Comparative Assessment of the Environmental Performance of Small Engines

Marine Outboards and Personal Watercraft

Prepared for

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and

Vehicle Design and Research P/L

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Industry:	Yamaha Motors Australia
	Honda Marine
	Mercury Marine
	Lakeside Marine Pty Ltd
	Haines Suzuki Marine
	Adelaide City Marine
	Kawasaki Motors Pty Ltd
Associations:	Eco Friendly Fishing Association
	Australian Marine Industry Federation
	Boating Industry Association
Government:	Department of the Environment and Water Resources
	NSW Department of Environment and Conservation
	Environment Protection Authority Victoria
	The Northern Territory Department of Natural Resources, Environment and The Arts.

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Abbreviations and Glossary

2c	Two stroke with carburettor
2di	Two stroke with direct fuel injection
2i	Two stroke with pre-chamber fuel injection
4c	Four stroke with carburettor
4i	Four stroke with fuel injection (includes direct injection)
ABS	Australian Bureau of Statistics
Air NEPM	National Environment Protection Measure for ambient air quality
BIA	Boating Industry Association
BTEX	Benzene, toluene, ethylbenzene, xylenes - carcinogenic or mutagenic aromatic hydrocarbons formed through the combustion process
CARB	Californian Air Resources Board
CBA	Cost Benefit Analysis
CO	Carbon Monoxide
DEC	Department of Environment and Conservation
di	Direct Injection
EFFA	Eco Friendly Fishing Association
efi	Electronic fuel injection
HCs	Hydrocarbons –most are VOCS and, in relation to small engines, terms are often used interchangeably
hp	Horsepower, 1hp = 0.746kW
ISO	International Standards Organization
kW	Kilowatts
MEPS	Minimum Energy Performance Standards
MOU	Memorandum of Understanding
NATA	National Association of Testing Authorities
NGOs	Non Government Organisations
NOx	Oxides of Nitrogen
NPI	National Pollutant Inventory
NSW GMR	New South Wales Greater Metropolitan Region which includes Sydney, Lower Hunter and Illawarra regions, encompassing the major metropolitan centres of Sydney, Newcastle and Wollongong. Population 4.7 million.
OEDA	Outboard Engine Distributors Association
PM10	Particles with an aerodynamic diameter of 2.5 micrometres or less
PM2.5	Particles with an aerodynamic diameter of 10 micrometres or less
Port Phillip Region	Region in Victoria that includes Greater Melbourne and Greater Geelong. It is defined in Victorian environment protection policies. Population 3.4 million (1996)
PWC	Personal Watercraft
SE Qld	South East Queensland is a region that covers the area from the Gold Coast to the Sunshine Coast and west to Toowoomba. It includes Brisbane and its suburbs and has a population of approximately 2.3 million people
VELS	Voluntary Emissions Labelling Scheme
VOCs	Volatile Organic Compounds
WELS	Water Appliances: Water Efficiency Labelling and Standards Scheme

Executive Summary

Background

This report sets out the results of a project to compare and benchmark emissions from outboard (petrol) engines and personal watercraft that were available for sale in Australia during 2006.

Small engines, such as conventional two stroke engines used in marine outboard and personal watercraft (PWC), are high polluters relative to their engine size and usage. These small engines emit volatile organic compounds (VOCs) and oxides of nitrogen (NOx) which contribute to ozone (photochemical smog) formation in summer. They also emit particles, carbon monoxide (CO) and a range of water and air toxics such as benzene.

The United States, California and Europe regulate exhaust emissions from marine engines - the USA has had these in place since 1998. Canada, which has an interim Memorandum of Understanding with the industry, is preparing to introduce outboard emissions regulations. There are no Australian regulations or standards that limit air and water emissions from marine outboard engines. However, as all marine engines sold in Australia are imported, many do comply with emission standards applicable to the country of origin or other regulated markets. On the other hand overseas manufacturers produce high emissions marine outboard engines to sell in unregulated markets such as Australia.

As substantial power is required to move small boats through water even the better performing small engines that comply with overseas emission limits emit far greater quantities of pollutants per hour than typical modern car engines. For example one hour of operation of a boat that complies with US 2006 emission standards (i.e. has a relatively clean engine) produces the same pollution as about fifty cars operated at a similar speed. Older style outboard engines that do not comply with US EPA 2006 limits are likely to emit around ten times the amount of pollution compared to conforming engines.

Estimates from the National Pollutant Inventory suggest that marine outboard engines contribute approximately 2.5 percent of the VOCs emitted into Australian urban airsheds from anthropogenic sources. Recently released emissions inventory data from NSW's Department of Environment and Conservation, indicates that the contribution during summer weekends, periods when conditions are particularly conducive to ozone formation, is around 9 percent.

National Environment Protection (Ambient Air Quality) Measure (Air NEPM) ozone standards are being reviewed and based on current human health evidence the argument appears to be strengthening for tighter ozone standards. Sydney's Greater Metropolitan Region (GMR) annually records exceedances of the current Air NEPM ozone standards while other jurisdictions meet, or are close to meeting the current ozone standards. Should a stricter standard or an eight-hour standard consistent with international standards/guidelines be adopted, achievability of Air NEPM ozone standards or goals could become an issue for some of the other major urban airsheds

and additional strategies to reduce precursor emissions from as yet uncontrolled sources such as outboard engines may be required.

Overseas Regulations

California and the USA regulate the combined emissions of VOCs and NOx (expressed as HC + NOx) and reports carbon monoxide (CO) emissions and have the same limits for two and four stroke outboard petrol engines.

The USA introduced exhaust emission limits for marine outboard engines in 1998 and these became progressively stricter up to 2006. California's standards, introduced in 2001, encourage early adoption of stricter emissions standards through a consumer star labelling program (Tiers 1 to 4). The USA 2006 limit is the same as the California Tier 1 standard while the Californian Tier 3 standard is more than 60% lower than the USA 2006. No engines can currently meet CARB Tier 4 limits.

The Europeans separately regulate VOCs (expressed as hydrocarbon (HC), NOx and CO emissions and have separate limits for two and four stroke petrol engines.

Figure E1 compares the US, Californian (CARB) and European emission limits for a 5 kilowatt outboard engine and a 40 kilowatt engine.

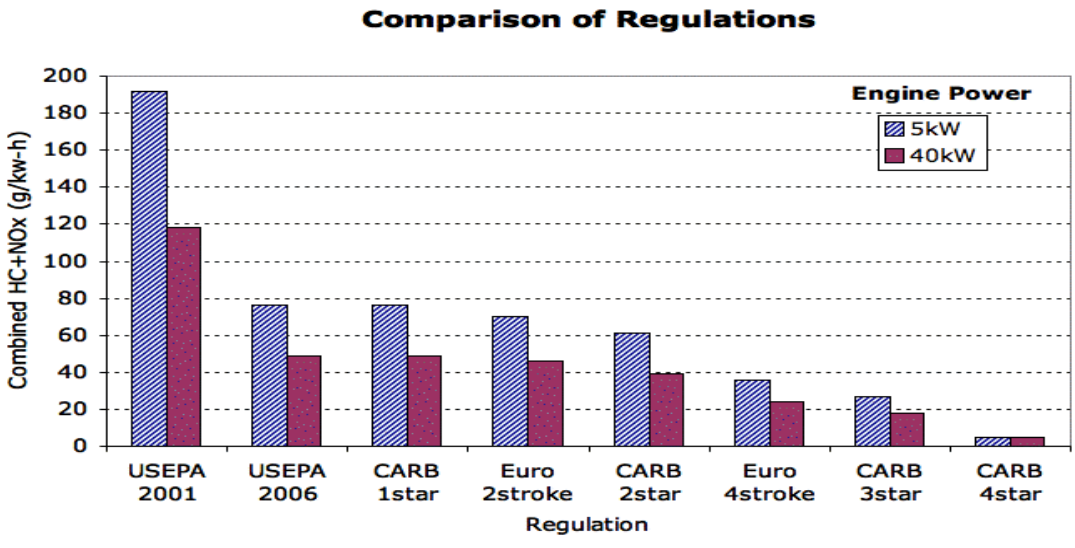

Figure E1: Comparison of Regulations

The Australian Market

There are no manufacturing or assembly operations of outboard engines in Australia. The six major outboard manufacturers in the world are represented in Australia and account for 98% of Australian sales of outboard engines. These are Yamaha (Japan), Mercury/ Mariner (USA), BRP (USA, brand names - Evinrude E-TEC, Johnson and Seadoo), Honda (Japan), Suzuki (Japan) and Tohatsu (Japan). All of the Australian operations of these manufacturers are marketing and distribution companies and all are members of the Outboard Engine Distributors Australia (OEDA). Sail/Osprey (China), not an OEDA member, is a relatively new importer of outboard engines and has a minor market share here.

Two stroke carburettor engines represented 63 per cent of the 47,937 outboard engines sold in Australia in 2005. Due to their inherent design features, these two stroke carburettor engines used in boats and personal watercraft, emit proportionally more volatile organic compounds (VOCs) and other air pollutants than the comparatively more expensive but more fuel efficient direct injection two stroke and four stroke engines. No two stroke carburettor engine sold in Australia meets any current United States or European emission standard (a small number meet less stringent superseded regulations).

The following figure compares 2005 sales of outboard engines in Australia by technology type with sales in other countries.

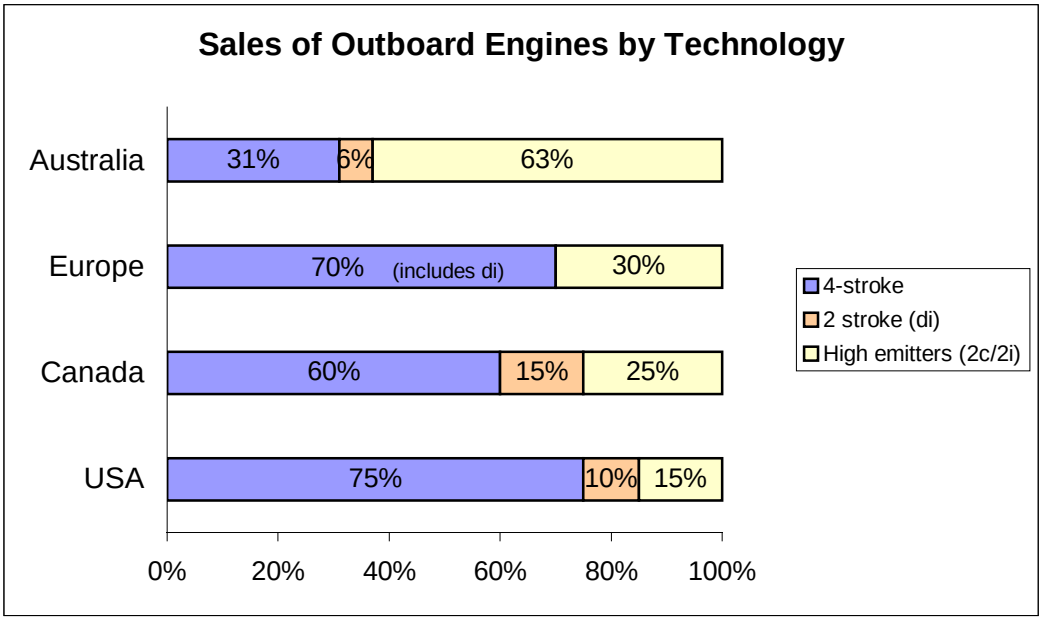

Figure E2: Sales of Outboard Engines by Technology

In Australia households account for 65-80% of boat sales with the remaining 20-35% being sold to organisations such as the police, customs, search and rescue, lifesaving clubs and coastal patrols or to commercial operators.

It is estimated that there are 735,000 registered powered boats and personal watercraft in Australia. While an exact percentage is difficult to determine, based in NSW 2003 data, up to 90% of registered powered boats could be two strokes. (2c/2i high emitters).

Voluntary Emissions Labelling Scheme (VELS) for Australia

In response to this project, the industry association, OEDA, whose members represent more than 98% of all outboard engines sold in Australia, has developed a labelling scheme which all its members have agreed to implement. The scheme known as the Voluntary Emissions Labelling Scheme (VELS) was launched at the Brisbane Boat Show in September 2006 and commenced on 1 January 2007. VELS has many similarities to the California tiered labelling approach but it continues to allow the

sale of high emitting engines (with a ‘no star – high emission’ label) and the upper limit for a ‘one star’ outboard engine is significantly higher than the 2001 USA limit.

OEDA has implemented a VELS promotional program which includes marketing the emissions labels to the media and to dealers, a hotline for general dealer enquiries, posters and other point of sale material, a web database and other program support activities. VELS embodies the attributes of other well structured labelling schemes by including monitoring systems, dispute resolution procedures and an audited review after 12 months.

The attractiveness of the OEDA VELS scheme is that it provides comparable information for Australian consumers which overcomes the difficulty the Australian consumers have had in being able to assess the relative environmental merits of otherwise similar outboards. Until VELS the six major importers labelled their products with a mix of EU, USA, Californian, Japan labels or had no emissions label.

What is not currently clear is how success of VELS will be measured. The most obvious success criteria would be a targeted reduction in the percentage of "high emission” (zero star and one star) outboard engines sold.

Measures to Increase Sales of Low Emission Outboard Engines

There is a range of options that could be considered for reducing emissions from the outboard engines in Australia. These include:

1. Maintaining the Status Quo
2. Government – Industry Partnership Program
3. Quasi regulation
4. Co-regulation
5. Regulations based on either a simple benchmark or tiered benchmarks

Based on preliminary analysis of these options, including an assessment of the strengths and weaknesses of each, the optimum approach is likely to be either a partnership program or co-regulation. Under both these approaches reductions targets can be set while allowing industry flexibility in how it reduces the sales of high emission outboard engines. Both these approaches are also comparatively low cost. As a next step it is important a negotiated reduction target for high emitting engines be determined. Discussion between government and industry can determine which of these approaches is the most practical. If these approaches prove unworkable or unable to achieve desired emissions reductions over time alternative options would need to be considered.

