TIC
TRUCK INDUSTRY COUNCIL
SAFER GREENER ESSENTIAL

THE AGEING OF THE AUSTRALIAN TRUCK FLEET: IMPLICATIONS AND OPPORTUNITIES

A NATIONAL TRUCK PLAN FOR AUSTRALIA

2013–2022

V4.0: Updated 30 July, 2013

TIC National Truck Plan 2013-2022.

Changes made for Version 4:

1. The actual Road User Charge increment for 1 July 2013 of 0.64 cents/L of diesel has been factored into the proposed incentive plan calculations. Annual increments after 2013 are now assumed to be 0.85 cents/L. TIC acknowledges that the 1 Jul 2014 increment could be much larger than this amount, due to the NTC's desire to provide a structural change away from excessive registration charges for trailers and combinations towards fuel-based charging, however the review is still in progress at time of writing, with no firm indication of the quantum of the amount.
2. Average distances travelled are now adjusted according to the latest ABS 9208.0 Survey of Motor Vehicle Use, covering the 12 months ended 30 June 2012, issued 23 April 2013. Previous Truck Plan versions used earlier issues of the Survey of Motor Vehicle Use.
3. Average fuel consumption calculations are now adjusted according to the same 2012 ABS Survey of Motor Vehicle Use issued 23 April 2013.
4. The actual T-Mark sales results have been inserted up to and including December 2012, using TIC T-Mark truck market data. Forecast data has been used for 2013 and beyond, and by end July 2013, the forecasts are accurate to within a few units.
5. All truck fleet population projections post-January 2012 use the ABS 9309.0 Motor Vehicle Census as at 31 January 2013, issued 23 July 2013.
6. The Proposed Incentive Program has been revised to be "revenue neutral" (actually positive by around $40million) over the five year duration of the program. This reflects the current status of the federal government budget deficit, and recognises that any combination of initiatives which is not self-funding (or involve offsets from other programs) is not likely to be considered.
7. The Proposed Incentive program WITH Carbon Tax component has been removed, given that the current government (as at July 2013) has elected to revert to an emissions trading scheme type program from 1 July 2014, with a projected CO_2 price of circa A$6.50 per tonne at this date, in lieu of the previous fixed price of circa A$25 per tonne.
8. The narrative has been updated to reflect facts and government policies as they are at July 2013.

Changes made for Version 3:

1. The 10-year period of coverage has been moved forward by two years.
   Now: 2013-2022, compared with previous versions 2011-2020.
2. The timeframe for a proposed incentive scheme was moved forward by 2 years, in recognition of federal budgetary pressures. That is, the new proposed incentive scheme would now have a start date of 1 July 2014, running for 5 years until 30 June 2019.
3. The actual Road User Charge increment for 1 July 2012 of 2.4 cents/L of diesel has been factored into the proposed incentive plan calculations. Annual increments after 2012 are assumed to now be 0.9 cents/L, up from the 0.7 cents/L used in previous versions.
4. Average distances travelled are now adjusted according to the latest ABS 9208.0 Survey of Motor Vehicle Use, covering the 12 months ended 31 October 2010, issued 23 August 2011. Previous versions used the 2007 Survey of Motor Vehicle Use.
5. Average fuel consumption calculations are now adjusted according to the same ABS Survey of Motor Vehicle Use issued 23 August 2011.

6. The actual T-Mark sales results have been inserted for 2010 and 2011, using TIC T-Mark truck market data for those years, with a realistic forecast for the 2012 tally, based on T-Mark data to end of August 2012.
7. All truck population projections post-2012 are based on the ABS 9309.0 Motor Vehicle Census as at 31 January 2012, issued 22 August 2012. Previous versions used the 2010 Motor Vehicle census.
8. A revised average scrappage rate for the past few years has been calculated, based on the new data above.
9. All health cost savings and proposed incentive program cost savings have been recalculated from 2014 based on the revised input data described above.
10. The narrative has been updated to reflect facts as they are at September 2012.

Contents

List of figures

List of tables

Executive summary

The Truck Industry Council (TIC) is an independent association representing twelve member companies that sell and support sixteen brands of heavy vehicle to the Australian market. Member companies include three Australian truck manufacturers (some of whom also import some models), six truck importers/distributors, as well as three major component suppliers; direct employment is approximately 17,500 jobs. TIC's key message – 'Today's Trucks: Safer, Greener, Essential' – is promoted through various means to governments and the freight industry at all levels.

This document was first produced in September 2011, setting out a plan for the decade covering 2011 to 2020, and is updated at least once yearly to reflect changes in economic conditions, factors affecting the proposals in the plan, and government policy. The third version was completed in August 2012, with a comprehensive recalculation of proposed incentives, and a shift to recognise the 10-year period 2013–2022. This fourth version considers the latest changes to carbon tax policy, road user charges, and the present fiscal state of the commonwealth. Accordingly, the primary adjustment in version four is to the proposed incentive program, which is now "revenue neutral" – in fact, slightly positive across the proposed five-year duration. TIC recognises that new funding proposals will not be considered unless there is an equivalent offset from within the same industry sector.

TIC has identified that today's truck manufacturers face numerous challenges, while simultaneously growing to meet the needs of a national freight task expanding at an average rate of 2.7%. The progress of new truck technologies over the past seventeen (17) years to tackle the environmental agenda from an air quality and health perspective is quite rapid and remarkable, such that trucks sold before 1996 were not required to meet any noxious emissions levels, yet today's new heavy vehicles must meet ADR 80/03, which requires compliance to the very latest Euro 5 or equivalent US and Japanese standards. The difference is such that a pre-1996 truck emits around sixty (60) times the particulate matter (or soot) and eight (8) times the nitrogen oxides of a new truck. These tougher standards are being achieved, at significant cost to industry, which is experiencing a downturn in sales that are currently at a level around 20% lower than the peak period before the 2008–2009 global financial crisis. Simultaneously, the national attention has turned towards issues such as the mitigation of carbon dioxide emissions, energy security, excise variations for diesel and alternative fuels, and global economic instability.

TIC has studied Motor Vehicle Census data and freight forecasts from the ABS and BITRE, and concluded that the Australian truck fleet is currently older than is necessary to effectively achieve the objectives of governments and public expectations. A 2012 truck average age of 13.85 years places Australia significantly behind most other developed countries in Western Europe, North America and Japan, which have an average truck age of between 6 and 9 years. Census data shows that almost two in every five (or 209,617 units at 31 Jan 2012) of the current truck fleet was manufactured before 1996, indicating these trucks are clearly a major contributor to the high average age of the national fleet. Since these trucks do not employ today's modern safety and environmental technologies, TIC argues that these pre-1996 trucks, especially those used in urban areas, are costing the community dearly. This document analyses historical annual scrappage rate, and a breakdown of urban versus rural usage rates. The conclusion made is that the primary focus of TIC's policy initiatives are aimed at modernising the Australian truck fleet.

The third part of this plan provides two forecast scenarios: the first is a business as usual (BAU) or 'do nothing' situation, while the second is a 'targeted' scenario, where an effective incentive program is developed to encourage earlier model truck users to voluntarily update their vehicles, while simultaneously reducing the high capital cost of purchasing new, clean, safe trucks. The scrappage rates are accelerated under the targeted scenario, resulting in modernised fleet by 2022 compared with the BAU scenario. The benefits (in 2012 dollars) of funding this modernisation of the truck fleet are identified through the avoided health costs associated with noxious emissions ($1,882 Million Median), cost savings to the community through avoided fatalities due to safer and more productive trucks ($157 Million Median), a conservative estimate of reduced carbon dioxide emissions ($53.7 Million), and direct operator cost savings ($2,815 Million Median).

An example of an 'effective incentive package' that could achieve the improvement to the fleet under the targeted scenario is provided, along with a number of further policy options for government and industry to consider. The incentive package combines a five-year investment allowance for new truck purchases with a stepped fuel tax credit, based on emissions level. The savings made from the fuel tax credit reduction given to operators of older, less environmentally friendly trucks pay for the investment allowances. This program is only applicable **without** a carbon tax / emission trading scheme component being applied from 1 Jul 14. Instead, the proposed incentive program would effectively take the place of a carbon component of the road user charge for heavy vehicles, becoming part of government's direct action policy.

The total benefits of adopting such an effective incentive program with a net estimated gain (of $47 million) to the commonwealth budget over five years has been calculated (at a Median level) as $4,908 Million to 2022, with ongoing benefits well beyond this timing, even though the example incentive program is recommended to end by 2019 after five years.

1 Introduction

The Truck Industry Council (TIC) is an independent, not-for-profit organisation representing the united views of truck manufacturers, truck importers, diesel engine companies and major component suppliers to the Federal Government, state and territory governments, local government, industry and business associations and the general public.

Membership of TIC is inclusive of all truck manufacturers and importers/distributors in Australia and currently consists of:

- 9 truck manufacturers and distributors representing 16 truck brands
- 3 engine and component suppliers representing five brands.

A full list of TIC members as of 1 July 2013 can be found in Appendix A**.**

In 2013 the truck industry is designing, engineering, testing, developing and manufacturing trucks at three major locations in Australia. The companies involved, and their locations, are:

- **VOLVO GROUP AUSTRALIA**, manufacturing **Volvo** and **Mack** brand trucks at Wacol, Queensland;
- **PACCAR AUSTRALIA**, manufacturing **Kenworth** trucks at Bayswater, Victoria; and
- **IVECO TRUCKS AUSTRALIA**, manufacturing **IVECO** trucks at Dandenong, Victoria.

These three plants are needed in order to meet the specific requirements of Australian operators who work in conditions unique in the world and, in conjunction with truck importers, they ensure the efficient transportation of the nation's growing freight task. The plants produce over 50% of all heavy duty[1] trucks sold in Australia, and a majority of the specialist vehicles used in Australia's mining, resources and vocational industries. In addition, most of the road trains that service outback Australia are also designed and built in Australia.

The Australian truck market is a $4 billion industry with sales before the global financial crisis (GFC) of 38,131 units[2] for calendar year 2007. For calendar year 2012, sales were 30,745 units[3] and represented a 19% reduction in unit sales compared to 2007, having not yet recovered from the GFC. Ancillary activities are conservatively estimated to have an economic value of a further $8 billion.

[1] See Glossary for definition of 'heavy duty'.

[2] Source: TIC T-Mark truck market industry sales database for all freight vehicles above 3500 kg GVM, YTD December 2007.

[3] Source: TIC T-Mark truck market industry sales database for all freight vehicles above 3500 kg GVM, YTD December 2012

Truck manufacturers and distributors in Australia are major employers of skilled and semi-skilled people (technical, computing, electronic and information technology) with total employment of approximately 17,500 in disciplines such as:

- Manufacturing, testing and development, spare parts support, head office staff and branches: 2500
- Direct suppliers, company owned sales outlets and authorised dealers: 7400
- Trailer, tanker, tippers, truck body builders and secondary manufacturers 7600

Every new truck sold by TIC members in Australia today is inherently safer, greener and cleaner than previous models, due to TIC working with government to comply with the requirements of the latest emission standards (such as ADR 80/03 which was mandatory from 1 January 2011) and the advanced technologies now voluntarily being employed by manufacturers. These advanced technologies not only make the truck greener and cleaner but also safer. TIC's local truck manufacturers, as well as truck importers and diesel engine companies, are also well advanced in the development and manufacture of alternatively fuelled trucks, particularly liquefied natural gas (LNG) for heavy duty long distance transport, and compressed natural gas (CNG) and ethanol mainly for urban distribution work. Equally, manufacturers are producing hybrid trucks that are available today for the Australian market with the immediate benefit of reducing consumption rates of diesel and alternative fuels. All new trucks sold today have significantly reduced noise levels due to compliance with the latest regulations.

1.1 Vision

The vision of the Truck Industry Council is described through its positioning statement:

Today's Trucks: Safer, Greener, Essential

The trucks sold in the Australian market today are safer and greener because of the advanced technologies being employed by manufacturers to make sharing the road safer for all road users and more environmentally friendly for all people. The majority of the general public appreciates and understands the essential need for trucks on Australian roads, the role trucks play in the economy and in the individual's day-to-day living[4].

1.2 Mission

The Mission of the Truck Industry Council is to promote the community benefits of modern truck technologies, while achieving the goals of continued growth, positive image and profitability of a successful truck and major components industry in Australia.

[4] Independent research commissioned by Truck Industry Council, 2008

The principal beneficiary of TIC activities is the general public, due to the fact that for every new truck sold into the Australian market, that truck is safer and greener than previous models, making the roads safer for all and the environment in which we live greener and cleaner.

This is achieved through co-operation with governments and industry groups, by reinforcing the positive aspects of modern trucks. TIC assists governments to develop policy and programs that will offer the best possible solutions to achieve economic growth, truck productivity and enhanced safety outcomes, while simultaneously reducing the environmental impact of road-based freight transportation.

2 The present

2.1 Industry challenges

Several challenges are imposed upon the industry by the public's and government's desires for the optimum Australian truck fleet, that will be required to meet the growing road freight task, while simultaneously improving safety and significantly reducing both harmful pollution and greenhouse gas emissions. These challenges are outlined below.

2.1.1 Government policy

Throughout its term, the current Federal Government has released or is developing a number of projections, discussion papers and policy initiatives that highlight the importance of ensuring that the composition of the nation's truck fleet is consistent with the freight task to be managed and within the capability of truck manufacturers to supply the market.

- **FORECAST FREIGHT TASK.** TIC supports the most efficient transport system possible. Road freight is expected to shoulder the majority of the increased freight task burden for the period covered by this National Truck Plan (the Plan), primarily due to consumers driving their need for timely delivery of goods and inadequate rail infrastructure. BITRE, in its report *'Road freight estimates and forecasts in Australia: Interstate, capital cities and rest of state' (Report 121),* provides a projection for the Australian freight task to 2030 and states that the total road freight task will grow by 80% between 2008 and 2030. It also states that interstate road freight will grow by 130% over the same period, and the urban road freight task by 70%. This represents substantial growth in line with projected GDP growth over the same period of about 2.7% per annum, and outstrips Australia's projected population growth.

  Such predictions indicate the need for a modern truck fleet capable of carrying the nation's freight task in an efficient and effective way.

- **PRODUCTIVITY IMPROVEMENTS.** Australia's future truck fleet will require increased productivity – a difficult undertaking given the huge increases in productivity achieved over the last twenty to thirty years. This subject is the focus of a recently released BITRE report entitled *'Truck productivity: Sources, trends and future prospects (Report 123)*. The report concludes with a very modest forecast rise in average load per articulated vehicle. This forecast is made despite the current national initiatives in play, such as the possible introduction of B-triples between major cities, and more widespread use of performance based standards in heavy vehicles.

  TIC believes that for truck productivity to be improved for the benefit of the industry and the community at large the vehicles that are the subject of such enhancements need to be late model (ADR 80/02 or 80/03) vehicles with their advanced safety and environmental technologies assisting all stakeholders to achieve their particular objectives.

Performance Based Standards (PBS) for Heavy Vehicles

Until recent years, the mass, dimension and road access limits for heavy trucks were determined through prescriptive standards in national and/or state regulations. The National Transport Commission (NTC), in conjunction with the state jurisdictions, has developed a set of fourteen performance-based standards, which could allow longer, wider or heavier vehicles and combinations (than would otherwise be permitted under the prescriptive standards) to operate on specified routes. This allows innovation to drive productivity and safety improvements, as long as the operator can show through simulation and testing that the new vehicle(s) comply with the requirements of the performance based standards.

In the six years to 2010, performance based standards have had limited success, appealing only to niche operations, mostly in remote areas. This is mainly due to the performance based standards approval process being over-complicated and costly; however, some recent changes to this approval process may lead to its widespread adoption. Further, some 'blueprint' performance based standards vehicles are being developed that could be adopted by many operators without requiring individual approvals.

In 2012, the NTC reports that more than 2,000 heavy vehicles are approved through the PBS process and operating across Australia. The establishment of a National Heavy Vehicle Regulator from 2013 is also expected to further streamline the performance based standards approval process. The intention of performance-based standards is to create significant incremental productivity improvements.

