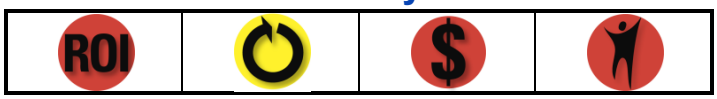
Costs will be incurred for each new Energy Star qualified stacked clothes washer-dryer. Each piece of equipment is more expensive than conventional equipment, but comes with higher efficiency.

Benefits will be achieved through reduced utility consumption by using more efficient Energy Star qualified equipment

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	3,800
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	400
Annual Water Savings (CCF)	200
Implementation Cost ($)	6,000
Annual Energy Cost Savings ($)	2,000
Available Rebates ($)	-
Simple Payback (yrs)	3.0

4.2.23 Commercial Tray Washer



Issues and Observations:

During the site walk, it was observed the Detention Center uses an Insinger tray washer. Many tray and dishwashers use an abundance of water, heat and chemicals. This utility inefficiency can be due to looking at first cost of equipment versus lifetime costs.

Recommendations:

Shaw recommends removing the Insinger Trac 321 tray-washer and replacing it with a Hobart CL54e dishwasher. Hobart's advanced Opti-Rinse technology is the industry's most advanced water- and energy-saving rinse system. Opti-Rinse technology creates a strong and powerful spray by forming an S-shaped pattern across the surface of the ware. The pattern means a saving of more than 50% in water and energy, and even helps you save additional money by reducing the size of the booster heater required.

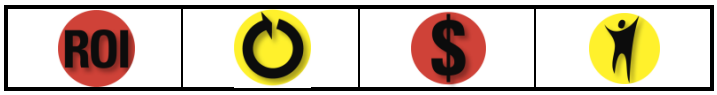
Costs and Benefits:

The efficiency of the washing and the use of racks allows for multiple trays to be washed at the same time. These efficiencies save water, hot water heating, chemicals and time. The costing for this ECRM came from Hobart's install team for removal of the existing unit and installation of the CL54e unit.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	123,900
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	300
Implementation Cost ($)	77,200
Annual Energy Cost Savings ($)	10,900
Available Rebates ($)	-
Simple Payback (yrs)	7.1

4.2.24 Hot Water Reset Control



Issues and Observations:

Presently, the existing boilers at each building do not feature Hot Water Reset control. Through observation of the BAS system, it was determined that existing boilers provide 180 degree water during the heating season. With the mild climate of Asheville, providing 180 degree supply water is not always necessary. Providing 180 degree supply water leads to a delta T varying from 20 to 30 degrees.

Recommendations:

Shaw recommends adding Hot Water Reset control to each boiler in all of the buildings. Hot Water Reset control will tell each boiler to reduce the supply water temperature to 150 degrees when the outside temperature is 55 degrees and above. It is recommended to add Hot Water Reset control after installation of the ultra-efficient boilers to further improve the efficiency if the replacement boilers.

Scope of Work

- Controls contractor to provide HWS and HWR temperature sensors
- Interlock hot water reset in existing Metasys controls

Table 4.18 Boiler Reset List

Bldg	OA Reset	HWST
Social Services Bldg	55° and Above	150
County Admin	55° and Above	150
Detention Addition	55° and Above	150
35 Woodfin	55° and Above	150
Animal Shelter	55° and Above	150
911	55° and Above	150

Costs and Benefits:

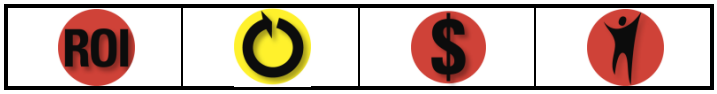
Costs for this ECRM have Buncombe County maintenance staff implementing the Hot Water Reset control through the BAS with assistance from JCI.

Benefits will be achieved by reducing the delta T value when the outside temperature commands less heating necessary for the buildings. A lower delta T value leads to better burn efficiency on the boilers, which will reduce natural gas consumption.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	-
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	3,600
Annual Water Savings (CCF)	-
Implementation Cost ($)	32,100
Annual Energy Cost Savings ($)	2,900
Available Rebates ($)	-
Simple Payback (yrs)	11.4

4.2.25 Convert Chilled and Heating Water System to Variable and Add Differential Reset



Issues and Observations:

The existing chilled and hot water system at the Social Services, Courthouse, Detention Center, Sheriff Office, and County Admin buildings are all constant volume. The pumps serving the chilled and heating water system in each of these buildings are constant volume and are both bypassed. This leads these pumps to maintain a static setpoint throughout each system. This setpoint does not adjust to building load requirements

The existing heating water system at the Detention Addition, 35 Woodfin, and Animal Shelter buildings have a variable pumping system in place , however these buildings do not implement Differential Pumping controls. The heating water pumping system is set to maintain a differential static setpoint.

Recommendations:

Shaw recommends adding VFD's and interlocking them to the chilled and heating water pumps at the Social Services, Courthouse, Detention Center, Sheriff Office, and County Admin buildings. This will convert both chilled and heating water systems at each of these buildings from constant volume to variable volume. It is also recommended to add differential pressure controls to all 8 buildings described above. These controls will have the maximum differential pressure in the chilled water set to the existing setpoint. The minimum differential pressure will be reduced to 15% of the existing setpoint.