1. Introduction

This report sets out the results of a project to compare and benchmark emissions from outboard (petrol) engines and personal watercraft that were available for sale in Australia during 2006. A range of possible options for managing outboard engine emissions are discussed ranging from consumer guidelines for selecting low emission engines to regulatory controls on emissions. There are currently no Australian state or national regulations that directly control emissions from these engines.

The project was commissioned by the Commonwealth Department of the Environment and Water Resources on behalf of state and territory government departments working on reducing the impacts of small engine emissions. The project was prepared in consultation with an Expert Panel that included representatives from the Outboard Engine Distributors Association (OEDA), the Boating Industry Association of NSW and the Eco Friendly Fishing Association (EFFA).

1.1 Emissions from engines by technology type

Small engines, particularly conventional two stroke engines used in applications such as marine outboard motors and personal watercraft (PWC) have relatively high emissions for their engine size and usage[1]. These small engines emit volatile organic compounds (VOCs) and oxides of nitrogen (NOx) which contribute to ozone (photochemical smog) formation in summer. They also emit particles, carbon monoxide (CO) and a range of air toxics such as benzene. The USA, Europe and California regulate emissions of VOCs (usually expressed as hydrocarbons (HC)), NOx in a combined limit (HC+NOx g/kW/hr), Europe also regulates CO emissions from outboard engines.

There are five types of spark-ignition engines used in outboard engines and personal watercraft:

- two stroke with carburettor (2c)
- two stroke with pre-chamber fuel injection (2i)
- two stroke with direct fuel injection (2di)
- four stroke with carburettor (4c)
- four stroke with fuel injection (4i)

Two stroke carburettor and pre-chamber fuel injection engines are inherently more polluting than the other three types. This is due to their inability to completely separate the inlet gases from the exhaust gases, resulting in up to 30% of the fuel being left unburnt, plus the need to add oil to the fuel to lubricate the engine. However, two stroke carburettor engines typically weigh less than a four stroke engine of the same power and this tends to make them attractive for smaller boats. They also tend to have fewer components, are generally cheaper to buy and have lower maintenance costs compared to four stroke engines.

[1] Outboard engines and personal watercraft covered in this report are engines up 186kW and 138KW respectively.

In contrast to traditional two strokes (carburettor and electronic fuel injection (efi)) direct fuel injection overcomes the unburnt fuel problem normally associated with two strokes. This results in significantly lower emissions. Direct fuel injection two stroke outboard engines that meet the stringent regulated exhaust emission limits that apply in the overseas are available in Australia. It is therefore important to distinguish between the type of induction (carburettor, pre-chamber injection or direct injection) of two stroke engines when considering environmental performance.

Carburettor and fuel-injected four stroke outboard engines that meet overseas regulated emission limits are available in Australia. Four stroke engines are generally quieter, more fuel efficient and are less polluting than traditional two stroke engines. Furthermore, four stroke and direct injection two stroke outboard engines are reported as having better low speed performance than two stroke carburettor engines. There are no four stroke engines using direct injection technology on the world market.

Personal watercraft (PWCs) use the same engine technology as outboard boat engines.

Figure 1 shows the range of HC plus NOx emission levels achieved by the various engine technologies available on the Australian market. It shows a significant gap between the high emission traditional two stroke carburettor engines (104 to 681 g/kw/hr) compared to the low emission engines which, with the exception of one four stroke 2.5 hp outboard, have combined HC+NOx emissions below 30 g/kw/hr.

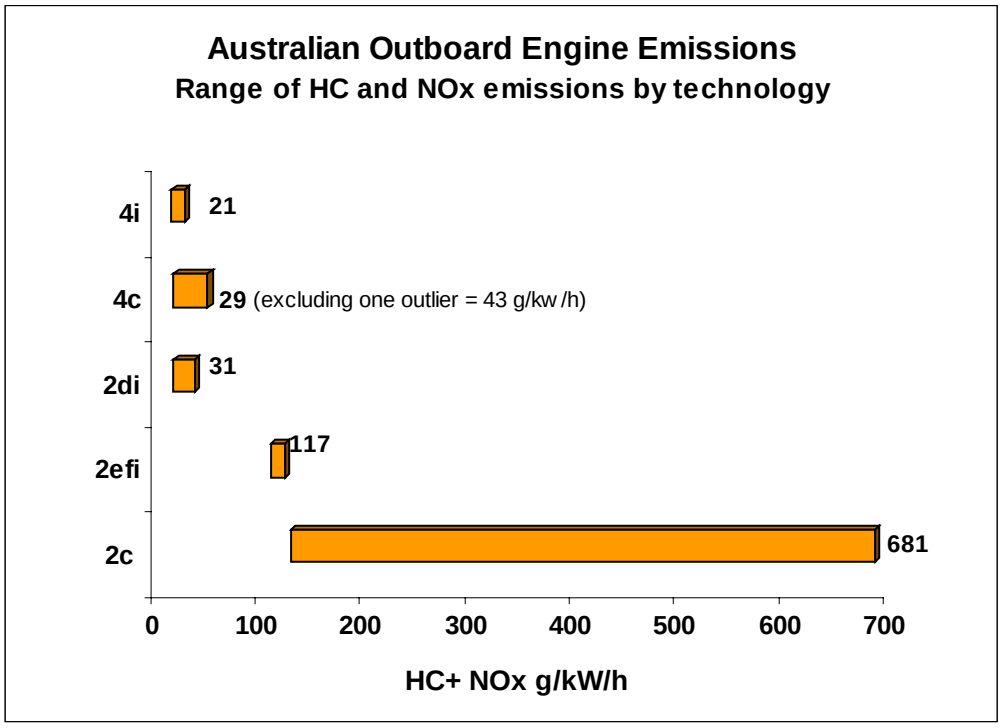

Figure 1: Australian Outboard Engine Emissions by Technology Type

Source: USEPA, OEDA

Comparison with motor vehicle emissions

In general, marine outboard engines and personal watercraft are not as advanced in environmental terms as motor vehicle engines. Substantial engine power is required to overcome the high resistance encountered when pushing a small boat at high speed through water. As a result, even the better-performing outboard engines emit significantly higher levels of air pollutants than do typical modern car engines, when assessed in hours of operation or kilometres travelled. For example, the US Environmental Protection Agency's (USEPA) 2006 limit for a small runabout 40 kilowatt (kW) outboard motor is about 2 kilograms (kg) of regulated pollutants per hour of operation. The equivalent limit for cars under Australian Design Rule 37 (which has been replaced by the more stringent Australian Design Rule 79) is less than 1 gram per kilometre or about 40 grams per hour. In other words, one hour of operation of a boat, with a relatively clean engine, produces the same pollution as about fifty cars, operated at a similar speed. For larger more powerful outboards the comparison with motor vehicle emissions becomes more dramatic as emission regulations for cars set limits based on kilometres travelled, irrespective of engine power, whereas, for example, the US regulations set limits for outboard motors based on exhaust emissions per kilowatt-hour. In other words, smaller engines are required to emit less total pollution per hour of operation than larger, higher-powered engines.

Older style outboard engines that do not comply with US EPA 2006 limits are likely to emit around ten times the amount of pollution compared to conforming engines. The older style engines also pollute waterways as all but a few of the smallest outboard engines discharge their exhaust under water.

All the above emission comparisons between outboard engines and motor vehicles are subject to differences in test methods but they indicate the disproportionate amount of pollution emitted by small marine engines. It also needs to be borne in mind that the average motor vehicles in Australia has a usage rate of more than 15,000 kilometres per year (ABS, 2003) compared to annual average boat usage - a NSW 2003 survey of found that powered boat owned by the general public was used for about 25 hours per year. Commercial operators however are likely to have a much higher usage than the general boat owner.

There are similar issues with older personal watercraft. When it introduced its regulations in 1999 Californian EPA estimated that seven hours of an unregulated personal watercraft use creates the same emissions as a new car driven more than 100,000 miles (ARB, 1999).

In 2002, Environment Canada's Environmental Technology Centre tested outboard engine exhaust for total hydrocarbons (or volatile organic compounds-VOCs), nitrogen oxides, carbon monoxide, carbon dioxide, oil and grease, and BTEX (benzene, toluene, ethylbenzene, xylenes - carcinogenic or mutagenic aromatic hydrocarbons formed through the combustion process). The results showed that two stroke outboards produce 12 times as much BTEX as four strokes, and five times as much oil and grease. Further comparisons of exhaust emissions from a light-duty van, a 9.9 horsepower (i.e. 3.7kW) two stroke outboard and a 9.9 horsepower four stroke outboard showed that the two stroke produced 50 per cent more carbon monoxide than the four stroke and nearly 60 times more than the van. The two stroke also

emitted 15 times more unburned hydrocarbons than the four stroke, and nearly 125 times more than the van.

Further studies have revealed that most hydrocarbons discharged onto the water surface as petrol evaporate to air within six hours, further adding to the air pollution load. However, heavier hydrocarbons, such as oil and grease, remain on the surface for a longer period of time and may affect the health of microscopic organisms (Environment Canada, 2002).

Because of the combustion of oil, two stroke engines also emit high levels of particles. Although small engines only contribute a small amount to total particle emissions, the rate of particle release compared to other engines can be very high.

2. Air Quality and Outboard Engines

Emission inventories make estimates of emissions of substances from multitude of source into airsheds. The National Pollutant Inventory (NPI) which is run cooperatively by the Australian, state and territory governments, contains data on 90 substances that are emitted to the Australian environment. The substances included in the NPI have been identified as important because of their possible health and environmental effects. Industry facilities estimate their own emissions annually and report to states and territories. Non-industry (or diffuse) emission estimates, which include emissions from recreational boating, are made by the states and territories on a periodic basis using information sources such as surveys, databases, and sales figures.

A summary of national and selected state and territory NPI emissions estimates for a selected range of pollutants from recreational boating is given in Table 1.

Table 1: National Pollutant Inventory Estimates for Recreational Boating

Substance	South East QLD	Port Phillip	Darwin	Hobart	National *
Common Air Pollutants (tonnes/year)					
Carbon monoxide	18,000	3,800	680	1,200	27,000
Oxides of Nitrogen	1,400	100	14	35	1,600
Particulate Matter 10.0 um	70	6.6	12	3.5	96
Sulfur dioxide	57	6.3	0.75	3.7	73
Total Volatile Organic Compounds	4,300	1,100	210	380	6,900
Air Toxics (tonnes/year)					
Benzene	170	69	6.5	21	310
Formaldehyde (methyl aldehyde)	160	16	4.7	14	220
Toluene (methylbenzene)	500	110	25	56	810
Xylenes (individual or mixed isomers)	160	80	20	17	320

* These total emissions are underestimates as no data is available through the NPI on emissions into major airsheds such as Perth and NSW's Greater Metropolitan Region.

It should be noted that national recreational boating emissions shown in Table 1 estimates are underestimates as the NPI only records:

- emissions for most major airsheds only, that is it is not Australia wide and does not include emissions into airsheds such as the NSW's Greater Metropolitan Region (which includes Sydney, Wollongong and Newcastle), Perth and ACT.

- exhaust emissions i.e. it does not include evaporative emissions from hoses, fuel tanks, etc,
- recreational boating emissions, it does not account for emissions from personal watercraft and most commercially used outboard engines.

It is therefore likely that the NPI national emission estimates represent approximately half of the emissions from marine outboard engines. This is based on the assumption that emissions are proportional to sales and over the last decade outboard sales in NSW and Western Australia represent about 40% of national sales. To add to the complexity in determining the contribution made by outboard engines using the NPI the data reliability of the NPI emission estimates for recreational boating, because of the techniques used, is gauged as medium with an uncertainty of between 20% and 80% (NPI, 1999).

The NSW Department of Environment and Conservation (DEC) has been upgrading its emissions inventory. Based on 2003 emissions data, non road anthropogenic sources contribute 61.9% of the VOCs to the GMR airshed. Preliminary results[2] indicate that VOC emissions from recreational outboard engines contribute, on an annual average, 2.1% of all VOC emissions in the GMR. On a typical summer weekend when boat usage peaks, this figure rises by a factor of around 3.7, meaning that at these periods outboards represent around 8~9% of total VOC sources in the airshed. Two stroke engines are assessed by DEC as being responsible for around 92% of total marine VOC emissions.

Therefore it could be assumed that outboards contribute approximately 2.5% on average to VOC emissions from anthropogenic sources in major airsheds in Australia and this rises significantly on hot summer weekends when boating is more popular and, co-incidentally, Air NEPM ozone standards are more likely to be exceeded.

2.1 Air Quality Standards

In June 1998 the National Environment Protection Measure for Ambient Air (Air NEPM) established national uniform standards for ambient air quality for the six most common air pollutants – carbon monoxide, nitrogen dioxide, photochemical oxidants (measured as ozone), sulfur dioxide, lead and particles less than 10 microns (PM10). The NEPM was varied in 2003 to include PM2.5 advisory reporting standards and in April 2004 a National Environment Protection Measure for Air Toxics was adopted.

Nationally the common pollutants of most concern (particularly in major urban areas) are fine particles and ground level photochemical smog (measured as ozone) which is formed in the warmer months when volatile organic compounds (VOCs) and oxides of nitrogen (NOx) react in the atmosphere under the influence of sunlight in a series of chemical reactions.

