Prepared for: UBC Building Operations

Carlene Wilson, Dawei Wang, Giulia Turco, Lorenzo Bisceglia, Vivien Wang

University of British Columbia

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Cloud9 Consulting
3291 Robson Street, Vancouver, BC
604.933.2823
info@cloud9consulting.com

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Cloud9 Consulting Team (Team 9):
Lorenzo Bisceglia | Vivien Wang | Dawei Wang | Giulia Turco | Carlene Wilson

EXECUTIVE SUMMARY

In January 2017, Cloud9 Consulting was approached by UBC Building Operations (Building Ops) to devise a plan to reach the emission target goals set out by the Climate Action Plan. The brief given was: How should UBC create a significantly more efficient and cost effective fleet of vehicles, while simultaneously dramatically reducing fleet vehicle greenhouse gas emissions?

ABOUT THE CLIENT

UBC Building Ops is the on-campus maintenance organization who manages a large fleet of vehicles for the campus. Through partnerships and economies of scale, the organization is able to achieve low costs for vehicles, fuel and maintenance services. UBC Building Ops has reduced emissions by 45% since 2007, though they have a ways to go to hit their targets for the future. Most importantly, 54% of all campus vehicles are owned outside of the organization, making hitting future targets more challenging.

The largest issue Building Ops is facing currently, is that not all faculties within UBC share the same vision on reaching the emissions targets. Even if they did, Building Ops has no way to monitor their progress as many of their vehicles are outside the organization's fleet. This main problem leads to three major symptoms, which include:

1. Emissions per vehicle still remain too high
2. Too many UBC-owned vehicles are on campus
3. Internal operations are not optimized for campus

Cloud9 has executed primary and secondary research in order to provide recommendations for Building Ops moving forward.

ANALYSIS AND RECOMMENDATIONS

All recommendations by Cloud9 will be focusing on the 2050 goal of zero emissions. Though the 2020 benchmark is much sooner, Cloud9 has discovered that costs associated with focusing on two separate goals will be much higher than focusing on the second of the two. With the recommendations in place for 2050, 2020 goals will simultaneously be achieved.

Building Ops is not yet in a position to fully centralize all vehicles on UBC, mainly, because there are departments who are opposed to joining, despite the clear data on costs savings and the benefit associated with the centralized fleet. Cloud9 initially considered an incentive program or cap and trade to either incentivise or nudge the faculties into joining, though we quickly understood that this may be seen as coercion and may not be adopted fondly by the faculties. That being said, our recommendations are built around the non-member faculties owning their own car, though attempting to create a shared values with Building Ops to achieve the emission targets.

Recommendation alternatives were evaluated based on their ability to lower the symptoms outlined above, and include their ability to:

1. Lower greenhouse gas emissions

2. Reduce fleet size
3. Optimization of the Building Ops system

After careful consideration and analysis, the three recommendations are as follows:

1. Remove fossil fuel vehicles and collect data
2. Reduce fleet size
3. Optimize campus operations

Though these are lofty goals, Cloud9 has outlined tactics to make each recommendation realistic and ready to be implemented.

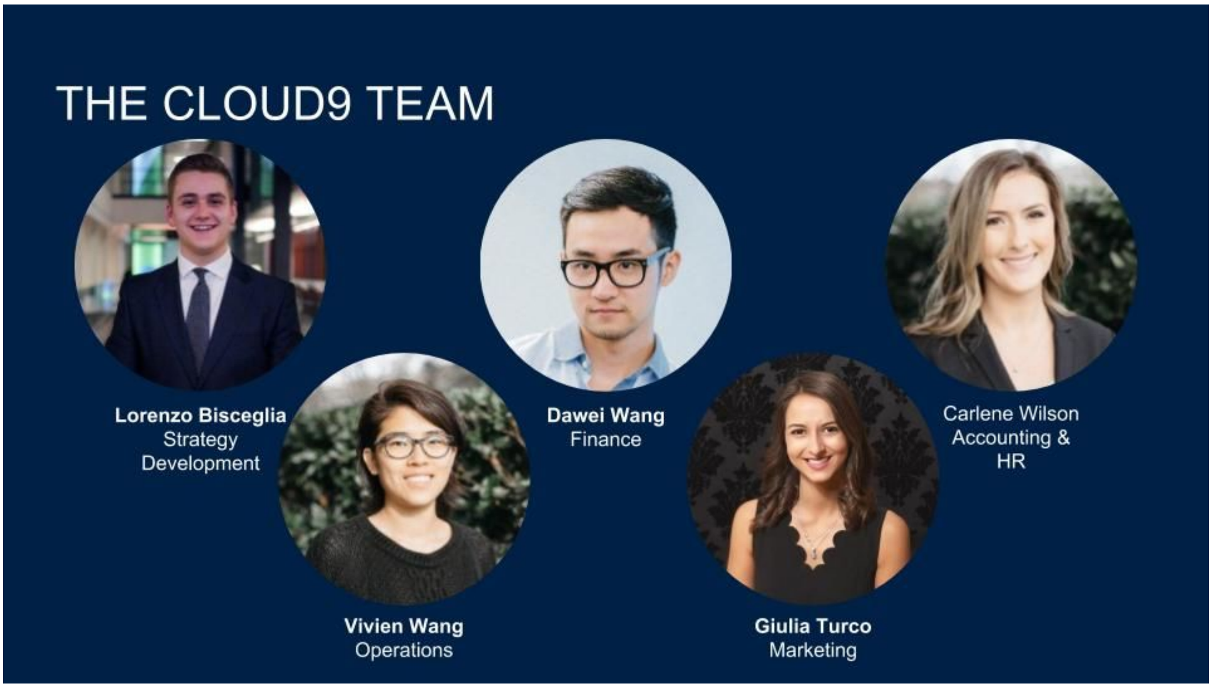
Recommendation 1: Remove fossil fuel vehicles and collect data
Recommendation one is built around government subsidized programs to incentivise car owners to trade in their vehicle for a clean energy vehicle. Using these governmental programs in junction with a Building Ops subsidy should be enough of an incentive for faculties to switch out their vehicles. The only request from Building Ops, would be that the faculty insert a telematics device in their car for solely the purpose of data collection. This recommendation will work because it is enough of an incentive to sway the faculties to move to non-GHG emitting vehicles, while Building Ops has slightly more control over the vehicles that are not associated with Building Ops. The data collected will be used to further improve the system moving forward.

Recommendation 2: Reduce fleet size
There is a binding constraint to fully electrifying all on-campus vehicles, and that is the lack of infrastructure to support it (charging stations, power, etc.). Our second recommendation is the introduction of Veemo bikes by Velometro. Unlike other bike sharing programs such as Mobi, Veemo provides a car-like experience using solar panels on the roof to generate electricity. Veemo's enclosed, electric-assist and three-wheeled vehicle is regulated as a bicycle. These bikes have the ability to replace vehicles for small, nearby jobs.

Veemo is already partnered with UBC to conduct a test run of the bikes Spring 2017. Building Ops shouldn't have a problem receiving a few vehicles to add to their fleet on a test-basis.

Recommendation 3: Optimize campus operations
Our last recommendation focuses on long-term costs. Cloud9 recommends Building Ops take the data collected from our first recommendation, and use it to create a centralized deployment application to improve efficiency. Building Ops currently function with 9 different platforms, this program will reduce the need of an employee to manage and deploy the vehicles.

Cloud9 takes these strategies and tactics into further depth in this report. This plan lays the groundwork to reach UBC's 2050 goal of zero emissions, as well as key metrics and change management.



We are a team of innovative and capable students with an array of knowledge in different areas. All 5 consultants are BCom candidates at the Sauder School of Business.

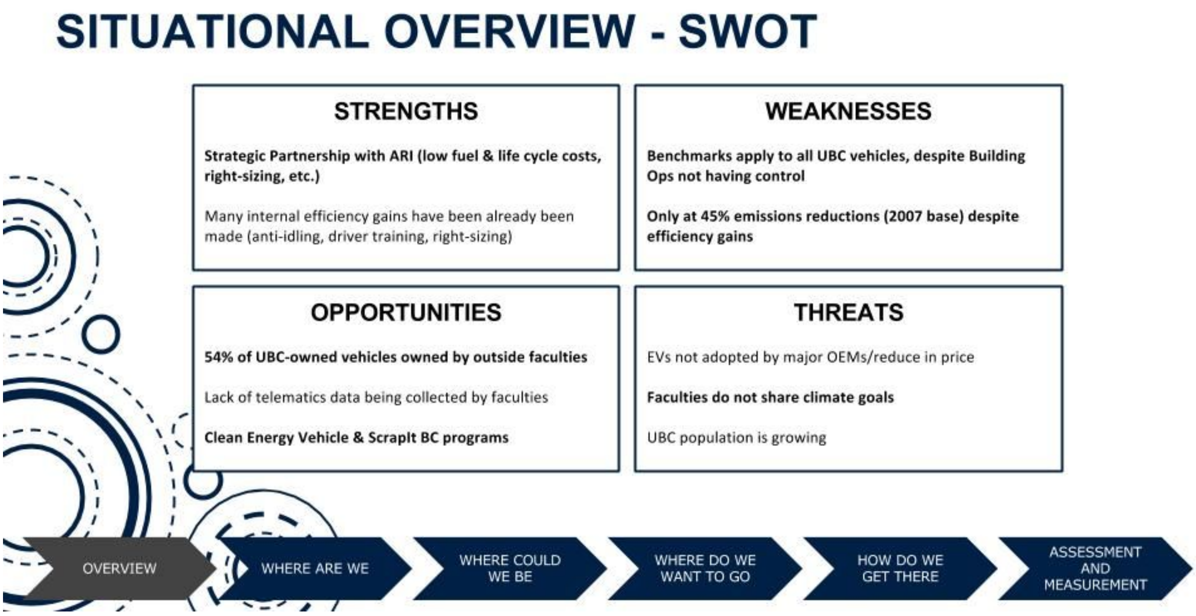
- **Lorenzo** has experience in project management and strategic implementation, with his most recent job being in a data integration role to facilitate a B2B customer segmentation.

- **Vivien** has a focus on business operations. Through case studies and work experience, Vivien has become excellent at reviewing business operations and identifying key drivers for operations improvements.

- **Dawei** has worked in various business development and financial analyst roles, from the agency side of advertising, to strategic consulting in Ethiopia, to analyst positions in banking.

