Heating the Patio at The Perch Restaurant: A Triple Bottom Line Assessment of Patio Heating Technologies

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UBC Social Ecological Economic Development Studies (SEEDS) Student Report

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A Triple Bottom Line Assessment of Patio Heating Technologies

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Executive Summary

The Alma Mater Society (AMS) of the University of British Columbia has nearly completed the construction of the new Student Union Building (SUB), located on UBC's Vancouver campus. The Perch restaurant, located in the new SUB, will provide students and visitors with healthy and environmentally responsible fare. Keeping with UBC's image as a leader in sustainability, the AMS requested that select students research into sustainable heating solutions for the Perch restaurant's rooftop patio, which would allow the Perch to expand patio sales periods, both daily and seasonal.

Given various restraints, including structural and power access limitations, our team has proposed two alternatives to traditional freestanding propane heaters: freestanding electric heaters, and a radiant floor heating system. Each of the three options is assessed according to their triple bottom line attributes: economic feasibility, environmental impact, and social reception. Net present worth of each option is calculated, from calculating cost and predicted revenue, in order to measure each option's economic feasibility. End-use and Upstream emissions of each product is analyzed, in order to calculate each option's environmental impact. Product performance from a customer satisfaction standpoint and general public reception of each option forms a basis of the social reception of each product.

After careful consideration of each product's merits and shortcomings, the two electric options seem to be the most sustainable. The use of electricity as a fuel source provides a much cleaner upstream emission levels, especially after BC's hydroelectric dam system is taken into consideration. In financial terms, all three options are similar, but with little adoption cost and low fuel price, freestanding electric heaters prove to be the most economically feasible option. In terms of customer experience, restaurant-goers tend to favor higher heat concentration provided by freestanding heaters; however, debate over the use of patio heaters has grown, giving patio heaters a bad reputation for heating the open air.

Although there is one clear option for the Perch restaurant patio, given the brevity and low frequency of intended use (due to Vancouver's weather patterns), relatively high cost of purchasing and operating, and purely negative environmental impact, it is recommended that the AMS forego purchasing an outdoor heating solution for the Perch restaurant patio.

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1.0 Introduction

The Perch restaurant, part of UBC's new SUB on the Vancouver campus, wishes to extend its patio season by purchasing and using patio heaters for its rooftop patio. The AMS, staying true to UBC's image as a sustainable leader, wanted to find a sustainable heating solution for the Perch restaurant patio. Student teams were asked to research outdoor heating solutions as alternatives to the industry standard freestanding propane heaters. The new SUB, however, was in its final stage of construction at this time, and therefore proposed heating solutions could not modify the building in any way. The heating solutions were to be portable, in order to accommodate multiple floor layouts, as well as aesthetically pleasing. The patio would not have any structural elements for which to mount heaters on, as the patio walls are made of glass. The patio itself would only have two electrical outlets, with another just inside the patio door.

Structural constraints quickly ousted large-scale project options, such as porting waste heat from the kitchen to heat the patio. The limited number of electrical outlets would cause tripping and fire hazards if wired improperly, or if individual table or seat heaters were used. The use of batteries in heaters would result in very short run-times and a large amount of waste. Using biofuel was considered, as UBC has its own club which produces biodiesel, but biodiesel patio heaters are not commercially available, and combustion of biodiesel gives off an aroma which varies with the fuel source, making it a poor option for a restaurant patio. Any heating element on or below the table poses significant health hazards. The pool of options quickly dwindled, finally giving two alternatives to freestanding propane heaters: freestanding electric heaters, and radiant floor heating.

Freestanding electric heaters operate very much like propane heaters, but convert electricity into heat, instead of burning fuel to create heat. Radiant floor heating uses a system of electrical wires laid down under a protective layer of flooring. Both are compared to freestanding propane heaters using a Triple Bottom Line (TBL) assessment.

The Triple Bottom Line assessment is a holistic accounting framework, which evaluates products on three aspects: economic feasibility, environmental impact, and social reception. These aspects are often referred to as the three 'P's — people, planet, and profit. Propane heaters, electric freestanding heaters, and radiant floor heating options will be assessed according to indicators of the three aspects of the triple bottom line, which will provide conclusive data that one of the three options is indeed the most sustainable.