Recent health studies have strengthened the evidence that there are short term ozone effects on mortality and respiratory disease. The studies also strengthen the view that there does not appear to be a threshold for ozone below which no effects on health are

[2] Presentation by Nick Agipades, NSW DEC, Manager Major Air Projects, to the Expert Panel, 27 April 2006

expected to occur. In recent years Australian epidemiological studies have been conducted which confirm the results of overseas studies that there is a relationship between elevated ozone levels and hospitalisations and deaths from certain conditions.

There are two national ozone standards, a one hour standard of 0.10ppm and a four hour standard of 0.08ppm, with a goal that allows for one exceedance per year by 2008. Sydney experiences a number of days each year of ozone levels above these standards. In 2003 Sydney exceeded the one hour standard on 11 days in 2003, 19 days in 2004 and 9 days in 2005. The four hour standard was exceeded on 13 days in 2003 19 days in 2004 and 13 days in 2005. Further reductions in VOC and NOx emissions are needed to reduce ozone concentrations in Sydney to levels that would comply with the Air NEPM.

Modelling of ozone for Sydney's Greater Metropolitan Region (GMR) indicates that the implementation of Euro emission limits for on-road vehicles, and hence the increased presence of these less polluting vehicles in the fleet and retirement of old more polluting vehicles from the fleet, is not sufficient to meet the current NEPM goals. Modelling suggests that very large reductions in precursor emissions would be required to meet the current ozone one hour goal (NEPC, 2005).

NSW is acting to reduce VOC emissions through state based initiatives. From NSW work undertaken in 2003-4 it became apparent that only limited VOC reductions could be achieved from state based initiatives aimed at small engines used in garden equipment and outboard motors and the issue requires national action (DEC, 2004).

The other jurisdictions meet, or are close to meeting the current National Environment Protection (Ambient Air Quality) Measure (Air NEPM) ozone standards (NEPC, 2005). However the ozone standards are being reviewed and based on current human health evidence the argument appears to be strengthening for tighter ozone standards. Should a stricter standard or an eight-hour standard consistent with international standards/guidelines be adopted, achievability of Air NEPM ozone standards or goals could become an issue for some of the other major urban airsheds (NEPC, 2005).

Even when the effects of bushfires and when hazard reduction burning are taken into consideration, airsheds such as Launceston, Melbourne and Sydney struggle to meet the national standards for particles (EPA, 2006). However there are only relatively small emissions of fine particles from outboard engines predominantly from two stroke engines make only a minor contribution to ambient fine particle loads.

While carbon monoxide emissions from outboard engines are regulated in Europe air monitoring in Australia indicates that carbon monoxide levels are well below the national air quality standards. In addition data indicates that lowering emissions of VOCs and NOx from outboard engines also reduces CO emissions.

Many of the pollutant sources which contribute to the formation of ozone and to particle levels also contain air toxics such as benzene, toluene, formaldehyde, and xylenes. These air toxics have been shown to be responsible for a range of health problems, including asthma, respiratory illnesses and cancer. The National Environment Protection Measure for Air Toxics requires each jurisdiction to monitor

and report annually on five air toxics: benzene, polycyclic aromatic hydrocarbons, formaldehyde, toluene and xylenes. The monitoring data is intended to inform future policy and also the public on ambient levels of these air pollutants. Monitoring of air toxics to date shows that levels are low and below the national monitoring investigation levels (EPA Vic, 2006, DEC, 2006). Lowering VOC emissions from outboard engines will also reduce ambient air toxics.

Most outboard engines emit their exhaust gases into the water. It has been reported that on average two stroke outboard engines emit 10-20% of the fuel /oil mixture into the water (Mosisch et al, 1999) as part of normal operations. Lower exhaust emissions will therefore also have a significant effect on reducing water pollution from boating (ARB, 1999).

3. Emission Standards for Marine Engines

The first meeting of the Small Engine Expert Panel: Outboard Equipment agreed that any benchmarking system is likely to be based on existing regulations and standard test procedures. The section reviews regulations in several countries.

The analysis of emissions limits described in this section is limited to hydrocarbons (HC) and oxides of nitrogen (NOx) as these are these are the emissions of key concern from outboard engines.

3.1 Australia

At present there are no Australian regulations or standards limiting air pollutant emissions from marine outboard engines. However most products sold in Australia are manufactured in the USA or Japan where products are manufactured primarily to USA or EU standards for sale in those markets, though many of these same manufacturers produce export only products that do not meet local standards. The following is a brief review of overseas regulations limiting emissions from marine outboard engines.

3.2 United States

In the United States the Environmental Protection Agency (USEPA) and the Californian Air Resources Board (CARB) both regulate emissions from outboard engines and personal watercraft.

Environment Protection Agency (USEPA)

Spark ignition engines

The USEPA sets exhaust emission limits for spark ignition (petrol) outboard engines and personal watercraft. The limits were introduced in 1998 and have become progressively stricter up to 2006. Hydrocarbon and NOx emissions are regulated as a combined measure and the resulting value must not exceed the limits shown in the Table 2.

Table 2: USEPA 2006 - Outboard and Personal Watercraft engines

Model Year	**HC + NOx (grams per kW-h)**	
	P < 4.3 KW*	**P >= 4.3 KW***
1998	278	$0.917 * (151 + 557 / P^{0.9}) + 2.44$
1999	253	$0.833 * (151 + 557 / P^{0.9}) + 2.89$
2000	228	$0.750 * (151 + 557 / P^{0.9}) + 3.33$
2001	204	$0.667 * (151 + 557 / P^{0.9}) + 3.78$
2002	179	$0.583 * (151 + 557 / P^{0.9}) + 4.22$
2003	155	$0.500 * (151 + 557 / P^{0.9}) + 4.67$
2004	130	$0.417 * (151 + 557 / P^{0.9}) + 5.11$
2005	105	$0.333 * (151 + 557 / P^{0.9}) + 5.56$
2006	81	$0.250 * (151 + 557 / P^{0.9}) + 6.00$

* P is the sales weighed average power (kW) of an engine family.

The USEPA regulations also have averaging, banking and trading (ABT) provisions. These provisions are complex but in broad terms averaging provides for the exchange of emission credits among engine families within a given engine manufacturer's product line (an engine family is a grouping of engines with similar characteristics). Averaging means that an engine family in a manufacturer's product line could be certified to an emissions level in excess of the applicable emission standard but its excess emissions must be offset by an engine family that is certified to an emissions level below the applicable emission standard. Banking means the retention of emission credits by the engine manufacturer generating the credits for use in a future model year (for averaging or trading). Trading is the exchange of emission credits between engine manufacturers which then can be used for averaging purposes, banked for future use, or traded to another engine manufacturer.

US marine engine manufacturers lobbied successfully for ABT provisions. The ABT provisions have provided the manufacturers with a practical and efficient means to achieve the limits as it allowed the manufacturers a phased development of cleaner outboards. With the final EPA limit achieved in 2006 some companies still hold credits that may see some high emission products manufactured and sold for some time (OEDA, personal communications).

Some high emissions engines being manufactured in the USA are also exported and are clearly marked "Not for sale in United States" (see example below). Manufacturers in regulated markets can utilize their excess factory capacity and written off tooling to produce and sell their older technology and cheaper product internationally (including Australia) where regulations will permit.

Marine compression ignition engines that use diesel fuel are also regulated in the USA. Preparation is also well underway to regulate evaporative emissions from the fuel system which will require boat builders to incorporate a mix of technologies such as non-permeable fuel hoses and fuel tanks. The evaporative emission standards are proposed for engines built in 2008 or later (USEPA, 2002). USEPA is also considering new emission standards to reduce exhaust emissions from marine spark

ignition engines (March 2006) and introducing standards for sterndrive and inboard engines (March 2003)

3.3 Californian Air Resources Board (CARB)

CARB sets requirements for spark-ignition marine engines manufactured from 2001. The regulation sets Corporate Average Emission Standards (CAES) – in effect, sales weighted emission performance for families of engines. More stringent requirements apply for CAES from 2004 and 2008.

The Californian standards are considerably more stringent than those that apply to the rest of the USA: CARB's 2001 exhaust emission standards are equivalent to US EPA 2006 standard; CARB's 2004 exhaust emission standards are 20% less than the US EPA 2006 standard; and, CARB's 2008 exhaust emission standards are 65% less than US EPA 2006 standard. The CARB has estimated by 2010 its standards for outboard emissions will reduce their emissions by 50 percent beyond the federal program (ARB, 1998).

CARB also has an engine labelling requirement that provides for four tiers of compliance as shown in Table 3 and from 2009 CARB is requiring onboard diagnostics.

Table 3: CARB Labelling Tiers

Tier	**HC + NOx** (grams per kW-h)	
	P < 4.3 KW	**P >= 4.3 kW**
1 – Low	81	$0.25 * (151 + 557 / P^{0.9}) + 6$
2 – Very Low	64.8	$0.20 * (151 + 557 / P^{0.9}) + 4.8$
3 – Ultra Low	30	$0.09 * (151 + 557 / P^{0.9}) + 2.1$
4 – Super Ultra Low	5	5

CARB marine engine regulations do not have banking and trading but allow averaging. CARB is currently considering introducing regulations to limit the evaporative emissions released by pleasure craft fuel systems.

Inboard/Sterndrive have been required to meet exhaust emission standards, certification test procedures, new-engine and in-use compliance provisions, and environmental labelling and warranty requirements since 2003.

3.3 Canada

Environment Canada and the Canadian Marine Manufacturers Association (CMMA) signed a Memorandum of Understanding (MOU) to voluntarily introduce cleaner outboard engines and personal watercraft into the Canadian marketplace.

Under the MOU the eleven participating member companies agree to provide engines for outboards and personal watercraft that comply with USEPA emission standards, commencing with the 2001 model year. The new engines are being phased in through to 2006. Under the MOU engine labelling is also required.

Environment Canada is currently developing *Marine Spark-Ignition Engine and Off-Road Recreational Vehicle Emission Regulations* for outboard engine, personal watercraft, off-road motorcycles, all-terrain vehicles, utility vehicles and snowmobiles. The planned regulations were to come into force January 1, 2007 for the 2007 and later model year engines and draft regulations have been circulated.

The proposed introduction date for regulation has been amended to January 1, 2008 for 2008 and later model year engines (Canadian Gazette, 2006). The most recent draft of the Canadian Regulations:

- Relies heavily on the USEPA and accepts EPA certification.
- Has a single maximum emissions level identical to the USEPA 2006 standard
- Calls for a single emissions mark for all certified engines (i.e. no consumer rating information)
- Mirrors international practice e.g. exemptions for competition engines.

Figure 2: Canadian Certification Mark

3.4 Europe

The European regulations which cover recreational craft and PWCs define a recreational craft as having a hull length of between 2.5 metres and 24 metres and a PWC, a length of 4 metres or less.

In June 2003 the European Parliament passed an amendment to its Directive 94/25/EC concerning the regulation of recreational boats. Under the European framework Member States are required to introduce national legislation to give effect to directives.

The relevant exhaust emission limits of Directive 2003/44/EC which amends Directive 94/25/EC, are in Table 4.

Table 4: European Emission Limits for Small Spark Ignition Marine Engines

Engine type	HC (g/k W- h)	NOx (g/k W- h)	CO (g/k W- h)	Particulates (g/k W- h)
Two stroke	$30+110/P^{0.75}$	10	150 + 600/P	NA
Four stroke	$6+50/P^{0.75}$	15	150 + 600/P	NA
Compression ignition (diesel)	$1.5 + 2/P^{0.5}$	9.8	5.0	1.0

P is the rated engine power in kW.

Directive 2003/44/EC includes personal watercraft (from 1/1/05 or 1/1/06 for two strokes) and sterndrive and inboard engines (four stroke spark ignition and compression engines from 1/1/05, 2 stroke from 1/1/06) and noise limits. Some of the provisions apply to second hand engines put on the market after 2005 or 2006

A review of Directive 2003/44/EC is underway and is required to be presented to the European Commission by the end of 2006 including recommendations on possible additional or tighter regulations controlling emissions recreational craft engines. Legislative proposals are then required to be submitted by the end of 2007.

3.5 Comparison of European and United States requirements

There are fundamental differences between European and US (both USEPA and CARB) regulations:

- the Europeans separately regulate hydrocarbon NOx and CO emissions whereas the US regulates combined emissions of HC and NOx and CO is reported but not regulated
- the Europeans have separate limits for two and four stroke petrol engines whereas the US has the same limits for all petrol engines
- US requirements become progressively stricter until 2006 (CARB 2008) each year
- CARB encourages early implementation of stricter emissions standards through a consumer labelling program (Tiers 1 to 4)
- The US, CARB and Europe also regulate emissions from inboards and sterndrives.

Taking into account the differences between the European, US and California regulations, Figure 3 compares the emission limits applying to engines of two power ratings (5kW and 40kW).