- **ENVIRONMENTAL AGENDA (AIR QUALITY AND HEALTH).** The Federal Government has actively pursued an agenda that sees the vehicles sold into the Australian market adopt the most stringent exhaust emissions standards available as soon as practicable. This agenda leads to improved air quality, particularly in congested urban areas, and can demonstrably lead to lower health costs within these same areas.

  For example, both Euro 4 and Euro 5 standards were adopted in Australian Design Rules for heavy vehicles within 2–3 years of their adoption in the European Union. At the time of writing this Plan, Euro 6 and equivalent standards are being considered for adoption in a new ADR, with the new ADR to become effective within the Plan's 10-year period. TIC will work in partnership with government to achieve an acceptable outcome, which may include changes to steer axle mass limits to compensate for the increased mass of the emissions reduction equipment.

- **MEETING LOW EMISSION STANDARDS (ADR 80/03 AND BEYOND): DIESEL ENGINE TECHNOLOGIES.** There are significant costs involved in meeting the extremely low emission standards of ADR 80/03, which became mandatory for all trucks built for sale in Australia from 1 January 2011. These costs, which also include the need to improve engine durability and fuel consumption, have varied from $5000 for a light-duty truck, up to $20,000 for a heavy-duty truck. It is further expected that ADR 80/04 will be introduced during the period covered by this Plan. The forthcoming ADR 80/04, which will likely require compliance to the Euro 6, US EPA 2010+ or Japan Post-NLT09 standards, is expected to become a mandatory requirement for all new trucks built from around 2017 to 2018. Costs to meet

ADR 80/04 are difficult to predict; however, early information suggests that the incremental costs will match or exceed those that applied to the ADR 80/03 introduction for 2011.

- **ALTERNATIVE FUEL–POWERED VEHICLE TECHNOLOGIES.** A significant problem is the additional cost involved in converting diesel engines to operate on gas, including the requirement for spark ignition and other alternative fuels such as ethanol. For light and medium duty trucks (suitable for urban areas) this differential with diesel-only trucks can be as much as $30,000 per vehicle. In addition, pressure vessels for CNG and vacuum-insulated fuel tanks for LNG are expensive. The incremental cost of a heavy duty truck for B-double operations between diesel and LNG power can cost as much as $150,000. This cost can be recovered over time, but also represents up to 30% of the initial purchase price of the vehicle, not including trailer costs. Similarly, the differential for hybrid trucks (light, medium and heavy duty) is considered to be up to an additional $30,000 per vehicle when compared to a diesel truck.
- **ENVIRONMENTAL AGENDA (CARBON DIOXIDE).** The Federal Government has clearly articulated its desire to pursue a policy that will see carbon dioxide equivalent emission levels reduced by 5% (compared to the year 2000 baseline) by the year 2020, increasing to 50% by 2050. The government's agenda to achieve these targets involves an economy-wide market mechanism. It is the view of TIC that such a mechanism needs to be supported by complementary actions such as industry specific remedies. This view is shared by the National Transport Commission[5].
- **CARBON TAX.** The pronouncement by the Federal Government in 2011 to introduce a carbon pricing mechanism aims to put a price on each tonne of carbon dioxide produced. The motivation for producers of carbon dioxide is to adopt practices that reduce the amount of carbon dioxide being released into the atmosphere. In July 2013, the federal government announced that the transition from a carbon tax with a fixed price to an emissions trading scheme would be adopted a year earlier than planned, now from 1 July 2014. While large carbon dioxide producers (such as large electric power generators) and their customers are affected by the Carbon Tax from 1 July 2012, the Labor government's policy to apply an additional Road User Charge (RUC) in the Fuel Tax Credit Scheme from 1 July 2014 has not yet been set into legislation. The projected price for a tonne of carbon dioxide emissions at 1 July 2014 is now expected to be in the region of A$6 (less than a quarter of the previous fixed price). The effect on the RUC would therefore be as little as 1.7c/Litre. By contrast, a change to a coalition government will lead to no increase in RUC from a carbon component. Regardless of election outcome, the objective of modernising the national truck fleet appears less likely without supporting complementary actions to encourage the uptake of newer technology vehicles. This version (V4.0) of the National Truck Plan does not consider a carbon dioxide related RUC increment on 1 Jul 14.
- **ENERGY SECURITY.** The Federal Government's Energy White Paper process has identified a number of key policy areas of importance to Australia's future energy security. The proposed Alternative Fuels Strategy will facilitate the development of Australia's alternative fuels capability in the long term and, as such, will potentially impact upon the nature and composition of the national truck fleet.
- **EXCISE ON ALTERNATIVE FUELS.** In light of the decision to phase in a fuel excise on alternative fuels, some otherwise progressive operators have been discouraged from adopting these fuels, even if the financial business case is positive. In Australia, alternative fuels such as natural gas (both in compressed and liquefied forms), ethanol and biodiesel offer excellent long-term viable propositions

[5] NTC discussion paper 'Freight transport in a carbon constrained economy', July 2008

for road transport. It has been a long-held view of the TIC that such an impost will have a detrimental effect on the uptake of new alternatively fuelled trucks at a time when such technology should be encouraged given its ability to reduce greenhouse gas and other noxious emissions.

2.1.2 Industry dynamics

- **GENERAL MARKET CONDITIONS.** Leading into the GFC, the Australian new truck sales market was strong, reflecting a robust economy and demand for new products. Post-GFC, manufacturers have had to contend with much weaker demand, due to uncertain economic times and low customer confidence. Since the GFC, a key element further affecting transport industry confidence levels is the difficulty in securing finance for new capital purchases.

  Against this backdrop and most recent data, the first half of 2013 result of 15,074 trucks sold is lower than the first half of 2008 by more than 17% (pre-GFC). Recent estimations by TIC suggests that the sales market may not return to pre-GFC sales figures until at least 2016 (without an incentive program in place), some eight years after the downturn in the second half of 2008.

- **LOW CUSTOMER UPTAKE OF NEW VEHICLES – FINANCE DIFFICULTIES.** Most lenders have more conservative lending criteria (compared to those that prevailed in 2007) that prevent some smaller fleets from making new vehicle purchases without secure long-term cartage contracts in place. Lower margins in the industry in the 2008–2012 period have also led to less internal funds being directed towards capital expenditure. These factors combine with the incremental cost of both clean diesel engines and alternatively fuelled engines being higher than ever before, due to the latest strict emissions standards and record levels of negative consumer sentiment, to produce an environment not conducive to the modernisation of the Australian fleet. The end result is that truck operators are not buying as many new trucks as they would wish to.

- **HIGHER REFURBISHMENT RATE.** Some large transport specialist fleets have a heavy truck replacement cycle of 3–4 years. However, these are the exception rather than the rule, with many small to medium sized fleets retaining new vehicles now for 10 years or more. As a result of general economic conditions, these fleets are keeping their trucks for longer, and choosing to refurbish vehicles rather than replace them with new trucks. In the past, it was common for the original owner of a heavy prime mover to sell at approximately one million kilometres of use, thereby avoiding the substantial cost of an engine rebuild at perhaps 1.2 million kilometres. In 2012, a greater number of fleets are choosing to keep their trucks and rebuild engines and transmissions. It is worth noting here that the rebuilt, remanufactured or replaced engine is typically a direct replacement for the original. It is rare, and often technically impossible, for fleet operators to specify a rebuilt engine that exceeds the original exhaust emissions standard required of the truck when first built.

- **LACK OF EXPERIENCED DRIVERS.** While truck sales are being hindered by economic and environmental conditions, the freight task continues to grow. Unfortunately, the pool of available drivers, particularly those willing to spend long periods away from home driving on long distance routes, is another limiting factor for many fleets. The average age of long distance truck drivers is rapidly approaching notional retirement age. The ‘two speed economy’ in Australia of recent years has seen younger members of the labour force being attracted to work in remote mining areas for substantial wages that transport operators cannot compete with. Therefore, Australia suffers from a lack of supply of qualified professional truck drivers.

- **LIMITED INVESTMENT AND PRODUCTION BY OEMs.** Given the current price differential between alternatively fuelled and powered trucks when compared to diesel, customer demand is reduced. This leads to Australian truck manufacturers and distributors declining to invest in these emerging technologies due to lack of demand. This cycle will continue unless an incentive is introduced to the market for a defined period, to build critical mass of alternative powertrains.

2.2 Key proposition: Today's technologies to modernise the Australian truck fleet

Today's new trucks, built to meet stringent safety and exhaust emissions standards, are not representing a significant enough proportion of the total truck population to provide the desired change in air quality in our cities that the community seeks, that Federal Government policy strives for, and that the tough emissions regulations were designed to achieve.

Heavy vehicles above 3500 kg GVM (i.e. those vehicles defined as 'trucks') built after 1 January 2011 must comply with ADR 80/03 for exhaust emissions, which specifies Euro 5, US EPA 2007 or Japan NLT05 standards. These levels are currently stricter than those for light passenger and commercial vehicles, which are required to meet Euro 4.

2.2.1 Comparison of noxious emissions between today's trucks and earlier model trucks

Since 2007, TIC has been promoting the following statement relating to soot/particulate matter (PM): 'It would take SIXTY of today's trucks to equal the exhaust emission levels of ONE pre-1995 model truck'.

As demonstrated further by the tables in Appendix A, the 'sixty to one' comparison is valid for soot/PM emissions, both when comparing European and US-sourced standards, and is similar to the comparison for Japanese vehicles. When vehicle age and deterioration over a 15+ year engine life is accounted for, it can be confidently assumed that the soot/PM levels of earlier model trucks on Australian roads is well over the 'sixty to one' claim, regardless of their origin. The 'sixty to one' statement is also valid today for nitrogen oxides (NOx) when comparing most US-certified engines, given that the required US EPA 2007 NOx limit is substantially lower than for other standards.

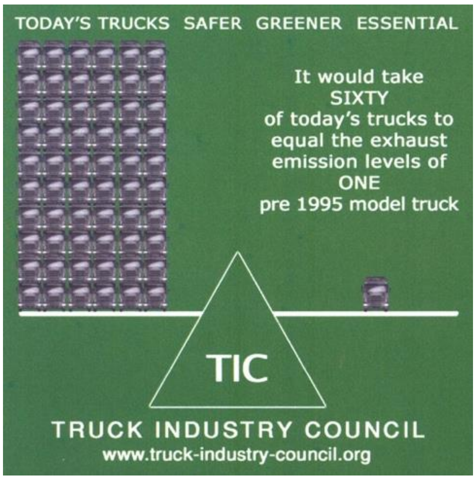

Figure 2.1 **TIC promotional drinks coaster**

2.2.2 Average age of the truck fleet

The average age of the Australian truck fleet is 13.84 years, and has grown over the past four years[6] (Table 2.1). This figure is considered ineffective if Australia is to achieve the objectives of the Federal Government's environmental policy and the expectations of the community. The number of less effective pre-1996 trucks still on Australia's roads is far more than is healthy for our air quality. Without an external incentive to accelerate the modernisation of the Australian truck fleet, fleets will hold on to their earlier model trucks for longer periods, resulting in a fleet composition that is contrary to the objectives of governments to improve overall emissions and safety levels.

Table 2.1 **ABS Motor Vehicle Census data for 2010 to 2013**

Truck type	31 Mar 2010		31 Jan 2011		31 Jan 2012		31 Jan 2013	
	No.	Ave. age (yrs)	No.	Ave. age (yrs)	No.	Ave. age (yrs)	No.	Ave. age (yrs)
Light rigid*	115,843	10.9	119,539	10.9	124,291	10.9	131,147	11.0
Heavy rigid†	315,435	15.4	318,223	15.5	322,115	15.6	325,998	15.6
Articulated‡	82,436	10.9	85,965	11.3	87,995	11.5	90,904	11.5
Non-freight carrying§	22,533	14.0	22,656	14.1	22,722	14.2	22,986	14.3
All trucks registered	**536,247**	**13.68**	**546,383**	**13.77**	**557,123**	**13.85**	**571,035**	**13.84**

Source: ABS 9309.0 (2010, 2011, 2012 & 2013)

Note: Current figure is only marginally lower than 2005 average of 14.4 years.

* Light rigid = trucks with GVM greater than 3.5 t and less than or equal to 4.5 t (i.e. trucks that can be driven on a car licence).

† Heavy rigid = rigid trucks with GVM > 4.5 t. Note this includes large rigid trucks that tow dog trailers and the like.

‡ Articulated = trucks with no significant load carrying area, fitted with a turntable device which can be linked to one or more trailers.

§ Non-freight carrying trucks = vehicles fitted with special purpose equipment, and having little or no goods carrying capacity (e.g. ambulances, cherry pickers, fire and emergency vehicles, service vehicles, tow trucks).

The basis for most of the data tables and forecasts in the original version of this Plan, especially in Section 3, has been the 31 March 2010 census data. The 31 January 2011, 31 January 2012 and 31 January 2013 data have since been released. For version 3, a comprehensive revision of all forecast tables and calculations that would be affected by the new data was undertaken.

Other western world developed countries, such as most of Western Europe, the USA, Canada and Japan have a truck fleet with an average age ranging from 5–9 years, which is much lower than the Australian figure (Table 2.2). To reach a target average age of 8 years, the Australian truck fleet requires radical intervention to reverse the increasing age problem. Clearly, an average fleet age approaching 14 years and

[6] Australian Bureau of Statistics, Motor Vehicle Census – Australia (Document 9309.0), issued 1 Feb 2011 for 31 Mar 2010 data, 28 Jul 2011 for 31 Jan 2011 data, 22 Aug 2012 for 31 Jan 2012 data and 23 Jul 2013 for 31 Jan 2012 data.

increasing is not in the interest of government's safety and environmental objectives if they are to be achieved in a reasonable timeframe.

Table 2.2 Average age of heavy commercial vehicles: Selected developed countries

Country	Average age (years)	Source
Spain	4.9	R.L. Polk 2009
Ireland	6.1	R.L. Polk 2009
France	6.4	R.L. Polk 2009
USA	6.7	Bloomberg, Nov 2010
Denmark	7.0	R.L. Polk 2009
Netherlands	7.2	R.L. Polk 2009
United Kingdom	7.8	R.L. Polk 2009
Switzerland	7.9	R.L. Polk 2009
Germany	8.0	R.L. Polk 2009
Austria	8.1	R.L. Polk 2009
Sweden	8.4	R.L. Polk 2009
Canada	9.2	R.L. Polk 2009
Japan	9.2	JAMA, 'The Motor Industry of Japan' 2010
South Africa	9.6	R.L. Polk 2009
Italy	10.7	R.L. Polk 2009
Iceland	11.4	R.L Polk 2009
Australia	**13.7**	**ABS Motor Vehicle Census 2010**

It is acknowledged that Western Europe has a near-by second-hand market for earlier model trucks in Eastern and Southern Europe, and North Africa. North America has Mexico and South America to readily accept its earlier model used trucks. Japan exports many second-hand vehicles to other right-hand drive markets such as New Zealand and parts of South-East Asia. By contrast, Australia has no equivalent heavy vehicle 'dumping ground'. While this makes the task more difficult, it does not alter the fact that measures must be taken to encourage the modernisation of the fleet, if community anticipated environmental and safety benefits are to be realised.

The ABS recorded the total number of trucks registered increasing from 458,205 units on 31 March 2005 to 536,247 units by 31 March 2010, or an increase of 17% (Table 2.3). This represents a compound increase of around 3.2% per annum, about the same as GDP growth over that 5-year period. Had the GFC not occurred, average growth over this same period would have been close to 3.8%; this would translate to 552,137 units by 31 March 2010.

2.2.3 Proportion of trucks on the road built pre-1996

The first comprehensive heavy vehicle exhaust emissions standard was ADR 70/00, which was mandatory for all new heavy vehicles built from 1 Jan 1996. Since pre-1996 built trucks are not as effective in treating pollutants due to the superior technologies now available, (Appendix B), it is enlightening to compare the proportion of the total truck census that was first registered pre-1995 (Table 2.3). Please note that the census data may show pre-1995 models in some cases, while the 2012 data refers to pre-1996. The error is not significant whether we compare pre-1996 or pre-1995 models.

