Newport City Hall & Police Station

Energy, Water and Waste Management Assessment

Prepared For: **Renee Helm, Executive Analyst**
Bruce Hanson, Public Works Superintendent
John Neska, Assistant Public Works Superintendent

Report prepared by RETAP on behalf of the State of Minnesota

Assessment: January 15, 2013
Report: March 18, 2013

Client: Newport City Hall & Police Station

Location:

596 7th Ave
Newport, MN 55055

Contacts:

Renee Helm, Executive Analyst, 651-459-5677, rhelm@newportmn.com

Bruce Hanson, Public Works Superintendent, 651-459-2475, brhanson@miniter.net

John Neska, Assistant Public Works Superintendent, 651-459-2475

RETAP Assessment Team

Gordon Amundson, Follow-Up Coordinator, 651 486-2915, amund001@umn.edu

Walter(Bud) Hauser, 651 452-3432, budhauser@comcast.net

Thomas Segar, 952 888-7159, segar_t@msn.com

Clarence Chaplin, Lead, 651 695-0982, cachaplin@mac.com

Table of Contents

List of Tables

1: Executive Summary

Newport City Hall was assessed for energy and waste management efficiency by a team from the Minnesota Retiree Environmental Technical Assistance Program on January 15, 2013. Specific recommendations are listed below.

Table 1: Assessment Recommendations

Recommendation	Potential Savings, Annual						
	KwH	Kw	Fuel *Kbtu	Water Gallons	Waste Yds	$'s	Tons CO2
1.) Replace existing furnaces with high efficiency, Energy Star models	0	0	41,720	0	0	$340	3
2.) Seal air leaks in building	250	0	34,000	0	0	$310	2
3.) Replace T8 32W bulbs with T8 25W bulbs and clean or replace diffusers	1,990	0.5	0	0	0	$190	1
4.) Replace outdoor mercury and high pressure sodium lights with LEDs	1,640	0	0	0	0	$175	1
5.) Shut down computers, printers, and other plug loads when equipment is not in use for extended periods	1,375	0	0	0	0	$150	1
6.) Install low-flow water nozzles on all faucets	1,140	0	0	20,000	0	$120	1
7.) Replace incandescent exit signs with LED ones	380	0	0	0	0	$40	0
8.) Begin a regular preventative maintenance program on HVAC equipment to maximize operating performance, efficiency, and equipment life	0	0	0	0	0	$0	0
Total:	**6,775**	**0.5**	**75,720**	**20,000**	**0**	**$1,325**	**9**

*1 Therm = 100 Kbtu

This analysis and potential savings estimates are based on utility bill data provided and on data provided for building structure, HVAC, lighting and waste management. Actual future savings will depend on weather, utility billing rates, site or operational changes, and on recommendations implemented.

2: Facilities

The Newport City Hall and Police Department is housed in a 3,886 square foot building built in the 1950s. The original building has a flat roof with walls constructed of concrete block. The newer portion has a pitched roof and 2x4 wall construction with siding and brick fascia on the lower portion. The interior has a dropped ceiling with a five foot space above.

The building sits on a small lot, near 7th Avenue, with a narrow space between it and the building to the south. Most of the remaining property is asphalt parking area.

City Hall is open 8 AM to 6 PM Monday through Thursday and has three employees. The police area is used 24 hours a day, 7 days a week. Two police officers rotate 12-hour shifts and spend most of their shifts on patrol.

The building is heated with two 1986 vintage natural gas furnaces, one 100,000 Btu and one 150,000 Btu. The city hall portion is air conditioned by a 3 ½ ton central air conditioning system installed in 2009. The police station uses one AC wall unit.

3: Energy, Water, Waste Costs and Benchmarks

Annual energy and waste management bill data is presented in "Table 5: Bill Data Summary" at the end of this report. Annual totals are:

Table 2: Annual Utility Charges

	Electricity		Fuel	Water	Waste	Total
Charges	$3,840		$2,154	$0	$132	$5,987
Rate	$0.07/KwH	$8.51/Kw	$0.0069/Kbtu			

The Newport City Hall and Police Station building spends almost $6,000/yr on energy and waste costs. Waste costs are minimal and there is no charge for water or sewer use.

In Table 3 below, a national database operated by the Department of Energy is used to benchmark energy consumption. The benchmark is a valuable tool because it allows for a comparison of a building's energy consumption with the median energy intensity for similar building types in a similar climate zone (in this case, the northern tier of the US). The city hall and police building is used for a variety of purposes. For that reason, the benchmark is a composite of three building types: public safety, public assembly, and office.

Data in the benchmark cover a 30-year period. Heating and cooling requirements are measured in degree days. The long-term trend for cooling degree days (CDD) is 699 and heating degree days (HDD) is 7916.

Utility data were collected for the period October 2011 through September 2012. For this period, cooling and heating degree days were respectively, 1187 and 5835. Compared with the long-term trend, both vary considerably from the 30-year average. This data mirrors the trend in recent years toward much warmer summers and winters. To provide a more meaningful comparison, the fuel consumption is weather-normalized for the lower HDD and is shown in parenthesis in Table 3.

The considerably higher CDD would also impact electrical use for cooling in the summer; but it is not a straightforward calculation to adjust the benchmark for electric use, and wasn't attempted.

The benchmark shows that actual electricity use is 12% higher than the benchmark, while fuel (natural gas) use is considerably higher (58% higher than the adjusted benchmark). As noted above, a portion of the higher electric use is a result of the much warmer summer in 2012. Implementing the recommendations in the report will bring the building in line with the adjusted benchmark (64 Kbtu/ft2). See Table 3.

An Energy Star building uses 20-30% less energy than the benchmark. For the period evaluated, an Energy Star building would consume approximately 45-51 Kbtu/ft2.

