



CITY OF RED LODGE BASELINE ASSESSMENT

October 2017

An Energy Use, Cost & Greenhouse Gas Emissions Inventory of City Government Operations

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Summary

The enclosed report is a baseline comprehensive assessment of energy use, greenhouse gas emissions, and costs generated by City government operations. This assessment is a valuable tool for identifying which aspects of city government hold the greatest potential for cost, energy, and carbon savings, and it establishes a benchmark upon which to evaluate the City's progress toward greater efficiency.

The baseline inventory of 2016 operations determined the following:

- City government energy use resulted in net annual emissions of 1,910 metric tons of carbon dioxide equivalent (mtCO₂e) and cost \$201,227 in total.
- 60% of emissions and energy use are attributed to Buildings & Facilities (Table 2).
- Over half of energy costs come from consumption of energy in Water Treatment (Table 2).

Background

Taking action to reduce the cost of energy used by government operations is a simple, sensible way to benefit local tax-payers, improve the regional quality of life, and protect the global environment. The unchecked use of fossil fuels and electricity are directly linked to greenhouse gas emissions and rising operation costs, both of which undermine a local government's ability to provide for its people. However, strategic actions can easily be taken to reduce emissions and costs. These actions begin with an analysis of government operations, and progress is gauged against an established baseline.

Methods

The first step toward reducing energy expenses and greenhouse gas emissions is to identify baseline levels and sources of emissions, as well as the sectors of government operations that are responsible for the bulk of these emissions. This data is then used to help select reduction goals and develop a plan of action. Greenhouse gas emissions are estimated by applying standardized emission factors to local government records of energy use.

For example, The Carnegie Library spends \$4,301 a year for 23,673 kilowatt-hours (kWh) of electricity. Because the EPA monitors and reports greenhouse gas emissions from power plants, it is known that every kWh of electricity purchased from NorthWestern Energy produces on average 1.6 pounds of greenhouse gases. Through calculations such as this, greenhouse gas emissions were estimated for the City of Red Lodge.

Method Summary

Scope: The scope of analysis includes electricity and natural gas used by City facilities and vehicles that are directly financially controlled by the City government. The EV Charging Station and employee commute were left out due to insufficient data.

Data Sources: Red Lodge’s energy data was gathered in 2016 by the previous Sustainability Coordinator, Katelynn Essig. City buildings, facilities, water treatment, and lighting data were gathered from the City’s utility expense records. The information for the City’s transportation fleet was obtained by analyzing credit card receipts from City vehicles.

Software: All data sources were analyzed using ClearPath, a software system provided by ICLEI, or Local Governments for Sustainability, which tracks emissions of greenhouse gases and reports them in equivalent carbon dioxide emissions (CO₂e). The software’s default calculations, values, and assumptions were used during analysis.

Baseline Year: To set energy and emissions reduction targets, government operations were inventoried for a specific baseline year, calendar year 2016, against which all future reduction measure will be compared.

Findings

The total annual greenhouse gas emissions from the City of Red Lodge operations in 2016 are estimated at 1,910 metric tons of carbon dioxide equivalents (mtCO₂e). That is equivalent to the amount of carbon dioxide sequestered each year by 407 acres of pine tree forest. These emissions, which are the result of energy consumption, cost the City \$201,226.82.

| Total Annual | Value | Units |
|------------------------------|-----------|---------------------|
| Total Energy Consumed | 31,903 | MMBtus |
| Total Operating Costs | \$201,227 | US Dollars |
| Total GHG Emissions Produced | 1,910 | mtCO ₂ e |

Table 1: 2016 City Government Baseline Totals
mtCO₂e: Metric Tons of Carbon Dioxide Equivalents
MMBtus: Million British Thermal Units

Sector Analysis

Total emissions and energy use by the City of Red Lodge government operations are divided into sectors. These are Buildings & Facilities, Streetlights, Transportation Fleet, and Water Treatment. By referencing Figure 1 and Table 2, it is clear that the bulk of the City's energy is consumed by City Buildings & Facilities. Water Treatment, which encompasses wastewater treatment, water treatment, and pumps and pumping stations, also uses a good share of energy. Sector usage reveals a similar breakdown when analyzed by greenhouse gas emissions, with Buildings & Facilities and Water Treatment producing close to 90% of our emissions (Figure 1). However, when it comes to sector costs, the city spends over half of its energy expenses on Water Treatment, and an additional 21% on Streetlights (Table 2).

