



Ecostation fleet assessment tool

User Guide and system overview

Prepared for

EPA VICTORIA AND THE VICTORIAN TRANSPORT ASSOCIATION

Prepared by

RARE CONSULTING PTY LIMITED

ABN 50 115 960 837

Level 50
120 Collins Street
Melbourne VIC 3000

T 03 9225 5470

F 03 9225 5050

JUNE 2010

About Ecostation

Ecostation is a joint initiative of the Victorian Environmental Protection Authority (EPA) and the Victorian Transport Association (VTA) designed to reduce greenhouse emissions and air pollution from the road freight sector. The initiative is currently being conducted as a pilot with a view to developing a nation-wide programme along similar lines to the USEPA SmartWay Transport Initiative and the UK Freight Best Practice Programme.

Under the pilot programme, the EPA and VTA are working with 26 industry stakeholders to develop processes and tools that will assist the wider road transport community in reducing GHG emissions and air pollution in the future. One of these tools is a simple model that allows heavy vehicle fleet operators to (a) assess the fuel efficiency of their fleet and (b) quantify the annual GHG emissions and air pollution generated by their fleet.

This paper provides a guide to the operation of the Ecostation fleet assessment tool.

1. Objectives and system overview

The majority of Australian commercial vehicle operators are aware of the increasing need to manage their fleets in such a way as to reduce fuel consumption and reduce emissions. The successful management of this challenge essentially requires the adoption of a five step improvement process as shown in Figure 1.

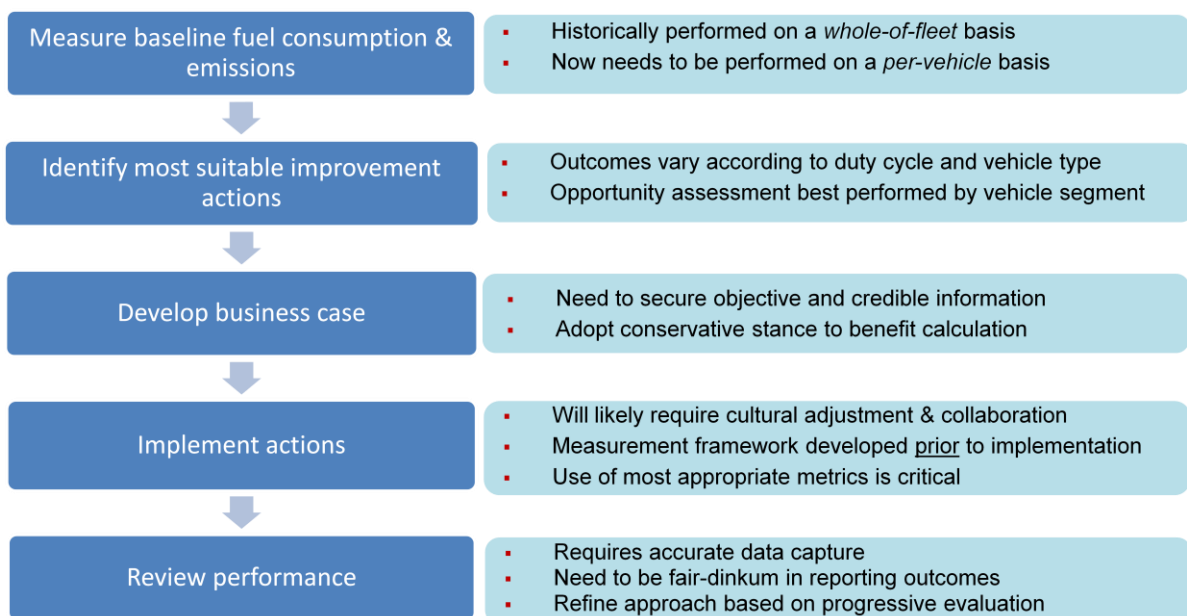


Figure 1: A five step process for progressive management of the fuel consumption and emissions performance of a commercial vehicle fleet.

