

Marketing Strategy:*The Shape of the Veterinary Industry:*

The veterinary industry in Bellingham is a differentiated oligopoly. While, according to IBISWorld, industry concentration is low on a national and international scale, we would argue that it's a different case entirely when you take a narrower view. There are only a handful of veterinary service providers in Bellingham, four are registered by the Bellingham Chamber of Commerce with a few outside of this as well. Additionally, we have found that the barriers to entry are quite high for the veterinary industry, mainly due to the capital and education it requires to be a functioning clinic.

Veterinary Industry Attractiveness and Competitive Forces:

The veterinary industry has strong competitive forces. However, there are constraints within the veterinary industry that offer opportunities for Vitality to have a competitive advantage. Consumers in Bellingham have many options and can choose the clinic they feel is best for them. Many buyers may be motivated by finding the best service for the lowest price, which puts constraints on the profitability of the vet industry. Vitality Veterinary Wellness is limited to sourcing materials and supplies in environmentally and socially responsible ways. These suppliers have differentiated products and aren't plentiful, meaning supplier power is relatively high, and they charge a premium for their products. While substitutes exist in this industry, they are low in numbers. Emerging technologies like telehealth and online pharmacies provide resources to pet owners that were once exclusively sold by vet clinics. Finally, the vet industry has high barriers to entry. It requires highly skilled employees and is incredibly labor-intensive. Barriers to entry also come from strict and constantly changing policies and standards. Further, high capital requirements act as an additional barrier to entry.

Strategies for a sustainable vet clinic to overcome the constraints of the veterinary industry should focus on providing a superior level and quality of care. It should be located in a place where consumers aren't price sensitive considering the high costs associated with running a sustainable vet clinic. While policy and regulation act as barriers to entry in the veterinary industry, a sustainable vet clinic can find competitive advantage by exceeding those standards and regulations and benefitting from the price premium that will come with it.

Positioning Strategy:

A positioning strategy is necessary for Vitality Veterinary Wellness to compete well in the local market. In developing one, key areas are chosen to concentrate and excel on that will differentiate the hospital from competition. We want to consider three things when doing so: the

feeling we give to customers, the promise we deliver, and the relationship we build with them. All three of these must be unique, and outrival competition.

The main strategy in differentiating Vitality Veterinary Wellness from other veterinary hospitals is the emphasis on sustainable business practice and ethical care. First impressions are very important, they are going to span from how the hospital is viewed online to how it is viewed when a potential customer drives by the clinic. With the idea of disruptive innovation in mind, we want customers to think green when they see the clinic. This can be achieved through visible solar PV installations, energy efficiency upgrades, large window installments, and a green roof.

Northshore Veterinary Hospital is Vitality Vet Wellness's largest rival in the Bellingham market with an AAHA and EnviroStars accredited reputation. However, in my conversation with a Northshore representative, it was evident that transparency was not their strongest suit. They advertise their dedication to sustainability, but are ill-equipped to speak on their conscious business practices, nor do they specifically mention what they do on their website. Transparency is going to be Vitality's best method of differentiating itself from its largest competitor and justify charging a premium. To do so, it is important to build a brand that customers can truly trust. Advertising how Vitality Vet Wellness is a climate conscious business needs to go farther than simply training employees to inform customers, it needs to be the center point of the hospital's marketing. We want to outline the explicit benefits that we provide and other firms do not to create a trustworthy business.

Transparency:

To maintain Vitality's image as a sustainable firm, it is vital that employees know exactly what green practices are in place and how to speak on them. Many customers may simply not ask, but it is always helpful to inform them to maintain the image of the firm. We do not want to appear as though we are not informed on our sustainable improvements and be associated with greenwashing. To execute training staff correctly and fully understand and communicate Vitality's ethical and sustainable practices, it would be advantageous to have a training slideshow or video. Creating a pamphlet to keep employees up to date as well as hand out to customers could be useful to get the information out coherently, however this would require copious amounts of wasted paper. To keep things paperless, Vitality may choose to direct customers to Vitality's website for an in depth analysis of the green practices within the firm, or outline its sustainable achievements in a poster within the clinic. This would allow for customers to understand the green side of the business they may not directly see, however it is advisable to make as many of the sustainable improvements visibly accessible to the consumer.

