# UVic Sustainability Scholars Program

# UVic Green Fleet Project

Prepared by:

Akash Mohanty, UVic Sustainability Scholar, 2024

Prepared for:

Kylie Hissa, Acting Manager, Office of Campus Planning & Sustainability

Kimiko West, Sustainability Analyst, Office of Campus Planning & Sustainability

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# Disclaimer

This report is a product of the UVic Sustainability Scholars Program, a partnership between UVic and various on- and off-campus organizations offering internship opportunities to graduate students working on sustainability-focused research projects that advance sustainability in the region. This project was conducted under the mentorship Kylie Hissa & Kimiko West.

The opinions and recommendations in this report and any errors are those of the author and do not necessarily reflect the views of the Office of Campus Planning & Sustainability or the University of Victoria.

# Territorial Acknowledgement

*I acknowledge and respect the lək̓ʷəŋən peoples on whose territory the university stands and the Songhees, Esquimalt and WSÁNEĆ peoples whose historical relationships with the land continue to this day.*

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# Executive summary

The University of Victoria's fleet is at a pivotal point as management seeks to align with the university's broader climate and sustainability goals.

As part of its commitment to the ambitious targets and goals outlined in the Climate and Sustainability Plan CSAP (2030), UVic is exploring the necessary steps to transition their fleet from Internal Combustion Engine (ICE) vehicles to zero emissions vehicles (ZEVs). However, this transition requires accurate and consistent vehicle data collection procedures to adopt a ZEV-targeted approach that recognizes the challenges associated with electrifying special purpose vehicles with high operational demands and the supporting ZEV infrastructure.

In 2023, UVic launched the "Sustainability Scholars Program" offering paid internships for graduate students from any discipline, to collaborate with community, government, Indigenous, and not-for-profit partners on professional and applied research projects that advance sustainability. The program focuses on the global challenges of the climate crisis and is grounded in the idea that local action is required to meet those challenges for future generations.

The Office of Campus Planning and Sustainability applied as a program sponsor and hired a master's student to initiate the Green Fleet Project, to help advance UVic's climate strategy. The project sought to review the current conditions of UVic's fleet composition and prepare key recommendations for fleet management to electrify their fleet over the short, medium, long-term.

Over a four-month period, this project successfully brought together key stakeholders from multiple departments to review the processes and procedures involved in managing the university's vehicle fleet.

The project included extensive field work to verify vehicles and meetings with department supervisors, as well as consultations with Risk Management and Campus Planning and Sustainability to align reporting metrics for insurance and sustainability requirements.

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# 1. Project Outline

This project aims to prepare and identify a Green Fleet Strategy specific to UVic's campus-owned fleet vehicles to support progress towards the goals identified in UVic's Climate and Sustainability Action Plan 2030 (CSAP) [1]. UVic is committed to meeting greenhouse gas (GHG) reduction targets by decarbonizing fleets; however, vehicle procurement needs to be assessed on a case-by-case basis.

Despite financial incentives, a strong economic case is important to obtain budget approvals for these purchases.

## 1.1 Objectives:

**1.1.1 Complete a qualitative analysis of UVic's Corporate Fleet** – To support the development of a methodology to benchmark and reduce mobile emissions in compliance with the BC Carbon Neutral Program aiding the University in its ongoing strategic targets in climate leadership and sustainability [2].

**1.1.2 Develop a decision-making framework -** Based on initial engagement and research, develop a decision framework relevant to UVic's corporate fleet priorities. This tool or assessment will support the business case for transitioning to a low-emission vehicle fleet.

## 1.2 Timeline

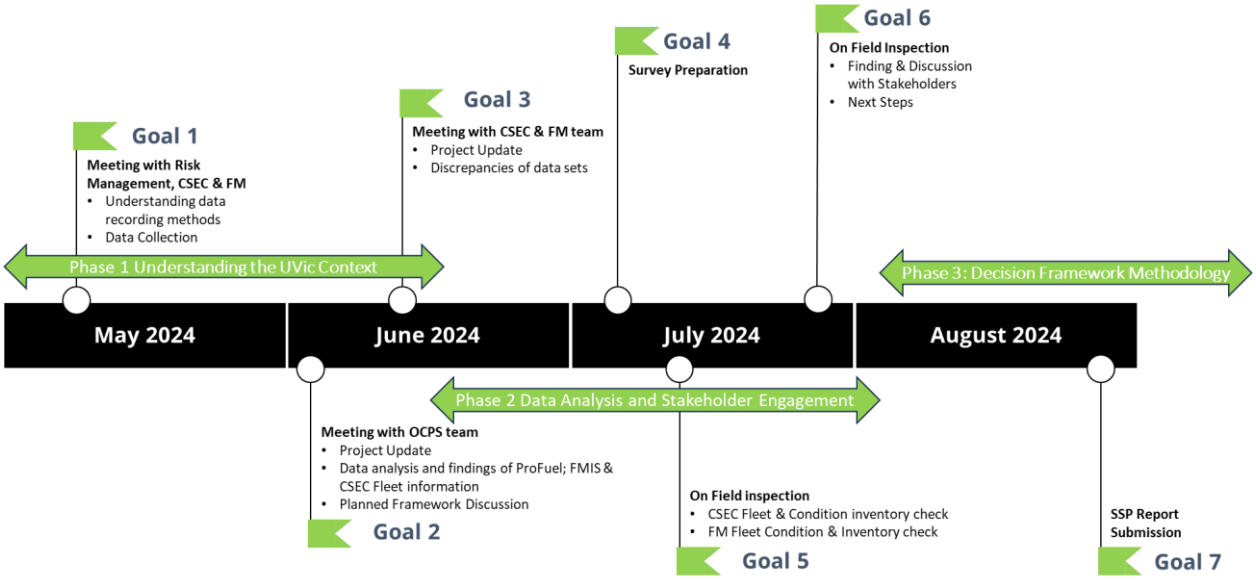



*Figure 1: Timeline of the SSP Green Fleet Project*

***Note: Due to time constraints life cycle assessment is out of scope for this project***

## 1.3 Stakeholder Engagement

The Office of Campus Planning, Campus Security, Facilities Management, Risk Management, and Purchasing Services served as the primary stakeholders involved in the procurement, maintenance, and reporting related to the university's fleet. primarily.

| Department | Purpose/Value |
|---|---|
| **Risk Management** | Responsible for insuring and registering any motor vehicle assets under UVic's ownership structure. |
| **Facilities Management** | Fleet management of 100 or so vehicle assets in the UVic corporate fleet motor pool. |
| **Campus Security** | Fleet management of 30 or so vehicle assets in the UVic corporate fleet motor pool. |
| **Purchasing Services** | Oversee procurement and advises on decisions regarding purchases of over $5000. |
| **Office of Campus Planning and Sustainability** | Project Coordinators and support team.<br>Responsible for the data required by legislation for UVic's mobile assets and their contributions to fossil fuel emissions. |

*Table 1: Stakeholders of the Green Fleet Project*

# 2. Background

## 2.1 Fleet management

The university's fleet is distributed across three departments.

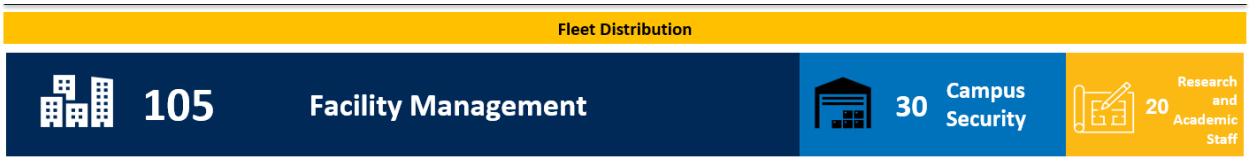



*Figure 2: Summary of Green Fleet Project baseline inventory: Vehicles distribution across departments as per 2023 data*

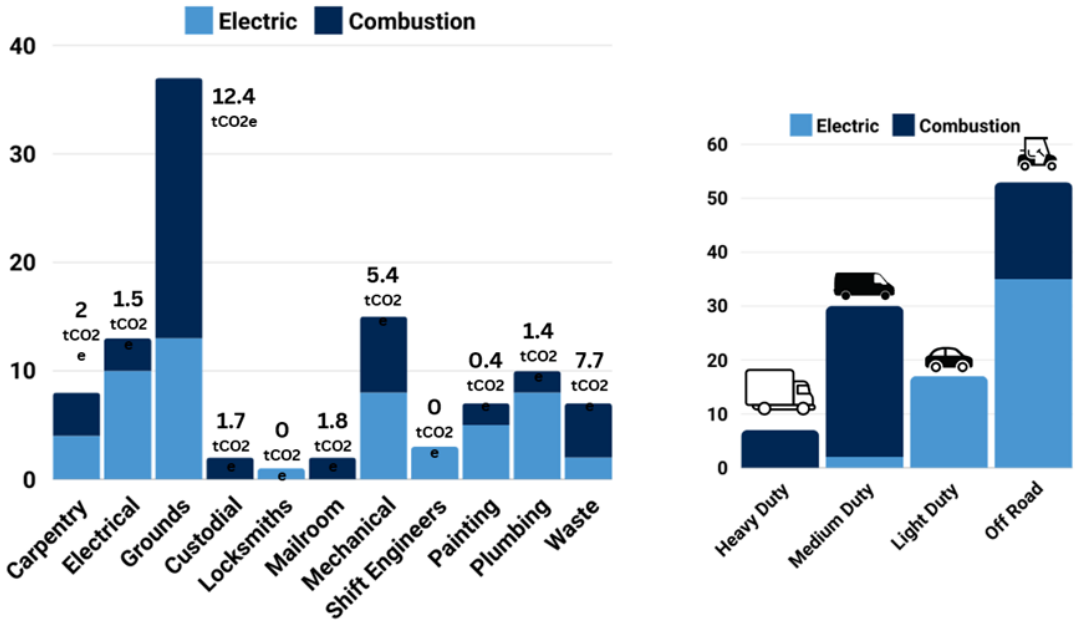



*Figure 3 Summary of Green Fleet Project baseline inventory: Facility Management as per 2023 data*

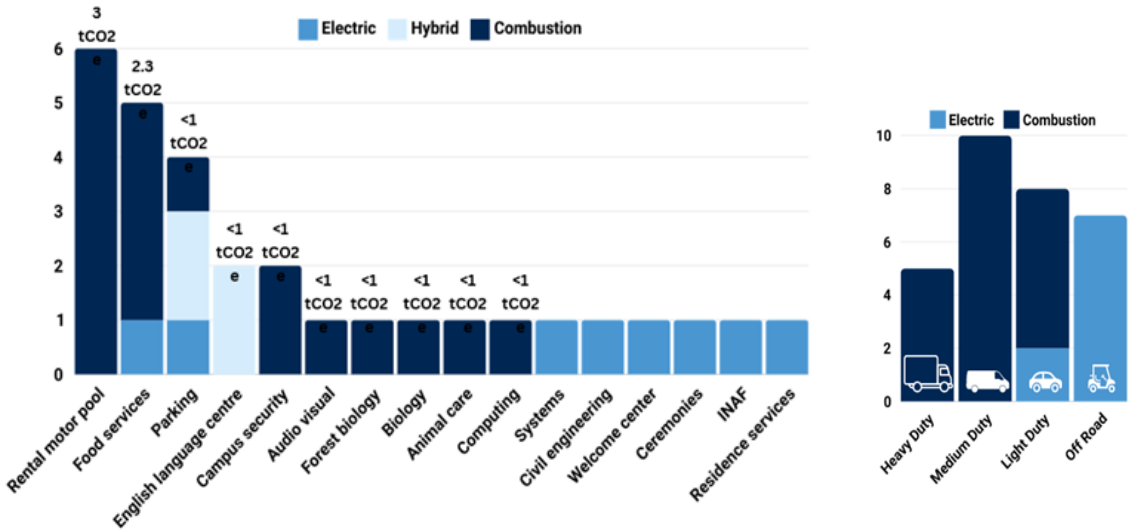



*Figure 4 Summary of Green Fleet Project baseline inventory: Campus Security as per 2023 data*

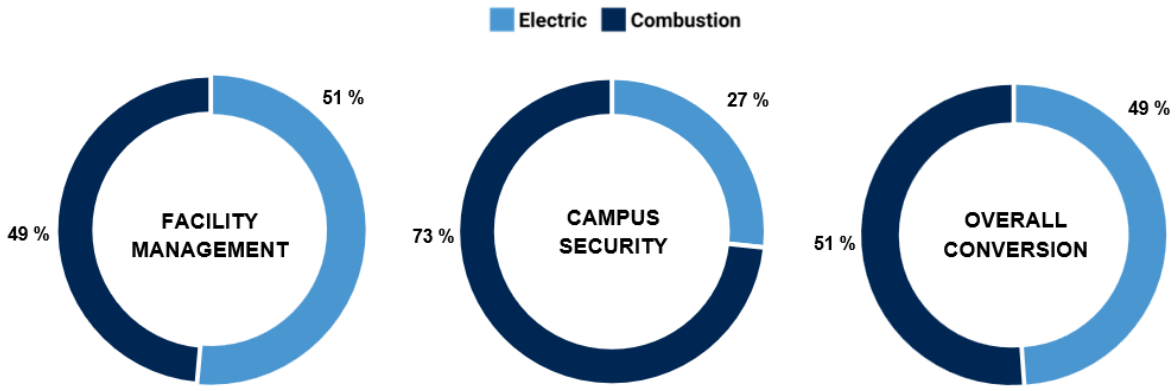



*Figure 5 Summary of Green Fleet Project baseline inventory: Conversion status as per 2023 data*

### 2.1.1 Campus Security

Campus Security Motor Pool – includes on- and off-road vehicles (vans, trucks, SUVs, golf carts). Campus Security operates a smaller fleet, representing 18% of the total fleet with 27 vehicles. These vehicles are distributed across 16 departments primarily to transport people or products throughout the Gordon Head Campus.