The *EcoStation Fleet Assessment Tool* has been developed to assist commercial fleet managers to assembled fleet improvement strategies by providing them with:

- A tool for calculating the baseline fuel consumption and emissions (Greenhouse and air pollution) generated by the annual operation of their heavy vehicle fleet,
- Guidance in respect of the relative performance of the suitability of different improvement actions for their specific fleet.

The EcoStation Fleet Assessment tool has been designed with two discrete elements (or modules) that are designed to support the achievement of each of the objectives listed above, as shown in Figure 2.

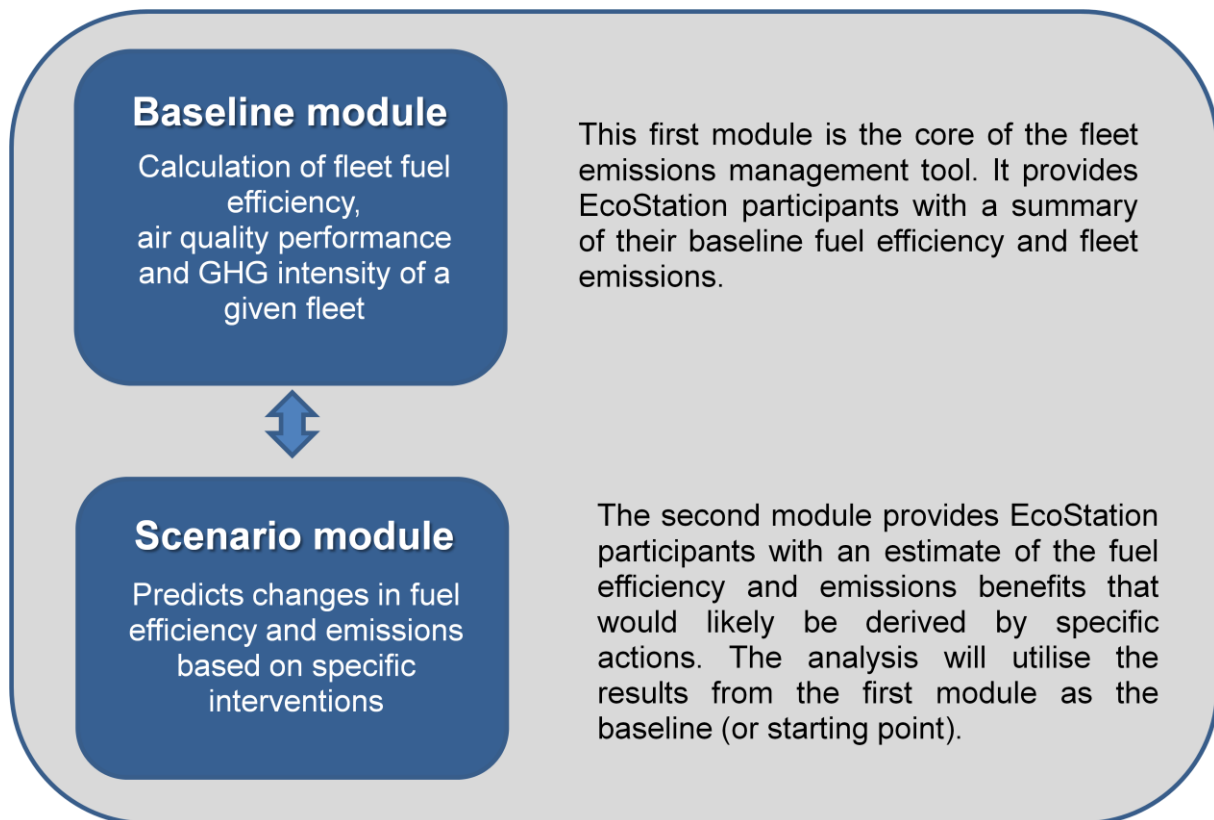


Figure 2: The EcoStation Fleet Assessment Tool comprises two discrete modules designed to help commercial fleet managers develop a fleet improvement plan.

1.1 Baseline module

This first module calculates the annual fuel consumption and emission production of a heavy vehicle fleet. Given the diversity of many heavy vehicle fleets (and the consequent differences in fuel consumption for different types of vehicles), the model calculates for consumption and emissions for a range of different vehicle categories (or fleet segments).