Value Chain:

Our service revolves around the well being and the longevity of the lives of our customers' pets. When developing our value chain, we have to have four things in mind: cost, uniqueness, configuration, and buyers own value chain. Our goal is to tap into the "super green"

consumer base while also tapping into the middle green consumer base in order to increase market share and revenue. We will not be a price competitive clinic, but instead we will focus on the uniqueness of the service we offer which will add value for our customers. Our goal is to create a sustainable clinic that practices responsible waste disposal, separates from fossil fuel energy generation through distributed energy sources, practices reduction of single use products, and uses materials that are less harmful to the environment. Although this adds value in the eyes of the super green consumers, it may not be enough to attract the middle green. Sustainability has multiple meanings, some of which don't necessarily pertain to just the environment. We look at providing a sustainable service to the pets we care for because this is the main driver for customer attraction and satisfaction in a veterinary clinic. We must configure a service that communicates both environmental and pet sustainability; stellar preventative pet care. We plan to do this by having added features to our service by making it a more personal experience through customer engagement. Examples of this customer engagement would be improved dietary plans/workshops that tailor a diet and exercise plan for the customers specific breed of pet. These plans would have an emphasis on sustainable food options that are both healthier for the pet and better for the environment. A study done by "Frontiers in Veterinary Science" showed that the majority of consumers don't recognize sustainable food products when asked to elaborate on food descriptions and are heavily influenced by their veterinarian when it comes to food choices for their pets. Other engagement techniques involve providing disposable waste bags upon visits and facility tours to demonstrate the happy and healthy environment the pets are exposed to. This will have increased customer satisfaction with pet care while engaging them in the benefits of sustainability. Customer satisfaction with pet care will tap into a larger population of customers' value chain and give our clinic a great competitive advantage to become defensible against our rivals.

LEED Building Certification

LEED building certification is an integral part of a sustainable vet clinic. It promotes authenticity and transparency for clients and employees through a whole building approach of sustainably designed buildings. Further, achieving LEED building certification has been proven cost-effective when it comes to building maintenance and costs.

LEED is a widely recognized and credible green building certification program. It focuses on certifying the equity, health and wellness, resilience, and sustainability a building achieves. On top of that, certification conveys the building delivers a triple bottom line return to people and the planet.

At least 40 points are required for LEED certification. Points above 50 achieve a silver, gold, or platinum certification. LEED points are accumulated through seven categories:

Integrative Process

Buildings earn points in this category when they reflect strong inter-connection between the components of the building's sustainable design. These are systems that promote overall high-performing and cost-effective outcomes. The following proposals achieve an integrative process on account of the value of the set of proposals being more than each component separately.

Location and Transportation

Buildings can earn points in this category when the location is compatible with means of transportation other than cars. Location is important to consider when attempting to gain LEED certification, especially if one desires more notable levels like silver or gold.

Sustainable Sites

Similarly to location and transportation, the location of the building must also communicate the natural environment it exists in is valued and respected.

Water

Sustainable and efficient means of obtaining and utilizing water are essential for LEED certification. For instance, energy efficient appliances that use less water than their traditional counterparts can earn the building points on the certification exam. Alternatively, innovative approaches to reusing water like rainwater collection systems will also earn points towards certification.

Energy

A building that reflects overall energy-efficiency that doesn't rely on less sustainable means of energy (fossil fuels) will help achieve LEED certification. Our proposal reflects an incredibly energy-efficient building that doesn't rely heavily on fossil fuels to operate. Energy certification is met through our proposed passive building design, green roof, and energy-efficient lighting and heating choices.

Materials and Resources

Materials and resources that are ethically and sustainably sourced also earn points towards certification. Using materials that promote a low ecological footprint and high environmental quality is essential to certification. Our proposal includes recommendations for sustainable building materials that will help achieve LEED building design.