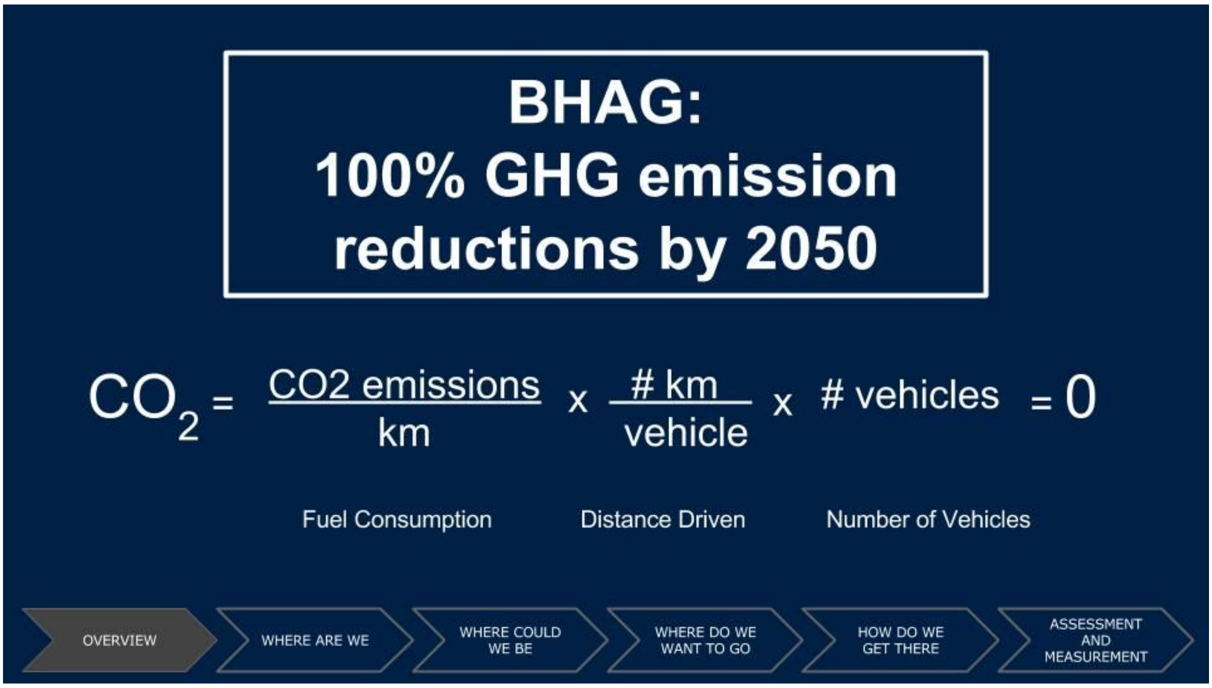
- **Giulia** has three years of experience in public relations where she has perfected her communication and strategic thinking. Giulia has an array of experience within the business development aspect of PR, and her experience includes crafting and developed a strategy for a large retailer's expansion throughout Canada, relationships with the media and influentials, and managing of projects.

- **Carlene** is heavily involved with UBC's Human Resource Management Club, where she organizes and plans events for fellow students. She has a Diploma in Accounting from Douglas College, and has three years of experience working as a Jr. Accounts Payable Specialists.



Prior to developing a strategy, Cloud9 completed a thorough strategic analysis of Building Ops' current system. A SWOT analysis is a useful tool to create goals and metrics based on Building Ops' current status. From the findings, Building Ops has achieved low fuel and maintenance costs for their vehicles managed under their fleet. They are also a charter member of the E3 fleet program and have received a platinum rating. This shows that they are optimizing and performing to their fullest potential. One of their weaknesses is, that although they have been able to efficiently control and manage their own fleet, there are many departments that haven't joined forces with them. Having a centralized unicen system is detrimental to achieving their long-term goal of reducing emissions by 2050. The technology industry is growing, and Cloud see this as both an opportunity and a threat. Advancing technology could be an opportunistic for Building Ops, but there is no way of knowing for sure.

Please see a more detailed SWOT in Appendix 24.



Building Ops' Big Hairy Audacious Goal (BHAG) is to reduce GHG emissions by 66% by 2020 and 100% by 2050, as per the 2007 baseline. To date, Building Ops has achieved transportation-based reductions of around 45%. To reduce GHG emissions, there are 3 main levers that can be pulled:

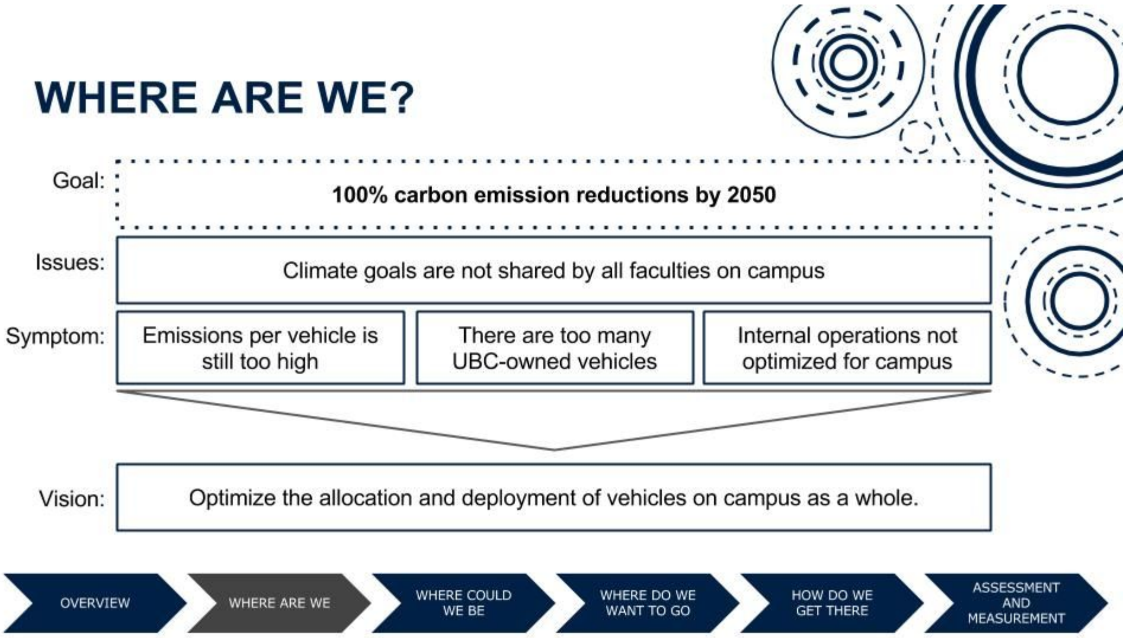
1. Reducing average fuel consumption of the fleet;
2. Reducing the number of kilometers driven per vehicle; and
3. Reducing the total number of vehicles being driven.

In order to achieve 0% emissions, one or all of these components must reach zero. It's impossible for the number of kilometers driven to reach zero, and the number of vehicles to reach zero. So, in order to meet its 2050 goals, Building Ops must eliminate fossil fuels from its fleet. Building Ops can best meet its goals by doing the following:

1. Minimize the distance driven;
2. Minimize the number of vehicles in the fleet; and
3. Completely eliminate fossil fuels from the fleet.

As discussed in the SWOT Analysis, Building Ops has already highly optimized its fleet with currently-available technology. It's assumed and expected that Building Ops will continue to monitor and optimize its fleet (with the help of ARI) as EVs become a more viable option, but we can only expect very modest returns in the near future. In order to continue to make progress towards its GHG emissions goals, Building Ops should look outside its own fleet. Specifically, Building Ops' should target the 54% of vehicles owned by other faculties.

While we have discussed the 2050 goal, we have so far ignored the intermediate 2020 goal of 66% reductions. Ideally, it would be possible to reach both goals through the same strategy, however we recognize that achieving an additional 20% of reductions in the next year is a near-impossible task. Furthermore, it should be noted that the targets of 66% reductions apply to the campus as a whole, and not to each individual department such as Fleet Management. While it would be great for each department to arrive at the goal by 2020, it may result in undue inefficiency and greenwashing for Building Ops to get there in time. Therefore we are not ignoring the 66% goal, but we are highlighting that it will be incidentally be met on our way to achieving 100% reductions. We expect to incidentally meet the 66% reduction goal by 2025, but we will primarily be focussing on the strategy for 2050.



Based on our analysis, the 54% of faculty-owned cars are the next clear opportunity Building Ops should explore. Based on information given by the client, Building Ops offers the following benefits to prospective customers such as faculties:

1. Discounts on fuel (e.g. 2016 Gasoline Average: $1.0935/L);
2. Maintenance discounts (Hourly Garage Rates: ~$65 vs. $120) and convenience;
3. Discounts on vehicle acquisition;
4. Assistance with salvage and disposal; and
5. Guidance on maximizing life cycle value.

Currently, some groups reach out to Building Ops for advice and guidance, but fleet decisions are decentralized overall. Furthermore, all departments operate with individual budgets and are not staffed with fleet specialists. Finally, most departments are not collecting telematics data and assets are suspected to be underutilized. This results in frustration and a misalignment of goals in the following ways:

1. Building Ops has made nearly all the progress it can on its own fleet;
2. Building Ops' success is measured on the emissions for the **campus as a whole**;
3. 54% of vehicles are not owned by Building Ops -- Building Ops has no control over how those vehicles are managed;
4. The vast majority of those vehicles are not managed by fleet staff specialists, do not consult Building Ops for guidance, and do not follow "best practices";
5. Departments operate with individual budgets and minimize their short term costs;
6. Departments are reluctant to follow Building Ops' advice (e.g. preventative maintenance every 6 months) because it increases short term costs;
7. Departments are not collecting data that can help them make long-term, life-cycle based decisions.

This misalignment of incentives results in a great deal of frustration for Building Ops. Building Ops seeks to minimize life cycle costs and maximize greenhouse gas reductions while faculties are primarily mindful of minimizing short-term costs. Underpinning this frustration is that greenifying a fleet reduces life cycle costs and total cost of ownership, but requires capital outlay and increased short term spending. This poises Building Ops and departments to be directly at odds about whether or not departments should greenify their vehicles. At its core, the primary issue is that **UBC's climate goals are not driven by all departments on campus**.

UPS

United Parcel Service (UPS) strives for excellence in everything they do. Today, they operate one of the largest private alternative fuel and advanced technology fleets in the U.S. The company has achieved success by always being an early adopter of innovative technologies. They currently follow a rolling laboratory approach to managing its fleet, by replacing vehicles whenever possible. They strive to reduce the amount of fuel through implementing telematics in all their vehicles. This allows them to do their due diligence of keeping track of mileage and maintenance to prevent problems before they begin. The business success depends on efficiency, which is why they focus on network optimization. Through one integrated and optimized network they can increase their efficiency and reduce their environmental impact. Their fleet currently consists of all-electric, hybrid electric, hydraulic hybrid, ethanol, compressed natural gas (CNG), liquefied natural gas (LNG), propane, renewable natural gas (RNG)/biomethane, and light-weight fuel-saving composite body vehicles such as pedal power. .

Google

The heart of American multinational tech giant Google sits in Googleplex, Google's main corporate campus. As a company that is driven by innovation and blue sky thinking, one of Google's primary goals is to create an environment that is both sustainable and self-sufficient. To achieve their goals of sustainability, Google has implemented a number of programs to optimize their fleet management, including introducing an on-campus bike share program, a 'GFleet' program, as well as self-driving and shared electric vehicles. To reduce the carbon emissions of their employees, Google offers privately run coach busses within the Palo Alto area to bring employees to and from work. Google derives much of their inspiration from nature, and claim to "create buildings that function like living and breathing systems by optimizing access to nature, clean air and daylight".

As we discussed, departments are not driving UBC's climate goals. We asked three experts as to why that would be the case and how we could encourage adoption.

Dr. Stephen Sheppard is a Professor of Urban Forestry at UBC. He is an expert on communicating the threat of climate change to school-age students and the general population.
His recommendations were largely centered around **communication**. His recommendation had 3 main points:

1. Collect data to actually scope out what faculties are actually doing to assess the size of the problem.
2. It may seems obvious that Building Ops offers superior cost savings and lowers its overall costs through fleet management. However, this may not be obvious to faculties. Therefore, it's necessary to communicate just how much money faculties will actually save by managing their fleet and showing them how electrifying their vehicles and taking advantage of government programs will save money in the long run.
3. Faculties may have reservations about being managed by an outside entity. Therefore, encourage high adoption rates by allowing faculties to maintain their own autonomy, ownership, and control of their vehicles, whenever possible. Also, oftentimes, several tactics used in tandem will appeal to more people and work better than a single tactic.