The key characteristics of the EcoStation Fleet Assessment Tool can be summarised as follows:

- Required MS Excel (Excel 97 – 2003 version or higher)
- Caters for heavy vehicle fleets comprising up to 4000 vehicles
- Allows calculation of fuel consumption based on either fuel used per kilometre travelled or fuel used per engine operating hour

- Allows input of data for eight different categories of commercial vehicles including:
 - Utilities
 - Vans
 - Rigid trucks (large and small)
 - Semi trailers
 - B-Doubles
 - Road trains
 - Busses and coaches
 - Miscellaneous commercial vehicles
- Accommodates a range of different vehicle fuels including (a) diesel, (b) petrol, (c) B20 biodiesel, (d) liquefied petroleum gas, (e) compressed natural gas, and (f) liquefied natural gas.
- Calculates fuel consumption rates and assesses emission performance for a total of 20 different vehicle segments, thereby helping fleet operators to better understand the contribution of different vehicle segments to total fleet fuel consumption and emission production.
- Utilises National Greenhouse Account Factors (2009 NGA Accounts) to derived GHG emissions for different vehicle segments
- Derives annual air pollution performance using the minimum tail-pipe standards specified in national vehicle emission standards.

A summary of the operation of this first element of the Baseline module is presented in Figure 3.