2.0 Economic Analysis

2.1 Analysis Methodology

In order to effectively analyze the economic feasibility of each of the three patio heater technologies, revenue, costs and profit were estimated as follows:

1. **Revenue Estimation Methodology and Assumptions:**

   To estimate the revenue generated from heating the patio, it is required to estimate the overall increase in sales that result from extending the patio season. This sales increase is the most difficult variable of all to predict. To simplify our calculations dramatically, we will assume the patio heaters will provide a 10% increase in sales for every hour they are in operation, (not 10% of total revenue). Although this factor of sales contribution is merely a guess, it is easy to adjust this value later when more data has been included. **Note that changing this value will result in very different revenue estimates and profit estimates**. For this reason, we have attached the Excel files used for the economic analysis section in Appendix A.

   Furthermore, to estimate the time that the patio heaters will be in use, we have gathered data from Environment Canada regarding mean monthly temperatures in the Vancouver area from October 2013, to September 2014. To simplify calculations we have made the assumption that for months averaging in the range of 0 to 5 degrees Celsius, the patio heaters will be used 2 hours each day (on average). For months with average temperatures in the range of 5 to 10 degrees Celsius, a time of use of 1 hour per day is assumed. It is also expected that the patio heaters are only used when the temperature is in the range of 0, to +10 degrees Celsius.

   One final assumption we have made to produce an estimate of patio heater revenue contribution, is the average daily revenue generated at The Perch. Based on the average meal price and a moderate rate of customers, we estimated $1000 per day to incorporate in our analysis. As with our assumed sales contribution factor of 10%, this value also can be easily adjusted in the Excel spreadsheet.

2. **Costs Estimation Methodology:**

The total costs for each project have been estimated by calculating initial costs and annual recurring costs associated with each type of patio heating technology.

The purchase costs have been estimated by averaging cost data found on patio heater manufacturer websites. We have ignored the installation costs associated with in-floor electric heaters as this is a case sensitive cost depending on floor materials and building structure, etc. (References are included at the end of report and in text citations are included as well).

Annual costs are estimated by obtaining energy consumption data for each heater type, and determining the cost for each unit of energy by consulting BC Hydro and the current market price of propane. Finally, these values are multiplied by the time we expect to be using the patio heaters for to generate our annual cost estimates.

3. **Profit Estimation Methodology:**

Ultimately, to estimate profit associated with each project we perform a net present worth analysis on each project. This net present worth expresses the sum of the total project costs and total project benefits in present day dollars. To illustrate this present worth (profit) in a clear format, we have graphed how our results vary over time. We have incorporated interest into our calculations to account for the depreciation of money over time.

2.2 Estimating Revenue

This section contains various tables to illustrate the methodology used to estimate the revenue generated from heating the patio.

Table 2.1: Patio Heater Usage

The average time the patio heaters are expected to be in use throughout the year is shown below. (The revenue generated from heating the patio is assumed to be independent of which technology is chosen.)

Month	Average Daily Vancouver Temperatures	Average Daily Usage (hours)	Average Monthly Usage (hours)
January	4.4	2	62
February	2.5	2	58
March	6.9	1	31
April	10.0	--	--
May	14.2	--	--
June	15.7	--	--
July	19.0	--	--
August	19.2	--	--
September	15.9	--	--
October	9.2	1	31
November	6.2	1	30
December	2.2	2	62

Average Annual Patio Heater Usage (hours) = **274**

Average Daily Vancouver Temperatures data obtained from Environment Canada Website climate.weather.gc.ca.

Data Collected at Vancouver Int. Airport Station from October 2013 to September 2014.

Table 2.2: The Perch Hours of Operation

The table below shows The Perch hours of operation. From this data we can easily see that The Perch will be open on average 78 hours each week, or roughly 11 hours each day.

Monday	10:30am - 10:00pm
Tuesday	10:30am - 10:00pm
Wednesday	10:30am - 10:00pm
Thursday	10:30am - 10:00pm
Friday	10:30am - 12:00pm
Saturday	10:30am - 12:00pm
Sunday	11:00am - 4:00pm
Holidays	CLOSED

Table 2.3: Patio Heater Revenue

This table shows the monthly, and annual patio heater revenue produced following the assumptions stated in the methodology section of this report. Using the estimated income of $1000 per day in combination with average monthly usage of heaters, we obtained the rightmost column below.