UVic Campus Security [3] (CSEC) utilizes a portion of the fleet for regular campus patrols, incident response, and providing security escorts. This ensures students, staff, and visitors a safe and secure environment. The department works closely with the Risk Management department to ensure that all security vehicles meet safety standards and are adequately maintained. CSEC provides ongoing training for security personnel to ensure they are prepared to handle various situations effectively, using the fleet vehicles efficiently.

Apart from maintaining security inside the campus, CSEC acts as a service department providing short- and long-term rentals to departments that may need to utilize a vehicle temporarily.

> **Example A:** the Office of Campus Planning and Sustainability wants to transport a truckload of trees for a tree planting initiative.
>
> **Example B:** a Student Residence leader would like to rent a few cars (Facilitated by Residence Services) to bring students to the Hartland Landfill as part of their semester programming.

### 2.1.2 Facilities Management

Facilities Management oversees the allocation of on- and off-road vehicles to different tasks and departments based on operational needs, ensuring support to the ongoing operations and upkeep of the campus as defined by the area within Ring Road and close surrounding area. This requires a range of vehicles to transport equipment, manage waste, and perform other campus upkeep tasks, otherwise known as "work orders[1]".

Facilities Management maintains the largest fleet, making up 69% of the total fleet with 106 vehicles. The size and diversity of this fleet suggest a critical role in supporting the organization's operational needs.

The following department (Table 2) highlights the various trade services under Facilities Management that service the daily operational demands of the university:

| Department | Role |
|---|---|
| Carpentry | The carpentry shop is responsible for maintenance work for all buildings. |
| Custodial | The locksmith shop is the sole provider of keys, locks and card access on campus. They're responsible for the repairing and maintenance of locks and key cutting. |
| Distribution | The distribution team provides internal delivery, event furniture rental, and mail services. |
| Electrical Shop | The electrical shop is responsible for the maintenance and repair of electrical systems. |
| Grounds | The grounds and Environmental Services team takes care of the outdoor spaces at UVic, making sure they're safe, clean, and welcoming for everyone. They look after things like the campus landscaping, green roofs, walkways, and watershed stewardship. |
| Mechanical Shop | The mechanical shop is responsible for the maintenance and repair of building mechanical systems on campus. |
| Paint Shop | The paint shop is responsible for maintaining painted surfaces on campus. |

[1] Work order is a maintenance document form that includes information about maintenance tasks to be done and shows the task's completion process. "FMIS access request - University of Victoria," *UVic.ca*, 2023. https://www.uvic.ca/facilities/service/administration/fmis/access.php (accessed Nov. 02, 2024).

| | |
|---|---|
| Plumbing | The plumbing shop is responsible for the maintenance and repair of plumbing-related systems. |
| Waste Reduction | The waste reduction unit has standardized the management of solid waste and recycling at the university. |

*Table 2 Role of departments under the Facility Management department [4]*

### 2.1.3 Research Department

There is a small pool of motor vehicles acquired by faculty in academic and research departments through grant funding. While these vehicles are insured annually by Risk Management, there is currently no department or employee designated to oversee their regular maintenance or record-keeping. This lack of oversight was identified as a concern in the Internal Audit—Emissions Reporting File 1522, as it impacts the accuracy of annual greenhouse gas reporting. However, this issue was not included in the scope of the current project, as the replacement of vehicles funded through grants involves a different framework and methodology.

## 2.2 Fuel Management

### 2.2.1 On-Campus Fuelling

UVic Facilities Management Maintenance and Operations manage campus fuel distribution and reconciliation through the Computrol: Profuel system, which tracks the total litres of fuel used per vehicle. However, the current process for measuring vehicle fuel and electricity consumption for greenhouse gas reporting and departmental fuel usage is inaccurate for several reasons:

- A 25% discrepancy exists between the total fuel recorded by the Profuel software and the amount purchased from Columbia Fuels.
- Many vehicles are incorrectly assigned to departments in the Profuel system, leading to inaccurate reporting of departmental fuel consumption.
- Some vehicles lack fuel cards, while others have duplicate cards, and most do not have a naming convention that links Profuel records to assets listed in the ICBC summary.

Gasoline and diesel are available on campus for traditional internal combustion engine (ICE) vehicles. For electric vehicles (EVs), several charging stations are strategically located across campus. Additionally, nearly 30% of UVic's mobile asset inventory consists of John Deere Gators, which are charged using standard outlet plug-ins.

| Type of Fleet | Use | Operated by | Fuel Types | Transportation Modes |
|---|---|---|---|---|
| **Motor Pool**<br>Vehicle assets used for on-campus operations | Landscaping<br>Bin collection<br>On-site transportation of goods and services<br>Rentals | Facilities Management<br>Campus Security (CSEC Motor Pool) | Gasoline<br>Diesel<br>Biodiesel<br>Electricity | Light-duty vehicles<br>Light-duty trucks, SUVs, and minivans<br>Heavy-duty |
| **Off-Road Equipment**<br>Vehicle assets used for on-campus operations | Grounds maintenance<br>Ice rink maintenance | Facilities Management | Gasoline<br>Diesel<br>Biodiesel<br>Propane<br>Electricity | Forklifts,<br>Zambonis,<br>Gators, Lawnmowers,<br>Trimmers,<br>Tractors,<br>Construction equipment |

*Table 3 On-Campus Fleet details*

### 2.2.2 Off-Campus Fuelling

If UVic employees need to refuel off-campus, they can use CCARDs 3 for purchases. However, the Chrome River expense reimbursement system [5] lacks specific fields to categorize vehicles or to record the total fuel consumed (in litres). This omission hinders detailed tracking and reporting of fuel usage, making managing and monitoring the fleet's overall efficiency challenging.

| Fleet Type | Use | Operated by | Fuel Types | Transportation Modes |
|---|---|---|---|---|
| **Academic and Research -Vehicle Fleet**<br>Insured vehicle assets for Research and Academic Departments | Grant implementation | Research and Academic Departments | Gasoline<br>Diesel<br>Biodiesel<br>Electricity | Light-duty vehicles<br>Light-duty trucks, SUVs, and minivans<br>Heavy-duty |
| **-Vessel Fleet**<br>Insured Vessel assets under the regulatory oversight of the Occupational Health and Safety Department | Fieldwork<br>UVic Rowing. | Research and Athletic Departments | Marine Gasoline<br>Marine Diesel | Marine |

*Table 4 Off-Campus Fleet details*

[2] Internal Audit Emission Reporting File 152: The Internal Audit conducted an in-depth review of the BC Carbon Neutral Program's requirements, focusing on the University of Victoria's (UVic) specific needs. This investigation included identifying essential data points for the emissions inventory, evaluating methods for collecting, analyzing, and entering these data into the Clean Government Reporting Tool (CGRT), and ensuring adherence to consistent and reliable reporting standards. "Audit process - University of Victoria," *UVic.ca*, 2024. https://www.uvic.ca/internalaudit/process/index.php (accessed Nov. 02, 2024).

[3] CCARDs are fuel cards provided to UVic employees to reimburse fuel expenses when they are on official work.

## 2.3 Reporting and Data Governance

The mobile carbon accounting for UVic's fleet is critical to understanding and reducing the university's overall greenhouse gas (GHG) emissions. In 2023, mobile emissions accounted for 2% of UVic's total GHG emissions. However, discrepancies between fuel consumption data reported by the ProFuel software system and actual fuel purchases have highlighted significant gaps that must be addressed in the 2024 reporting period. Emission factors shown in above picture (figure 6) used from 2023 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions [6].

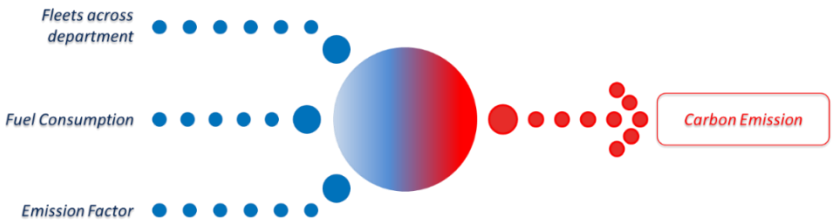



*Figure 6 Carbon emissions calculation*

### 2.3.1 Emissions Reporting File 152 – Internal Audit

Climate action and reducing greenhouse gas emissions are strategic priorities for the university and a necessity to meet the globally accepted targets for minimizing the impacts of climate change.

The Internal Audit team identified 3 key recommendations related to fleet information, which focus on standardizing data collection, automating data entry, and enhancing quality assurance practices, all of which were crucial for the success of the greenhouse gas emissions targets outlined in the Climate and Sustainability Action Plan (2030).

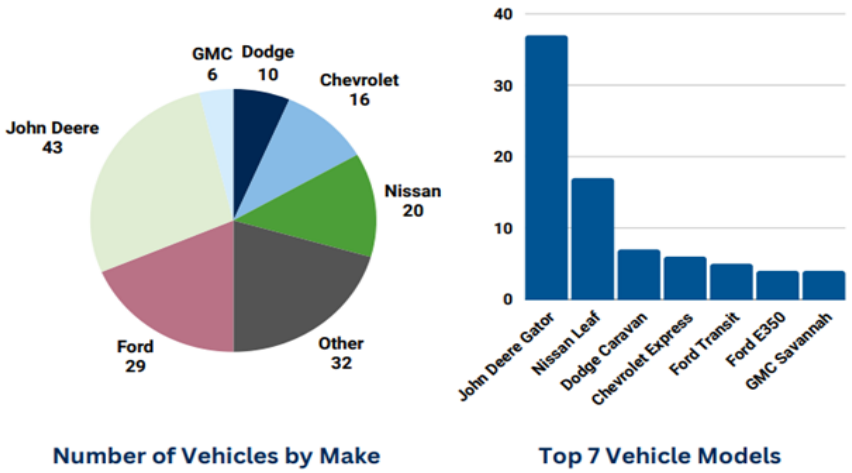



*Figure 7 Vehicle Trends – total Fleet (2023)*

| *Management reviewed and signed off on these recommendations, with a targeted completion date of May 2024.* |
|---|
| 5.1 Develop and implement procedures for vehicle operators to record and track actual fuel consumption, or at a minimum, to track actual mileage via odometer readings. |
| 5.2 Explore the possibility of using fuel cards to obtain more accurate consumption data and document the decision and reasons. |
| 5.3 Implement a process to have areas establish data owners who will provide bulk fleet information such as academic fleet, FMGT fleet, Campus Security, and marine instead of Sustainability having to keep a record of each vehicle |

*Table 5 Recommendations on fleet reporting procedure "File 152 | Emissions Reporting"*

# 3. Key findings

Purchasing Services, Risk Management, and Surplus Management are Departments involved in any changes to the mobile asset inventory, however, they do not have purview on the activity of the vehicles or vessels themselves. This decentralized approach to fleet management makes it difficult to understand the lifecycle of any vehicle the university owns.