Scope of Work

- Contractor to verify that minimum pumping for boilers/chillers are met.
- Replace all existing 3-way valves to 2-way valves for both heating a cooling hydronic systems
- See mechanical drawings for count of existing 2-way valves
- Provide new power to all new 2-way valves.
- Provide new VFD and all electrical necessary to interlock to existing heating and cooling pumps.
- Exclude all condenser water pumps from scope of work.
- Convert to Primary/Secondary system if necessary.
- Interlock new valves and VFD to Metasys

Table 4.19 Variable System Upgrade List

BLDG	HTG to be Retrofitted	CLG Sys To Be Retrofitted	DP Setback Heating	DP Setback Cooling
Social Services	X	X	X	X
Courthouse		X		X
Detention Center		X		X
Detention Addition			X	X
35 Woodfin			X	X

Sheriff Office		X		X
County Admin	X		X	
Animal Shelter			X	X

Table 4.20 Differential Pressure Reset

Sequence	Description
Differential Pressure Reset	a. The pump VFD speed DP2 setpoint shall be reset between a min and max setpoint (3-10 for example) psi. The initial differential pressure setpoint shall be 3 psig (adj.). If network communication is lost for more than 10 minutes, the setpoint shall be reset to 0.75 x maximum DP2 setpoint and an alarm issued. The maximum DP2 setpoint is the pressure required to provide full pump design flow (taking into account the design diversity of all the connected load) to all control valves simultaneously while providing full design flow to the "hydraulically most remote" load (some coordination between the design engineer, BAS engineer and the TAB is expected). The minimum value is an arbitrarily set number representing a low value that will likely result in pump operation at min speed for optimal energy savings but still high enough to maintain minimal flow after enable until DP has time to reset if required. b. As cooling/heating requests increase, the setpoint shall incrementally respond up by 0.5 psi per request value, limited to 3 psi (adj.) per period (see above for time period), to the maximum reset value. c. With no cooling requests, the setpoint shall incrementally be trimmed down by 0.5 psi (adj.) per period to the minimum reset value.

Costs and Benefits:

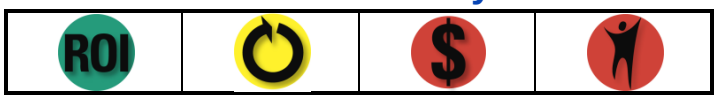
Costs incurred for this ECRM will come from materials costs associated with the VFD's to be installed at the four buildings described above. Labor for installation and controls will be completed in-house by Buncombe County maintenance staff.

Benefits will be achieved through reduced pump energy consumption by modulating the pumps on the chilled water systems and allowing pump differential pressure to reset.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	169,000
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	-
Annual Water Savings (CCF)	-
Implementation Cost ($)	172,200
Annual Energy Cost Savings ($)	12,400
Available Rebates ($)	-
Simple Payback (yrs)	13.9

4.2.26 Fix Solar Thermal System



Issues and Observations:

During the site visit, it was observed that there is a solar thermal domestic hot water system installed at the Social Services building. This system is closed loop glycol system. The system makes use of a south-facing solar array to absorb solar energy into the glycol/water mix. This heated mixture is circulated through the solar array by a low-energy pump and distributed to 9 hot water storage tanks. When hot water is needed, the solar-heated water in the storage tank pre-feeds the primary water heating system. When pre-fed with the solar hot water, the water heater is not activated, or activated for less time than without the solar thermal system. Through staff interviews, it was determined that this system has not worked since it was installed.

Recommendations:

Shaw recommends hiring a solar thermal contractor to come on site to the Social Services building to service the existing solar thermal domestic hot water system. It is recommended to have the contractor bleed out the air in the system that has infiltrated since the system was installed. The contractor shall verify the size of the circulation pump serving the system to ensure it is adequately sized. The contractor shall also check the solar array for holes through which air has been entering the system. These holes will need to be fixed, either by patching or replacement of the component in the solar array.

Costs and Benefits:

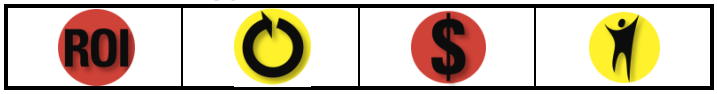
Costs for this ECRM will be incurred for the hiring of the solar thermal contractor to service the solar thermal system. Additional material and labor costs may also come from repairs to the system, or for a new circulation pump as recommended by the contractor.

Benefits will be achieved through returning the solar thermal domestic hot water system to full functioning status. This will allow the domestic hot water to be heated by free solar energy. Natural gas consumption previously used to heat the domestic hot water will thereby be reduced.

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	-
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	500
Annual Water Savings (CCF)	-
Implementation Cost ($)	1,000
Annual Energy Cost Savings ($)	500
Available Rebates ($)	-
Simple Payback (yrs)	2.0

4.2.27 Energy Star Clothes Washers - Commercial



Issues and Observations:

The Detention Center features commercial laundry room on the first floor. This laundry room holds three (3) commercial sized laundry machines used for washing linens. It was determined that these are all conventional commercial clothes washers

Recommendations:

Shaw recommends replacing each conventional commercial clothes washer machine with the equivalent Energy Star qualified model. The Energy Star models are more efficient than conventional units with use of electricity, natural gas, and water. More efficient equipment will reduce consumption of all three utilities

Costs and Benefits:

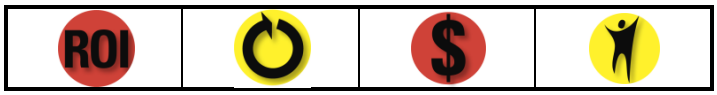
Costs will be incurred for each new Energy Star qualified commercial clothes washer machine. Each piece of equipment is more expensive than conventional equipment, but comes with higher efficiency.

Benefits will be achieved through reduced utility consumption by using more efficient Energy Star qualified equipment

Energy and Economics Summary

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	2,500
Demand Reduction (kW)	-
Annual Natural Gas Savings (Therms)	300
Annual Water Savings (CCF)	200
Implementation Cost ($)	45,000
Annual Energy Cost Savings ($)	1,300
Available Rebates ($)	-
Simple Payback (yrs)	34.6

4.2.28 Solar PV



Issues and Observations:

During the site visit it was observed 35 Woodfin has a large rooftop area where a solar PV system can be installed. Through interviews it was also determined that Buncombe County has land located near the city that is ideal for a Solar PV system.

Recommendations:

Shaw recommends installing an 850 KW rated Solar PV system on North East corner of the building. The system itself will be roof mounted and tilted for maximum efficiency. This will also include all the necessary equipment such as inverters, meters, and conduit. At the acre site, Shaw recommends installing a 4,000 KW rated Solar PV system on the land. The intent would be to have this PV system tied back into the power grid and the extra KW produced would be sold back to the local utility. This work would include substations housing the converters and the transmission lines connecting back to the utility.

Costs and Benefits:

Costs will be incurred for the installation of the Solar PV system, mounting system, inverters, transmission lines, and substations. Benefits will be achieved through the production of KW throughout the year to offset energy used by the county.