Month	**Average Hourly Sales for Perch**	**Average Monthly Usage of Heaters (hours)**	**Monthly Patio Heater Revenue**
January	$90.00	62	$558.00
February	$90.00	58	$522.00
March	$90.00	31	$279.00
April	$90.00	-	-
May	$90.00	-	-
June	$90.00	-	-
July	$90.00	-	-
August	$90.00	-	-
September	$90.00	-	-
October	$90.00	31	$279.00
November	$90.00	30	$270.00
December	$90.00	62	$558.00
	Annual Revenue From Patio Heaters:		$2,466.00

2.3 Estimating Costs

As the purchase price varies greatly over a range of patio heaters, we have estimated that propane heaters will cost $330 each, and electric free standing heaters will cost $230 each, (*homedepot.com*). This purchase price may change depending on the preferences of stakeholders. We have chosen the higher bracket price patio heaters for this cost assessment.

Energy consumption data has been listed below, as well as price per unit of power for electricity and propane. By combining these figures with the estimated annual time the patio heaters will be in operation, we are able to estimate the annual costs.

> "BC Hydro's residential usage charge is a two-tiered Conservation Rate. You pay 7.52 cents per kWh for the first 1,350 kWh you use over an average two-month billing period. Above that amount, you pay 11.27 cents per kWh — what we call Step 2 — for the balance of the electricity used during the billing period." (BC Hydro, see link in references).

In our analysis, we will assume the perch is already consuming 1350 kWh in 2 months, so we will use a rate of 11.27 cents per kWh to calculate operating costs of electric technologies.

Table 2.4: Annual and Initial Cost Data

This table contains data for typical products for each heating option, found at homedepot.ca. Other data in this table such as price of propane and propane consumption has been referenced from Natural Resources Canada, (see references page). To reach a similar value of kWh between the two electric heating options, we provided data for three free standing electric patio heaters rather than one.

	Propane Heaters	**Electric Free Standing Heaters (x3)**	**Electric In-floor Heaters**
Average energy rating	30,000 BTU/hour	4500W	220V * 20Amps = 4400W
Average hours operating heater in 2 months	274/6 = 45.67 hours	45.67	45.67
Average BTUs in 2 months	1438605	-	-
Average kWh in 2 months	421.61	205.5	200.9
Propane Price	83 cents/ L	-	-
Propane Use in 2 months (at 1.2L /hour)	54.8 L	-	-
Electricity Price above 1350 kWh in 2 months	-	**11.27 cents/kWh**	**11.27 cents/kWh**
Total cost estimate in 2 months	45.48	23.16	22.64
Total Annual Operating Costs	**272.88**	**138.96**	**135.84**
Purchase Costs	**$330.00**	**$690.00**	**$749.00**

2.4 Profit and Net Present Worth

Profits are determined by calculating the present worth of each project option, where present worth expresses the sum of the total project costs and total project benefits in present day dollars over a ten year time period. An interest rate of 2.03%% is used to account for the depreciation of money throughout these calculations. *(Newnan, 2014).*

Calculating Net Present Worth:

In the following calculations, 'PW' represents present worth, 'PWB' represents present worth of benefits, and 'PWC' represents present worth of costs. An analysis period of 10 years is used to examine each project option. Also, it should be noted that the installation cost of floor heaters have not been included, which implies the initial costs would exceed the $749 purchase price. We have ignored this cost completely in our calculations that follow. Note: The current rate of inflation in Canada is 2.03% (www.inflation.eu).

Project Option 1: Propane Heaters

$PW1 = PWB1 - PWC1$

$PWB1 = A(P/A, i = 2.03\%, n = 10\ years)$, *where A = annual revenue = $2466*

$= A\frac{(1+i)^n - 1}{i(1+i)^n}$ *= $22,116*

$PWC1 = \$330 + A(P/A, i = 2.03\%, n = 10\ years)$, *where A = $272.88*

$= \$\mathbf{330} + \boldsymbol{A}\frac{\mathbf{(1+i)^n - 1}}{\mathbf{i(1+i)^n}}$ ***= $2,777***

$PW1$ = $19,338

Project Option 2: Free Standing Electric Heaters (x 3)

