

Date: May, 2009

City of Duluth
B3 Benchmarking Project

Completed by
Minnesota Resource Conservation, Inc
4059 Nelson Rd,
Duluth MN 55803
218-724-4994
Danderson@mnresource.com

Project Summary

Minnesota Resource Conservation Inc. (MRC) was contracted by the City of Duluth to complete the State of Minnesota B3 energy benchmarking requirement that requires all municipalities in the State of Minnesota to input historical energy usage for all buildings >5000 Square Feet in size in an online database named the B3 Benchmarking Database. This database uses total historical energy usage, building use type and total square feet to create a virtual reference building that is used to compare the existing buildings with the virtual building to determine its target energy use. The metric for comparison on the B3 Benchmarking website is expressed in Total KBtu/Sq Ft and is expressed as a percentage below or above the virtual reference buildings energy usage. The premise behind this effort is to identify and prioritize buildings that have higher than predicted total energy usage and can be targeted for energy conservation measures that will most likely produce cost effective energy savings.

After discussion with the City of Duluth about the scope of the project it was determined that the data collection and energy analysis should be expanded to include all city of Duluth buildings over 500 square feet. The total number of buildings that was included in the B3 benchmarking analysis is 95.

Methodology

To complete this project, MRC obtained a list of all city facilities. This list was forwarded onto the utility companies that provide energy services to these buildings to acquire one year of historical billing and consumption data. This data was used for the B3 website inputs and was also inputted into a spreadsheet that was used to calculate total energy usage expressed in KBtu/Sq. Ft. as well as total KBtu/Sq. Ft. by each utility type (Electric, Natural Gas, and Steam). This report breaks down each building by individual utility type usage expressed in KBtu/Sq. Ft. as well as by total building energy consumption. By looking at each building by specific utility type as opposed to total energy usage, this provides an opportunity to identify specific utility fuel conservation targets that may not appear evident if expressed only in total KBtu/Sq Ft terms. An example of this would be if a building has low natural gas usage and high electrical energy usage the Total KBtu/Sq. Ft. metric might place this building in the middle or towards the bottom of the priority list. By sorting the buildings by individual energy usage as well, this will help target buildings for utility specific conservation efforts. Site visits were also conducted to each site to gather any utility meter information, to confirm the size of the building and in some cases determine if the building still exists. Appendix B, the Individual Site Profile and Summary,

gives a general overview of each separate building, pictures of the site, as well as data about its energy usage.

This project did not include gathering data for each building's HVAC system or thermal envelope details. The B3 Benchmarking report provides an idea of what buildings may be consuming more energy than they could be. The next step could be to conduct a more extensive energy analysis on buildings that are near the top of the priority list to determine what energy efficiency improvements could be made to that building as well as their identify associated improvement costs and energy savings paybacks.

For the purpose of this analysis, the Btu value used for a unit of electricity was 3413 Btu/ kWh. The Btu value used for a unit of natural gas was 100,000 Btu/therm, and the Btu value used for a unit of steam was 1195.6 Btu/pound of steam. Because specific HVAC information was not required to be gathered for this project, efficiency losses were not factored into the specific fuel consumption of the buildings.

The KBtu/Sq Ft totals displayed in aggregate as well as by individual utility type were derived from the Btu amounts listed above. Because access to the core algorithms within the B3 website was not available, the Total KBtu/SqFt values in the tables below may differ slightly from the Total KBtu/SqFt values within Appendix A B3 summary page (attached as separate PDF File).

B3 Benchmarking Website Database Summary for Buildings \geq 5000 SqFt

Attached at the end of this report as Appendix A is the summary page from the B3 Benchmarking website. This summary page provides each buildings actual energy usage, the benchmark energy usage and a percentage above or below 100%. Ideally, if the buildings actual energy usage is below 100%, then it is using less than the reference or benchmark building and would not be a candidate for energy efficiency measures. As stated in the project summary section above, because the B3 Benchmarking website uses *Total* KBtu/Sq. Ft. as it's metric and not KBtu/Sq. Ft. for each energy type, opportunities to address a buildings individual energy usage could be missed which is why this report includes the billing data in both formats.