Indoor Environmental Quality

Finally, the indoor environmental quality category in the LEED building design exam addresses how the indoor building environment affects people inside it. To elaborate, this category addresses the design strategies that exemplify high air quality, lighting quality, and acoustic design. Our recommendations for a sustainable vet clinic will earn points in this category through excellent lighting from a large window surface area, high air quality from excellent ventilation. Overall, strategic building design as a result of our recommendations promotes a healthy environment that positively influences employee performance and well-being.

In short, the following recommendations will produce a high chance of LEED building design certification by exemplifying an integrative approach to sustainable building design that reflects high efficiency and an excellent positive environment.

Key Actions:

We have compiled a few key action items to provide a detailed cost analysis and environmental impact report on each, however these are not our full recommendations for the clinic.

Light/ solar tube installations:

Solar tubes can be used interchangeably to overhead lighting fixtures in the clinic. The idea is that all of the lighting fixtures will be LED rather than incandescent, and all overhead lighting will have a solar tube counterpart that can be used in replacement to the overhead lighting during the day.



Light tubes consist of a translucent weatherproof head, which would be installed on the roof membrane, followed by a reflective pipe underneath it to carry the sunlight into its intended target. The reason we picked a solar tube rather than simply a sky light was for a few reasons. A solar tube will cost around \$750 rather than a \$1500 sky light, they provide better energy efficiency because they do not transfer heat from the sun, and they have lower maintenance as well. On the other hand, the light tubes will provide no solar passive heat during the winter.

During the summer, however, the clinic will not need to compensate for heat from the lighting with any air conditioning.

If we were to assume that every overhead light fixture was matched with an equally bright solar tube, then each light tube would save around 60 kWh of energy during daylight operating hours. In my comparison, I assumed each overhead lighting fixture would hold 6 LED bulbs. If the bulbs were incandescent, this would save 720 kWh of energy.

As far as costs, as mentioned previously, it would cost around \$750 per light tube for both materials and installation. If the building and roof are under construction and/or renovation during the time they are installed, labor costs may be less.

Solar PV installation:

Instead of purchasing carbon offsets for the carbon you admit through energy use, a solar PV can be a good method of offsetting all of the appliances that use a large amount of energy within your business. Ultimately, it will be an expensive investment, and cost more than simply purchasing energy like any other business, but that is not what the goal and vision of Vitality Veterinary Wellness is about.

Cost analysis:

A solar PV installation will cost differently per kW capability of the system. Here is a table of the average costs of each system, before and after the Federal Investment Tax Credit:

Average solar panel cost by system size in Washington

System Size	System Cost	System Cost (after ITC)
3 kW	\$7,950	\$5,883
4 kW	\$10,600	\$7,844
5 kW	\$13,250	\$9,805
6 kW	\$15,900	\$11,766
7 kW	\$18,550	\$13,727
8 kW	\$21,200	\$15,688
9 kW	\$23,850	\$17,649
10 kW	\$26,500	\$19,610

<https://www.energysage.com/local-data/solar-panel-cost/wa/>

Something to consider when installing a solar PV is the payback period and the levelized cost of electricity (LCOE). The average payback period of these kinds of investments is 13.48 years meaning it will take around that amount of time for your energy savings to pay back your initial investment.

The calculated LCOE of a 10-kWh solar PV installation would be around \$0.2164423 per kWh compared to simply paying the PSE energy rates of \$0.097543 per kWh (first 600 kWh) and \$0.116365 (remaining kWh). Here are my calculations:

Year	Annual Cost	Annual Quantity	Discounted Costs	Discounted Quantity		
0	19610	0	19610	0	Sum of discounted costs:	19610
1	0	14016	0	12187.82609	Sum of discounted quantity:	90601.51358
2	0	14016	0	10598.10964		
3	0	14016	0	9215.747514	LCOE (\$/kWh):	0.2164423
4	0	14016	0	8013.69349		
5	0	14016	0	6968.429122	LCOE (\$/MWh):	216.4423002
6	0	14016	0	6059.503584		
7	0	14016	0	5269.133552	Assumptions:	
8	0	14016	0	4581.855262	I am using a 15% discount rate because this is a	
9	0	14016	0	3984.221967	typical rate at which one could invest their money in	
10	0	14016	0	3464.540841	an investment fund rather than purchasing a new	
11	0	14016	0	3012.64421	solar PV system.	
12	0	14016	0	2619.690617	Because Vitality Vet Wellness is a fairly large	
13	0	14016	0	2277.991841	business, we will be using a 10 kW solar PV.	
14	0	14016	0	1980.86247	The average solar PV in Washington costs \$26,500.	
15	0	14016	0	1722.489105	With the federal investment tax credit deducted	
16	0	14016	0	1497.816613	from the price, a 10 kW system would amount to	
17	0	14016	0	1302.449228	about \$19,610 to install	
18	0	14016	0	1132.564546	I am using a 16% capacity factor for a 10 kW	
19	0	14016	0	984.8387361	solar PV in Washington.	
20	0	14016	0	856.3815096	Solar PVs generally have a useful lifespan of 25	
21	0	14016	0	744.6795736	years before their capacity factor begins to fall	
22	0	14016	0	647.5474553	based on my findings from a 2012 study by the	
23	0	14016	0	563.0847437	National Renewable Energy Laboratory (NREL).	
24	0	14016	0	489.6389076		
25	0	14016	0	425.7729631		

Environmental impact:

The environmental impact from becoming a carbon neutral business such as Vitality Veterinary Wellness is huge. Emissions from electricity generation differ per type of fuel or energy source a business is using, as well as other factors relating to efficiency of electric power plants, etc. Because of this, the amount of CO2 produced per kWh will vary. Based on how much carbon was emitted in the US from energy consumption, the average amount of carbon emissions per kWh equaled about 0.91 pounds of CO2 emissions per kWh. This is also utilizing natural gas as a reference point and not coal or petroleum, which would be much worse. You can see the pounds of emissions/kWh on the table below. <https://www.eia.gov/tools/faqs/faq.php?id=74&t=11>

U.S. electric utility and independent power electricity generation and resulting CO2 emissions by fuel in 2019

	Electricity generation	CO2 emissions		
	million kWh	million metric tons	million short tons	pounds per kWh
Coal	947,891	952	1,049	2.21
Natural gas	1,358,047	560	617	0.91
Petroleum	15,471	15	17	2.13

Electricity generation is net electricity generation. Includes electricity-only power plants. Combined heat and power plants are excluded because some of their CO2 emissions are from heat-related fuel consumption.

Using light tubes rather than LED bulbs during the day would be saving about 55 pounds of CO₂ emissions from entering the atmosphere each year per solar tube. Compared to incandescent bulbs, you would be saving about 660 pounds of CO₂ emissions per solar tube each year.

A 10 kW solar PV installation will have the largest effect on minimizing your carbon footprint. It is estimated that you could produce about 14,000 kWh of energy per year with one 10 kW solar panel. Therefore, if used at full capacity, you would be saving about 12,750 pounds of carbon dioxide emissions each year per 10 kW solar PV you install.

The sustainable development goals associated with these installments are aimed to work towards goal 9: build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation and goal 7: ensure access to affordable, reliable, sustainable and modern energy for all. We want to develop reliant and resilient infrastructure, solar tubes allow for a method of lighting that does not rely on an energy source. Similarly, solar panels allow the clinic to source most of its energy locally and can rely on a constant source. Similarly, these installments create more affordable and reliable sourcing and hopefully help foster these improvements for other local firms.

Building Materials:

The two materials we investigated were Hempcrete and Marmoleum. Hempcrete would be used in the construction of the building in place of concrete in most of the structure, though likely not all due to being unsuitable for being highly load bearing. We recommend reaching out to people in the area who are experienced in sustainable building work, one good example being the Highland Hemp House who may be a great partner to work with and is located in Washington. Marmoleum would, as one might guess from the name's similarity, be used in place of linoleum as a more sustainable alternative.

By integrating sustainable building materials, we will be working towards the "sustainable cities and communities" UN Sustainable Development Goal. The building will not only be sustainable in itself but help to make the community more resilient by offering an alternative to less green-conscious veterinary solutions. Goal 7, affordable and clean energy is contributed to in a roundabout way but nonetheless the insulation properties of hempcrete will help in reducing energy needs for heating and cooling.