Table 2.3 **Year of manufacture pre-1995 (2005 vs. 2010 data)**

Truck type	31 Mar 2005 census		31 Mar 2010 census	
	Pre-1995 models	% of total	Pre-1995 models	% of total
Total trucks (all)	**458,205**		**536,247**	
Light rigid	46,742	53	32,280	28
Heavy rigid	192,514	69	144,494	46
Articulated	34,736	50	21,440	26
Non-freight carrying	11,978	60	8,642	38
All trucks registered	**285,970**	**62***	**206,856**	**39***

* Percentages rounded to whole numbers. Census does not include concessional registrations, which include many seasonal use farm trucks.

A notable trend identified through the ABS Motor Vehicle Census data is that, on average, trucks are getting larger, thus improving productivity and capacity per vehicle.

- Between 2005 and 2010, the number of articulated trucks registered increased by 18%.
- However, for articulated trucks with GCM > 60 t, (i.e. capable of B-double and/or road train operation) this number increased by 49.3%, to > 40,000 units in 2010.
- In 2010, more than half of all articulated trucks have > 60 t GCM.
- Between 2005 and 2010, the total number of rigid trucks increased by 17%.
- However, for rigid trucks with GVM > 20 t, the increase was 30%, to > 83,000 units.

Australia is witnessing higher productivity from its heavy rigid truck and articulated truck fleets, as confirmed by BITRE (Report 123). However, census data also showed that light rigid vehicles of between 3500 and 4500 kg GVM are increasing at a rate much faster than the overall truck population. These trends are consistent with general market trends wherein consumers require their consumer products faster and more frequently. The above trends need to be taken into consideration when forecasting future truck statistics for the 10-year period covered in this Plan.

2.2.4 Annual scrappage rates

To understand how many new truck sales per annum actually replace earlier model vehicles, and how many are added to the total fleet, we need to study census data against sales rates recorded by TIC through T-Mark[7]. (Refer to Appendix D for the relevant calculation.)

We can see from Table D.1 that the average scrappage rate is 17,736 units per annum for the period 2005–2012, or an average of 3.58% of the prior year's census. These figures are used when producing forecasts in Section 3 of this Plan. For reference, R.L. Polk figures suggest that the average scrappage rate for trucks in the US was consistently 5.0% until 2007. To dramatically reduce the average age of the Australian truck fleet, one option for government consideration is to boost the scrappage rate. This will be discussed further in Section 3.

Census data is also available to ascertain where the earlier model trucks are operating. This data is determined by postcode provided by the registered owner of each vehicle. Table 2.4 compares vehicle type in metropolitan and rural areas (as defined by the ABS), separated by two distinct age groups. Table 2.4 shows that a significant proportion (almost 39%) of pre-1995 vehicles are registered in the urban areas. In the rigid truck segments, the majority of operations for these vehicles are assumed to be performed within the major cities (urban areas). In the articulated segment, however, well over half of the vehicles travel long interstate and intrastate distances, meaning that the proportion of their fuel burned is much less in urban areas.

Table 2.4 **Urban vs. rural postcode: Comparison of pre-1995 and post-1995 trucks**

	Pre-1995				Post-1995			
	Light rigid	Heavy rigid	Artic.	Non-freight	Light rigid	Heavy rigid	Artic.	Non-freight
Urban	18,121	57,763	7,280	5,052	58,515	114,086	32,518	10,680
Rural	14,159	86,731	14,160	3,590	24,723	56,249	28,402	3,167
Total	**32,280**	**144,494**	**21,440**	**8,642**	**83,238**	**170,335**	**60,920**	**13,847**
Urban (%)	56	40	34	58	70	67	53	77
Rural (%)	44	60	66	42	30	33	57	23

Source: ABS (2010); Australia Post postcode table

[7] TIC T-Mark industry sales database to March 2011

Further, it is reasonable to assume that many trucks registered in rural areas actually spend some of their operational time in the cities. The assumptions used for Section 3 in this area of usage can be seen in Table C.1 (Appendix C). Therefore, we can conclude that on top of the 88,216 pre-1995 trucks registered in urban areas in 2010, if we conservatively estimate that 20% of the rural-registered trucks perform some of their task within the major cities, we have a further 23,728 trucks to consider. Accordingly, a conservative estimate identifies that almost 112,000 pre-1995 trucks are over-contributing to the air quality concerns in Australian cities, even though these vehicles are typically operated for less time and distance than those used for interstate and intrastate freight. It is ironic that the new, cleaner trucks are often used to cover the long distances in rural areas for the first few years of their operating life, while the earlier model trucks, which are less reliable and less effective in managing pollutants, are used closer to 'home base' in the large population centres.

PART-TIME FARM TRUCKS

The Plan acknowledges the role played by the agricultural sector in the success of the Australian economy. In particular, the role the truck plays in the distribution of farm produce to the domestic and international markets is vital. While some of the pre-1995 trucks are registered in rural areas, the ABS Motor Vehicle Census data does not include primary producers' 'concessional' or part registration in its scope. Therefore, the focus of this Plan does not include such vehicles, which are used for only a small part of each year and typically in sparsely populated areas. Their impact to the overall health costs associated with noxious emissions is insignificant.

2.3 Healthy trucks – Improving the health of all Australians

Research suggests a link between common air pollutants and adverse health impacts on human beings. In June 2012, the World Health Organisation through the International Agency for Research on Cancer (IARC), changed the status of diesel engine exhaust from "probable carcinogen" to "known carcinogen", based on compelling scientific evidence. Diesel engine exhaust fumes are also known to contribute to other health effects in the form of respiratory difficulties through to the onset of chronic asthma, increased susceptibility to infections, impaired lung function, cardiovascular conditions, loss in the quality of life (morbidity) and premature death (mortality). People with existing asthma are prone to a worsening of their condition. Further, statistics support the proposition that the adverse effects of air pollutants result in increased hospital admissions, school and kindergarten absences and the increased use of asthma medications. All age profiles are represented in the cohort of people affected, in particular children and the elderly.

The existing literature shows that long-term exposures have more adverse health effects and hence higher cost implications for the community (BTRE 2005). In 2005, the Bureau of Transport and Regional Economics reported that the cost of vehicle air pollution on life and illness was $2.7 billion (central estimate). BTRE released figures suggesting that in the year 2000 premature deaths from vehicle exhaust pollution were between 900 and 2000 people, and stated that more than 85% of these early deaths would have occurred in the capital cities, where over 80% of Australians live (BTRE 2005). A further 900 to 4500 morbidity cases were estimated. The report also stated that vehicle exhaust emissions contributed between 1400 and 2000 asthma attacks in Australia each year. Similarly the Department of Infrastructure and Transport states in the Regulation Impact Statements for exhaust emissions ADRs that there are strong correlations between levels of air pollutants (e.g. NOx, soot/PM) and adverse urban health impacts. Supporting the relationship between air pollution and adverse health, the Health Effects Institute (US based) released in January 2010 a landmark study into the health risks associated with exposure to traffic, finding that:

- air pollution does impact on human health and provides evidence that initiatives aimed at reducing pollution levels should be supported;
- children living within 500 metres of a major road or freeway were at greater risk of developing asthma;
- those children who already had asthma were likely to have their condition exacerbated;
- across all other age groups new asthma cases were likely to be triggered;
- the adult population faced a greater likelihood of lung and heart-related illness.

In Victoria, for example, hundreds of thousands of Victorians live within 500 metres of major roads (Gough D. 2010, www.theage.com.au) and, according to the findings of the Health Effects Institute study, are at a greater risk of developing adverse health conditions.

There are two main forms of air pollution that are of concern in capital cities. Emissions from vehicles, for example soot/PM, are a known trigger for the onset of asthma, and can cause cancer and cardiovascular disease. Equally NOx has been shown to have a causal relationship with serious health problems such as asthma, respiratory disease and reduced lung function in children[8]. The main cause of air pollution is motor vehicle exhaust. Transport as a whole is the third largest contributor (14%) of greenhouse gas emissions in Australia. Road transport accounts for about 90% of transport emissions, the road freight task (trucks) component of this being 39% with predictions that these freight transport emissions are expected to grow 27% between 2010 and 2020.

Earlier model trucks, as stated previously in this report, are major contributors of soot/PM and NOx, especially in heavily populated centres, when compared to the latest technologies available to handle these pollutants.

BTRE notes in its analysis that the long life cycle (i.e. the high average age) of commercial vehicles dampens the uptake of new technology vehicles, including the latest model diesel engines and predicts low ‘penetration rates for hybrid fuel vehicles’ (p. 46) to the year 2020.

In Section 3, covering the future to 2022, TIC has developed two scenarios; the first describes a business as usual (BAU) or ‘do nothing’ case, while the second scenario describes the composition of the Australian truck fleet if a successful, targeted government incentive program was to be adopted over the period 2014–2019. The analysis calculates health costs associated with the noxious emissions from the vehicles operating under both scenarios, and therefore the difference between the two identifies the avoided health costs achieved through the targeted incentive program. Such analysis is then very useful for identifying the likely cost-benefit ratio that could be achieved by an incentive program.

[8] Blackburn, R., ‘Something in the Air’, 2007

2.4 Heavy rigid trucks and the urban freight task

Table 2.3 showed that heavy rigid trucks are over-represented in the pre-1996 age group. Similarly, heavy rigid trucks are most commonly found in the urban areas. This applies whether the application is tippers, general freight, Pantechs, refrigerated units, tray bodies or various specialised cargoes. The perception (whether right or wrong) of trucks in our cities being dirty and unsafe is not enhanced by the fact that their average age exceeds 15 years. Any policy initiative designed to modernise the Australian truck fleet should pay particular attention to the heavy rigid trucks based in urban areas.

INCREASED CONGESTION

Earlier model trucks can over-contribute to peak hour congestion. CityLink, the operator of Melbourne's inner city toll roads, publicised in March 2011 (through media channels) that two heavy duty trucks break down every day (531 occurrences in 2010, with 137 deemed hazardous) on the inner city freeway network, costing the community and business an enormous amount in lost time and income. Earlier model vehicles that are not regularly maintained are generally less reliable vehicles, and these vehicles are also doing the majority of their work in and through cities. Unfortunately, when one of these vehicles breaks down on a busy motorway, tens of thousands of hours of productive labour are lost, especially in morning and afternoon peak hours.

A CityLink spokesperson is quoted as saying:

> CityLink data supports the anecdotal evidence that truck breakdowns on Melbourne's M1 and Tullamarine Freeway happen regularly, significantly disrupt traffic and undermine the efficiency of the road network and are largely due to mechanical failure occurring when the vehicle is under stress like tackling an incline in congested traffic.

While this report relates to Melbourne's CityLink tollway network, the logical conclusion is drawn that similar problems occur in the other capital cities, resulting in many millions of dollars of lost productivity every year.

Analysis relating to avoided health costs can be calculated quite reliably, for example the calculations shown in Appendix C. A similar analysis that estimates the avoided congestion costs achieved in major cities through the modernisation of the truck fleet is at Appendix G, and also the deaths and injuries avoided through a safer truck fleet, see Appendix E. Based on these analyses, TIC is confident that any effective program that accelerates the modernisation of the truck fleet will reap significant rewards through a reduction in lives lost and in incidences of trauma, as well as a reduction in lost time through congestion due to truck breakdowns.

FATALITIES

More productive trucks travel less distance to carry the same amount of freight, thereby reducing risk and contributing to a reduction in fatalities. Further, late model trucks are fitted with safety features that are designed to avoid fatalities, both from the occupant and other road users. A recent research report from Europe concluded that heavy-duty trucks and buses greater than 15 years old are 4.6 times more likely to be involved in a fatal accident than vehicles of less than 5 years old[9]

2.5 Conclusion

TIC concludes that the current national truck fleet age requires a plan to tackle the problem of the disproportionate number of pre-1996 vehicles still registered and operating, especially in urban areas.

The Plan needs to focus on TIC promoting policy to government that addresses the substantive issue of the average age of the national truck fleet.

The key objectives for the National Truck Plan 2013–2022 must be to:

1. Promote and have government acknowledge the significant safety and environmental benefits now available due to technological advances in today's trucks.
2. Prepare and deliver a TIC information program aimed at politicians, bureaucrats and regulators must address methods to accelerate the modernisation of the Australian truck fleet, through the adoption of these safety and environmental technologies.
3. Acknowledge that pre-1996 trucks represent almost 2 in every 5 trucks on the road in 2012, and since these trucks were not required to comply with any emissions standards, this is the key group of vehicles that can be targeted by TIC for government action.

[9] National Technical University of Athens report to Ministry of Transport and Communications, Greece, 2007

3 The future

The purpose of this section is to forecast truck numbers under two different scenarios: a BAU scenario, and a targeted scenario, an environment that features an attractive package of incentives for truck operators to voluntarily renew their fleets with trucks employing the latest safety and environmental technologies. The assumption is that an attractive incentive would specifically aim to modernise the Australian truck fleet, especially in urban areas. These scenarios are used in order to project the comparative health and safety benefits of creating such a program.

3.1 Forecast data

Using data from the ABS Motor Vehicle Census, and the scrappage rates calculated in Appendix D, it would take around 14 years (i.e. Year 2025) before most of the pre-1996 vehicles are scrapped. By this stage, the trucks in focus will be around 30 years old or more. It is acknowledged that a small percentage (~1%) may be retained on the register for historic purposes and occasional use in remote areas. Table 3.1 shows what would happen to the Australian truck fleet in a BAU scenario; Table 3.2 shows what would happen in a targeted scenario.

Recommendation:

The primary goal of the National Truck Plan is to modernise the Australian truck fleet by working with government to achieve a series of incentives or program, where pre-1996 model trucks are replaced at an accelerated rate, with a target for this cohort representing less than 5% of trucks registered on Australian roads by mid-2019.

The schedule target date for renewal of the pre-1996 trucks by 2019 is important as it falls within the 5-year scope of government budgets, if an incentive program began for the 2014-15 financial year. Therefore, a 5-year program dealing with this key goal would be completed by the 2018–2019 financial year (Year 5).

Table 3.1 BAU scenario: Forecast scrappage, truck census growth and new truck sales rates

Census Year	Total Estimated New Truck Sales (12 mths to Census)	Scrappage / Attrition*	Est. pre-96 % of total scrappage	Pre-96 Units scrapped	Net Registration Increase	Estimated Truck Census	Comment
2010	***29,642***	18,613	80%	14,890		536,247	Actual sales & 31March Census
2011	***28,707***	17,160	80%	13,728	11,547	546,383	Actual data (10 mths) to 31 Jan 11
2012	***28,250***	18,031	80%	14,425	10,740	557,123	Actual 12 mth sales to 31 Jan 12
2013	***30,913***	18,942	78%	14,775	14,207	571,330	Actual 12 mth sales to 31 Jan 13
2014	***34,750***	20,467	77%	15,760	14,283	585,613	
2015	***36,790***	20,979	74%	15,524	15,812	601,424	No incentives from 1 Jul 14
2016	***38,626***	21,545	70%	15,082	17,080	618,505	
2017	***39,475***	22,157	65%	14,402	17,318	635,823	
2018	***40,580***	22,777	60%	13,666	17,803	653,626	
2019	***41,625***	23,415	55%	12,878	18,210	671,836	
2020	***42,274***	24,068	50%	12,034	18,207	690,043	
2021	***43,399***	24,720	55%	13,596	18,679	708,722	
2022	***44,595***	25,389	45%	11,425	19,206	**727,929**	Trucks needed to do the task
Totals (2013-2022 Inclusive)		224,459	73.3%	153,566	170,806		*10-year Truck Plan period*

* Scrappage rate of 3.58% of previous year's census reflects 2005–2012 average

Pre-1996 Trucks at 2012 Census:	209,617 Units, or 37.6%	of total truck census
Pre-1996 Trucks remaining at end March 2019:	123,289 Units, or 18.4%	of estimated truck census
Pre-1995 Trucks remaining at 2022:	56,051 Units, or 7.7%	of estimated truck census

Table 3.2 Targeted scenario: Forecast scrappage, truck census growth and new truck sales rates

Census Year	Total Estimated New Truck Sales (12 mths to Census)	Scrappage / Attrition*	Est. pre-96 % of total scrappage	Pre-96 Units scrapped	Net Registration Increase	Estimated Truck Census	Comment
2010	***29,642***	18,613	80%	14,890		536,247	Actual sales & 31March Census
2011	***28,707***	17,160	80%	13,728	11,547	546,383	Actual data (10 mths) to 31 Jan 11
2012	***28,250***	18,031	80%	14,425	10,740	557,123	Actual 12 mth sales to 31 Jan 12
2013	***30,913***	18,942	78%	14,775	14,207	571,330	Actual 12 mth sales to 31 Jan 13
2014	***34,750***	20,467	78%	15,964	14,283	585,613	
2015	***48,020***	32,209	83%	26,733	15,812	601,424	*Incentive Program starts 1 Jul 14*
2016	***54,970***	37,890	82%	31,070	17,080	618,505	*Year 2 of incentive*
2017	***58,139***	40,821	80%	32,657	17,318	635,823	*Year 3 of incentive*
2018	***63,582***	45,779	77%	35,250	17,803	653,626	*Year 4 of incentive*
2019	***65,271***	47,061	70%	32,943	18,210	671,836	*Year 5 of incentive*
2020	***51,799***	33,592	5%	1,680	18,207	690,043	*Incentive ends 30 Jun 19*
2021	***43,399***	24,720	3%	742	18,679	708,722	
2022	***44,595***	25,389	2%	508	19,206	**727,929**	Trucks needed to do task
Totals (2013-2022 Inclusive)		326,870	98.6%	206,745	170,806		*10-year Truck Plan period*

*Scrappage rate of 3.58% of previous year's census reflects 2005-2012 average

Pre-1996 Trucks at 2012 Census:	209,617	Units, or 37.6%	of total truck census
Pre-1996 Trucks remaining at end March 2019:	36,189	Units, or 5.4%	of estimated truck census
Pre-1995 Trucks remaining at 2022:	2,872	Units, or 0.4%	of estimated truck census

Assumptions:

1. Initial goal: Lift scrappage to twice the recent average (from 3.58 to 7.2%) of previous year's census within 3 years, and reduce pre-1996 trucks to < 5.0% of census by mid-2019.
2. Scrappage rate after 2019 drops back to approximately 4.5% of the fleet (from up to 7.2% with incentives, compared to a 3.58% average for the 2005–2012 period).
3. A well-constructed incentive program for safer, greener and cleaner trucks could make a valuable contribution towards achieving this scenario.