$PW2 = PWB2 - PWC2$

$PWB2 = A(P/A, i = 2.03\%, n = 10\ years)$, *where A = annual revenue = $2466*

$= A\frac{(1+i)^n - 1}{i(1+i)^n} = \$22{,}116$

$PWC2 = \$690 + A(P/A, i = 2.03\%, n = 10\ years)$, *where A = $138.96*

$= \$690 + A\frac{(1+i)^n - 1}{i(1+i)^n} = \$1{,}936$

PW2 = $20,180

Project Option 3: Electric Floor Heating

$PW3 = PWB3 - PWC3$

$PWB3 = A(P/A, i = 2.03\%, n = 10\ years)$, *where A = annual revenue = $2466*

$= A\frac{(1+i)^n - 1}{i(1+i)^n}$ *= $22,116*

$PWC3 = \$749 + A(P/A, i = 2.03\%, n = 10\ years)$, *where A = $135.84*

$= \$749 + A\frac{(1+i)^n - 1}{i(1+i)^n}$ *= $1,967*

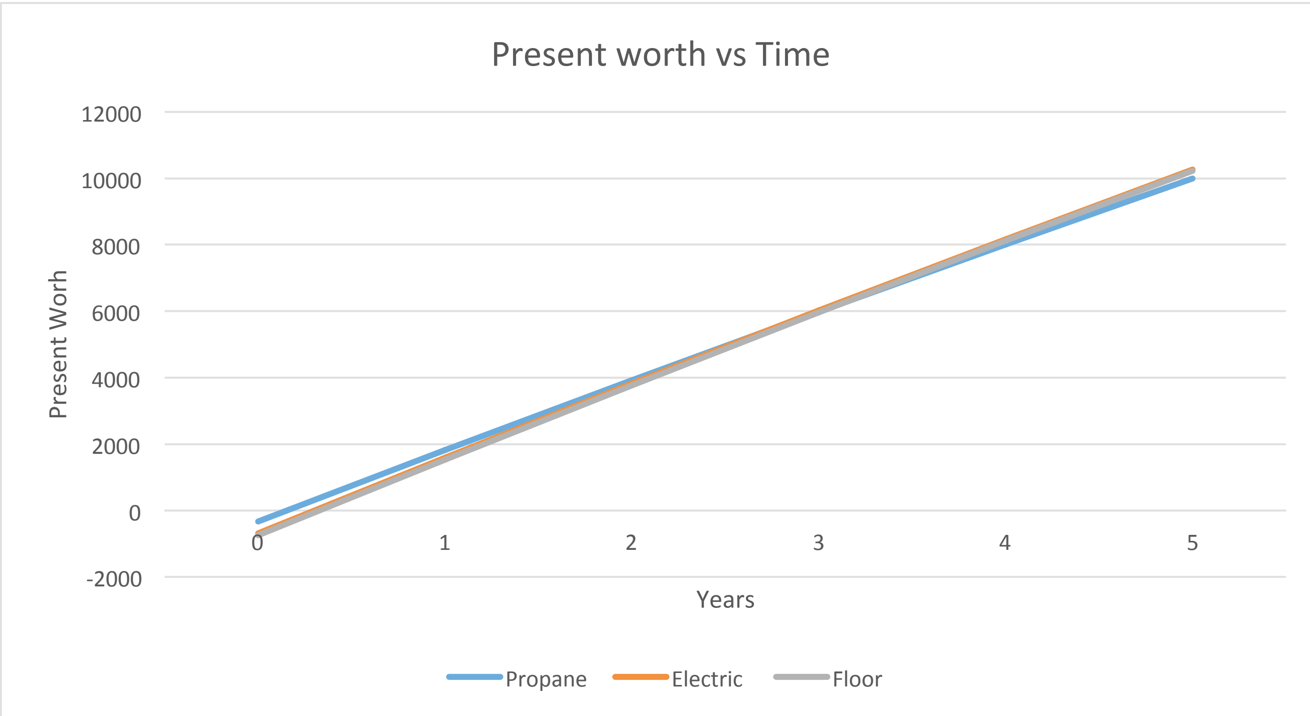
PW3 = $20,148

Within the 10 year time frame we can see that the 3 free standing electric heaters provide the highest net present worth. However, the profit for each project is dependent on time. The graph below shows how the profit for each option varies with time. Even over a 5 year period, we can see that the electric heating technologies generate the most profit over time, but it is very close among all three options.

Not that the graph suggests that around 3 years is when every technology is approximately of equal worth.

Figure 2.1: Present worth vs. time for each of the three patio heater technologies.

This figure illustrates how each heating technology provides profit over time. The excel workbook used for obtaining the data in this section has been attached as an appendix for a closer viewing.