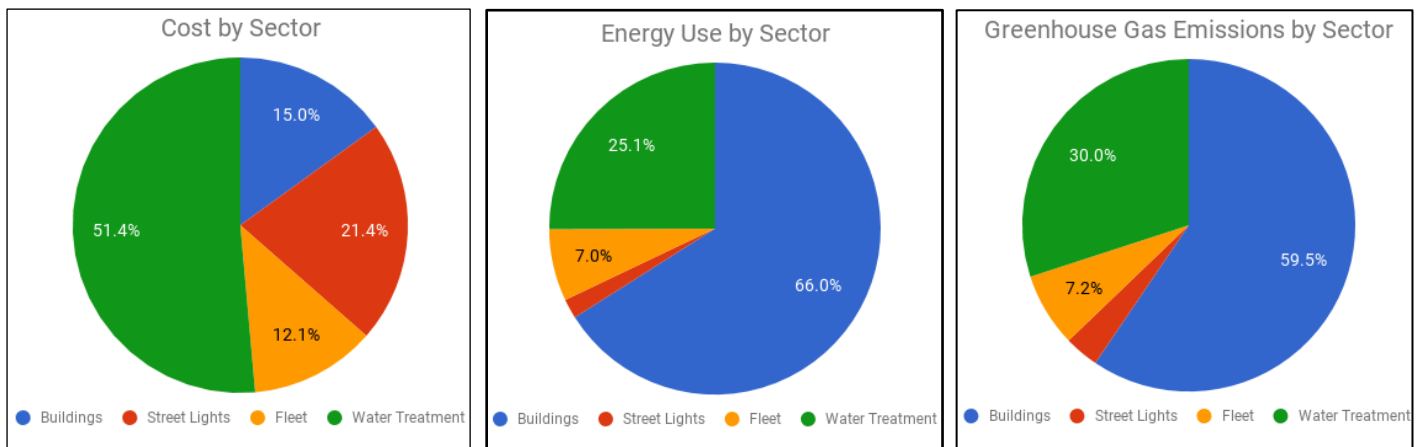


Figure 1: Total Annual Cost, Energy, and Emissions by Sector

| Sector | Energy (MMBtu) | Energy Usage (%) | GHGs (mtCO2e) | GHG Usage (%) | Cost (\$) | Cost Usage (%) |
|------------------------|----------------|------------------|---------------|---------------|---------------------|----------------|
| Buildings & Facilities | 18,062 | 66% | 1132 | 59.5% | \$30,271.69 | 15% |
| Water Treatment | 11,550 | 25.1% | 577 | 30% | \$103,463.60 | 51.4% |
| Transportation Fleet | 1,905 | 7% | 137 | 7.2% | \$24,410.05 | 12.1% |
| Streetlights | 519 | 1.9% | 64 | 3.3% | \$43,081.48 | 21.4% |
| Total | 31,903 | 100% | 1,910 | 100% | \$201,226.82 | 100% |

Table 2: Total Annual Cost, Energy, and Emissions by Sector

mtCO2e: Metric Tons of Carbon Dioxide Equivalents

MMBtus: Million British Thermal Units

Building and Facility Analysis

City Hall currently monitors monthly facility energy costs, and this data was used to establish an emissions inventory for City Buildings & Facilities with the help of the ClearPath software. Water Treatment data has not been included in this standard building analysis, because it is a sector of its own. However, the energy, emissions, and costs produced are not insignificant and will be discussed in a later section.

Table 3 shows the annual cost, energy, and greenhouse gas emissions from City buildings. It reveals that the majority of building energy costs can be attributed to the City Hall/Police Station, Public Works Shop, Library, and Public Pool. The pool's energy costs are high, but this is normal for pools and cannot be addressed without installing an alternative energy source. LED lighting retrofits have taken place at City Hall, the Public Works Shop, and the Library but further energy efficiency improvements would benefit the City. Particularly at the Public Works Shop and Library, where annual energy usage is 3,932 MMBtus and 1,937 MMBtus respectively (Table 3).