Moreno Zanotto has a Masters in Public Health with a specialization in cycling traffic interactions and transportation-based infrastructure. His recommendations are to reduce the number of vehicles being driven by reducing **behavioural barriers**:

1. Offer alternatives such as a bike-sharing network whereby faculties will have a newfound ability to get around campus quickly without the use of a car. The research supports the idea that if the infrastructure is built (such as a skytrain line or a bike sharing network), people will start to use it.
2. Make cycling more attractive by creating separated bike lanes to minimize accidents and rider anxiety, and maximize cycling speed and efficiency.
3. Offer weather-proofing measures if possible, especially in a rainy climate like Vancouver.
4. Offer incentives for drivers to try cycling and support their continued use through training and management buy-in.

Dr. Omar Herrera is the the Manager of Transportation Futures at the Clean Energy Research Center (CERC). His recommendations were around **technical barriers to optimization**:

1. There is a constraint on UBC's electrical transformers and ability to draw power from the grid. It's unlikely that unilateral electrification of the vehicle fleet can be accomplished without major construction and upgrade costs. Therefore, if 100% emissions reductions are to be realized, it's necessary to explore other alternatives like hydrogen fuel cells, hybrids, on-site power generation, or reducing fleet size
2. CERC is working on an artificial intelligence, Aurora. While Aurora is still in Beta, it is designed to help optimize routes, traffic, and vehicle flow for the entire campus. Aurora would mesh extremely well with autonomous vehicles, which are increasingly in vogue.
3. CERC is partnering with VeloMetro, the Vancouver startup behind Veemo, an alternative, electric-assisted pedal vehicle. UBC will be used as a pilot project, with rollout happening in spring 2017.

Overall recommendations:

1. Increase faculty adoption of electric vehicles by communicating why departments will benefit financially and/or reducing financial barriers;
2. Decrease the number of vehicles on campus by providing a bike share network and infrastructure; and
3. Improve data collection to both assess the scope of the problem and integrate effectively with emerging AI optimization techniques.

KEY CONSIDERATIONS AND ALTERNATIVES

ALTERNATIVES	GHG REDUCTION	FLEET REDUCTION	OPTIMIZATION
Cap & Trade	✓	✗	✗
Consultation & Communication	✓	✗	✓
Veemo	✓	✓	✗
Optimization	✗	✓	✓

It's already established that to reach the 100% reductions goal, the following actions must be taken:

1. Minimize the distance driven;
2. Minimize the number of vehicles in the fleet; and
3. Completely eliminate fossil fuels from the fleet.

In tactical terms, this translates to a strategy that will do the following:

1. Optimize the vehicle mix and routes taken by **all campus-owned vehicles**;
2. Reduce the size of the **campus fleet**; and
3. Eliminate transportation-based GHGs for the **entire campus**.

The 4 alternatives that have been considered are:

1. **A Campus-wide Cap & Trade Policy** for transportation-based emissions. A UBC-sanctioned cap & trade policy passed through the Board of Governors would have the potential to align the incentives of Building Ops and departments and greatly reduce GHG emissions. However, this is quite a forceful, domineering tactic that seeks to impose Building Ops' will on other faculties. This policy could be damaging to relationships with faculties in the long run, especially as it negatively impacts departments' budgets. Furthermore, this policy is a singular tactic and does not directly optimize the allocation of vehicles or reduce the size of the fleet.
2. **A Consultation & Communication Initiative** with faculties. The purpose of this process would be to:
    i. Foster goodwill with faculties and learn about their concerns regarding partnering with Fleet Management;
    ii. Appeal to emotion by communicating Fleet Management's vision of 100% emissions reductions by 2050 and creating a sense of urgency;
    iii. Appeal to ethics by leveraging Fleet Management's E3 Rating and demonstrating authority and willingness to help;
    iv. Appeal to reason by educating faculties on the governmental programs available, as well as demonstrating the potential cost savings that can be had from performing a thorough fleet analysis, right-sizing vehicles, and electrifying the fleet;
    v. Ultimate goal: negotiate the implementation of telematic devices in each faculty's fleet.

  b. If faculties are still reluctant to install telematics (due to cost concerns or autonomy concerns), consider a **Cost-Share Incentivization Program** to help holdout faculties replace aging vehicles with electric vehicles:
    i. Offer a 50/50 cost share on the purchase price of an EV through ARI, after governmental subsidies of $11,000 (CEV program $5,000, BC Scrap-It Program

$6,000);

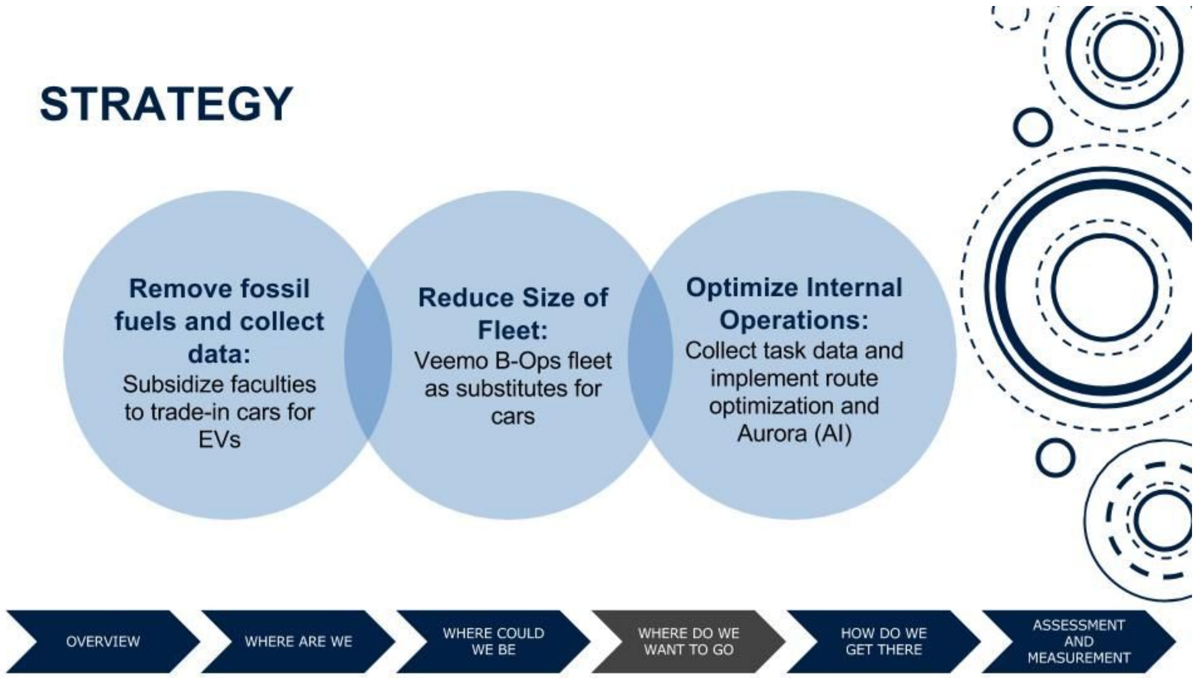
  ii. The <u>department</u> owns the vehicle;
  iii. In exchange, Building Ops installs telematics in the department's fleet for a minimum of 6 months. The faculty covers the monthly operating cost of the telematics during this time (~$50/month/vehicle). Furthermore, Building Ops does maintenance on the fleet during this trial period;
  iv. All data on the faculty's fleet is displayed in a dashboard that the department manager has full access to. This dashboard would be able to show the benefits from reduced fuel costs, maintenance costs, downtime, and GHG reductions compared to the retired vehicle;
  v. Monthly/quarterly reviews will be held with the department manager to discuss potential cost savings and areas of improvement;

 c. While this strategy would help reduce GHGs and the data collected could be used to optimize vehicles, fleet reduction would not be achieved. Replacing one aging vehicle with a new EV retains the size of the fleet.

3. **A Veemo bike network** and partnership with VeloMetro to allow UBC's staff to do short-distance trips. Currently, it's assumed that UBC staff walk to any job within walking distance. For all other trips, they use vehicles. By offering an electric-assisted pedal alternative, GHG reductions are achieved while also changing the product mix. With a new product mix of vehicles at UBC's disposal, the overall size of the vehicle fleet can be reduced. If used in tandem with a cost sharing strategy, this would have the secondary benefit of offsetting much of those costs. However, optimization is not achieved with this tactic.

4. **Aurora Artificial Intelligence** and partnership with the Clean Energy Research Centre. With increased adoption of best practices by faculties, the product mix of vehicles can be optimized for the entire campus, resulting in a smaller fleet. Furthermore, integration of the data collected by faculties can be implemented for highly optimized route planning, vehicle movement patterns, and vehicle deployment. While this strategy achieves optimization and fleet reduction, it does not impact fossil fuel combustion on its own.

Each of recommendations 2, 3, and 4 are unable to complete the strategy on their own. However, when taken together, each recommendation has strengths where the others have weaknesses. Therefore, it seems that an integrated approach is best if all goals are to be met. Therefore, as stated in the vision, the goal to optimize the allocation and deployment of vehicles on campus as a whole. This goal will be achieved through an integrated approach of **Communication and Data Collection, a Veemo Bike Network, and Optimization using Aurora AI.**



UBC should have a focus on 2050 climate action goal to emit zero emissions and begin implementing tomorrow. From Building-Ops' BHAG analysis, fuel consumption, distance driven and numbers of vehicles are three key drivers to GHG reductions. To meet the ultimate goal, zero emissions, there are three areas could be worked on:

1. remove fossil fuels and collect data;
2. optimize internal operations;
3. reduce size of fleet.

The approach is three-pronged, but they are not mutually exclusive.

The first approach aims to reduce average fuel consumption of the fleet. With more telematics installed, UBC could have better knowledge about fuel consumption on mileage. Thus, the fleet could be better managed. The fleet management team also has more facts to demonstrate its achievement on GHG reduction. The second arm of the strategy is reducing size of the fleet. Fewer vehicles emit fewer GHG emissions. The total number of vehicles being driven on the campus should reduced to achieve this goal. The last area to work on is to optimize internal operations. With optimized operations, the number of kilometers driven per vehicle could be reduced and fleet vehicles are used effectively.

RECO 1: REMOVE FOSSIL FUELS & COLLECT DATA *Create Shared Values*

Our first action is to remove fossil fuels from the entire UBC fleet, including both Building-Ops and Non-Building-Ops. In order to achieve this, we must negotiate with departments and communicate Building Ops' vision to find an opportunity to create shared value with these departments. If faculties are hesitant to join, we can propose a Cost Sharing Incentive Program. Although this initial step will be rather expensive, this is the ground work to our overall strategy, and the costs can be recuperated in lower fuel, insurance, and maintenance costs in later steps. We have identified three steps to achieving this goal:

1. Electrifying the fleet: The Province of British Columbia and SCRAP-IT encourage the adoption of new clean energy vehicles and are currently offering an incentive program which will result in potentially $11,000 worth of savings towards the purchase of a new clean energy vehicle. To encourage the the adoption of this program, for every vehicle that is replaced with an electric car, we will split the remaining costs with the department. This is simply an incentive program, and the department will remain the sole owner of the vehicle.

2. Telematic System Installed: We ask that every car that is purchased instal a telematic device. By having these devices in most vehicles, we will be able to collect and gather data on mileage and fuel consumption. We will share this data with faculties and reiterate that this data is for their benefit, to inform future purchase decisions. It is advisable to hold monthly/quarterly meetings to consult with participating faculties and highlight where improvements can be made. This data collection process is currently an issue, since we don't have this information for our vehicles.