Environmental impact:

Hempcrete is carbon negative. It is a carbon store, and is made largely out of easily replenishable resources. At the end of its lifespan it is biodegradable and requires few chemicals

which may have adverse health effects. Hemp is also a phytoremediator so in the process of being grown, it helps to remove contaminants from its soil.

Marmoleum is carbon neutral and LEED certified and made of 70% rapidly renewable resources, along with a 43% recycled content. It has a lifespan of about 30 years and is also biograde so it can be easily scraped. When used properly, it can actually be used with controlled incineration and generate more energy than was used to manufacture it.

Cost analysis:

Hempcrete is significantly more expensive than traditional concrete, which is one of its major downsides. Quotes vary but it seems like up to about \$50 more per square foot wouldn't be unusual. It is also more difficult to get a hold of construction firms who use it often. Again, I would recommend reaching out to like minded people in Bellingham who may be experienced with this, like those at the Highland Hemp House.

MARMOLEUM FLOORING COSTS			
	ZIP CODE	SQ. FT.	<input type="button" value="Update"/>
	<input type="text" value="98229"/>	<input type="text" value="2500"/>	
	Basic	Better	Best
Marmoleum Flooring – Material Prices	\$6525.00 - \$9112.50	\$9225.00 - \$12487.50	\$12600.00 - \$14287.50
Marmoleum Flooring – Installation Cost	\$2812.50 - \$3037.50	\$3375.00 - \$3712.50	\$3825.00 - \$4275.00
Marmoleum Flooring – Total	\$9337.50 - \$12150.00	\$12600.00 - \$16200.00	\$16425.00 - \$18562.50
Marmoleum Flooring – Total Average Cost per square foot	\$4.30	\$5.76	\$7.00

This image is made up of estimates from a cost calculator. Here is the information of the nearest dealers who sell marmoleum for commercial use:

DIVISION 9 FLOORING
 18311 BOTHELL EVERETT HWY, SUITE 220
 BOTHELL, WA 98012-5234
 Phone: 425-205-4020
 Fax: 425-205-2028
MHECEL@DIVISION9FLOORING.COM

MQI CONTRACT FLOORING
 20209 BROADWAY AVENUE, BUILDING E
 SNOHOMISH, WA 98296-5145

Phone: 360-217-7007

Fax: 360-863-6471

RUBENSTEIN'S CONTRACT CARPET LLC

501 SOUTH LUCILE STREET

SEATTLE, WA 98108-2518

Phone: 206-762-5610

Fax: 206-762-2409

Cleaning Procedures:

The right cleaner is critical to a good looking Marmoleum floor. High pH cleaners or those with harsh alkalis (such as Ammonia or Mop & Glow Triple Action) will degrade Marmoleum resulting in sticky residue or haze that could damage or discolor your floor with continued use. Forbo recommends their Marmoleum Neutral Floor Cleaner that comes as a concentrate to dilute with water, available in quart or gallon size. **Marmoleum Neutral Floor Cleaner** is a neutral pH cleaner that will clean the floor without damaging. If you want to use a different cleaner, look for a neutral pH level in the cleaner and test an inconspicuous area of the floor prior to cleaning the full flooring surface.

Hempcrete seems to require less attentive cleaning. While we did not find any specific cleaning procedures, you can assume hempcrete should be well maintained like any other flooring.

Passive Building Design:

Passive building design is a cost-effective method to implement sustainable features and take advantage of natural energy opportunities. These sustainable vet clinic features can positively impact consumer's outward and inward perception of the building and corresponding service. It rests on the principle of strategic building design that passively decreases the electricity load for heating, cooling, ventilation, and lighting. Key elements of passive building design are building location and orientation, building layout, window design and location, insulation, thermal mass, shading, and ventilation. Passive design is especially valuable when constructing a new building because it is relatively low-cost upfront compared to the energy savings one can expect in the future. Retrofitting existing buildings is more tricky and requires more attention to determine the most cost-effective decisions.

Environmental and Social Impact:

Passive building design of commercial buildings can also help reduce electricity demand during peak load times, where the power grid is at full capacity. A commercial building can have a big impact on the peak load and reducing that can help reduce the clinic's contribution to fossil

fuels. Further, the lower the load of the building, the more feasible solar panels are on the building.