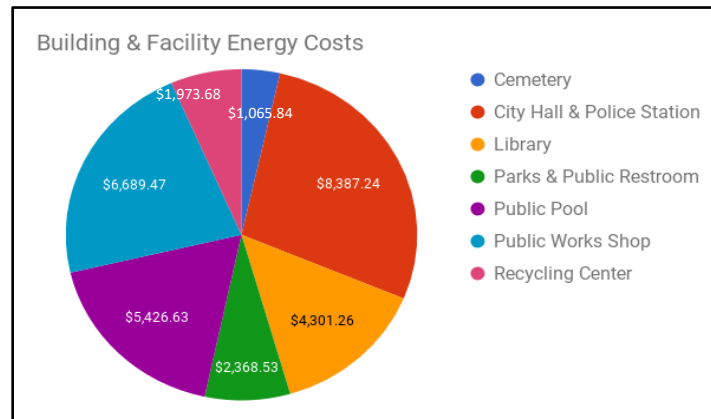


Figure 2: Building and Facility Costs by Facility

| Buildings & Facilities | Total Floor Space (Sq. Ft.) | Total Energy Cost (\$) | Total Energy Use (MMBtus) | Total GHGs (mtCO2e) |
|----------------------------|-----------------------------|------------------------|---------------------------|---------------------|
| Cemetery | -- | \$1,065.84 | 32 | 4 |
| City Hall & Police Station | 7,328 | \$8,387.24 | 5,472 | 300 |
| Library | 3,232 | \$4,301.26 | 1,937 | 109 |
| Parks | -- | \$2,368.53 | 27 | 3 |
| Public Pool | 500 | \$5,426.63 | 4,586 | 249 |
| Public Restroom | 2,700 | *in Parks | 683 | 37 |
| Public Works Shop | 8,512 | \$6,689.47 | 3,932 | 213 |
| Recycling Center | 2,400 | \$1,973.68 | 1,393 | 75 |
| Total | 24,672 | \$30,212.65 | 18,062 | 990 |

Table 3: Building and Facility 2016 Energy Use Inventory

mtCO2e: Metric Tons of Carbon Dioxide Equivalents MMBtus: Million British Thermal Units

Water Treatment Analysis

City Hall also currently monitors the monthly electric bill of the wastewater treatment plant, water treatment plant, and pumps and pumping stations. These facilities will be combined and referred to as Water Treatment for the purpose of this analysis.

Figure 4 displays the amount spent annually on Water Treatment, which far exceeds our energy expenses in all other City buildings. Table 4 shows that the majority of energy costs in Water Treatment come from wastewater treatment. An energy audit done in 2016 revealed that 65% of energy usage at the wastewater treatment plant is attributed to processing (Figure 3). Due to this, cutting down Water Treatment expenses by a large degree is unlikely.

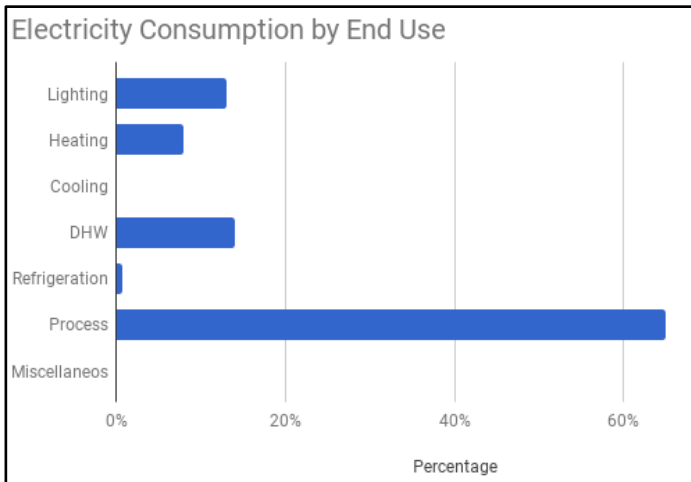


Figure 3: Wastewater Treatment Plant Energy Audit Results

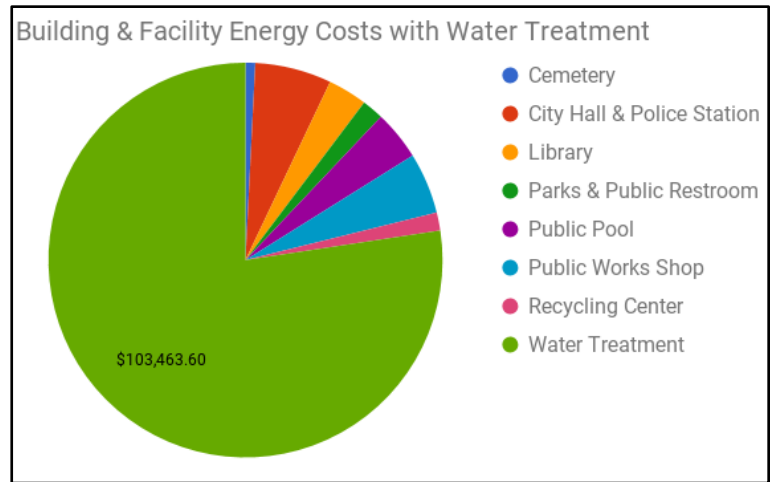


Figure 4: Building and Facility Costs including Water Treatment

| Source | Cost (\$) | Energy (MMBtus) | GHG Emissions (mtCO2e) |
|----------------------|---------------------|-----------------|------------------------|
| Pumps & Stations | \$19,352.65 | 4,805 | 59 |
| Wastewater Treatment | \$65,151.34 | 4,846 | 231 |
| Water Treatment | \$18,959.61 | 1,899 | 287 |
| Total | \$103,463.60 | 11,550 | 577 |