Energy and Economics Summary 35 Woodfin

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	109,794
Demand Reduction (kW)	
Annual Natural Gas Savings (Therms)	
Annual Water Savings (CCF)	
Implementation Cost ($)	4,845,000
Annual Energy Cost Savings ($)	8,600
Available Rebates ($)	
Simple Payback (yrs)	563.4

Energy and Economics Summary Acre Site

Estimated Cost and Savings Description	Savings
Annual Consumption Savings (kWh)	1,033,360
Demand Reduction (kW)	
Annual Natural Gas Savings (Therms)	
Annual Water Savings (CCF)	
Implementation Cost ($)	32,000,000
Annual Energy Cost Savings ($)	87,800
Available Rebates ($)	
Simple Payback (yrs)	364.5

5.0 Measures Considered But Not Recommended (MCBNR)

5.1 Overview of MCBNR

In addition to the ECMs recommended above, some measures were considered but, upon further analysis, not recommended for a variety of reasons. These measures will be described in this section.

5.1.1 LED Exit Signs

Issues and Observations:

During the site visit, it was observed that most of the Buncombe County buildings already use LED exit signs, with the exclusion of the Interchange and Sheriff's buildings. Due to the size of these two buildings and the number of existing exit signs, savings from this measure would be minimal. It is not recommended to immediately retrofit the exit signs to LED lamps, but to do so as existing fixtures or lamps expire.

5.1.2 Add Door

Issues and Observations:

The Social Services building contains some laboratory spaces which feature refrigerators that hold vaccines and other medications for distribution to Buncombe County residents. During the site visit, it was observed that a doorway between two laboratory spaces did not include a door. This allowed free movement of air between the adjacent spaces. The space containing the refrigerators is currently conditioned using Mitsubishi split-system air conditioning. These systems are used to maintain a lower space temperature to reduce operation of the refrigerators holding the vaccines.

The space adjacent to the laboratory is conditioned using the roof top units to maintain a higher temperature for the occupants of the building. It was initially thought that adding a door to separate these adjacent spaces would reduce the flow of differently conditioned air between the spaces. It was thought that this would reduce operation of the split-system air conditioning systems. Through further analysis, it was determined that energy and cost savings for this measure would be minimal. The split-systems already have a high efficiency and the reduction in their use by adding the door would be minimal. The costs associated with installing the door would be significant enough to produce a long ROI. Also, the contaminants that could be added to the air while installing the door could significantly affect the functioning of the refrigerators and could contaminate the vaccines and medications.

5.1.3 Seal Compressed Air Leaks

Issues and Observations:

The HVAC controls system at the Courthouse is currently a pneumatic system. Through staff interviews, it was determined that this system has a significant number of leaks due to the age of the system and the size of the building. These leaks lead the compressor to operate more than necessary to maintain the pneumatic pressure within the system. This leads to unnecessary energy consumption by the leak and back-up compressors.

While savings from reduced compressor operation would be significant, the costs associated with performing and ultrasonic leak detection test to find specific leaks and remedying these leaks would be very large. This would lead to a long ROI for this measure.

5.1.4 Higher Efficiency Chillers

Issues and Observations:

Presently, some of the existing Carrier air-cooled chillers serving the main part of the Courthouse are of low or standard efficiency. The same is true of the Trane air-cooled chiller at 35 Woodfin. The paybacks based on energy alone are over 35 years each. While energy isn't the only factor to replace older equipment, Shaw recommends developing a capital plan to replace one of the Carrier chillers on the Courthouse every few years as they are getting older and use R22 refrigerant.

6.0 Financial Cost Benefit Analysis

6.1 Overview of Financial Cost Benefit Analysis

This section of the IGA report takes the cost and savings from previous sections and develops financial projects of these impacts. The cost of capital of 2.25% was received from Buncombe County's Finance Director. A conservative utility cost escalation of 3% is used. When ECRMs are constructed in future years, the construction costs are assumed to be 6% higher each year. The following sub-sections show a financial performas using differing installation time periods and ECRMs implemented.

6.2 Performa 1- Install Everything at Year 0

6.3 Performa 2- Install Everything Over Ten Years

6.4 Performa 3- Customized Option

6.2 Performa 1- Install Everything at Year 0

Table 6.1 Financial Performa

Cashflow and ROI Statement											
Benefit Drivers	Year										
	0	1	2	3	4	5	6	7	8	9	10
Net Savings (as a result of changes/improvements) Energy Efficiency and Demand Management		$ 250,400	$257,912	$265,649	$273,619	$281,827	$290,282	$298,991	$307,960	$317,199	$326,715
Total Annual Benefits		**$250,400**	**$257,912**	**$265,649**	**$273,619**	**$281,827**	**$290,282**	**$298,991**	**$307,960**	**$317,199**	**$326,715**
Implementation filter		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total Benefits Realized		**$250,400**	**$257,912**	**$265,649**	**$273,619**	**$281,827**	**$290,282**	**$298,991**	**$307,960**	**$317,199**	**$326,715**
Costs	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Ongoing Costs	$2,916,100	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	**$ 2,916,100**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Benefits	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Benefit Flow	($2,916,100)	$250,400	$257,912	$265,649	$273,619	$281,827	$290,282	$298,991	$307,960	$317,199	$326,715
Cumulative Benefit Flow	($2,916,100)	($2,665,700)	($2,407,788)	($2,142,139)	($1,868,520)	($1,586,692)	($1,296,410)	($997,419)	($689,459)	($372,260)	($45,545)
Discounted Benefit Flow	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Discounted Costs	$ 2,916,100	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Discounted Benefits	$0	$244,890	$246,686	$248,496	$250,318	$252,154	$254,004	$255,867	$257,744	$259,634	$261,539
Total Discounted Benefit Flow	($2,916,100)	$244,890	$246,686	$248,496	$250,318	$252,154	$254,004	$255,867	$257,744	$259,634	$261,539
Total Cumulative Discounted Benefit Flow	($2,916,100)	($2,671,210)	($2,424,524)	($2,176,028)	($1,925,710)	($1,673,555)	($1,419,551)	($1,163,684)	($905,940)	($646,306)	($384,767)
ROI Measures											
Cost of Capital	2.25%										
Utility Escalation	3.00%										
Construction Cost Escalation	6.00%										
Net Present Value	**($376,300)**										
Return on Investment		**8%**	**17%**	**25%**	**34%**	**43%**	**51%**	**60%**	**69%**	**78%**	**87%**