Although thorough engagement with Purchasing Service and Surplus Management was out-of-scope for this project, including them in the development of a data governance framework for fleet asset management should be considered as part of this project's recommendations.

Effective fleet management relies heavily on accurate and comprehensive data collection across various systems. The analysis of the Mobile Asset Inventory Data Sets for 2023 highlights the diverse capabilities and significant gaps across the current data management systems. While each system offers valuable data for specific aspects of fleet management, there is a clear need for better integration and standardization to ensure that all critical data points are captured consistently.

The figure below is a representation of UVic's mobile asset inventory after the projects data analysis and verification process. By enhancing data integration, the campus can move towards a more targeted, efficient, and cost-effective approach to electrification.

## 3.1 Current Data Flow

Annual reporting requirements for sustainability metrics including the transportation of vehicles owned or leased by the university are becoming increasingly more stringent. As it stands, departments operate independently, each with its unique processes and systems. While this approach offers each department autonomy in processes and decision making, this lack of standardization leads to inconsistencies in data collection, reporting, and

fleet management. The Green Fleet Project supported an analysis of the Mobile Asset Inventory Data Sets for 2023 and highlighted the significant gaps across the current systems. The lack of uniform tracking methods—particularly for odometer readings, fuel consumption, and vehicle type classification—creates challenges in optimizing fleet management, ensuring accurate reporting, and making data-driven decisions.

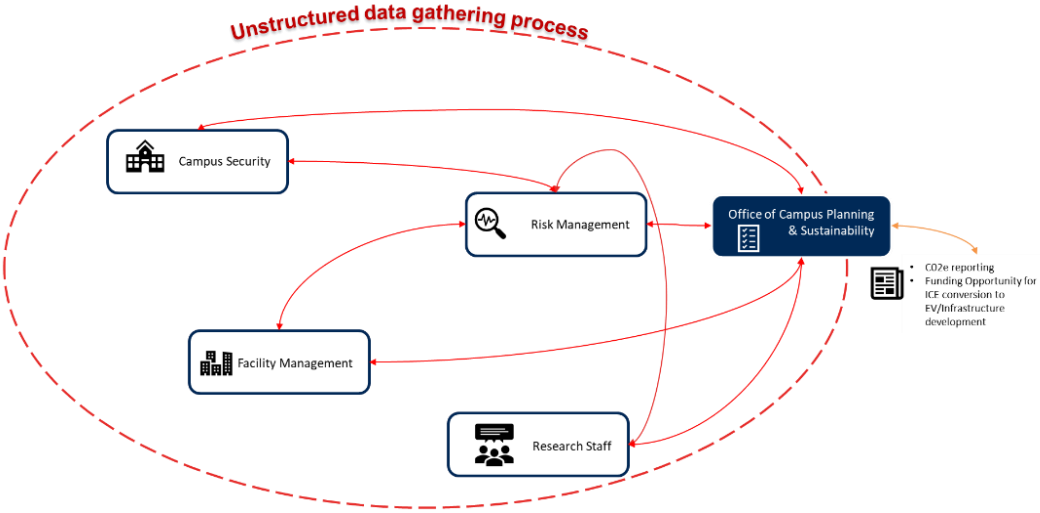



*Figure 8 Current Data reporting Structure*

## 3.2 Fleet Data Management

### 3.2.1 Insurance dataset

Risk Management maintains an ICBC summary sheet updated annually and contains a track record of vehicle intake. Information is maintained in a manual format. Once a vehicle is purchased and registered insurance is renewed and distributed back on the original data provided by the department. Data from each department gets updated on 31st October every year, and if in case new vehicles are added to the department following information is recorded:

The following fields are key metrics included in the ICBC Summary dataset.

| Field | Definition |
|---|---|
| **Model Year** | The year in which the vehicle was manufactured. This helps in deciding the vehicle's age and its eligibility for replacement or continued use. |
| **CVIP** | Commercial Vehicle Inspection Program (CVIP), a mandatory inspection required for commercial vehicles to ensure they meet safety standards. |
| **Model** | The specific model of the vehicle, showing the make and design of the vehicle (e.g., Ford F-150, Toyota Prius). |
| **Fuel Type** | The type of fuel used by the vehicle, such as gasoline, diesel, electricity, or hybrid. |
| **Plate No.** | The unique license plate number assigned to the vehicle by the transportation authority for identification and registration. |
| **Registration No.** | The official number assigned during the vehicle registration process, shows legal permission for the vehicle to run on public roads. |
| **Body Type** | The physical structure and design of the vehicle, such as sedan, truck, van, or SUV. |
| **ICBC Rate Class** | The Insurance Corporation of British Columbia (ICBC) rate class decides the insurance premiums based on the vehicle's use (e.g., personal, commercial). |
| **Serial Number** | The unique Vehicle Identification Number (VIN) or serial number is used to find the vehicle and track its history. |
| **Excess Rating Category** | A classification that decides if the vehicle falls into an excess rating for insurance purposes, impacting the cost of coverage. |
| **Insurance Price** | The cost of insurance of the vehicle, which is based on factors like the vehicle's value, type, and usage. |
| **Vehicle Type** | The category or classification of the vehicle (e.g., passenger vehicle, heavy-duty truck, electric vehicle). |
| **Contact Person** | The individual responsible for managing or overseeing the vehicle, listed as the point of contact for queries or issues. |

*Table 6 Definition of the information recorded by ICBC summary sheet by risk management department*

**Strengths:** The system is effective in tracking registration and any self-reported changes made by the departments or individuals responsible for the vehicles. It also ensures that assets are properly associated with their respective primary departments or contacts, facilitating accountability and streamlined communication.
**Weaknesses: T**he ICBC Summary List does not track several key data points, such as procurement details, odometer readings, or maintenance records.

For the strategic electrification of the fleet, this dataset lacks the granularity needed to assess vehicle conditions or determining the timing for replacement. Additionally, it does not monitor small boat motor sizes, generators, or surplus/retired vehicles, which could result in inefficiencies or overlooked resources.

### 3.2.2. Fuel use dataset

The UVic Motor Pool [7] and Facilities Management fleet use fuel cards and Profuel software to oversee the consumption of diesel and gasoline by the vehicles under sub-department operational use. It is specific to vehicles with internal combustion engines (ICE).
**Strengths:** This system is pivotal for monitoring fuel usage, which is a significant operational cost and environmental consideration. By tracking fuelling at designated stations, the software provides valuable insights into fuel consumption patterns and potential areas for cost-saving.
Pro-Fuel Software is somewhat effective in tracking odometer readings for gas and diesel vehicles, which is critical for understanding vehicle usage and scheduling maintenance.
**Weaknesses:** The software has notable limitations, including its inability to allocate fuel usage to specific vehicles as outlined in the ICBC Summary. This could lead to less precise data when trying to optimize fuel efficiency. Furthermore, the software currently does not support electric vehicles (EVs), which is a significant drawback as the fleet transitions towards more sustainable options.

### 3.2.3. Campus Security Dataset

Campus Security maintains several Excel spreadsheets summarizing vehicles and the departments that operate them. This system plays a critical role in ensuring that all operational vehicles are accounted for and that their usage is monitored for security and logistical purposes.
**Strengths:** The system is effective in tracking the mode of transportation (e.g., type of vehicle) and the type of fuel used. This information is crucial for both operational efficiency and environmental reporting, as it allows for the monitoring of fuel type usage trends and the associated carbon footprint.
**Weaknesses:** Maintaining spreadsheets is not a supportive model to scale and provide tangible insights on a weekly basis.

### 3.2.4. Facilities Management dataset

Facilities Management utilizes a FMIS software developed by Accruent to theoretically manage maintenance records and facilitate the auction or sale of assets. The software has not been maintained consistently and as such the ability to extract and analyze meaningful vehicle data has dissipated.
**Strengths:** The FMIS Fleet system excels in tracking assets, including those that are uninsured. It has capabilities that are not currently utilized that could serve as a single source of truth for data management.
**Weaknesses:** The current system does not track odometer readings, fuel consumption, fuel type, or transportation mode. These omissions mean that the system cannot provide a complete picture of vehicle usage or operational costs, which are vital for informed decision-making.

## 3.3 FAMIS vs FMIS

Across the website and data available there are two naming structures for the Facilities Management Information System. UVic's Facilities Management pays for FAMIS 360.

FAMIS 360: Facilities Management Software for Optimized Maintenance is provided by Accruent software development, but the typical naming convention is FMIS as it is an acronym for Facilities Management Information System.


*Figure 9 Process map of work order generation to execution in FMIS [8]*

Work orders, which are critical for managing fleet maintenance and addressing operational needs, are created by each department using Facilities Management FMIS (Fleet Management Information System). These work orders are prioritized and assigned based on the specific requirements and urgency of the issues. However, due to the decentralized nature of fleet management, the prioritization and execution of work orders can vary significantly between departments. This variability can result in delays, redundancies, or even missed opportunities for preventive maintenance and cost savings.

## 3.4 Vehicle use

There is no tracking of odometer readings by either Facilities management or the Research and Academic vehicle operators, as a result, it is unclear the frequency these vehicles are used and if they should be prioritized for replacement.
Campus security captures odometer readings manually for all the vehicles under their management monthly. This data supports the maintenance fee structure for Campus Security. The below figures are examples of how odometer readings and calculating distance travelled per department could provide insights for fleet management.

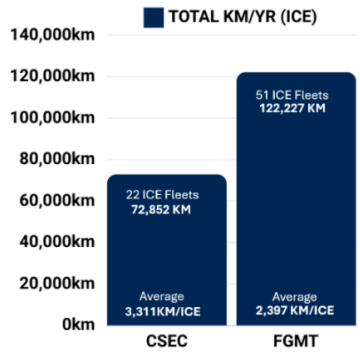



*Figure 10 Total & Average distance travelled by ICE fleets of CSEC & FM Department*

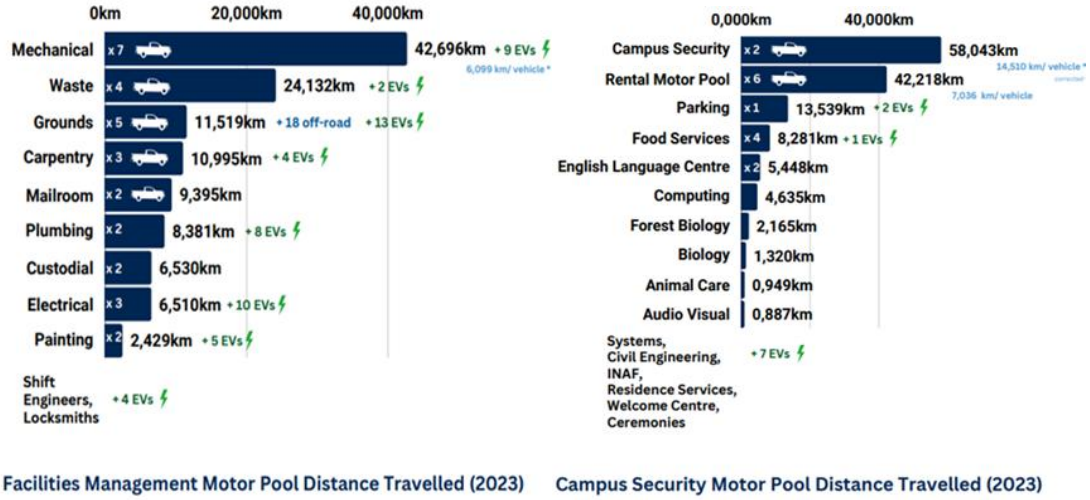



*Figure 11 Sub-Department wise tracking of fleets under FM and CSEC*

### 3.5. Maintenance and repair

Most of UVic's vehicles are repaired and maintained within the university, but some are serviced externally.