3. Communicate Shared Values: In the long-term we hope that by collecting this data we can communicate the benefit to driving an electric fleet and hopefully more departments will adopt this program. There are main benefits to driving a clean energy vehicle. By having a concrete data analysis of how much money they could have saved, we will be able to communicate to all departments the benefits of electric vehicles. The increase in communication using factual information will create shared values between the departments and Building Opps of reducing GHG emissions.

RECO 2: REDUCING THE SIZE OF THE FLEET *Reduce costs*

Reduce Cars on campus by introducing car sharing Veemo fleet

Bike lanes and infrastructure building

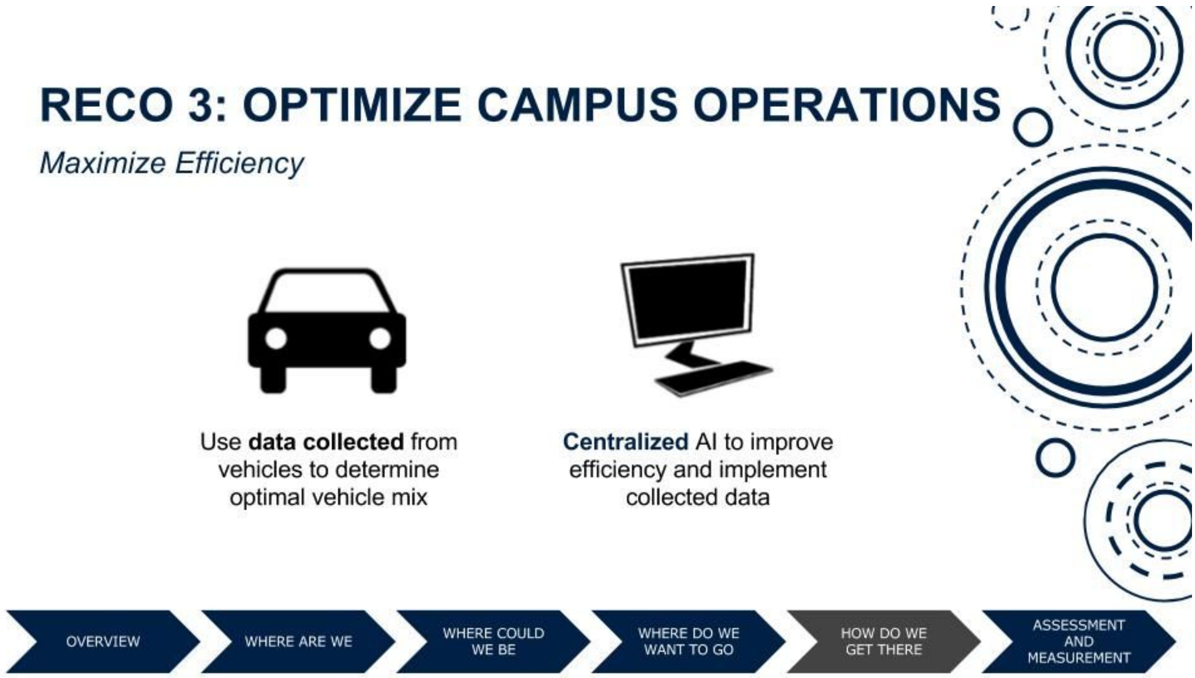
OVERVIEW | WHERE ARE WE | WHERE COULD WE BE | WHERE DO WE WANT TO GO | HOW DO WE GET THERE | ASSESSMENT AND MEASUREMENT

The second recommendation is to reduce the size of the fleet. Smaller size fleet directly contribute to lower GHG emissions. While ensuring daily operational needs are met, reducing the size of the fleet is another driver to reduce GHG emissions. There are two tactics to achieve this goal.

1. Introducing car sharing Veemo fleet: Veemo is an enclosed, electric-assist and three-wheeled vehicle. It provides a car-like experience but it is regulated as a bicycle. Driving Veemo doesn't need a driver's licence and no need to buy insurance either. Veemo combines the best of electric car, bike and Car2go. With weather protection and cargo space, we believe that Veemo is a clean transportation alternative that transports UBC's staff and necessary tools to complete basic tasks on the campus. In addition to Veemo's zero emission, Veemo liberates fuel costs and the operating costs.

The company, VeloMetro Mobility, is launching a veemo pilot fleet on UBC campus. This illustrates that, from developer's perspective, Veemo will be best performed on UBC Vancouver campus. Also, Veemo has a cloud-based platform that supports corporate fleet management. The comprehensive system enables operators to focus on the fleet maintenance and user based development. Based on the above analysis, UBC could purchase Veemo cars and incorporate them into our fleet. Having Veemo cars in the fleet reduces numbers of vehicles, increase fleet's flexibility and expedites GHG emissions reduction.

2. Bike Lane Infrastructure: While a closed vehicle that protects the driver from the rain already makes cycling more attractive, it's important to limit all possible barriers that would limit Veemo uptake. The current cycling situation is congested, especially on key routes such as University Boulevard and Main Mall. With a growing student population, this intermingling of pedestrian and cycling traffic will only become more chaotic over time and withdraw from the efficacy and attractiveness of cycling. Therefore, it's recommended that UBC conduct a study on separating bike traffic and pedestrian traffic. Such a policy would have the potential to minimize potential liability expenses, reduce rider anxiety and frustration, and increase cycling efficiency and enjoyment overall. These factors would improve the uptake of the Veemo or any future bike sharing networks.



The third recommendation is to use the data that has been collected to optimize the vehicle mix and deployment on campus.

If recommendations 1 and 2 are successful, there will be a wealth of data from department vehicle use available to be mined. Furthermore, the overall campus fleet will be increasingly electric, right-sized, and faculties will be monitoring complete life-cycle costs. With this shift in focus on long term costs, we see it being feasible that departments may be interested in increasing the utilization rates of their vehicles, pushing for them to be more efficiently driven, or outsource their fleet management altogether.

Either way, we anticipate that departments will be using their data to explore sharing their vehicles and begin to optimize the campus transportation process. After the successful implementation of recommendation 1 and 2, we would recommend and in-depth study to determine the optimal tactic going forward. However, whether it’s a car share that departments can buy into with a flat monthly fee, a platform that allows them to lend out their underutilized assets, or another tactic that remains to be seen, a trend of centralization of intelligence is likely to occur. This, in conjunction with increasingly-autonomous vehicles, makes it possible for Aurora AI to optimize the kilometer footprint of all vehicles on campus.

IMPLEMENTATION

	Kotter's 8-Step Change Model	
7-day plan	1. Create Urgency	UBC's competitive edge depends on climate leadership
	2. Form a Powerful Coalition	Senior managers, drivers, and staff who believe in climate goals
	3. Create a Vision for Change	With faculties, towards 100% clean energy, efficient movement
30-day plan	4. Communicate the Vision	With faculty heads by appealing to climate urgency, cost concerns
	5. Empower Action	Cost-share to reduce barriers, offer Veemo network to offset cars
	6. Create Quick Wins	Help faculties pick low-hanging fruit via ARI telematics data
90-day plan	7. Build on the Change	Bike lanes, collecting task data, Aurora AI, expanding E3 fleet
	8. Make it Stick	Continued communication, driver training, monitoring ARI data

In order to meet the 2050 goal of 100% emission reduction, and successfully implementing the recommendations made above, UBC will be faced with large changes in the organization. An effective plan to anticipate, monitor and correct issues that may arise must be in place. In implementing the recommendations above, it is important to note that employees must have a clear sense of direction for UBC to successfully implement changes. These steps have been broken down into 7-day, 30-day and 90-day:

- **7-day plan:** within the first 7 days of implementing a new program or project, Cloud9 has identified that the urgency and importance of the change must be communicated with employees of building ops in an effective matter. It is important that the employees understand how the change might not just benefit the company, but also themselves, for the change to be fully adopted. Suggestions for this include an immediate town hall to fully understand the needs of the employees, and allow their concerns to be heard and acknowledged. Another suggestion comes with the communication of some sort of incentive program, such as a monetary award for the employee who has contributed the most and maintained a positive attitude during the first month of the change.

- **30-day plan:** This 30-day plan will include engaging with the other Building-ops stakeholders, such as the departments at UBC who are or are not yet involved with Building-ops. Again, communication of the benefits for the campus, as well as the benefits pertaining directly to these stakeholders is imperative at this time. Alongside this communication, it is important to keep the Building-ops workers in mind, as change must be monitored to ensure it is being adopted.

- **90-day plan:** the 90-day plan consists of iterating the change as needed, and continued monitoring of all stakeholders. Constant communication can be eased up on after 30 days, though another town hall should be held to ensure content and understanding from everyone who is affected. More tactically speaking, the first 90 days should be spent looking into further building out the infrastructure, as well as proper training of employees.

IMPLEMENTATION - TIMELINE

Tactics:	Key Activities:	Timeline: Year 1	Year 2	Year 3	Year 4	Year 5
STEP 1: Reduce emissions per vehicle	Cost sharing incentivization	■	■	■		
	Data-collection		■			
	Communication of cost savings to create shared value		■			
	Leverage E3 rating in negotiations	■				
	Decal branding	■	■	■		
STEP 2: Reduce number of vehicles on campus	Increase of campus Veemo network			■		
	Increase bike lanes			■		
	Realignment of driver incentives			■	■	
	Decentralize tools			■	■	
STEP 3: Optimize internal operations	Data integration and mining				■	
	Optimization of vehicle fleet					■
	Leverage autonomous technologies (Aurora)					■

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WHERE ARE WE
WHERE COULD WE BE
WHERE DO WE WANT TO GO
HOW DO WE GET THERE
ASSESSMENT AND MEASUREMENT

Taking a look at the actual timeline of the implementation plan, we've categorized the three-pronged strategy into a namely three-step approach.

The first phase of the plan is to reduce the amount of emissions per vehicle in operation. As we previously discussed, the cost sharing incentivisation plan of replacing the conventional fleet with electric vehicles would begin in the next three years, and continue throughout, as technological advances become more prevalent. To increase chances of creating a successful negotiation term, UBC Building Ops would leverage our E3 standing in their discussions. Approaching Year 2 of the plan, data collection would begin through various integrated programs, as well as the continuation of communication between faculties in terms of cost savings. Throughout the integration of the new EV fleet, the first three years would also be used to either re-brand the decal labeling on the current fleet, as well as any new vehicles introduced.

The second phase of the plan would begin in the third year, as UBC approaches the end of Step 1, and focuses on the actual reduction of the number of motor vehicles on campus. This is when the integration of the campus Veemo network into a separate fleet of UBC vehicles would begin. With an understanding that the adoption of these three-wheeled electric vehicles may be difficult, but plan to offset that risk by potentially increasing the number of bike lanes along both University Boulevard as well as Main Mall. Throughout Years 3 and 4, UBC would focus on the realignment of driver incentives, as well as implement the plan of creating a decentralized tool system.

Lastly, the final phase of the plan is to look at ways of optimizing UBC's current operations. This includes integrating the data collection and mining gathered from previous years into a strategic plan in Year 4, and finally looking at ways of optimizing route options and plans, as well as integrate autonomous technologies such as Aurora in Year 5.

