Facility Assessment Report
City of Bellingham RCM – Civic Field Sportsplex

Facility Address: 1225 Civic Field Way.

City of Bellingham Contact:
Myron Carlson, Public Works Facilities Manager
210 Lottie Street, Bellingham WA, 98225
mhc@cob.org
(360) 778-7830

Community Energy Challenge Contact: Sustainable Connections
Jordan Beaudin, Energy Management Engineer
jordan@sustainableconnections.org
(360) 647-7093 x103

Report Overview

On June 6, 2016 Sustainable Connections performed a facility assessment at the Bellingham Sportsplex in order to identify opportunities to reduce energy usage and costs and improve building systems. This assessment was conducted as part of the Resource Conservation Management Services (RCMS) program between the City of Bellingham and Sustainable Connections that began in April 2016.

As you are aware, the costs of maintaining a joint ice rink and indoor soccer facility are quite high. In this case they are due almost exclusively to the large amounts of energy that are required to maintain your indoor ice rink. To a large extent these costs are unavoidable and a necessary cost of providing a valuable community service like this. In general, indoor ice rink facilities are some of the largest users of energy around. When operating there is a constant requirement to cool the ice sheet and keep it at optimal temperatures. There is also a constant requirement to maintain environmental conditions in the arena that prevent fogging and condensation on indoor surfaces. Accompanying this are the requirements to regularly surface the ice with hot water, the needs to keep certain spaces adequately heated, and the requirements to ventilate the space to remove contaminated air when required. With this, at nearly all times you are running refrigeration, dehumidification, heating and ventilation equipment. In order to compensate for these high usage costs, you are not heating your spectator spaces, keeping your office space at low temperatures during the winter and delaying the purchase of upgraded seating in your ice rink area. Even though you have made prior investments in energy efficiency, we believe that there are still opportunities to lower your energy costs in this building, and ideally this could free up funds for some of the planned improvements that you would like to make.

The needs of an ice rink facility are well known and there are a number of ways to reduce usage and run a facility that is highly efficient. Under the direction of your knowledgeable refrigeration contractor and facilities staff, a lot of these measures have already been done at your facility and you are currently seeing the benefits. Specifically, you are using a large amount of the heat rejected from your refrigeration system to heat your re-surfacing water, your domestic hot water, and the heated water used to occasionally warm the ground under your rink to prevent frost heaving. You are also varying the speed of your coolant pump based on cooling needs and allowing the ice temperature to rise at times when it is acceptable. While additional usage cost savings could be possible through the installation of higher efficiency refrigeration equipment and heat recovery on your ventilation system, these options are not economically feasible at this time.

While there are not any cost effective options to reduce your usage through adjustments to your refrigeration system, we believe that there are still some good opportunities to reduce your energy usage and improve the condition of the building. This can be accomplished through modifications to the building shell and installation of higher efficiency heating and lighting equipment. Adding a rainwater collection system to reduce your water usage is also an option for you to reduce costs. Since upgrades to the roof and ceiling system are already planned, adding these efficiency measures into this project should be possible at a reasonable cost.

In the report below I have listed the opportunities for improvements in this facility. The measures are listed in approximate order of highest to lowest savings potential. Where possible we have tried to provide an estimate of the potential savings and implementation costs. Where specific costs are unknown, high equals $1000 or more and low equals less than $1000. We have also listed the expected payback period for each measure. Potential savings are based on estimated annual run hours and your average usage costs. Where applicable, we have also listed any utility rebates that you are eligible for. In some cases though, accurate estimates may only be possible with a detailed analysis based on contractor bids for the work to be performed. If projects requiring a more detailed analysis are pursued, we can help with those calculations at that time.