Clarifications

Appendix A is the summary page from the B3 database website. The B3 summary page lists multiple columns of information for each building. The columns listed "needs action" and "completed" refer to the information inputted into the individual site summary page for each buildings. To trigger an "ok" in the "Needs Action" column, we found that the billing data needs to be inputted in a calendar year format. Most of the billing histories we received were in a 365 day format based on the day the billing history request was submitted. After manipulating the dates to reflect a calendar year, it was discovered that the lack of the "ok" in the "Needs Action" column does not affect the KBtu/SqFt number. As a result, the actual billing date cycles were left in place in most cases.

Individual Site Summary

Also included in this summary is a site visit report that provides the basic information on each building. The information included on this separate report is physical address, a picture of the building, total energy usage, energy usage by utility type, and any physical exterior features of the buildings. Also included are any general notes about the building.

Reporting Summary

Because the B3 Benchmarking website only considers buildings 5000 square feet and larger, this report groups all the city buildings into either >5000 Sq. Ft. or > 5000 Sq. Ft. Within each of these size classifications the building are then sorted by four types of billing history energy usage analyses. The four types are:

1. Total KBtu/Sq. Ft.
2. Total Electrical KBtu/Sq. Ft.
3. Total Natural Gas KBtu/Sq. Ft.
4. Total Steam KBtu/Sq. Ft. (if applicable)

Please note that two buildings use Fuel Oil as the primary heating fuel and those buildings were included within the Natural Gas sections.

Billing History Analysis by Building Size and Utility Type for Buildings > 5000 SqFt

Buildings >5000 Square Feet Total Energy Usage in KBtu/Sq Ft

Building Name	Square Feet	Total KBtu/SqFt
Zoo- Polar Complex	6380	1007.85
Zoo - Administrative Building	10942	291.62
Parks Toolhouse	6894	196.33
Zoo- Children's (Primate Center)	7010	191.93

Firehall #7	5475	165.34
Duluth Art Institute	5463	164.25
Firehall #4	5475	156.73
Firehall #2	7365	129.81
Enger Golf - Club House	6414	127.41
City Center West	22487	119.36
Firehall #10	11160	117.61
Goodfellowship Community Club	8820	114.75
Zoo- Animal Care Center	7533	114.29
Toolhouse - Lund	10200	111.47
Fleet Services Building	22000	88.67
Portman Community Club	5680	85.97
Wheeler Fieldhouse (Comm. Club)	10680	85.78
Woodland Community Club	9328	83.88
Central Hillside Comm. Center	16630	80.39
Woodland - Fryberger Arena	24990	74.05
Washington Center	34000	67.74
Firehall #1	32800	66.99
Memorial Community Club	7454	62.36
Facilities Maintenance Bldg	39765	60.73
Duluth Heights Community Club	10560	59.35
Wade Stadium- Concessions	12000	51.50
City Hall	127964	47.91
Police Garage	8728	43.00
Main Library	69228	38.48
Water & Gas - Distribution	82272	36.60
Toolhouse - West Duluth	18868	33.91
Chester Bowl - Chalet	11840	33.80
Water Plant- Pump Building	12350	31.74
Toolhouse - Lakeside	6014	24.77
Toolhouse - West Duluth - New Garage	5355	10.93
Park Point - Beach House	5890	10.66
Casino Parking Ramp	120316	4.82
Coney Parking Ramp	21444	3.54
Depot Parking Ramp	95682	2.30
Water Plant- Treatment Building	65382	0.00
Merrit Community Club	5088	0.00

Buildings >5000 Square Feet Total Natural Gas Usage in KBtu/Sq. Ft

Building Name	Square Feet	Total KBtu/SqFt
Zoo- Polar Complex	6380	762.46
Zoo - Administrative Building	10942	201.98
Parks Toolhouse	6894	176.89
Zoo- Children's (Primate Center)	7010	151.31
Duluth Art Institute	5463	142.14
Firehall #7	5475	135.16
Firehall #4	5475	125.50
Firehall #2	7365	115.61
Goodfellowship Community Club	8820	114.75
Firehall #10	11160	112.48
Toolhouse - Lund	10200	100.70
Enger Golf - Club House	6414	91.67
Portman Community Club	5680	85.76
Wheeler Fieldhouse (Comm. Club)	10680	76.09
Woodland Community Club	9328	74.34
City Center West	22487	74.29
Zoo- Animal Care Center	7533	69.35