**Facilities Management** sets up recurring maintenance schedules through automated work orders in FMIS and handles ad-hoc issues via manually requested work orders.

Gators and Golf carts are maintained by FGMT in the Saunders mechanical shop.

**Campus Security maintains** an Excel spreadsheet to monitor and issue the regular maintenance of their fleet. CSEC services their vehicles off-campus and must plan for an interruption of service during this time.

**Research and Academic vehicle**s are expected to maintain regular maintenance schedules, but there is no monitoring, accountability, or documentation involved.

## 4. Recommendations

### 4.1 Centralize fleet data governance

Centralized data governance is a framework for managing an organization's data resources from a single authoritative body, often a centralized team or department. This approach ensures that data policies, standards, and procedures are consistently applied across the organization. A primary benefit of centralized governance is improved data quality and consistency, as decisions are made by a unified group rather than disparate departments with potentially conflicting priorities [9].

Centralized data governance plays a crucial role in fleet reporting by ensuring consistent data management across all operational areas, leading to more accurate and timely insights into fleet performance. In this approach, all fleet data—such as vehicle maintenance records, fuel usage, driver behavior, and operational efficiency—are standardized and managed by a central authority. This governance model enforces uniform data quality standards, which minimizes discrepancies in reporting and enables reliable performance tracking [10]. However, the centralized model may lack agility, as local fleet managers may need approval from the central team for changes in reporting metrics, which can delay decision-making.

Despite potential drawbacks, centralized governance in fleet reporting allows large organizations to gain consistent insights into fleet operations, aiding in better decision-making, cost reduction, and risk management [11].

The following table highlights the barriers in the current decentralized fleet data management system:

| Department | Recording Method | Data Recording | Issues |
|---|---|---|---|
| Facilities Management | Manual/ Automatic | FMIS and Profuel Software | Quantity data is incorrect.<br>Vehicle descriptions mismatched with ICBC datasets.<br>Lack of odometer readings<br>Lack of insights into how fleets are assigned to the department<br>No information on which vehicles are travelling off-campus.<br>Does not include maintenance costs |
| Risk Management | Manual | Excel | Discrepancies in rate classification.<br>ICBC vehicle categorization is different than greenhouse gas reporting and ZEV grant classification.<br>Procurement information not available. |
| Campus Security | Manual | Excel | Preferably clean data maintenance of data sets but do not follow software |
| Research Department | None | No Data recording | No standard procedures to capture the transportation mode, fuel type, and consumption data |

*Table 7 Discrepancies of data sets based on "ICBC Summary.xlsx", "FMIS.xlsx" & "Campus Security Motor Pool Summary.xlsx"*

The initial findings from the qualitative and quantitative analysis of the data sets maintained by Facilities Management and Campus Security point to the difficulty in determining the exact scenario regarding the optimized use of the fleet as well fuel consumption within the university. This observation underscores the critical need for unwavering adherence to clear policies, procedures, and Standard Operating Procedures (SOPs).

As a result, much of this project involved the consolidation and verification of datasets to develop a true inventory of UVic's fleet mix.

### 4.1.1 Benefits to centralized data governance

Project [12] evaluates Portland State University's fleet management, recommending centralization and electrification to optimize fleet use and reduce greenhouse gas emissions. Centralization is proposed to streamline processes across departments, supporting sustainability goals through more effective resource allocation and reduced emissions. In measuring and estimating the costs of maintenance and operation of the vehicle, one must consider every angle of the cost of the vehicle particularly in the course of defensive assets [13]. Centralization could yield the following information:

- **Frequency of Usage by Department**: Detailed records of how often each department drives fleet vehicles (aka the weekly distance travelled in kilometers (KMs)) would aid in understanding usage patterns and identifying peak demand times.
- **Actual Number of Vehicles Required by Each Department:** An accurate assessment of each department's vehicle operation requirements (i.e. off-road, snow clearing) would ensure that each department has access to the appropriate number of vehicles to meet their operational requirements without over-allocating resources.
- **Maintenance Schedules and Compliance:** Centralized tracking of maintenance schedules would ensure that all vehicles are serviced regularly and comply with safety standards, reducing the risk of breakdowns and extending the lifespan of the fleet.
- **Cost Allocation and Budgeting:** Clear records of fleet usage would allow for more accurate budgeting and cost allocation, ensuring that departments are charged fairly for their usage and that the overall fleet budget is managed efficiently.
- **Cost savings:** analyzing fleet usage data could support efficient vehicle deployment and car-sharing models, minimizing the need to replace vehicles at a 1:1 ratio. Additionally, monitoring distance travelled and reducing the number of vehicles in UVic's Motor Pool/Corporate Fleet would enjoy cost-savings from annual insurance rates and claims.
- **Environmental Impact**: By tracking vehicle usage and maintenance, the university could better assess the environmental impact of its fleet and make data-driven decisions to reduce emissions, such as transitioning to electric vehicles where feasible.
- **Vehicle Availability and Scheduling:** A centralized system would optimize vehicle availability and scheduling, reducing downtime and ensuring that vehicles are available when needed.
- **Incident Reporting and Resolution:** A standardized process for reporting and resolving incidents involving fleet vehicles would improve response times and ensure that issues are addressed promptly and systematically.
- **User Accountability**: Tracking who uses each vehicle and for what purpose would enhance accountability, ensuring that vehicles are used appropriately and responsibly.
- **Sustainability reporting and resolution**: a consistent, reliable, and automated centralized data collection software could increase efficiency and efficacy in sustainability reporting as well as minimize human error, miscommunication, and data entry inconsistencies across employee turnover.

## 4.2 Assign a fleet administrator

To optimize fleet management, data collection and integration methods must be centralized, consistent, and standardized across all departments. This standardization is essential for accurately identifying opportunities to reduce costs, enhance resource allocation, and improve overall efficiency. By ensuring a uniform approach to data governance, the fleet can be effectively managed to support the campus's daily operations, fulfill work orders, and respond swiftly to emergencies, while aligning with sustainability goals and improving decision-making.

This can be achieved by assigning a fleet administrator to record and validate information from facility management, campus security, and research and academic departments.

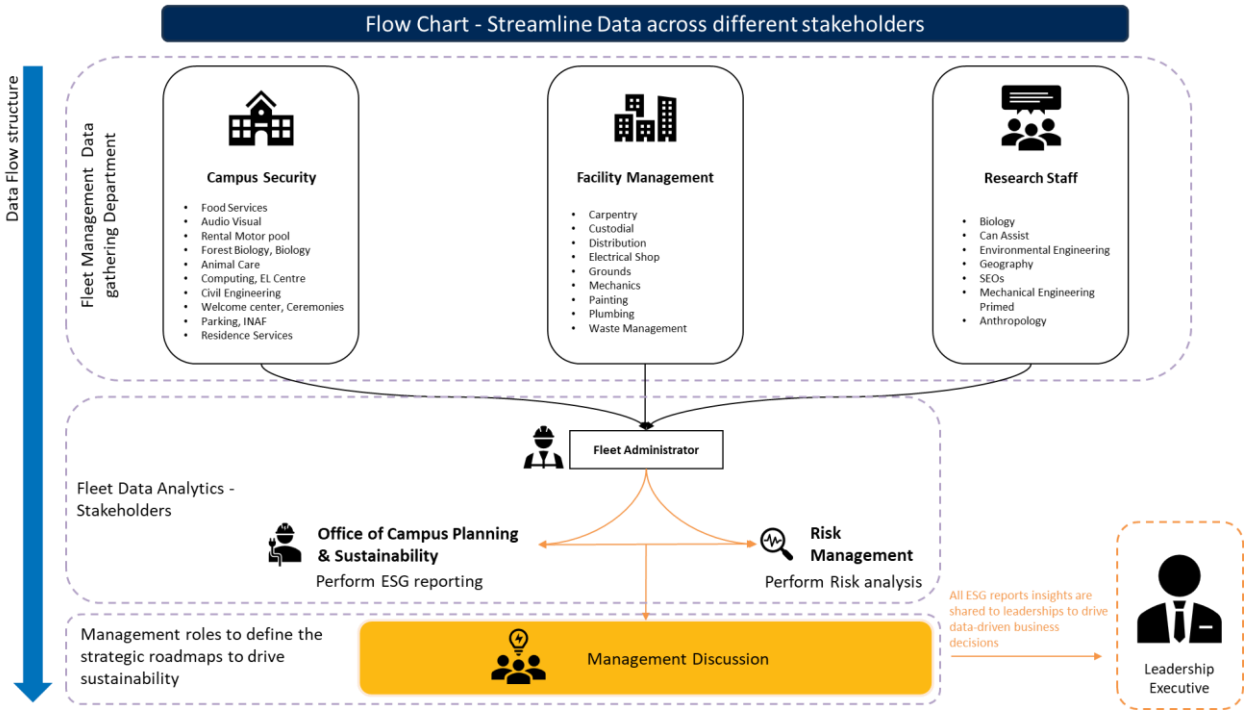



*Figure 12 Recommended data flow and decision-making process*

The following options are suggested to improve centralized data standardization and accurate reporting:

**Option 1: Direct Reporting to Fleet Administrator**

- **Benefit:** Simplifies communication and ensures direct access to relevant data.
- **Hurdle:** Requires strict adherence by research staff to standardized reporting practices.

**Option 2: Reporting through Campus Security**

- **Benefit:** Campus Security has a strong track record in fleet management, and delegating this responsibility could enhance data accuracy.
- **Hurdle:** Overburdening Campus Security could pose a challenge, especially considering previous difficulties engaging with Research and Academic Departments.

### 4.2.1 Considerations and Guidelines

The study [14] states importance of evaluating the success of the implemented Fleet Management system (FMS) in providing tangible benefits to its users. The importance of maintenance culture in fleet management, emphasizing that a proactive approach can significantly reduce breakdowns and maintenance costs. Factors like insufficient funding, use of substandard parts, and lack of skilled mechanics contribute to high maintenance costs, particularly in educational institutions [15]. Common challenges in fleet management, include frequent breakdowns, poor scheduling, and inefficient maintenance practices. The study [16] suggests that implementing stricter controls and compliance with fleet policies can help institutions like the University of Education, Winneba, improve fleet efficiency and reduce costs.

So, following consideration should be taken account:

- **Centralization & Consistency:** Both the reporting structure and the fleet management system need to be centralized, with a consistent approach across departments.
- **Data Accuracy:** Regular audits, accurate reporting systems (FMIS, ProFuel), and real-time odometer tracking are essential for maintaining precise fleet data.
- **Training & Communication:** Continuous training for staff and clear communication protocols are necessary to ensure all departments are aligned with data governance standards.
- **Technology & Automation:** Leveraging technology to streamline data collection, reporting, and analytics will enhance efficiency and reduce human errors.

By addressing these recurring themes, UVic can improve fleet data standardization and achieve more accurate and comprehensive reporting.


*Figure 13 Figure from ARAI White Paper Publication [17]*

## 4.3 Update fuel management systems

Data provides direction and stands as a pillar in any strategic decision-making process, stronger data sets strengthen decision-making further. Adopting fleet electrification strategies from cradle to gate (Purchasing to Surplus) should rely on accurate data. For data collection and analysis to be informative and robust, the same data entry and data management best practices must occur across departments and over time. Ensuring that data collection and analysis processes are robust and that all stakeholders are trained in using these systems is crucial for success.

### 4.3.1 Data governance and software integration (Aka Telematics)

Telematics refers to the integration of telecommunications, informatics, and wireless devices to allow the transmission and storage of data. In the context of fleet vehicles, telematics holds immense significance for monitoring and managing multiple vehicles efficiently.

Fleet telematics seen as a 'productivity tool' is best placed to support transport companies to optimize and maximize their fleet better[4].
Fleet telematics plays a crucial role in monitoring fleet vehicles by collecting and analyzing various data points, such as vehicle location, speed, mileage, and even driver behavior. With the help of telematics, fleet managers can remotely track the real-time location of their vehicles, enabling them to optimize routes, ensure timely delivery of goods, and respond promptly to any emergencies. [18] [19]
Adopting telematic software technology can support the management of large datasets over time as well as real time monitoring, there are multiple avenues for integrating technology into the data collection processes, minimizing or eliminating the opportunities for manual entries and human error.