3.0 Environmental Analysis

3.1 Propane Toxicity, Contaminations and Spills

Propane is not a toxic substance, and as long as it released as a liquid or vapor, it will not cause any direct environmental risk. It is however, a chemically reactive substance but is normally removed by natural oxidation in the presence of sunlight (Propane 101, 2011). Propane does not affect the global climate as it is removed from the air faster than it takes to react with other elements.

3.2 Hydroelectricity

Hydroelectricity is electricity produced by hydropower; which is electrical power generated by the gravitational force of falling or flowing water. Hydroelectricity is the most commonly used type of renewable energy (BC Hydro, 2014).

3.3 Upstream vs. End-Use Emissions

There is a difference between emissions produced where the energy is consumed (end use) and the emissions produced where a refined and usable energy product is extracted and converted to energy (upstream). End-use emissions are released where the energy is used, whereas upstream emissions are the total emissions from recovering, processing and transporting fuels from their source to the end user.

This report shows the complete lifecycle of greenhouse gas emissions from propane and hydroelectricity use for a heater, a particular application. By analyzing upstream emissions and end-use emissions individually, this report provides a better understanding and more informative statistics of the effects of propane and hydroelectric uses.

3.4 Upstream Emissions Analysis (propane vs. electricity)

Table 3.1, below, shows a Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model, the formula this report uses to calculate greenhouse emissions. This formula was taken from Propane Education & Research Council, 2007. This model computes emission in grams per million Btu of multiple chemicals, mainly the three greenhouse gases calculated in this study: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Table 3.2 shows these and other fuels, such as gasoline and natural gas, to give a better comparison of the effects of various fuels.

Table 3.1: GREET model Used to calculate greenhouse emissions

Metric tons (GHG) = grams (GHG)/MMBtu (fuel) * MMBtu of fuel consumed /106
Total metric tons of CO2 equivalent = metric tons CO_2*(1) + metric tons CH_4*(25) + metric tons N_2O*(298)

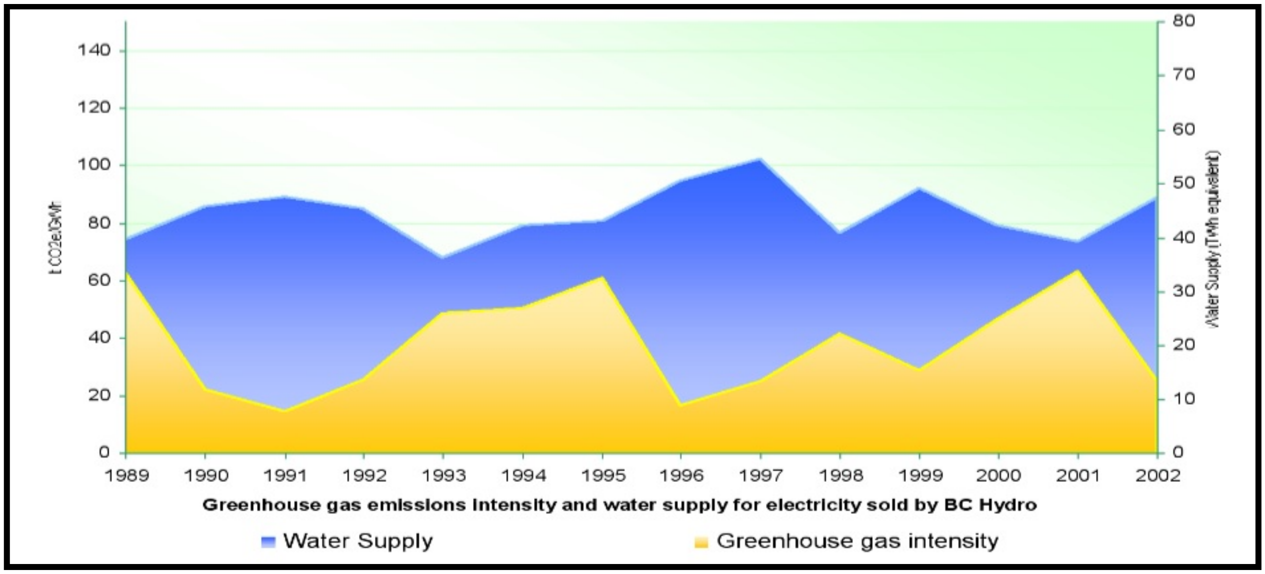
Table 3.2: Upstream emissions factors (grams per million Btu)