Table 4: Water Treatment 2016 Energy Use Inventory
 mtCO2e: Metric Tons of Carbon Dioxide Equivalent
 MMBtus: Million British Thermal Units

Transportation Fleet Analysis

The City's existing inventory of fleet vehicles includes vehicle type, annual miles traveled, and gallons of fuel purchased. The fleet consists of 16 vehicles; 8 trucks, 6 SUVs, and 2 smaller cars. Fifteen of these vehicles run on gasoline and one runs on diesel fuel. Seven of these vehicles are police cars and the remaining nine are used by the Public Works Department and Planning Department.

Using the City's record of fuel expenses and average vehicle fuel efficiencies assumed by the ClearPath software, annual fuel expenses and emissions were estimated. In 2016, the City spent \$24,410 on fuel for the city fleet (Table 2). Note, that this cost does not include repairs or maintenance on city vehicles. Figure 5 shows that fuel costs were split almost evenly between Public Works and Police & Planning, and represent only 12% of total costs and 7% of total energy use and emissions (Table 2). The police fleet is relatively new, but gradually replacing the Public Works vehicles with more fuel efficient cars could be an option.

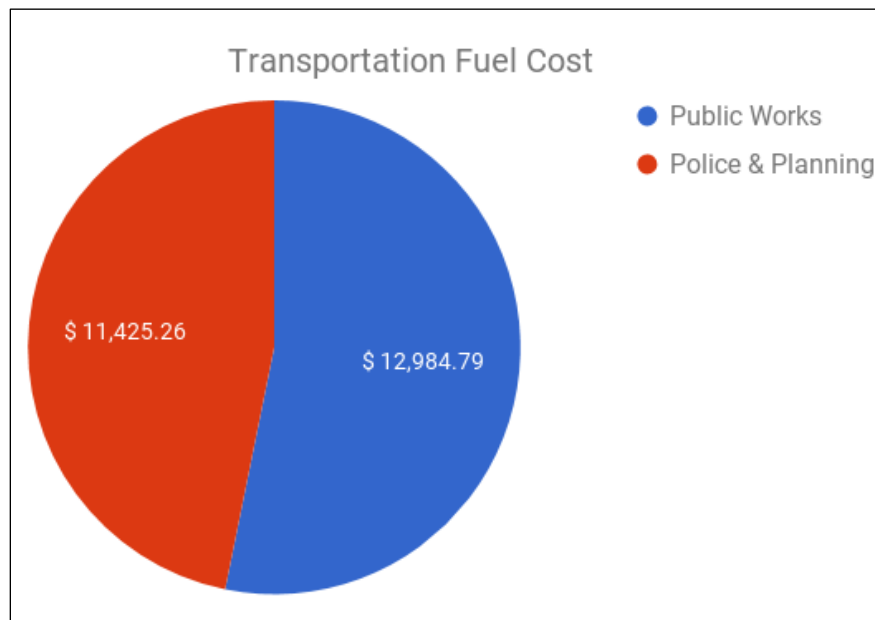


Figure 5: Transportation Fleet Fuel Costs by Department

Streetlight Analysis

City Streetlight data is tracked by the City through energy bills and meter readings. In 2016, it cost \$43,081.48 to operate the 264 streetlights in Red Lodge. As depicted in the table and graph below, this expense largely exceeds that of City buildings. In 2016, the cost of the streetlights was \$12,868.83 more than the cost to power the City buildings, even though the streetlights use 17,410 fewer MMBtus of energy than the buildings (Table 5).

Decreasing the amount of energy and money spent on streetlights has been a priority of the City's for several years now, and 14 of the streetlights have successfully been retrofitted to LED. Expanding the LED retrofit program to include all of Red Lodge's streetlights would save us money, energy, and greenhouse gas emissions, and is currently being attempted by City officials through NorthWestern Energy.

| Source | Emissions (mtCO2e) | Energy (MMBtu) | Cost \$ |
|--------------|--------------------|----------------|-------------|
| Buildings | 1,132 | 17,929 | \$30,212.65 |
| Streetlights | 64 | 519 | \$43,081.48 |

Table 5: Building and Streetlight 2016 Energy Use Inventory Comparison
 mtCO2e: Metric Tons of Carbon Dioxide Equivalents MMBtus: Million British Thermal Units