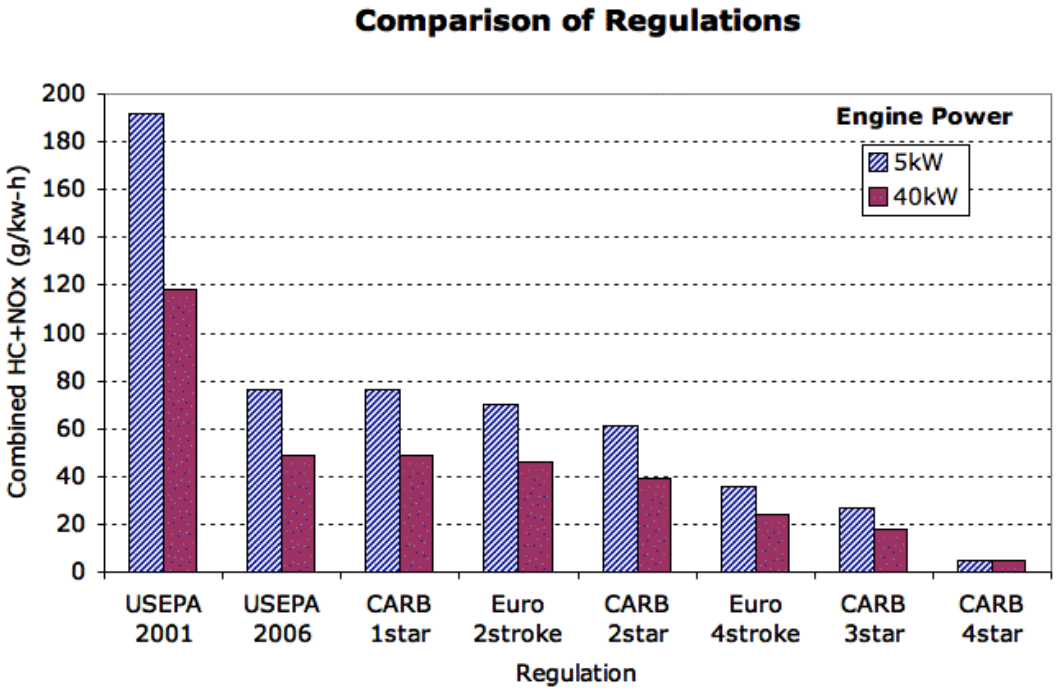

Figure 3: Comparison of Overseas Emission Regulations

In summary:

- European requirements for two stroke engines are similar to the USEPA 2006 requirements but European four stroke requirements are substantially more stringent (about half the emissions)
- USEPA 2006 requirements, which are the same as CARB Tier 1, are substantially more stringent than the USEPA 2001 requirements
- CARB Tier 4 emission limits (i.e. a 4 star engine) are more than 90% lower than those of USEPA 2006
- European four stroke requirements are between the CARB Tier 2 and 3 requirements and are more stringent than the US standards.

4. Australian Market for Outboard Engines and Personal Watercraft

There are no Australian manufacturers of outboard engines with the eight brands of outboard engines and personal watercraft being imported by six distributors. All the major brands offer a full range of low emission engines. Their sales account for 98% of Australian sales of outboard engines and they are members of OEDA. Sail/Osprey is not a member of OEDA and mainly distributes small two stroke carburettor outboards, mostly via the internet.

Yamaha (Japan) is reportedly the market leader and offers a full range of products across the size and technologies spectrums, as well as PWCs. Yamaha has recently announced a new production facility in Japan to expand their four stroke production capacity.

Mercury/ Mariner (USA) offers a full range of products and technologies. This company has a joint venture production facility in Japan with Tohatsu and shares some models.

BRP (USA) markets products under the Evinrude E-TEC, Johnson and Seadoo (PWCs) brand names. This company has focussed on expanding the low emission two stoke direct injection E-TEC range. The Johnson brand sells four stroke and traditional two stroke engines manufactured by Suzuki.

Honda (Japan) has focused exclusively on four stroke technology since the 1960's and markets a full size range of four stroke engines and recently a small range of PWC.

Suzuki (Japan) has a long history in the boating industry. It has a range of four stroke engines and a small number of two stroke carburettor engines.

Tohatsu (Japan) offers a range of two stroke, four stroke and direct injection engines up to 115hp (i.e. small to medium range).

Sail/Osprey (China) is a relatively new importer of small two stroke and four stroke outboards with a minor market share. The products seem to be available under several brand names but information about the company and its products is limited. The distributor is not an OEDA member.

4.1 Models of outdoor engines and personal watercraft

To develop a profile of outboard engine models currently available on the Australian market a review was undertaken of manufacturers' brochures and web sites, boating magazines and booklets. OEDA also arranged for relevant model and emissions data to be gathered from its members.

Engine characteristics and retail prices were obtained for most products. The breakdown is in Table 5 below. Many manufacturers' brochures claimed their products complied with USEPA or CARB standards.

Table 5: Breakdown of Current equipment on the Australian Market

Type	Ranges	Technology	Image
Outboard engines 9 makes 238 models Annual Aust sales: Approx 47,000	Engine power: 1kW to 200kW Engine displacement: 50ml- 2600ml Price: $799 - $30,888	2c: 89 (37%) 2i: 4 (2%) 2di: 30 (13%) 4c: 55 (23%) 4i: 60 (25%)	
Personal Watercraft 4 makes 25 models Annual Aust. sales: Approx 2,000	Engine power: 54kW to 160kW Engine displacement: 700ml to 1500ml Price: $10,900 -$17,000	2c: 2 (13%) 2i: 4 (17%) 4c: 2 (9%) 4i: 14 (61%)	

Figure 4 compares the 2005 models of outboard engines with those that were available in Australia in 2003 and shows that there has been a significant drop in carburettor models, in both two stroke and four stroke categories over the two years.

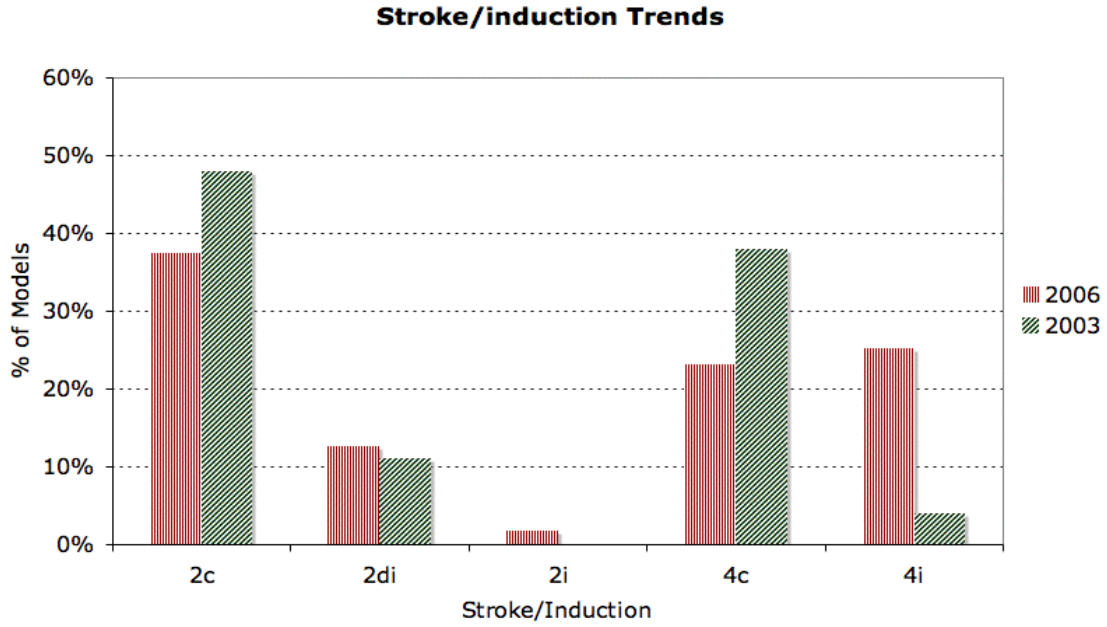

Figure 4: 2003 and 2005 comparison of types of outboard engines available in Australia

Note: The 2003 data did not distinguish between two stroke injected and two stroke direct injected and all 2003 direction engines have been classified as 2di in **Figure 4**.

4.2 Likely compliance with overseas regulations – outboard engines

Table 6 identifies the estimated compliance of the models of outboard engines available on the Australian market with CARB/USEPA requirements (where the USEPA 2006 regulations are treated as equivalent to CARB 1 star requirements).

Table 6: Likely compliance of outboard engines with emissions regulations

	Stroke and Induction					
Standard	**2c**	**2di**	**2i**	**4c**	**4i**	**All**
None	89	0	4	1	1	95
CARB 1 Star /USEPA 2006	0	0	0	0	0	0
CARB 2 Star	0	14	0	13	0	27
CARB 3 Star	0	16	0	41	59	116
Total	89	30	4	55	60	238
% CARB 2 Star or better #	0	100%	0	98%	98%	60%

"CARB 2" is the current (2004) Californian standard. 3 Star is the 2008 standard.

Table 6 shows that at least 60% of outboard engines models comply with some emission regulation, compared to 53% in 2003, and these are predominantly either four stroke or fuel-injected two stroke. No two stroke carburettor engines complied with any current regulations (a few comply with earlier US EPA standards).

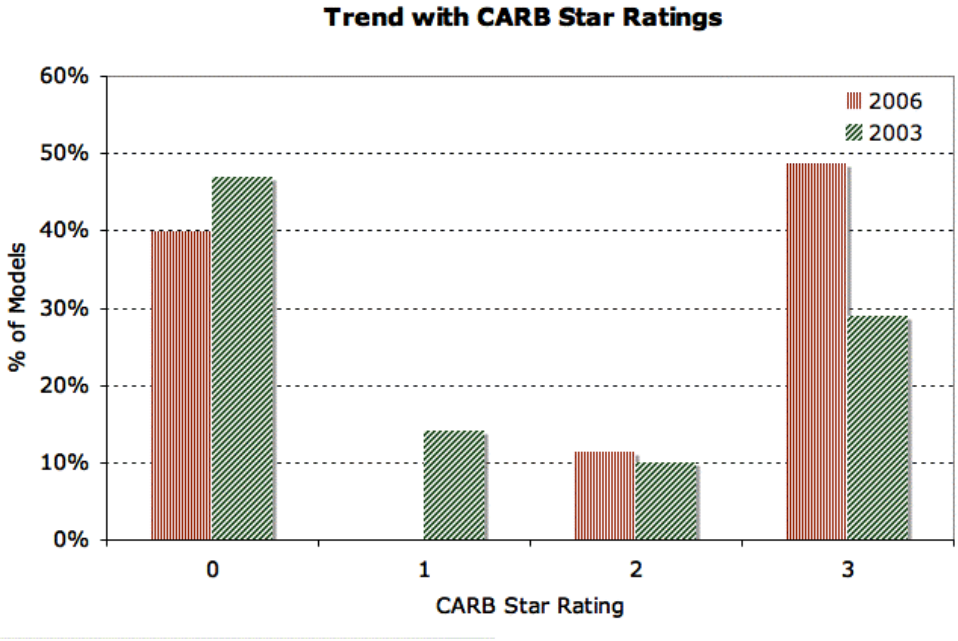

Figure 5: Australian Outboards Assessed against CARB Standards

Figure 5 shows that there has been a small reduction in the proportion of outboards that do not meet any CARB standard (47% in 2003, down to 40% in 2005) and the proportion of models meeting CARB 3 star rating has risen from 29% to 49%. Interestingly the number of models having CARB 1 star rating has dropped from 14% to zero.

4.3 Likely compliance with overseas regulations - personal watercraft

From available data, in 2003 approximately 33% of these craft were powered by two strokes in 2003. The current figure is now 29%. Kawasaki's representative on the Expert Panel predicted that by 2008 that it is likely two stroke PWC will no longer be available for sale in Australia. Personal watercraft engines compliance with emission standards is identified in Table 7.

Table 7: Likely compliance of personal watercraft with emissions regulations

	Technology				
Standard	**2c**	**2i**	**4c**	**4i**	**Total**
Unspecified	1	1		2	4
Specified					
None	2	2			4
CARB 1 Star					0
CARB 2 Star		1		9	10
CARB 3 Star			2	3	5
Total specified	2	3	2	11	19
Total	3	4	2	14	23
% CARB 2 Star or better	0%	25%	100%	86%	65%

'Specified' means that the status of the products' emissions compliance was identified.
'Unspecified' means that the status of emissions compliance was unable to be identified.

Figure 6 suggests that low emissions models of personal watercraft now outnumber models with high emissions.

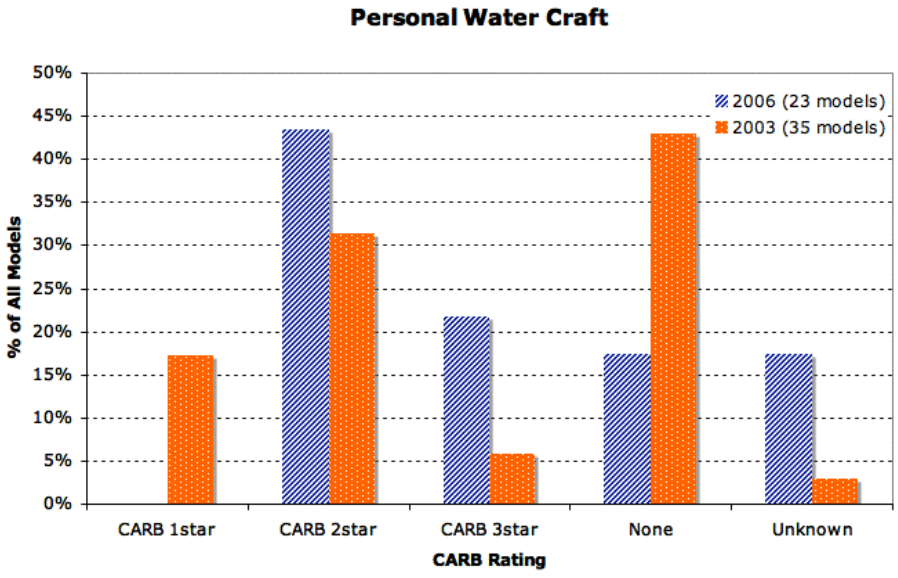

Figure 6: Australian Personal Watercraft Assessed against CARB Standards

4.4 Outlook

The lower emissions performance of four stroke and direct-injected two stroke is evident from the above discussion. However the technology will need to be monitored as substantial improvements may be possible through the use new or adapted technologies. It is therefore important that any monitoring of trends be based on compliance with emissions standards rather than proportion of different engine types. It is also important to distinguish between available models and sales. Subject to these cautions, the following sets out an analysis of sales trends for outboard engines.