### 4.3.2 Fuel management software comparison table

| Key Performance Indicator's | Fleetio[20] | FMIS [5] [21] | Profuel[22] |
|---|---|---|---|
| Fuel tracking | ✓ | x | ✓ |
| Vehicle replacement analysis | ✓ | x | x |
| Vehicle categorization | ✓ | x | x |
| Odometer reading | ✓ | x | x |
| Procurement details | ✓ | x | x |
| Fuel cost | ✓ | x | ✓ |
| Vehicle assignment | ✓ | x | x |
| Vehicle status (Active/Inactive/In shop/Out of Service/Sold) | ✓ | ✓ | x |
| Vehicle location | ✓ | x | x |
| Service cost | ✓ | ✓ | x |
| Inspection summary | ✓ | ✓ | x |
| Repair priority class trend | ✓ | ✓ | x |
| Contact renewal reminders | ✓ | x | x |
| Service reminder | ✓ | x | x |
| On-time service compliance | ✓ | x | x |
| Vehicle inspection | ✓ | x | x |
| Real-time odometer reading | ✓ | x | x |
| Cost per meter | ✓ | x | x |

*Table 8 Data recording feasibility with respect to the current subscription model by UVic*

[4] "Commercial Vehicle Sales Are Ailing, So Why Is The Connected Truck Telematics Market Still In Good Health?," *Frost & Sullivan*, Jun. 03, 2020. https://www.frost.com/growth-opportunity-news/commercial-vehicle-sales-are-ailing-so-why-is-the-connected-truck-telematics-market-still-in-good-health/ (accessed Nov. 03, 2024)

[5] Facilities Management refers to their software as FMIS; however, the contracted service and software provided by Accruent software developers are called FAMIS, FAMIS provided by Accruent software developers. The FMIS naming convention is used here and throughout the document to reduce confusion for readers.

#### 4.3.2.1 Accruent: FAMIS – 360 Facilities Management Information System

FMIS is Accruent's asset management solution that can streamline maintenance operations, improve inventory accuracy, automate and prioritize work orders, and ensure compliance across various industries.

FMIS can draw analytics work regarding the KPIs mentioned above. It can be used to overview the life cycle analysis but can't picture the total cost of ownership.

#### 4.3.2.2 Computrol: Profuel (Current hardware/Software)

Computrol is a fuel management system designed to deliver precise, accurate data for fuel operations within a single integrated solution. The website and services seem to satisfy the required KPIs for vehicle assessment and lifecycle-costing. However, the UVic experience of the software is archaic. Additionally, this software is not inclusive of electricity usage and would become obsolete as the fleet continues to transition too electric.

1. **Continuing with Profuel recommendations:**
   - Redistribute fuel cards across departments, ensuring that the allocation aligns with current operational needs.
   - The fleet administrator must actively monitor fuel card usage to prevent misuse and ensure accurate tracking of fuel consumption.
2. **Replacement of Worn-Out Fuel Cards:**
   - The Fleet administrator conducts a review of the current fuel cards, identifying those that are worn out or damaged.
   - Replace any cards promptly to ensure continued functionality and accurate data collection.
3. **Scheduled Monitoring of Fuel Card Condition:**
   - Implement a biannual (every 6 months) inspection of fuel card conditions to ensure they are assigned to the correct department and in good working order.
   - This regular monitoring will help identify issues early and ensure that there is only one fuel card assigned to one vehicle.
4. **Annual Fuel Consumption Reporting:**
   - Ensure ProFuel can generate an annual fuel consumption report.
   - This report should be comprehensive and detailed enough to be utilized for annual CO2e (carbon dioxide equivalent) reporting, supporting sustainability and environmental compliance efforts.
5. **ProFuel 2**
   - ProFuel 1 to be upgraded to ProFuel 2, and needs to be checked with whether any of above recommendations can be covered up with the latest version
6. **Procedure/Policy**
   - Assigning of Fuel card to account no. to vehicle type needs to be developed & implemented by the Fleet Administrator.
   - Monitor the condition of fuel cards on a semi-annual basis via survey.

#### 4.3.2.3 UVic CCards / Fleetio

Fleetio offers a comprehensive out-of-the-box solution for effective fleet management. This includes pre-trip and post-trip inspections, odometer readings, fuel usage tracking, and lifecycle analysis. The platform can support the entire UVic fleet, including Research and Academic vehicles, providing a centralized system for fuel use and vehicle management across all operators and fleet managers on campus. However, Fleetio does not function as a fuel card 6. To enable fuel or electricity transactions at on-campus fuelling stations, integration with a CCARD 7 or Transact ONEcard [23] would be necessary. Fleetio's built-in reporting and analytics capabilities ensure fleet managers can access real-time, accurate data without the need for additional tools or manual processes.

### 4.3.2 Considerations when considering fuel management software

1. How effectively can the software store fleet information?
2. What is the process for inputting information?
3. Does the FMIS support uploading Excel, Word, or PDF files to generate reports automatically?
4. What is the average time to release a work order?

*For instance, how long does it take to book a motor pool vehicle, and what is the overall cycle time?

5. What challenges exist in the current system?
6. Can FMIS create a dedicated tab for fleet information?
7. What percentage of data is manually entered? For example, when booking a motor pool vehicle, how many fields must be filled in manually?

It is crucial to thoroughly evaluate FMIS's capabilities in these areas before fully committing to it as a centralized fleet management solution. Ensuring that all required KPIs can be tracked and that dashboards are automatically generated within the system (via the report tab) will be key to effective fleet management and operational efficiency.

A SWOT analysis evaluates the internal strengths and weaknesses, and the external opportunities and threats in an organization's environment. The internal analysis is used to identify resources, capabilities, core competencies, and competitive advantages inherent to the organization. The external analysis identifies market opportunities and threats by looking at competitors' resources, the industry environment, and the general environment [24].

[6] Fuel cards are for people who drive cards, and these cards are accessible from the in-house fueling station.

[7] CCards are credit cards provided by university employees to be reimbursed for expenses.

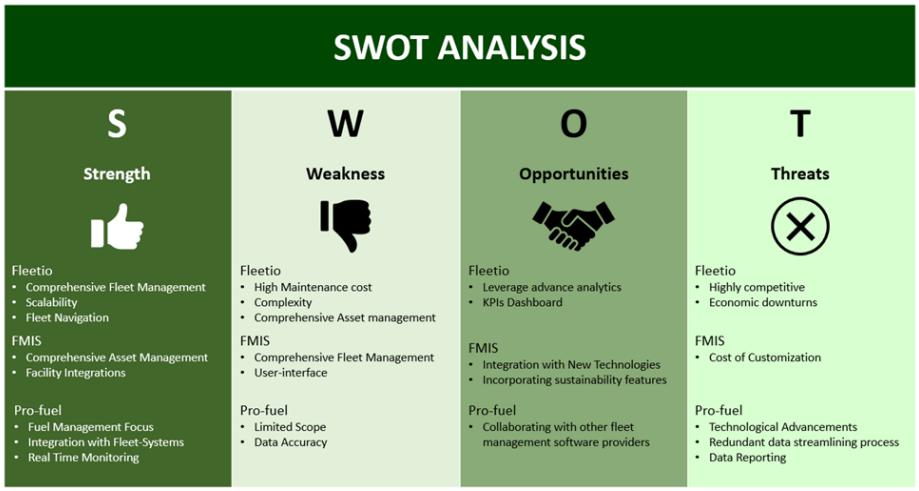



*Figure 14 SWOT ANALYSIS of Fleetio vs FMIS vs ProFuel*

Note: SWOT Analysis is based on the current subscription model adopted by UVic.

Additionally, the origin and quality of FMIS dashboards need attention. While the dashboards provide useful high-level analytics, there is uncertainty regarding how they are generated. It is unclear whether these dashboards are created natively within FMIS or manually compiled using external tools and data exports. This distinction is critical, as manually generated dashboards can introduce errors, require extra effort, and may not provide real-time insights.

## 4.4 Establish a vehicle replacement policy

There is currently no policy in place to define which vehicles should be prioritized for replacement or how decisions regarding future replacement and retirement of fleet vehicles will be made. Stakeholders should be involved and take responsibility for defining a vehicle replacement policy for the university's fleet. It is essential that the fleet manager plays a key role in establishing and implementing this policy in a centralized manner. This would ensure that individual departments coordinate with a central manager when purchasing new vehicles, streamlining the process and maintaining consistency across the fleet.

### 4.4.1. Overview of UVic's motor vehicle policy No: AD2315

This policy ensures the efficient acquisition, maintenance, replacement, and operation of motor vehicles used for university business. The policy emphasizes the use of low-emission vehicles to align with the university's sustainability goals and outlines driver responsibilities to ensure safe and compliant vehicle operation.

### 4.4.2 Vehicle replacement policy

| WFMA's Replacement Policy | | |
|---|---|---|
| **Utilization** | **km / Year** | **Hours / Year** |
| Light | under 12,000 | under 600 |
| Medium | 12,000 to 18,000 | 600 to 900 |
| Heavy | 18,000 to 24,000 | 900 to 1,200 |

*Figure 15 WFMA Replacement Policy [42]*

A key recommendation from this project is to include definitions and metrics regarding vehicle replacement for the UVic Corporate Fleet/ Motor Pool. This would support a targeted approach focusing on the most eligible vehicles to replace under the Government of BC's Clean Transportation Plan [25].

A reference for vehicle replacement can be taken from the Winnipeg Fleet Management Agency (WFMA) [26], based on utilization, as they typically report during annual audits.

| | | | |
|---|---|---|---|
| Radio patrol cars | 125,000 miles and or | 5yrs | (total life cycle) |
| Un-Marked Police | 125,000 miles and or | 8yrs. | |
| Medic units | 150,000 miles and or | 5 yrs. | (Front line) |
| Fire pumper | 100,000 miles and or | 12 yrs. | (Front line) |
| Fire Ladder | 100,000 miles and or | 12 yrs. | (Front line) |
| Compact sedan | 125,000 miles and or | 10yrs | |
| SUV | 125,000 miles and or | 10 yrs | |
| Pick-up truck | 125,000 miles and or | 10 yrs. | (6 to 8 yrs. Snowfighting) |
| Cargo van | 125,000 miles and or | 10 yrs | |
| Tri axle dump | 150,000 miles and or | 12yrs | |
| Crew cab dump | 150,000 miles and or | 12yrs | |
| Inlet Cleaner | 20,000 **hours** and or | 12 yrs. | |
| Sewer Vac | 20,000 **hours** and or | 12 yrs. | |
| Trash compactor | 20,000 **hours** and or | 8 yrs. | (Front line) |
| Street sweeper | 15,000 **hours** and or | 10 yrs. | |
| Wheel loader (salt) | 15,000 **hours** and or | 10 yrs. | |

Adopting these key performance metrics into existing Motor Vehicle Policy highlights the value of consistent data management regarding vehicle categories and odometer readings. Another example is the Philadelphia city council [27] fleet life cycle policy needs to be prepared in context to the UVic.

*Figure 16 Optimal Fleet replacement strategy policy implemented by Philadelphia City Council [27]*

#### 4.4.2.1 UVic vehicle replacement using this framework

**Facilities Management**

| Department | Campus Security | Facility Management | Research Staff |
|---|---|---|---|
| **Sub-Department** | 16 | 11 | 8 |
| **Fleet Size** | 30 | 105 | 20 |
| **Total Fleet Size** | | **155** | |
| **Fleet Size %** | **20%** | **69%** | **13%** |
| **ICE Fleet** | 17 | 51 | 18 |
| **In terms of KMs referring to WMFA Replacement Policy (Utilization)** | | | |
| **High Priority** | **2** | **6** | **No Tracking** |
| **In terms of Age >15 years** | | | |
| **High Priority** | **6** | **14** | **4** |

*Table 9 Vehicle replacement Priority based on WFMA Policy and Age>15 years*
***Note: - Gators quantity is not considered in Facility management feet size.***

Facilities Management operates the largest fleet, accounting for 69% of the total with 105 vehicles (excluding Gators). This fleet size plays a critical role in supporting operational needs but also has a significant impact on maintenance costs, efficiency, and emissions. Six vehicles have been identified as high priority for replacement due to high utilization (average driven 625 km per week) and their unique, specialized equipment, which would be costly to replace. Additionally, 14 vehicles are over 15 years old, making them inefficient, unreliable, and more expensive to maintain.