Table 3: Benchmarks

	KwH/Ft²	Fuel Kbtu/Ft²	Total Kbtu/Ft²	$'s/Ft²	Tons CO2
Newport City Hall and Police Station Building Total	9.2	57	88	$1.54	37
*Dept of Energy Benchmark	8.2	50 (36)	78 (64)	$1.37 ($1.23)	33(30)
Building with recommendations implemented	7.4	30	55	$1.08	28

*Department of Energy Information Agency 2003 Building Average Data, Zone 1(Degree Days > 7000) for Office buildings. Note: Energy Star building energy efficiency requirements can be 20% to 30% more stringent than DOE IA Benchmarks. The numbers in parenthesis represent fuel consumption corrected for actual heating degree days during the study period.

4: Potential Savings

Building Envelope

A new flat asphalt roof was installed in 2000 and 3 to 4 inches of foam insulation was added, resulting in an R value of approximately 19 (R19). The front walls, with 2x4 construction, contain fiberglass or rock wool batt insulation, resulting in R11. The remainder of the building is concrete block. It is not known whether the concrete block walls contain filler insulation. An 8-inch concrete block wall with cavities filled with perlite would be about R9. If the cavities are not insulated, the R value would be considerably lower (R2-R3). The building would benefit from additional wall insulation; however, the cost/benefit is high. For that reason, RETAP did not include additional wall insulation in its recommendations.

Stopping air infiltration can have a noticeable effect on energy use. For example, installing high-quality weather stripping on the rear door and sealing the air leak in the furnace room would result in potential savings of $310/yr. Insulating the electrical outlets on the outer walls should also be done as RETAP could feel cold air infiltrating during the assessment.

These efficiency actions are very low cost and should be done immediately.

HVAC

The two residential-type furnaces were installed in 1986. At the time they were installed, as explained to RETAP, the economizer on the unit for city hall was disconnected. Since the furnaces are 27 years old, they may be reaching the end of their useful life. The Minnesota energy code requires all commercial buildings to provide fresh air intake for healthy indoor air quality. When replacing this unit, an economizer will need to be installed.

Replacing the two units with high efficiency models in the low 90's efficiency would have saved $340 during the period studied. The savings increase to $460 for a winter equal in HDD for the 30-year average in the benchmark. RETAP recommends that Newport plan for the replacement of the furnaces.

Implementing the infiltration and furnace efficiency recommendations will bring the fuel consumption in line with peer energy use.

The thermostat in city hall is programmable and set at 72 day and 62 evening. In the winter, it is generally recommended that thermostat settings be 68 when the building is occupied and 60-62 when vacant. It is recommended that a locked thermostat be installed, but one that allows occupants to override the setting for a brief period. In this way, when the building is used when staff aren't present, occupants can adjust the setting, but it will revert to the previous setting after a set period of time.

The police station thermostat is manual and was set at 67F, and usually left at that level because the building is used around the clock. If it tends to stay at this temperature, replacing the thermostat with a locked, programmable one may not be necessary.

The city hall portion is cooled by a 3.5 ton Carrier air conditioner with a SEER of 15. A SEER of 15 is a very efficient unit (see Glossary for definition of SEER). The AC wall unit for the police station is an older model. When replaced, it should be replaced with an Energy Star model. Energy Star models use about 10% less energy.

A preventative maintenance schedule should be instituted to insure that all HVAC equipment remains in good condition and operates at maximum efficiency. A good preventative maintenance program will pay for itself in lower energy costs.

Lighting

The city hall and police areas are primarily lit by 32-watt, T8 fluorescent fixtures covered with plastic diffusers. The diffusers are either dirty or discolored with age and are blocking some light. RETAP recommends replacing the 32-watts bulbs with 25-watt bulbs, for a savings of 25%, and cleaning or replacing the diffusers. Total estimated savings are $190/yr.

Newport should also investigate replacing the outdoor dawn to dusk lighting (one mercury and three high pressure sodium) with LED fixtures. Because this technology is new, Newport should enlist the advice of an electrical contractor with knowledge of LED lighting. Approximate savings are $175/yr. Rebates are now available for some outdoor LED lighting and will be provided in the lighting audit discussed below.

The Center for Energy and Environment operates a lighting program for Xcel called “One-Stop Efficiency Shop”. This program, funded by Xcel, is a full-service rebate program available to small businesses in Xcel Energy’s Minnesota service territory. CEE will perform a lighting audit, calculate savings from installing more energy efficient lighting, calculate the rebate available from Xcel, and file the paperwork for you. CEE also has financing available at 3.9% for your project.

RETAP would like to thank CEE for providing the analysis to replace the outside lighting with LEDs. The savings used in this report are approximate; because LED replacements are evolving, and it can be difficult to precisely measure wattage reductions. Regardless of the final numbers, RETAP is finding that the wattage reduction with LEDs is significant.

Other Savings

Plug Loads - During the assessment RETAP noted cable TV equipment in the council chambers left in stand-by mode along with computers and printers in the police station left on, presumably around the clock. There was also an electric heater in the city hall office area.

Typical plug loads for an office building range from 10-15% of total electric use. Assuming the city hall and police building plug load is 15% of total electric use, and shutting off equipment not being used can save 25%, electrical savings of $150 are possible.

The City of Minneapolis is trying to eliminate space heaters in a particularly inefficient building by purchasing heating mats for their employees. The difference in energy consumption is large: 1500 watts for a space heater vs. 90 watts for the mats (search the web for “electric heating mats” for more information). Consider replacing the space heater with an electric floor mat, and adding a timer or occupancy sensor so it isn’t left on when not needed.

Also consider purchasing a Kill-a-watt meter ($25) to analyze loads and savings opportunities; sometimes these meters can be borrowed from your local library. Determine if any items plugged in can be unplugged or put on a power strip with a timer. In addition to buying Energy Star computers, always try to replace desktop computers and monitors with laptops, which use significantly less energy.

Water, Sewer

The Newport City Hall and Police Station is not assessed for water and sewer use. However, installing low flow aerators on all faucets not only saves water, but also electricity for heating water. Using assumptions for water use and energy savings found in a Penn State study, Newport can save $120/yr in electrical costs by installing low flow nozzles of approximately 1.0-1.5 gpm.