Note:

While such a targeted program is expected to achieve the stated goal of modernising the Australian truck fleet by reducing its average age, through replacing most pre-1996 trucks from Australian roads, the average age of the Australian truck fleet is estimated to remain relatively high at approximately 11.5 years by 2022.

3.2 Avoided health costs through the targeted scenario

Tables 3.1 and 3.2 provide the scrappage rates, pre-1996 trucks remaining and truck census numbers required to meet the freight task through to 2022. Health costs were calculated through the following analysis:

- The number of vehicles, by classification (according to ABS data) were identified for each year of the Plan from 2013 to 2022.
- The origin of these vehicles (classified as either urban or rural) was considered.
- An estimate of rural and urban use by vehicle type and origin was considered.
- The average number of kilometres travelled, according to ABS vehicle classification, was used.
- Health costs per tonne of emissions have been identified for hydrocarbons, NOx and PM produced by diesel vehicles. Values for health costs were aligned with those used in recent Regulation Impact Statements for exhaust emissions ADRs, as drafted by the Department of Infrastructure and Transport.
- Noxious emissions per kilometre were identified according to year of manufacture (and therefore required emissions standard) for the whole fleet.
- The total health cost for the national truck fleet for each year of both BAU and targeted scenarios was calculated.
- The ‘avoided health cost’ achieved by the targeted scenario, which includes an effective 5-year fleet renewal incentive program being adopted from July 2014, is then calculated by subtracting the total health cost of the targeted scenario from the total health cost for the BAU scenario.

Please refer to Appendix C for further details of the postcode and health cost analysis.

Figures 3.1 and 3.2 represent the summary of this body of work. The charts represent one compelling reason for modernising the truck fleet. However, there are further major benefits that will be realised should such an incentive program be adopted. These are identified in Section 3.3.

3.3 The growing freight task and the changing national truck fleet: Other avoided costs

The BITRE road freight task forecast 2008–2030 reports that road freight will increase by 80% overall, which represents a year-on-year growth of 2.7% per annum. When translating this average forecast growth rate to the period covered by this Plan, it equates to an increased total road transport freight task of 30% between 2010 and 2020.

The same BITRE road freight task forecast predicts that interstate movements will increase by 130% by 2030 (i.e. 2.3 x 2008 levels) representing a year-on-year growth of 3.8%, which is significantly higher than GDP estimates for the same period. The equivalent increase for the Plan period 2013–2022 is 45% for interstate freight. BITRE further states that efficiencies over the past 30 years, especially in articulated trucks and primarily through the introduction of B-doubles, have significantly reduced the number of trucks that would have been required to achieve today’s freight task.

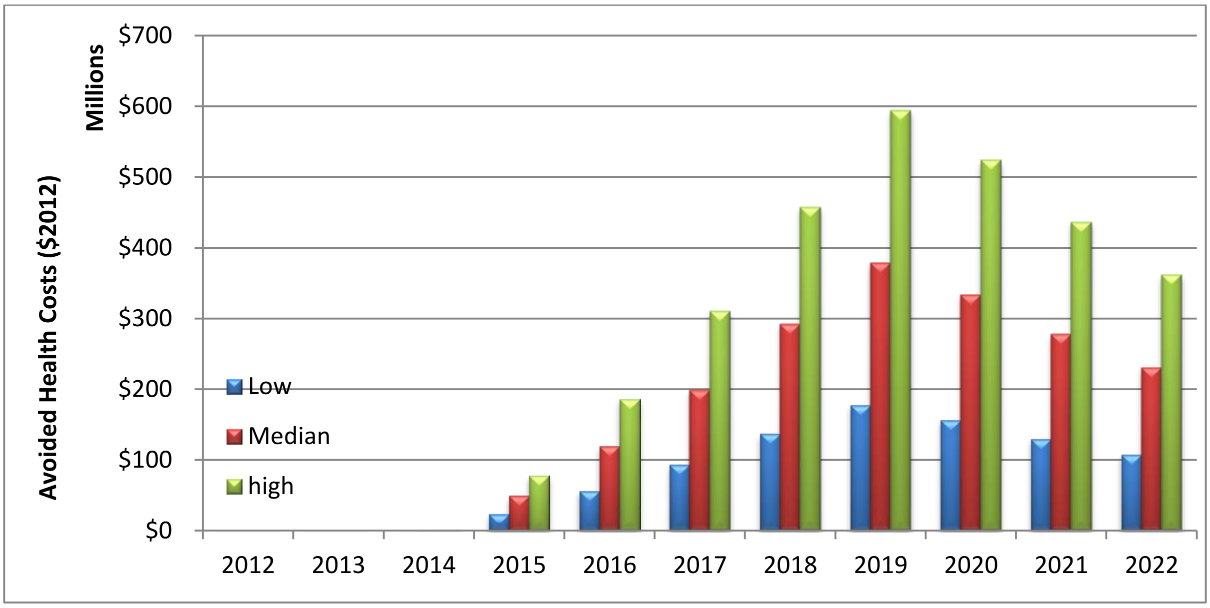

Figure 3.1 **Avoided health costs per year by adopting effective incentive programs**

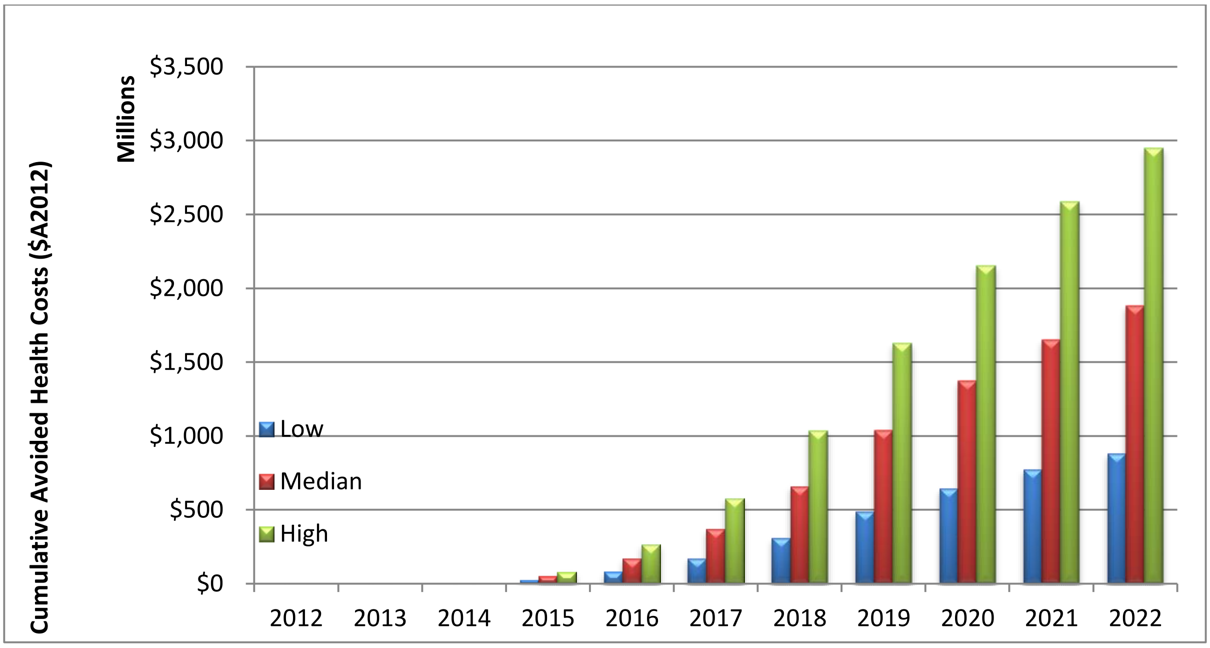

Figure 3.2 **Cumulative avoided health costs from adopting effective incentive programs**

Further efficiencies are expected in the coming years, through increased use of performance based standards and B-triples. Appendix E shows calculation of the expected benefits of these more productive vehicle types to 2020. The benefits are realised faster under the targeted scenario, as these more productive vehicles are required by regulation to be late model or new vehicles.

When comparing the targeted incentive program scenario with the BAU scenario, the analysis in Appendix E shows that (using Median figures):

- 39.1 fatalities saved, representing a community benefit of $157 Million;
- Carbon dioxide emissions savings of 1.69 million tonnes, or $53.7 Million; and,
- Direct Operator benefits totalling $2,815 Million.

Allowing for efficiencies through innovation and further replacement of single trailer trucks with B-doubles, the increase may result in a 40% increase in the interstate truck fleet, but with up to a 60% increase in load capacity.

With proposed incentives targeting earlier model trucks resulting in higher attrition rates, an estimate in growth of new truck sales is necessary to meet the requirements of both:

- modernising the Australian truck fleet to improve environment and safety, and
- meeting the freight task growth estimate.

This TIC-estimated change over 10 years of 170,806 registrations is a 30.7% increase over 2012, reflecting the change in the road freight task predicted by BITRE, with weighting towards interstate freight and larger vehicles (both rigid and articulated), and also accounting for the increasing trend towards more frequent, smaller deliveries to final urban delivery locations.

The resultant forecast change in the national fleet mix is estimated for both ABS vehicle classifications and the TIC T-Mark major segmentation in Tables 3.3 and 3.4 respectively. Table 3.3 refers to the segmentation described by the ABS. This does not match the industry segmentation that is commonly referred to in the TIC T-Mark monthly sales data reports, hence the separate tables.

Table 3.3 Fleet mix and growth projections: ABS vehicle classifications				
Truck Type	2012 Census	Past (5-yr) average growth p.a.	TIC Estimated Growth 2012 to 2022 (p.a.)	Projected Census at 2022
Light Rigid **(GVM between 3.5 and 4.5t)**	124,291	4.5%	4.1%	185,936
Heavy Rigid 1 **(GVM between 4.5 and 20t)**	233,156	1.0%	1.0%	257,549
Heavy Rigid 2 **(GVM > 20t)**	88,959	4.2%	4.2%	134,235
Articulated 1 **(GCM < 60t)**	43,435	1.2%	1.0%	47,979
Articulated 2 **(GCM > 60t)**	44,560	5.9%	5.5%	76,115
Non-Freight Trucks	22,722	1.4%	1.4%	26,111
TOTAL Trucks	**557,123**	**2.60%**	**2.71%**	**727,926**

With a few assumptions, the data can be estimated for the T-Mark industry light duty, medium duty and heavy duty truck segments, as shown in Table 3.4.

Table 3.4 Fleet mix and growth projections: T-Mark industry segments					
Truck Type	**2012 Census**	**% of Total**	**Estimated Growth 2012 to 2022 (p.a.)**	**Projected Census at 2022**	**% of Total**
Light Rigid (Including LDV) **(GVM between 3.5 and 8.0t)**	207,734	37.3%	2.9%	275,379	37.8%
Medium Duty Trucks **(GVM > 8.0t, GCM < 39t)**	164,861	29.6%	0.9%	180,439	24.8%
Heavy Duty Trucks **(3+ axle and all with GCM > 39t)**	184,528	33.1%	4.0%	272,111	37.4%
TOTAL Trucks	**557,123**	**100%**	**2.71%**	**727,929**	**100%**

Assumptions:

1. Growth in freight task as per BITRE estimates of 2.7% p.a.
2. Share of total freight task is changing, with less carried by medium-duty segment.
3. Growth in light duty segment is heavily weighted towards 3.5–4.5 t (car drivers licence) segment.
4. Non-freight vehicles distributed evenly between light-duty, medium-duty and heavy-duty segments.
5. Productivity gains at heavy-duty end are offset by productivity losses at light-duty end.

3.4 Annual new truck sales projections for 2013–2022

Estimated total sales, attrition and increased registrations by year in the period 2013–2022 are derived from the scenarios in Tables 3.1 and 3.2. To generate these estimates no external economic factors were considered other than BITRE estimates and TIC's Plan to modernise the Australian fleet by encouraging the uptake of post-1996 model trucks. The incremental annual sales projections and pre-1996 vehicle scrappage rates are summarised in Table 3.5. These figures, while estimates, are a reasonably conservative guide for the other aspects of the Plan. All initiatives and actions generated should be developed consistent with growth projections at least in line with Table 3.5.

Table 3.5 **Incremental truck sales and accelerated pre-1995 truck scrappage achieved by the targeted scenario**

Census Year	Total Estimated New Truck Sales (12 mths to Census)	Incremental New Truck Sales (12 months)	Additional Pre-1996 Units scrapped	Comment
2010	**29,642**	***0***	0	Actual sales and 31 March Census
2011	**28,707**	***0***	0	Actual sales to 31 March 2011
2012	**28,250**	***0***	0	Actual sales to 31 March 2012
2013	**30,913**	***0***	0	Actual sales to 31 March 2013
2014	**34,750**	***0***	205	TIC Forecast
2015	**48,020**	***11,230***	11,209	Incentives apply from 1 Jul 2014
2016	**54,970**	***16,345***	15,988	1st year of incentives
2017	**58,139**	***18,664***	18,255	2nd year of incentives
2018	**63,582**	***23,002***	21,584	3rd year of incentives
2019	**65,271**	***23,646***	20,064	4th year of incentives
2020	**51,799**	***9,524***	-10,354	Incentives cease 30 Jun 2019
2021	**43,399**	***0***	-12,854	
2022	**44,595**	***0***	-10,917	
Totals		***102,411***	53,179	*10-year Truck Plan period*

3.5 Example incentive program consistent with targeted scenario

This document has described a targeted scenario, which proposes a government incentive program available for 5 years, from 2014–2015 FY to 2018–2019 FY inclusive. Its intention will be to achieve a doubling of the overall heavy vehicle scrappage rate by 2019, and to modernise the Australian truck fleet by around four years. The difference in truck sales and scrappage rates anticipated between the BAU and Targeted Scenarios is summarised in Table 3.5 on the next page. Adoption of an effective incentive plan to achieve the numbers described in this Targeted Scenario would result in cumulative benefits from the following categories:

- a cumulative median avoided health cost benefit of almost $1.9 billion by 2022;
- a cumulative median saving in community costs associated with fatalities of $157 million by 2022;

- a reduction of median carbon dioxide emissions calculated as $53.7 million by 2022 across the fleet, through the use of a greater number of more productive trucks
- a cumulative median direct cost savings to truck operators of more than $2.8 billion by 2022.