Recommendation Overview

No.	Measure	Estimated Cost	Rebate	Estimated Annual Savings Amount	Estimated Payback Period
1	Install Low-E Ceiling in Ice Arena	$30,000	Yes	$3870	5 Years
2	Plan for Replacement of T-8 Lighting	$10,000	Yes	$1500	7 Years
3	Install Rainwater Collection System	$27,000	Yes	$940	30 Years
4	Replace Exterior Metal Halide Lights With LED	$2,000	Yes	$715	3 Years
5	Plan for Installation of High Efficiency Furnace Units	High	Yes	$525	5 Years
6	Properly Set Thermostats	Free	No	10% HVAC Costs	0 Years
7	Upgrade Insulation and Vapor Barrier When Installing New Roof	TBD	No	TBD	TBD

Estimated Retrofit Benefits

Energy Reduction	7%	Annual Savings	$7550

If all measures were implemented, we estimate that it would reduce your energy use by at least 7% and result in savings of at least $7550 per year.

Facility Description

Built in 1997 | 79,135 Total square feet

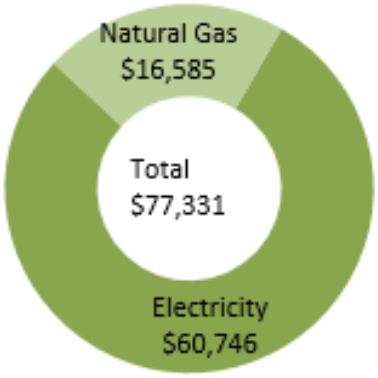
This facility is broken up into two main areas, with smaller support spaces in between. The north half of this building contains two indoor soccer fields, a larger one with bench and spectator areas and a smaller one without any accessory spaces. The south area of the building contains an ice rink with a spectator area, locker rooms, and small assembly rooms. This area also has a garage space for the ice treatment equipment and a mechanical room for the rink refrigeration system. Between these spaces is an office area, front counter area, and concession spaces.

Energy Usage Information

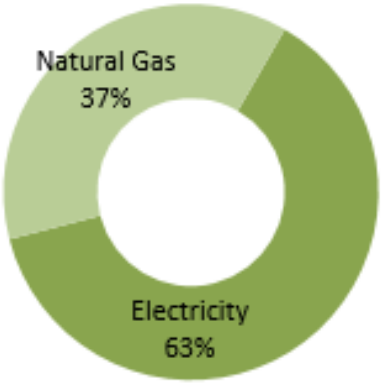
2015 Total Annual Electric Usage: 954,564 kWh
2015 Total Annual Gas Usage: 19,430 Therms
2015 Energy Use Intensity: 66 kBtu/sqft/yr
2015 Carbon emissions: 1,038,196 lbs CO2/yr
2013-2015 Average Water Use for Ice Sheet Resurfacing: 1,237,000 Gallons, $5,879 Usage Costs