Facilities Management is prioritizing the replacement of older vehicles and has consulted Enterprise fleet management 8 to explore a capital lease strategy for fleet renewal. While a detailed evaluation of the risks and opportunities of this strategy was beyond the scope of this project, the high number of aging vehicles underscores the need for strategic fleet renewal to avoid operational disruptions and rising lifecycle costs.

**Campus Security**

Campus Security manages 30 vehicles, representing 18% of the fleet. Despite its smaller size, six vehicles are over 15 years old, signalling an urgent need for replacement to maintain reliability, especially given the critical role of security and vehicle performance for off-campus rental services.

Two vehicles have been flagged for high-priority replacement based on heavy utilization, indicating that, despite the smaller fleet size, some vehicles are intensively used and essential for operational effectiveness.

**Research and Academic**

The Research and Academic department operate the smallest fleet, with 20 vehicles, making up 13% of the total. While the fleet may experience less intensive use, the lack of utilization data complicates assessments of which vehicles require urgent replacement due to wear and tear.

Four vehicles are over 15 years old, suggesting the need for close monitoring and regular maintenance checks. Without utilization data, there is a higher risk of unexpected breakdowns or elevated maintenance costs, making it critical to track these vehicles more carefully.

## 4.5 Adopt a phased vehicle replacement approach

Electric vehicles (EVs) have higher capital costs than internal combustion engine vehicles (ICEs), and despite financial incentives, a strong financial case is necessary for budget approval. There is currently no policy in place to define which vehicles should be prioritized for replacement or how decisions regarding future replacement and retirement of fleet vehicles will be made. The fleet manager must play a key role in establishing and implementing this policy in a centralized manner. This would ensure that individual departments coordinate with a central manager when purchasing new vehicles, streamlining the process and maintaining consistency across the fleet.

### 4.5.1 Key Metrics for a Phased Vehicle Replacement Approach

- **Right-Sized Fleet:** Assess the fleet to ensure vehicles are optimally sized for their tasks.
- **Monitoring High-Utilization Vehicles:** Regularly monitor high-use vehicles to ensure proper maintenance and efficient usage.
- **Assessment of Low-Utilization Vehicles:** Evaluate underused vehicles for potential decommissioning to reduce costs.
- **Vehicles Over 10 Years Old:** Identify vehicles older than 10 years to assess their maintenance costs and need for replacement**.**

### 4.5.2 Qualitative data analysis and vehicle operator engagement

While centralized data governance is crucial for tracking key performance metrics, continuous engagement with vehicle operators is equally important. Operators' insights can provide valuable context for fleet management decisions. It is recommended that a qualitative survey of drivers and supervisors be conducted annually (Before 31st October) to offer critical feedback for fleet condition. Regularly conducting these surveys will help assess vehicle conditions, gather input on the transition to a green fleet, and ensure information remains up to date.

The use of surveys is essential in this context, as it provides a structured approach to gathering quantitative data on motivations, perceptions, and decision-making factors related to EV adoption in fleet management [28] [29] [30].

[8] Facility Management has plan to lease their fleets and have consulted with Enterprise Fleet Management | "Fleet Management Services, Tracking, and Vehicle Leasing | Enterprise Fleet Management," *Efleets.com*, 2024. https://www.efleets.com/en.html (accessed Nov. 02, 2024).

A template survey to be reviewed and distributed can be found: https://forms.office.com/r/Z0cXJ86Kwk.

#### 4.5.2.1 Overview of vehicle survey and key metrics to capture

| Section | No. Of Question | Description | Importance |
|---|---|---|---|
| Section 1 | 7 | Driver Information | Understanding driver details is essential for managing our fleet effectively and tailoring services to meet drivers' needs. |
| Section 2 | 11 | University Vehicle Usage and Reporting | Collecting data on vehicle usage and reporting practices helps optimize fleet operations, and improve data collection efficiency |
| Section 3 | 5 | Optimizing Fleet Performance: Service & Maintenance | Effective service and maintenance practices are vital for the longevity and reliability of our fleet, ensuring optimal vehicle performance and Safety |
| Section 4 | 2 | Eco-Friendly Techniques | Gathering insights on eco-friendly techniques promotes sustainable practices within our fleet operations and helps reduce our carbon footprint. |
| Section 5 | 3 | Training Program Insights | We need to understand current training experiences to enhance safety, efficiency, and expectations. |
| Section 6 | 5 *Likert Scale | Vehicle & Equipment Safety | Keeping vehicles and equipment safe is crucial for protecting our people and resources. |
| Section 7 | 2 *Likert Scale | Vehicle-Sharing Policy and Centralized System | We need drivers' perspectives on vehicle-sharing and a centralized system to improve fleet management. |
| Section 8 | 5 *Likert Scale | Overview of Electric Vehicles (EVs) | Gathering insights on the usage and perceptions of electric vehicles supports the assessment and potential improvements for our EV program |

*Table 10 Survey Section wise description with reference from "Survey Question from Municipality of Strathroy-Caradoc – Comprehensive Fleet Review & Green Fleet Strategy [40]"*

### 4.5.3. Evaluating opportunities and hurdles related to specialized vehicles

Special purpose vehicles, waste trucks, and heavy equipment present unique challenges for the transition to a green fleet. These vehicles are often highly specialized, with unique configurations and equipment tailored to specific tasks such as emergency response, waste collection, or maintenance work. Replacing them with electric alternatives requires careful consideration of whether suitable zero-emission vehicle (ZEV) options can meet operational needs without compromising performance. For instance, waste collection vehicles have high energy demands due to frequent stop-and-go operation and hydraulic system use. Although electric models are emerging, their range, payload capacity, and durability under heavy use must be thoroughly evaluated to match the performance of their internal combustion engine (ICE) counterparts. Moreover, electric versions of these vehicles tend to have significantly higher upfront costs, which, combined with uncertain long-term savings in maintenance and fuel, complicates decision-making.

### 4.5.4 Leasing vs. Purchasing Heavy Equipment and Specialized Vehicles

Leasing heavy equipment and specialized vehicles, including seasonal vehicles, can be a cost-effective solution, reducing the need for large upfront investments as well as ongoing maintenance and storage costs. This approach is particularly advantageous for vehicles that are infrequently used.

- Leasing offers flexibility and reduces capital expenditure, but it may limit customization and usage options.
- Purchasing provides long-term savings and ownership advantages but requires a substantial initial investment and may carry the risk of technological obsolescence, especially as electric vehicle (EV) technology advances.

Deciding whether to lease or purchase should be guided by a detailed cost-benefit analysis that considers vehicle utilization, operational needs, and the pace of technological development. The balance between flexibility, cost savings, and the ability to support a transition to a green fleet is key to making informed decisions.

### 4.5.4. Government incentivized approach to vehicle replacement

To better position the university for maximizing financial benefits and aligning with provincial sustainability goals, it is recommended that UVic implement a data-driven approach to categorizing its fleet vehicles based on government-defined classifications for light, medium, and heavy-duty vehicles. This categorization would allow UVic to take full advantage of available incentives and rebate programs, including those under the cleanBC Go Electric Program [31], which provides rebates for light-duty vehicles. In 2019, B.C. became the first jurisdiction to legislate a 100% zero-emission vehicle sales target [32] as part of its efforts to reduce greenhouse gas emissions in the transportation sector. The Zero-Emission Vehicle Act [33] sets provincial ZEV sales targets at:

- 26% of light-duty and Class 2B vehicle sales by 2026
- 90% by 2030
- 100% by 2035

To support these targets, the BC Government offers rebates ranging from $1,500 to $3,000 for light-duty passenger vehicles, applicable at the point of purchase for eligible B.C.-based organizations. Car-share programs can receive up to 50 rebates, while other fleets, including UVic's, can qualify for up to 10 rebates per purchase. The program applies to vehicles priced at up to $50,000 for cars and $70,000 for larger vehicles. It is also

important to note that the CleanBC Roadmap to 2030 [34] includes commitments to developing ZEV requirements for medium- and heavy-duty vehicles. Although these categories face more significant barriers to electrification, aligning UVic's fleet categorization with emerging definitions will prepare the university to access future rebates as these programs expand.

By utilizing data to categorize the fleet according to these vehicle definitions, UVic will enhance its ability to:

- Identify and prioritize vehicles eligible for current light-duty vehicle rebates.
- Anticipate and plan for future incentives for medium- and heavy-duty vehicles.
- Support the university's overall carbon reduction strategy in alignment with provincial and national climate targets.

This strategic alignment would allow UVic to benefit from financial incentives while reinforcing its commitment to sustainability and zero-emission vehicle adoption.

### 4.5.6 Infrastructure considerations

As UVic considers expanding its ZEV fleet, assessing the charging infrastructure is crucial to ensuring that the transition is smooth and effective. Optimizing parking locations further supports operational efficiency, making these strategies well-founded.

- **Current ZEV Charging Capacity:** Assess the existing ZEV charging infrastructure to determine if it can support an expanded fleet of electric vehicles.
- **Parking Location:** Evaluate and optimize parking locations to improve fleet accessibility and operational efficiency.

### 4.5.7. Replacing electric vehicles

John Deere electric gators represent the highest portion of UVic's fleet. Although they are already electric, they have been identified by Campus Security and Facilities Management as expensive to maintain.

There is no clear documentation on how the gators are distributed across departments based on the purpose it is supposed to serve. Also, there are no odometer readings available for the gators to assess the distance travelled nor is there a way to track the electricity they are consuming. However, there are benefits to the Gators including low insurance costs and off-road abilities. The John Deere gators therefore provide an excellent case study under the UVic context to better understand this recommendation.

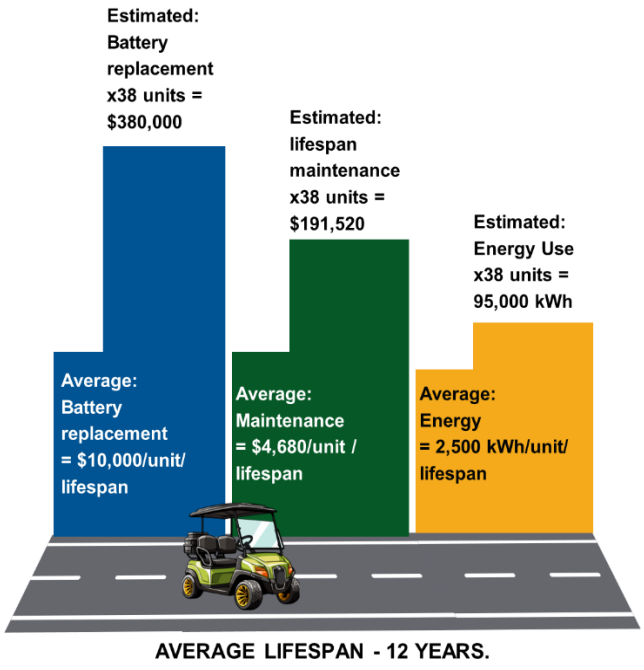



*Figure 17 Operational Cost UVic Gator*

**Strategy:**

**Remove 50% Gator** (Current Average Weekly Usage: 4 Hours Over Last 15 Years): Consider removing half of the Gator vehicles due to their low utilization rate, which indicates they may not be essential.

**Brainstorming with the ECS [35] Team for Gator Conversion:**

Engage with the ECS team to explore the possibility of converting Gators to a more suitable or environmentally friendly alternative.

**Rebate of Retiring Vehicles**

Involving stakeholders ensures that the decision to retire vehicles is well-supported and based on usage data. The market research on gasoline versus electric vehicles aligns with current trends toward sustainability and cost efficiency, making it a valid approach.

**Approval of Stakeholders with Weekly Usage Data:**

Engage stakeholders in the decision-making process by presenting data on weekly vehicle usage to support the case for retiring certain vehicles.