Energy Source	CO_2	Ch_4	N_2O	Total CO_2 equivalent
Liquid propane gas	8,939	115	0.16	11,855.00
Natural gas	12,207	248	0.19	18,455.00
Gasoline	17,476	108	1.31	20,595.00
BC hydro electricity	1,465.35	0	0	1,465.35
BC hydro fossil fuel electricity generation	-	-	-	3,516.85

Upstream emissions from propane production depend on its feedstock. According to e Propane Education & Research Council in 2007, propane is usually produced from natural gas or crude oil, and therefore upstream emissions to produce liquid propane gas (LPG) depend on the relative effect of each method. In Table 3.2, the feedstock shares are 60% natural gas and 40% crude oil. LPG produced from crude oil has slightly higher greenhouse emissions than from refining natural gas.

Propane Education & Research Council in 2009 claims that hydroelectricity depends on the availability of water. Graph 3.1 shows that in a hydroelectric based power system, such as British Columbia's, greenhouse emissions from electricity varied significantly from year to year according to water supplies and reservoir levels. During years with low stream flows and/or low reservoir levels, hydro power is supplied thermally using fossil fuels to generate electricity to users, which resulted in greenhouse gas emissions. However, 98% of the time, electricity in BC is generated from hydropower, with very low emissions. Therefore, this report assumes that electricity produced always comes from hydro power.

Graph 3.1: Greenhouse gas emissions intensity and water supply for electricity sold by BC Hydro.



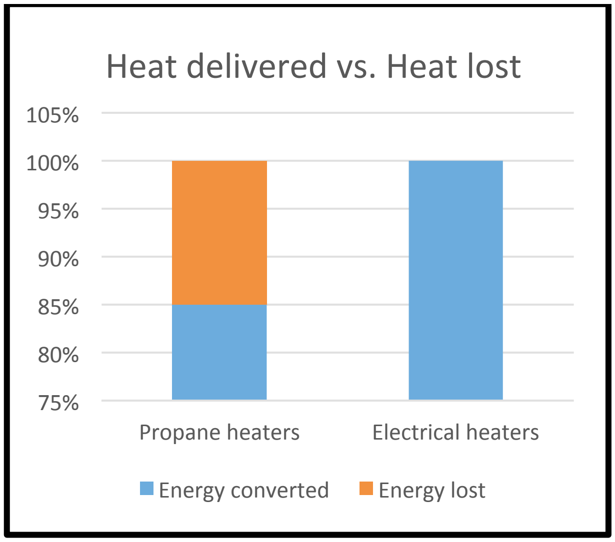
BC Hydro. (2003). Greenhouse Gas Report

3.5 End-Use Emissions Analysis

End-use emissions are specific to the technology in each application. For propane heaters, total end-use emissions were obtained in the same way as total upstream emissions, but unit is deferent because it depends on the application used. Studies from Propane Education & Research Council in 2007 have found that propane heaters can emit up to 62 kg CO_2 Equivalent/Million Btu. On the other hand, electric floor heaters and standing heaters, which depend on hydroelectric power, do not emit any CO_2.

Estimated useful heat delivered by a propane furnace was 38 million Btu based on an energy consumption of 52.6 million Btu per year of propane, which shows duct losses (15%). On the other hand, in term of usage, electric standing and in-floor heaters can be 100% efficient because all of electrical energy used is converted into heat and there is no combustion loss through the chimney (Propane Education & Research Council, 2009). Graph 3.2 shows the rates of heat delivered to heat lost for propane vs. electrical heaters.

Graph 3.2: Heat delivered vs. Heat Lost



Although both electric standing and in-floor heaters are equally efficient at converting energy, in floor heaters are better heat distribution systems because heat coming from in-floor heaters directly transfers to the objects around them.

Greenhouse gas emissions and energy losses also depend on what is being heated. For instance, on a patio with central heating, greenhouse gas emissions and energy losses are usually higher than running efficient space heating. This is because central heating systems usually heat a whole area and space heaters only heat the space near them (Australian Government,2013). Therefore, in this project installing separate in floor heating that can be controlled in each room as needed saves energy and decreases greenhouse emissions.

Overall, considering environmental friendly heaters involves a whole process, including upstream to the end use impacts. The analysis to calculate total emissions should consider how power is generated, the heating technology and the efficiency of the energy distribution.