RISKS AND MITIGATION

RISKS	LIKELIHOOD	SEVERITY	STRATEGIC MITIGATION	CONTINGENCY
Veemo uptake low, fleet doesn't shrink	LOW	HIGH	Driver consultation, incentivization	Cap & Trade
Faculties resist, feel threatened	MED	MED	Cost-sharing, communication	Insist on telematics only
EV technology doesn't become more accessible	MED	HIGH	Partner with CERC to create a tailored solution	Alter climate goals
Electric infrastructure constraint	HIGH	LOW	Reduce fleet size	Explore hydrogen, hybrids, CNG

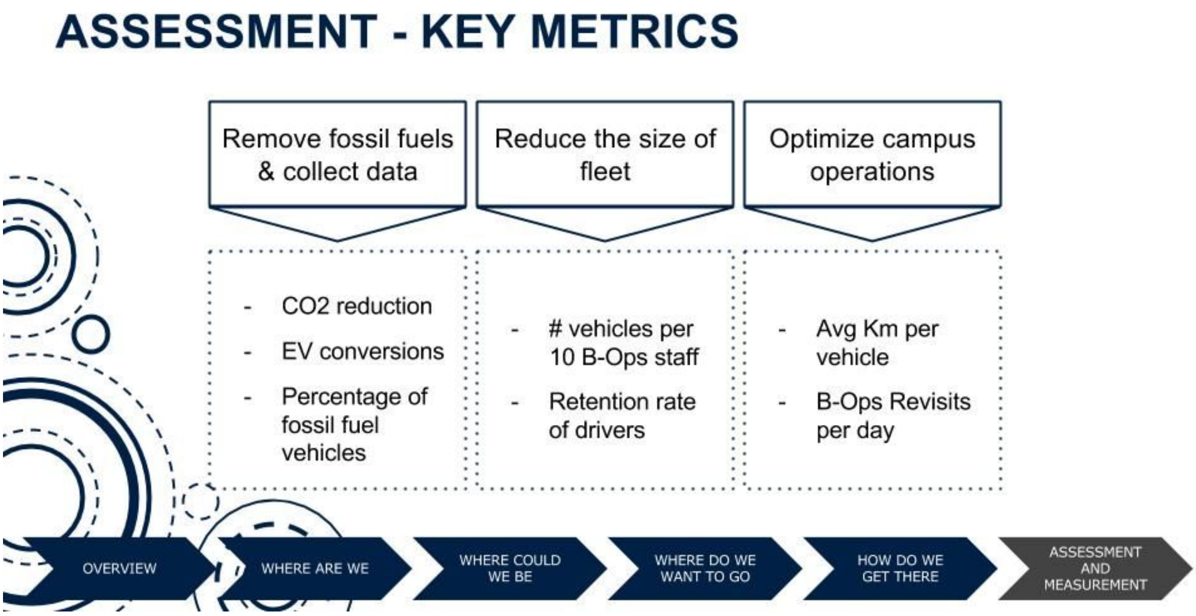
Through conducting Kotter's 8-Step Change Model, we conclude top four risks associated with our strategy. We sort them by likelihood from low to high.

Risk #1: Veemo uptake is low and fleet doesn't shrink
This is important because it is a main area that our budget goes in, and it is crucial for successfully reducing fleet size. The strategic mitigation of this risk is driver consultation and incentivization. Through communication and consultation, we want to make sure that drivers understand the importance of reducing GHG emissions and how a big role they play in achieving this goal. Providing incentives is another tactic that helps to increase Veemo uptake. If this doesn't work, we will consider adopting cap and trade.

Risk #2: Faculties want to remain autonomy and resist the change
Our strategy requires interactions and collaborations with other departments who have their own vehicles. Furthermore, we anticipate that departments will experience organizational changes. Departments will feel threatened about the changes, resist them and want to remain the autonomous. To handle this, we will communicate the vision of the change with faculty heads. Also, we hope our cost-sharing tactic could reduce their cost concerns and motivate them to join the change. The contingency plan for dealing with resistance will be slowing our progress by only installing telematics.

Risk #3: EV technology doesn't become more accessible
In the best of situations, our fleet only consists of electric vehicles and zero emissions are achieved. However, the concern is that the achievement highly depends on EV technology. If EV technology doesn't become accessible enough, we will consult the Clean Energy Research Centre at UBC to see if there are other available technologies or new clean energy to help with the GHG reduction. We can partner with them to creating a tailor solution for UBC. If that doesn't work, we will consider to alter climate goals.

Risk #4:Electric infrastructure is not updated accordingly
We anticipate high likelihood of electric infrastructure constraint because of increasing uptake of electric vehicles and slow expansion of charge stations. Hopefully, by having more Veemo cars in our fleet will reduce dependency on electric vehicles, which gives us more time to update EV infrastructure. The severity is relatively low in this case because we can explore other alternatives such as hydrogen, hybrids and CNG.

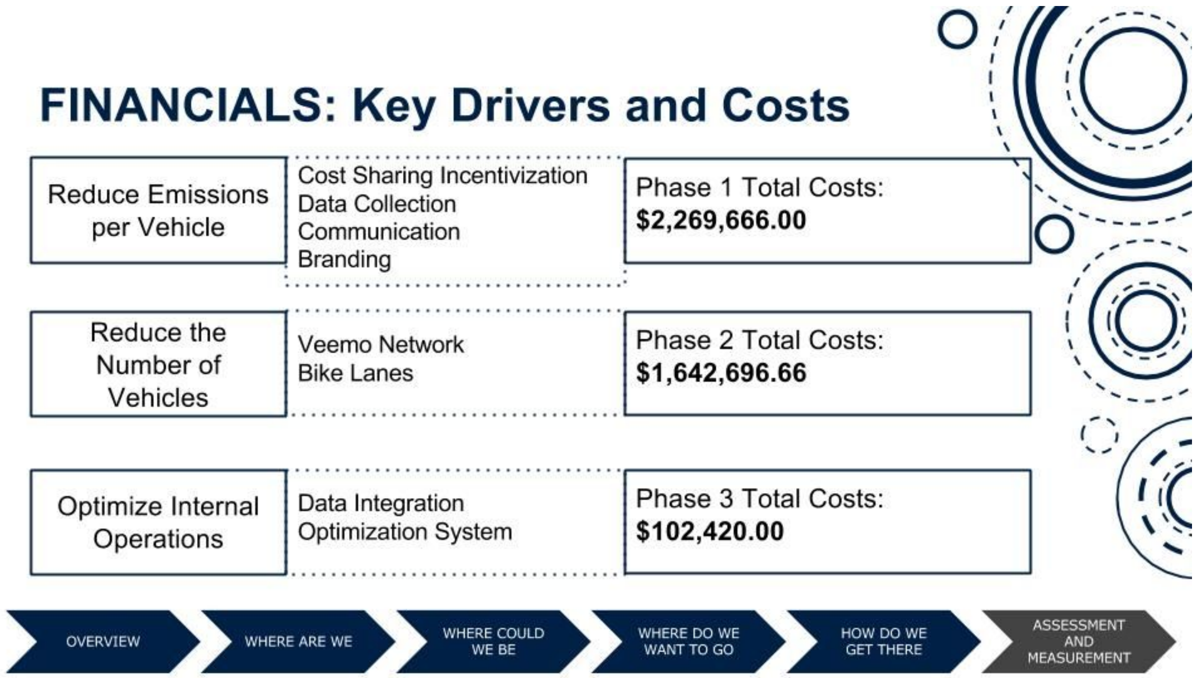


To determine the success of the suggested implementation plan, there are various metrics that must be looked at when analyzing the results of the overall strategy. These metrics vary depending on the phase of the plan UBC is in, and are as follows:

In the first phase, the goal is to definitively eliminate GHG emissions, and thus the amount of CO_2 reductions per average vehicle is an important figure to observe. Related to this, the number of electric vehicles converted into the UBC fleet, as well as the overall percentage of combustion engine vehicles still retained will provide a measure of the success of Step 1 of the implementation plan.

In the second phase, the goal is to actually reduce the size of the fleet itself, and optimize the operations of the current vehicles in operation. To measure this, the number of vehicles in operation per every 10 UBC departments staff will provide a key metric as to not only the efficiency of vehicle use, but the effectiveness of each individual vehicle given a particular job. Additionally, because of the implementation of the Veemo fleet, we will be able to measure the number of drivers that regularly use these alternative modes of transportation, as well as the actual frequency of use. This will provide value data on whether the adoption of the Veemo fleet is campus-wide, or specific to a core group of individuals who are either innovators or early adopters.

Finally, the third phase of the implementation plan is to optimize campus operations through utilizing data collected from previous phases, and implementing a route-optimizing platform for vehicles and drivers. To determine the metrics behind this step, measuring the average kilometres driven per vehicle, as well as relative to previous years, will provide us with efficiency feedback. Additionally, GPS tracking and check-in capabilities will show the number of times a UBC employee or vehicle visits the same building in a given time frame, allowing UBC Building Ops to potential re-plan job visits, and collectively complete tasks while utilizing a smaller number of resources.



To implement the three-step strategy brought forward by the Cloud9 Consulting team, there are a number of key drivers when considering the costs involved with each phase.

In phase 1 of the implementation plan, the primary goal is to reduce the number of emissions per vehicle, and this will be done primarily through the replacement of combustion engine vehicles with new, electric vehicles. Activities in this phase include the cost sharing purchasing program, data collection implementation through telematics, and communication and branding of UBC Building Ops. When looking at the cost sharing incentivization activity, key drivers include the cost of the new EVs themselves ($32,700), the government subsidisation of $11,000, and finally an implementation of 2.5% fleet replacement per quarter. Data collection is based off of an average monthly telematics cost of $50 per vehicle, and $15 for integrating software. Finally, the communication and branding activities are centrally focused around media buying, as well as the re-branding of decal graphics and placements on vehicles themselves. In the next five years, Step 1 of the implementation plan will cost approximately $2.3 million dollars.

The goal of phase 2 is to reduce the number of vehicles on campus as a whole, which will be completed primarily through the implementation of the Veemo vehicle share program, as well as supplementing that with additional bike lanes both on University Boulevard and Main Mall. Drivers of the Veemo program include the actual use of the Veemos, charged at a rate of $0.29 per minute, and the adoption rate of UBC workers. Additionally, UBC will need to implement charging stations throughout the campus, at an approximated cost of $50,000 per station. The cost structure of this phase also includes an additional $500,000 budget for the building of new bike lanes, to be spread out among four quarters. Step 2 will cost approximately $1.6 million in five years.

The final phase of the implementation plan revolves around optimizing the route and operations of the UBC fleet. This includes the actual integration of optimization programs, as well as the tracking of the frequency of vehicle visits per building in a given time period. The adoption of this program will be at a rate of 25% in Year 4, with costs at $15 per month per vehicle, totalling just over $100,000.

To complete the entire implementation plan will cost just over $4 million in five years.