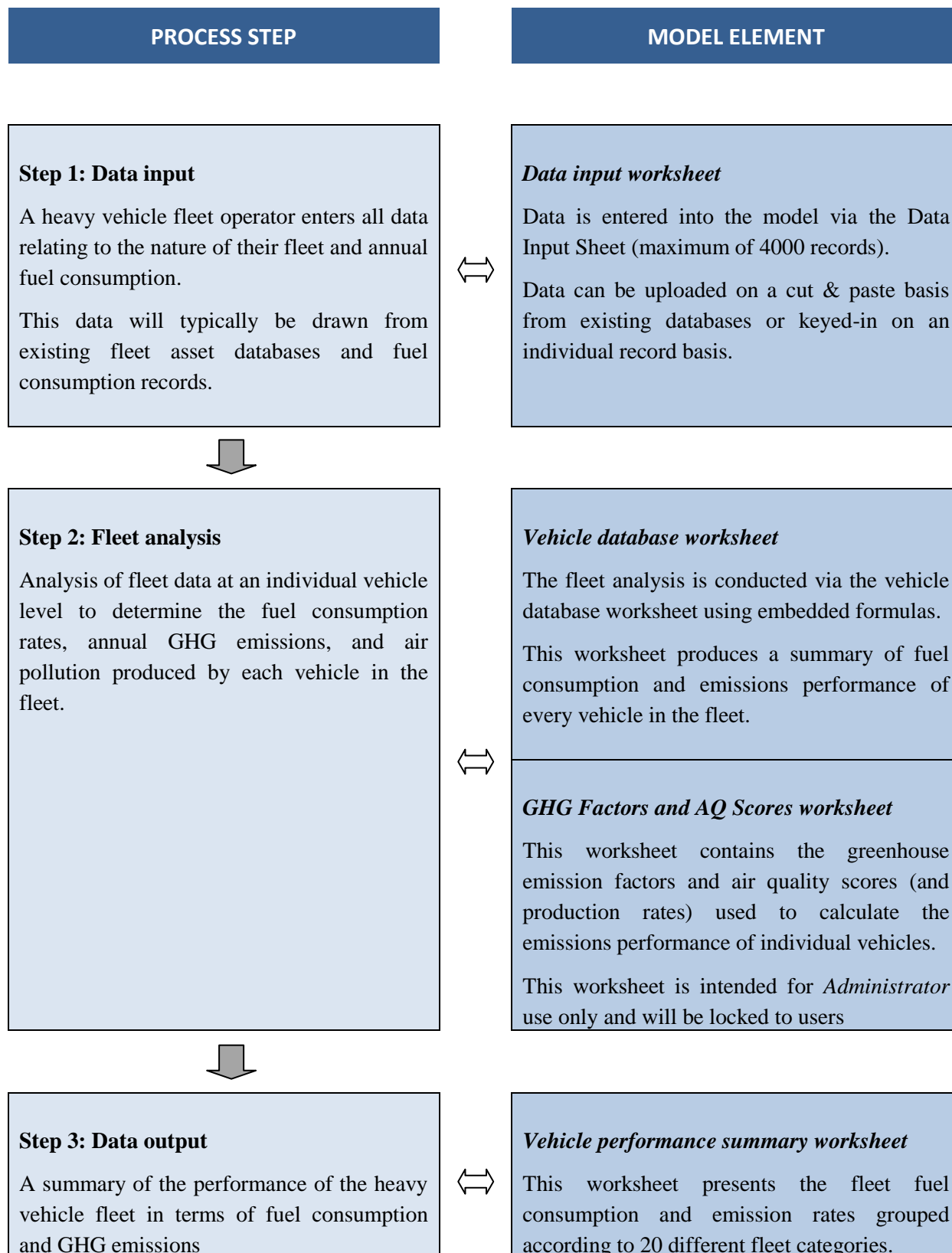
1.2 Scenario module

The Scenario module is designed to assist fleet operators assess the relative merits of a range of different fleet improvement actions according to four principle improvement strategies (See Figure 4).

Given that the fuel efficiency and emission benefits of the above strategies vary according to the type of vehicle and the specific use of the vehicle, the tool allows the fleet manager to assess the benefits by vehicle the same 20 categories used in the Baseline module.

Estimated benefits are calculated using emission reduction factors derived from an extensive assessment of past industry experience with fleet improvement actions

Table 1: How the assessment tool works (Microsoft Excel)



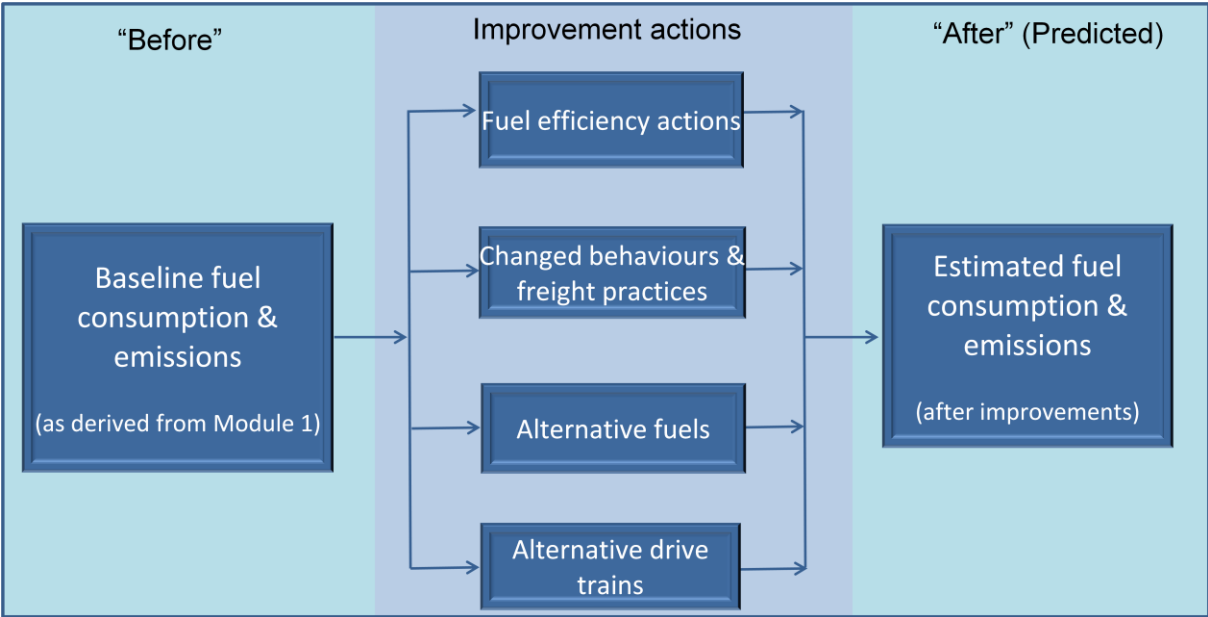


Figure 4: Summary of data inputs required from the fleet operator

Part A: Baseline module

Provides the user with a summary of baseline fuel consumption and emissions

2 Data input worksheet (user input)

The **Data Input Sheet** has been developed to capture all of the fleet data required to estimate the fuel vehicle fuel efficiency and related emissions of a given fleet. The work sheet has been developed at a relatively straightforward level with a view to capturing data from an organisation’s existing fuel records and fleet asset inventory database.