The Outboard Engine Distributors Association (OEDA) provided Australian sales statistics for different types of outboard motor from 1998 to 2005. OEDA represents the companies that sell about 98% of the outboard engines and personal watercraft in Australia and currently low price high emission imports by non-OEDA members are not of significance on the Australian market. Data up to 2005 is provided in Table 8.

In 2004 OEDA and the Boating Industry Association of NSW (BIANSW) expected that the proportion of fuel injected two stroke engines would gradually increase from 10% to 50% of all new two stroke sales between 2003 and 2007 due to the withdrawal of two stroke carburettor models from the market (DEC, 2004). This has not occurred. These industry organisations also estimate a 5% turnover of the outboard motor fleet each year.

Table 8: Trends in Outboard Sales in Australia (based on OEDA/BIANSW sales data)

Year	2c	2i	4c/i	Total	%2i or 4
1998	32,186 (84%)	190 (<1%)	6,035 (16%)	38,411	16.2%
1999	34,594 (83%)	432 (1%)	6,708 (16%)	41,734	17.1%
2000	32,984 (80%)	683 (2%)	7,724 (19%)	41,391	20.3%
2001	29,263 (72%)	1,139 (3%)	10,041 (25%)	40,443	27.6%
2002	32,139 (74%)	1,319 (3%)	10,122 (23%)	43,580	26.3%
2003	28,725 (68%)	3,192 (8%)	10,628 (25%)	42,545	32.5%
2004#				42,490	
2005	30026(63%)	2959(6%)	14950(31%)	47937	37.4%

Note: The 2003 data did not distinguish between 2 stroke injected and 2 stroke direct injected and all 2003 direction engines have been classified as 2di.
There is no breakdown for 2004

Table 8 shows that in 2005 63% of Australian sales were high emitting two stroke outboard engines which gives a very different profile to that of outboard engine models available in Australia.

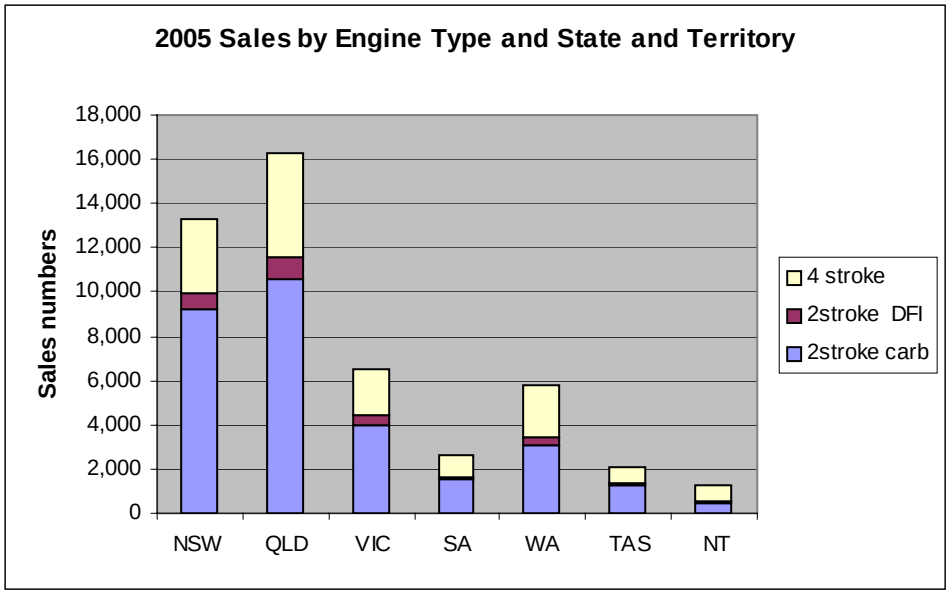

Figure 7: State and Territory outboard sales for 2005

Figure 7 indicates that approximately a third of all outboard engine sales in Australia in 2005 are made in Queensland and about a quarter are in NSW. Interestingly Western Australia has a significantly lower uptake of two stroke carburettor engines compared to the other states. Without further research analysis no explanation for these data can be made.

Honda Marine's estimate of 2005 world sales data for outboard motors, provided in Figure 8, shows that without regulatory control fewer low-emission new engines are being sold in Australia than in other developed countries[3]: Australian have a preference for two stroke engines as they are significantly cheaper than four stroke engines and have better initial acceleration, especially for activities like waterskiing.

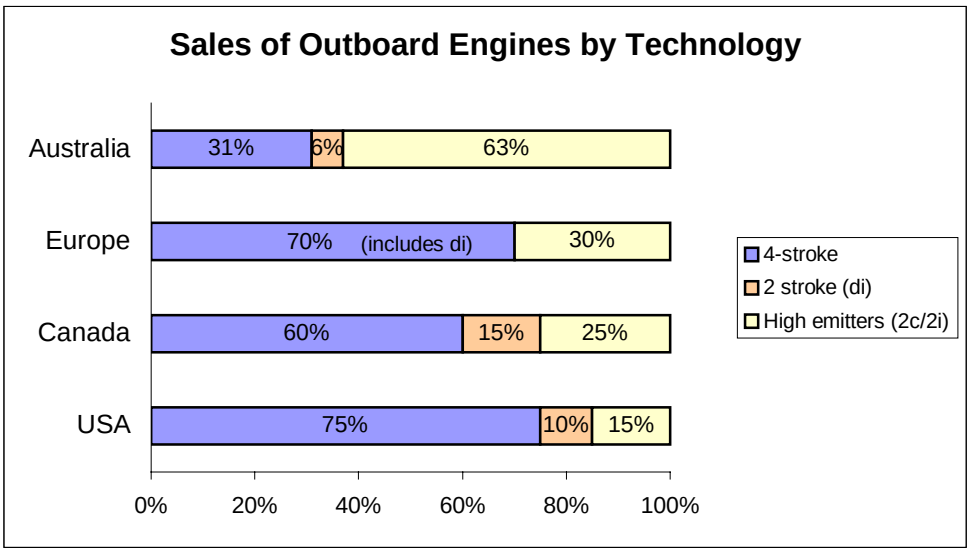

Figure 8: Outboard Engine Sales in Developed Countries by Technology Type

[3] Tim Davies, Honda, personal communications

In conclusion based on the information available;

- no new two stroke carburettor engines sold in Australia meet current (2006) overseas emissions standards
- 98% of four stroke engine and 98% fuel-injected two stroke engines are likely to comply with at least one exhaust emission limit (either USEPA, CARB or Europe)
- it is estimated that about 60% of new outboard engine models on the Australian market meet CARB 2 or 3 star requirements. However, according to OEDA, sales of these engines amount to about 37% of total sales
- Australia is well behind other developed countries in its uptake of low emission outboard engines
- The number of brands and models of PWC has reduced since 2004. At least 65% of current models comply with CARB 2 or 3 star requirements.

5. Australian Users of Small Engines

5.1 Boats and Personal Watercraft – Sales and Use

Australia wide, 65-80 percent of boat sales are to households, with the remaining 20-35 percent being sales to organizations such as the police, customs, search and rescue organizations and NGOs such as lifesaving clubs, coastal patrols and commercial operations (IBIS, 2003, John Goddard, 2006[4]). IBIS considers the marine equipment industry is a growth industry due to the ageing population with its increased leisure time plus the convenience provided by the increased number of marinas. It also claims that the key determinant of increased sales to the industry is disposable household income. The NSW Maritime Authority (2006) reported a 31.2% increase in the number of registered recreational boats over the decade to 2004-05.

The general consumer's outboard engine has a lifespan of between 7 to 15 years depending on the level of use and how the engine has been maintained. One industry source estimated that the average person uses their boat for about 70 hours per year although a survey in NSW estimated usage at 25 hours per year while commercial boat operators are likely use their boats more intensively than the general consumer.

It is estimated that 75% of boats purchased by the general consumer are used for fishing, 20% for cruising (including houseboats) and 5% for waterskiing. According to the Australian Bureau of Statistics (ABS) (2003) fishing, either shore- or boat-based, is one of the top ten most popular physical activities for Australians with approximately 5 million Australians taking part (ABS, 2003). The Fishing Industry Research and Development Council (1999) estimated that 19.8% of all Australians go fishing at least once a year, with 43% of all recreational fishing effort taking place from boats.[5]

With the exception of some dams and some areas in Marine Parks there are few restrictions on where boats can be used. However there are a range of regulations that restrict the way personal watercraft are used in some States. For example, in Queensland using a PWC to freestyle, surf and wave/wake jump is prohibited in certain Gold Coast and Sunshine Coast areas such as canals and in nominated creeks and harbours[6]. In NSW personal watercraft are banned from Sydney Harbour and from operating between sunset and sunrise anywhere in NSW. In addition personal watercraft are not to be operated in an irregular manner (for example riding in a circle or unnecessarily weaving) within 200 metres from the shore within an area between Port Hacking, Wamberal and the Blue Mountains, excluding waters off the coast. Outside this zone, a restriction has been placed on irregular riding wherever a dwelling is located within 200 metres off a riverbank or shore and is visible from the water (Maritime Authority – NSW (a)).

[4] John Goddard, Tohatsu, presentation to Expert Panel, July 2006

[5] The National Recreational and Indigenous Fishing Survey, Henry and Lyle, FRDC Project No. 99/158

[6] www.msq.qld.gov.au/qt/msq.nsf/index/msq_pwc

One important difference between typical boating in Australia compared to the USA is that about 90% of recreational Australia boating is conducted in salt water whereas in the USA only about 30% is salt water based with most boating being undertaken on fresh water lakes.[7]. Salt water creates greater technological challenges for reducing emissions through the use of catalytic converters.[8]

Registration

In general, recreational boats capable of travel at speeds of 10 knots or more, commercial vessels, moored vessels, sailing vessels of 5.5 metres and over and all personal watercraft are required to be registered with the local transport or maritime authority in each state. In addition boat and PWC operators are required to hold an operator's licence in most states and then generally only for vessels over 6 hp. There are no registration or licence requirements in the Northern Territory.

From registration data and other information it is estimated that there are approximately 735,000 registered boats in Australia. The difference between this number and the total shown in Table 9 is probably because of inconsistent reporting of PWCs, the absence of Northern Territory data and only approximate numbers being reported for South Australia and Queensland. These numbers would include sterndrives, inboards and compression (diesel) engines although the majority are outboards. PWCs appear to represent 2-3% of the registrations so their population is possibly less than 25,000 nationally.

Table 9: Boat and PWC Registrations in 2004-05

State	**No. of registered vessels (Boats and PWCs**	**PWC** (where available)
New South Wales	203,258	7078
Queensland	193,000 +	
South Australia	53,000 +	
Tasmania	23,987	580
Victoria	151,738	
Western Australia	72,000	
Total	696,983 +	

Sources: EPA SA draft Code of Practice for Vessel and Facility Management: Marine and Inland Waters 24 May 2006, www.icoma.com/library.
VicRoads Annual Report 2004-05, www.vicroads.vic.gov.au/vrpdf/corp/section5r&lv2.pdf
Queensland Department of Transport, 2004/05 Annual Report, www.transport.qld.gov.au
NSW Maritime Annual Report 2004-05, www.martime.nsw.gov.au/annualreport/editorial.pdf
Marine and Safety Tasmania, Annual Report 2004-05, www.mast.tas.gov.au

As part of the update of the air emissions inventory for the Greater Metropolitan Region (GMR) in NSW the results of mail and telephone survey work undertaken in 2003 showed that:

[7] John Goddard, Presentation to Expert Panel, July 2006
[8] Material presented to Expert Panel meeting 19 July 2006

- Approximately 150,000 of the 190,000 powered boats registered in NSW in 2003 were owned by people living the GMR and this equates to about 8% of people in the airshed owning a recreational craft
- On average these boats were operated for 25 hours per year
- 90% of outboards were two stroke engines

.

In summary

- There are around 735,000 registered boats in Australia the majority of which are outboards.
- Households account for 65- 80% of boats are sold with the remaining being sold to organisations.
- There are approximately 25,000 PWCs in Australia
- There are restrictions in some states on the use of PWCs.

5.2 Purchasing behaviour

General Consumer

The purchase of outboard engines and personal watercraft by the general consumer is an infrequent and complex purchase which carries a certain of amount of risk such as functional risk (for example the boat may not be powerful enough for waterskiing), physical risk (the boat could stall and cause a boating accident), financial, psychological (it could damage the consumer's self-image) or status (lose status amongst peers). As the price of a boat and engine package is normally thousands of dollars, the consumer is likely to undertake extensive research and consult a range of sources before deciding on the boat package they will purchase. From research into consumer behaviour for infrequent high risk purchases sales people are likely to be important sources of information in these consumer research efforts.

Indications are that consumers are increasingly using the Internet for information on the products they are seeking to buy. For example, a 2001 survey of 8000 consumers from eight countries found that 38% of those surveyed consider the Internet to be an important source of information for future vehicle purchases. The same survey showed that of those consumers who had purchased a new car, just over a quarter (26.7%) of 18 to 35 year olds and 16.8% of those over 35 had used the Internet to research the purchase (Cap Gemini, 2001). Given the rapid uptake of the Internet in Australia, and its availability in public places such as libraries, it is likely that an even higher percentage of Australians would use the web to research products they intend to purchase.

The general consumer is likely to lessen the purchase risk by seeking information and by evaluating the information on the available products over a period of time. The consumer may also lessen the risk by, for example, buying the brand offering the best warrantees and guarantees and buying a brand they have used before.