FINANCIALS

	2020	2025	2030	2035	2040	2045	2050
GOOD							
STEPS 1 + 2: Reduce Emissions per Vehicle + Number of Vehicles on Campus							
% Combustion Engine Vehicles Reduced	30.00%	60.00%	80.00%	90.00%	95.00%	100.00%	100.00%
Total Vehicles Reduced	105	210	280	315	332.5	350	350
Fuel Costs per Litre	$1.10	$1.10	$1.10	$1.10	$1.10	$1.10	$1.10
Electricity Used, Petrol Equivalent	$0.38	$0.38	$0.38	$0.38	$0.38	$0.38	$0.38
Kilometres per Litre	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Fuel Costs per Kilometre	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06
Kilometres Driven per Vehicle	180000	180000	180000	180000	180000	180000	180000
Total Fuel Costs Saved	$1,088,640.00	$2,177,280.00	$2,903,040.00	$3,265,920.00	$3,447,360.00	$3,628,800.00	$3,628,800.00
STEP 3: Optimize Internal Operations							
% of Optimization of Data System	0.00%	25.00%	40.00%	40.00%	40.00%	40.00%	40.00%
Fuel Consumption Saved per KM	$0.00	$0.28	$0.44	$0.44	$0.44	$0.44	$0.44
Electricity Consumption Saved per KM	$0.00	$0.10	$0.15	$0.15	$0.15	$0.15	$0.15
Combustion Engine Vehicles	245	140	70	35	17	0	0
Electric Vehicles	105	210	280	315	333	350	350
Kilometres Driven per Vehicle	180000	180000	180000	180000	180000	180000	180000
Total Optimization Savings	$0.00	$10,521,000.00	$13,204,800.00	$11,390,400.00	$10,457,280.00	$9,576,000.00	$9,576,000.00
Total Cost Savings	$1,088,640.00	$12,698,280.00	$16,107,840.00	$14,656,320.00	$13,904,640.00	$13,204,800.00	$13,204,800.00

Total Costs
$4,014,782.66

NPV of Total Cost Savings
$39,134,063.89

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It is important to break down the cost savings into its constituent components:

1. Fuel cost savings from switching from fossil fuels to electricity;
2. Maintenance and fuel cost savings from running fewer vehicles; and
3. Maintenance and fuel cost savings from driving fewer kilometers per vehicle.

Combining the cost savings from Steps 1 and 2, it is clear that there are significant cost savings of $0.72 per km just from switching to EVs. Furthermore, in Step 3, we layer on a 40% reduction in the distance driven by all campus vehicles. Together, these measures amount to significant fossil fuel savings which are estimated to have a Net Present Value of approximately $39,134,000, using a discount rate of 2%. The total number of vehicles required within the fleet of UBC Building Ops was determined by the current 225 vehicles, with an incremental increase to 350 by Year 3. Key drivers of all three phases include the actual percentage of combustion engine vehicles being replaced, through a fuel consumption rate of 12.5 kilometres per litre.

There are a few steps that UBC can take to start:

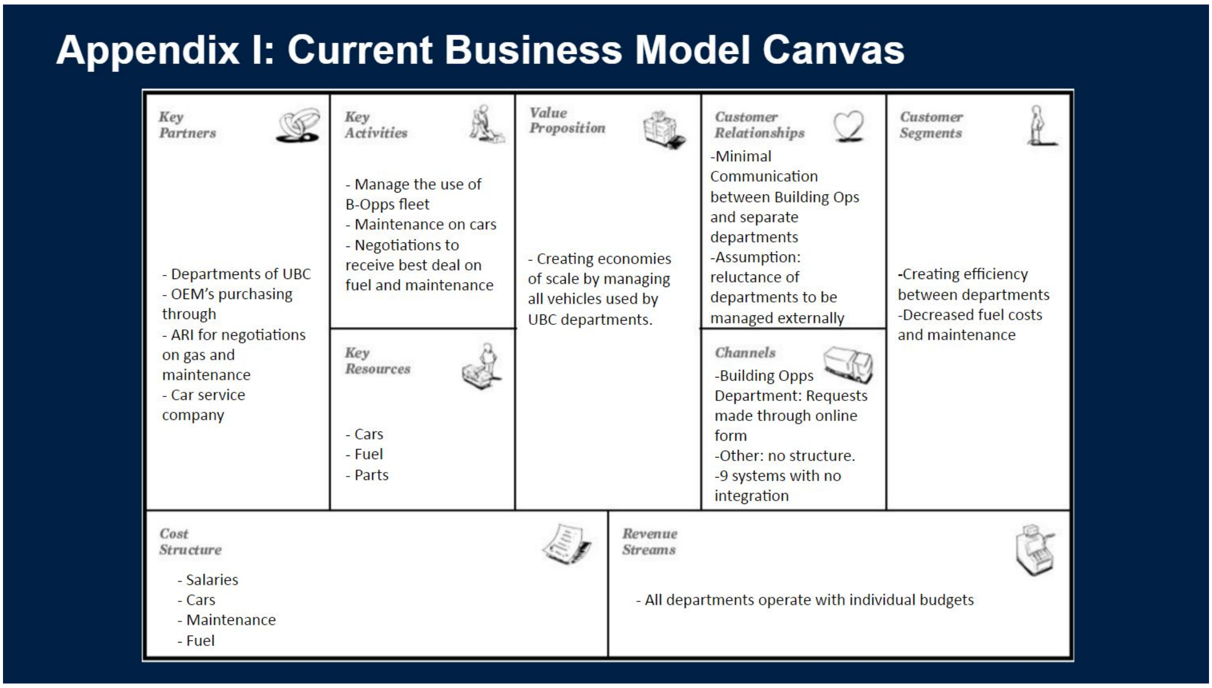
Renting Veemo to students and staff:
UBC Building Operations is subject to the limited budget each year. Thus, getting maximum value for each dollar spent on Veemo Cars is crucial. Renting Veemo cars to students and staff is one way to help maximize utilization. This also could offset Veemo costs for UBC by collecting rent from users. Thus, one of the next step is to explore the possibility of renting Veemo cars to students and staff during non-work hours. A survey is suggested to conduct to see students and staff's willingness to use Veemo Cars during evening hours.

Talking to 50 drivers in UBC Building Operations
Drives play an important role in our strategy implementation, especially for the intake of Veemo. Through face-to-face interviews with drivers, UBC Building Operations could understand how the implementation goes, what adjustments could be made, and what improvements can be done.

Renegotiate yearly budget with UBC
Budget is crucial for achieving climate goals. If UBC Building Operations has more capital on hand, GHG emission target could be hit faster by the larger uptake of clean energy vehicles. The sooner replacing older vehicles with ones that run on fossil fuels, the earlier zero-emissions goal could be achieved. It is recommended to renegotiate with UBC in exploration of expanding annual budget.

Initiating conversations with faculties
It is recommended to begin speaking with each faculty to find out their pain points with the current system and what their needs are. This serves better to align incentives among departments and Building Operations by creating shared values. The positive results could solve the potential resistance from departments.

THANK YOU



UBC Building Op's current business model is based on attempting to centralize all vehicles on the UBC campus. Though the value proposition should be quite compelling to faculties, and the cost savings prove to be quite significant, the majority of the UBC groups have not opted to be included in this centralization. The main hypothesis for this lack of integration stems from its inconvenience. Faculties find it much more convenient to own their own vehicles, that they can take whenever and wherever without having to go through the cumbersome registration, pick up and drop off. Our recommendations above aim to tackle, and work around this discrepancy.

Appendix 2: Competitive Analysis - White Space Grid

	COST SAVINGS (Maintenance, fuel, vehicles)	MAINTENANCE CONVENIENCE	TRANSPORTATION CONVENIENCE	DATA COLLECTION	AUTONOMY
UBC Building-Ops	2	3	1	3	1-2 (based on contract)
Car-sharing	3	3	2	1	1
Internal Vehicles	1	1	3	1	3

* 3 is high, 1 is low.

This competitive analysis looks at alternatives and substitutes for UBC Building Ops. As you can see, Building Ops poses great cost savings.

Appendix 3: PEST

POLITICAL	ECONOMIC	SOCIAL	TECHNOLOGICAL
Governmental taxation policy Government subsidy program Future political support	Demand and importance for clean technology Falling Canadian currency Supply of fossil fuel	Growing awareness and attitude towards sustainability Buying trend for CEVs Lifestyle change towards car sharing and carpooling	Telematics technology is available, though relatively expensive In-memory computing technology Management and centralization software is readily available

Political

- Current taxation policy
- Carbon Tax: It is applied to the purchase or use of fuels in the province. It is designed to incentivize people and business to innovate cost-efficient methods of reducing emissions and to pay less carbon tax.
- Grants, funding and initiatives
- Clean energy vehicle Point of Sale Incentive Program: It offers up to $5,000 off the purchase price of an electric vehicle, and up to $6000 for a hydrogen fuel cell vehicle.
- BC SCRAP-IT Program: It is a voluntary early retirement vehicle program that encourages BC residents to replace their old polluting vehicles with cleaner energy vehicles. The program aims to reduce greenhouse gas emissions and to lower exhaust pollutants. Incentives are up to $6000 for new electric vehicles and $3,000 for used electric vehicles.
- Future political support
- CEV charging infrastructure program: This program could potentially help with the expansion of EV infrastructure.

Economic:

- There is Increasing demand of clean technology and clean energy
- Falling canadian currency is disadvantaged when purchasing import vehicles.
- Decreasing supply of fossil fuel may drive fuel price up.

Social:

- People have growing awareness towards sustainability, especially high-educated people.
- A buying trend for clean energy vehicle is prevalent, such as electric vehicles.
- Lifestyle change: people, especially Generation Y, have high willingness to use car-sharing, car-pooling or similar service if they were readily available and convenient.

Technological:

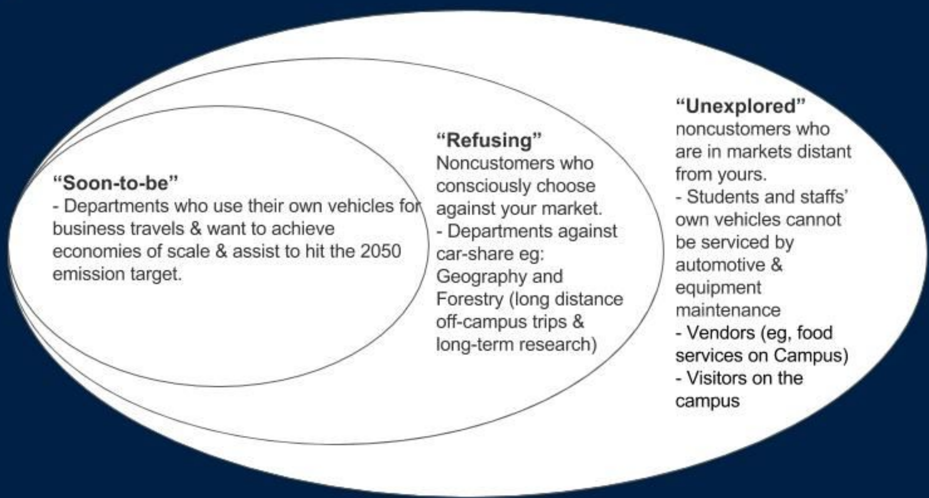
- Telematics integrated use of telecommunications with information and communication technology.
- In-memory computing technology helps in expanding capabilities in data analysis. It enables fleet management to accelerate processing all the incoming data, such as fuel consumption, idling time and gas purchases, and generating reports faster.
- Artificial intelligence: AI techniques are adopted gradually in fleet logistics.
- EnerGuide in Canada Label for Vehicles is the official Government of Canada mark for rating and labelling the energy consumption or energy efficiency of products. Customers can look up vehicle’s fuel consumption, fuel economy, annual fuel cost and environmental impacts before making purchasing decision.