Fleet data is required at an individual vehicle level and a summary of the specific data input requirements is provided in Table 1.

Table 1: Summary of data inputs required from the fleet operator

Data descriptor	Format	Nature of data
Vehicle Identifier	<i>Number or number and text format</i>	Requirement for entry of a unique identifier for each vehicle that comprises the fleet. This data would typically be the vehicle registration plate or a fleet number generated by the organisation for asset management purposes
Vehicle type	<i>Drop-down menu</i>	A description of the physical configuration of the vehicle (8 categories)
Vehicle application	<i>Drop-down menu</i>	A description of the task performed by the vehicle (e.g. interstate linehaul, concrete agitator, waste collection etc)
Vehicle operating weight	<i>Numerical</i>	The typical operating weight (GCM) of the vehicle
Fuel type	<i>Drop-down menu</i>	The type of fuel used in the vehicle. Provision has been made for six different fuels (conventional, biofuels and gaseous fuels)
Year of manufacturer	<i>Numerical</i>	The year of manufacture as noted on the compliance plate (i.e. note first registration date)
Emission standard	<i>Drop-down menu</i>	Nomination of the federal emission standard that applies to the vehicle (based on date of manufacture)
Vehicle kilometres	<i>Whole number</i>	Annual vehicle kilometres travelled for haul vehicles
Vehicle hours	<i>Whole number</i>	Annual engine hours for vehicles that are better measured in terms of hours of operation
Annual fuel use	<i>Whole number</i>	Total number of litres of fuel used in year

The **Data Input Sheet** has been designed to allow the fleet operator to upload fleet information in multiple-record or single record format.

A series of data entry rules have been developed to minimise the entry of erroneous data (a summary of these checks is provided in rows 4021 to 4056 of the worksheet). A data entry operator can choose to over-ride an error message if appropriate.

The worksheet accommodates up to 4000 records but can be expanded to accommodate larger vehicle fleets if required.

3. Vehicle Database worksheet

This worksheet is a fully automated worksheet that derives fuel consumption, annual GHG emissions, and annual air pollution production figures for each vehicle entered into the database. The worksheet accommodates fleets comprising up to 4000 vehicles.

This worksheet does not require any input from EcoStation participants and is not intended as a visible output of the Fleet Assessment Tool. That said, the output could potentially be used by EcoStation participants as a basis for detailed fleet planning if required.

Essentially, this worksheet contains all of the formulas used to produce the model outputs. In order to accommodate a range of different fuels, all fuels are converted to diesel litre equivalent (DLE) using energy intensity factors published in the *National Greenhouse Accounts (June 2009)*

The lower part of the worksheet (Row 4015 and below) contain the database criteria that is being used to aggregate the data by fleet segment for reporting purposes in the Fleet Performance Summary worksheet. These criteria can be amended by the Administrator to include additional fleet segments or revise existing segments.

4. GHG factors and AQ scores

This worksheet is for administrator use only and contains all of the factors used to derive the GHG emission and air pollution production rates used to produce the *fleet performance summary* worksheet.

The GHG emission factors have been drawn from the 2009 National Greenhouse Account Factors and will need to be amended if changes to these factors are made by the Commonwealth Department of Climate Change in the future.

The Air quality production factors have been derived by converting the emissions production limits (in grams/kwh) prescribed in national vehicle emission standards and converting these limits to grams/litre rates for use in the model. This approach allows the derivation of emission production rates for different classes of vehicles.

5. The fleet performance summary (user output)

This worksheet delivers the principal output of the model and is intended to provide EcoStation participants with a workable summary of the fuel efficiency and emissions performance of their fleet. Individual vehicle data is grouped according to 20 vehicle segments for reporting purposes.