A summary of the benefits from these categories is described in Table 3.6.

Table 3.6 **Benefit Calculations: Adopting an Effective Truck Incentive Plan that achieves the Targeted Scenario**

Benefit Description	Low Range Estimate	Median Range Estimate	High Range Estimate	Comment
	$Million (2012 Basis)			
Avoided Health Costs	881.1	1,881.6	2,949.5	Refer Appendix C for further details
Avoided Fatalities	135.2	157	221	Refer Appendix E for further details. Cost of one life lost consistent with Dept of Finance and Deregulation figure
Reduced CO_2 / Carbon Tax	45.7	53.7	75.5	***Conservative Estimates. Fuel savings >5% now predicted for 2017 and beyond***
Operator Direct savings	2,510.2	2,815.4	3,786.1	Refer Appendix E for further details
Totals	**3,572**	**4,908**	**7,032**	Benefits calculated to 2022 only, but will continue beyond this date

TIC acknowledges the assistance of *RARE Consulting* in the preparation of avoided health cost estimates, and the *Industrial Logistics Institute* in the preparation of estimates for reduces fatalities, CO_2 savings and operator direct cost savings.

While the community benefits through the four categories above exceed $4.9 billion (Median costs – refer Table 3.6), this needs to be considered in conjunction with the cost of an incentive program through the federal budget, and also the type of program which would be the most effective at achieving the stated goals. This analysis will assist to determine the cost-benefit ratio of the whole program. Example 1 incentive program described on the following page indicates what a 5-year incentive program might cost the Federal Government in net terms (if the Carbon Tax is not implemented on 1 July 2014). In this example, a total community benefit of between $3.5 billion and $7.0 billion in return for a $1.16 billion net cost over 5–7 years is determined (refer to cost breakdown in Example 1 on next page).

3.6 Policy options for government consideration

Options to modernise Australia's truck fleet making it comparable to other industrialised nations, while making significant health and environmental gains, include:

- **PROMOTE A CONSISTENT, POSITIVE MESSAGE.** Encourage the voluntary uptake by operators of modern trucks through consistent promotion of the many benefits of safer, cleaner, greener vehicles. Particular focus to be placed on the economic and social benefits of new trucks operating in urban areas, compared to earlier model trucks.

PROPOSED INCENTIVE PROGRAM (**WITHOUT** CO_2 **RUC increase applied 1 JUL 14)**

First Component: 15% Investment allowance on all new ADR 80/03 truck sales for 5 years. Provided as an additional tax deduction in first year of purchase.

Second Component: 30% investment allowance on all new ADR 80/03 PLUS trucks (alternative fuels and propulsion) for 5 years. As above, an additional company tax deduction in first year of purchase.

Less: expenditure saved through reduced tax credit as follows:

Third Component: Fuel excise and tax credit restructured according to emissions compliance level of the truck, noting the Productivity Commission review of fuel excise and carbon tax announcement. No tax credit for pre-1996 vehicles, with full tax credit for ADR 80/03 (and above) vehicles, phased in over 3 years. Then, adjust RUC by emissions standard by year.

Other important Assumptions:

- Total units to be sold 2014–2015 to 2018–2019: (Refer Table 3.2)
- 95% are conventional diesel, 5% alternative fuel and hybrid
- 38% light duty, 28% medium duty, 34% heavy duty
- Average market prices assumed for new vehicles in light duty, medium duty and heavy duty segments
- Average incremental cost of alternative fuel and hybrid systems accounted for

Estimated cost savings through reduced tax credits shown in the table below.

NOTE: Refer detailed calculation spreadsheets (available upon request) for details of these cost saving calculations

Incentive Revenue Positive over 5 years	Savings By Year		Cost of Investment Allowance ($m)	Net for Year	Cumulative
	Financial Year	$m		$m	$m
Year 0	2013-14	0.0	0.0	0	0
Year 1	2014-15	235.5	250.9	-15.4	-15.4
Year 2	2015-16	338.9	278.2	60.7	45.2
Year 3	2016-17	324.5	309.9	14.6	59.9
Year 4	2017-18	315.2	321.8	-6.6	53.3
Year 5	2018-19	292.8	298.6	-5.8	47.5
By end Year 5		1,507.0	1,459.5		**47.5**

- **ECONOMIC INCENTIVES: NEW TRUCKS.** Accelerate the introduction of greener technologies by encouraging the purchase of low emission trucks through economic incentives (investment allowances, vehicle rebates and green vehicle tax breaks) for new trucks meeting the ADR 80/03 emission standards and 'ADR 80/03 PLUS'[10] trucks employing alternative fuel and powered technologies.
- **ECONOMIC INCENTIVES: CLEANER USED TRUCKS.** Acknowledging that some operators will not be in a position to purchase a new vehicle, the government could consider providing a tax incentive (for example, a 10-15% investment allowance) towards the purchase of used ADR 80/02 and ADR 80/03 emissions controlled trucks.
- **DIFFERENTIAL NET FUEL PRICING ACCORDING TO EMISSIONS.** One option available for government is to reduce the fuel tax credit in accordance with emissions compliance level of the vehicle. For example, pre-1996 trucks may attract no fuel tax credit, while ADR 80/03 trucks would attract the full credit. Alternatively, government may consider a policy that would increase the road user charge or fuel excise level for older, less stringent emissions standard trucks. However, when the proposed Carbon Tax effect on the Road User Charge, and resultant fuel tax credit is applied from 1 July 2014, the quantum of the tax credit is expected to diminish to the extent that any differential applied will not be a sufficient incentive to modernise the operator's fleet. Further, the Productivity Commission's review of fuel tax and excise may result in a different outcome when its findings are revealed in 2012 (for example, a variable fuel tax credit based on emissions standard). By reducing fuel tax credits for earlier model trucks, the savings created could contribute towards new vehicle incentive programs. Figure 3.3 is an example of what a differential between Fuel Tax Credits according to emissions compliance level may look like.

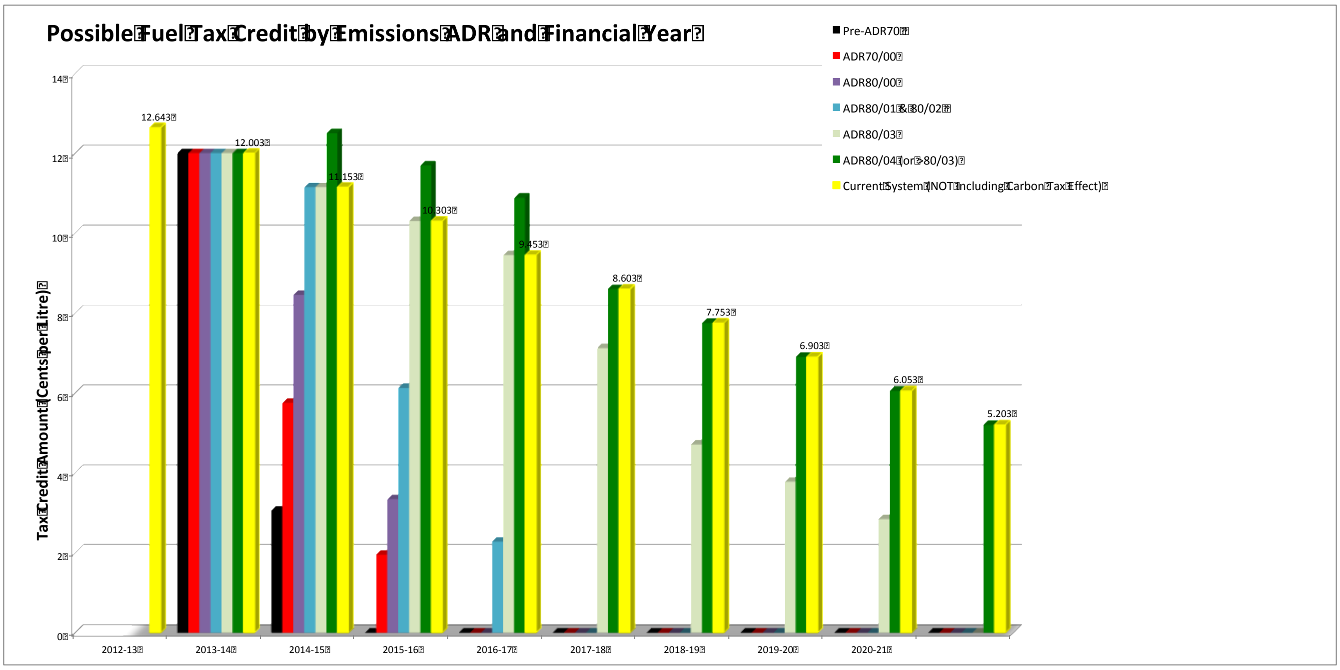

Figure 3.3 **Possible emissions-based fuel tax credit by ADR & financial year**

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10 An "ADR 80/03 PLUS" vehicle is one which significantly exceeds the mandatory emissions standard through use of alternative fuels and technology, or by achieving a higher standard such as USEPA 2010 or Euro VI.

- **EXCISE ON ALTERNATIVE FUELS.** A reversal of, or postponement of the policy decision to impose an excise on alternative fuels including natural gas and liquefied petroleum gas when used as a vehicle fuel, would remove this unnecessary disincentive for truck fleets to adopt the alternatives. Due to the very small number of alternative fuel trucks currently in use, the administrative burden for collecting the excise is likely to exceed the revenue generated for many more years.
- **PREFERENTIAL REGISTRATION AND STAMP DUTY RATES.** Enhanced federal/state relations whereby registration charges and stamp duty for low emission trucks would be restructured and reduced based on the emission standard of the truck (according to ADR).
- **ENCOURAGE LOCAL RESEARCH AND DEVELOPMENT FOR TRUCKS TO SUIT AUSTRALIA**. Enhance R&D funding to truck manufacturers, distributors and engine manufacturers to develop a world class alternative fuel and powered truck manufacturing industry for domestic use, given Australia's competitive strength as a source of abundant natural gas and noting the nation's unique transport requirements.
- **ASSISTANCE WITH CAPITAL FINANCE.** Capital funding preference to truck operators that encourages their adoption of new and near-new vehicles (those built to comply with ADR 80/02 from 2002/3 and ADR 80/03 from 2010/11). This could take the form of a specific fund that provides capital equipment loans towards new, safe, clean trucks.
- **GOVERNMENT FLEET POLICIES: LEADING BY EXAMPLE.** All levels of government to set vehicle purchase policies that focus on the latest environmental standards and safety features.
- **GOVERNMENT CONTRACT TENDER REQUIREMENTS TO INCLUDE MINIMUM VEHICLE STANDARDS**. Government civil works and construction tenders to require strong preference of a minimum emissions, safety and noise standard for vehicles that are used to perform government funded work such as building construction, roads, and public works.

Appendices

A List of Truck Industry Council membership and brands represented at 30 July 2013

B Comparison of emissions standards to those found in today's trucks

C Calculation of comparative health costs between BAU and targeted scenarios

D Calculation of truck scrappage rates 2005–2012

E Operational, Safety & CO_2 Benefits between BAU and targeted scenarios

F References

G Abbreviations & glossary

Appendix A

List of Truck Industry Council membership and brands represented at 30 July 2013

CAT Trucks Australia (NC^2)

1 Caterpillar Drive
Tullamarine Vic. 3043
http://australia.cat.com/trucks

Cummins South Pacific Pty Ltd

2 Caribbean Drive
Scoresby Vic. 3179
www.cummins.com

Eaton Pty Ltd

33-35 Garden Street
Kilsyth Vic. 3207
www.eaton.com

Hino Motor Sales Australia Pty Ltd

6-10 Parraweena Road
Caringbah NSW 2229
www.hino.com.au

Isuzu Australia Ltd

858 Lorimer Street
Port Melbourne Vic. 3207
www.isuzu.com.au

Iveco Trucks Australia Ltd

Princes Highway
Dandenong Vic. 3175
www.iveco.com.au

Mercedes Benz Australia/Pacific Pty Ltd
(Mercedes-Benz, Freightliner & Fuso)

44 Lexia Place
Mulgrave Vic. 3170
www.mercedes-benz.com.au
www.freightliner.com.au
www.fuso.com.au

MTU Detroit Diesel Australia

488 Blackshaws Road
Altona North Vic. 3025
www.mtudda.com.au

Paccar Australia
(Kenworth & DAF)

64 Canterbury Road
Bayswater Vic. 3153
www.paccar.com.au
www.kenworth.com.au
www.daf.com.au

Scania Australia Pty Ltd

212-216 Northbourne Road
Campbellfield Vic. 3061
www.scania.com.au

Volo Group Australia Pty Ltd
(Volvo, Mack & UD Trucks)

L1/20 Westgate Street
Wacol Qld 4076
www.volvotrucks.com.au
www.macktrucks.com.au
www.udtrucks.com.au

Transpacific Industries CV Group
(Western Star, MAN, & Dennis Eagle)

72 Formation Street
Wacol Qld 4076
www.westernstar.com.au
www.man.com.au
www.fotontrucks.com.au

Appendix B

Comparison of emissions standards to those found in today's trucks

Table B.1 **European standards comparison and applicable ADR**

Build year	Reference standard	NOx level (g/kWh)	Multiple of 2011 NOx limit	PM level (g/kWh)	Multiple of 2011 PM limit
Pre-1995	None	Typical: 16+	**8 x**	Typical: 1.2+	**60 x**
1996	ADR 70/00 (Euro 1)	8.0	4 x	0.36	18 x
2003	ADR 80/00 (Euro 3)	5.0	2.5 x	0.10	5 x
2008	ADR 80/02 (Euro 4)	3.5	1.75 x	0.02	1 x
2011	ADR 80/03 (Euro 5)	2.0	1 x	0.02	1 x

Table B.2 **US EPA standards comparison and applicable ADR**

Build year	Reference standard	NOx level (g/bhp-h)	Multiple of 2011 NOx limit	PM level (g/bhp-h)	Multiple of 2011 PM limit
Pre-1995	None	Typical: 12+	**60 x**	Typical: 0.8+	**80 x**
1996	ADR 70/00 (US EPA 91)	5.0	25 x	0.25	25 x
2003	ADR 80/00 (US EPA 98)	4.0	20 x	0.10	10 x
2008	ADR 80/02 (US EPA 04)	2.0	10 x	0.10	10 x
2011	ADR 80/03 (US EPA 07*)	0.2	1 x	0.01	1 x

* US EPA 07 has same NOx and PM limits as US EPA 2010, but with concessions for engine suppliers relating to averages across the model range and a flexible introduction schedule.

Table B.3 **Japanese heavy diesel engine standards comparison and applicable ADR**

Build year	Reference standard	NOx level (g/kWh)	Multiple of 2011 NOx limit	PM level (g/kWh)	Multiple of 2011 PM limit
Pre-1995	Japan 88/89 or no standard*	Typical: 16+	**8 x**	Typical: 1.35+	**50 x**
1996	ADR 70/00 (Japan 94)	7.8 max	3.9 x	0.96	35 x
2003	ADR 80/00 (no Japanese equivalent permitted)				
2008	ADR 80/02 (J-NLT05)	2.0	1 x	0.027	1 x
2011	ADR 80/03 (J-NLT05 + OBD)	2.0	1 x	0.027	1 x

* The Japanese 88/89 limit levels were expressed in ppm, and so are difficult to compare. The ‘typical’ figures shown here are reasonable estimates expressed in g/kWh.

Appendix C

Calculation of comparative health costs between BAU and targeted scenarios

The Truck Industry Council (TIC) engaged Rare Consulting to undertake an analysis of the health costs associated with pre-1996 trucks, and the avoided health costs that can be achieved by implementing incentives to remove pre-1996 trucks from operation.

The main air pollutants associated with vehicle exhaust that are of concern to human health are hydrocarbons (HCs), oxides of nitrogen (NOx), and fine particulate matter (PM). Motor vehicles are one of the major emitters of air pollutants in urban Australia, contributing more than 80% of carbon monoxide emissions, 60–70% of NOx and up to 40% of hydrocarbons (DITR 2009). These air pollutants are known to cause health issues such as trouble concentrating, asthma attacks, cancer, reduced lung function, heart attacks and premature death. Studies have found that exhaust particles can affect both healthy individuals and those with a predisposition to cardiovascular and lung ailments.

