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### Client Details

The Dalhousie Office of Sustainability has the mission statement of supporting solutions that create positive social, ecological, and economic change in university operations

### Problem Statement

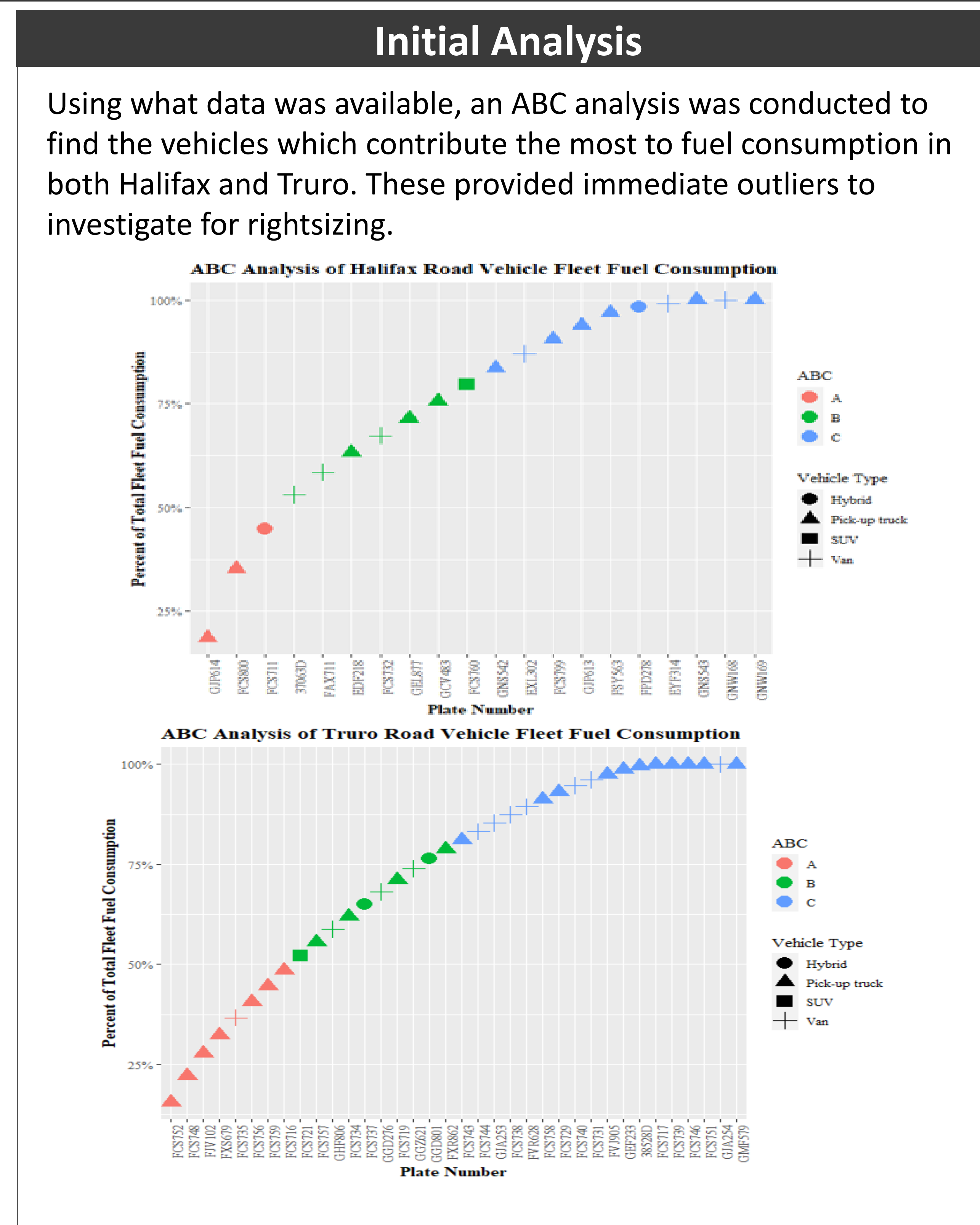
The Dalhousie Office of Sustainability is seeking a fleet review to assess fleet rightsizing and optimization, a tool which will assist in making business cases for green options, and recommendations for improving fleet emissions.

### Scope

- Key vehicles to assess for rightsizing
- Operational recommendations
- LCC Tool
- Fleet exploration tool

### Initial Conditions

- Decentralized fleet
- Fleet inventory available
- Noncomprehensive fuel consumption data
- Noncomprehensive maintenance data



### Methods

#### Communication with stakeholders

Stakeholders at both Halifax and Truro campuses were contacted either in focus groups, or via a survey. This was done with the intention to understand personalized needs within the fleet, to better incorporate demands within the tools.

#### Fleet Demand Tool

MILP used to determine fleet composition using the following variables.

Variable	Definition
$x_{\{i,j\}}$	Vehicles in year $i$ of vehicle class $j$
$E_{\{i,j\}}$	Estimated missions in year $i$ from vehicle class $j$
$D_{\{i,j\}}$	Demand in year $i$ for vehicle class $j$
$G_{\{i\}}$	Emission goal for year $i$

OF: Minimize

$$(1) \sum_{i=1}^i \sum_{j=1}^j x_{i,j} E_{i,j}$$

ST:

$$(2) x_{i,j} \in i$$

$$(3) \sum_{i=1}^i \sum_{j=1}^j x_{i,j} \geq D_{i,j}$$

$$(4) \sum_{i=1}^i \sum_{j=1}^j x_{i,j} \geq D_{i,j} - D_{i-1,j-1}$$

$$(5) \sum_{i=1}^j x_{i,j} E_{i,j} \leq G_i$$

#### LCC Tool

Costs relevant to ownership of a vehicle over a 10-year span were collected, and a comprehensive system was created to estimate ownership costs of various vehicle models, and the optimal time to salvage after extended use.