The building sits on a small flat lot with much of the land either paved parking lot or building. The roof drains on the north and west side discharge to the paved area. When practical, as much water as possible should be contained on site (unless there is an area adjacent to your facility that collects and allows water to drain into soil) to reduce storm water flow to our lakes and rivers. You may want to see if changing the discharge to the small area next to the north side of the building is feasible.

Occasionally, verify that your building is water-leak free, by reading your water meter before and after a two-hour period when no water is being used. If the meter does not read exactly the same, there is a leak. Repair dripping faucets by replacing washers. A faucet, dripping at the rate of one drop per second, will waste 2,700 gallons per year. Leaking toilets can be detected by adding food coloring to the tank and checking the bowl for coloring in 30 minutes. If the toilet flush handle frequently sticks in the flush position and allows water to run constantly, replace it or adjust it. Replace the toilet flap valve if it leaks.

5: Solid Waste Management: Efficiency, Waste Prevention and Waste Reduction

Tennis Sanitation handles waste and recycle hauling. The city hall and police building is only charged $11/month. Recycling is single stream.

Many waste minimization and recycling efforts are being followed. Paper is 30% post-consumer and an eco brand of toilet paper is used. The large printer is set to duplex. iPads were purchased for the city council and planning commission and have reduced paper use. Cleaning agents are non-toxic, fluorescent bulbs are recycled, reusable items are sold on MN Bids, and electronics are recycled.

Following are guidelines for effective solid waste and recycling management. The aggregate guidelines are listed below (even though you are following many of these procedures) to provide a reminder of ways to reduce waste and environmental impact.

1. General Recycling

   1a. Appoint a recycling coordinator and/or a “green team” to monitor your recycling and environmental programs and provide on-going education.

   1b. Recycle all standard materials—office paper/newspaper/cardboard/magazines/ junk mail; bottles and cans; scrap metal; printer cartridges and other high volume recyclable materials you may generate. The more recyclables you can divert from trash dumpsters, the more you save in state and county waste management fees and taxes (17-47%).

   1c. Place recycling bins where people are; where waste will be generated.

   1d. Cluster recycling bins with trash bins (one bin for trash and one bin for each type of recyclable material you collect).

   1e. Recycling bins should be clearly marked. Simple graphics and few words are more effective than lots of words. Use consistent bins, colors and signage throughout the organization.

   1f. Monitor trash bins (dumpsters, other containers) for recyclables, which should be removed and placed in recycling bins.

2. Printers/Copiers and Mailroom

   2a. Reduce paper use by increasing two-sided copying. Set all printers and copiers to automatically print double-sided.

   2b. Reuse draft and computer paper for notes and scrap paper.

   2c. Establish policies to reduce the amount of paper used throughout the organization, e.g. 1” margins for all documents and correspondence. Distribute documents electronically for meetings, etc. as much as possible. Set the default setting on all copiers/printers and computer print drivers, set to duplex (double-sided) printing.

   2d. Use at least 50% post-consumer recycled content office and copier paper, and preferably 100% recycled content, which will not jam in copiers and printers.

   2e. Capture and reuse office supplies. Hold occasional “office clean outs” to capture folders, binders, paper clips, etc. for restocking in central supply area.

3. Supply Room/Janitor Services

   3a. Initiate an Environmentally Preferred Purchasing (EPP) program; look for ‘Green Seal’ or ‘Restore’ non-toxic soap and/or cleaners, solvents, etc., and/or use concentrates and dilute on site; look for products with recycled or

reused content, such as 100% recycled content paper and remanufactured printer cartridges, paper towels, toilet paper, etc.

3b. Ask suppliers to use reusable packaging on shipments delivered to you.

4. Kitchens/Break Rooms/Cafeterias/Conference Rooms

4a. If you operate a kitchen or cafeteria, and you generate a significant amount of food waste, consider developing a composting program. Compost on-site or work with your hauler to collect for off-site composting or food-to-animals. Unused food suitable for consumption can be given to Salvation Army, Second Harvest, food shelves, etc.

4b. Provide reusable cups, plates, trays, and silverware in all kitchens, cafeterias, conference rooms, etc.

5. Groundskeeping/Yard Waste/Brush

5a. Use mulching mowers and leave grass clippings on lawns. Establish a compost pile for grass, leaves, brush and internal plant waste from buildings.

6. Dumpsters

6a. Give reusable items away, or sell them, e.g., through the Minnesota Materials Exchange, Salvation Army, Twin Cities Free Market, Craigslist, etc.

6b. Monitor amounts in dumpsters and bins over a period of time to determine the necessity of the current pick-up frequency. If not nearly full when picked-up, revise the pick-up frequency. Evaluate whether the next size larger dumpster would allow for less frequent pick-ups. Consider contracting for "on demand" or "as needed" pick-ups, only when dumpsters or bins are full. This is especially necessary after implementing or increasing recycling and composting since there will be less trash.

6c. Work with your refuse and recycling haulers to maximize your waste and recycling systems. Periodically or at contract renewal time, consider requesting competitive bids from other local haulers. Contact MPCA about contract elements that can yield better value from your contracts.

Following are specific waste management recommendations.

Table 4: Waste Management Recommendations

Recommendations	$ Savings	Limit Landfill	Preserve Resources	Limit CO_2
1.) Consider purchasing paper towels with recycled-fiber content			X	X
2.) Reuse paper printed on one-side for draft documents, temporary notes and scrap paper.	X		X	X

$ Savings -- Potential cost savings from reduction in on-site solid waste generation leading to decreases in refuse hauler charges.
Limit Landfill -- Potential reduction in solid waste disposed in landfills or incineration facilities.
Preserve Resources – Helps preserve dwindling supplies of earth resources.
CO2 Emissions -- Potential reduction in CO2 emissions from recycling of cans, bottles, paper, etc. versus use of virgin materials; reduction in CO2 emissions and methane from incineration facilities and landfills.