Outboards are generally bought as part of a boat package through a retailer. The retailer who often holds a franchise for several brands of boats and engines, puts together the package. The promoted boat package will often be the lowest price option

which will invariably include the cheapest engine, most likely a two stroke carburettor. However, many packages are designed to meet popular boat uses and may favour four stroke or direct-injected two stroke engines. The purchaser usually has to make a range of decisions when buying a boat, for example, on equipment and accessories but the boat's motor, whether inboard or outboard, is probably the second most important purchase consideration, after the choice of hull. The key consideration when choosing an engine is its fitness for purpose - that is, the fitness for the activity the boat is to be used for and the required power to weight ratio. Boat hulls specify the minimum recommended and maximum allowable horsepower engine to be used.

Recent analysis in the USA indicates that boat packages have a price elasticity of demand of between -1.5 and – 1.25. In other words a 1% increase in price would lead to a 1.25 to 1.5% drop in sales (U.S. International Trade Commission , 2005). While prices and models of outboard engines in the USA are different to those in Australia removal of the cheaper, high emission two stroke engines is likely to have a negative impact on overall engine sales especially for the smaller engines.

Analysis by the Eco Friendly Fishing Association indicates that low emission engines are some 25.2% more expensive than the equivalent two stroke (2c or 2i) engine when compared within brands. Overall the OEDA database analysis indicates a price differential of 18%-23% for engines of the same power. Figure 9 shows the relationship between power and price where four strokes are relatively more expensive at the lower end of the power range, and where the higher percentage of sales are made.

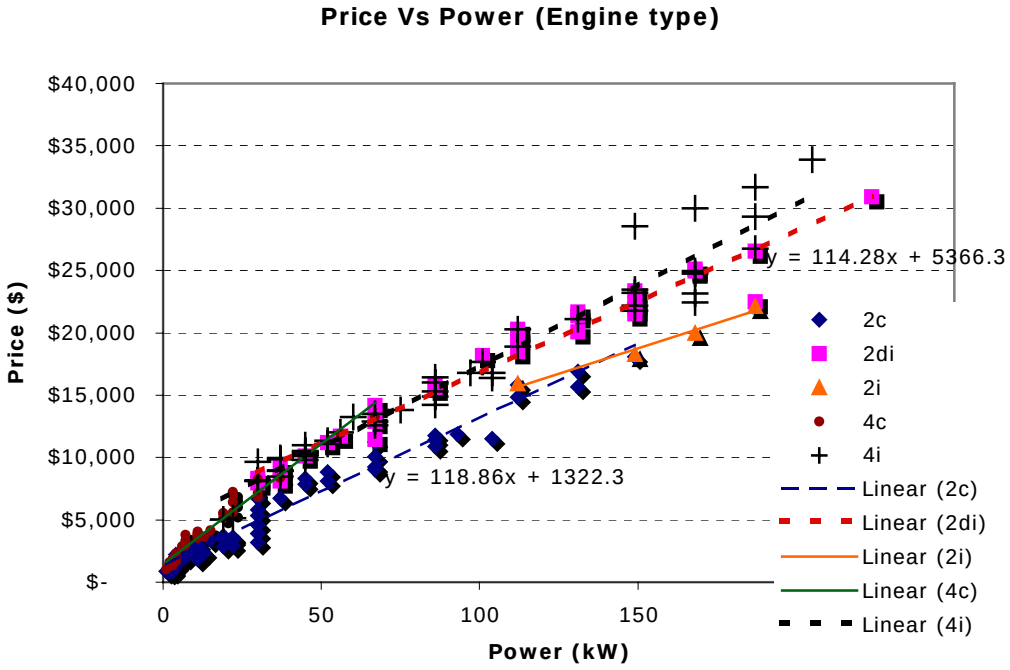

Figure 9: The Relationship between Power, Price and Engine Type

Promotion of Outboards to Consumers

Boat shows which are generally held annually in most capital cities and in some regional towns around Australia are the most important venue for sales of boats to the general consumer (BIA, manufacturers and boat retailer, personal communications). These boat shows, where many millions of dollars of sales are often made, provide the consumer with an opportunity to look at the latest technology, compare different makes and models, investigate available specials and negotiate purchases.

After the boat show the main forms of advertising where consumers source information about boats is from boating and fishing magazines followed by radio, rural TV and regional news. For example a survey at the Sydney 2004 Boat Show 62% of survey respondents indicated that magazines were their main source of information on boating, followed by the internet (42%) and newspapers (28%).

A number of advertisements for outboard engines in boating and fishing magazines make environmental claims such as *'already exceeds the American EPA's emission standards for the year 2006 – the most stringent environmental standards in the world*" and "*a 3 star Ultra low emissions rating from the California Air Resources Board (CARB)*"

In addition 'boat tests' in magazine articles occasionally mention environmental attributes of the boat: '*you could fit a normal two-stroke, but frankly it would be sacrilege to fit that older, smoky technology to the stern.*" (Trailerboat Fisherman May/ June 2004, p43); and, "*meets a three-star level under California's tough CARB rating system and so will satisfy any concerns about environmental emissions*." (Trailerboat Fisherman, May/ June 2004, p35) while a news item claims an engine is compliant with the '*EPA Tier II*' (Modern Boating, 2006).

A number of outboard engine manufacturers include information about emissions in their product brochures. Honda for example "*each of our outboard engines complies with the most stringent anti-pollution regulations, such as EPA 2006 or CARB 2008*." (Honda Marine: four stroke range, 2004). While Mercury shows the CARB three stars logo on a page advertising both two stroke carburettor and four stroke engines (Modern Boating, 2006). Without knowledge of USEPA and CARB emission standards, and their differences, the claims in manufacturers' brochures, in advertisements and in magazines could be meaningless or even confusing for consumers.

In summary, consumers are likely to purchase outboards and personal watercraft based on a range of attributes such as fitness for purpose and cost that are ranked and weighted. Sales staff are likely to be an important information source as are specialised magazines and increasingly the internet. Currently there is environmental information about emissions in some advertisements and product brochures but most consumers are unlikely to have the knowledge to assess the difference between cited regulations.

5.3 Commercial Purchasing

The way purchasing decisions are made by government or other large organizations is very different to the way the general consumer makes the purchase. Many of the purchases are for large quantities of goods and there are well established policies and procedures in place where the purchase criteria are established early in the buying process. The people involved in making the purchase are likely to be more knowledgeable about the product than the average consumer and are unlikely to be the eventual user of the goods. Value for money, fitness for purpose, ability to supply, life span, on-going operating costs such as for fuel and maintenance and, over recent years, environmental aspects are likely to be important considerations in the purchasing decision.

State Government

While government agencies such as Maritime Safety Authorities, Police, Fisheries, National Parks and State Emergency Services purchase boats, Government is not a significant overall purchaser of outboard engines and generally values the qualities of four stroke engines. Some Government agencies such as the NSW Maritime Authority have the ability to influence the purchases of community organizations such as volunteer coastal patrols that they assist with boat purchases through grants.

Hire and drive

Many popular waterways around Australia have commercial hire boat operations. The boats are generally aluminium dinghies powered by a small outboard motor or slightly bigger launches with inboard engines. In 2003 there were 173 hire and drive licensed operators in NSW, who provide all mechanically powered hire vessels under 6 metres in length, as well as small yachts and canoes and the like.

Other sectors

Although industry sources believe commercial operators such as fishing and tour operators most likely use inboard or four stroke outboard engines, no detailed information was available on engines preferred by this sector (Honda Marine, personal communications).

5.4 Australian Retailing

The outboard engine sales industry was found by IBIS business analysts to comprise many sellers, with most retailers having less than 10 employees. ABS (2003) estimated that Australian recreational boating industry is worth approximately $500 million and recreational fishing supports approximately 90,000 jobs.

Nationally there are about 600 dealers with franchises to sell new outboard engines with fourteen of the largest dealers selling between 500 and 800 new outboard engines and personal watercraft per year. Many dealers sell more than one brand of outboard. In addition there are around 200-300 very small retailers (usually sub agents) that sell a few outboard engines a year and an active market in secondhand outboard engines (Tim Davies, Honda, personal communications).

5.5 Identifying the Target Markets

In the absence of information to indicate otherwise, there appears to have been only very limited promotion in Australia of air emission impacts from outboard engines and personal watercraft and so consumers would likely have little awareness of their impact on air quality. Some manufacturers provide advice on product compliance with USA or CARB standards and in many cases engines are sold with an emissions compliance label. However the labels for the different standards (USEPA, CARB, Europe and Japan) are very different, comparisons are difficult and consumers, and even sales staff, could well be confused by their meaning. Nevertheless, surveys generally indicate that Australians are generally concerned about air quality and are aware of the air pollution impacts of motor vehicles. These results suggest that many consumers would be receptive to including environmental considerations when purchasing an outboard engine or personal watercraft.

Any program chosen to increase the supply and uptake of cleaner outboards should have a strong emphasis on changing the buying pattern of general consumers because it is this sector that buys the majority of outboard engines and personal watercraft in Australia. Sales to other market segments - government, commercial fishing and tour operators and NGOs are also sizable and their annual hours of operation and engine turnover are likely to be higher than that of the general consumer. They are also more likely to be buyers of more sophisticated technology such as four strokes.

6. Result of Stakeholder Consultation

6.1 Voluntary Emissions labelling Scheme

The industry association OEDA, whose members sell about 98% of all outboard engines in Australia, has developed a labelling scheme which all its members have agreed to implement. The scheme which was launched at the Brisbane Boat Show in September 2006, and was implemented on 1 January 2007. The labelling scheme is largely based on CARB emission standards. The 'No Star' high emission label is set at a level similar to the US EPA 1999 standard for outboards less than 4.3kW. It is intended that the Star rating emission limits will be periodically reviewed to ensure that their relevance and usefulness is maintained. More details of the labelling scheme are provided in Boxes 1 and 2.

Box 1: OEDA VELS Labels

OEDA Australian Label	**OEDA Emissions Limit** HC + NOx g/kW/hr	**Comparison with CARB star rating** HC + NOx g/kW/hr (see below)	**Comparison with EPA Limits** HC + NOx g/kW/hr
	> 250	None	None
	64.8 – 250*	1 star = 64.8 - 81	For P < 4.3 KW EPA 1999< 253 EPA 2006 < 81
	30 – 64.8*	2 stars = 30 – 64.8	
	5 – 30*	3 stars < 30	
	< 5*	4 stars < 5 Note: no current outboard engine can meet this limit.	

Box 2: Explanation of VELS

Limits identified with * in the table above are indicative only. These limits have identical specifications to CARB 2, 3 and 4 star limits which have lower emission limits (kW/hr) as engine power increases.

OEDA 3 Star

The OEDA 3 Star emission limit equals CARB 3 Star.

Where engine power < 4.3kW then the upper limit = 30 g/kW/hr

Where engine power > 4.3kW then the lower limit is a sliding scale down from 30 using the formula: $0.9(151+557/P^{0.9})+2.1$ where p is in kW

OEDA 2 Star

OEDA 2 Star equals CARB 2 Star.

Where engine power < 4.3kW then the upper limit = 64.8 g/kW/hr

Where engine power > 4.3kW then the lower limit is a sliding scale down from 64.8 using the formula $0.2(151+557/P^{0.9})+4.8$ where p is in kW.

OEDA 1 Star

The OEDA 1 Star limit departs from CARB and does not depend on engine power.

The lower limit = 64.8 g/kW/hr.

The upper limit = 250 g/kW/hr, which is similar to US EPA 1999 limits for engines less than 4.3kW. The 250 g/kW/hr is higher than the limit set for a 150kW engine by the US EPA 1998 limit, equivalent to 147 g/kW/hr. This 250 limit was set as a target that would place the 30% of the total highest emission engines (sold in Australia at the time) in the Zero star rating level.

OEDA No Star

Engines with emissions above 250 g/kW/hr receive a Zero star label with appropriate warning of high emissions e.g.: "Zero Star Rated, Very High Emissions" or similar.

Certification

All certification requires the outboard to be tested ISO 8178 Test cycle E4 and verified by an audited laboratory to OEDA's satisfaction. Published certification from US EPA, CARB or a European Authority is automatically accepted.

OEDA is offering the labelling scheme to PWC distributors but is not proposing to require its members to label personal watercraft at this stage. For personal watercraft there is not such a strong need for action because:

- Personal watercraft sales in Australia are small compared to those of outboard engines (about 2000 units per year compared to more than 47,000 outboard engines per year)
- The majority of personal watercraft sales are low emission models.

6.2 Implementation

OEDA has outlined a promotion program which includes promotion to media, promotion to dealers including a hotline for general dealer enquiries, posters and other point of sale material within dealerships, a web database and other promotion through throughout Australia. Since the launch articles have appeared in fishing and boating publications, a web site has been launched (www.oeda.com.au) and dealer and journalist education has commenced. Further details about the promotional program and associated budget are yet to unveiled. Monitoring and reporting and a review of the program after 12 months are also proposed.

The OEDA scheme is based on the premise that some outboards imported into Australia already carry a CARB Stars label and removal of the CARB label would be costly. Therefore introducing a label that is substantially aligned to the CARB stars will minimise confusion for dealers and purchasers. As imported engines have been tested to ISO 8178 and have laboratory certificates USEPA, CARB or European, certification will provide sufficient proof of compliance with the Australian scheme. OEDA has indicated that it will follow the same engine family certification as used in the northern hemisphere.

Distributors who are members of OEDA and market engines without certification will be required to have those engines tested by a NATA certified laboratory or, alternatively fit a “high emissions” zero star label. The VELS scheme is not exclusive to OEDA members and distributors who are not OEDA members and distribute outboard engines that have USEPA, CARB or European certification will be welcome to participate in the labelling scheme.

It is likely, based on practicality and cost that the Australian star labels will be applied by the dealers and it is most likely they will bear the legal liability for incorrect labelling.