#### Vehicle Input Form

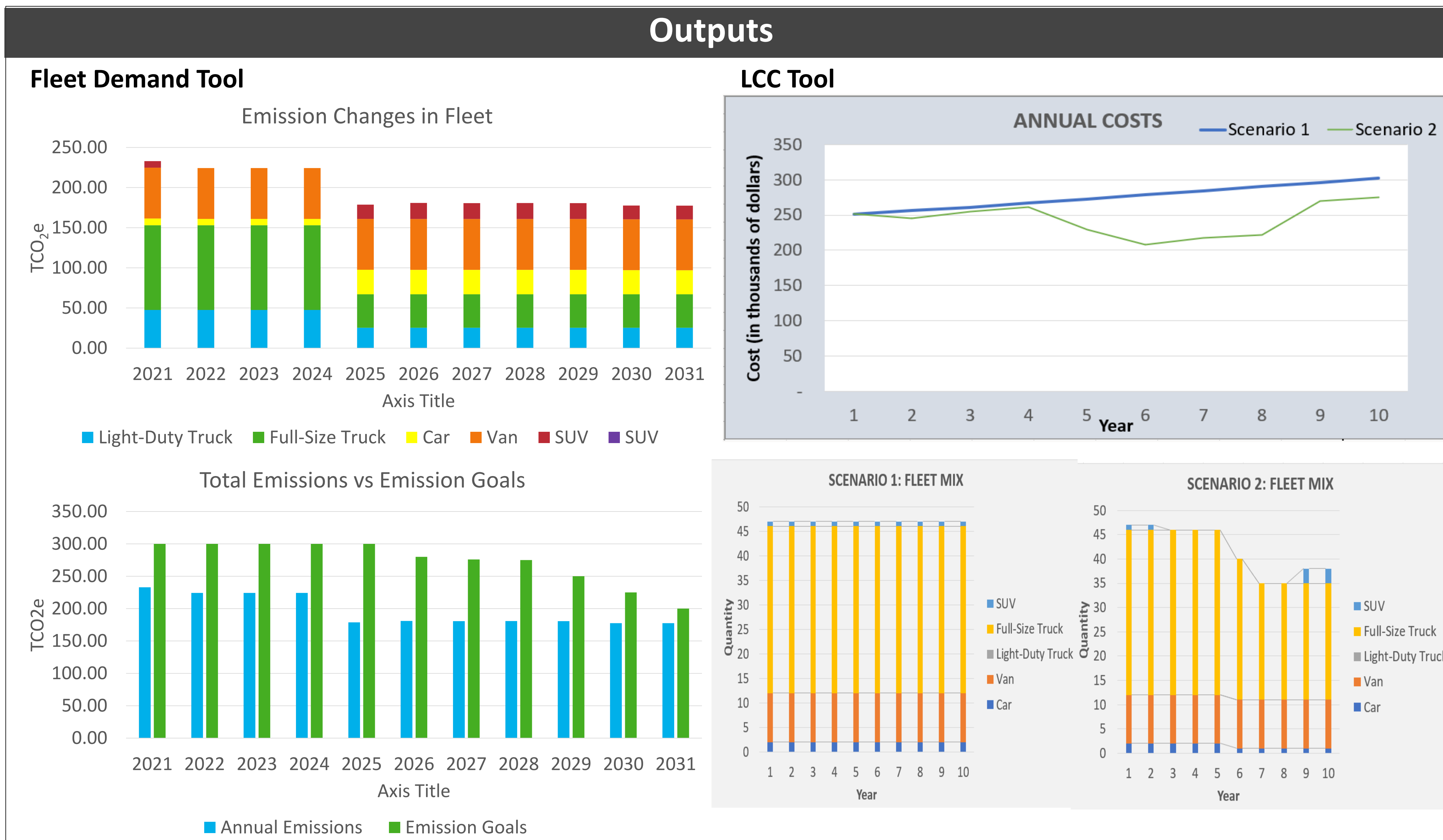
Vehicle Class:  Annual Mileage:  Fuel Type:  Vehicle Year:

Retire Vehicle in future

Retirement Information: Retire in Year:

Scenario Selector:  Scenario 1  Scenario 2

Buttons: Clear, Back, Enter Vehicle



### Implementation

The Dalhousie Office of Sustainability will be provided with the following

- User manuals for both the Fleet Demand Tool and the LCC Tool
- Recommendations for fleet organization
- Recommendations for data collection
- Recommendations for vehicle operation
- Copies of all data collected

### Design Outcomes

- Clearly defined outliers for vehicle use
- Fleet demand tool provides an environment to explore different fleet compositions
- LCC tool provides economic details to vehicle ownership, helping Dalhousie departments prepare for greener vehicle ownership
- Ability for fleet management or fleet alteration to be estimated in both annual emissions of new vehicles, and the costs of changes.