6.3 Performa 2- Install Everything Over Ten Years

Table 6.2 Financial Performa

Cashflow and ROI Statement											
Benefit Drivers	Year										
	0	1	2	3	4	5	6	7	8	9	10
Net Savings (as a result of changes/improvements) Energy Efficiency and Demand Management		$25,040	$51,582	$79,695	$109,448	$140,914	$174,169	$209,293	$246,368	$285,479	$326,715
Total Annual Benefits		**$25,040**	**$51,582**	**$79,695**	**$109,448**	**$140,914**	**$174,169**	**$209,293**	**$246,368**	**$285,479**	**$326,715**
Implementation filter		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Total Benefits Realized		**$2,504**	**$10,316**	**$23,908**	**$43,779**	**$70,457**	**$104,502**	**$146,505**	**$197,095**	**$256,931**	**$326,715**
Costs	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Ongoing Costs	$291,610	$309,107	$327,653	$347,312	$368,151	$390,240	$413,654	$438,474	$464,782	$492,669	$0
Total	**$291,610**	**$309,107**	**$327,653**	**$347,312**	**$368,151**	**$390,240**	**$413,654**	**$438,474**	**$464,782**	**$492,669**	**$0**
Benefits	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Benefit Flow	($291,610)	($306,603)	($317,337)	($323,404)	($324,372)	($319,783)	($309,153)	($291,968)	($267,687)	($235,738)	$326,715
Cumulative Benefit Flow	($291,610)	($598,213)	($915,549)	($1,238,953)	($1,563,325)	($1,883,108)	($2,192,261)	($2,484,229)	($2,751,916)	($2,987,654)	($2,660,939)
Discounted Benefit Flow	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Discounted Costs	$291,610	$302,305	$313,392	$324,885	$336,800	$349,152	$361,958	$375,232	$388,994	$403,260	$0
Discounted Benefits	$0	$2,449	$9,867	$22,365	$40,051	$63,039	$91,441	$125,375	$164,956	$210,304	$261,539
Total Discounted Benefit Flow	($291,610)	($299,856)	($303,524)	($302,521)	($296,749)	($286,114)	($270,516)	($249,857)	($224,038)	($192,956)	$261,539
Total Cumulative Discounted Benefit Flow	($291,610)	($591,466)	($894,990)	($1,197,511)	($1,494,260)	($1,780,374)	($2,050,890)	($2,300,748)	($2,524,786)	($2,717,742)	($2,456,203)
ROI Measures											
Cost of Capital	2.25%										
Utility Escalation	3.00%										
Construction Cost Escalation	6.00%										
Net Present Value	**($2,402,155)**										
Return on Investment		**0%**	**1%**	**3%**	**5%**	**7%**	**10%**	**13%**	**17%**	**21%**	**29%**

6.4 Performa 3- Customized Option

Table 6.3 Financial Performa

Cashflow and ROI Statement											
Benefit Drivers	Year										
	0	1	2	3	4	5	6	7	8	9	10
Net Savings (as a result of changes/improvements) Energy Efficiency and Demand Management		$36,400	$71,070	$153,512	$181,283	$195,276	$236,840	$277,617	$296,154	$315,552	$326,715
Total Benefits Realized		**$36,400**	**$71,070**	**$153,512**	**$181,283**	**$195,276**	**$236,840**	**$277,617**	**$296,154**	**$315,552**	**$326,715**
Costs	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Ongoing Costs	$76,000	$47,700	$547,867	$131,965	$71,709	$525,521	$1,489,729	$493,792	$523,420	$76,027	$0
Total	**$76,000**	**$47,700**	**$547,867**	**$131,965**	**$71,709**	**$525,521**	**$1,489,729**	**$493,792**	**$523,420**	**$76,027**	**$0**
Benefits	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Annual Benefit Flow	($76,000)	($11,300)	($476,797)	$21,548	$109,575	($330,245)	($1,252,889)	($216,175)	($227,266)	$239,526	$326,715
Cumulative Benefit Flow	($76,000)	($87,300)	($564,097)	($542,550)	($432,975)	($763,220)	($2,016,109)	($2,232,284)	($2,459,551)	($2,220,025)	($1,893,309)
Discounted Benefit Flow	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Discounted Costs	$76,000	$46,650	$524,021	$123,443	$65,602	$470,190	$1,303,549	$422,572	$438,070	$62,229	$0
Discounted Benefits	$0	$35,599	$67,977	$143,600	$165,846	$174,716	$207,240	$237,576	$247,862	$258,286	$261,539
Total Discounted Benefit Flow	($76,000)	($11,051)	($456,044)	$20,156	$100,244	($295,475)	($1,096,308)	($184,996)	($190,208)	$196,057	$261,539
Total Cumulative Discounted Benefit Flow	($76,000)	($87,051)	($543,096)	($522,940)	($422,696)	($718,170)	($1,814,479)	($1,999,475)	($2,189,683)	($1,993,625)	($1,732,087)
ROI Measures											
Cost of Capital	2.25%										
Utility Escalation	3.00%										
Construction Cost Escalation	6.00%										
Net Present Value	**($1,693,972)**										
Return on Investment		**29%**	**16%**	**32%**	**49%**	**45%**	**30%**	**34%**	**37%**	**44%**	**51%**
Percent Savings	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Energy Units (Btu)	0.0%	2.2%	1.9%	1.5%	1.1%	2.1%	2.0%	1.7%	2.0%	2.0%	0.0%
Water (CCF)	0.0%	0.0%	0.9%	23.3%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%