Given the comparatively liberal 250g/kW/hr Australian limit proposed for combined hydrocarbon and nitrogen oxide emissions, and as there is provision for engines that do not meet the limit to carry a ‘no stars- high emissions’ label OEDA is not proposing to incorporate the USA’s averaging, banking and trading provisions. This will significantly minimise the scheme’s administrative burden.

6.3 Assessment of the OEDA scheme

Table 10 and Figures 9 and 10 below shows the range of outboards on the Australian market and their emission levels (HC + NOx g/KW/hr) as assessed against the OEDA Voluntary Emissions Labelling Scheme (VELS).

Table 10: Assessment of OEDA's VELS Scheme based on Engine Power Rating

Horsepower range	OEDA Star Rating (sales)				
	0 Star	1 Star	2 Star	3 Star	All
A 0-10	7%	2%	2%	9%	20%
B 11-25	4%	7%	3%	7%	20%
C 26-50	2%	9%	3%	10%	24%
D 51-90	0%	8%	1%	10%	18%
E 91-150	0%	4%	1%	8%	13%
F 150+	0%	1%	1%	3%	4%
All Sales	13%	30%	11%	46%	100%

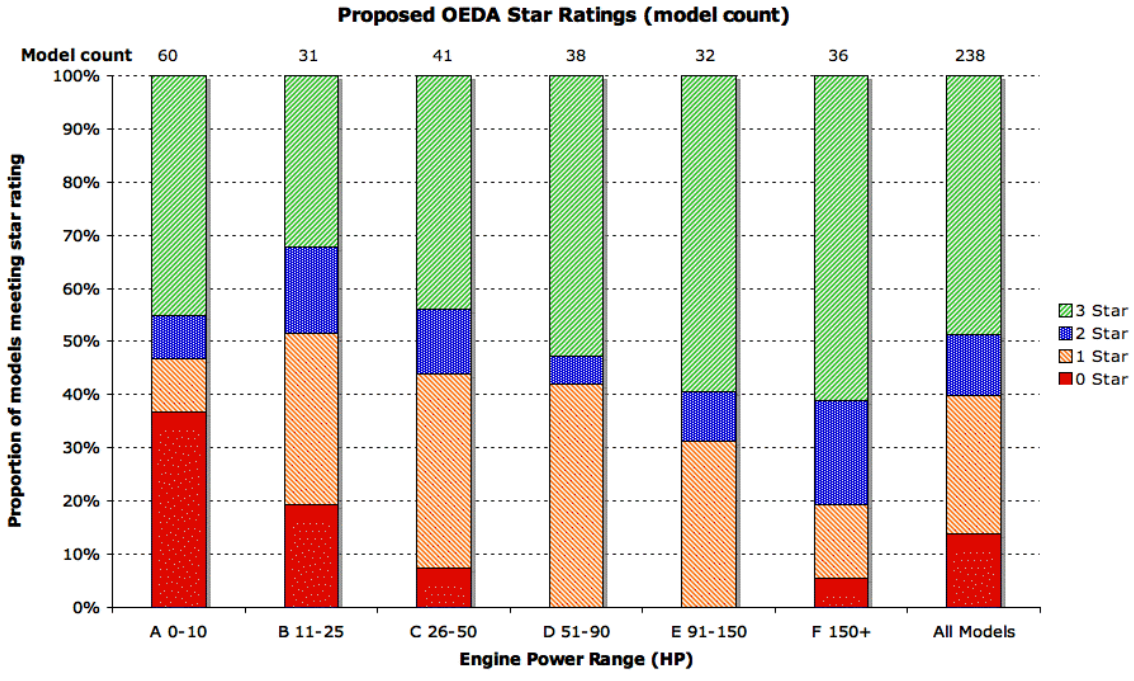

Figure 10: Assessment of OEDA's VELS Scheme based on Engine Power Rating

It is estimated that 46% of all sales under VELS will meet CARB 3 Star requirements while 13 percent of models will carry a 'no stars – high emission' label as they emit more than 250g/kW/hr of combined hydrocarbon and nitrogen oxide per hour of

operation. On the other hand if VELS aligned to the current CARB and USA EPA limit of 81 g/kW/hr then 40% of outboard engines sold in Australia in 2005 would carry a 'zero star' label.

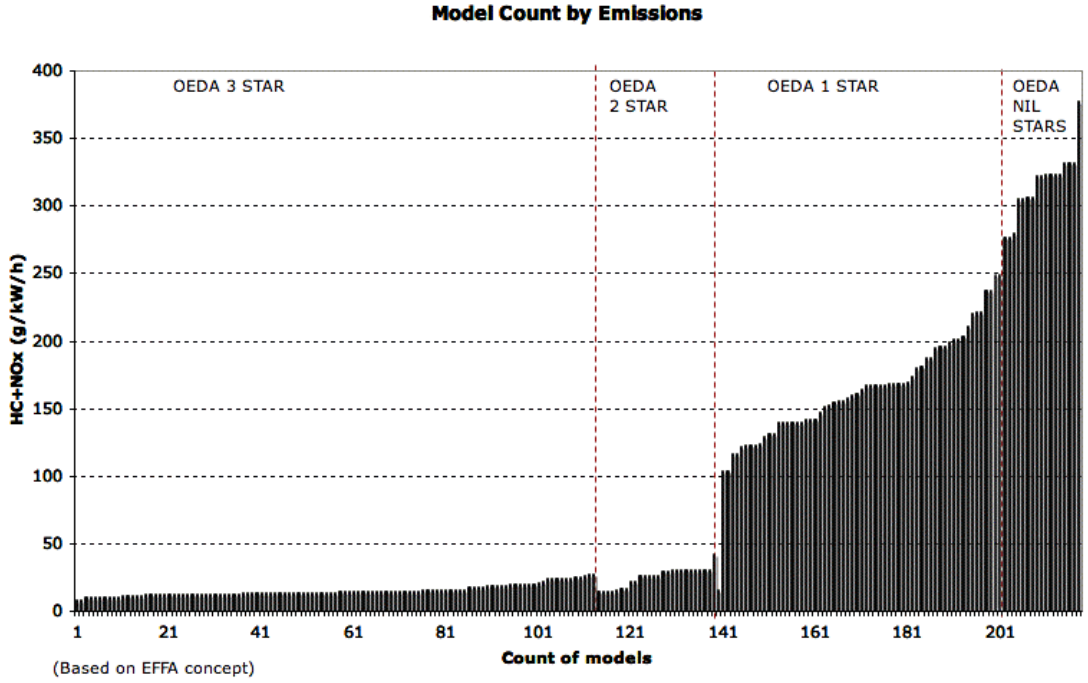

Figure 11: OEDA VELS program emissions assessment

Figure 11 shows the distribution of models by emissions and VELS rating. All of the 2 star models are high powered and therefore have more stringent emissions limits than low power models which generally earn a 3 star rating at the same level of emissions.

Figure 12 which assesses the OEDA VELS program using sales data and model counts shows there is relatively little difference between the various models available and the number of engines by star ratings sold that meet the proposed OEDA star ratings.

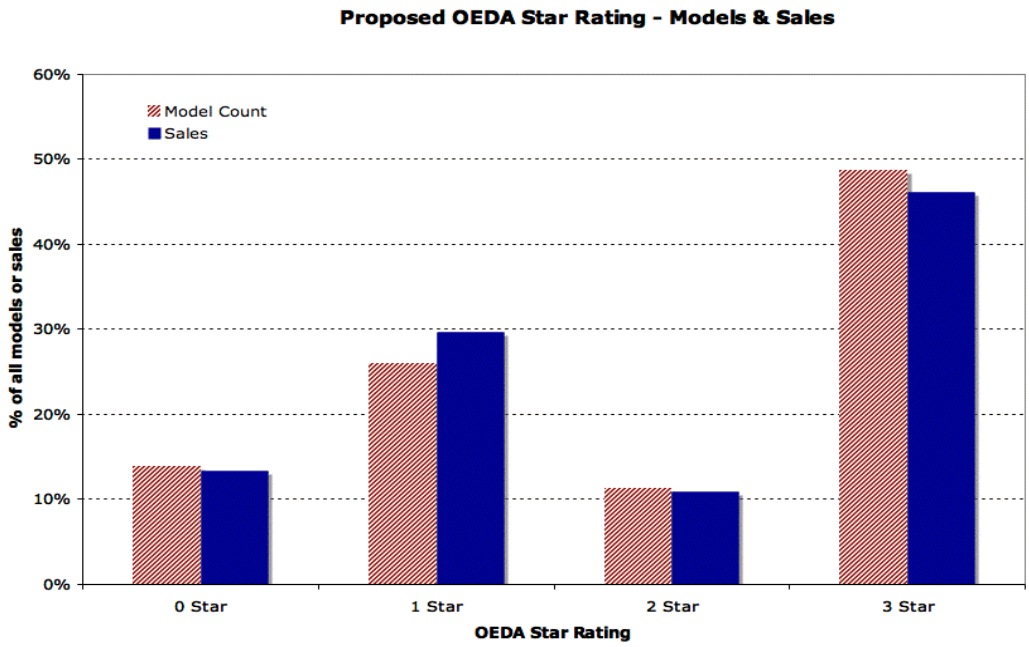

Figure 12: Sales and Model count assessment of VELS

Figure 13 shows number of outboard engines sold by engine type for the period 1998 to 2005. It also shows sales projections made in 2003. It was anticipated by the OEDA in 2003 that the total number of two stroke carburettor engines sold would by 42% of total sales whereas the actual sales of these engines in 2004 and 2005 were 67% and 63% respectively. Without the influence of a labelling scheme it could be anticipated that in 2007 two stroke carburettor engines will still represent 57% of sales.

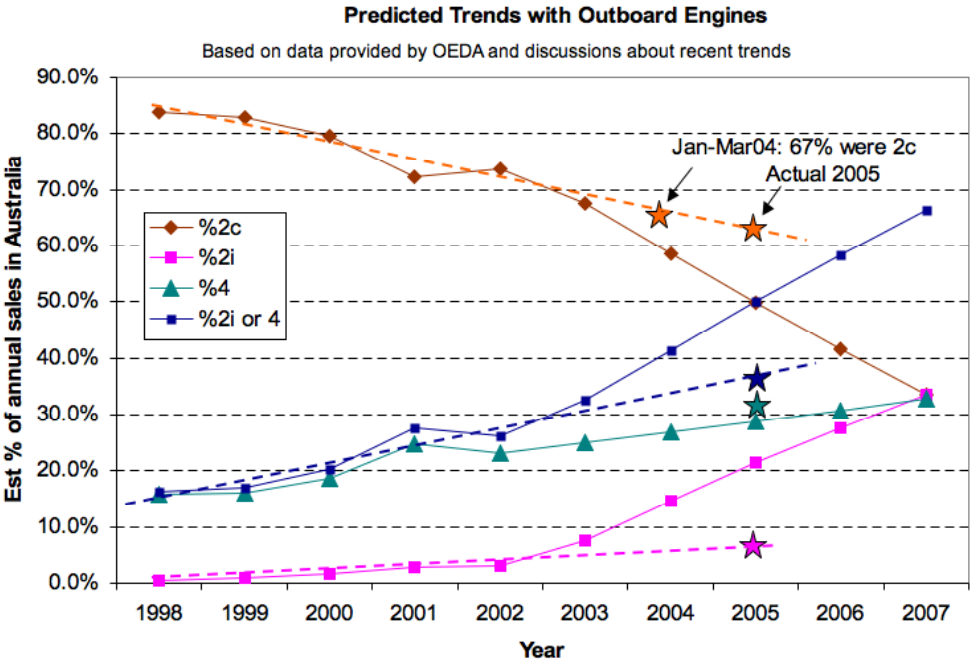

Figure 13: Outboard Engine Annual Sales Trends

6.4 VELS Program Discussion

The attractiveness of VELS, and other similar labelling schemes, is that they provide comparable emission performance information for Australian consumers. This overcomes the current difficulty the Australian consumers have in being able to assess the relative environmental merits of otherwise similar outboards, with or without overseas labels.

The VELS Program embodies the attributes of other well-structured labelling schemes by including monitoring systems, dispute resolution procedures and a review after 12 months. In addition OEDA has implemented a comprehensive promotional campaign to advertise the labels to relevant media, dealers and the public (budget estimated at $100,000).

What is not currently clear is how the success of VELS will be measured. The most obvious success criteria would be targeted reductions in the percentage of high emission (zero star and one star) outboard engines that significantly exceeds the current market trend. Current trends indicate that two stroke carburettor outboards (no stars/'high emission' and one star labelled outboards) would represent, without any intervention, about 50% of sales by 2009. Therefore it could be feasible, under the voluntary scheme, to aim for a target where these engines represent around 35% of outboard sales by 2009 and are almost eliminated from the market by 2015.

Other success criteria could also be proposed based on having a greater percentage of outboards with 2 and 3 stars and possibly some with 4 stars (although this is highly dependent on breakthroughs in overseas technology).

While OEDA members have agreed to implement VELS, companies that do not wish to participate in VELS and sell high emitting engines can sell on the Australian market without indicative labelling. It is difficult to foresee the likely sales growth potential of these engines sold by these companies.

The impact on air quality from VELS is unlikely to noticeable for many years. This is because:

- The turnover of outboard engines is estimated at approximately 5% per year
- The marine equipment market is regarded as a growth market
- VELS is an information scheme and does not restrict the sale of high emitting engines.

7. The Way Forward

The optimum approach on outboard engine emissions is one which is sustainable and cost effective. This is usually determined through a costs and benefits analysis (CBA) that assesses a number of options. CBA assigns monetary values and typically assesses the impacts on the consumer, on human health, on the environment, on industry and on government. A detailed costs and benefits analysis is beyond the scope of this report, however the following sections draws on available information to provide some indication of the possible costs and benefits that are associated with emissions from outboard engines.