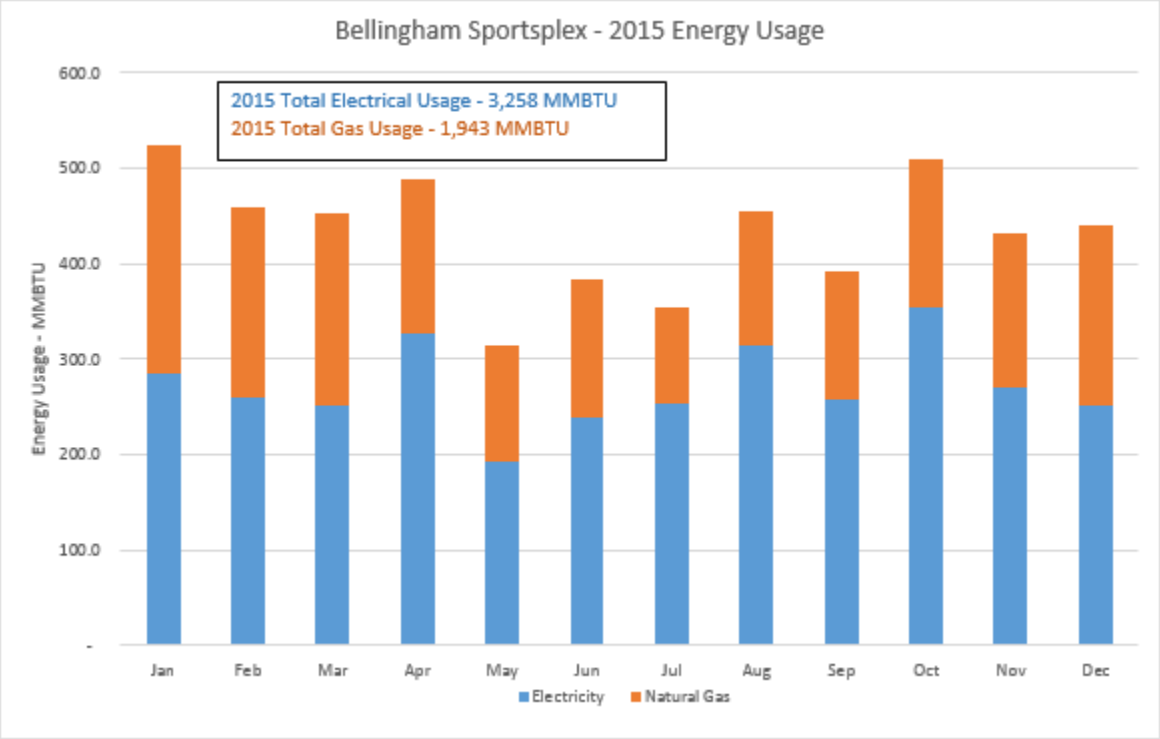
The charts below give graphical representations of your annual and monthly energy usage and costs at this facility. In 2015 you used 24% more energy in the form of electricity. Your electricity costs were nearly 5 times as much as your gas costs.