Not only will these recommendations provide low-cost heating, cooling, and ventilation for the building operator, it also provides substantial environmental and competitive advantages. To specify, a passively designed building generally has characteristics resembling modern architecture like big windows and a simple and easy to digest design. Both the consumer's inward and outward perception of the vet clinic is very dependent on their willingness to pay, so it would benefit that as well. Further, a passively designed building will provide comfort and excellent indoor air quality.

A modern looking building that also reflects a passive building design can portray skill, precision, and proficiency from the outside. Walking in, consumers could perceive a gentle and empathetic quality of service.

Recommendations for Passive Building Design:

Below are recommendations to passively heat and cool the building as well as develop passive ventilation. The building should be oriented so the south and north sides are longest to produce the most effective passive building design. South-facing windows with proper glazing, coating, and orientation paired with appropriate overhangs and thermal mass will provide a comfortable indoor temperature with little electric heat. Windows and vents that are strategically placed across the building can take advantage of air movement and natural wind patterns to provide adequate natural ventilation.

1. Location and Orientation

- a. Choose or develop a building with the long side facing south and north. When a building is oriented this way, it is much more adept at passive heating and cooling.
- b. The building orientation should also be decided based on natural wind patterns in order to maximize the benefit of natural or passive ventilation.

2. Passive Ventilation

a. The Building Envelope

- i. Envelope design greatly impacts energy efficiency, air quality, and moisture control.
- ii. Airtight construction and quality insulation.
- iii. Alternatively, a double envelope design may prove cost-effective and especially valuable for a green veterinary clinic. A double-envelope

design, also known as a passive solar house with a solarium, is essentially two sets of walls that improve insulation and use energy from the sun to maintain building temperature without forced air heating.

1. There are a few pros to this design:
 - a. Aesthetically pleasing to look at which enhances customer perception of the value of service. Further, it promotes high indoor environmental quality that improves the well-being of people inside.
 - b. It has been proven to be cost effective, especially in climates that are more neutral like in Bellingham due to the reduced energy costs from heating and cooling.
 - c. It can be multi-purposed. For instance, plants can be included throughout the double wall to enhance the look of the building. On top of that, the walls can act as a hallway or even a place to walk pets during cold winter months.
2. There are also some cons associated with a double building envelope:
 - a. This type of design is incredibly expensive, sometimes \$10,000 plus since it is essentially a second exterior wall. However, the energy savings may prove to offset the initial up-front cost overtime.
 - b. This type of design makes it harder to control the internal temperature of the building and may result in uneven temperatures that could prove uncomfortable for pets and people.

b. Natural ventilation

- i. Washington is especially great for natural ventilation because it has a fairly neutral climate most of the year.
- ii. Advanced window and vent systems that are strategically placed and take advantage of the physics of hot and cold air circulation.

3. Passive Heating and Cooling

a. Windows

- i. South wall should have the most windows. Thus, design the building in a way where the most advantageous places for natural light exist in this space.
 - ii. Windows need to be advanced with appropriate glazings and coatings tailored to the needs of the building based on its location. In this case, if you're going to have a lot of windows, get good ones.
- b. Exterior Shading
- i. Overhangs are necessary to ensure the building is properly heated in the winter but doesn't run the risk of overheating in the summer.
- c. Thermal Mass
- i. Concrete Walls or floors or anything with a high thermal mass will help the building store heat and keep it warm even after the sun goes down. Materials with a high thermal mass will help maintain a comfortable building temperature with low dependence on electric heating.

Cost Analysis:

In this case, we assume the extra cost of building a passively designed building is similar to achieving a building that is LEED certified. The average extra cost of a LEED certified building is an average of \$3.50 per square foot. On the other hand, the calculated 20 year NPV of the green buildings are as follows. Based on a twenty-year timeline, the initial cost of the construction does not surpass the benefit it has for all of the categories of building operation. In other words, the benefits of green construction across twenty-years in this study surpassed the up-front costs.