Appendix 4: SWOT

Strengths	Weaknesses
- Maintenance available on campus at a discounted rate - Charter member of the E3 (Energy, Environment, Excellence) Fleet program, Platinum Rating status **- Strategic Partnership with ARI (low fuel, acquisition costs, right-sizing vehicles and fleet, life cycle analysis)** **- Many internal efficiency gains have been already been made (anti-idling, driver training, right-sizing)**	- 9 disjointed platforms make communication difficult - Unaware of the purpose and use for many faculty vehicles **- Building Ops does not have control over all emitting vehicles** **- Misalignment of incentives between faculties and Building Ops** **- Only at 45% emissions reductions (2007 base) despite efficiency gains**
Opportunities	**Threats**
- 54% of UBC-owned vehicles owned by outside faculties - Lack of telematics data being collected by departments - EV, energy storage, and autonomous vehicle technology is advancing **- Clean Energy Vehicle & ScrapIt BC programs**	- Departments migrate and create their own fleet system **- EVs not adopted by major OEMs or do not come down in price** - Shifting political support for climate programs **- Departments do not drive climate goals** - UBC population is growing - Electric infrastructure has limited remaining capacity (bottleneck)

*Please see explanation in slide 3

Appendix 5: Non-Customers



Summary of tapped and untapped market

Appendix 6: Financials: Costs of Step 1

	FY1				FY2				FY3				FY4				FY5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
STEP 1: Reduce Emissions per Vehicle																				
Cost Sharing Incentivization																				
Cost per Vehicle	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00	$32,698.00
Government Incentive	$11,000.00	$11,000.00	$11,000.00	$11,000.00	$11,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$6,000.00	$4,000.00
Cost Share	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Additional % of Vehicles Replaced	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
Total % of Vehicles Replaced	2.50%	5%	7.50%	10%	12.50%	15%	17.50%	20%	22.50%	25%	27.50%	30%	32.50%	35%	37.50%	40%	42.50%	45%	47.50%	50%
Number of New EVs	6	6	6	6	8	8	8	8	9	9	9	9	9	9	9	9	9	9	9	9
Cost of Cost Sharing Incentivization	**$65,094.00**	**$65,094.00**	**$65,094.00**	**$65,094.00**	**$86,792.00**	**$106,792.00**	**$106,792.00**	**$106,792.00**	**$120,141.00**	**$120,141.00**	**$120,141.00**	**$120,141.00**	**$120,141.00**	**$120,141.00**	**$120,141.00**	**$120,141.00**	**$120,141.00**	**$120,141.00**	**$120,141.00**	**$120,141.00**
Data-collection																				
Telematic Devices per vehicle	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00
Subscription of Software	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00
Additional % of Vehicles Integrated	0.00%	0%	0.00%	0%	15.00%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Total % of Vehicles Integrated	0.00%	0%	0.00%	0%	15.00%	20%	25.00%	30%	35.00%	40%	45.00%	50%	55.00%	60%	65.00%	70%	75.00%	80%	85.00%	90%
Number of Vehicles Installed	0	0	0	0	45	15	15	15	18	18	18	18	18	18	18	18	18	18	18	18
Cost of Data-Collection	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$8,775.00**	**$2,925.00**	**$2,925.00**	**$2,925.00**	**$3,510.00**	**$3,510.00**	**$3,510.00**	**$3,510.00**	**$3,510.00**	**$3,510.00**	**$3,510.00**	**$3,510.00**	**$3,510.00**	**$3,510.00**	**$3,510.00**	**$3,510.00**
Communication of Cost savings to Create Shared Value																				
Media Spend and Advertising	$0.00	$0.00	$0.00	$0.00	$25,000.00	$25,000.00	$25,000.00	$25,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total Cost of Communications	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$25,000.00**	**$25,000.00**	**$25,000.00**	**$25,000.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Leverage E3 Rating in Negotiations	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Decal Branding																				
Rebranding Cost	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50
Additional % of Vehicles Re-Branded	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	2.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total % of Vehicles Re-Branded	7.50%	15.00%	22.50%	30.00%	37.50%	45.00%	52.50%	60.00%	67.50%	75.00%	82.50%	90.00%	97.50%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Number of Vehicles	17	17	17	17	23	23	23	23	27	27	27	27	27	9	0	0	0	0	0	0
Total Cost of Branding	**$42.50**	**$42.50**	**$42.50**	**$42.50**	**$57.50**	**$57.50**	**$57.50**	**$57.50**	**$67.50**	**$67.50**	**$67.50**	**$67.50**	**$67.50**	**$22.50**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Total Quarterly Costs	$65,136.50	$65,136.50	$65,136.50	$65,136.50	$120,624.50	$134,774.50	$134,774.50	$134,774.50	$123,718.50	$123,718.50	$123,718.50	$123,718.50	$123,718.50	$123,673.50	$123,651.00	$123,651.00	$123,651.00	$123,651.00	$123,651.00	$123,651.00
Total Annualized Costs				$260,546.00				$524,948.00				$494,874.00				$494,694.00				$494,604.00
Total Cost of Phase 1																				$2,269,666.00

Five year breakdown of costs for key drivers of Step 1 of the implementation plan.

Appendix 7: Financials: Costs of Steps 2 + 3

	FY1				FY2				FY3				FY4				FY5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
STEP 2: Reduce Number of Vehicles on Campus																				
Increase of Campus Veemo network																				
Veemo Bikes per Minute	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29	$0.29
Minutes Used	0	0	0	0	0	0	0	0	30000	60000	90000	120000	150000	187500	234375	292968.75	366210.9375	457763.6719	572204.5898	0
Charging Stations	0	0	0	0	0	0	0	0	4	2	1	1	0	0	0	0	0	0	0	0
Cost per Charging Station	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00
Total Cost of Veemo Network	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$208,700.00**	**$117,400.00**	**$76,100.00**	**$84,800.00**	**$43,500.00**	**$54,375.00**	**$67,968.75**	**$84,960.94**	**$106,201.17**	**$132,751.46**	**$165,939.33**	**$0.00**
Increase Bike Lanes	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$125,000.00	$125,000.00	$125,000.00	$125,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total Cost of Bike Lanes	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$125,000.00**	**$125,000.00**	**$125,000.00**	**$125,000.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Total Quarterly Costs	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$333,700.00	$242,400.00	$201,100.00	$209,800.00	$43,500.00	$54,375.00	$67,968.75	$84,960.94	$106,201.17	$132,751.46	$165,939.33	$0.00
Total Annualized Costs				$0.00				$0.00				$987,000.00				$250,804.69				$404,891.97
Total Cost of Phase 2																				$1,642,696.66
STEP 3: Optimize Internal Operations																				
Data Integration and Mining																				
Fleet Management System Cost per Vehicle	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00
Additional % of Vehicles Installed	0	0	0	0	0	0	0	0	0	0	0	0	25.00%	25.00%	25.00%	25.00%	0	0	0	0
Total % of Vehicles Installed	0	0	0	0	0	0	0	0	0	0	0	0	25.00%	50.00%	75.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Number of Vehicles Installed	0	0	0	0	0	0	0	0	0	0	0	0	88	175	263	350	350	350	350	350
Cost of Optimization System	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$3,960.00	$7,875.00	$11,835.00	$15,750.00	$15,750.00	$15,750.00	$15,750.00	$15,750.00
Total Quarterly Costs	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$3,960.00	$7,875.00	$11,835.00	$15,750.00	$15,750.00	$15,750.00	$15,750.00	$15,750.00
Total Annualized Costs				$0.00				$0.00				$0.00				$39,420.00				$63,000.00
Total Cost of Phase 3																				$102,420.00
Total 5 Year Costs																				$4,014,782.66

Five year breakdown of costs for key drivers of Steps 2 and 3 of the implementation plan.

Appendix 8: Financials: Cost Savings

	2020	2025	2030	2035	2040	2045	2050
GOOD							
STEPS 1 + 2: Reduce Emissions per Vehicle + Number of Vehicles on Campus							
% Combustion Engine Vehicles Reduced	30.00%	60.00%	80.00%	90.00%	95.00%	100.00%	100.00%
Total Vehicles Reduced	105	210	280	315	332.5	350	350
Fuel Costs per Litre	$1.10	$1.10	$1.10	$1.10	$1.10	$1.10	$1.10
Electricity Used, Petrol Equivalent	$0.38	$0.38	$0.38	$0.38	$0.38	$0.38	$0.38
Kilometres per Litre	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Fuel Costs per Kilometre	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06
Kilometres Driven per Vehicle	180000	180000	180000	180000	180000	180000	180000
Total Fuel Costs Saved	$1,088,640.00	$2,177,280.00	$2,903,040.00	$3,265,920.00	$3,447,360.00	$3,628,800.00	$3,628,800.00
STEP 3: Optimize Internal Operations							
% of Optimization of Data System	0.00%	25.00%	40.00%	40.00%	40.00%	40.00%	40.00%
Fuel Consumption Saved per KM	$0.00	$0.28	$0.44	$0.44	$0.44	$0.44	$0.44
Electricity Consumption Saved per KM	$0.00	$0.10	$0.15	$0.15	$0.15	$0.15	$0.15
Combustion Engine Vehicles	245	140	70	35	17	0	0
Electric Vehicles	105	210	280	315	333	350	350
Kilometres Driven per Vehicle	180000	180000	180000	180000	180000	180000	180000
Total Optimization Savings	$0.00	$10,521,000.00	$13,204,800.00	$11,390,400.00	$10,457,280.00	$9,576,000.00	$9,576,000.00
Total Cost Savings	$1,088,640.00	$12,698,280.00	$16,107,840.00	$14,656,320.00	$13,904,640.00	$13,204,800.00	$13,204,800.00

	2020	2025	2030	2035	2040	2045	2050
BAD							
STEPS 1 + 2: Reduce Emissions per Vehicle + Number of Vehicles on Campus							
% Combustion Engine Vehicles Reduced	20.00%	30.00%	40.00%	50.00%	60.00%	60.00%	60.00%
Total Vehicles Reduced	70	105	140	175	210	210	210
Fuel Costs per Litre	$1.10	$1.10	$1.10	$1.10	$1.10	$1.10	$1.10
Electricity Used, Petrol Equivalent	$0.38	$0.38	$0.38	$0.38	$0.38	$0.38	$0.38
Kilometres per Litre	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Fuel Costs per Kilometre	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06
Kilometres Driven per Vehicle	180000	180000	180000	180000	180000	180000	180000
Total Fuel Costs Saved	$725,760.00	$1,088,640.00	$1,451,520.00	$1,814,400.00	$2,177,280.00	$2,177,280.00	$2,177,280.00
STEP 3: Optimize Internal Operations							
% of Optimization of Data System	0.00%	5.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Fuel Consumption Saved per KM	$0.00	$0.06	$0.22	$0.22	$0.22	$0.22	$0.22
Electricity Consumption Saved per KM	$0.00	$0.02	$0.08	$0.08	$0.08	$0.08	$0.08
Combustion Engine Vehicles	280	245	210	175	140	140	140
Electric Vehicles	70	105	140	175	210	210	210
Kilometres Driven per Vehicle	180000	180000	180000	180000	180000	180000	180000
Total Optimization Savings	$0.00	$2,784,600.00	$10,231,200.00	$9,324,000.00	$8,416,800.00	$8,416,800.00	$8,416,800.00
Total Cost Savings	$725,760.00	$3,873,240.00	$11,682,720.00	$11,138,400.00	$10,594,080.00	$10,594,080.00	$10,594,080.00

Sensitivity analysis of potential cost savings of the 5 year implementation plan.

