

# City of Gillette

## Energy Audit & Building Assessment



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## Introduction

This report reviews the initial assessment and actions taken by the City of Gillette to identify potential energy conservation initiatives. The goal of the assessment was to prioritize potential actions based on total energy savings, return on investment, ease of implementation, and ability to monitor and track any realized efficiencies. The Sustainability Coordinator for the City of Gillette performed an energy audit of City facilities in October 2009. In addition, a site assessment was conducted January 2010 with the assistance of the City's HVAC service provider, Johnson Controls.

The audit consisted of gathering data identified by the Seattle Climate Partnership Carbon Footprint Calculator. Utility bill analysis was employed to quantify electricity (kWh), natural gas (therms), and water (Tgals) consumption. Data was collected for the period FY 2008-2009 for five (5) municipal building/facility locations.

In addition to compiling energy data for the audit, it was determined that collecting additional data would be beneficial to the overall assessment. Therefore, transportation data (employee commute and City vehicle usage); purchases of key materials, goods and services; waste disposal and recycling data were also collected. All data was then entered into the Carbon Footprint Calculator and a carbon footprint was estimated plus potential actions were identified.

## City Initiatives

The City of Gillette has been proactive in its approach to energy efficiency and resource conservation and as a result a number of projects have already been completed. The list below serves as a catalog of actions taken.

### City-Wide

1. EPlan (ProjectDOX)- all divisions will have capability to review paperless plans

### Administrative Services Department

1. Hired Sustainability Coordinator
2. Pilot project to test 30% post-consumer content paper
3. Member of Wyoming chapter of USGBC

### Building Maintenance Division

1. Replaced Styrofoam plates and cups with paper and recyclable plastic products
2. Integrated "green" cleaning supplies, recycled content paper products and recycled content plastic bags
3. Placed recycling containers throughout City facilities to increase collection of plastic bottles and aluminum cans

4. Office paper collection via desk-side collection containers
5. Light fixtures: as the T-8 Florescent bulbs burn out, they are being replaced with Alto bulbs (more efficient and less mercury)
6. As T12 ballasts burn out, they are being replaced with T8s (more energy efficient)
7. HVAC: each thermostat is equipped with a sensor; if a room is not occupied the temperature moves to a default setting from the manual setting to save energy
8. Motion detectors in conference rooms, rest rooms and other areas in City buildings

#### **Geographic Information Systems Division**

1. Designing routes for solid waste and snow removal vehicles to maximize efficiency and reduce fuel consumption

#### **Information Technology (IT) Division**

1. Recycling cardboard (especially from new equipment)
2. City computers are programmed to shut down at night
3. Cisco color phones will go into sleep mode
4. Printers will go into sleep mode
5. Monitors shut off and so do the new USB speakers
6. Virtual Servers - less energy and less equipment
7. Paper recycling
8. Used print cartridges are returned to manufacturer

#### **Vehicle Maintenance Division**

1. Recycling scrap metal
2. Use of waste oil to heat building

#### **Engineering Department**

1. AutoDesk- paperless review of preliminary plans
2. Electronic code books versus paper

#### **Building Inspection Division**

1. Implemented energy efficiency requirements in July 2009
  - a. Chapter 11- 2006 Edition International Residential Code
  - b. 2006 Edition International Energy Conservation Code (Commercial)

#### **Finance Department**

1. Purchasing software with EECBG grant money to allow for electronic archiving of documents to save paper

## **Utilities Department**

### 1. Green Power

- a) A portion of the City of Gillette's electrical supply portfolio is energy from renewable resources, most notably wind energy generated at the Kimball, Nebraska, wind 'farm'. City utilities may purchase 'green power' in blocks of 100 kWh per month. Purchase of green power is a voluntary way to show support for the environment and to promote the development of renewable energy in conjunction with conventional fuels such as coal and natural gas.
- b) Member of APPA and DEED

## **Electrical Services Division**

1. Provides self-audit forms to citizens to assess energy usage and identify conservation opportunities – free service
2. Equity / Owner in the Kimball Wind Generation facility in Kimball, Nebraska

## **Water Division**

1. Use of Variable Frequency Drives in water pumping system
2. WaterWise partner for water conservation

## **Streets Division**

1. Light Emitting Diode (LED) lighting for all City owned traffic lights
2. LED pedestrian crossing signals
3. LED flashing/warning lights for school zones

## **City of Gillette Carbon Footprint**

Data identified by the Seattle Climate Partnership Carbon Footprint Calculator was collected October 2009 by the City's sustainability coordinator. Utility bill analysis was employed to quantify electricity (kWh), natural gas (therms), and water (Tgals) consumption. Data was collected for the period FY 2008-2009 for five (5) municipal building/facility locations.