Cost of Initial Construction (\$/sq.ft)	\$3.50
Savings on energy	\$5.80
Emissions Savings	\$1.20
Water Savings	\$0.50
Operation and Maintenance Savings	\$8.50
Productivity and Health Benefits	\$36.90

How it benefits the customer and other occupants:

- Comfort
- Indoor air quality
- Resilient building with less maintenance
- Improves consumer perception of level of service

Green Roof:

Nature based infrastructure serves as a multi-beneficial solution. Green roofs are a perfect example of this multi beneficial solution, as it serves as a resilience tool against excess rainfall runoff, it increases the lifespan of the roof by adding a layer of durability, and it helps reduce energy usage and noise levels.

Green roof Costs and Benefits:

Environmental benefits:

- Improved water quality due to reduced stormwater runoff and fewer overflows of combined sanitary and stormwater sewage systems
- Increased habitat promoting biodiversity
- Lower temperatures for building roofs and the air above them in most climates
- Reduced energy consumption in some climates
- Improved sound absorption in the top floors of buildings
- Improved air quality

Economic benefits:

- Lower energy costs due to the cooling effect of the plant respiration and the insulation, shading and thermal mass of the plant and soil layers
- A less frequent roof replacement schedule due to greater durability than conventional roofs
- Reduced the stormwater management costs
- The creates of job opportunities in the roof installation and maintenance and in the emerging fields of urban agriculture
- Longevity of the roof becomes 40 years compared to 17 of a conventional roof installation

Financial Analysis:

Green roofs provide a payback period (based on a 50 year average annual savings) of approximately 6.2 years and an internal rate of return of 5.2%. However this is just the national average. Research suggests that if green roofs were to replace conventional roofs of all 5.9 million square feet of roof top real estate in the DC area, the 50 year NPV would be 22.7 million dollars, or \$.42 per square foot of building area.

There are two main types of green roofs: Extensive and Intensive. Extensive roofs are relatively inexpensive to install and are mainly for environmental benefits while intensive roofs allow for greater variety and size of plants such as shrubs and small trees but are typically more expensive to install and maintain. Most commercial and public buildings tend to use extensive roofs unless the roofs are intended primarily as occupied garden amenity space. As discussed in the customer engagement section, this could be a good opportunity to grow in house fruits and vegetables that would be fed to the pets upon visit. This would be perceived as an action to provide healthy foods to their pets that they may not always get while serving as a mitigation technique for greenhouse gas emissions.

Environmental Cost Benefit Analysis:

Air Quality:

The reduction of nitrogen-oxide compounds by a green roof is calculated to be worth \$.0008 to \$.589 per square foot of green roof. This isn't based on savings, but the contingent valuation of reducing these compounds from the atmosphere.

Aesthetics and Quality of life:

Although aesthetics and quality of life are difficult to quantify, one study has shown the overall effect of green building to have a net present value of \$12 per gross square foot in terms of greater productivity and lower absenteeism. In addition, research has found that office workers are 2.9% more productive when the view out of their office includes vegetation.

Roof longevity:

The epa's studies the average life expectancy of a green roof at 40 years compared to the conventional roof at 17 years. The soil and vegetation layers provide significant protection from UV rays which are a large contributor to deterioration of a roof's life expectancy.

The characteristics of buildings will vary greatly which will ultimately affect the energy and stormwater management savings. However, the additional premium from installing a green roof will equal if not have more benefits over its lifetime. That being said, the savings will increase as the amount of floors the building decreases and the square footage of the roof increases.

Local example:

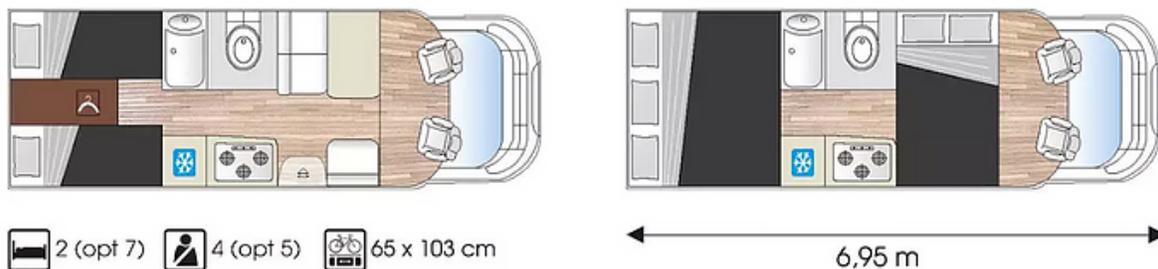
Western Washington University installed a green roof in 2010 as one of many sustainable features for major renovations of Miller Hall. The green roof consists of a mat system of sedum plants, flowering plants that require little maintenance. “The advantages of the green roof include savings on heating and cooling costs, better sound insulations, reduction in stormwater runoff and extra protection resulting in a longer roof lifespan.” The intrinsic value that comes from the green roof includes natural aesthetics that will improve the productivity of those who have the privilege to view it while working.