Appendix 9: Summary of Heaviest Emitters

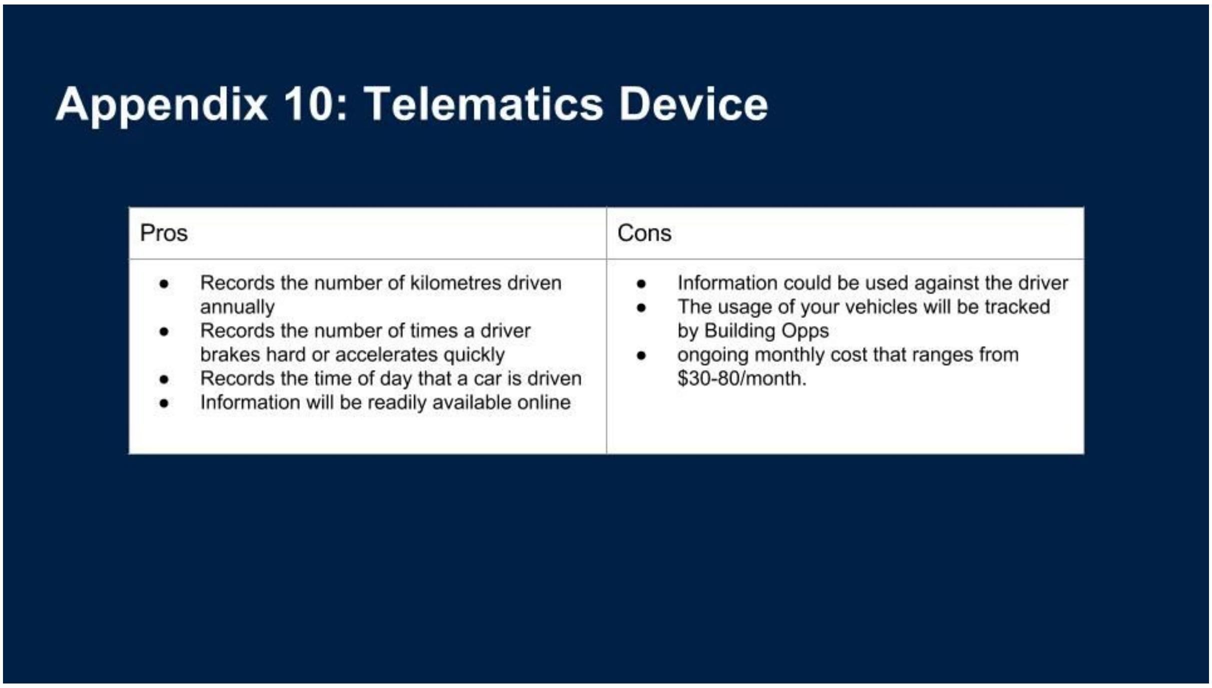
UBC Jan 06, 2017

Fuel Usage Report

From	Jan 01, 2016
To	Dec 31, 2016
Distance Unit	km

Fuel Economy Metric (L/100km) Device	Total
271 - Carpenters - Dodge Sprinter	77.14
298 - Waste Management - CNG Refuse	73.16
385 - Waste Management - Roll Off	72.22
260 - Glazier - Dodge Sprinter	70.48
292 - Hard Landscape - Int Dumpbox	59.90
208 - GMC Cube - Moving Crew	58.02
207 - HIAB - TOOL CRIB	57.80
314 - Millwright - Transit	56.24
251 - Utilities (Steam) - Dodge Sprinter	55.26
381 - Waste Management - Recycle Truck	54.74
286 - Ford Van - Sign Shop	54.26
383 - Gardeners/HL - Hooklift/Chipper/Brir	53.69
264 - Moving Crew - GMC Cube Van	50.06
247 - Gardeners - Ford Dumptruck	49.96
279 - Hard Landscape - Int Dumpbox	49.27
375 - Gardeners - F450 Hooklift	48.96
246 - Gardeners - Ford Dumptruck	48.43
294 - Wast Managment - Compactor	42.33
376 - Gardeners - F450 Hooklift	39.22
232 - Gardeners - CABCH	39.01
Grand Total	1110.17

Illustrative graph of largest consumers of fossil fuels, by category.



Telematic devices is generally a system that you install in your car that records information about your driving habits, such as the number of miles you drive, your speed, and how quickly you brake. These systems can also assess the time of day when you drivel. This information will be of value in the long-term. Many departments may be reluctant of the implementation of these devices and If the operating group does not see value added to the bottom line, the level of support for this cost is diminished. The pros and cons of having these devices installed in your department's vehicles are as follows:

Pros:

- Records the number of kilometres driven annually
- Records the number of times a driver brakes hard or accelerates quickly
- Records the time of day that a car is driven
- Information will be readily available to you online

Cons:

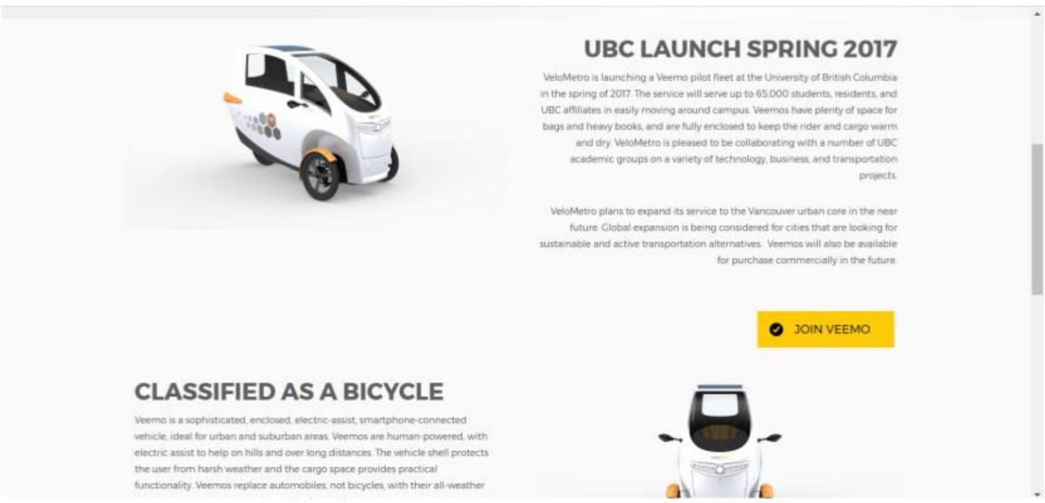
- Information could be used against the driver
- The usage of your vehicles will be tracked
- Ongoing monthly cost that ranges from $30-80/month.

Appendix 11: Standardized Mix (2012)

Note: client indicates as of 2017, standardized mix consists of Ford Transit Connect, Mercedes Sprinter, Smart Fortwo, **Toyota Prius C Hybrid, Ford pick-ups F150 to 550**

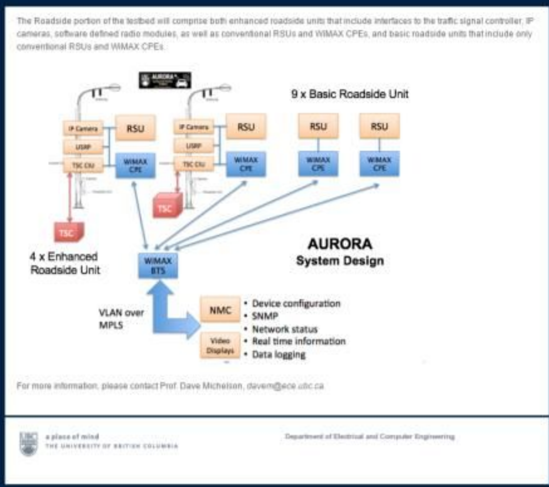
Visualization of UBC's ideal vehicle mix, prior to VeloMetro implementation.

Appendix 12: Veemo - UBC Pilot Project



Proof of VeloMetro's Veemo launch at UBC in Spring of 2017.

Appendix 13: Aurora Artificial Intelligence



Framework of UBC's Aurora Artificial Intelligence network. Appendix is not meant to be instructive, but rather demonstrative that such an AI exists and is actively being developed.

Appendix 14: Kotter's 8 Steps to Managing Change

Visualization of Kotter's 8 Steps to Managing Change.

Appendix 15: Cap and Trade

Pros	Cons
The mechanism is established and has precedence (e.g. Ontario, California)	There could be significant backlash from faculties due to the policy impacting their budgets
Targets GHG emissions directly	The tactic is quite forceful/aggressive and may strain relationships with faculties for future endeavours
Is not mutually exclusive with an innovation initiative and both could be used in tandem if crafted properly	The Board of Governor's process for approving such a policy is unknown and potentially very difficult/slow to navigate
There is a strong, financial incentive for a faculty to emit below its allotted credits	There would need to be complete collection of emissions data (via telematics devices) conducted on every non-Building Ops vehicle to ensure faculties are adhering to the Cap
There is a strong, financial incentive to request Building Ops' services whenever possible	Faculties may still prefer the convenience of having their own vehicles
The emission levels can be ratcheted down on a very predictable, gradual schedule so faculties can plan effectively and adjust	This policy disproportionately hurts faculties that have high GHG emissions per capita, such as those who conduct field research in remote locations
The University has a history of supporting leading-edge climate initiatives	

Main benefits and risks for a campus cap & trade policy designed to align faculty and Building Ops' incentives.

Appendix 16: Secondary Sources

Parkes et al. - 2013 - Understanding the diffusion of public bikesharing systems evidence from Europe and North America-annotated

Shaheen et al. - 2012 - Public bikesharing in North America Early operator and user understanding-annotated

2016 - UBC Climate Action Plan, 2020


Journal of Transport Geography

Understanding the diffusion of public bikesharing systems: evidence from Europe and North America

A non-exhaustive summary of literature referenced throughout the presentation.

Appendix 17: Waste Management

- Revolutionized the field of waste collection

Canadian companies such as “Molok” and “Underground Disposal Systems LTD” have revolutionized the field of waste collection. Companies such as these have create a system that used gravity to compression waste emphasizing a deep collection method that is clean and tidy. This advanced technology achieves an average of a 2:1 compaction ratio compared to normal garbages and disposal systems. While only 40% of the system is seen, 60% is found underground. There is less need for emptying, therefore it reduces emissions and the impact on the environment. These companies provide all different sizes and colours to be aesthetically pleasing.

Appendix 18: BC Scrap-It Program & CEV Program

BC Scrap-It Program

- $6,000/$3,000 incentive (new/used) + $250 PoS discount
- choose incentives incl. new or used cars, electric cars, transit passes, bicycles, car sharing memberships or $200 cash
- 500 available annually (126 still available as of Mar. 26, 2017)
- **Can be stacked with CEV for BC program, total value of $11,250 (new)**
- Smart ForTwo Electric is eligible on both lists
- Requirements:
  - All applicant(s) must be the registered owner(s) of the vehicle being scrapped.
  - All applicants must have had continuous driving insurance (not including storage) for 6 months prior

The B.C. SCRAP-IT program is a voluntary early retirement vehicle program that provides incentives to help British Columbians to replace their higher polluting vehicles with cleaner forms of transportation. The incentive program is designed to reduce greenhouse gas emissions across the province by offering $6000 towards a new electric vehicle. As of December 2016, the program has scrapped 41,083 vehicles.

Clean Energy Vehicle Program is funded by the province of British Columbia and provides point-of-sale incentives battery electric and hydrogen fuel cell vehicles. This program is intended to encourage and accelerate the adoption of clean energy vehicles in British Columbia for both their environment and economic benefits. The vehicle incentive in the CEV Program enables the purchaser or lessee of an eligible vehicle to receive a before tax point of sale vehicle incentive of up to $5,000.