6: References

Minnesota Waste Wise: **www.mnwastewise.org**
Rethink Recycling: **www.rethinkrecycling.com**
Xcel Energy: **www.xcelenergy.com**
Center for Energy and Environment: **www.mncee.org**

7: Glossary

The following definitions are given for terms used in this report*;

- **Actual Demand,** in Kw, is the highest average fifteen (15) minutes of demand over a billing period.
- **Billed Demand** or **Adjusted Demand** is actual demand plus an adjustment for low power factor.
- **Load Factor** is a measure of efficiency of using electrical power, and is the ratio of average load supplied during a designated period to the peak load occurring that period.

$$\textbf{Load Factor} = \frac{\text{Kwh used in a given time period}}{\text{Peak Kw times hours in period}}$$

- **Power Factor PF** measures how effectively your equipment uses electrical current from the utility. **PF** is a measure of how the current delivered to the equipment is converted into useful energy and is listed as a percentage. If the **PF** is below 90 percent, Xcel Energy, like many utilities, charges extra because it costs the utility more to build and operate the additional equipment to carry the extra current needed to run your equipment.
- **Adjusted Demand** = **Actual Demand** times 90/**PF**, when **PF** is < 90.
- **Kbtu** is a unit of energy equal to 1,000 btu (British Thermal Units). A **Therm** is a unit of energy equal to 100 Kbtu. A **CCF** is 100 cubic feet of natural gas. For the purposes of measuring energy use, a therm and a CCF of natural gas are equivalent.
- **Seasonal Energy Efficiency Ratio (SEER):** The SEER rating of a unit is the cooling output in BTU during a typical cooling-season divided by the total electric energy input in watt hours during the same period. The higher the unit's SEER rating the more energy efficient it is.

* From Xcel Energy, “Small Business Guide to Energy Savings”, 1999 and NSP, “How to Reduce Your Energy Costs”, 1996 with 1998 modifications for NSP.

Table 5: Bill Data Summary

	Electric						Fuel			Water		Waste			Total
Month	KwH	Kw	PF %	LF %	$'s	Cooling Deg Days	**Kbtu	$'s	Heating Deg Days	Gallons	$'s	Cu Yds	$'s		$'s
Oct-11	2,573	10		36	$268	54	13,400	$144	344						$412
Nov-11	3,017	7		54	$257	0	39,800	$332	766						$589
Dec-11	3,080	9		41	$311	0	53,000	$420	1,157						$731
Jan-12	2,806	8		50	$279	0	50,400	$389	1,285						$668
Feb-12	3,025	11		36	$315	0	44,600	$349	1,072						$664
Mar-12	2,520	10		36	$276	16	9,600	$118	522						$394
Apr-12	2,534	10		35	$265	0	8,200	$100	442						$365
May-12	2,673	12		30	$302	80	100	$60	112						$362
Jun-12	3,877	14		37	$446	236	0	$60	11						$506
Jul-12	3,960	12		45	$428	475	0	$60	0						$488
Aug-12	3,267	10		45	$362	230	0	$60	3						$422
Sep-12	2,656	10		35	$324	96	500	$62	121						$386
Total:	**35,988**	***10**	*	***40**	**$3,840**	**1,187**	**219,600**	**$2,154**	**5,835**		**$**		**$**		**$5,987**

*Average PF: Power Factor LF: Load Factor, KwH/(Kw X Hours Per Month) **100 Kbtu = 1 Therm Deg Days Normal-Heating: 7,916, Cooling: 699

Average Rates: $0.07/KwH $8.51/Kw $0.0069/ Kbtu Fuel $0/Gallon Water $0/Cubic Yard Waste

Newport Fire Station #1

Energy Water and Waste Management Assessment

Prepared For: Renee Helm, Executive Analyst
Bruce Hanson, Public Works Superintendent
John Neska, Assistant Public Works Superintendent

Report prepared by RETAP on behalf of the State of Minnesota

Assessment: January 15, 2013
Report: March 30, 2013

Client: Newport Fire Station #1

Location:

155 20th Street
Newport, MN 55055

Contacts:

Renee Helm, Executive Analyst 651-459-5677 rhelm@newportmn.com
Bruce Hanson, Public Works Supt 651-459-2475
John Neska, 651-459-2475

RETAP Assessment Team

Gordon Amundson, Follow-Up Coordinator, 651 486-2915, amund001@umn.edu
Walter(Bud) Hauser, 651 452-3432, budhauser@comcast.net
Thomas Segar, 952 888-7159, segar_t@msn.com
Clarence Chaplin, 651 695-0982, cachaplin@mac.com

Table of Contents

List of Tables

The Minnesota Retiree Environmental Technical Assistance Program conducts environmental assessments for Minnesota businesses and institutions to help **prevent pollution reduce waste and improve energy efficiency**. Support for Minnesota RETAP is provided by the Minnesota Office of Environmental Assistance (OEA). Minnesota RETAP is housed in the offices of the Minnesota Technical Assistance Program (MNTAP) at the University of Minnesota.

1: Executive Summary

Newport Fire Station #1 was assessed for energy and waste management efficiency by a team from the Minnesota Retiree Environmental Technical Assistance Program on January 15, 2013. Specific recommendations are listed below.