A decision to remove 50% of the Gators is supported by the low utilization rate, which suggests that these vehicles are underused and could be phased out to save costs. Brainstorming with the ECS team for conversion options indicates a proactive approach to finding more efficient or sustainable solutions.

# 5. Decision-Making Framework for Life-Costing Analysis

Electrifying the fleet can be approached from the ground up through operational/driver requests or by the top-down through executive leader decisions. From a top-down approach, it is essential to understand the total number of vehicles owned by the university, the way they are utilized across departments, and the "state" they are in operational.

To develop a decision-making process, a thorough review of the ebook [36] [37] and associated sustainable reports [38] [39] [40] [41], this review aimed to identify and define the key elements critical to informed decision-making, in alignment with the established context and guidelines. Creating a roadmap is essential for the successful conversion from Internal Combustion Engine (ICE) vehicles to Electric Vehicles (ZEVs). Here is an overview of each step in a process roadmap to strategically retire and renew UVic's fleet.

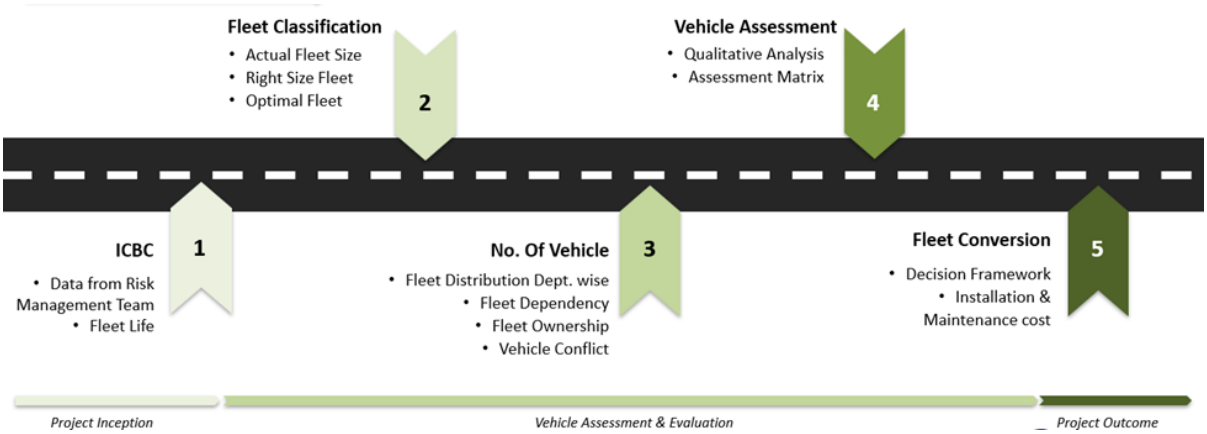



*Figure 18 Suggested Process MAP for UVic ZEV Conversion*

**Note: The initial goal of this project was to develop a decision-making framework for electrifying UVic's fleet; the process map (fig. 18) highlighted above is the initial recommendation developed from other institutional and industry best practices. However, due to the project's key findings, the focus shifted to developing the systems and processes to enable this framework to come to fruition.**

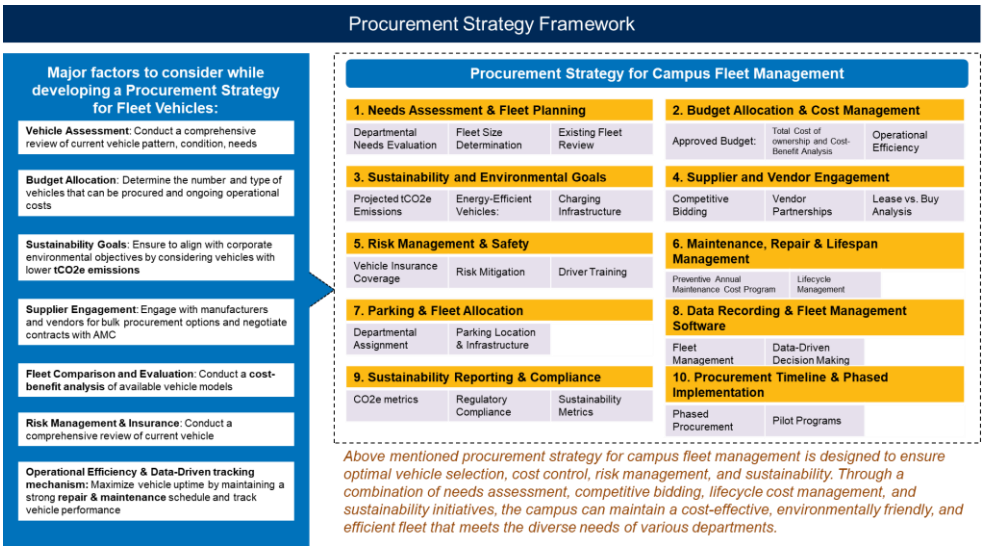
Ultimately this process map highlighted above requires the data to populate and be reviewed by fleet management and decision-makers at UVic. Section five is therefore hypothetical until the data can be organized in a fashion that can support strategic and cost-effective decision-making toward 100% electrification.

## 5.1 Procurement

The procurement process is where quantity, type, and performance are rationalized by departments. [42]


*Figure 19 Procurement process followed by WFMA [42]*

Updating Purchasing Services and including the following stages outlined below in the existing procurement processes could provide a comprehensive framework for managing the acquisition and maintenance of a vehicle fleet. Each stage contributes to ensuring that the fleet is procured, managed, and operated in a cost-effective, efficient way, and aligned with organizational goals. Standardization across these stages, particularly in data recording and risk management, can significantly improve operational efficiency and resource allocation. This framework also highlights the importance of considering long-term costs, sustainability, and risk mitigation in fleet management decisions.




*Above mentioned procurement strategy for campus fleet management is designed to ensure optimal vehicle selection, cost control, risk management, and sustainability. Through a combination of needs assessment, competitive bidding, lifecycle cost management, and sustainability initiatives, the campus can maintain a cost-effective, environmentally friendly, and efficient fleet that meets the diverse needs of various departments.*

*Figure 20 Suggested Procurement Framework*

**Note: The suggested framework and factors considered for the procurement process illustrate the hypothesis by delving into the current scenario. However, due to time constraints, the topic was not discussed in a detailed manner. Based on this, suggestions can serve as a useful tactical strategy.**

Stakeholders should engage in "Questions to consider when thinking about green fleets" supports the organization's goals of sustainability, cost-efficiency, and operational effectiveness.

## 5.2 Key Performance Indicators KPIs

The Key Performance Indicators (KPIs) are essential for monitoring the effectiveness of the fleet management strategy [43] {44] [45]. Also, case study [46] suggests optimizing vehicles can improve fuel efficiency. Based on the framework components, the suggested KPIs can be formed within stakeholder accountability.

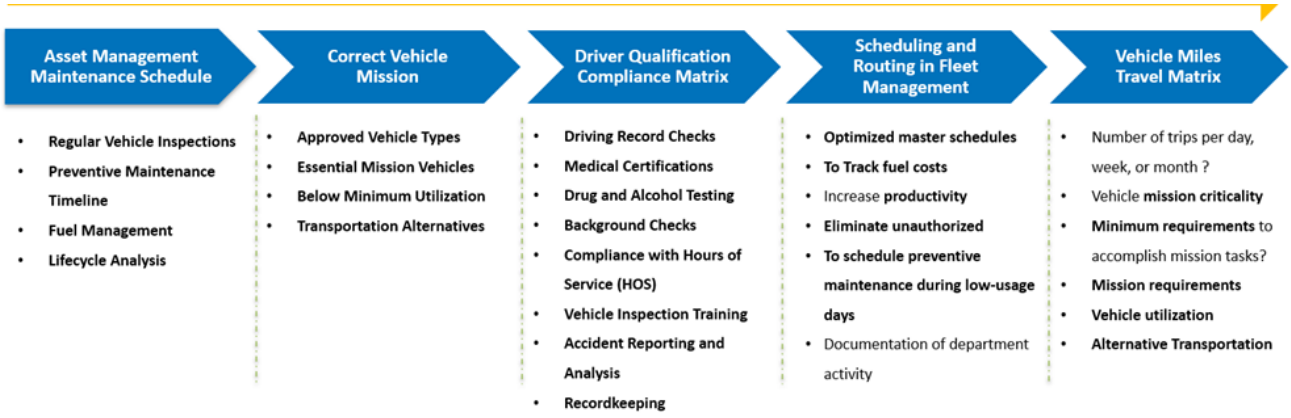



*Figure 21 KPIs required for monitoring*

| Component | Key Performance Indicators (KPIs) | Measurement | Priority | Why? |
|---|---|---|---|---|
| Asset Management Maintenance Schedule | **Vehicle Uptime (%)** | Percentage of time vehicles are operational | High | Fleet reliability and availability |
| | **Maintenance Cost per Vehicle (CA$)** | Average maintenance cost per vehicle | High | Cost efficiency in fleet management |
| | **Preventive Maintenance Compliance Rate (%)** | Percentage of vehicles maintained on schedule | High | To check vehicles are maintained regularly and prevent breakdowns |
| | **Average Vehicle Age (Years)** | Average age of vehicles in the fleet | High | To check and implement a policy of timely replacement and updated fleet in the system |
| | **Fuel Efficiency (Liters/km or MPG)** | Fuel consumption efficiency | High | To know the fuel consumption |
| Correct Vehicle Mission | **Fleet Utilization Rate (%)** | Percentage of fleet vehicles actively in use | High | To know the current stage of the Optimal fleet |
| | **Mission-Critical Vehicle Availability (%)** | Availability of mission-critical vehicles | High | Availability of fleets for the right task at the right location at the right time |
| | **Right-Sized Vehicle Percentage (%)** | Proportion of vehicles matching mission requirements | High | Is the assigned vehicle being ok with mission requirements? |
| | **Alternative Transportation Usage (%)** | Use of alternative transportation methods | Medium | Cost savings and Environmental sustainability Opportunity |
| Driver Qualification Compliance Matrix | **Driver Certification Compliance Rate (%)** | Percentage of drivers with up-to-date certifications | Medium | Safety and regulatory compliance |
| | **Accident Rate per 100,000 km/miles** | Number of accidents relative to distance travelled | Medium | Monitoring and improving driver safety |
| | **Training Completion Rate (%)** | Percentage of drivers completing mandatory training | Medium | To evaluate Driver Skills Matrice |
| | **Drug and Alcohol Test Compliance Rate (%)** | Rate of compliance with drug and alcohol testing | Medium | Ensures adherence to safety protocols |
| Scheduling and Routing in Fleet Management | **On-Time Maintenance Rate (%)** | Percentage of maintenance done on schedule | Medium | To know unexpected downtime |
| | **Fuel Cost per Trip ($)** | Average fuel cost per trip | Medium | Potential savings in route optimization |

| | | | | |
|---|---|---|---|---|
| | **Idle Time Reduction (%)** | Reduction in idle time | Medium | To check Unnecessary fuel consumption |
| **Vehicle Miles Travel Matrix** | **Average Miles per Vehicle per Month (Miles/km)** | Average distance travelled by each vehicle | Low | Indicates vehicle utilization levels |
| | **Trip Efficiency (%)** | Efficiency of trips based on fuel use and time | Low | Optimization of trip planning |
| | **Vehicle Replacement Rate (%)** | Rate of vehicle replacement based on lifecycle | Low | Timely fleet renewal |
| | **Environmental Impact (CO2 Emissions per Mile/km)** | CO2 emissions per distance travelled | Low | Carbon Reporting |

*Table 11 KPIs with Priority level as per current of state of UVic Green Fleet*

## 5.3. Decision-making scenarios

There are many factors to consider when procuring and retiring a vehicle, and there are also different authorities to be consulted throughout the process. For example, the vehicle operators' qualifications and job duties, reputational commitments to zero-emission vehicles, department budget, and funding opportunities.