4.0 Social Analysis

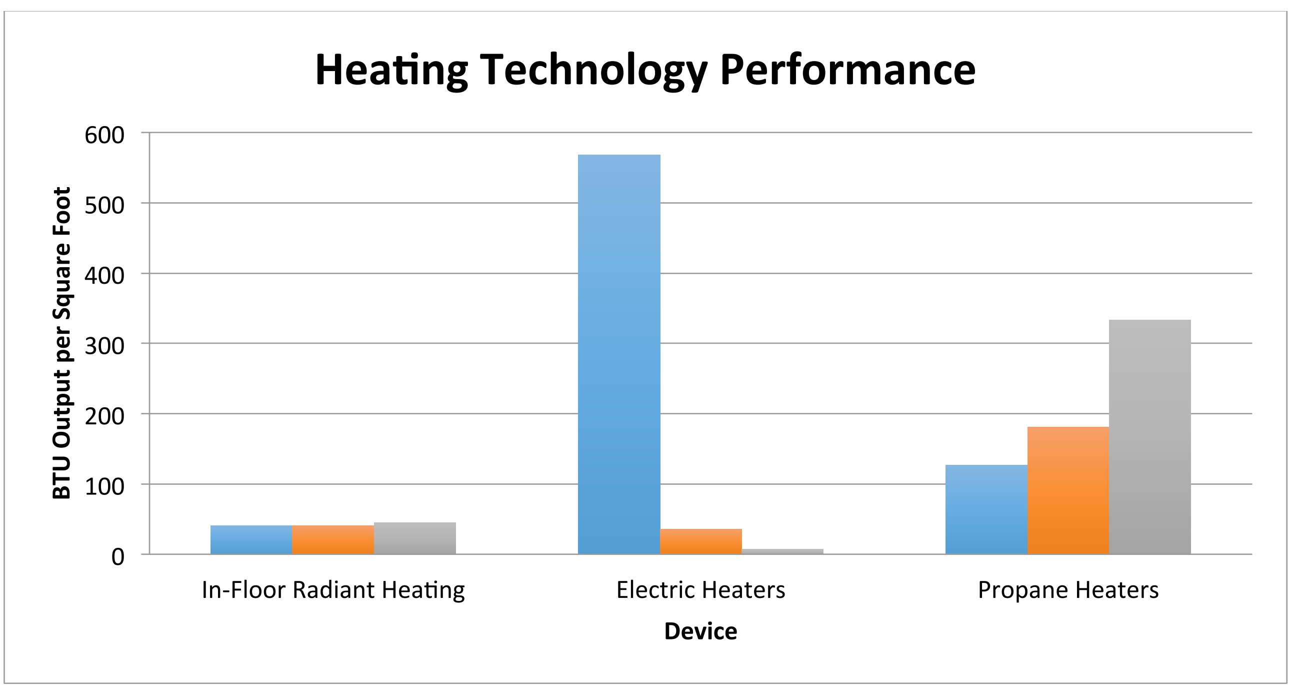
Over the past few years, criticism towards the use of patio heaters has grown exponentially. To analyze the impact patio heaters will have, if implemented, the use of both primary sources and newspaper articles have been utilized. The sources were used to focus on: the estimated customer satisfaction from each technology, and the anticipated public reception of the patio heaters, based on prevalent social attitudes worldwide.

4.1 Customer Satisfaction

In order to gauge customer satisfaction from each of the devices, the investigation examined the heat output per square foot of each one. It is anticipated that the higher the heat output, the more comfortable and satisfied the user will be. In order to get an accurate heat output per square foot, data from three devices, that use the same heating technology, but differ in their manufacturer, will be used in the comparison. The results are demonstrated in Graph 4.1 below.

Graph 4.1: Heating Technology Performance

From the graph, it can be seen that certain electric heaters will offer the greatest customer satisfaction. Propane heaters prove to be a good alternative, followed by in-floor heating, which will provide the lowest anticipated customer satisfaction.



4.2 Public Reception

As mentioned above, public reception of patio heaters has become increasingly negative. Looking at the international level, multiple cities around the world have attempted to limit the use of patio heaters, while the city of Paris has attempted to rule them out completely. An article written about the attempt to ban them in Paris says, "[The city council] has declared war on the heaters, calling them an ecological disaster" (Samuel, 2010). Although patio heaters remain popular, public opinion is starting to change as people recognize that 'heating the open air' is a wasteful use of energy that can result in polluting the atmosphere. As worldwide attitudes become increasingly negative, if patio heaters are introduced in the AMS building, it will reflect poorly on UBC's reputation as a leader in sustainability.