Table 1: Assessment Recommendations

Recommendation	Potential Savings, Annual						
	KwH	Kw	Fuel *Kbtu	Water Gallons	Waste Yds	$'s	Tons CO2
1. Seal gaps in two entry doors and 1 bay door			17,000			$133	1.0
2. Replace sixty-six 40-watt T-12 fluorescent lamps using magnetic ballasts with T-8 lamps of equivalent lumens and using electronic ballasts.	3,994	1.1				$443	2.8
3. Replace outdoor mercury lamps with LED lamps	3,070					$330	2.1
4. Shut down computer, printer and other plug loads when not in use	400					$44	0.3
5. Install low flow nozzles on all faucets				10,000		$60	0.4
6. Replace four incandescent Exit lights with LED lights	585					$66	.04
7. Replace the two Modine gas fired suspended unit heaters estimated at 70% or less efficiency with new 93% efficient heaters			69000			$541	4.1
8. Replace the Slant Fin boiler estimated at 70% or less efficiency with a new 92% efficiency boiler			22,000			$173	1.3
9. Add ceiling insulation to increase the current R18 to R40			20,700			$160	1.2
10. Consider addition of foam board insulation to the interior walls with a protective surface on the exposed area.							
11. Begin a regular preventative maintenance program on all HVAC equipment to maximize operating performance, efficiency and equipment life							
Total	8,049		128,700	10,000		$1,950	13.4

*1 Therm = 100 Kbtu

This analysis and potential savings estimates are based on utility bill data provided and on data provided for building structure, HVAC, lighting and waste management. Actual future savings will depend on weather, utility billing rates, site or operational changes, and on recommendations implemented.

2: Facilities

The City of Newport's Fire Station #1 is a 4,800 square foot building with approximately 3,500 sq. ft. bays and 1,300 sq. ft. of office space, a training room and bathrooms. The building was originally built in the 1950's with a 1976 addition. It is constructed of cement block with stucco exterior. The walls are uninsulated, bay doors are insulated and the ceiling has R18 foam insulation.

The Fire Station is normally unoccupied, except when responding to calls (approximately 45 per month), and use of the training room one night per week.

The east and west bay portions of the building are heated by two Modine gas fired unit heaters of 400,000 BTU and 150,000 BTU capacities. The office and the upper training room area are heated via an 180,000 BTU boiler and each have a 12,000 BTU window air conditioning unit for air conditioning.

3: Energy, Water, Waste Costs and Benchmarks

Annual energy and waste management bill data is presented in "Table 4: Bill Data Summary" at the end of this report. Annual totals are:

Table 2: Annual Utility Charges

	Electricity		Fuel	Water	Waste	Total
Charges:	$2,659		$3,886	$0	$0	$6,541
Rate:	$0.11/KwH	$0/Kw	$0.0078/Kbtu	$0/Gal	$0/Yd	

Newport Fire Station # 1 spends over $6,500/yr on energy and waste costs. Waste costs are minimal and Fire Station #1 is not charged for water or sewer use.

In Table 3 below, a national database operated by the Department of Energy is used to benchmark energy consumption. The benchmark is a valuable tool because it allows for a comparison of a building's energy consumption with the median energy intensity for similar building types in a similar climate zone (in this case, the northern tier of the US).

Data in the benchmark cover a 30-year period. Heating and cooling requirements are measured in degree days. The long-term trend for cooling degree days (CDD) is 699 and heating degree days (HDD) is 7916.

Utility data were collected for the period October 2011 through September 2012. For this period, cooling and heating degree days were respectively, 1191 and 5842. Compared with the long-term trend, both vary considerably from the 30-year average. This data mirrors the trend in recent years toward much warmer summers and winters. To provide a more meaningful comparison, the fuel consumption was adjusted for the lower HDD and is shown in parenthesis. The discussion below uses this adjusted benchmark for comparison to actual fuel use.

The considerably higher CDD would also impact electrical use for cooling in the summer; but it is not a straightforward calculation to adjust the benchmark for electric use, and wasn't attempted.

The benchmark shows that actual electricity use is well under benchmark. This is understandable due to the limited use of the building. The fuel (natural gas) use is considerably higher (nearly twice as high) than the benchmark. Implementing the recommendations in this report will bring the building more closely in line with the benchmark.

Table 3: Benchmarks

	KwH/Ft^2	Fuel Kbtu/Ft^2	Total Kbtu/Ft^2	$'s/Ft^2	Tons CO2
Newport Fire Station #1 Building Total	4.7	97	113	$1.36	41
*Dept. of Energy Benchmark	7.9	50 (36)	78 (64)	-	-
Building with recommendations implemented	3.0	70	81	$0.96	27.6

*Department of Energy Information Agency 2003 Building Average Data, Zone 1(Degree Days > 7000) for Education buildings.
Note: Energy Star building energy efficiency requirements can be 20% to 30% below DOE IA Benchmarks.

4: Potential Savings

Building Envelope

The building is reported to have R18 insulation in the ceiling. Adding insulation to the ceiling, if that is possible, will have minimal impact on fuel use, but is still a good strategy if the building is going to be used for a significant period. Increasing insulation to R40 assuming high efficiency heaters and boiler are installed (see below) results in fuel savings of about $160 per year. Sealing the gaps in the weather stripping on the two entry doors and the bay door is very cost effective and should be done immediately. RETAP estimates a savings of $133 per year.

It is not known whether the concrete block walls contain filler insulation. An 8 inch concrete block wall with cavities filled with perlite would have an R value of about 9. Based on temperature on the inside of the block walls RETAP believes they are probably not insulated. If the cavities are not insulated, the R value would be considerably lower (2-3). The building would benefit from additional wall insulation; however, the cost/benefit is high. RETAP does recommend, however, that an insulating contractor be consulted to determine the feasibility of adding foam insulating board with a protective interior covering.

HVAC

The two Modine unit heaters and the boiler were installed when the addition was completed in 1976.

RETAP was unable to determine the efficiency of the unit heaters. Many unit heaters are in the 80% efficiency range when new. Since one of these units is about 60 years old and the other about 40 years old, the efficiency has deteriorated and may be only 65-70%, or possibly less.

Replacing the two Modine unit heaters along with the Slant Fin boiler with high efficiency models would have saved $714 during the period studied. The savings increase to $967 for a winter equal in HDD for the 30-year trend in the benchmark. RETAP recommends that replacements be planned.

Lighting

The bay areas are lit by sixty six 40 watt, 4 foot, T-12 fluorescent lamps. Fourteen of these lamps are on 24/7. RETAP recommends replacement of the 40 watt bulbs with T-8 lamps of equivalent lumens. The magnetic ballasts used for the T-12's would be replaced with electronic ballasts. This would result in a total savings of $443 per year.

