An initiative of the

South Australian Freight Council

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Performing an Environmental Benchmark

How To Guide for the Transport and Logistics Industry

What is an Environmental Benchmark

Benchmarking is the process of improving performance by identifying, understanding, analysing and implementing best practice processes discovered through analysis of one's peers. Benchmarking the environmental performance of your business is very useful in comparing your practises to other organisations and in helping to identify opportunities that can increase the energy efficiency of your business. An environmental benchmark for the transport and logistics industry may catalogue all processes that spend fuel or electricity but may also include other areas of environmental interest such as a company's waste and water usage, for example.

The amount of energy used in an identified process should be carefully calculated (e.g. the amount of diesel needed to run a heavy vehicle for a year) and compared to an appropriate industry leading organisation where that information is available.

What Processes Should I Benchmark ?

The first thing to consider before starting an Environmental Benchmark is deciding on what areas to benchmark. This will be called your "Performance Metric". Most benchmarks use an output or activity to analyse. For example in shipping this may be the amount of quantities shipped, or in road transport the amount of kilometres travelled. In the Road Freight industry the more popular used environmental performance metric is Emissions per Tonne Kilometre, and is usually referenced as grams per tonne kilometre. This is a figure that describes the average emissions your business produces in moving one tonne of freight one kilometre.

In warehousing the most common environmental performance metric is emissions per square metre. Emissions from warehousing would likely be calculated from purchased electricity and applied against your facility size.

While a good environmental benchmark uses data from organisations that have already made significant strides in reducing their emissions their data may not be publicly available to benchmark against. Where this is the case it is still acceptable to utilise the median values collected from either surveying suppliers or national averages.

Benefits of Benchmarking

Comparing your organisation to other organisations in terms of environmental performance not only illustrates how well you are performing in comparison but it also illustrates potential opportunities for your organisation to increase fuel, electricity and operational efficiency. This will not only identify ways to reduce your emissions, it may also highlight ways to reduce expenditure and increase profit.

For example, a company haven undertaken an environmental benchmark on their trucking fleet may discover they produce significantly more emissions per tonne kilometre than a competitor. By investigating this further they may find their competition undertakes a variety of measures that helps reduce their emissions and bills such as utilising more aerodynamical retrofits, use of wider tyres, use of alternative fuels in their trucking fleet and eco-driver training for their driving staff.

Identifying an Organisation to Benchmark

Figures on emissions per tonne kilometre in a business can be produced knowing the total cargo your fleet carried in a year, the amount of total kilometres travelled by your fleet and by calculating the amount of emissions produced from the amount of diesel used in the year. It is more difficult to benchmark these figures against industry leaders as much of the data needed to figure their emissions per tonne kilometre remains confidential. It should be noted though that certain figures can be estimated by comparing to the national average, figures which are available.

Furthermore some operators across their business units don't maintain sufficiently the records to provide correct tonnage data. In this scenario it may be useful to just use emissions per kilometre as your performance metric.

Having said this, when selecting a leading organisation to benchmark against it will likely help selecting an organisation that makes available much of their data publicly. This may take the form of a large publicly limited company that releases certain data each year to its shareholders or other organisations that contribute publicly available environmental reports to government or NGO bodies either voluntarily or as a legislative requirement.

Performing the Benchmark

The following will help you benchmark your performance against one of Australia's two leading companies (in terms of market share and environmental performance) for tonnes per kilometre travelled and emissions per square metre in warehousing.

Emissions per Kilometre Tonne are usually represented as grams/tkm. To calculate your fleet's emissions per kilometre tonne we need to know three figures.

- Kilometres
- Emissions
- Tonnage

Kilometres

Kilometres can be figured out by knowing the amount of kilometres travelled in one year for each of your vehicles (or one type if analysing only a particular type of truck). This requires detailed data collection by an organisation but should be able to be calculated without any great difficulty for the majority of road operators.

Emissions

Emissions are calculated by knowing the amount of diesel your entire fleet burned in a year. Once you have this figure multiply this by 2.6 to discover the amount of emissions in kilograms you produced in a year. Diesel for every 1 litre burned produces 2.6kg of CO2.

Emissions (CO2 kg)

Litres of Fuel used ____________

Multiplied by

2.6 (CO2 emissions from litre of diesel) ____________

Equals

Emissions (CO2 kg) ____________

Tonnage

Tonnage can often be harder to identify, even a lot of Australia's biggest companies don't have sufficient data to correctly identify this figure. A benchmarking organisation needs to identify not only how much freight it handled in one year, but what the average weight this freight was per trip undertaken by its road fleet.

If you know your total tonnage divide this by the total amount of trips undertaken to calculate your average tonnage per trip. Multiplying this figure by your total kilometres will let you derive your total tonne kilometre (tkm) for the year.