New trucks are manufactured in accordance with the regulations specified in the Australian Design Rules (ADRs), which align with the United Nations Economic Commission for Europe guidelines. Manufacturer compliance with ADRs has been a requirement since 1996 when ADR 70/00 (based on Euro 1) was implemented. In accordance with technological advancements in emissions reduction, the regulations have progressively increased to the current ADR 80/03 (based on Euro 5), with a new ADR based on Euro 6 currently being investigated. Prior to 1995 there were no regulations and trucks manufactured prior to 1996 make a significantly higher contribution to air pollutants. For example a pre-1996 truck produces eight times the NOx limit of a 2012 truck and 60 times the PM limit.

While the introduction of ADRs has reduced the amount of pollution, there are still a large number of vehicles in operation that were manufactured prior to 1996 with no requirement to comply with standards. The concern raised by TIC is that the trend is for these older trucks to be used for the shorter distance routes in urban areas where there is more congestion and closer proximity to populated areas, thus amplifying health impacts.

BACKGROUND

The TIC National Truck Plan for 2013-2022 addresses the implications and opportunities associated with an ageing truck fleet. The purpose of the Plan is to implement a strategy to ensure that the nation's truck fleet is efficient. As a means of ensuring this they are encouraging the replacement of pre-1996 trucks with newer models that comply with recent emissions ADRs and, accordingly, produce less air pollution and have lower associated health costs. The Plan aims to present a cost-benefit analysis that demonstrates a justification for government incentives to be offered for the removal or replacement of pre-1996 trucks from operation by the resultant savings in health costs.

The business as usual case assumes that there are no incentives or penalties in place that would change the current behaviour of truck ownership and operation. The targeted case scenario is a forecasted projection of truck numbers assuming that government incentives are in place from 1 July 2014 – 30 June 2019 to encourage the removal or replacement of pre-1996 trucks. TIC has provided forecasts for both scenarios derived from BITRE (2010), and scrappage rates derived from ABS data (2012).

METHODOLOGY

In order to determine whether the cost of investing money in government incentives is justified by the potential avoided health costs, the health costs associated with both the BAU and targeted cases have been compared. The methodology adopted is as follows.

- **VEHICLE CLASSIFICATION.** For the purposes of this analysis, vehicle segmentation is in accordance with ABS data: light rigid (3.5–4.5 t), heavy rigid (>4.5 t), articulated and non-freight.
- **DETERMINE THE NUMBER OF PRE-1996 VEHICLES ON THE ROAD.** The estimated number of pre-1996 vehicles scrapped each year (data provided by TIC) was deducted from the number currently on the road (ABS data). The split between light rigid, heavy rigid, articulated and non-freight vehicles was estimated by linearly interpolating from the current split (ABS data) and the 2022 projected figures (TIC derived from BITRE). This was done for the BAU and the targeted cases. The targeted case has an increased scrappage rate to reflect incentives applied to remove pre-1996 trucks from the road.
- **URBAN VS. RURAL REGISTRATION.** For the purposes of this assessment we examined the pre-1996 trucks that are operating in and around capital cities and highly urban areas. ABS census data of truck registrations according to postcode was used to determine the split between urban and rural. The segmentation of the ABS data was maintained. Areas were determined to be urban if they were a capital city or were in an area within relatively close proximity so that it would be expected that the truck would go through a capital city. For example Geelong and surrounds were counted as part of Melbourne, Wollongong and surrounds as part of Sydney, and Sunshine Coast as part of Brisbane. The percentage of urban vehicles was applied to the total of pre-1996 vehicles calculated for each case to estimate the number of pre-1996 trucks operating in urban areas for each year.
- **URBAN VS. RURAL OPERATION.** It was acknowledged that trucks registered in urban areas will do a percentage of their travels in rural areas and vice versa. Table C.1 (sourced from data provided by TIC members) was used as an approximation of the percentage of kilometres that could be attributed to either rural or urban.
- **POLLUTION PRODUCTION RATE.** The ATF (2010) report provides pollution production rates for the various air pollution parameters. The rate for hydrocarbons is the combined rate of methane and non-methane volatile organic compounds. It was assumed that the majority of vehicles would be operating on diesel fuel, and that the average vehicle speed would be 40 km/h in urban situations and 80 km/h in rural situations. To accord with the ABS segmentation, the ATF rates for light commercial and rigid vehicles was linearly interpolated to provide a rate for light rigid, rigid was used for heavy rigid, articulated for articulated, and other truck for non-freight. The pollution production rates used are provided in Table C.2, and notably for these parameters the rates for urban and rural were the same.

Table C.1 Percentage of each vehicle segment journey in urban vs. rural by registration location

Vehicle segment	Rural		Urban	
	Urban (%)	Rural (%)	Urban (%)	Rural (%)
Light rigid	10	90	90	10
Heavy rigid	15	85	90	10
Articulated	10	90	70	30
Non-freight carrying	10	90	90	10

Table C.2 Pollution production rate (g/km)

Vehicle segment	HC production (g/km)	NOx production (g/km)	PM production (g/km)
Urban			
Light rigid	0.699	5.479	0.626
Heavy rigid	1.874	13.3285	1.177
Articulated	1.722	20.3876	0.859
Non-freight carrying	1.880	13.3285	0.614
Rural			
Light rigid	0.699	5.479	0.626
Heavy rigid	1.874	13.3285	1.177
Articulated	1.722	20.3876	0.859
Non-freight carrying	1.880	13.3285	0.614

Source: ATF (2010)

- **AVERAGE ANNUAL KILOMETRES.** The average annual kilometres travelled by each segment was taken from the ABS Survey of Motor Vehicle Use. The latest available data was for the 12 month period to end of October 2010. The differences between the data for 2010, when compared with 2007 data used in previous versions of this document, were not substantial, although the averages appeared to have reduced vs 2007 and 2003. It has been assumed that this dip in truck utilisation was related to economic conditions in the 2-3 year period immediately following the Global Financial Crisis. Accordingly, 2010 data has been assumed to be a conservative estimate of average distances travelled for the period 2013–2022. The ABS had segmented vehicles into rigid, articulate and non-freight. The proportion of kilometres that could be attributed to light rigid and heavy rigid was determined by assuming heavy rigids travel further than light rigids, and ensuring that the average was still equal to that given in the ATF (2010). Table C.3a shows the annual kilometres used for part of the analysis, and also the estimated cost savings through Phase 3 of the proposed incentive program.

Table C.3a		Average annual kilometres			
Year	**Light rigid (3.5-4.5t)**	**Heavy rigid 1 (>4.5-20t)**	**Heavy Rigid 2 (>20t)**	**Articulated**	**Non-freight**
2010	14,000	18,000	37,200	85,000	9,800

Source: ABS (2010), with Light & Heavy Rigid data separated by calculation. ABS reports all Rigid trucks travel 20,800 km p.a.

An alternative method is to look at the annual kilometres per area of travel as given in the ABS Survey of Motor Vehicle Use, as given in Table 3.5b. As both data sets impose limitations, both have been used in the assessment to provide an estimation of the range of potential avoided health costs. The 'kilometres per area' are used in conjunction with the 'area of operation' (not age-specific) as given by the SMVU (Table C.5b) rather than the postcode analysis results.

Table C.3b	Average annual kilometres			
Area	**Light rigid**	**Heavy rigid**	**Articulated**	**Non-freight**
Capital city	17,850	24,550	31,400	15,000
Other urban	10,000	12,600	19,300	8,100
Other	11,775	14,500	59,100	6,600
Interstate	12,000	15,500	86,800	11,000

Source: ABS (2011)

- **ANNUAL TONNES OF POLLUTION EMITTED.** An estimate of the total tonnes of pollution per year was calculated using the factors in Table C.2 and the annual kilometres travelled per segment (Table C.3).
- **HEALTH COSTS.** To convert the amount of pollution to a monetary equivalent, the health costs associated with each pollution parameter provided in the 'Draft RIS – Euro 5/6 emission standards for light vehicles' were used (DITR 2009). The figures in the Draft RIS were derived from the results of studies undertaken by Coffey Geosciences (2003), Watkiss (2002) and Beer (2002).

  A CPI of 3.5% was assumed and applied to the 2009 prices to estimate 2011 prices. As per the Draft RIS, and the uncertainties surrounding the unit value estimates, upper and lower bounds were provided (Table C.4). These prices were applied to the tonnage of emissions estimates to determine the resultant median, upper and lower bound health costs for each vehicle segment.

The avoided health costs (targeted case compared to BAU) can then be used to determine the degree of investment in incentives that will provide a net positive cost-benefit ratio.

Table C.4 **Average health costs ($/tonne of emissions) for capital cities in 2012 prices**

	2012 ($AUS)		
	HC	**NOx**	**PM**
Capital city			
Low	4,896	585	130,419
Median	9,792	1,171	260,838
High	14,688	1,756	391,257
Rest of Australia			
Low	58	85	30,912
Median	114	171	61,826
High	172	256	92,738

RESULTS

The results of the postcode analysis showed that there was a split of 56% of pre-1995 light vehicles registered as operating in urban areas near capital cities, 40% of pre-1995 medium vehicles and 34% of pre-1995 heavy vehicles.

The majority of smaller trucks are registered as operating within the cities, while the majority of heavy vehicles are registered as operating in the longer distance rural areas. The postcode analysis does not provide evidence to suggest that the majority of pre-1995 vehicles operate in the city areas; in fact, the results indicate the contrary. However, there are still a large number of pre-1995 vehicles in operation in urban areas. Table C.5a shows the number of pre- and post-1995 vehicles in each vehicle segment that are registered in either an urban or rural postcode.

Table C.5a **Urban vs. rural postcode: Comparison of pre-1995 and post-1995 trucks**

	Pre-1995				Post-1995			
	Light rigid	Heavy rigid	Artic.	Non-freight	Light rigid	Heavy rigid	Artic.	Non-freight
Urban	18,121	57,763	7,280	5,052	58,515	114,086	32,518	10,680
Rural	14,159	86,731	14,160	3,590	24,723	56,249	28,402	3,167
Total	**32,280**	**144,494**	**21,440**	**8,642**	**83,238**	**170,335**	**60,920**	**13,847**
Urban (%)	56	40	34	58	70	67	53	77
Rural (%)	44	60	66	42	30	33	57	23

Source: ABS (2010)

For comparison the area of operation for heavy vehicles as per the ABS SMVU (2011) is given in Table C.5b and was used in the secondary assessment in conjunction with the kilometres in Table C.3b previously.

Table C.5b **Area of operation**

Area	Light rigid (%)	Heavy rigid (%)	Articulated (%)	Non-freight (%)
Capital city	41.8	41.7	29.6	34.2
Other urban	21.5	21.5	19.7	21.5
Other	32.3	32.3	35.7	41.3
Interstate	4.4	4.5	14.9	3.0

Source: ABS (2011)

The full spreadsheet of pollution health cost calculations is available electronically, with total predicted health costs for the BAU and targeted cases shown in Tables C.7, C.8 and C.9.

Figure C.1 demonstrates the annual total avoided health costs by implementing the targeted scenario. As shown, significant savings are realised from 2016 when the avoided health costs are estimated to be between $56 million and $186 million, and the savings continue to rise until 2019 when the incentives cease.

Figure C.2 illustrates the cumulative avoided health costs by implementing the targeted case for 2014-2022. As shown, by the year 2022 there has been between $881 million and $2.9 billion saved in avoided health costs (based on 2012 prices).

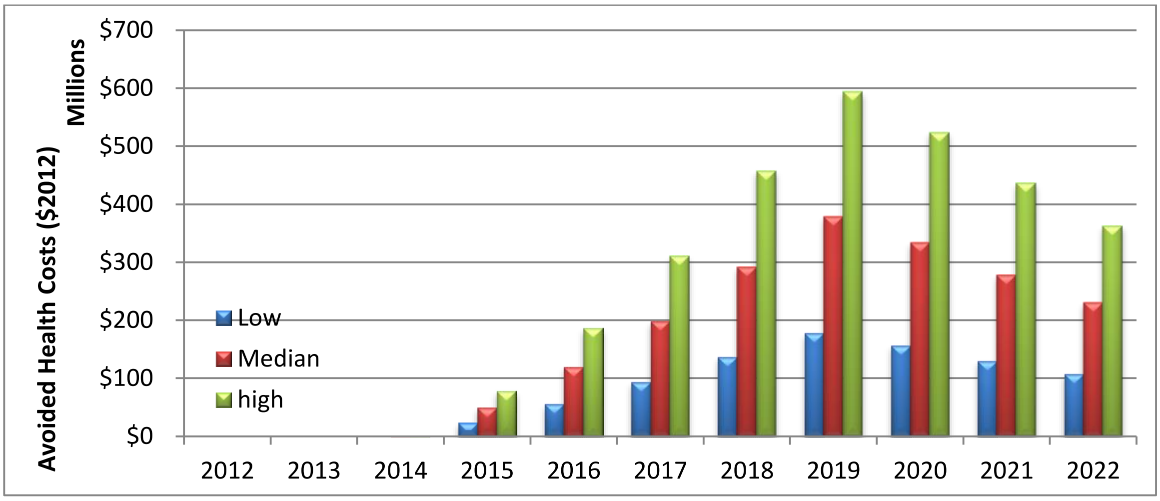

Figure C.1 **Annual avoided health costs by implementing incentives over all truck segments**

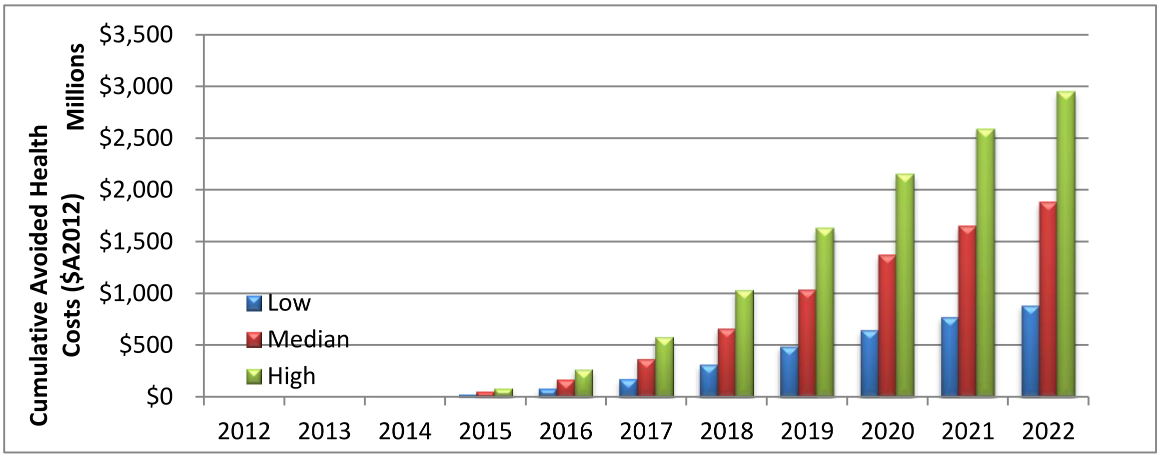

Figure C.2 **Cumulative avoided health costs by implementing incentives over all truck segments**

Table C.6 shows the median savings for the four vehicle segments with the implementation of the targeted scenario compared to BAU. It can be seen that the largest avoided health costs are from the heavy rigid and articulated vehicle segments.

Table C.6 **Median total health savings per vehicle segment**

Year	Light rigid	Heavy rigid	Articulated	Non-freight
2012	$0	$0	$0	$0
2013	$0	$0	$0	$0
2014	$89,678	$534,772	$256,146	$10,200
2015	$5,071,354	$29,612,961	$14,396,458	$561,828
2016	$12,344,126	$70,591,877	$34,832,047	$1,332,018
2017	$20,849,267	$116,783,378	$58,485,978	$2,191,410
2018	$31,120,025	$170,758,716	$86,795,415	$3,186,134
2019	$40,944,442	$220,112,677	$113,553,251	$4,083,332
2020	$36,562,911	$192,597,270	$100,842,455	$3,551,865
2021	$30,850,381	$159,249,826	$84,627,181	$2,919,232
2022	$25,923,619	$131,150,751	$70,735,736	$2,389,399

CONCLUSIONS

The estimated reduction in health costs associated with the removal of pre-1995 trucks is substantial. By the year 2022 the total avoided health costs is between $881 million and $2.9 billion, with a median point of $1.8 billion.