There are seven 100-watt mercury lamps on the exterior of the building which are on dusk to dawn. RETAP recommends replacing them with LED fixtures, but because this technology is new, RETAP recommends enlisting the advice of an electrical contractor with knowledge of LED lighting. Approximate savings are $330/yr. Rebates are now available for some outdoor LED lighting and information is provided in the lighting audit discussed below.

The Center for Energy and Environment (CEE) operates a lighting program for Xcel called "One-Stop Efficiency Shop". This program, funded by Xcel, is a full service rebate program available to small businesses in Xcel Energy's Minnesota service territory. CEE will perform a lighting audit, calculate savings from installing more energy efficient lighting, calculate rebate available from Xcel, and file the paperwork for you. CEE also has financing available at 3.9% for your project.

The four Exit signs with incandescent bulbs should be replaced with LED's for a savings of $66 per year.

Plug Loads - During the assessment RETAP noted a computer and printer in the office left on, presumably around the clock. There was also charging equipment left on and apparently cannot be turned off.

Typical plug loads for an office building range from 10-15% of total electric use. Fire Stations plug loads are undoubtedly less. Consider purchasing a Kill-a-watt meter ($25) to analyze loads and savings opportunities. Sometimes these meters can be borrowed from your local library. Determine if any items plugged in can be unplugged or put on a power strip with a timer. In addition to buying Energy Star computers, always try to replace desk top computers and monitors with lap tops, which use significantly less energy.

Water, Sewer

See the discussion in the City Hall and Police report.

Waste

See the discussion in the City Hall and Police report.

5: Solid Waste Management: Efficiency, Waste Prevention and Waste Reduction

See the discussion in the City Hall and Police report.

6: References

Minnesota Waste Wise: **www.mnwastewise.org**
Rethink Recycling: **www.rethinkrecycling.com**
Xcel Energy: **www.xcelenergy.com**

7: Glossary

The following definitions are given for terms used in this report*;

- **Actual Demand,** in Kw, is the highest average fifteen (15) minutes of demand over a billing period.
- **Billed Demand** or **Adjusted Demand** is actual demand plus an adjustment for low power factor.
- **Load Factor** is a measure of efficiency of using electrical power, and is the ratio of average load supplied during a designated period to the peak load occurring that period.

$$\textbf{Load Factor} = \frac{\text{Kwh used in a given time period}}{\text{Peak Kw times hours in period}}$$

- **Power Factor PF** measures how effectively your equipment uses electrical current from the utility. **PF** is a measure of how the current delivered to the equipment is converted into useful energy and is listed as a percentage. If the **PF** is below 90 percent, Xcel Energy, like many utilities, charges extra because it costs the utility more to build and operate the additional equipment to carry the extra current needed to run your equipment.
- **Adjusted Demand** = **Actual Demand** times 90/**PF**, when **PF** is < 90.
- **Kbtu** is a unit of energy equal to 1,000 btu (British Thermal Units). A **Therm** is a unit of energy equal to 100 Kbtu. A **CCF** is 100 cubic feet of natural gas. For the purposes of measuring energy use, a therm and a CCF of natural gas are equivalent.

* From Xcel Energy, "Small Business Guide to Energy Savings", 1999 and NSP, "How to Reduce Your Energy Costs", 1996 with 1998 modifications for NSP.

Table 4: Bill Data Summary

	Electric						Fuel			Water		Waste			Total
Month	KwH	Kw	PF %	LF %	$'s	Cooling Deg Days	**Kbtu	$'s	Heating Deg Days	Gallons	$'s	Cu Yds	$'s		$'s
Oct-11	1,676	0		0	$187	54	23,500	$213	344						$401
Nov-11	2,077	0		0	$223	0	77,800	$627	766						$851
Dec-11	2,052	0		0	$242	0	109,800	$855	1,157						$1,097
Jan-12	1,765	0		0	$207	0	103,700	$782	1,285						$989
Feb-12	1,850	0		0	$212	0	86,600	$650	1,072						$863
Mar-12	1,599	0		0	$186	16	22,100	$200	522						$387
Apr-12	1,518	0		0	$170	0	19,500	$158	442						$329
May-12	1,443	0		0	$166	80	5,200	$81	112						$248
Jun-12	2,676	0		0	$330	236	2,200	$69	11						$400
Jul-12	2,250	0		0	$281	475	1,900	$68	0						$350
Aug-12	1,968	0		0	$248	230	2,500	$72	3						$321
Sep-12	1,584	0		0	$200	96	9,000	$105	121						$305
Total:	**22,458**	***0**	*	***0**	**$2,659**	**1,187**	**463,800**	**$3,886**	**5,835**		**$**		**$**		**$6,541**

*Average PF: Power Factor LF: Load Factor, KwH/(Kw X Hours Per Month) **100 Kbtu = 1 Therm Deg Days Normal-Heating: 7,916, Cooling: 699

Average Rates:	$0.11/KwH	$0/Kw	$0.0078/ Kbtu Fuel	$0/Gallon Water	$0/Cubic Yard Waste

Newport Fire Station No. 2

Energy Water and Waste Management Assessment

Prepared For: **Renee Helm, Executive Analyst**
Bruce Hanson, Public Works Superintendent
John Neska, Assistant Public Works Superintendent

Report prepared by RETAP on behalf of the State of Minnesota

Assessment: January 15, 2013
Report: March 18, 2013

Client: Newport Fire Station No. 2

Location:

973 Glen Rd
Newport, MN 55055

Contacts:

Renee Helms, Executive Analyst 651-459-5677 rhelm@newportmn.com
Bruce Hanson, Public Works Supt 651-459-2475
John Neska, 651-459-2475

RETAP Assessment Team

Gordon Amundson, Follow-Up Coordinator, 651 486-2915, amund001@umn.edu
Walter(Bud) Hauser, 651 452-3432, budhauser@comcast.net
Thomas Segar, 952 888-7159, segar_t@msn.com
Clarence Chaplin, 651 695-0982, cachaplin@mac.com

Table of Contents

List of Tables

The Minnesota Retiree Environmental Technical Assistance Program conducts environmental assessments for Minnesota businesses and institutions to help **prevent pollution, reduce waste and improve energy efficiency**. Support for Minnesota RETAP is provided by the Minnesota Office of Environmental Assistance (OEA). Minnesota RETAP is housed in the offices of the Minnesota Technical Assistance Program (MNTAP) at the University of Minnesota.