Where tonnage can be figured out combine your three figures to calculate your emissions per kilometre tonne.

Emissions ÷ (Average Tonnes per trip x Kilometres)
= Emissions per Tonne Kilometre

Where tonnage cannot be calculated it is best to benchmark for emissions per kilometre. To do this calculate:

Emissions ÷ Kilometres
= Emissions per Kilometre

The 'Yardstick' - National Average

The Australian Bureau of Statistics maintains detailed records on motor vehicles in the country. From their spreadsheets or reports (updated regularly) an organisation can identify the amount of freight vehicles, the total kilometres travelled and the average fuel consumption per 100km across the nation.

Please Note: Heavy Vehicles are divided in their reports into Rigid and Articulated trucks. Articulated trucks have a much lower emissions output per tonne kilometre, so any organisation that operates more or less articulated trucks over rigid trucks than the national average may have skewed results (5 rigid trucks for every 1 articulated truck). However for example you may still benchmark just your rigid fleet against the national rigid fleet to accurately benchmark against the national average.

	Industry	
	Rigid	Articulated
Total Kilometres Travelled	9,234,315,000	7,363,310,000
Total Tonne-Kilometres	35,314,006,000	151,003,000,000
Average Tonne Kilometres per truck	92,300	1,900,000
Number of Trucks	382,600	79,475
Average Fuel Consumption per 100km	30	58

Source: Australian Bureau of Statistics (2014)

The above table represents the latest information available from the ABS (Cat. No. 9208.0). From the data we can calculate the amount of diesel used by all rigid and articulated trucks in the surveyed year by dividing the total kilometres travelled by the figure for the average fuel consumtion.(**2,770,294,500 litres for Rigid Trucks** and 4**,270,719,800 for Articulated Trucks**).
Remember to multiply this by 2.6 to get the emissions produced in kilograms. (1 litre of diesel produces 2.6kg of Emissions)

This then allows us to fully calculate the emissions per tonne kilometre:

Emissions ÷ (Average Tonnes per trip x Kilometres)
= Emissions per Tonne Kilometre

Rigid Trucks

7202,765,700,000 g ÷ 35,314,006,000 (tonne kilometres)
= 203g per tonne kilometre

Articulated Trucks

11,103,871,480,000 g ÷ 151,003,000,000 (tonne kilometres)
= 73g per tonne kilometre

These two figures represent the average emissions per tonne kilometre transported throughout Australia and is a useful metric to measure your organisation against.

Emissions per Kilometre

This would also represent **780g per kilometre for Rigid Trucks** and **1,508g per kilometre for Articulated Trucks**.

Comparison Organisation

As mentioned previously there is unlikely any road transport operator that would provide the necessary data for a 100% accurate benchmark study in its entirety either for business confidentiality reasons or simply because they don't know themselves.

However often we can gather certain data and make educated assumptions by relating it to the national average to give us a good guideline.

Sample Organisation #1

The organisation we are to compare against is one of Australia's leading trucking companies. The company through a publicly available environmental report revealed that in 2015 it is likely to produce 1.04 tonnes of CO_2 per every 1000km. This is a reduction of energy intensity of 50% since 2007 and is a useful metric to utilise.

Most of the information available for our Sample Company comes from 2012/2013 so we must try and use metrics for this year where available. The company has in separate reports noted that in 2012/2013 they produced 216,559 tonnes of CO_2 emissions from their use of diesel. We know they average 1.04 tonnes of CO_2 per every 1000km travelled in 2015 but they would likely have produced 1.25 tonnes of CO_2 for every 1000km travelled in 2012/2013 according to their projections. This allows us to calculate that the company's fleet travelled 173,247,000 km in the year (divide total emissions by average emissions per 1000km).

Now unfortunately no figures are available on the amount of cargo the company carried in a year (or any other major Australian operator for that matter). But we can estimate with the use of national averages. By dividing their emissions by 2.6 we can calculate the amount of fuel they used in a year and compare this to the national average. It is likely the company used 83,291,923 litres of diesel a year. The total amount of diesel used throughout Australian rigid and articulated trucks was 6,909,000,000 litres. This would indicate our sample company represents 1.2% of the national heavy vehicle freight market. If we apply this figure to the known national total tonne-kilometres we can estimate that our Sample Company travels 2,316,296,000 tonnes kilometres a year.

Please note these are estimates and again can be skewed significantly by the percentage of articulated trucks to rigid trucks if their average is significantly more or less than the 1:5 national ratio as the data for our sample company does not let us know the percentage of their fleet between articulated and rigid trucks.