Central Hillside Comm. Center	16630	66.30
Fleet Services Building	22000	63.05
Memorial Community Club	7454	62.36
Woodland - Fryberger Arena	24990	61.77
Facilities Maintenance Bldg	39765	53.66
Duluth Heights Community Club	10560	47.77
Toolhouse - Lakeside	6014	22.38
Chester Bowl - Chalet	11840	20.41
Toolhouse - West Duluth	18868	19.26
Water & Gas - Distribution	82272	9.18
Firehall #1	32800	7.91
City Hall	127964	0.02
Casino Parking Ramp	120316	0.00
Depot Parking Ramp	95682	0.00
Main Library	69228	0.00
Water Plant- Treatment Building	65382	0.00
Washington Center	34000	0.00
Coney Parking Ramp	21444	0.00
Water Plant- Pump Building	12350	31.74 (Fuel Oil)
Wade Stadium- Concessions	12000	0.00
Police Garage	8728	0.00
Park Point - Beach House	5890	0.00
Toolhouse - West Duluth - New Garage	5355	0.00
Merrit Community Club	5088	0.00

Buildings >5000 Square Feet Total Electrical Usage in KBtu/Sq. Ft.

Building Name	Square Feet	Total KBtu/SqFt
Zoo- Polar Complex	6380	245.39
Zoo - Administrative Building	10942	89.63
Wade Stadium- Concessions	12000	51.50
City Center West	22487	45.07
Zoo- Animal Care Center	7533	44.94
Zoo- Children's (Primate Center)	7010	40.62
Enger Golf - Club House	6414	35.73
Main Library	69228	31.66
Firehall #4	5475	31.24
Firehall #7	5475	30.18
Washington Center	34000	27.74
Water & Gas - Distribution	82272	27.42
Fleet Services Building	22000	25.62
Duluth Art Institute	5463	22.11
Parks Toolhouse	6894	19.44
Toolhouse - West Duluth	18868	14.64
Firehall #2	7365	14.20
Central Hillside Comm. Center	16630	14.09
Chester Bowl - Chalet	11840	13.40
Firehall #1	32800	13.09
City Hall	127964	12.31
Woodland - Fryberger Arena	24990	12.28
Duluth Heights Community Club	10560	11.58
Toolhouse - West Duluth - New Garage	5355	10.93
Toolhouse - Lund	10200	10.77
Park Point - Beach House	5890	10.66
Wheeler Fieldhouse (Comm. Club)	10680	9.69
Woodland Community Club	9328	9.54
Facilities Maintenance Bldg	39765	7.07
Firehall #10	11160	5.13

Casino Parking Ramp	120316	4.82
Coney Parking Ramp	21444	3.54
Toolhouse - Lakeside	6014	2.39
Depot Parking Ramp	95682	2.30
Portman Community Club	5680	0.21
Water Plant- Treatment Building	65382	0.00
Water Plant- Pump Building	12350	0.00
Goodfellowship Community Club	8820	0.00
Police Garage	8728	0.00
Memorial Community Club	7454	0.00
Merrit Community Club	5088	0.00

Buildings >5000 Square Feet Total Steam Usage in KBtu/Sq. Ft.

Building Name	Square Feet	Total KBtu/SqFt
Firehall #1	32800	46.00
Police Garage	8728	43.00
Washington Center	34000	40.00
City Hall	127964	35.57
Main Library	69228	6.82

Billing History Analysis by Building Size and Utility Type for Buildings < 5000 SqFt