The segmentation approach used in this worksheet has been developed to accommodate two objectives, namely to provide fleet operators with:

- a) a summary of fuel consumption and emissions that can be used to plan improvement actions. The majority of fleet improvement actions apply to specific vehicle segments only and cannot be applied on a whole-of-vehicle fleet basis. Consequently, fleets need assessment data that is broken down in such a way as to assess the suitability of specific improvement actions given the structure of their specific fleet.
- b) a measure that is sufficiently sensitive for assessment of the benefits derived by implementation of individual actions. Past industry experience indicates that fleet operators have tended to assess the fuel efficiency benefits of specific action by comparing pre and post intervention fuel consumption at a whole of fleet level. This approach tends to deliver mixed results and can be distorted by growth in fuel consumption for vehicles that are not directly subject to the improvement intervention. Consequently there is a need to develop fuel consumption and emission baselines at a fleet segment level in order to quantify the real-world economic and environmental benefits of specific interventions in the future.

An example of the output of the fleet assessment tool is presented in Table 2.

Fleet fuel efficiency and GHG emissions are presented on a diesel litre equivalent (DLE) basis using the energy intensity and GHG intensity figures published in the *National Greenhouse Accounts Factors Workbook (June 2009)*. This approach allows easy comparison of the performance of alternative fuel vehicles with conventional diesel vehicles.

Fleet Air quality performance is reported as a score out of five – the higher the score, the better the air quality performance. An Air Quality Score (AQS) is assigned for fleet segment.

The worksheet has been structured to produce a short report that can be appended to an internal memorandum for management or provided to the EcoStation administration team in the future as part of annual reporting requirements.

Table 2: Example output produced by Fleet Performance Summary worksheet

Fleet structure		Average fuel consumption (Diesel litre equivalency)		Air quality score	GHG performance		GHG production	
Fleet category	No of vehicles	Litres/100km	Litres/hour	AQS	GHG (tonnes)	GHG (category %)	kg/km	kg/hour
Utility	0							
Van	0							
Rigid truck								
Local pick-up and delivery	8	34.5		3.00	280	1%	0.931	
Urban haul	0							
Regional line-haul	10	43.8		3.10	1973	10%	1.182	
Interstate line-haul	0							
Commercial waste	12	0.0	73.3	3.00	3940	19%		197.6
Residential waste	0							
Urban tipper	0							
Council/utility vehicle	0							
Semi Trailer								
Local pick-up and delivery	0							
Urban haul	0							
Regional line-haul	4	50.7		3.50	1074	5%	1.368	
Interstate line-haul	1	47.4		4.00	181	1%	1.279	
B-Double								
Urban haul	0							
Regional line-haul	20	49.8		3.90	5602	27%	1.342	
Interstate line-haul	21	55.7		3.62	5534	27%	1.504	
Road train	0							
Bus/Coach	8	46.7		3.25	2187	11%	1.260	
Other vehicles	0							
Total fleet	84				20771	100%		

Part B: Scenario module

An interactive module that allows the user to assess the likely fuel consumption and emissions benefits of different fleet improvement actions

6. Scenario module (Interactive tool)

The scenario module is a single worksheet that allows a fleet manager to assess the benefit that would likely be adopted from the adoption of approximately 22 actions under four umbrella improvement strategies (see figure 5).

<p style="text-align: center;">Fuel efficiency improvement actions</p> <ul style="list-style-type: none"> ▪ Auxiliary power systems ▪ Variable displacement systems ▪ Ancillary equipment ▪ Automated manual transmissions ▪ Low rolling resistance tyres ▪ Improved aerodynamics ▪ Lightweight trailer design 	<p style="text-align: center;">Behavioural change & freight practice actions</p> <ul style="list-style-type: none"> ▪ Eco Driving ▪ Idle reduction ▪ Load consolidation ▪ Night-time freight movements ▪ Preventative maintenance programmes
<p style="text-align: center;">Alternative fuels</p> <ul style="list-style-type: none"> ▪ Ethanol (E10) ▪ Ethanol (E85) ▪ Biodiesel (B20) ▪ CNG (Dedicated, spark ignition) ▪ LNG (Dedicated, spark ignition) ▪ LNG (Dual fuel, compression ignition) ▪ LNG (HPDI, compression ignition) 	<p style="text-align: center;">Alternative drive trains</p> <ul style="list-style-type: none"> ▪ Hybrid (Electrical) ▪ Hybrid (Mechanical)