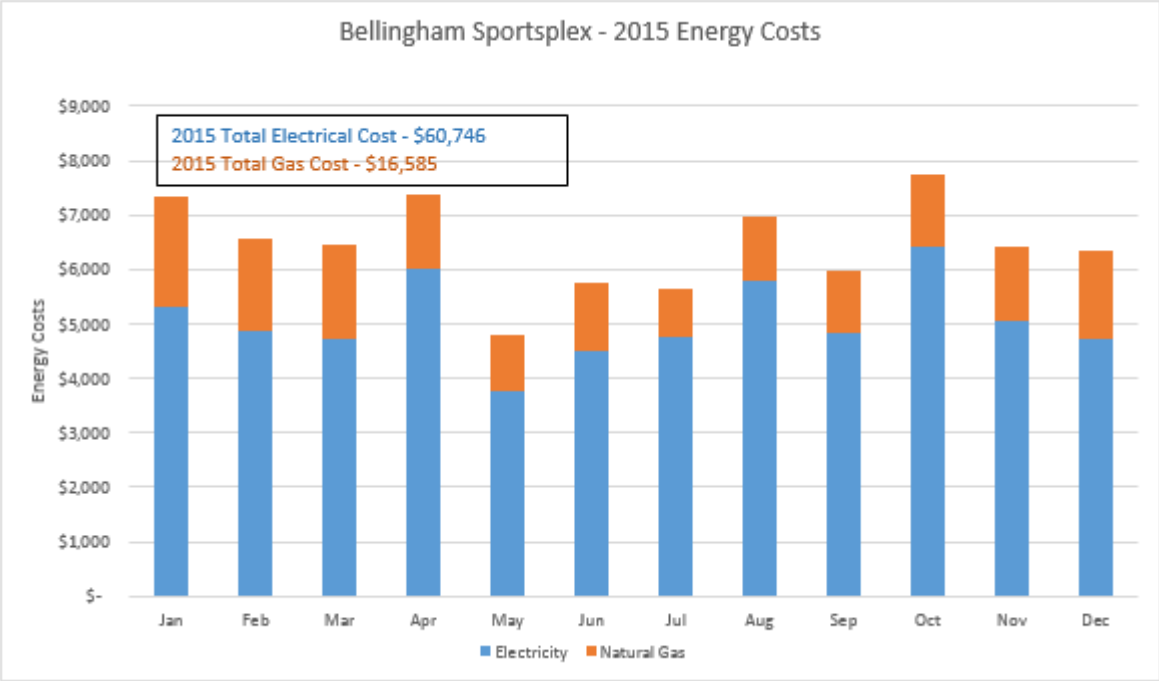
2015 Energy Costs



2015 Energy Usage







Benchmarking

EUI Rating: To benchmark the performance of a building and set a baseline for future changes in energy use we use a measure called the Energy Use Intensity (EUI). The EUI expresses a building's energy use as a function of its size without any adjustments for climate or occupancy.

For 2015 we calculated your EUI at 65 kBtu/sqft/yr. For a facility like yours with large energy requirements this is not a very high number. This represents the prior energy reduction work that you have done on your ice rink refrigeration system and installing efficient lighting. It also represents the fact that most of this building is currently not heated or cooled. We believe that there are a still some upgrades that could be made to this building that would further reduce your energy usage.

Next Steps

Let me know if you have any interest in pursuing any of the recommendations listed in this report and we can assist with contacting contractors and calculating rebate amounts. We would also be happy to look over any proposals that you might receive for work to be performed, and can offer bid comparison services if needed. We also have experience securing financing for projects that lower energy usage, and we can assist you if you would like to pursue this option.

Please feel free to contact me with any questions or comments.

Jordan Beaudin
Energy Management Engineer
Sustainable Connections
jordan@sustainableconnections.org
(360) 647-7093 x103 (Office)
(360) 393-9584 (Cell)

Recommendations

The list below gives the specific details of the energy cost saving measures that were given above. The recommendations are listed below in order of highest to lowest estimated cost savings.

No	RECOMMENDATION	COMMENTS
1	**Install Low Emissivity Ceiling in Ice Arena When Installing New Roof Structure**	Studies performed by the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (AHSRAE) have found that on average the largest energy use of an ice rink refrigeration system is for removing heat that is added to the ice sheet through radiation from the ceiling and walls. In their studies, the energy use for this function comprises about 28% of the total refrigeration load, or about twice as much as any other load on the system. Installation of a low emissivity (Low-E) ceiling can significantly reduce the amount of heat that is radiated to the ice sheet. Their studies show installation of a Low-E ceiling can reduce the costs of a refrigeration system by about 15%, depending on the exterior and interior environmental conditions. As an additional benefit, Low-E ceilings also improve lighting levels and quality, reduce moisture and condensation issues, and improve acoustics and building appearance. Since installation of this ceiling system could be combined with the roof and insulation replacement project, we expect that the additional costs for this installation would be reasonable **Estimated Costs**: The typical costs before any rebates are factored in for installing a Low-E ceiling above an ice rink is about $30,000. Including this work with the roof replacement project would lower the installation costs. **Estimated savings**: In your building we estimate the refrigeration load to cost about $25,800 per year. 15% savings on this amounts to $3870 per year. **Rebate/Incentive**: PSE currently offers custom rebates of up to $.30/kWh saved on projects that reduce electricity consumption. The installation of a Low-E ceiling would be eligible for a custom rebate that could be calculated based on the specifics of the type of ceiling system proposed. We estimate that the PSE rebate would be at least $10,000. **Contractor Recommendation**: Hi-Pro Sporting Goods in Vernon BC is a BC Hydro Approved contractor with experience installing these systems. Their contact information can be found at the end of this report.
2	**Consider Replacing Interior T-8 Fixtures with LEDs when T-8 Bulbs and Ballasts Begin to Fail**	About 10 years ago you replaced your existing interior lights with T-8 fixtures with occupancy sensors. Although the savings were likely minimal compared to the overall amount of energy you use in this facility, you have undoubtedly been receiving the benefit of this replacement for many years.  Lighting technology is constantly being improved, and there are currently LED products on the market that offer improved light quality, longer bulb life, and lower usage costs. These types of lights are currently being installed in many sports facilities due to the benefits that they offer. Since the labor costs to install LED fixtures are about half of the total replacement cost, you may want to consider upgrading to LEDs if you reach a point where you are starting to consistently notice failed T-8 bulbs and/or ballasts or your lights need to be removed or adjusted as part of the upcoming roof project. Specific benefits of LED lighting include: - Possible to dim for events with lower lighting needs. - Longer life – many LEDs are rated at up to 100,000 hours, compared to a typical 40,000 hour fluorescent lamp and ballast life. - Reduced energy consumption – LEDs use about 50% of the energy that T-8s do.