City of Gillette Utilities Department supplied electricity and water consumption data. Natural gas consumption was provided by Source Gas. City vehicle usage data was supplied by Fleet Division, Purchasing supplied information regarding major purchases, and Solid Waste Division furnished recycling and trash data.

It was determined that the City of Gillette has an approximate Carbon Footprint of 9,961 metric tons of CO<sub>2</sub>e annually.

# Energy Audit and Assessment Checklist

## Energy Consumption

- Electricity
- Natural Gas

## Lighting

- Lighting Survey
- Occupancy/Motion sensors

## HVAC

- Chiller/Cooling Tower
- Air Handling Units
- Rooftop Units
- Blowers
- Variable Frequency Drive Opportunities

## Motors

- High Efficiency Motors
- Variable Frequency Drive Opportunities

## Air Compressors

- Air Compressor Efficiency
- Heat Recovery Opportunities
- Air Leaks
- Motor Efficiency

## Boilers

- Age
- Life Expectancy
- Efficiency Rating

## Building Automation System

- System Types
- DDC vs. Pneumatic
- VAV
- Control System

## Background

### Facility Description

The City of Gillette has a variety of buildings and structures utilized by a number of departments and divisions throughout the municipality. In an attempt to ease the audit and assessment, only five structures were included in the audit and one structure included in the assessment. Structures included in the audit were: City Hall, City West, Animal Control, Wastewater, and Warehouse. The structure selected for the on-site walk through and assessment was City Hall. The oldest portion of the building is 26 years old (1984) and an addition to the main structure was completed in 2000.

Facility	Square Feet	Number of Employees
City Hall	85,527	181
City West	41,782	129
Animal Control	7,010	7
Wastewater	34,118	11
Warehouse	3,840	2
<b>Total</b>	<b>172,277</b>	<b>330</b>

### Energy Use

The energy audit conducted compiled data for the period Fiscal Year 2008-2009 (July 1, 2008 to June 30, 2009). Electricity consumption data was provided by the City of Gillette's Utility Department and natural gas consumption was provided by Source Gas.

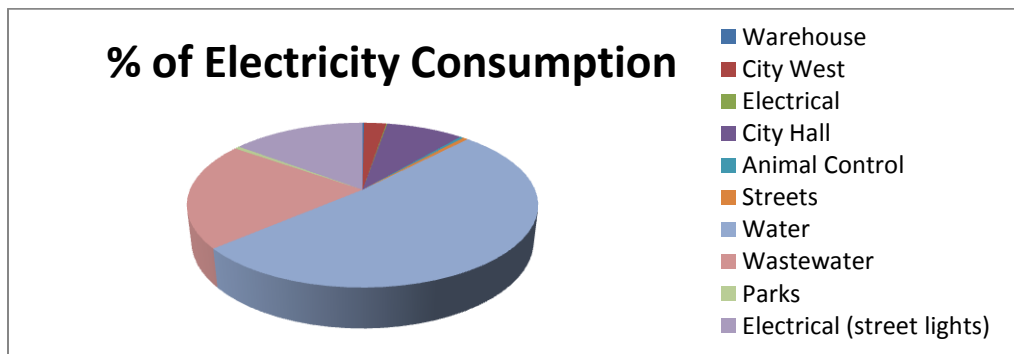
Facility	kWh	Therms
City Hall	1,671,760	60,431
City West	491,096	36,417
Animal Control	73,000	10,503
Wastewater	4,200,000	106,108
Warehouse	33,748	2,590
Streets Division	112,000	
Water Division	10,300,000	
<b>Total</b>	<b>17,041,974</b>	<b>216,049</b>