Table 6.4 Years ECRMs Installed

						Year to Install									
ECRM	ECRM Name	Annual Savings	Estimated Incentive	Initial Cost	Simple ROI	1	2	3	4	5	6	7	8	9	10
1	Interior Lighting Retrofit	$ 500	$ 1,000	$ 7,500	13.0							1			
2	Exterior Lighting	$ 3,500	$ 4,500	$ 49,600	12.9						1				
3	Delamp Fixtures	$ 3,300	$ 5,500	$ 13,700	2.5		1								
4	Add Occupancy Sensors	$ 9,000	$ 12,500	$ 169,100	17.4						1				
5	DDC Scheduling / Temp setback	$ 19,000	$ -	$ 28,800	1.5	1									
6	Thermostat Addition	$ 20,100	$ -	$ 76,700	3.8			1							
7	Demand Controlled Ventilation	$ 7,600	$ -	$ 56,800	7.5					1					
8	Optimize Economizers	$ 10,300	$ -	$ 33,600	3.3				1						
9	Duct Static Reset	$ 25,100	$ -	$ 25,200	1.0		1								
10	Higher Efficiency Condensing Unit	$ 2,600	$ 1,800	$ 103,500	39.1							1			
11	Variable Frequency Drives (VFDs)	$ 800	$ 4,400	$ 12,300	9.9						1				
12	Vending Miser	$ 1,200	$ -	$ 2,000	1.7		1								
13	Computer Controls	$ 17,400	$ -	$ 47,200	2.7	1									
14	Energy Efficient Transformers	$ 12,000	$ -	$ 122,700	10.2						1				
15	Sheriff Offices DDC Retrofit	$ 10,300	$ -	$ 205,200	19.9							1			
16	Filter Replacement	$ 2,600	$ -	$ 27,300	10.5						1				
17	High SEER RTU Replacement	$ 1,000	$ 1,200	$ 42,400	41.2							1			
18	Replace Chiller Pipe Insulation	$ 500	$ -	$ 2,600	5.2		1								
19	High Efficiency Heating Boilers	$ 16,600	$ -	$ 656,800	39.6								0.5	0.5	
20	High Efficiency Domestic Boilers	$ 1,400	$ -	$ 54,700	39.1							1			
21	Water Conservation (Fixtures/Control)	$ 55,600	$ -	$ 410,900	7.4			1							
22	Energy Star Clothes Washers- Residential	$ 2,000	$ -	$ 6,000	3.0		1								
23	Commercial Tray Washer	$ 10,900	$ -	$ 77,200	7.1				1						
24	Hot Water Reset Control	$ 2,900	$ -	$ 33,100	11.4						1				
25	Convert Chilled & Heating Water Sys to Variable w/ DP Reset	$ 12,400	$ -	$ 640,900	51.7							1			
26	DHW heating system ReCx	$ 500	$ -	$ 1,000	2.0		1								
27	Energy Star Clothes Washers- Commerical	$ 1,300	$ -	$ 45,000	34.6										1
	Totals	**$ 250,400**	**$ 30,900**	**$ 2,951,800**	**11.7**										

7

Appendix

Appendix A – Preventative Maintenance Best Practices

Table 7.1 Preventative Maintenance Schedule

PREVENTATIVE MAINTENANCE SCHEDULE							BUNCOMBE COUNTY							2013
		Q	Quarterly		B	Bi-annualy		A	Annually		M	Monthly		
						** Maintenance staff permitted to stagger as scheduling permits								
Building	Equipment Type	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Filter/Belts
35 Woodfin	Boilers	M	M						A	M	M	M	M	
	Chillers				A									
	AHU's	B			Q			B			Q			
	Pumps	A						B						
	Split Systems	A						B						
	Gas Water Heaters	A												
	Heat Pumps	A												
911 Center	Boiler	M	M						A	M	M	M	M	
	Split Systems	A						B						
	Gas Water Heaters	A												
	Pumps	A						B						
	Fan Coil Units	A						B						
	RTU's	B			Q			B			Q			
	Exhaust Fans	A						B						
	VRS	A						B						
Animal Shelter	Boilers	M	M						A	M	M	M	M	
	Chillers				A									
	ERUs	B			Q			B			Q			
	Pumps	A						B						
	Exhaust Fans	A						B						
County Admin	Boilers	M	M						A	M	M	M	M	
	RTU's	B			Q			B			Q			
	DX AC	A			Q			Q			Q			
	Pumps	A						B						
	Exhaust Fans	A						B						
Courthouse	Boilers	M	M						A	M	M	M	M	
	Chillers				A									
	OAU	B			Q			B			Q			
	Split Systems	A						B						
	AHU	B			Q			B			Q			
	Pumps	A						B						
	Gas Water Heaters	A												
	Air Compressor	A						B						
	VRS	A						B						
Detention Addition	Boilers	M	M						A	M	M	M	M	
	Chillers				A									
	Cooling Tower	B						B						
	AHU's	B			Q			B			Q			
	Pumps	A						B						
	Air Compressors	A						B						
	Exhaust Fans	A						B						
	FCUs	A						B						
	Split Systems	A						B						
	Gas Water Heaters	A												
	DX AC	A			Q			Q			Q			
Detention Center	Boilers	M	M						A	M	M	M	M	
	Chillers				A									
	Cooling Tower	B						B						
	AHUs	B			Q			B			Q			
	MUAs	A			Q			Q			Q			
	Split Systems	A						B						
	Pumps	A						B						
	Exhaust Fans	A						B						
	Walk-in Coolers/Freezers	A			Q			Q			Q			
Interchange	Chiller				A									
	FCUs	A						B						
	Pumps	A						B						
	AHUs	B			Q			B			Q			
	DX AC	A			Q			Q			Q			
	Split Systems	A						B						
Sheriff	Chiller				A									
	AHUs	B			Q			B			Q			
	FCUs	A						B						
	Pumps	A						B						
	Gas Water Heaters	A												
Social Services	Boiler	M	M						A	M	M	M	M	
	Chiller				A									
	AHUs	B			Q			B			Q			
	Split Systems	A						B						
	Pumps	A						B						
	Gas Water Heaters	A												

Buncombe County, NC – Preventative Equipment Maintenance Plan

Preventative Maintenance

Perform Preventative maintenance on the listed equipment in included Annual, Bi-Annual, Quarterly and Monthly running inspections

Running Inspections note:

- Any unit found not running shall be turned on with facilities approval and inspected.
- Any unit running and needs to be turned off for inspection needs facilities approval before turning unit off, to perform inspection.