Buildings <5000 Square Feet Total Energy Usage in KBtu/Sq Ft

Building Name	Square Feet	Total KBtu/SqFt
Arlington Pump Station	572	5220.39
West Duluth Booster Station	680	3165.38
New Proctor Station	646	1355.90
Bayview Station	646	1198.67
Lakeside Pump Station	540	587.93
Orphanage Pump Station	950	379.95
Sewer Lift Station #8	610	326.57
Endion Depot	2544	286.64
Firehall #6	2184	243.19
Water & Gas - Office Building	3825	230.77
Aerial Bridge	898	210.05
Wheeler- Concessions	900	206.05
Animal Shelter	3360	191.10
Glen Avon - Hockey Building	1061	160.46
Firehall #5	2818	159.61
Grant Community Club	2425	157.78
Firehall #11	2800	154.91
Lower Chester Community Club	2016	153.88
Irving Community Club	4352	144.12
Riverside Community Club	1750	141.84
Aerial Bridge	898	135.44
Lester Golf - Clubhouse	4720	132.49
Observation Community Club	1560	131.67
Bayfront Park Building	1728	125.32
Zoo- Australian Building	4410	121.27
Gary Recreation Center	2400	121.25
Sewer Lift Station #15	1226	109.79
Norton Park Community Club	2236	104.43
Water & Gas - East Pump Building	1672	91.99
Lincoln Park - Pavilion	2250	89.55
Lincoln Park Community Club	950	89.18

Lester Park Library	3560	88.68
Hillside Sport Court	930	79.46
Lafayette Square	4840	75.81
Middle System Station	2160	69.31
Harrison Community Club	4800	66.08
Piedmont Community Club	4160	46.25
Fairmont Park Pavilion	2240	44.44
Lester Golf - Toolhouse	2960	29.87
Lester Park - Comfort Station	500	28.02
Sewer Lift Station #14	522	24.25
Lakeview Chalet	3280	16.58
Wheeler - Garage	576	7.61
Fon-du-lac Community Club	1736	5.91
Longview Tennis Club	2160	3.13
Cobb Warming Shack	960	3.04
Water Treatment Building	4464	2.91
Enger Tower	745	2.01
Toolhouse - West Duluth - Large Garage	3000	0.00
Chester Bowl - Quonset Hut	1008	0.00
Chester Bowl - Garage North	576	0.00
Lester Golf - Garage & Range Bldg	576	0.00
Highland Pump Station	513	0.00

Buildings <5000 Square Feet Total Natural Gas Usage in KBtu/Sq. Ft.

Building Name	Square Feet	Total KBtu/SqFt
Endion Depot	2544	286.64
Firehall #6	2184	183.52
Animal Shelter	3360	181.88
West Duluth Booster Station	680	152.94
Aerial Bridge	898	151.67
Firehall #5	2818	149.01
Grant Community Club	2425	142.80
Firehall #11	2800	138.32
Riverside Community Club	1750	136.91
Lower Chester Community Club	2016	126.44
Irving Community Club	4352	123.71
Lakeside Pump Station	540	105.56
Norton Park Community Club	2236	104.43
Gary Recreation Center	2400	95.08
Sewer Lift Station #15	1226	93.23
Water & Gas - East Pump Building	1672	91.99
Bayfront Park Building	1728	88.66
Lester Park Library	3560	80.90
Lincoln Park - Pavilion	2250	80.18
Hillside Sport Court	930	79.46
Zoo- Australlan Building	4410	77.23
Aerial Bridge	898	77.06
Observation Community Club	1560	77.05
Middle System Station	2160	69.31
Lafayette Square	4840	68.99
Glen Avon - Hockey Building	1061	67.86
Orphanage Pump Station	950	58.95
Harrison Community Club	4800	53.90
Piedmont Community Club	4160	46.25
Arlington Pump Station	572	0.17
Lester Golf - Clubhouse	4720	73.97 (Fuel Oil)
Water Treatment Building	4464	0.00

Water & Gas - Office Building	3825	0.00
Lakeview Chalet	3280	0.00
Toolhouse - West Duluth - Large Garage	3000	0.00
Lester Golf - Toolhouse	2960	0.00
Fairmont Park Pavillon	2240	0.00
Longview Tennis Club	2160	0.00
Fon-du-lac Community Club	1736	0.00
Chester Bowl - Quonset Hut	1008	0.00
Cobb Warming Shack	960	0.00
Lincoln Park Community Club	950	0.00
Wheeler- Concessions	900	0.00
Enger Tower	745	0.00
Bayview Station	646	0.00
New Proctor Station	646	0.00
Sewer Lift Station #8	610	0.00
Chester Bowl - Garage North	576	0.00
Lester Golf - Garage & Range Bldg	576	0.00
Wheeler - Garage	576	0.00
Sewer Lift Station #14	522	0.00
Highland Pump Station	513	0.00
Lester Park - Comfort Station	500	0.00

Buildings <5000 Square Feet Total Electrical Usage in KBtu/Sq. Ft.