1: Executive Summary

Newport Fire Station No.2 was assessed for energy and waste management efficiency by a team from the Minnesota Retiree Environmental Technical Assistance Program on January 15, 2013. Specific recommendations are listed below.

Table 1: Assessment Recommendations

Recommendation	Potential Savings, Annual						
	KwH	Kw	Fuel *Kbtu	Water Gallons	Waste Yds	$'s	Tons CO2
1.) Replace suspended unit heater with high efficiency model	0	0	25,300	0	0	$210	1.5
2.) Install new door seals on both bay doors and entrance door	0	0	15,000	0	0	$120	1.3
3.) Replace outdoor halogen lamp with LED	770	0	0	0	0	$80	1.0
4.) Add insulation to ceiling	0	0	6,400	0	0	$55	0.4
5.) Replace T12 lighting with 25 watt T8 lamps	150	0	0	0	0	$15	0.1
6.) Replace incandescent exit light fixture with LED fixture	150	0	0	0	0	$15	0.1
7.) Replace outdoor incandescent with CFL	170	0				$18	0.1
8.) Begin a regular preventative maintenance program on HVAC equipment to maximize operating performance, efficiency, and equipment life							
9.) Find an efficient lamp replacement for 1500 watt halogen security light							
Total:	**1,240**		**46,700**			**$513**	**4.5**

*1 Therm = 100 Kbtu

This analysis and potential savings estimates are based on utility bill data provided and on data provided for building structure, HVAC, lighting and waste management. Actual future savings will depend on weather, utility billing rates, site or operational changes, and on recommendations implemented.

2: Facilities

Fire Station No.2 was built in the 1960's and is pole barn construction with painted steel panel exterior. Interior walls are covered with painted chip board. The building is 1415 square feet with two bay doors, a bathroom, suspended gas unit heater, and one small (three-five gallon) electric water tank. The building is not air conditioned.

Between the two fire stations, the Newport volunteer fire department responds to about 90 calls per month.

3: Energy, Water, Waste Costs and Benchmarks

Annual energy and waste management bill data is presented in Table 4: Bill Data Summary, at the end of this report. Annual totals are:

Table 2: Annual Utility Charges

	Electricity		Fuel	Water	Waste	Total
Charges:	$808		$1,259			$2,063
Rate:	$0.125/KwH	$0/Kw	$0.0093/Kbtu	$0/Gal	$0/Yd	

The fire station is not charged for water or waste. Total energy costs are $2,063 for the period analyzed. This period, from October 2011 through September 2012 was a mild winter and a hot summer, a trend that has become the norm in recent years.

Electric consumption, reflecting the building's light use, is significantly below the benchmark (see Table 3 below); while fuel is significantly above benchmark. Normalizing the benchmark for the mild winter of 2011-12, reduces energy intensity from 50 Kbtu/Ft2 to 36 Kbtu/Ft2 (see values in parenthesis in Table 3); resulting in a less favorable comparison to the benchmark.

Implementing the recommendations provided in this report reduces the building's energy intensity from 90Kbtu/ft2 to 68Kbtu/ft2. While fuel consumption is still high, the low electric use does bring the overall energy intensity close to the benchmark of 63Kbtu/ft2. Because the building's electric use is so much lower than the benchmark, overall energy costs are in line with the benchmark; and with recommendations implemented, significantly below benchmark. An Energy Star building uses 20-30% less energy than the benchmark. For the period evaluated, an Energy Star building would consume approximately 47 Kbtu/ft2.

Table 3: Benchmarks

	KwH/Ft^2	Fuel Kbtu/Ft^2	Total Kbtu/Ft^2	$'s/Ft^2	Tons CO2
Fire Station No.2 Building Total	4.3	90	104	$1.46	11.0
*Department of Energy Benchmark	7.9	50 (36)	77 (63)	$1.55 ($1.42)	12.0 (10.0)
Building with Recommendations Implemented	3.2	57	68	$.99	6.5

*Department of Energy Information Agency 2003 Building Average Data, Zone 1(Degree Days > 7000) for Education buildings. Note: Energy Star building energy efficiency requirements are 20% to 30% more stringent than DOE IA Benchmarks.

4: Potential Savings

Building Envelope

The building is reported to have R18 insulation in the walls and R21 in the ceiling. Adding insulation to the ceiling, if that is possible, will have a minimal impact on fuel use; but is still a good strategy if the building is going to be used for a significant period. Increasing insulation to R40, assuming a high efficiency unit heater is installed (see below), results in fuel savings of about $55/yr for the study period ($75 for a normal winter).

Installing high quality weather stripping on both bay doors and the entrance door is very cost effective and should be done immediately. RETAP estimates a savings of $120 ($165 for a normal winter).

HVAC

RETAP was unable to determine the efficiency of the unit heater. Many unit heaters are in the 80% efficiency range when new. Since this unit is about 50 years old, the efficiency has deteriorated and may be only 65-70%, or even less. RETAP recommends the unit heater be replaced with a high efficiency model. Replacement with a 92% efficient unit, assuming a current efficiency of 70%, reduces energy use by 24% or $210/yr. Savings assumes you first replace the weather stripping on both bay doors and the entrance door and add ceiling insulation. For a "normal" winter, fuel savings increases to $280/yr.

A preventative maintenance schedule should be instituted to insure that the unit heater operates at maximum efficiency. A good preventative maintenance program will pay for itself in lower energy costs.