Equipment List:

- See attached Schedule document

General Notes:

- **Contractor responsible for tracking and logging all refrigerant as needed to maintain proper operation of equipment.**
- **All work to be scheduled in advance through facilities.**

Pumps

Scheduled Maintenance will be performed on a Quarterly basis and will consist of one (1) Annual and one (1) Bi-Annual running inspection.

BI-ANNUAL RUNNING INSPECTIONS

- Identify and Document all findings and recommendations on inspection reports
- Check and tighten all electrical connections
- Log pump condition on arrival
- Check for proper operation of controls via BAS and record the following
    1. Voltage
    2. Amperage
    3. Pressures
    4. Temperatures
- Inspect and clean starter
- Check pump alignment
- Check all seals for leaks
- Clean all strainers
- Check proper operation of all pressure gauges
- Check and log GPM flow rate of pumps, not any differences against design parameters
- Exercise valves

ANNUAL INSPECTION

This includes all items in Bi-Annual run inspections, with the addition of:

- Grease pump and motor bearings

Exhaust Fans

Scheduled Maintenance will be performed on a quarterly basis and will consist of one (1) Annual and one (1) Bi-Annual running inspection.

BI-ANNUAL RUNNING INSPECTIONS

- Identify and Document all findings and recommendations on inspection reports
- Check and tighten all electrical connections
- Clean unit of dust and dirt
- Grease motor and all bearings
- Adjust belt tension and replace as needed

ANNUAL INSPECTION

- Includes all items in Bi-Annual run inspections

Air Handling Units/ Roof Top Units

Perform Preventative maintenance on the listed equipment to include two (2) Bi-Annual and four (4) quarterly running inspections.

QUARTERLY RUNNING INSPECTIONS

- Review manufacturer's instructions
- Identify and Document all findings and recommendations on inspection reports
- Check evaporator coil for leaks
- Check for leaks in piping
- Replace Pre filters
- Drain Pan tabs
- Exercise the valves
- Check fan blades for dust buildup and clean

BI-ANNUAL INSPECTION

This includes all items in quarterly run inspections, with the addition of:

- Check coils for leaks and clean
- Check belts for wear, cracks, and proper tension
- Replace Pre filters and normal filters
- Check all operating and safety controls; calibrate sensors as required
- Clean all dampers and controls
- Test all actuators for proper operation, repair or replace as needed
- Test entire damper for proper sealing when not operational
- Recover, recycle, or reclaim refrigerant as appropriate
- Check fan RPM against design specifications
- Clean interior of unit

Energy Recovery Units

Perform Preventative maintenance on the listed equipment to include two (2) Bi-Annual and four (4) quarterly running inspections.

QUARTERLY RUNNING INSPECTIONS

- Identify and Document all findings and recommendations on inspection reports
- Check evaporator coil for leaks
- Check for leaks in piping
- Replace Pre filters
- Drain Pan tabs
- Exercising the valves

BI-ANNUAL INSPECTION

This includes all items in quarterly run inspections, with the addition of:

- Clean coils
- Clean interior of unit
- Replace Pre filters and normal filters
- Check all operating and safety controls; calibrate sensors as required
- Clean all dampers and controls
- Test all actuators for proper operation, repair or replace as needed
- Test entire damper for proper sealing when not operational
- Check operation of heat wheel
- Check heat wheel belts for cracks and degradation, replace as needed

Outdoor Air Units

Perform Preventative maintenance on the listed equipment to include two (2) Bi-Annual and four (4) quarterly running inspections.

QUARTERLY RUNNING INSPECTIONS

- Identify and Document all findings and recommendations on inspection reports
- Check evaporator coil for leaks
- Check for leaks in piping
- Replace Pre filters
- Drain Pan tabs
- Exercising the valves

BI-ANNUAL INSPECTION

This includes all items in quarterly run inspections, with the addition of:

- Clean coils
- Clean interior of unit
- Replace Pre filters and normal filters
- Check all operating and safety controls; calibrate sensors as required
- Clean all dampers and controls
- Test all actuators for proper operation, repair or replace as needed
- Test entire damper for proper sealing when not operational
- Check operation of heat wheel
- Check heat wheel belts for cracks and degradation, replace as needed

Cooling Towers

Perform Preventative maintenance on the listed equipment to include two (2) Bi-Annual

BI-ANNUAL

- Inspect louvers for correct position and alignment
- Inspect casings for leaks or defects
- Check for loose or rotten boards on wood casings
    - Examine from the interior
- Inspect the exterior distribution system including flange connectors and gaskets, distribution basins, splash guards
- Examine the drain boards for damage and proper drainage
- Check fan decks and supports for decay, missing and broken parts, and gaps
- Inspect the interior distribution system piping for decay, rust, or acid attack
- Inspect mechanical equipment supports and fasteners for evidence of weakness
- Check alignment of gears, motors, and fans
- Inspect fans and air inlet screens and remove any dirt and debris
- Clean gear box and change oil
- Check water distribution, adjust water level and flush out troughs as necessary
- Check all piping, connections, and brackets for looseness
    - Tighten as necessary
- Check nozzles for clogging and proper distribution
- Clean exterior and interior of cooling tower

Air Compressors

Perform Preventative maintenance on the listed equipment to include one (1) Annual and two (2) Bi-Annual running inspections.

BI-ANNUAL RUNNING INSPECTIONS

- Identify and Document all findings and recommendations on inspection reports
- Check and tighten all electrical connections
- Clean unit of dust and dirt
- Grease motor and all bearings
- Adjust belts' tension and replace as needed
- Test automatic drain bleeder
- Test dryer for proper operation

ANNUAL INSPECTION

This includes all items in the Bi-Annual run inspections, with the addition of:

- Change the oil
- Replace dryer filter

Fan Coil Units

Perform Preventative maintenance on the listed equipment to include one (1) Annual and two (2) Bi-Annual running inspections.