Building Name	Square Feet	Total KBtu/SqFt
Arlington Pump Station	572	5220.22
West Duluth Booster Station	680	3012.43
New Proctor Station	646	1355.90
Bayview Station	646	1198.67
Lakeside Pump Station	540	482.37
Sewer Lift Station #8	610	326.57
Orphanage Pump Station	950	321.00
Water & Gas - Office Building	3825	230.77
Wheeler- Concessions	900	206.05
Glen Avon - Hockey Building	1061	92.59
Lincoln Park Community Club	950	89.18
Firehall #6	2184	59.67
Lester Golf - Clubhouse	4720	58.51
Aerial Bridge	898	58.38
Aerial Bridge	898	58.38
Observation Community Club	1560	54.62
Fairmont Park Pavillon	2240	44.44
Zoo- Australian Building	4410	44.04
Bayfront Park Building	1728	36.66
Lester Golf - Toolhouse	2960	29.87
Lester Park - Comfort Station	500	28.02
Lower Chester Community Club	2016	27.44
Gary Recreation Center	2400	26.17
Sewer Lift Station #14	522	24.25
Irving Community Club	4352	20.41
Firehall #11	2800	16.59
Lakeview Chalet	3280	16.58
Sewer Lift Station #15	1226	16.56
Grant Community Club	2425	14.97
Harrison Community Club	4800	12.18
Firehall #5	2818	10.60
Lincoln Park - Pavillon	2250	9.37
Animal Shelter	3360	9.23

Lester Park Library	3560	7.78
Wheeler - Garage	576	7.61
Lafayette Square	4840	6.82
Fon-du-lac Community Club	1736	5.91
Riverside Community Club	1750	4.92
Longview Tennis Club	2160	3.13
Cobb Warming Shack	960	3.04
Water Treatment Building	4464	2.91
Enger Tower	745	2.01
Piedmont Community Club	4160	0.00
Toolhouse - West Duluth - Large Garage	3000	0.00
Endion Depot	2544	0.00
Norton Park Community Club	2236	0.00
Middle System Station	2160	0.00
Water & Gas - East Pump Building	1672	0.00
Chester Bowl - Quonset Hut	1008	0.00
Hillside Sport Court	930	0.00
Chester Bowl - Garage North	576	0.00
Lester Golf - Garage & Range Bldg	576	0.00
Highland Pump Station	513	0.00

Notes on Specific Buildings

After numerous attempts to gather the necessary data to provide complete information on all 95 buildings within this report, the following buildings as they are listed with the tables above or on Appendix A may appear lower on the energy consumption range due to the various factors listed:

- Water Plant- Treatment Building (65382sqft)
 - Unable to locate gas account
 - Shares electric service with Water Plant-Pump Building
- Water Plant- Pump Building (12350sqft)
 - Shares electric service with Water Plant- Treatment Building
- Wade Stadium (12000sqft)
 - no heating fuel located
- Goodfellowship Community Center (8820sqft)
 - No electric account found for meter# 213103
- Police Garage (8728sqft)
 - No electric meter or account found
 - Steam use seems incorrect
- Memorial Community Center (7454sqft)
 - No electric account found
- Toolhouse- West Duluth new garage (5355 SqFt)
 - No heat used in building

Date: May, 2009

- Merrit Community Center (5088sqft)
 - No gas or electric consumption data found

Follow up

Should any user wish to access the data on the B3 website, the login and password are as follows:

Login – Danderson@mnresource.com

Password – duluthb3

Appendix A

PDF File of B3 Database Website Summary Page (See attached, next page)