| Decision-Making Scenarios | Key Decision | Factors to Consider |
|---|---|---|
| **Transition to Electric Vehicles (ZEVs)**<br>UVic is considering replacing ICE vehicles with ZEVs to meet sustainability goals but faces challenges with data accuracy and infrastructure needs. | Adopt EV's based on a phase 1,2,3 approach based on vehicle categories and utilization (weekly km's)<br>1. Light-duty vehicles – easy to convert<br>2. Medium-duty vehicles - more difficult to convert<br>3. Heavy duty vehicles/specialized vehicles – most difficult to convert | Vehicle age<br>Utilization rates<br>Infrastructure readiness<br>Leasing vs ownership |
| **Fleet Data Management and Standardization.**<br>The current decentralized fleet data management system leads to inconsistent data management and hinders accurate analysis. | Implement a centralized data governance system to standardize data collection across departments assigning a Fleet Administrator to oversee the consistent flow of data. | Training needs, data accuracy, departmental resistance or support.<br>Operational needs, availability of suitable EV models, |
| **Special Purpose Vehicles Management**<br>Managing the transition of special purpose vehicles to a green fleet is challenging due to their specialized nature and energy requirements. | Lease or purchase electric alternatives for special purpose vehicles. | Long-term cost savings |
| **Fuel Management System Update**<br>The current ProFuel software has discrepancies and does not effectively support ZEV tracking. | Upgrade existing ProFuel system or adopt a new fuel management system that can track all fuel types, including electricity for ZEVs.<br>Feasibility of Fleetio Software | Software capabilities<br>Integration with existing systems<br>Accuracy of data<br>Cost of upgrade vs new system |
| **Vehicle Replacement Planning**<br>There is no formal vehicle replacement policy, and many vehicles in the fleet are over 15 years old. | Establish a vehicle replacement policy that prioritizes vehicles based on age, utilization, and maintenance costs. | Age and condition of vehicles<br>Cost of replacement<br>Budget constraints |

*Table 12 Decision making scenarios with Key decisions and Factors to be considered*

## 5.4. Technological and Infrastructure Challenges:

**Charging Infrastructure:** The deployment of special-purpose electric vehicles and waste trucks will require specialized charging infrastructure, particularly for vehicles that operate in remote or less accessible areas. The need for fast charging to minimize downtime is also critical, and current infrastructure may not be sufficient to support a large fleet of heavy-duty EVs.

**Battery Performance:** The performance of electric vehicles, particularly in heavy-duty applications, is heavily dependent on battery technology. Factors such as range, charging time, battery life, and performance in extreme weather conditions need to be thoroughly assessed to ensure that these vehicles can meet operational demands.

### 5.5 Regulatory and Environmental Considerations:

**Compliance:** There may be specific regulatory requirements for special purpose and waste vehicles that must be met, such as emissions standards, noise regulations, and safety certifications. Transitioning to an electric fleet may involve navigating complex compliance landscapes, especially if the vehicles are subject to different standards due to their specialized nature.

## 6. Conclusion

The recommendations focus on the critical need for standardization and centralization in fleet data governance to enhance decision-making and optimize resource allocation. By categorizing the fleet and implementing a unified system, UVic can ensure data accuracy and improve operational efficiency across departments.

### Key Findings:

**Decentralized fleet data governance:**

- The current model for data collection and management related to UVic's fleet is fragmented, with departments independently managing their data, leading to inconsistencies that hinder data-driven decision-making.

**Transition to electric vehicles (ZEVs):**

- UVic is exploring the transition from internal combustion engines (ICE) vehicles to zero-emission vehicles (ZEV)s however, there are barriers to the ZEV market transformation including vehicle supply, affordability, infrastructure and the unique circumstances to UVic's special purpose and highly utilized vehicles.

**Vehicle replacement and lifecycle management:**

- Many vehicles in UVic's fleet are over 15 years old, highlighting the need for a formal vehicle replacement policy to optimize fleet costs and ensure vehicles meet operational needs without excessive maintenance costs.

**Fuel management and environmental impact:**

- The current fuel management system (ProFuel) is limited in its ability to track ZEVs and accurately monitor fuel/electricity usage. Developing and integrating a fuel consumption system is essential for a future-focused fuel management strategy, which directly ties into UVic's goals of reducing its carbon footprint.

**Special purpose vehicles:**

- Managing special-purpose vehicles, such as Waste Reduction's garbage compactor, presents unique challenges. The transition to ZEVs for special-purpose vehicles must consider their specialized requirements and the availability of suitable alternatives.

### Recommendations:

**Centralize Fleet Data Management:**

- Appoint a Fleet Manager and implement a unified fleet management system to standardize vehicle purchasing and data collection, ensuring consistent vehicle usage and fuel tracking.

**Upgrade Fuel Management Systems:**

- Enhance fuel tracking capabilities to include electricity usage for EVs, improving data accuracy and supporting sustainability goals.

**Establish a Vehicle Purchasing and Replacement Policy:**

- Develop a formal vehicle purchasing and replacement policy that considers vehicle age, utilization, and maintenance costs. This policy will help UVic maintain an efficient fleet and reduce long-term costs.

**Adopt a Phased ZEV Transition:**

- Prioritize older, underutilized, and high-impact vehicles for EV transition while gradually building supporting infrastructure. All while identifying funding opportunities available through the Clean BC Transportation Plan.

**Focus on Specialized Vehicles:**

- Conduct a thorough assessment of the requirements for special purpose vehicles and explore leasing or purchasing EV alternatives that meet operational needs.

UVic's commitment to sustainability in fleet management will require strategic efforts to centralize data, adopt EVs, and improve lifecycle management. These efforts will help the university achieve sustainability objectives while maintaining fleet efficiency.

# APPENDIXES

## APPENDIX 1: UVic Fleet Distribution

**35 DEPARTMENTS | 155 VEHICLES**

University of Victoria

| FACILITIES MANAGEMENT | |
|---|---|
| 11 DEPARTMENTS | 105 VEHICLES |
| GROUNDS | 37 |
| MECHANICAL | 15 |
| ELECTRICAL | 13 |
| PLUMBING | 10 |
| CARPENTRY | 8 |
| PAINTING | 7 |
| WASTE | 7 |
| SHIFT ENGINEERS | 3 |
| JANITORS | 2 |
| MAILROOM | 2 |
| LOCKSMITHS | 1 |

| CAMPUS SECURITY | | | |
|---|---|---|---|
| 16 DEPARTMENTS | | 30 VEHICLES | |
| RENTAL MOTORPOOL | 6 | AUDIO VISUAL | 1 |
| FOOD SERVICES | 5 | FOREST BIOLOGY | 1 |
| PARKING | 4 | BIOLOGY | 1 |
| ENGLISH LANGUAGE CENTRE | 2 | ANIMAL CARE | 1 |
| CAMPUS SECURITY | 2 | COMPUTING | 1 |
| | | SYSTEMS | 1 |
| | | CIVIL ENGINEERING | 1 |
| | | WELCOME CENTER | 1 |
| | | CEREMONIES | 1 |
| | | INAF | 1 |
| | | RESIDENCE SERVICES | 1 |

| ACADEMIC | |
|---|---|
| 8 DEPARTMENTS | 20 VEHICLES |
| ENVIRONMENTAL STUDIES | 5 |
| BIOLOGY | 4 |
| MECHANICAL ENGINEERING | 3 |
| CANASSIST | 2 |
| ONC | 2 |
| SEOS | 2 |
| ANTHOPOLOGY | 1 |
| GEOGRAPHY | 1 |

## APPENDIX 2: UVic Resources and Description

| Document/Resource | Description |
|---|---|
| Sop_mobile_fuel_combustion_v2_kw_2023_final.Docx | Protocols for recording mobile fuel combustion emissions.<br>Informs the process for assessing the carbon footprint of UVic's fleet. |
| Data_collection_academic_fleet | Dataset of vehicle usage in academic and research departments.<br>Supports the analysis of vehicle usage and emission trends within academic departments. |
| Fleet Summary | A comprehensive list and status of all fleet vehicles at UVic.<br>Provides a detailed inventory of the fleet, including vehicle type, age, and operational condition. |
| Audit response_GHG emissions reporting_v1_2024-06-11.Docx | UVic's response to GHG emissions audit, addressing key gaps and recommendations.<br>Identifies gaps in GHG reporting and proposes improvements for better data collection and fuel consumption tracking. |
| Greenfleet_interimreport_kw | Interim report of the Green Fleet Project with updates on progress and initial findings.<br>Summarizes the project's key findings, challenges, and preliminary recommendations. |
| Gator Stats | Detailed statistics on John Deere Gator vehicles, including usage and maintenance costs.<br>Provides data on operational costs and recommendations for optimizing Gator usage in UVic's fleet. |
| Emission Factor Catalogue | A list of emission factors for calculating fleet emissions.<br>Standardizes the GHG emissions calculations for fleet reporting. |
| UVic – Enterprise Fleet Proposal Plan | Proposal for managing UVic's fleet, including options for leasing and transitioning to electric vehicles.<br>Offers strategic recommendations for fleet renewal and EV transition. |

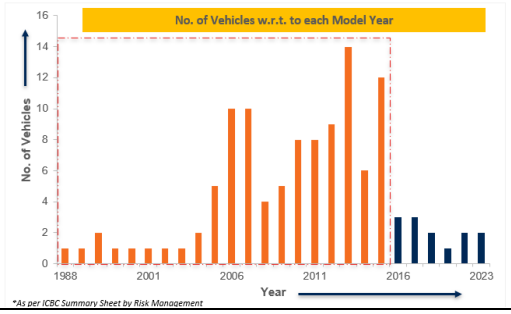
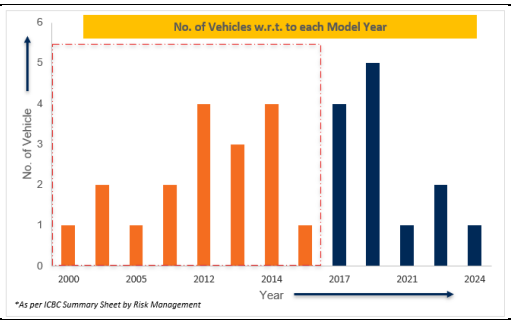
## APPENDIX 3: Fleet Inventory Check

| Task | Purpose |
|---|---|
| Conducting fieldwork to verify new fleet inventory dataset:<br>**Date 1st July'24 -12th July'24** | This process sought to verify license plates, Motor Pool Numbers, EQ Numbers, and the UVic department utilizing the vehicle asset. It also captured odometer readings for all motor vehicles under the Campus Security Motor Pool and Facilities Management. |

## APPENDIX 4: Data sets

| Datasets | Purpose/Value |
|---|---|
| SSP Green Fleet Project | Sustainable Scholar program green fleet project details |
| SSP Project Plan | Project goals and details by office of campus planning and sustainability |
| **Fleet Summary**<br>fleet_summary_kw - Copy.xlsx | *Consolidates the datasets below prioritizing:*<br>• Motor Pool Number<br>• EQ number<br>• Vehicle make, model, year<br>• Serial number<br>• License plate<br>• Odometer reading<br>• Department contact<br>• Fleet manager |
| **ICBC Summary**<br>I2023_2024 ICBC_Summary MASTER - Copy.xlsx | *Provides an overview of all the motor vehicle assets registered and insured at the University.*<br>• Motor Pool Number<br>• Serial number<br>• License plate |
| **FAMIS**<br>FAMIS_Fleet Vehicle VIN listing 2023-08-11.xlsx | Contains a record of vehicles under the FGMT management<br>• EQ number<br>• Serial number<br>• License plate |
| **Campus Security Motor Pool Summary**<br>MPinvent.xls | Contains a record of vehicles in the CSEC motor Pool including:<br>• Motor pool number<br>• Odometer reading<br>• Department contact |
| **Profuel summary report**<br>profule_filter_down.xlsx | Contains internal combustion engine data related to:<br>• Gasoline usage<br>• Diesel usage<br>• Odometer readings across one fiscal year |
| Sop_mobile_fuel_combustion_v2_kw_2023_final.Docx | The standard procedure outlines the context and steps to acquiring, analyzing and submitting fuel consumption data for emissions. |

# APPENDIX 5: Vehicle age > 10 years

| **Model Year vs No. of Vehicle**<br>**Facility Management** | **Model Year vs No. of Vehicle**<br>**Campus Security** |
|---|---|
|  |  |

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