Government investment will need to consider the cost of the incentives and the cost of the pre-1995 truck disposal. In order to achieve the highest avoided health costs the incentives would be best aimed at the heavy duty vehicle segment.

An alternative to the total removal of pre-1995 trucks from operation is their relocation to rural areas where the associated health costs are greatly reduced.

Table C.7 **BAU scenario – Total range of predicted pollution costs**

Year	Light rigid			Heavy rigid			Articulated			Non-freight		
	Low	Median	High	Low	Median	High	Low	Median	High	Low	Median	High
2012	$40,628,838	$83,118,446	$127,028,812	$245,104,932	$517,163,993	$816,179,020	$83,312,323	$240,447,201	$461,050,403	$4,983,673	$10,786,017	$17,407,121
2013	$38,097,171	$77,939,163	$119,113,382	$224,984,666	$474,710,840	$749,180,209	$77,620,567	$224,020,259	$429,552,227	$4,551,116	$9,849,847	$15,896,274
2014	$35,265,555	$72,146,245	$110,260,144	$203,901,701	$430,226,421	$678,975,689	$71,401,165	$206,070,479	$395,134,054	$4,103,083	$8,880,182	$14,331,370
2015	$32,390,075	$66,263,590	$101,269,761	$183,381,967	$386,930,403	$610,646,684	$65,177,277	$188,107,752	$360,691,057	$3,670,507	$7,943,972	$12,820,457
2016	$29,518,502	$60,388,929	$92,291,594	$163,672,411	$345,343,836	$545,015,502	$59,042,603	$170,402,508	$326,741,774	$3,258,211	$7,051,651	$11,380,378
2017	$26,707,714	$54,638,621	$83,503,475	$145,048,663	$306,048,292	$482,999,973	$53,106,808	$153,271,244	$293,893,082	$2,871,473	$6,214,644	$10,029,565
2018	$23,976,540	$49,051,189	$74,964,277	$127,560,511	$269,148,820	$424,765,883	$47,401,916	$136,806,390	$262,322,210	$2,510,994	$5,434,471	$8,770,476
2019	$21,343,664	$43,664,853	$66,732,411	$111,251,499	$234,737,297	$370,458,229	$41,959,097	$121,097,902	$232,201,649	$2,177,328	$4,712,326	$7,605,035
2020	$18,829,330	$38,521,029	$58,871,174	$96,168,093	$202,911,767	$320,231,744	$36,812,053	$106,243,047	$203,717,904	$1,871,051	$4,049,461	$6,535,262
2021	$15,874,952	$32,476,966	$49,634,113	$79,454,347	$167,646,268	$264,576,360	$30,868,414	$89,089,146	$170,825,806	$1,536,582	$3,325,578	$5,367,018
2022	$13,355,909	$27,323,508	$41,758,153	$65,514,190	$138,232,960	$218,156,800	$25,832,665	$74,555,502	$142,957,973	$1,259,220	$2,725,292	$4,398,240

Note: low is the minimum low cost estimate from the two methods, median is the average median cost estimate from the two methods, and high is the maximum high cost estimate of the two methods

Table C.8 **Targeted scenario – Total range of predicted pollution costs**

Year	Light rigid			Heavy rigid			Articulated			Non-freight		
	Low	Median	High	Low	Median	High	Low	Median	High	Low	Median	High
2012	$40,628,838	$83,118,446	$127,028,812	$245,104,932	$517,163,993	$816,179,020	$83,312,323	$240,447,201	$461,050,403	$4,983,673	$10,786,017	$17,407,121
2013	$38,097,171	$77,939,163	$119,113,382	$224,984,666	$474,710,840	$749,180,209	$77,620,567	$224,020,259	$429,552,227	$4,551,116	$9,849,847	$15,896,274
2014	$35,221,719	$72,056,567	$110,123,090	$203,648,250	$429,691,649	$678,131,721	$71,312,413	$205,814,333	$394,642,901	$4,097,983	$8,869,144	$14,313,556
2015	$29,911,164	$61,192,236	$93,519,278	$169,347,187	$357,317,443	$563,912,036	$60,189,062	$173,711,294	$333,086,274	$3,389,592	$7,335,995	$11,839,269
2016	$23,484,613	$48,044,803	$73,426,231	$130,216,065	$274,751,959	$433,608,657	$46,973,680	$135,570,460	$259,952,352	$2,592,199	$5,610,220	$9,054,110
2017	$16,516,456	$33,789,353	$51,639,817	$89,700,297	$189,264,914	$298,694,522	$32,842,057	$94,785,266	$181,747,948	$1,775,762	$3,843,230	$6,202,435
2018	$8,764,870	$17,931,164	$27,403,958	$46,631,050	$98,390,104	$155,277,513	$17,328,255	$50,010,975	$95,894,567	$917,920	$1,986,627	$3,206,137
2019	$1,329,755	$2,720,411	$4,157,568	$6,931,199	$14,624,620	$23,080,316	$2,614,139	$7,544,650	$14,466,644	$135,652	$293,588	$473,809
2020	$957,141	$1,958,117	$2,992,565	$4,888,457	$10,314,497	$16,278,156	$1,871,246	$5,400,592	$10,355,475	$95,110	$205,844	$332,203
2021	$795,086	$1,626,585	$2,485,889	$3,979,414	$8,396,442	$13,251,116	$1,546,022	$4,461,965	$8,555,687	$76,959	$166,559	$268,803
2022	$684,275	$1,399,889	$2,139,432	$3,356,545	$7,082,209	$11,177,016	$1,323,507	$3,819,767	$7,324,289	$64,515	$139,627	$225,339

Note: low is the minimum low cost estimate from the two methods, median is the average median cost estimate from the two methods, and high is the maximum high cost estimate of the two methods

Table C.9 **Avoided health costs of implementing incentive program**

Year	Light rigid			Heavy rigid			Articulated			Non-freight		
	Low	Median	High	Low	Median	High	Low	Median	High	Low	Median	High
2012	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2013	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2014	$43,835	$89,678	$137,054	$253,450	$534,772	$843,968	$88,752	$256,146	$491,153	$5,100	$11,038	$17,814
2015	$2,478,911	$5,071,354	$7,750,483	$14,034,780	$29,612,961	$46,734,648	$4,988,215	$14,396,458	$27,604,784	$280,915	$607,976	$981,189
2016	$6,033,889	$12,344,126	$18,865,363	$33,456,345	$70,591,877	$111,406,845	$12,068,923	$34,832,047	$66,789,422	$666,012	$1,441,431	$2,326,268
2017	$10,191,258	$20,849,267	$31,863,657	$55,348,366	$116,783,378	$184,305,451	$20,264,751	$58,485,978	$112,145,135	$1,095,710	$2,371,414	$3,827,129
2018	$15,211,671	$31,120,025	$47,560,319	$80,929,462	$170,758,716	$269,488,370	$30,073,661	$86,795,415	$166,427,643	$1,593,075	$3,447,845	$5,564,339
2019	$20,013,910	$40,944,442	$62,574,844	$104,320,300	$220,112,677	$347,377,914	$39,344,958	$113,553,251	$217,735,004	$2,041,676	$4,418,739	$7,131,225
2020	$17,872,189	$36,562,911	$55,878,609	$91,279,636	$192,597,270	$303,953,588	$34,940,807	$100,842,455	$193,362,428	$1,775,941	$3,843,617	$6,203,059
2021	$15,079,867	$30,850,381	$47,148,225	$75,474,933	$159,249,826	$251,325,245	$29,322,392	$84,627,181	$162,270,119	$1,459,623	$3,159,019	$5,098,214
2022	$12,671,634	$25,923,619	$39,618,721	$62,157,645	$131,150,751	$206,979,784	$24,509,158	$70,735,736	$135,633,683	$1,194,705	$2,585,665	$4,172,901

Note:

low is the minimum low cost savings estimate from the two methods, median is the average median cost saving estimate from the two methods, and high is the maximum high cost savings estimate of the two methods

Appendix D

Calculation of truck scrappage rates 2005–2012

Table D.1 **Truck scrappage rates 2005–2010**

Year	Truck Census @ 31March / (31 Jan from 2010)	Unit Increase	% Increase	New truck Sales (12 months to end Census)	Scrappage	% scrappage of prior year Census	Scrappage as % of new sales
2004	443,614						
2005	458,205	14,591	3.29%	32,620	18,029	4.06%	55.27%
2006	475,519	17,314	3.78%	35,062	17,748	3.87%	50.62%
2007	490,242	14,723	3.10%	33,029	18,306	3.85%	55.42%
2008	511,850	21,608	4.41%	39,047	17,439	3.56%	44.66%
2009	525,218	13,368	2.61%	33,635	20,267	3.96%	60.26%
2010	536,247	11,029	2.10%	29,642	18,613	3.54%	62.79%
2011*	546,383	10,136	1.89%	24,112	13,976	2.61%	57.96%
2012	557,123	10,740	1.97%	28,250	17,510	3.20%	61.98%
Average		**14,189**	**2.89%**	**31,925**	**17,736**	**3.58%**	**56.12%**

* 2011 figures are 10 months of data, due to change in ABS reporting cycle.

Appendix E

(NOTE: Updated March 2012 with further calculation information)

Operational, Safety and CO_2 Benefits between BAU and targeted scenarios

Version 3.0 (and later) comment:

The original body of work to calculate these savings was based on the incentive program beginning on 1 July 2012, for a Plan covering 2011-2020. While the proposed incentive schedule has now been moved forward by two years, it is considered that the savings identified in this Appendix are still valid (or conservative) for the period 2013-2022. Therefore, they have not been extensively revised.

Implementing a future national truck access regime for new higher productivity vehicles (through Performance Based Standards or PBS) will allow for a quantum leap in productivity. This productivity benefit arises from an overall savings in kilometres that comes from the adoption of these vehicles, which are also safer and more environmentally friendly.

The following analysis uses a similar framework to that used by the National Transport Commission (NTC) in the Regulation Impact Statement for Performance Based Standards (PBS - 2010), for the adoption of high productivity vehicles. The benefits of the adoption of these new vehicle technologies, under PBS arrangements, were examined over the period 2011-2020. The benefits were estimated in 2011 dollars with fatalities and operational costs being escalated at 3% per annum. The CO_2 benefit was initially set at a carbon price of $23 per tonne and escalated at 7% per annum from 2012. *This revision (V 3.0) acknowledges the annual escalation of 2.5% as per government policy, however the difference is relatively insignificant to the total savings calculation.*

Calculating the PBS Benefits

The financial benefits of PBS were generated from applying specific vehicle class take-up rate, divided by the total 10 year period, to estimate the number of PBS vehicles likely to emerge in that year.

The PBS vehicle reduction factor, which comes from regression analysis, is applied to a fraction of the vehicle population that will take up PBS. A reduction comes about as fewer PBS vehicles will be required to undertake the task that would have been done by non-PBS vehicles but for these PBS vehicles this task is performed with a saving in kilometres.

This reduction in kilometres is also the basis for the benefits of fatality savings, and CO_2 savings.

The saved kilometres times the $/per kilometre rate for hire and reward and for ancillary operators is applied to their respective sectoral vehicle populations in each vehicle class for that year. It should be noted that generally ancillary operator costs are lower than the for hire operators as labour need not be fully paid against an award, for example a farmer, and generally trucks are older and therefore the operating cost profiles will also have a lower capital component.

Table E.1: Vehicle Classes that will adopt Performance Based Standards	
1.	Rigid trucks: 2 axle: no trailer: GVM over 12.0 tonne
2.	Rigid trucks: 2 axle: with trailer: GCM to 42.5 tonne
3.	Rigid trucks: 3 axle: no trailer: GVM over 18.0 tonne
4.	Rigid trucks: 3 axle: with trailer: GCM over 42.5 tonne
5.	Rigid trucks: 4 axle: with trailer: GCM over 42.5 tonne
6.	Articulated trucks: single 3 axle trailer: 6 axle rig
7.	Super B-doubles
8.	B-triples
9.	A-doubles
10.	Articulated Buses **(Not considered here)**

This process is repeated by vehicle class, each year, with the costs being escalated by the adjusted by the expected transport cost escalation index. This was 3% which is slightly conservative as the last 10 year escalator has been 3.55% per annum for line-haul operations which will delivery the biggest PBS savings. Equation E1 reflects this process.

This process is continued for the 11 vehicle classes that have been targeted for PBS take-up, over the 20 year period 2001 to 2030. The vehicle operating costs are presented in Appendix B. The highest dollars per kilometre rates are not necessarily for the largest vehicles but can also be incurred by low, or very low, average kilometre vehicles.

Equation E1:

$$\$ \text{ Savings} = \sum_{PBSv} \sum_{n} \left[(\text{Kms saved}) * (\$/\text{km Orig Veh}) - \text{PBS Kms} * (\text{PBS } \$/\text{km} - \text{Orig Veh } \$/\text{km})\right]$$

The above equation suggests that there are kilometre savings in the original vehicle kilometres but this is offset somewhat by the extra cost of running PBS vehicles. This calculation is performed across each year from 2011 to 2020 and across all potential PBS vehicle types. The benefits were escalated but not discounted, which means they were a nominal value for the ten years examined.

Estimating the Safety Benefits of PBS

PBS vehicles are expected to save 1.65 billion kilometres for the period 2011 to 2030. If the crash rates per 100 million truck kilometres are applied to the respective vehicle types for the kilometre savings generated by PBS, then the number of fatal crashes and fatalities can be estimated. Table E.2 crash rate times the kilometre savings for rigid trucks and for articulated trucks respectively

Table E.2: Fatal Crash and Fatalities rates by vehicle type

	Fatal Crashes	Fatalities
Truck Type	**per 100m kms**	**per 100m kms**
Rigid Trucks	0.90	0.96
Articulated	2.09	2.55

Source: NTC, 2010

Table E.3: Fatal Crash and Fatalities Savings through PBS, 2011 to 2020

	PBS	Expected	Expected
	Kms Savings	**Fatal Crash**	**Fatalities**
PBS Rigids Trucks	182,243,719	1.640	1.74
PBS Articulated	1,465,925,297	30.646	37.38
Total		**32.27**	**39.09**

Source: Industrial Logistics Institute

In brief the 1.65 billion kilometres not travelled will, on face value, avoid slightly in excess of 39 lives to 2020. However, this is in all probability a conservative estimate based on the average crash rates for all articulated trucks. According to recent National Truck Insurance (NTI, 2011) data, B-doubles and potentially B-Triples are exhibiting lower crash rates than single articulated trucks, although their tonne-kilometre task has now passed that of the single semi-trailer.

In 2007 the Netherlands Ministry of Transport and Public Works estimated that their mini B-triple combinations, which had significant urban route access, would halve the fatal incidents of their double combinations. Although this was a forecast it would suggest that B-triple combinations, in conflict with perceptions, would be much safer vehicles than B-doubles. In fact this is one of the major arguments for PBS vehicles. The assessment criteria are in place to ensure that these vehicles are as safe as existing vehicles and in some cases safer than specific existing vehicles.

Equation E2:

PBS Fatality Savings = $\sum_{10}$ ((Annual Nominal Fatality benefit x $(1.03)^n$

Estimating the Environmental Benefits of PBS

For the purpose of this analysis only the greenhouse benefits are examined; the health cost savings from avoided air pollutants are calculated in Appendix C. By 2022 the majority of the PBS vehicles population will be Euro V or its next generation replacement technology (Euro VI and equivalents). This would also suggest that PM_{10} and NOx emissions would be lower than many of the older non-PBS vehicles in operation.

For the 10 modelled generic vehicle types that are likely to take-up PBS each group will generate kilometre savings. However, unlike a flat rate being applied to kilometre savings as is the case for crashes, each PBS group has a different fuel consumption rate to the non PBS vehicle(s) it replaces. Usually because of their extra carrying capacity for either mass or cubic operations, PBS vehicles will be slightly more fuel intensive than their non PBS counterparts. So the CO_2 saving is not just the saving in CO_2 by fewer kilometres, but this saving must be adjusted downwards by an increment as the PBS vehicle is a little thirstier than the non PBS vehicle(s) it replaces.