No	RECOMMENDATION	COMMENTS
		Estimated Costs: We estimate that the cost to replace all interior lights after all utility rebates are factored in would be about $10,000. **Estimated Savings**: We estimate that replacing your interior lights with LED lights would save you about $1,500/year. **Rebate/Incentive**: PSE currently offers rebates of $0.20/kWh saved for lighting improvement projects, up to 70% of the total project cost. **Contractor Recommendation**: Evergreen Lighting is a local contractor that we have worked with in the past. Their contact information is given at the end of the report.
3	**Install a Rainwater Collection System for Your Ice Resurfacing Water**	During our visits it was mentioned by both the maintenace and management staff that one of the largest expenses in operating this facility is the cost of water used for resurfacing the ice sheet. The billing history on the water account that is labeled as being for ice treatment indicates that you use about 1.2 million gallons of water per year for resurfacing, at an average annual cost of $5880. While on site your maintenance manager also mentioned that he sees the possibility of installing a rainwater collection system that could collect rainwater and use it for treating the ice.  With the upcoming project to replace the roof you have a unique opportunity to install a system like this that could capture thousands of gallons of water per year and offset some of the costs of resurfacing. If you were to collect just 1" of rainwater from 8,000 square feet of roof (you have about ten times this amount of roof area at your facility), it would give you about 5000 gallons of water. In Bellingham we get about 35 inches of rain per year. Although the payback period for a rainwater collection system is not very attractive, a similar project to this was recently completed in Abbottsford BC, and they have been seeing very positive results. Along with the reduced costs from lower water usage, using rainwater for re-surfacing has also been found to result in a clearer, harder ice sheet that requires less refirgeration due to the absence of the chemicals that are added to municipal water. **Estimated Costs**: A rough estimate of the cost to install a rainwater collection system at your facility before any rebates are factored in is $30,000. If this were included with the roof replacement project the costs could be lower than this. **Estimated savings**: If a system similar in size to what was constructed at the Abbotsford arena were installed (12,000 square feet of roof area harvested with a 4000 gallon storage tank), we estimate that the cost savings from reduced water usage could amount to about $940 per year. Note that his amount is highly dependent on the amount of roof area connected to the system and the size of the storage tanks. **Rebate/Incentive**: The City of Bellingham Water Conservation Program can offer an incentive of $3000 to help finance this project. **Contractor Recommendation**: Barr Plastics was the supplier of the Abbottsford system and can assist with design of the rainwater collection and associated systems that will be required. They are also willing to give a tour of similar systems installed in the area.Their contact information can be found at the end of this report.