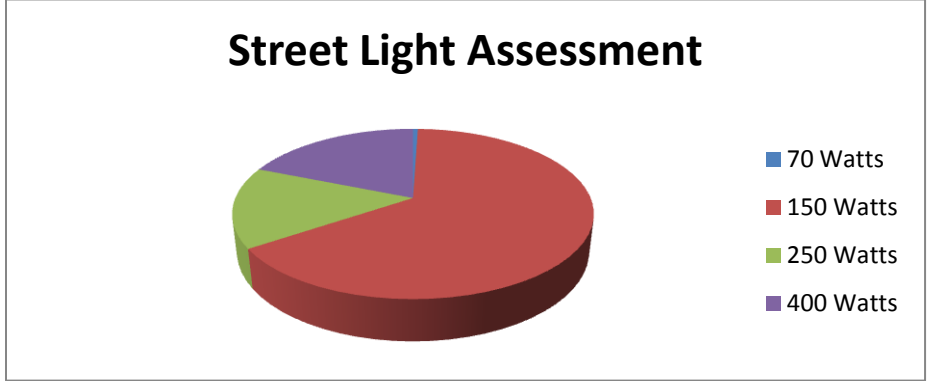
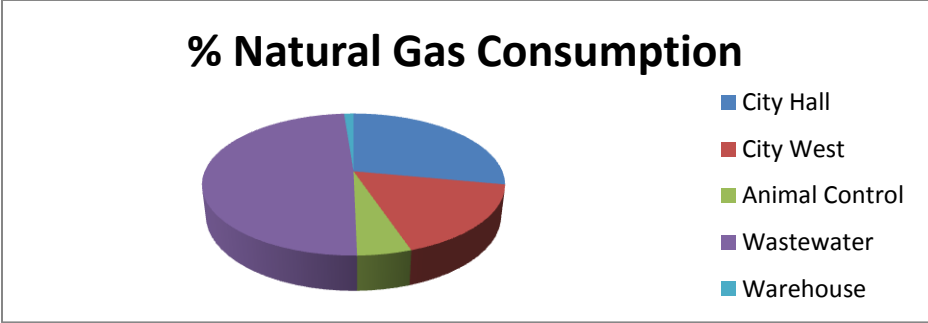
### Facility Assessment

Location	kWh	# City staff/location	kWh per employee	sq ft per location	kWh per sq ft
Warehouse	33,748	2	16,874	3,840	9
City West	491,096	129	3,807	41,782	12
Electrical	20,130				
City Hall	1,700,000	181	9,392	85,527	20
Animal Control	73,000	7	10,429	7,070	10
Streets Division	112,000				
Water Division	10,300,000				
Wastewater	4,200,000	11	381,818	34,118	123
Parks Division	112,000				
Electrical Division	2,935,816				
<b>Total</b>	<b>19,977,790</b>	<b>330</b>			

### Street Light Assessment

Wattage	Quantity	Estimated Usage
70	14	5,096
150	1731	1,350,180
250	411	534,300
400	503	1,046,240
<b>Total Lights/Energy</b>	<b>2659</b>	<b>2,935,816</b>
Current Rate	\$0.0500	
Budget		\$146,790.80





## Energy Efficiency Opportunities

Although energy consumption for street lighting is not the largest consumer of electricity based on the audit, the City of Gillette intends to pursue pilot LED street lighting projects. Current plans include utilizing EECBG grant money received October 2009 to fund Phase I of a pilot project using LED luminaires for three outdoor lighting locations: City Hall, City West, and Wastewater. In addition, the City plans to initiate Phase II of the pilot project to replace HPS street lights along Highway 14-16 with LED luminaires. It is anticipated that approximately 90 lights along the route will be part of the pilot.

This area was selected due to its straight corridor, minimal major intersection count, no major alterations planned for the selected area, and minimal impact on residential communities. Hwy 14-16 is a roadway that roughly runs east/west through the City. Wyoming DOT reports for 2006 a range of 2,300 to 4,400 vehicle daily trips (VDT) in the area impacted by the pilot. The area that will receive the LED luminaires is approximately 16,725 ft or 3.16 miles. Major goals of the project include testing performance of the lighting in Wyoming’s climate and determining quality of light and subsequent public perception.

As mentioned earlier, City Hall has been selected as the focus of HVAC retrofits and early stage efficiency initiatives. Thus, a site assessment was conducted with the assistance of the City’s HVAC service provider, Johnson Controls. A number of potential actions were identified during the



walkthrough and four subsequent meetings. One key element emerged from the meetings, namely to identify immediate actions and begin the long range planning process for future actions.

Listed below is a summary of identified efficiency opportunities:

### Immediate

Install VFD's for cool air/hot air exchange motors and hot water circulating pumps- quantity six (6); cost projections reflect an investment of \$50,000 with an estimated energy savings of 50,000 to 60,000 kWh. Prices and energy saving estimates were supplied by Johnson Controls. The retrofits will pay for themselves in less than 4 years.



Pilot LED Street Light Project- plans are to replace approximately 90 luminaires at a cost of \$75,000 with an estimated energy savings of 47,000 kWh. Prices and energy saving estimates were supplied by Cascade Lighting, an LED vendor and representative of BetaLED and GE. The LED lighting will be installed on Hwy 14-16 in a length of roadway approximately 3.16 miles. Based on 2006 Wyoming DOT traffic data, the roadway experiences 2,300 to 4,400 average vehicle trips (AVT) in the areas that would be affected by the LED retrofit.