Figure 5: Scenario tool supports the consideration of 22 fleet improvement actions in four areas

This worksheet requires that users nominate the proportion of the fleet that they plan to subject to a specific improvement action (assigned per fleet segment). It is important that only one action is nominated per fleet segment (i.e. columns) as stated in the instructions provided in the worksheet.

Once a percentage application to the fleet is nominated (entered as a whole number from 1 to 100), the fleet model will automatically calculate the percentage net benefit in terms of fuel efficiency improvement (and associated GHG emissions improvement). As with the baseline analysis, all percentage improvements are quoted in terms of diesel litre equivalence (DLE).

The interactive part of the worksheet is contained in rows 5 to 80 of the worksheet. The user can enter a variety of different scenarios for each fleet segment.

The emission factors used to support this analysis were derived from an extensive review of past industry experience of fleet improvement actions (and reasoned extrapolation). These factors can be changed by the Administrator of the fleet model and are listed in rows 100 to 140.

Part C: Miscellaneous information

Some concluding remarks on model limitations and further information about EcoStation.

7. Confidentiality of data and limitations of analysis

7.1 Data confidentiality

The EcoStation fleet assessment tool has been developed as a tool to be used by EcoStation participants. It is envisaged that the tool will be made available to EcoStation participants (upon sign-up to the initiative) via either a CD or via download from the EcoStation web-site.

It is important to note that the tool has been designed as a resource that can be used within an organisation. As a consequence, all data entered into the model will be solely held by the fleet operator and will not be retained by the Victorian Government or the Victorian Transport Association.

Participants will be required, however, to submit the completed Fleet Performance Summary worksheet as part of the annual reporting process required under the EcoStation initiative. This material will be used solely for the purposes of assessing performance of EcoStation participants.

7.2 Limitations of analysis

The accuracy of the EcoStation Fleet Assessment tool is limited solely by the quality of data provided via the *Data Input Worksheet*. Given that the majority of Australian heavy vehicle operators currently analyse fleet fuel consumption on a whole-of-fleet basis, it is likely that the accuracy of the initial analyses will be partially constrained by gaps in fuel consumption at an individual vehicle level. Over time, however, this issue is expected to be resolved by improved data collection systems enabled by the tool.

It should be noted that the Air Quality Performance outcomes identified in the worksheet are derived via the application of the maximum tailpipe emission limits specified under vehicle emission standards (i.e. ADR 70/00 to ADR 80/03). Whilst this information is useful for the purposes of baseline comparison required for the EcoStation initiative, it is a derived indicator that assumes:

- a) The vehicle is well maintained and the emissions control system is operating in accordance with manufacturer specifications
- b) The emission system fitted to the vehicle is operating at the threshold level (in reality, some vehicles will deliver an emissions performance that is below the required maximum limits but there is no meaningful way of accommodating this variation without subjecting the entire fleet to vehicle emission tests)

8 Further information

These explanatory notes have been prepared to guide Ecostation participants in the effective use of the EcoStation Fleet Assessment tool. The tool has been constructed using MS Excel and therefore does not require any skills other than a working knowledge of this software.

Further information about the model can be obtained by contacting Ms Kim LeCerf (Innovation Catalyst, Victorian EPA) or Ms Kate McCready (Project Support Officer, Victorian EPA).

Ms Kim LeCerf
Innovation Catalyst
Service Growth Unit
EPA Victoria
Level 3,
200 Victoria Street
Carlton Victoria 3052

(03) 9695 2647
Email: kim.lecerf@epa.vic.gov.au

Ms Kate McCready
Project Support Officer
Service Growth Unit
EPA Victoria
Level 3,
200 Victoria Street
Carlton Victoria 3052

(03) 9695 2597
Email: kate.mccreadyf@epa.vic.gov.au