No	RECOMMENDATION	COMMENTS
4	**Replace Exterior Metal Halide Lights with LEDs.**	The exterior of your facility is currently lit by older metal halide lights. We recommend replacing these with LED fixtures. This offers the following advantages: - Reduce energy use by about 85% - More uniform light distribution - Improved color rendition - Reduced maintenance due to longer bulb life  **Estimated Costs:** We estimate that the cost to replace all exterior lights after all utility rebates are factored in would be about $2000. **Estimated Savings**: We estimate that replacing your exterior lights with LED lights could save you up to $715/year. **Rebate/Incentive**: PSE currently offers rebates of $0.20/kWh saved for lighting improvement projects, up to 70% of the total project cost. **Contractor Recommendation**: Please see the contact information for Evergreen Lighting at the end of the report.
5	**Install High Efficiency Furnaces When Existing Units Need Replacement**	The furnaces that serve your office and meeting and equipment rooms are older and nearing the end of their service life (the locker room units were recently replaced). Since all of the heated spaces in your building are inside of or adjacent to a refrigerated arena, you likely have high run times on all of your heating equipment. When it comes time to replace these units we would suggest that you look into replacing them with a higher efficiency model that will have lower operating costs and will save you money in the long run. On average, a standard 80% efficient Lennox furnace costs about $3000, and a similarly sized 96% efficient Lennox furnace costs about $4500. Although 50% more expensive to purchase, the higher efficiency unit costs about 17% less to operate and will result in siginificant cost savings over it's lifetime. In your building we estimate that you spend about $6350 on heating every year. We expect that about half of this goes to heating your office and meeting and equipment rooms. With this usage the additional costs of higher efficiency furnaces would payback in about 5 years when you factor in the available utility rebates. Since the expected lifetime of these units is about 20 years, you will save significant amounts of money over the long run. We suggest talking to your HVAC contractor about upgrading the furnaces to high efficiency units when they need replacement. **Estimated Costs**: We estimate that the additional equipment costs of installing high efficiency furnaces before any rebates are factored in is about 50% above the costs of standard efficiency furnaces. **Estimated savings**: We estimate that the cost savings from installing high efficiency furnaces in your office and meeting and equipment room areas would be about $525 per year. **Rebate/Incentive**: Cascade Natural Gas currently offers an incentive of $3.00 per kBTU/hr when you install a high efficiency furnace.
6	**Maintain Proper Settings on Thermostats**	In this building the only areas that you are currently heating are your office and front desk areas, the locker rooms, and the meeting and equipment rooms. The heat in all of these spaces are controlled through programmable thermostats. At the time of our visit the thermostat in the office space was not set to match the occupied schedule and was not set up with a proper unoccupied set point. These settings may have been erased during recent power outages. Your facilities manager also noted that he often notices the locker rooms are very warm when he arrives in the morning, as if they are heating very early in the morning. 

No	RECOMMENDATION	COMMENTS
		Since you already have programmable thermostats in place, there is no reason that you should not utilize these to reduce your costs. For efficient operation we recommend the following: 1. Verify the correct time and day of week. 2. Check the schedule quarterly in the thermostat to ensure it matches occupancy. 3. Verify reasonable temperature set points. o Heating: 68-70ºF (occupied); 58ºF (unoccupied) 4. If occupants are making unwelcome changes, lock thermostats to prevent tampering (use the built-in lock feature or install a plastic lock box). 5. Keep the batteries fresh. **Estimated savings**: We estimate that improperly set thermostats could be resulting in equipment operating costs at 10% higher than needed.
7	**Upgrade Insulation and Vapor Barrier When Installing New Roof Structure**	The insulation and vapor barrier in your ceilings has been damaged by moisture that has been leaking through the roof and from flying hockey pucks and soccer balls. In it's current condition it is causing poor occupant comfort in the office and indoor soccer spaces and allowing moisture to condense in the ceilings, leading to additional water drips into the space and further damaging the insulation. It could also be leading to high refrigeration costs in the ice arena. Since you are already looking into replacing the roof, it makes sense to also repair this insulation and vapor barrier at this time, and possibly upgrade it to better suit the environments it serves. If the roof replacement leads to work on the walls, it would also be a good opportunity to upgrade the insulation and vapor barrier there as well.  Since the indoor soccer area is essentially not conditioned, it is hard to justify a large investment in additional insulation at this time. The more insulation you are able to add though, the higher the occupant comfort will be during all seasons. With increased insulation you will also reduce your exhaust fan use in the summer, and may find that it makes sense to heat this space in the future. The ice arena is a very unique area, and the insulation and vapor barrier needs for this space are different from the needs of the indoor soccer area. Although it would seem to make sense to add as much insulation to the walls and ceilings as possible in order to keep the space cold, in many cases insulating to very high values has lead to condensation issues on ceiling surfaces. Due to the large temperature and humidity differences that exist between the air in the space and the outside air, extra care must be taken to install an effective vapor barrier between the roof structure and the space to prevent condensation. This vapor barrier should be robust to stand up to abuse from balls and pucks. Design studies have shown that thoroughly sealing the roof assembly to prevent outside air from leaking in to the building and ultilizing rigid foam for the insulation have resulted in good performance. Since the needs of these types of spaces are well known, an experienced architectural firm should be able to specify an appropriate insulation and vapor barrier system for this building. We would suggest that you request applicants' experience with this type of building in your request for a proposal.