### Future

- Upgrades to cooling tower/chiller
- Upgrade Controls
- Change from pneumatic to digital
- Reduce size of motor for air compressor
- Air activator- electric
- EP electric over air- change to digital
- Change VAV from air to digital
- Change air activated motors in GPA to electric

## Action Summary

Listed below are actions identified by the Seattle Climate Partnership Carbon Footprint Calculator. The following table ranks the options from most to least cost-effective, in terms of cost per ton of carbon reduced.

	<b>Emission Reduction (tons)</b>	<b>Cumulative Reduction(tons)</b>	<b>Cost per Ton (\$/ton)</b>
Increase Recycling	0.5	0.5	\$ (279.03)
Retro-commission Systems	8.3	8.8	\$ (161.41)
Continuous Improvements	1021.4	1,030.2	\$ (92.68)
Lighting upgrades - CFLs or LEDs	4.1	1,034.3	\$ (69.90)
Lighting upgrades - T8 Tubes	6.0	1,040.2	\$ (48.41)
Lighting upgrades - Exit Signs	1.3	1,041.5	\$ (29.78)
Optimize Business Travel	170.4	1,211.9	\$ (5.25)
Reduce Office Paper Use	10.2	1,222.1	\$ -
Purchase More-Efficient Vehicle	2.3	1,224.4	\$ 2.26
Switch to Recycled Office Paper	2.5	1,226.9	\$ 44.80
Subsidize Employee Bus Passes	19.5	1,246.4	\$ 295.27
<b>Total of all above reductions:</b>		<b>1,246</b>	<b>tons of CO2</b>
<b>Total reductions available at zero or negative cost:</b>		<b>1,222</b>	<b>tons of CO2</b>
<b>Total reductions available at less than \$10/ton:</b>		<b>1,224</b>	<b>tons of CO2</b>

## Closing Remarks

As the old adage states, “You can’t manage what you can’t measure.” This certainly applies to energy efficiency projects. It is the intension of the City of Gillette to implement initiatives that will improve performance and efficiency of its facilities and infrastructure while providing taxpayers the best return on investment as possible. With that said, however, it is important to note that due to the rapid pace of

evolution of newer technologies such as LED street lighting, a slow methodical and well thought out selection process will be necessary for pilot and demonstration projects.

Fortunately many larger cities and counties have taken leadership roles in an effort to investigate and evaluate new technologies as well as identify and document actions that could benefit a community of any size. As a result, the City of Gillette will track the actions taken by larger communities and determine which projects would be suitable for its long term energy efficiency plans. With that insight and direct experience the City will be well positioned to share data with other communities in Wyoming.

## Equipment List

<b>Mechanical Equipment</b>	<b>QTY</b>	<b>HP</b>	<b>CFM / GPM / BTU PER HR / TONS</b>	<b>Area Served</b>
Air Compressor	1	Duplex 10 hp		All of Building
Air Dryer	1		12 cfm	All of Building
Pneumatic Control System	1			Throughout Building
Boiler	1	30 hp	1.5million	Basement
Boiler	1	50 hp	2.4million	Basement
Screw Chiller	1	150 ton		Basement
Circulating Pump	2	7.5 hp		Basement
Circulating Pump	2	20 hp		Basement
Air Handler	1	25 hp		Basement
Unit Heater	4			Mech. Room
Cabinet Heater	5			Entries
Unit Heater	9			Ceiling Plenum
Cooling Tower	1	10 hp		Marley
Exhaust Fan	7	Fractional		Rooftop
VAV Boxes	96			All of Building
Hot Water Radiation	55			All of Building
Domestic Hot Water Pump	1			Basement
Hot Water Heater	1			Basement
Digital Controller	8	DX-9100		Basement
NCM	1			Basement
Monitor	1			Basement
Modem	1			Basement

Return Fan VFD	1	30 hp	Main AHU
Supply Fan VFD	1	50 hp	Main AHU

## Equipment List

Mechanical Equipment	QTY	HP	CFM / GPM / BTU PER HR / TONS	Area Served
Fan Coil	1	3 ton		Elect. Room
Condensing Unit	1	3 ton		Elect. Room
Transfer Pump	1	40 hp		All of Building
<b>New Addition</b>				
Air Handler 1	1	10 hp		?
Air Handler 2	1	10 hp		?
Air Handler 3	1	15 hp		?
Air Handler 4	1	7.5 hp		?
Air Handler 5	1	7.5 hp		911 Dispatch
Chiller	1	70 ton		All of Building
Condensing Unit	1	12		Dispatch
Humidifier	2			911 Dispatch
Hot Water Pumps	2	15 hp		All of Building
Chilled Water Pumps	2	7.5 hp		All of Building
VAV Boxes	41			