

**Energy & Greenhouse Gas Inventory for the City of Helena's  
Municipal Operations**

**Draft Prepared by Patrick Judge (January 3, 2008 version)**

Early in 2008, the Helena Climate Change Task Force recommended that the City of Helena join the International Council for Local Environmental Initiatives (ICLEI) and that it use ICLEI's software to analyze the city's carbon footprint, beginning with the operations of the city government itself. The City Commission accepted that recommendation.

The data collection and initial analysis were performed by city staff members Liz Hirst and Carrie Hahn, for the years 2001 and 2007. Liz and Carrie labored for several months to complete the painstaking project, and did an excellent job. On several occasions, beginning in August, members of the Energy Working Group met with Liz and Carrie, to check in and offer any technical assistance that might be needed. One early suggestion was to make sure to translate the "dekatherms" unit of natural gas usage reported on NorthWestern Energy's bills to the "therms" requested by the program (by multiplying by 10).

On December 3rd, Liz and Carrie presented their findings to the Helena Climate Change Task Force. The initial analysis (Data Set 1) revealed the following:

**Data Set 1 -- City's Original Analysis**

<u>Energy (MMBTU)</u>	<u>2001</u>	<u>2007</u>	<u>% Change</u>
TOTAL	111,443	84,313	-24.3
<u>Carbon (tons CO2e)</u>	<u>2001</u>	<u>2007</u>	<u>% Change</u>
TOTAL	12,183	9,666	-20.7
<u>Energy Cost (\$)</u>	<u>2001</u>	<u>2007</u>	<u>% Change</u>
TOTAL	1,233,607	1,990,059	61.3

These results were quite encouraging, showing significant decreases in both energy consumption and associated carbon emissions. Much of that reduction occurred in the water and waste water treatment plants, which were (and continue to be) the city's largest category for both energy and carbon. When broken out, that category shows an extraordinary 49% reduction in energy use and a 37% reduction in carbon emissions. Clearly, Don Clark and his team are highly deserving of commendation, based on their

efforts to increase efficiency and to conserve both financial and environmental resources. The level of creativity, innovation, and commitment they have demonstrated is truly exemplary.

The city also benefitted from good work being done in many other departments. The initial analysis showed a 15.9% reduction in energy use in city buildings, and a 17.5% reduction in building-related carbon emissions. Other categories showed relatively modest increases. The overall net energy savings had a substantial beneficial impact on the budget. Had the improvements not been made, the city would be paying more than half a million dollars extra, every year, on its energy bills. That analysis is as follows:

<u>Cost per Unit Energy</u>	<u>2001</u>	<u>2007</u>
\$ / MMBTU	11.07	23.60

Helena used significantly less energy (27,130 MMBTU) in 2007 than in 2001. Using the 2007 energy price (above), the savings is:

$$27,130 \text{ MMBTU} \times \$23.6 / \text{MMBTU} = \$640,268$$

Despite these impressive improvements, the city's energy bill still rose by 61% (in nominal dollars) over this period. That's because the efficiency gains -- while very dramatic -- were insufficient to fully counter the impact of rising energy prices. The overall price of energy paid by the city more than doubled over this time period.

On December 12th, the Energy Working Group met with Liz and Carrie to further familiarize itself with the ICLEI software and results. The working group identified a number of refinements they wished to make, including the following:

1) Part of the change in the reported building emissions was an accounting artifact. Between 2001 and 2007, the city took over the responsibility for paying the energy bills in several buildings (the Utility Maintenance building, the Chamber of Commerce building, and the City County building). Conversely, the city stopped paying the energy bill for the Neighborhood Center (which had a far bigger effect than the sum of the other three). These accounting changes skew the results, as they do not represent real changes in carbon emissions. The net effect is to artificially depress the energy and carbon numbers for 2007. Data Set Two was developed to address this concern. It assumes that each of these

buildings (and also various vehicle categories) remained constant over the time period (did not suddenly appear or disappear). The results of that second analysis are as follows:

**Data Set 2 -- City's Analysis**

**Modified to Address the Accounting Issues**

<u>Energy (MMBTU)</u>	<u>2001</u>	<u>2007</u>	<u>% Change</u>
TOTAL	115,318	89,471	-22.4
<u>Carbon (tons CO2e)</u>	<u>2001</u>	<u>2007</u>	<u>% Change</u>
TOTAL	12,584	10,199	-18.9

While these changes temper the reductions somewhat (the carbon reduction in the buildings category drops to 7.5%), the overall conclusions remain much the same.

2) The second modification the working group made was to the waste category. It was noted with some confusion that none of the solid waste that was reported had any impact on carbon emissions. The working group performed a sensitivity analysis by changing the waste category from "other waste" to "paper waste" (the worst emitter). Sure enough, this increased the carbon emissions -- but only modestly from 0 tons CO2-equivalent to 114 tons for 2007 (102 tons for 2001). In the city's overall carbon profile, this represents a change of about 1%. The paper waste category is thought to be a more accurate reflection of the actual waste stream (due to problems with the paper recycling program), so it was left in the analysis.