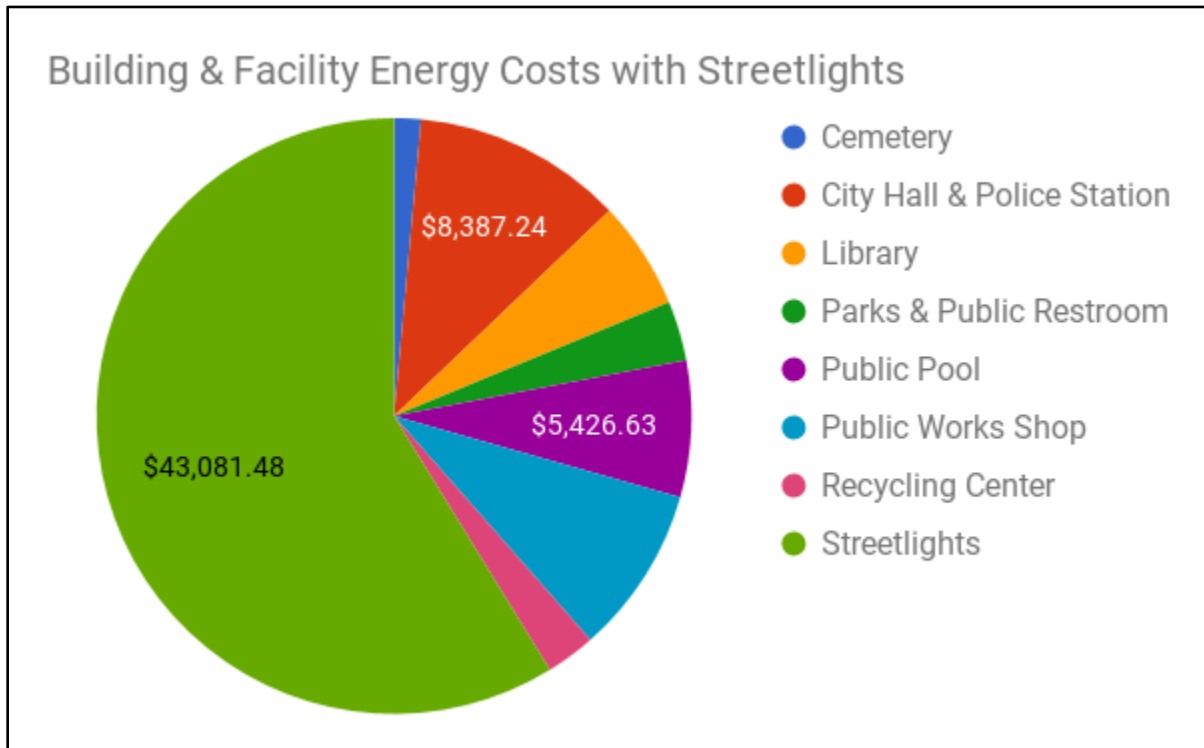


Figure 6: Building and Facility Costs including Streetlights

Next Steps

With this comprehensive assessment, the City of Red Lodge has completed the first step toward cost, energy, and greenhouse gas reductions. This study of 2016 City government operations establishes a working baseline for evaluating future action. It clearly identifies:

- City government energy use resulted in net annual emissions of 1,910 mtCO₂e and cost \$201,227 in total (Table 1).
- 60% of emissions and energy use are attributed to Buildings & Facilities (Table 2).
- Over half of energy costs come from consumption of energy in Water Treatment, which encompasses wastewater treatment, water treatment, and pumping stations (Table 2).
- City Hall, the Public Works Shop, and the Library, represent the greatest opportunity for cost and carbon savings (Table 3).
- Streetlight costs are disproportionately high when compared with actual energy usage (Table 5).

City Hall, the Police Station, the Library, and the Public Works Shop have recently received energy efficiency upgrades in the form of LED lighting retrofits, and represent a shift toward a more sustainable Red Lodge. The following next steps are recommended in order to continue this process in a strategic manner.

Recommended Next Steps

1. Establish realistic energy and greenhouse gas emissions reduction goals. An example of this would be setting a goal to decrease our emissions and energy usage by 15% of 2016 levels within 10 years from now.
2. Develop a plan of action built around these goals that includes successful strategies and tactics utilized by similar communities. Focus efforts on the sectors of City operations that are the biggest greenhouse gas and energy users.
3. Ensure that this plan is incorporated into the City Growth Policy and referenced when making decisions that affect City operations.
4. Assign a staff member to monitor energy and greenhouse gas reduction projects, document savings, and measure progress toward stated goals.
5. Expand the scope of the action plan to include the community's energy, costs, and emissions.