BI-ANNUAL RUNNING INSPECTIONS

- Identify and Document all findings and recommendations on inspection reports
- Check evaporator coil
- Check and adjust fan belts and pulleys
- Grease fan and motor bearings
- Check and calibrate operating and safety controls for both cooling and heating
- Check and clean contractors and starters
- Check and tighten all electrical connections on control panels of each unit
- Check operation of heaters
- Check for leaks

ANNUAL INSPECTION

Includes all items in Bi-Annual run inspections, with the addition of:

- Clean evaporator coil and drain pan
- Drain and clean condensate pan
- Lubricate fan shaft bearings and motor bearings
- Straighten coil fins
- Check all operating and safety controls; calibrate sensors as required

Walk-In Cooler/Freezers

Scheduled Maintenance will be performed on a quarterly basis and will consist of one (1) Annual and three (3) running inspections.

QUARTERLY RUNNING INSPECTIONS

- Identify and Document all findings and recommendations on inspection reports
- Check for proper operation and condensate pan heater
- Inspect and clean contactors and starters
- Tighten all electrical connections on control of each unit
- Check refrigeration circuit for leaks in evaporator and condenser coils
- Check and document each circuit while running
    1. Record all temperatures and pressures
    2. Record current draw
    3. Record voltages
    4. Check super heat and sub cooling
- Gauge up and Log all readings
- Check proper operation of evaporator and condenser fans

ANNUAL INSPECTION

This includes all items in quarterly run inspections, with the addition of:

- Inspect and clean both evaporator coils
- Inspect and clean condenser coils
- Oil fan motor bearings
- Check compressor safeties
- Check and calibrate operating and safety controls

DX Air Conditioners

Scheduled Maintenance will be performed on a quarterly basis and will consist of one (1) Annual and three (3) running inspections.

QUARTERLY RUNNING INSPECTIONS

- Identify and Document all findings and recommendations on inspection reports
- Inspect and blow out condenser coils
- Straighten fins on condenser coils
- Inspect and rinse evaporator coils
- Clean all coils
- Inspect fan belts and pulleys
- Grease/oil fan motor bearings
- Inspect and clean contactors and starters
- Tighten all electrical connections on control panels of each unit
- Check and document each circuit while running
    1. Record all temperatures and pressures
    2. Record current draw
    3. Record voltages
    4. Check super heat and sub cooling
- Check for refrigeration leaks on all lines, valves, fittings, coils, etc.
- Replace filters every other quarterly inspection

ANNUAL INSPECTION

- This includes all items in quarterly run inspections

Make Up Air Fans

Scheduled Maintenance will be performed on a quarterly basis and will consist of one (1) Annual and three (3) running inspections.

QUARTERLY RUNNING INSPECTIONS

- Identify and Document all findings and recommendations on inspection reports
- Inspect shaft, motor, and fan bearings and lubricate as needed
- Inspect belts, pulleys and sheaves
- Inspect all operating and safety controls
- Check operation of unit via BAS system
- Check and tighten all electrical connections for motor, disconnect and starter
- Record voltages and amperages readings for motor

ANNUAL INSPECTION

This includes all items in quarterly run inspections, with the addition of:

- Grease all bearings and clean fan blades

Split- Systems

Perform Preventative maintenance on the listed equipment to include one (1) Annual and two (2) Bi-Annual running inspections.

BI-ANNUAL

- Review manufacturer's instructions
- Inspect and clean interior and exterior of machine
- Clean the drain pan and note excessive corrosion
- Visually inspect refrigerant piping
- Inspect refrigerant piping insulation
- Change out filters
- Check evaporator coil for leaks
- Check compressor functionality and staging

ANNUAL

Includes all items in Bi-Annual run inspections, with the addition of:

- Check refrigerant levels and pressure test
- Check proper operation of compressor fan

Variable Refrigerant Systems

Perform Preventative maintenance on the listed equipment to include one (1) Annual and two (2) Bi-Annual running inspections.

BI-ANNUAL

- Visually inspect refrigerant piping
- Inspect refrigerant piping insulation
- Change out filters
- Check evaporator coil for leaks
- Check compressor functionality and staging

ANNUAL

Includes all items in Bi-Annual run inspections, with the addition of:

- Check refrigerant levels and pressure test
- Check proper operation of compressor fan

Gas Water Heaters

Perform Preventative maintenance on the listed equipment to include one (1) Annual inspection.

ANNUAL

- Verify domestic hot water supply temperature
- Drain water storage tank
- Check igniter and burner operation
- Check for leaks in hot water piping
- Visually inspect hot water piping insulation
- Visually inspect exhaust ventilation and ducting

Heat Pumps

Perform Preventative maintenance on the listed equipment to include one (1) Annual inspection.

ANNUAL

- Inspect piping for leaks
- Inspect wiring for deterioration
- Check mounting bolts for tightness
- Check crankcase heater
- Check fan for vibration or excessive noise
    - Lubricate fan and motor as needed
- Check refrigerant levels
    - Check for leaks of refrigerant loss is detected
- Check temperature drop across condensing coil
- Clean air intake and screens
    - Change filters as necessary
- Clean coil surfaces
- Check that reversing valve is energized in the “heat” mode and de-energized in the “cool” mode
- Check valves and replaces as needed

Chillers

Perform Preventative maintenance on the listed equipment to include one (1) Annual inspection.

ANNUAL

- Test operating temperature controls
- If multiple chillers are present, verify sequencing
- Check chilled water reset settings and function
- Check chiller lockout setpoint
- Check pressure drop across evaporator and condenser coils
    - If exceeds manufacturer's recommendation, clean coils
- Verify motor amperage load limit
- Conduct vibration analysis to check all alignments to specifications
- Check all seals and lubricate where necessary
- Check compressor oil level and cleanliness
    - Replace as needed
- Check all electrical connections and terminals for full contact and tightness
- Check and record refrigerant condition
    - Add refrigerant as needed
- Check condenser and evaporator coils for corrosion
- Check fan blades for dust and debris and clean as needed
- Clean exterior of chiller

Boilers

Perform Preventative maintenance on the listed equipment to include one twelve (6) Monthly inspections during operating season and (1) Annual inspection.