3) The third modification was a correction to the ethanol usage figures. While there was no ethanol use reported in 2001, in 2007 it shows up for various vehicles in various departments. The original analysis assumed "E-85", which is a blend of 85% ethanol and 15% gasoline and which requires a "flex-fuel" vehicle. The working group (in consultation with Liz and Carrie) felt that the ethanol usage was more likely E-10 (which runs in any gasoline-powered vehicle, and which is currently available in Helena).

Data Set Three was developed to include all of these modifications:

- addressing the accounting issues
- changing the waste category from "other" to "paper"
- changing the ethanol assumption from "E-85" to "E-10"

The results of that analysis are as follows:

**Data Set 3 -- City's Analysis**  
**Modified to Address the Accounting,**  
**Ethanol, and Waste Issues**

<u>Energy (MMBTU)</u>	<u>2001</u>	<u>2007</u>	<u>% Change</u>
TOTAL	115,341	89,856	-22.1
<u>Carbon (tons CO2e)</u>	<u>2001</u>	<u>2007</u>	<u>% Change</u>
TOTAL	12,691	10,397	-18.1

4) The group also had questions about the mix of electricity resources assumed by the program. The program offers a list of regions to choose from, and Liz and Carrie correctly selected the Western Electricity Coordinating Council / Northwest Power Pool as Helena's region. However, the group had some reservation's about using the generic regional mix, because they suspected that NorthWestern Energy's specific power mix was probably more coal dependent. Some quick research confirmed that hypothesis:

<u>Resource</u>	<u>WECC/NWP (2005)</u>	<u>NWE (2009)</u>
Hydro	49%	25%
Coal	34%	55%
Gas	11%	7%
Nuclear	3%	1%
Renewable	2%	7%
Other (& rounding error)	1%	5%
	=====	=====
TOTAL (%)	100%	100%

The assumptions used by the program included the following values for the carbon intensity of the WECC/NWP mix:

2001 499.3 tons CO2-e/ gigawatt-hour  
2007 546.9 tons CO2-e / gigawatt-hour

If corresponding (but larger) figures could be developed for NWE's mix, they might be entered into the program to increase the accuracy of the results. However, the Energy Working Group has not yet had a chance to investigate that issue further. It also may be unwise to do so, because it is likely that other Montana cities have simply used the regional mix, and maintaining consistency may be the best approach. Also, doing so would affect the overall emission totals more than it would the relative changes between the two years (and it is the latter metric that is of greater use to citizens and policymakers hoping to understand trends and the impact of various measures).

Members of the working group did express an interest in obtaining some kind of comparison to a similar city. The most obvious choice is Bozeman, which is roughly similar to Helena in both in size and climate, and which recently completed the same ICLEI process for the years 2000 and 2006. That comparison is as follows:

<b><u>Tons CO2e</u></b>	<b><u>Bzmn 2000</u></b>	<b><u>Helena 2001</u></b>	<b><u>Bzmn 2006</u></b>	<b><u>Helena 2007</u></b>
Buildings	2384	2910	3226	2691
Vehicle Fleet	1487	1631	1543	1788
Streetlights	326	922	564	1005
Waste	72	102	119	114
Water/Sewage	1958	6263	2652	3908
<b>TOTAL*</b>	<b>6227</b>	<b>11828</b>	<b>8104</b>	<b>9506</b>

\*Note that the reported totals are slightly different from the totals shown here. In Helena's case, that's because the employee commute figures were left out -- Bozeman did not include those in its analysis. So the more meaningful apples-to-apples totals were used instead.

The comparison is useful in that it shows similar "ballpark" type results between the two cities, providing some evidence that major errors in the cities' analysis were avoided. It shows that while Helena's municipal carbon footprint is larger than Bozeman's, the City of Helena is on a downward trajectory (while Bozeman's emissions increased over this period).

#### Other Notes

The Energy Working Group wishes to make clear that this is a preliminary analysis

only, and that the numbers are subject to change if other corrections / improvements are identified. That being said, it appears that the City of Helena has already made some good progress in addressing its own carbon emissions. Other projects that are underway (such as the LED traffic light replacement project, the upcoming Legion Field lighting project, and the upcoming Wastewater Treatment Plant Stirling Engine project) are not yet reflected in these results. There is much good work already accomplished, more on the way, and more that can be done. The working group is putting together a suite of recommendations to expand upon the city's efforts to reduce its emissions, and save taxpayers dollars.

### Next Steps

The ICLEI program has four modules, only one of which (Government Analysis) has been completed. Other capabilities of the software include:

- forecast builder -- helps project how emissions are expected to evolve into the future, under "business-as-usual" assumptions.
- goal setting -- many cities adopt explicit reduction goals -- Bozeman, for example, adopted a goal of reducing emissions 15% below 2000 levels by 2020.
- modeling both the environmental and fiscal impact of potential recommendations -- this facilitates the creation of a Climate Action Plan for the city.

This entire process can be duplicated / expanded for the community at large (by using the other two modules). The City Commission may choose to continue with that level of formal analysis, but an extension to the task force's term would be required. Regardless, the task force is moving forward with recommendations that will help the citizens of Helena (not just their government) to use energy more efficiently. But it is only appropriate that the city government "lead by example", by first making sure its own house is in order.