General Energy Saving Tips	**Set up Computers and Printers for Duplex Printing**	Set up all computers to print double-sided as a default if the printer allows. Computer users can always change the setting for occasional print jobs as needed, but this default will save paper and reduce your trash and recycling volumes. Make this setting in the **Printers and Faxes dialog box** accessed from the Start menu or the Control Panel.
	Purchase Energy Star® Labeled Computers and Office Equipment	Energy Star® labeled equipment uses 20-30% less energy, and uses less power when off (phantom load), saving you energy and money even when it's turned off! Establish a company policy to buy only Energy Star® equipment

Contractor Information

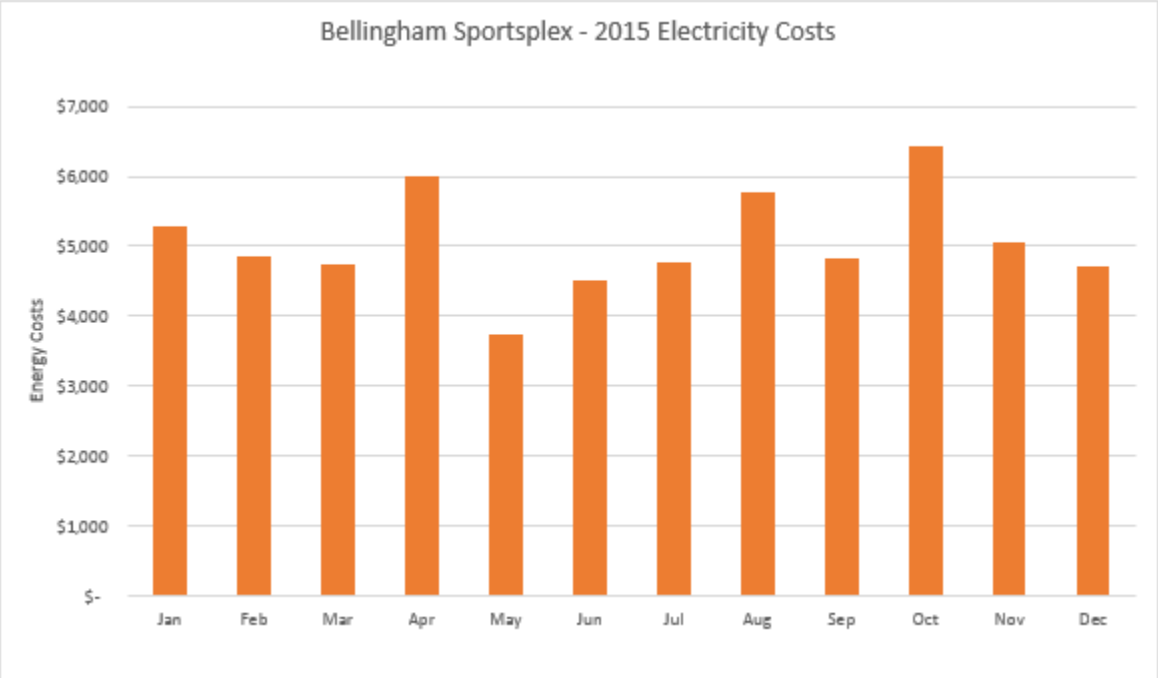
Evergreen Lighting
Corey Carter
360-201-7898
corey@evergreenlight.net