Eco friendly mobile clinic:

As a potential extension to the clinic, Vitality Veterinary clinic was interested in having a mobile clinic. There is a big market for pets who do not want to go to the veterinary office, and this is where mobile clinics come in. It would be smart for Vitality to extend their competitive advantage within the area and reach an audience that other competing clinics may not be. There are a multitude of reasons why it may be smart for a pet to avoid the office. It could be past trauma associated with veterinary offices, or simply avoiding contamination from a sick animal to another. Vitality emphasises the importance in preventative, ethical care and mobile clinics could be a great way to exemplify their high level of care.

Offering a drive-thru within the clinic could be another solution to providing care for these patients at a distance, however, it may be less logical. Aside from the obvious advantage of reducing stress on an animal suffering through car ride, it would be more eco-friendly to offer a service where an electric vehicle clinic could visit a client rather than the client driving their less fuel efficient car. It would reduce emissions whilst providing stress free care.

Some of the more impressive electric vans on the market that would be spacious enough for a mobile clinic would be the Vauxhall Vivaro-e or the Volkswagen e-Transporter. These would be a good option for at-home care, where all medical supplies and staff could easily be transported to a client’s house for care with zero carbon emissions. However, if Vitality wished to have a clinic within the vehicle, it would be advisable to have a larger vehicle.



Above is a diagram of the Iridium eMobil Electric Motorhome. This fully electric vehicle is originally designed as a motor home, however with renovations could be ideal for a mobile clinic. There would be sufficient room and capabilities for an examination table, seating and a computer as well as a few other crucial appliances such as a fridge to store vaccines. The vehicle is equipped with plumbing and electrical abilities.

Carbon Offsetting:

Vitality has become increasingly concerned with the CO2 emissions from certain anesthetic gases that are non-replaceable in medical practice. The main contributing gases Vitality is concerned with would be nitrous oxide, sevoflurane and isoflurane. These are potent greenhouse gases that absorb and trap infrared radiation within the atmosphere. To illustrate the carbon footprint of utilizing these gases, we can note that one hour of 2% *sevoflurane* emits a CO2 equivalent similar to that driving 6.5 km, one hour of 1.2% *isoflurane* emits a CO2 equivalent similar to that driving 14 km and one hour of 60% *nitrous oxide* emits a CO2 equivalent similar to that driving 95 km.

So how can we avoid this extensive carbon footprint? We can't necessarily avoid it because it is impossible to eliminate these revolutionary anesthetics in veterinary practice without jeopardizing the health and safety of the animals in Vitality's care. However, it would be smart to purchase carbon offsets equal to the amount of emissions created by these anesthetics.

Based on how much anesthetic Vitality is using each month, we could neutralize the carbon footprint of your business by purchasing a set amount of offsets. Subscribing to a monthly offset subscription is ideally more budget friendly, however if Vitality prefers to cater it directly to how much carbon was emitted per month, one time purchases are available. Here is a snapshot of some options for business carbon offsets off of the website terrapass.com:

Business Carbon Offset (One Time Purchase)	\$11.00 per mT
Business Carbon Offset (Monthly Subscription)	\$9.99 per mT / month

Terrapass works on several different projects to reduce carbon or other harmful greenhouse gas emissions to offset emissions that cannot be as easily avoided. This way Vitality can continue to provide adequate, ethical surgical care to animals in need of anesthesia whilst also neutralizing its carbon output.

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