MONTHLY

- Test operating temperature controls to check burner operation
- Test the low water level cut-out
- Test low gas pressure switch
- Check condensate drain system
    - Clean and flush as necessary

ANNUAL

Includes all items in Bi-Annual run inspections, with the addition of:

- Clean burner of any dust or debris accumulated
- Inspect burner for signs of deterioration or corrosion
    - Replace as needed
- Check pH level of system fluid
- Check condensate system for leaks
- Clean condensate system
- Clean inlet screen of dust or debris accumulated
- Inspect and clean heat exchanger
- Replace igniter, flame rod and gaskets as needed
- Drain and flush water side of heat exchanger
- Check exhaust venting system
    - Check all joints and duct connections for tightness
    - Check pipes for corrosion or deterioration, replace as needed
    - Inspect and clean screens in the vent terminal
- Perform combustion analysis and readjust as necessary
- Perform a leak test of gas valves
- Test pressure safety relief valve

Appendix B – EMS Trends

Figure 7.1 35 Woodfin AHU-1 DAT & MAT vs. OAT

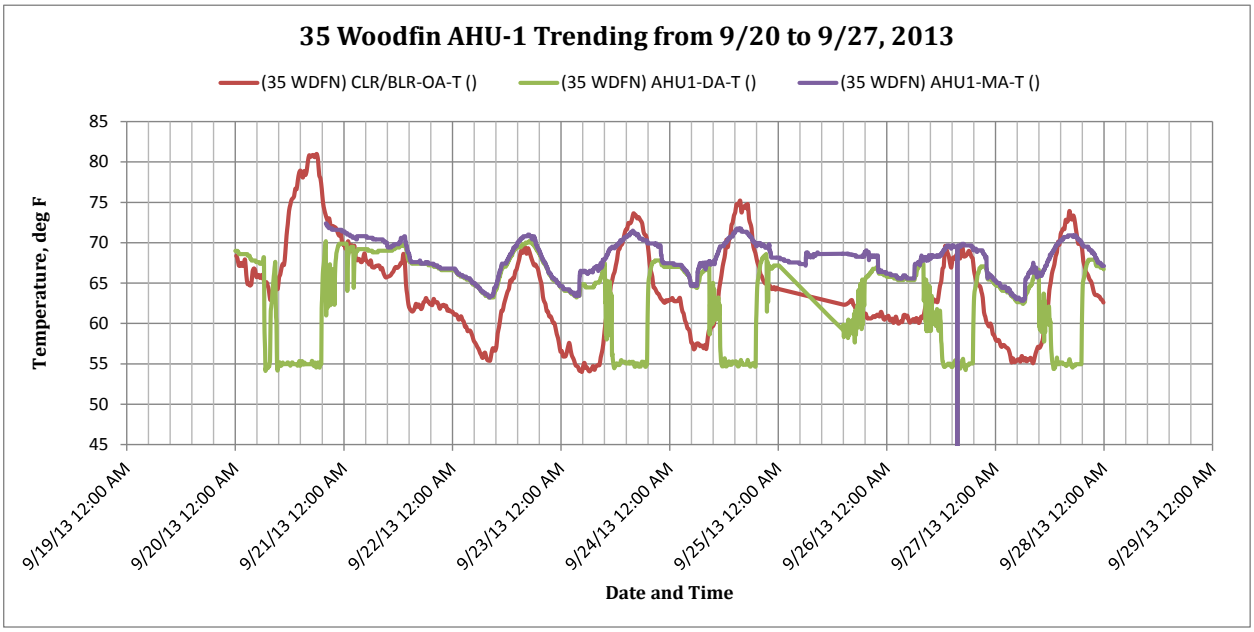


Figure 7.2 Detention Addition Room Temperatures

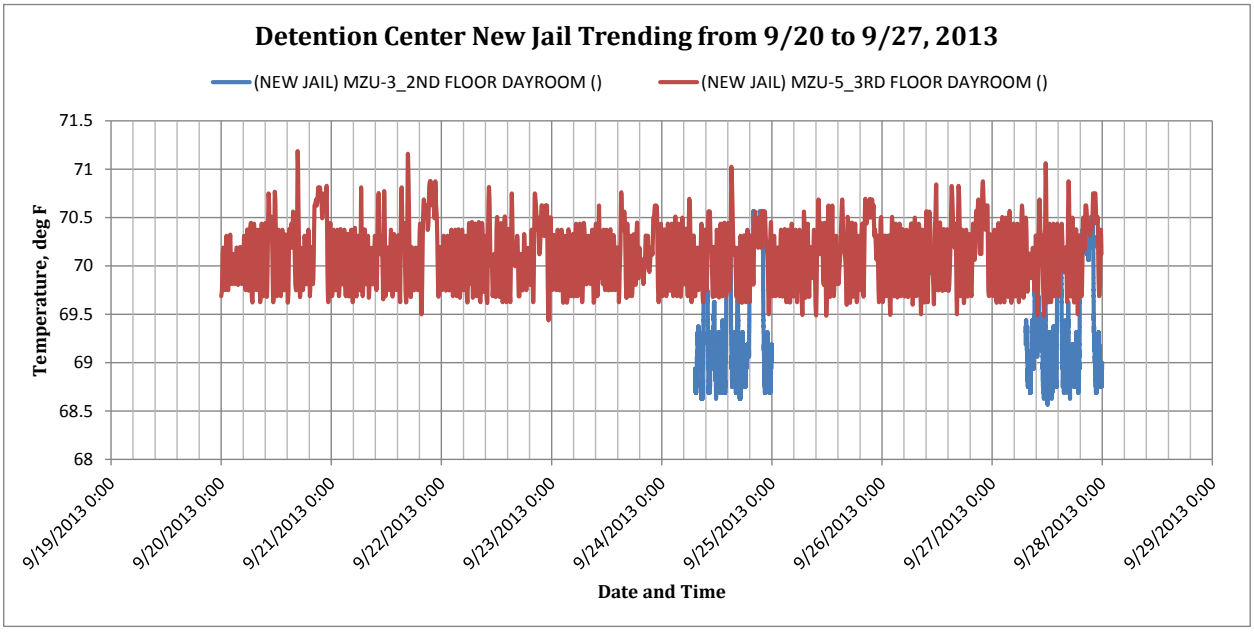


Figure 7.3 Detention Center Trending