Equation E3

CO_2 (savings tonnes) = $\sum_{PBSv} \sum_{n}$ **[**(Kms saved)/100 x (Orig Veh L/100k) – (Kms saved/100*(PBS L/100k – Orig Veh L/100k)**]** x (2.68/1000)

The above equation states that the contribution of each class of PBS vehicle will generate savings through the annual reduction in kilometres, but this will be slightly offset by the higher fuel use for the PBS vehicle.

The net impact across the 10 simulated PBS vehicle classes was estimated at:

- 630 million litres of diesel savings from 2013 to 2022.

Table E.4: Annual Vehicle Growth Factors and Deflators 2008 to 2030	
B-double, A-double, B-triple growth rates p.a	**1.062**
Single Articulated Trucks growth rates p.a	**1.022**
Rigid Trucks growth rates p.a	**1.008**
Road Transport Cost Escalators	**1.03**
Cost of Life escalator	**1.03**
CO_2 market escalator	**1.07**

Analysing sensitivity of PBS Benefits

Three sensitivity options were calculated for policy comparison, expressed as low, median and high scenario sensitivities. (refer Table E.5 below)

Table E.5 Growth Assumptions for the Productivity Scenarios

Scenario Option	Description for 2013 - 2022
Low Growth Scenario	• A low 3.2% continued growth rate for vehicles above 60 tonnes GCM, • B-Triple uptake will constitute 30% of this growth, • Super B-Doubles will constitute 15% of this growth, • A-Doubles will constitute 2.5% of the growth.
Median Growth Scenario	• Adopting at 6.2% continued growth rate for vehicles above 60 tonnes GCM (Table 3.3), • B-Triple uptake will constitute 30% of this growth, • Super B-Doubles will constitute 15% of this growth, • A-Doubles will constitute 2.5% of the growth.
High Growth Scenario	• Adopting at 6.2% continued growth rate for vehicles above 60 tonnes GCM, • B-Triple uptake will constitute 40% of this growth, • Super B-Doubles will constitute 15% of this growth, • A-Doubles will constitute 2.5% of the growth.

The benefits from adopting high productivity technology are achieved through undertaking the specific vehicle task with less distance travelled, usually through towing higher capacity payloads.

Table E.7 presents the findings for the median scenario option for the ten years 2011 to 2020. The operational cost savings of newer 'high productivity vehicles' will deliver some 93% of the total savings involving operational, fatality and CO_2 benefits.

The fleet mix, from which the operation benefits are generated, involves rigid trucks through to B-Triples, which are Level-3 (referring to their access road classification) vehicles. The estimates are somewhat conservative as vehicle combinations such as BAB Quads and other Level-4 vehicles have not been modelled in this analysis.

Table E.6 New Vehicle High Productivity Benefits (Median Growth Scenario) 2013–2022		
Vehicle Type	Benefits ($ million)	% Benefits
B-Triples	$1,591.1	52.6%
Super B-Doubles	$334.7	11.0%
A-Doubles	$146.7	4.8%
Other Articulated Combinations	$201.7	6.7%
Rigid (Including Rigids with Trailers)	$536.5	19.0%
Articulated Buses	$4.1	0.1%
a. Sub-Total	**$2,814.8**	**93.0%**
b. Carbon Dioxide Costs	**$53.7**	**1.8%**
c. Fatality Savings	**$157.0**	**5.2%**
TOTAL	**$3025.5**	**100%**

The total number of lives saved range from 33.7 to 55.1 over the ten year period with a median scenario expectation of 39.1 lives saved. This is almost 4 lives per annum over the analysis period. Fuel savings would generate CO_2 savings from 1.4 million tonnes to 2.37 million tonnes. Kilometre savings are significant and range from savings of 1.4 to 2.3 billion kilometres in savings.

Table E.7 New Vehicle High Productivity Benefits (Low, Median, High Scenarios) 2013–2022		
Fatalities Saved	CO_2 (million tonnes)	Billion km Saved
Low 33.7	Low 1.44	Low 1.43
Med 39.1	Med 1.69	Med 1.65
High 55.1	High 2.37	High 2.27

The 10 year escalated benefits for the three modelled productivity scenarios are listed in Table E.8. The operational productivity is by far the major contributing factor in the three benefits of safety, Carbon Dioxide abatement and operations.

Over the decade from 2013 to 2022, under the three scenarios there would be a benefits range from $2.69 billion dollars for the low scenario adoption of new high productivity vehicle technology, to $3 billion dollars for the medium scenario, and $4 billion dollars for the high scenario. In all cases it is assumed that a national network for Level 3 vehicles exists and connects capital cities and major regional cities.

Table E.8 Impacts Growth Assumptions for the Productivity Scenarios

Year	Low				Medium				High			
	Safety	CO_2	Ops	Total	Safety	CO_2	Ops	Total	Safety	CO_2	Ops	Total
2011	11.8	3.3	219.0	**234.1**	13.7	3.9	245.6	**263.2**	19.3	5.5	330.3	**355.0**
2012	12.1	3.5	225.5	**241.2**	14.1	4.2	253.0	**271.2**	19.9	5.8	340.2	**365.9**
2013	12.5	3.8	232.3	**248.6**	14.5	4.4	260.5	**279.5**	20.5	6.3	350.4	**377.1**
2014	12.9	4.1	239.3	**256.2**	15.0	4.8	268.4	**288.1**	21.1	6.7	360.9	**388.7**
2015	13.3	4.3	246.5	**264.1**	15.4	5.1	276.4	**296.9**	21.7	7.2	371.7	**400.6**
2016	13.7	4.6	253.8	**272.2**	15.9	5.4	284.7	**306.0**	22.3	7.7	382.9	**412.9**
2017	14.1	5.0	261.5	**280.5**	16.4	5.8	293.2	**315.4**	23.0	8.2	394.4	**425.6**
2018	14.5	5.3	269.3	**289.1**	16.8	6.2	302.0	**325.1**	23.7	8.8	406.2	**438.7**
2019	14.9	5.7	277.4	**298.0**	17.3	6.7	311.1	**335.1**	24.4	9.4	418.4	**452.2**
2020	15.4	6.1	285.7	**307.2**	17.9	7.1	320.4	**345.4**	25.2	10.0	430.9	**466.1**
Total	135.2	45.7	2510.2	**2691.2**	157.0	53.7	2815.4	**3025.5**	221.0	75.5	3786.1	**4082.6**

Appendix F

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Appendix G

Abbreviations & glossary

Abbreviations

ABS	Australian Bureau of Statistics
ADR	Australian Design Rule
BAU	business as usual
BITRE	Bureau of Infrastructure, Transport and Regional Economics (formerly BTRE)
BTRE	Bureau of Transport and Regional Economics (now known as BITRE)
g	gram
g/bhp-h	grams per brake horsepower-hour
GCM	gross combination mass
GDP	gross domestic product
GFC	global financial crisis
GVM	gross vehicle mass
h	hour
HC	hydrocarbon
kg	kilogram
km	kilometre
kWh	kilowatt-hour
LDV	light duty vehicle
LNG	liquefied natural gas
NOx	nitrogen oxides
OBD	on-board diagnostics
OEM	original equipment manufacturer
PM	particulate matter
ppm	parts per million
R&D	research and development
t	tonne
TIC	Truck Industry Council
US	United States
US EPA	United States Environmental Protection Agency
YTD	year to date
>	greater than
<	less than
$m	million dollars

Glossary

ARTICULATED TRUCK	A heavy vehicle that is defined as having a 'fifth wheel' or turntable on the top of the chassis designed for hitching to a 'king pin' on semi-trailers or a combination of trailers. Note: rigid trucks that have towing hitches at the rear, for towing 'dog' or 'pig' trailers are not included in this classification.
AUSTRALIAN DESIGN RULE (ADR)	All new vehicles sold in Australia must comply with all of the applicable ADRs.
ADR 70/00	The ADR that introduced noxious emissions standards for heavy vehicles. Commonly referred to as Euro 1, which was one of the allowable standards. The US EPA 1991 and Japan 1994 standards were also permitted. Mandatory for new truck models on 1 Jan 1995, and all new trucks sold from 1 Jan 1996.
ADR 80/00	Replaced ADR 70/00. Commonly referred to as Euro 3, although US EPA 1998 (2000 Model Year) standard was also permitted. Mandatory for new truck models on 1 Jan 2002, and all new trucks sold from 1 Jan 2003.
ADR 80/01	Original replacement for ADR 80/00. Required compliance to Euro 4 or US EPA 2004 standard. Original timing: new truck models from 1 Jan 2007, all truck models from 1 Jan 2008. Was superseded by ADR 80/02 before 2008.
ADR 80/02	Superseded ADR 80/01, and included an update to the Euro 4 on-board diagnostic systems. Retained 1 Jan 2008 mandatory timing for all new trucks (some exemptions granted until 29 Jan 2008). Permitted Japanese New Long Term 2005 standard as an alternative, as well as US EPA 2004.
ADR 80/03	Replaced ADR 80/02. Commonly referred to as 'Euro5', although US EPA 2007 and Japan New Long Term 2005 (with on-board diagnostics) were alternative standards. Mandatory for new truck models on 1 Jan 2007, and all new trucks sold from 1 Jan 2008.

ADR 80/03 PLUS	TIC description for trucks and truck engines that significantly exceed the minimum requirements of ADR 80/03 by using alternative fuels (such as LNG, CNG or ethanol) or a hybrid system. Terminology used to differentiate from ADR 80/03 diesel engines.
BAR	A unit of pressure equal to 100 kilopascals, and roughly equal to the atmospheric pressure on Earth at sea level.
B-DOUBLE	A high productivity articulated vehicle used throughout Australia (on designated or restricted routes) since the mid-1990s. Consists of a prime mover towing two trailers linked by turntable and king pin couplings. The most common examples are 25–26 metres in overall length, and offer about 50% more productivity (in mass and volume) than a single semi-trailer.
B-TRIPLE	A high productivity articulated vehicle on trial in designated permit routes or road train routes. Consists of a prime mover towing three trailers linked by turntable and king pin couplings. The most common examples are 34–36 metres in overall length, and offer about 30% more productivity (in mass and volume) than a B-double. The NTC is developing a modular B-triple concept for use nationally which uses existing prime movers and trailer parts from the common 26 m B-double combination.
CARBON DIOXIDE (CO_2)	The primary gas of concern attributed to global warming and climate change.
COMPRESSED NATURAL GAS (CNG)	A promising alternative fuel for light and medium duty trucks. Consists mainly of methane gas, compressed to about 200 bar on board the vehicle.
EURO 1 – 6	Refers to the various stages of vehicle exhaust emissions standards developed for the European markets.
FREIGHT TASK	The combined requirement for freight movements across a geographic area. Unless specified, includes all modes such as rail, sea air and road freight.
FUEL TAX CREDIT	A reimbursement of part of the fuel excise paid by operators of on-road heavy vehicles above 4500 kg GVM. From 1 July 2011, the fuel tax credit received is 15.054 cents per litre of diesel, and is adjusted annually according to changes in the road user charge.

GLOBAL FINANCIAL CRISIS (GFC)	Refers to the world economic situation that occurred in the second half of 2008, and the subsequent consequences.
GRAMS PER BRAKE HORSEPOWER-HOUR	A measure of exhaust tailpipe emissions from an engine in relation to time and the power produced. The US market typically refers to power in brake horsepower.
GRAMS PER KILOWATT-HOUR	A measure of exhaust tailpipe emissions from an engine in relation to time and the power produced. This is the international unit, using metric or SI units.
GROSS COMBINED MASS (GCM)	Refers to the maximum mass of the whole vehicle, including any trailers attached, measured where the tyres contact the road.
GROSS VEHICLE MASS (GVM)	Refers to the total mass of the vehicle (not including trailers), measured at point of contact with the road.
HEAVY COMMERCIAL VEHICLE	Equivalent to a truck (in Australian terminology). Refers to commercial vehicles with a GVM greater than 3500 kg.
HEAVY DUTY TRUCK	(1) All trucks with three or more axles, and (2) vehicles with a GVM greater than 8000 kg and a GCM greater than 39,000 kg
HEAVY RIGID TRUCK	ABS definition: Rigid trucks with GVM > 4.5 t.
HEAVY VEHICLE	Equivalent to a truck (or bus in Australian terminology). Refers to vehicles with a GVM greater than 3500 kg. See also 'truck', 'heavy commercial vehicle'.
HYBRID SYSTEM	A drive system which propels the vehicle through a combination of two or more propulsion systems. In trucks, this is typically a combination of electric motor and diesel engine, although other combinations are possible.
HYDROCARBON (HC)	A noxious pollutant controlled by exhaust emissions standards such as ADR 80/03.
LIGHT COMMERCIAL VEHICLE	Refers to all commercial vehicles with a GVM less than or equal to 3500 kg. Includes many sports utility vehicles and crew cab utilities. Sometimes referred to confusingly as 'light trucks'.
LIGHT DUTY TRUCK	As defined in T-Mark market data. All trucks with a GVM between 3501 kg and 8000 kg inclusive.

LIGHT DUTY VAN SEGMENT	As defined in T-Mark market data. All van-bodied vehicles with a GVM between 3501 kg and 8000 kg inclusive. Often confused with light commercial vans, which usually have a GVM < 3500 kg.
LIGHT RIGID TRUCK	ABS definition: Trucks with a GVM of between 3501 kg and 4500 kg inclusive. This is also the category which can still be driven on a car driver's license in Australia.
LIGHT VEHICLE	Vehicles with a GVM < 3500 kg.
LIQUEFIED NATURAL GAS (LNG)	A promising alternative fuel for heavy trucks in some applications. Requires methane to be cooled initially to –161°C.
MEDIUM DUTY TRUCK	As defined in T-Mark market data. All trucks with a GVM > 8000 kg, and a GCM of < 39,000 kg.
NITROGEN OXIDES (NOx)	Refers to various nitrogen-based pollutants controlled by exhaust emissions standards such as ADR 80/03. A key contributor to acid rain, especially in urban areas.
NON-FREIGHT CARRYING TRUCK	Vehicles fitted with special purpose equipment, and having little or no goods carrying capacity (e.g. ambulances, cherry pickers, fire and emergency vehicles, service vehicles, tow trucks).
ON-BOARD DIAGNOSTICS (OBD)	On-board diagnostics system fitted to trucks to detect gas and pollutant levels at various stages of the combustion process.
PANTECH	Short for 'Pantechnicon', a term used to describe fixed-side van type bodies on trucks and trailers. The name is of British origin, referring to a brand of horse-drawn furniture trailer.
PARTICULATE MATTER (PM)	A noxious pollutant controlled by exhaust emissions standards such as ADR 80/03. A key contributor to asthma and other respiratory issues, especially in urban areas.
PERFORMANCE BASED STANDARDS	An Australian initiative that allows some departure from the typical prescriptive standards for designing and building a heavy vehicle, through proving that a new design can meet levels of performance. Has the potential to increase productivity and safety levels simultaneously. See breakout box on page 5.

PRE-1995 (or PRE-1996) TRUCKS	The group of trucks identified by TIC that were built before engines were required to comply with exhaust emissions standards such as ADR 70/00. These trucks were also built before many of today's safety features were available.
PRIME MOVER	The front component of an articulated vehicle. Contains the driver, engine and 'fifth wheel' or turntable for hitching to the semi-trailer or combination of trailers.
RURAL AREAS	Defined for this analysis as those postcodes **outside** the greater metropolitan areas of Australian capital cities and major regional centres (> 200,000 people).
T-MARK	TIC's truck market data collection and report distribution service. Collects and compiles all on-road trucks sold in Australia, and provides clients with standard and customised analysis reports.
TRUCK	(Australian Definition). A commercial vehicle with a GVM > 3500 kg. See also 'heavy commercial vehicle'.
URBAN AREAS	Defined for this analysis as those postcodes **inside** the greater metropolitan areas of Australian capital cities and major regional cities (> 200,000 people).
US EPA 94, 98, 04, 07, 10	United States Environmental Protection Agency exhaust emissions standards for the year identified.