Estimated Emissions per Tonne Kilometre

Emissions ÷ (Tonnes x Kilometres) = Emissions per Tonne Kilometre

216,559,000,000 g ÷ (2,316,296,000) = Emissions per Tonne Kilometre

93g* = Emissions per Tonne Kilometre

*This figure represents an estimate if the Sample Company used a sample 1:5 split between articulated and rigid trucks.

If the company ran a 1:2 split (1 articulated truck to 2 rigid trucks) their emissions per tonne kilometre would likely be around 84g per tonne kilometre. If the company ran a 1:10 split their emissions per tonne kilometre would likely be around 115g per tonne kilometre.

If the company ran a 1:10 split their emissions per tonne kilometre would likely be around 115g per tonne kilometre.

What we Know

Produced 216,559 tonnes of CO_2 emissions in FY2013

Average 1.04 tonnes of CO_2 for every 1000km travelled (likely 1.25 tonnes in FY13)

What we can Calculate

Company's fleet travelled 173,247,000 km in FY13

(produced 1.25tonnes of CO_2 for every 1000km travelled)

Used 83,291,923 litres of diesel in FY13

(Divide total emissions by 2.6 (kg CO_2) to calculate figure)

What we can Estimate

Company enjoys 1.2% of the heavy vehicle road freight market

(% of national fuel used over company's annual fuel used)

Travelled some 2,316,296,000 tonne kilometres in FY13.

(1.2% of national tonne kilometres)

Emissions per Tonne Kilometre

93

Grams per Tonne Kilometre

Warehousing Emissions per Square Metre

Warehouse emissions per square metre are usually represented as grams per square metre (g/m^2). To calculate your warehouse emissions per square metre you need to know the:

- Size of the area to be analysed
- Emissions produced over a year in that space

This is a relatively straightforward benchmark to perform. Total emissions can be figured out by calculating the energy purchased in your electricity bill over the course of a year for the analysed building. Then you simply divide total emissions by the area in metre^2 of your office, depot or warehouse.

Emissions / Area
= Emissions per Square Metre

It is important to note that different states have different quantities of emissions per kWh. To calculate the amount of emissions produced depends on the state the emissions were produced in. Greenhouse gas emissions from electricity vary from state to state because different fuels are used to generate it. The emissions produced per kWh are outlined in the below graph.

State	kg CO2-e/kWh
ACT	0.88
NSW	0.88
QLD	0.86
SA	0.65
TAS	0.26
VIC	1.19
WA	0.82
NT	0.71

Source: National Greenhouse Accounts (2013)

The 'Yardstick' - National Average

Unfortunately no figures could be found that would allow us to calculate the national average emissions per square metre for Australian warehouses. No two figures for ***Average Size*** or ***Average Emissions*** could be correlated to each other.

The Financial Times in 2014 states that the average size of a warehouse in Australia is now 14,000 m^2. However no mention of the average energy consumption of a warehouse could be found to sufficiently calculate emissions per square metre.

The most in depth study we could find to provide data on warehousing was a report by Energetics commissioned by the Department of Climate Change and Energy Efficiency (2012). The report used a large sample of certain commercial sector and small/medium business buildings to provide calculated estimates of the energy efficiency opportunities in terms of cost and payback periods for the buildings.

Out of a sample of 35 non-refrigerated warehouses they found the average electricity consumption of their sample size to be 3,161mWh per annum. While we can assume that the average warehouse size is 14,000m^2 throughout Australia, Energetics provide no details on the average size of their warehouse sample size. The sample size is too small to be a true indicate of the national average and therefore we can't use these two sets of figures to estimate the average emissions per square metre.

The closest non-Australian figure we could find was a US study that said the average emissions produced by a non-refrigerated warehouse was 6.1 kWh per square foot, or 0.57 kWh per square metre. The same level of energy consumption in Australia would likely produce 456,000 grams annually per square metre of emissions.

Similarly it found refrigerated warehouses to average 24.9 kWh per square foot or 2.3 kWh per square metre resulting in a likely 1,840,000 grams per square metre of emissions in Australia.

Comparison Organisation

Sample Organisation #2

Figures to calculate the emissions per square metre for our second organisation require less estimate work than the first example in discovering emissions per tonne kilometre. Figures are available for their total area of warehousing and total emissions across many years, but figures for both in the same year can only be found for 2010, so we must use this as our baseline.

In 2010 the sample organisation oversaw 3 million square metres of warehousing space. They further made public that they produced 533,000 tonnes of emissions between fuel and warehousing. Though it is not disclosed for 2010 but in later years the company outlined that 14% of their emissions are created from warehousing. Assuming this to be the case for 2010, it is likely the company produced 77,420 tonnes of emissions through warehousing activities alone.