Implementing the above changes - adding insulation, replacing the weather stripping, and installing a high efficiency unit heater – reduces the building's fuel energy intensity by 33 Kbtu/Ft2; or from 90 Kbtu/Ft2 to 57 Kbtu/Ft2. As you can see in Table 3, this still is above the weather normalized benchmark (36 Kbtu/Ft2). It is possible that the unit heater is operating at very low efficiency, and replacing it will have even larger savings than is estimated in this report.

Bay doors are closed both for security and energy savings when the crew responds to a call. If the doors are open for long periods, this could explain a portion of the high fuel use. Installing a thermostat with a locking feature, will insure building is operated at the desired temperature.

Staff should use the opportunity provided by this report to review with the fire department crew both the high fuel use and energy efficiency in general. They may have ideas why the fuel consumption is high. And by focusing attention to energy use, behaviorial changes alone may result in significant fuel savings.

Newport is also using the B3 website to track their energy use. This database can weather normalize both fuel and electric use and is an excellent resource for monitoring ongoing energy consumption. After making the above efficiency improvements, Newport will be able to see their impact on energy; and will be in a better position to look for remaining contributors, if any, to high fuel consumption.

In summary, estimated fuel savings of $385 for the period studied, increases to $520 for a winter typical of the 30 year benchmark. Newport should keep this in mind when deciding whether to implement the energy and savings recommendations.

.

Lighting

The interior is lit by T12 fluorescent fixtures with magnetic ballasts. These should be replaced with more efficient T8 lamps and electronic ballasts. Standardizing all three facilities on 4 foot, 25 watt T8 lamps will simplify bulb replacement and may result in some savings on bulb purchases. It is recommended that an occupany sensor be installed with the new lighting to prevent lights being left on.

The incandescent exit sign should be replaced with LED; and the outdoor 24 hour fire lamp replaced with a CFL.

The mercury dusk to dawn light should be replaced with LED. Savings for this one bulb is approximately $80/yr.

RETAP was unable to find a suitable replacement for the 1500 watt halogen dawn to dusk bulb. Since it is costing you approximately $700/yr. to operate this one light, high priority should be placed on finding a replacement. RETAP has asked CEE to investigate; and, if you decide to use them for your lighting assessment, they may have a replacement by the time you contact them. For more information on CEE, see the City Hall and Police Report.

Water, Sewer

See discussion in the City Hall and Police Report.

Waste

See the discussion in the City Hall and Police Report.

5: **Solid Waste Management: Efficiency, Waste Prevention and Waste Reduction**

See the discussion in the City Hall and Police Report.

6: References

Minnesota Waste Wise: **www.mnwastewise.org**
Rethink Recycling: **www.rethinkrecycling.com**
Xcel Energy: **www.xcelenergy.com**

7: Glossary

The following definitions are given for terms used in this report*;

- **Actual Demand,** in Kw, is the highest average fifteen (15) minutes of demand over a billing period.
- **Billed Demand** or **Adjusted Demand** is actual demand plus an adjustment for low power factor.
- **Load Factor** is a measure of efficiency of using electrical power, and is the ratio of average load supplied during a designated period to the peak load occurring that period.

$$\textbf{Load Factor} = \frac{\text{Kwh used in a given time period}}{\text{Peak Kw times hours in period}}$$

- **Power Factor PF** measures how effectively your equipment uses electrical current from the utility. **PF** is a measure of how the current delivered to the equipment is converted into useful energy and is listed as a

percentage. If the **PF** is below 90 percent, Xcel Energy, like many utilities, charges extra because it costs the utility more to build and operate the additional equipment to carry the extra current needed to run your equipment.

- **Adjusted Demand** = **Actual Demand** times 90/**PF**, when **PF** is < 90.
- **Kbtu** is a unit of energy equal to 1,000 btu (British Thermal Units). A **Therm** is a unit of energy equal to 100 Kbtu. A **CCF** is 100 cubic feet of natural gas. For the purposes of measuring energy use, a therm and a CCF of natural gas are equivalent.

---

* From Xcel Energy, "Small Business Guide to Energy Savings", 1999 and NSP, "How to Reduce Your Energy Costs", 1996 with 1998 modifications for NSP.

Table 4: Bill Data Summary

	Electric						Fuel			Water		Waste			Total
Month	**KwH**	**Kw**	**PF %**	**LF %**	**$'s**	**Cooling Deg Days**	****Kbtu**	**$'s**	**Heating Deg Days**	**Gallons**	**$'s**	**Cu Yds**	**$'s**		**$'s**
Oct-11	530	0		0	$67	54	6,700	$76	344						$143
Nov-11	693	0		0	$82	0	28,000	$236	766						$319
Dec-11	629	0		0	$82	0	25,300	$215	1,157						$298
Jan-12	554	0		0	$73	0	28,700	$232	1,285						$305
Feb-12	517	0		0	$67	0	23,000	$189	1,072						$257
Mar-12	552	0		0	$72	16	6,000	$70	522						$142
Apr-12	397	0		0	$53	0	4,900	$57	442						$110
May-12	369	0		0	$51	80	1,200	$37	112						$88
Jun-12	406	0		0	$59	236	700	$35	11						$95
Jul-12	418	0		0	$61	475	700	$35	0						$97
Aug-12	509	0		0	$72	230	700	$35	3						$108
Sep-12	447	0		0	$64	96	1,000	$37	121						$101
Total:	**6,021**	***0**	*****	***0**	**$808**	**1,187**	**126,900**	**$1,259**	**5,835**		**$**		**$**		**$2,063**

*Average PF: Power Factor LF: Load Factor, KwH/(Kw X Hours Per Month) **100 Kbtu = 1 Therm Deg Days Normal- Heating: 7,916, Cooling: 699

Average Rates: $0.125/KwH $0/Kw $0.0093/ Kbtu Fuel $0/Gallon Water $0/Cubic Yard Waste