Hi-Pro Sporting Goods
Brendan Miller
250-542-4224
brendanmiller@hiprosports.net

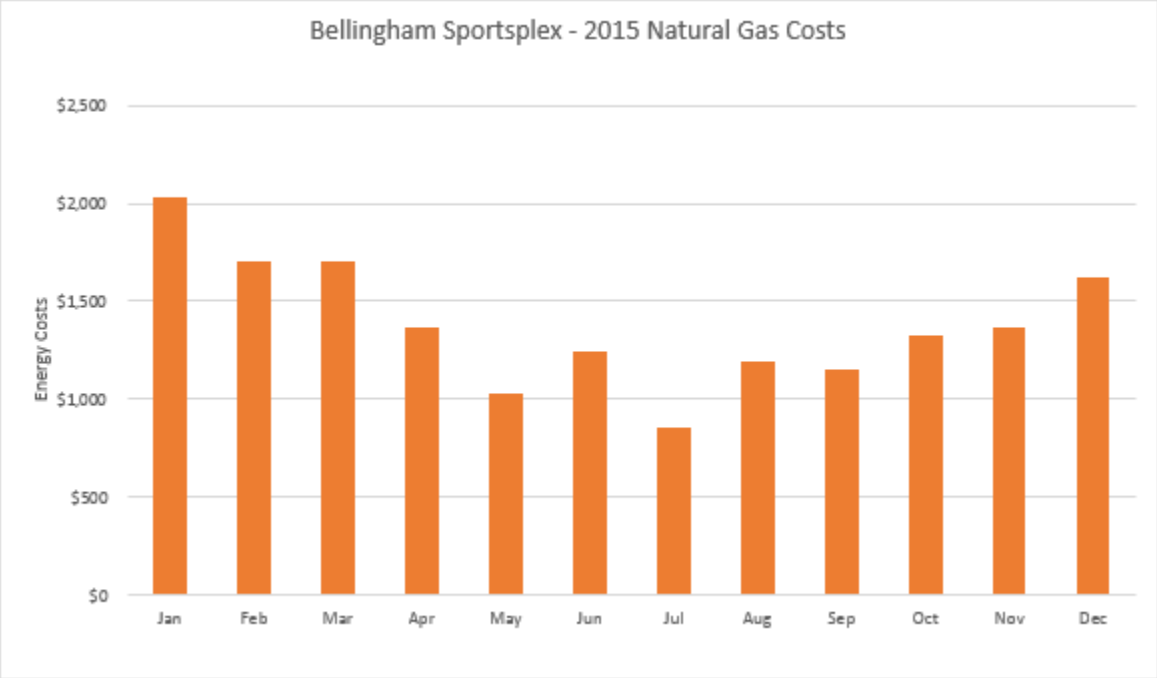
Barr Plastics
Dean Barret
604-743-0225
dean@barrplastics.com

Appendix

Here are some charts showing more details on energy usage in your buildings.



The chart above shows your electricity usage for 2015. The monthly differences likely represent variations in ice rink refrigeration needs.



The chart above shows your natural gas usage for 2015. Since you have high usage costs even in the warmer months of the year, it shows that a large part of your natural gas usage is from the operation of your dehumidification system and that you are also doing some heating of the spaces in the ice arena area during the summer.

Many thanks to the Sustainable Connections Energy Program Business Sponsors!