Therefore we can estimate their Emissions per Square Metre to be

Emissions	/	Area	=	Emissions per Square Metre
77,420,000,000 g	/	3,000,000 m2	=	25,806 grams per Square Metre

They later reported by end of the 2011/12 financial year they had reduced their emission intensity by 5.15% meaning this figure by FY 13 should be roughly **24,476 grams per square metre.**

Note: It must be remembered that many of the larger operators have more automated premises which increases energy usage but require less staff.

It therefore is important to undertake an 'Emissions per Hour of Employment' analysis to truly understand your relation to your benchmarked competitor.

To do this:

Total Emissions / Total Employment Hours (for a given year) = Emissions per Hour of Employment

What we Know

Produced 553,000 tonnes of CO2 emissions in FY2013

14% of their emissions are produced by electricity for warehousing

Had a total 3,000,000 m2 of warehousing floor space in 2010. (Has since expanded on this)

What we can Calculate

Company produced 77,420 tonnes of emissions through warehousing activities

(total emissions divided by 14%)

Company produced 25,806 grams per square metre in FY 10 but likely reduced this to 24,476 g/m^2 by FY13.

(Company reduced their emissions by 5.15% between 2011 and 2013)

Emissions per Metre^2 of Warehousing Space

25,806

Grams per Metre^2

Strategies to Reduce your Emissions

By now you should be able to measure your emissions produced in comparison to two of Australia's leading Transport and Logistics operators and the national average. After completing the benchmark If you fare worse off than our two "yardsticks" or didn't meet the national averages perhaps you might consider adopting some proven strategies to reduce your operational emissions.

The Sustainable Freight website (www.sustainablefreight.com.au) includes many case studies and fact sheets that should provide fuel for thought on reducing your emissions.

Sample Organisation #1

- Reduced their emission intensity from 25GJ/1000km in 2006 to 18GJ/1000km in 2009.
- They are likely to meet their target of 12.5GJ/1000km by 2016.
- Introduced Eco-Driving Training resulted in a 14% energy saving through using less fuel.
- Improve Aerodynamic Vehicle Design – 0.75%. This includes the purchase of new, more efficient vehicles as well as the retrofitting of existing vehicles.
- Improve Vehicle Utilisation - 3%. This includes the strategy of utilising more efficient, larger freight vehicles where possible.

Our two sample organisations have undertaken hundreds of measures to reduce their emissions. Each measure may not be applicable to your business but listed below is some key strategies on how they have or intend to further reduce their emissions.

Sample Organisation #2

- Reduced their emission intensity by 4.3% in two years with a plan on reducing their emission intensity by 20% by 2020 from 2010 levels.
- 150 energy efficiency/reduction initiatives
- Plans to better source and utilise more 20% biodiesel in their road transport fleet – this has the ability to reduce emissions by 20%.
- Saves 1,040 tonnes of CO2 per year by speed limiting their triple road trains from 100kph to 90kph.
- Warehouse light sensors – turns on light when the light intensity falls below 165 lux. Decreased energy consumption in one warehouse by 31%.

Questions the Benchmark Should Answer

After conducting your environmental benchmark and identifying the measures your peers are currently using to reduce their emissions you may have identified some strategies that may help your company reduce your emissions also.

While some measures may reduce emissions (and costs) more so than others they may be too costly to introduce or deemed to not have a quick enough payback periods. It therefore is important at this stage to prioritise measures according to your needs or resources.

Some questions to ask that will help with this process include:

- What measures will produce the greatest environmental benefit, and/or cost reduction?
- What measures will be the most cost effective to produce?
- What, if at all any, will produce the greatest disturbance to the everyday running of your business?

The next important step is to demonstrate your findings to management and come up with a Business Plan that will

(cont.)

allow you to put your identified measures into practice.

A business case is a cost-benefit analysis that takes into account the upfront costs and benefits as well as the costs and benefits over the lifetime of an investment. It describes the work to be done and what the project will deliver if funding is approved.

At this stage the business case will have identified the best opportunities for achieving savings, which should likely include free or low-cost opportunities, but also the most cost-effective opportunities. Some initiatives will have longer payback periods than others, but some businesses may need to recover the original capital costs quicker than others so it is important to know the appropriate payback periods. The business case will help you your company improve its environmental performance in relation to its competitors.

There are many online templates available to help you develop your business case that can provide great assistance. For example EnergyCut.info has made available from their website a template to help develop your business case.

SustainableFreight.com.au

The Sustainable Freight initiative is being undertaken in a wider context of heightened national interest in sustainable practises.

While there is much debate about the impacts that transport and logistics is having on the environment and whether these impacts could or should be mitigated, it is clear that the environment is increasingly becoming part of the ongoing transport and logistics narrative.

The South Australian Freight Council developed the Sustainable Freight website to inform the Transport and Logistics Industry on the energy saving opportunities available to their businesses.

For more information see www.sustainablefreight.com.au .

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