In order to investigate what UBC students think about the implementation of patio heaters, an informal discussion was conducted with fellow classmates. It was determined that students do not feel that patio heaters fit in at UBC and the AMS. They acknowledged that UBC is known as a worldwide leader in sustainable practices, and AMS aims to be sustainable based on the support of the students, thus they felt patio heaters did not fit in with this 'branding.' Although a public campaign at the Perch Restaurant would be able to point out that customers are using the most sustainable patio heaters commercially available, the technology at its core, is not sustainable. Due to these prevalent social attitudes, at UBC and worldwide, it is determined that public reception of patio heaters would be negative.

Conclusion and Recommendations

The three-pronged approach of the Triple Bottom Line assessment was used to compare three viable heating solutions for the Alma Mater Society's Perch restaurant in the new Student Union Building.

Through examination of each of the three heating solutions' potential revenue, costs, and profit, the net present worth of each project option was calculated. Although all three options are financially viable over a ten-year period of use, the use of three freestanding electrical heaters provides the most economical solution, with a net present worth of $20,180 over ten years. It is important to note that installation costs of radiant floor heating are highly variable, and therefore were not included in the economic analysis; if installation costs were included, it would detract from the net present value of the radiant floor heating option by the value of the installation cost.

Each of the heating solutions were compared according to its ecological viability. Each option's greenhouse emissions were calculated using a GREET model, considering both upstream and end-use emissions. The GREET model allowed for each of the options' ecological impact to be measured and compared according to a single numerical indicator. Due to the low upstream emissions associated with British Columbia's hydroelectric system, as well as the high end-use efficiency of electrical heaters, the two electric heaters demonstrate greater ecological viability than propane heaters. Radiant floor heating, however, proves to be the most ecological option, as more heat is directly transferred to the objects in the surrounding area, as opposed to heating the surrounding air.

In terms of social performance, the three options were compared according to their heating performance, as a measure of customer satisfaction. In order to account for variance in performance of different products on the market, three products of each technology were compared, according to their heating performance. Electric freestanding heaters provided the greatest BTU output per square foot, outperforming both propane heaters and radiant floor heating options. While electric freestanding heaters may provide the most customer satisfaction, general public reception of patio heaters places a negative connotation on the use of such technology to effectively heat the open air.

The triple bottom line assessment of propane, freestanding electric, and radiant floor heating options has produced one clear victor. While radiant floor heating may be the most environmentally sustainable option, electric freestanding heaters are nearly as environmentally friendly, and are the most financially viable of the three options over ten years.

However, exogenous variables have not yet been taken into account. The Perch Restaurant plans to keep the patio closed when the temperature drops below comfortable levels, or when it is raining. Given Vancouver's mild temperatures and high frequency of precipitation, the patio is likely to be closed for the majority of the academic year, when the Perch is likely to see the highest customer traffic. In addition, in summer months, patio heaters are likely to be used only when the temperature is in the range of 5-15° — for example, on late summer evenings. Due to the brevity and low frequency of intended use, relatively high cost of purchasing and operating, and environmental stigma of patio heaters, we recommend that the Perch Restaurant forego the option of purchasing patio heaters altogether.

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Appendix A

Time	Propane	Electric	Floor
0	-330	-690	-749
1	1819.485445	1590.740959	1534.798883
2	3926.204494	3826.104046	3773.159054
3	5991.008031	6016.992107	5966.984567
4	8014.730012	8164.290019	8117.161489
5	9998.1878	10268.86506	10224.55826
6	11942.18249	12331.56724	12290.02603
7	13847.49926	14353.22968	14314.39903
8	15714.90764	16334.6689	16298.49488
9	17545.16185	18276.68519	18243.11495
10	19339.00113	20180.06292	20149.04464
11	21097.14998	22045.57083	22017.05375
12	22820.31852	23873.96239	23847.89675
13	24509.2027	25665.97608	25642.31309
14	26164.48466	27422.33566	27401.02753
15	27786.83295	29143.75053	29124.7504
16	29376.90283	30830.91593	30814.17789
17	30935.3365	32484.51331	32469.99234
18	32462.7634	34105.21054	34092.86253
19	33959.80045	35693.6622	35683.44392
20	35427.05229	37250.50985	37242.37893