Consumer Costs and Benefits

When CARB was assessing the impact of introducing controls on outboard engines in 1998 it estimated that the new technology engines would burn 30 per cent to 40 per cent less fuel and oil. This means considerable savings in running costs to consumers who at the time of the CARB regulations paid $US2 to $US 2.50 per gallon for fuel and up to $US20 per gallon for the two stroke engine oil that is mixed with petrol in these marine engines (ARB 1998). Given the time since this assessment and currency and fuel price fluctuations it is difficult to translate these savings into the Australian context without additional analysis but shifting from higher polluting outboards to newer technology engines will reduce running costs notwithstanding the higher capital cost to purchase better technology engines.

Health Costs and Benefits

The Final Impact Assessment for the Ambient Air Quality National Environment Protection Measure (NEPC 1998) estimated that the health damage costs from exposure to ozone nationally to be in the range of $90 – $270 million (in 1998 dollars). This figure did not include mortality costs because of difficulty in assigning a figure to human life, nor did it include costs associated with minor symptoms such as sore throat, cough, headache, chest discomfort and eye irritation that can result from ozone exposure. On the cost of ozone exposure the Impact Assessment states that '*the social well-being associated with potentially 6 and 20 million fewer irritating symptoms annually cannot be reliably quantified, but at $1 a symptom, it adds up to an appreciable amount*'.

Since the Air NEPM Impact Assessment ozone levels in Australian urban areas have not fallen significantly but the population and medical costs have increased since then.

However using on the above figures to make a rough estimate, the contribution made by outboard engines to the health damages cost from ozone exposure would be, at a minimum, $2.25 - $7 million (not including the cost of mortality or minor symptoms). As any action on outboard engines is likely to only remove high emission outboards engines CBA would be required to include an assessment of the proportional health benefits that would accrue from only removing the high emitters over time.

Environmental Costs and Benefits

In addition to the human health benefits associated with reduced exposure to ozone there is a range of other public benefits including reduced damage to vegetation and therefore higher crop yields, less damage to materials and structures, particularly some rubber products, and improved visibility due to a reduction in smog haze. Plus there are benefits associated with lower emissions of other air pollutants and reduced water pollution.

To date there appears to have been little work undertaken in assigning a monetary value to these benefits as it is considered that they are likely to be small compared to human health impacts.

Industry and Government Costs and Benefits

As all outboard engines sold in Australia are imported the main costs to reduce the emissions contribution made by outboard engines will be associated with program administration and compliance particularly if regulations are introduced.

The Productivity Commission, an independent agency which is the Australian Government's principal review and advisory body on microeconomic policy and regulation recently examined the cost effectiveness of measures to improve the energy efficiency in household appliances. As part of its review, 'The Private Cost Effectiveness of Improving Energy Efficiency', it examined labelling programs (i.e. regulated tiered benchmarks) and minimum mandatory energy efficiency requirements (i.e. a regulated simple benchmark). While the household appliance market is considerably larger than the outboard engine market the Commission's final report contains some information that is useful for determining the approach that could be used to establish an emissions reduction scheme for outboard engines. A summary of relevant sections of this report is provided in Appendix 2.

The Commission identified both administration and compliance costs associated with labelling programs and minimum mandatory energy efficiency requirements as well the impacts these had on product suppliers.

The Department of the Environment and Water Resources provided details to the Commission on the costs involved in administering both the labelling scheme and the minimum performance standards for energy programs. The information provided showed that:

- the administration costs of the simple benchmark approach were substantially lower (less than one tenth) than for labelling and 84 per cent of administration costs were passed on to appliance purchasers, with the remainder borne by governments,
- the compliance costs for labelling are higher;
- minimum mandatory energy efficiency requirements can have a greater cost for suppliers than labelling, since suppliers must adjust their model ranges to meet the MEPS levels by the given date. These compliance costs are however influenced by the 'lead in' time between introduction and the implementation of the regulatory.

- The increased cost to appliance purchasers of labelled appliances was about two and half times higher compared to appliances purchased under minimum mandatory energy efficiency requirements, this being due to consumers voluntarily purchasing more efficient appliances.

Overall the Commission considered that labels should be more actively considered as an alternative to minimum performance standards. The Commission's support was based on the ability of labels to, amongst other things:

- directly address "a source of market failure — the asymmetry of information between buyers and sellers of energy-using products."
- provide information to the consumer that is readily-accessible and easily-understood so they can help the consumer make better-informed choices.
- Have net social benefits and possibly have net benefits for consumers.
- provide a greater incentive for suppliers to sell environmentally better products.
- warn consumers, through a disendorsement label, that an appliance is very inefficient. This approach can discourage, but not prevent, consumers from buying the poor performing product.

7.1 Options to Reduce Emissions from Outboard Engines

There is a range of options that could be considered for reducing emissions from the outboard engines in Australia. These include:

1. Maintaining the Status Quo
2. Partnership Programs
3. Quasi regulation
4. Co-regulation
5. Regulations

In the following discussion about these options many Australian examples are mentioned. Further details about these programs plus an overview are provided in Appendix 1.

7.2 Option 1 – Maintaining the Status Quo

Based on data supplied by OEDA the sales of high emitting two stroke carburettor engines as a percentage of total outboard engine sales decreased from 84% % to 63% in the period 1998 to 2005 (see Figure 13). Therefore without the influence of VELS there was decrease of about 3% per year in sales of high emitters. This rate may also accelerate over time as overseas manufacturers retire production lines that manufacture older models.

As an outcome of stakeholder consultations OEDA has introduced VELS which aims, through self regulation, to accelerate the uptake of low emission outboard engines.

The likely impact of VELS is unknown as no reduction targets have been proposed however it could be anticipated there will be result in a sales decrease in high emitters in excess of 3% per annum. With VELS in place Government may assess that a projected 3% plus reduction in the sales of high emitting engines is acceptable and decide not to act.

There are few voluntary programs that have had long term success and many have ultimately ended in the introduction of regulations. Examples where this has happened include the water efficiency labelling scheme and the gas appliance labelling scheme: the water efficiency labelling scheme was not being universally applied with the best performing appliances being labelled while the poor performers not labelled resulting in a limited overall impact; and, the gas appliance labelling scheme may have operated successfully early on (perhaps when gas was supplied by States owned enterprises) but the standards were allowed to languish and became out of date.

Other important weaknesses of voluntary programs such as VELS is they do not restrict other companies that sell high emitting engines from entering the market, nor do they stop program participants from leaving the program.

7.3 Option 2 – Industry - Government Partnership

In the discussion papers prepared for the NSW small engine project (2004) some examples of successful voluntary Government-Industry Partnership programs were provided. The examples included were:

- the National Industry Reduction Agreement where the major newspaper and magazine publishers in Australia agreed to promote recovery and recycling of old newspapers and magazines;
- the NSW EPA-Oil Industry MOU on Summer Fuel, the National Packaging Covenant (which has legislative backup); and,
- the EPA Victoria's agreement with the Altona Chemical Complex.

From the Australian programs reviewed it appears that the best indicators for successful partnership programs are:

- a relatively small number of firms within the industry;
- a commitment and involvement by all of the industry;
- clear program aims and objectives plus program targets; and,
- a willingness by the industry to enter into a cooperative partnership with government.

The recreational marine industry in the main meets the first of these indicators and is close to meeting the third criteria. From consultations with OEDA members during this project it is also likely that the industry would consider entering into a cooperative partnership with government.

Usually government's role in these programs is comparatively minor and it may give little or no commitment to support the program financially or otherwise. Government may provide some support to assist industry reach its targets: for example, government may introduce procurement policies that require government departments

to only purchase “three star” outboard engines. An important characteristic of partnership programs is they give industry a high degree of flexibility to tailor the program to be best suit its requirements while maintaining ongoing consultation with government.

7.4 Option 3 - Quasi Regulation/ Partnership Program

Quasi regulations can take a range of forms the most usual being the establishment of a code of practice that industry endorses and implements. A fundamental part of the code of practice would be emissions standards. There are few examples of the use of codes of practice to limit emissions.

Government’s role under this scenario is likely to be in assisting in the development of standards.

As all outboard engines are imported and OEDA members already have agreed to test engines to internationally recognised standards this approach is considered to have limited applicability in this instance.

7.5 Option 4 - Co Regulation

Co-regulation is an agreement by industry and government to certain undertakings that support the uptake of cleaner products with a regulatory base. It allows industry program flexibility to achieve certain negotiated targets. Australian examples of co-regulation include:

- The Green Vehicle Guide which operates through an industry government agreement where industry report test results to government in an agreed format within a certain timeframe. Government manages the data and promotes the program. This program is underpinned by Australian Design Rules for motor vehicles.
- The electrical appliance stand-by power program where there are agreed targets established that industry is required ‘voluntarily’ to meet, failure to achieve the targets will result in regulation.
- The Packaging Covenant which is a program that allows industry the flexibility to design it own programs to reduce packaging waste and achieve certain target. The Covenant is complemented by the NEPM on used packaging which specifies certain government responsibilities to support the program plus measures that will be introduced if targets are not met.

Co-regulation for marine outboard engines could take a similar form to the standby power program or the packaging program: an agreement by industry and government on a percentage reduction target for the sale of high emitting engines within a specified timeframe together with an agreement that regulation will be adopted if the target is not met. This type of approach would allow the industry to implement VELS and government to be ready to act if targets are not met. It would involve program monitoring against targets and ongoing consultation between government and industry.

7.6 Option 5 - Regulation

Regulation, which requires a clear acknowledgement of a sufficient problem by Government, places uniform mandatory compliance obligations on industry. The costs associated with regulations are usually shared between government and industry with the development of regulations and program administration costs being borne by government with industry meeting compliance costs including emissions testing and, if applicable, labelling costs.

It could be argued that regulation should be introduced in the States or Territories where there are exceedances of the Air NEPM ozone standards. However development of state based regulations for outboard engine emissions is unlikely as they would be incompatible with the 1992 Intergovernmental Agreement on the Environment signed by the Commonwealth, States and Territories and existing Commonwealth and State Government mutual recognition legislation. The Intergovernmental Agreement on the Environment which underpins the development of National Environment Protection Measures, obligates all jurisdictions to ensure equivalent protection from air pollution to all Australians.

In addition enforcement of any state based legislation would be a key problem. Under the Commonwealth Mutual Recognition Act 1992 and the Trans-Tasman Mutual Recognition Act 1997, goods that are imported into, or produced in, an Australian State or Territory or New Zealand that can be sold lawfully in that jurisdiction, can be sold freely in a second jurisdiction even if the goods do not comply with the regulatory standards of the second jurisdiction. This means non-regulated small engine products legally sold in one State could be legally sold in any other state regardless of whether emissions limits on small engines applied in that State.

National regulation on the other hand would provide national consistency. It would also provide the opportunity to adopt world's best practice standards and incorporate penalties for non-complying parties.

Under the Australian Constitution the Commonwealth does not posses specific legislative powers in relation to the environment and heritage. There are, however, some of legislative powers that can support environment and heritage legislation.

Legislative mechanisms may be created through the development of a National Environment Protection Measure (NEPM) that then becomes law within each jurisdiction. A NEPM can accommodate flexibility of implementation where jurisdictions that have elevated ozone levels can tailor their NEPM program to their specific air quality needs. An example of this flexible approach is the Diesel NEPM which has a suite of programs which can be implemented by jurisdictions.

From the review of Australian regulations to reduce the environmental impacts of products and the overseas approaches to control emissions from small engines two regulatory approaches become apparent: a simple benchmark or tiered benchmarks. These are outlined below.

Regulatory Option 1 - A Simple Benchmark Approach

The most basic regulatory approach that could be taken would be to have a single emission standard for combined HC + NOx emissions that must be met by all new outboard engines sold in Australia from the date the regulations are introduced. This approach would:

- remove all high emission marine outboard engines from sale;
- be supported by an Australian Standard; and
- provide consumers with confidence that all products meet certain emissions standard.

Regulatory Option 2 -Tiered Benchmarks

Current Australian directions to reduce the environmental impact of consumer products favour tiered benchmarks using a 'star' rating system (see appendix 1 for examples).

For outboard engines a tiered system of emissions would most likely mimic either CARB standards or the more liberal VELS standards and use a system of 'stars' to provide information to consumers about environmental performance but not limit consumer choice. A tiered 'star' system approach would:

- reward those products, with more stars, that meet the more stringent overseas standards;
- either operate with minimum emissions performance standards or disendorsement labels;
- be supported by a product label and possibly a web database;
- provide consumers emissions information and the option to purchase a lower emission engine;
- be supported by an Australian Standard; and
- be devised to meet world's best practice which is an overarching approach supported by Government.

The Table 11 summarises the main strengths and weaknesses of the above options (with the exception of quasi regulation which is considered an unlikely option).

Table 11: Strengths and Weaknesses of Each Option

Strengths	Weaknesses
Status Quo (VELS)	
Provides consumers with emissions information	No targets and hard to quantify emissions reductions
Does not limit consumer choice	Slow reduction in high emitters
No cost to government	Lack of support by government
Industry passes on cost to purchasers	Below world's best practice
	No barrier to new market entrants
	No enforcement recourse available
Partnerships	
Some sharing of responsibility government – industry	Slow reduction in high emitters
Potential for Government assist in advance reductions in high emitters.	No restrictions on non signatories
Targets set and emissions benefits quantifiable	Below world's best practice
Co-Regulation	
Ongoing consultation between industry and government, recourse to regulation.	If based on VELS below world's best practice
Targets set and emissions benefits quantifiable	
Requires new market entrants to achieve targets	
Can builds on VELS and can provide some implementation flexibility	
Emissions test standard adopted	
Regulation Option 1- Simple Benchmark	
World's best practice standard adopted and is mandatory	ovide incentives to manufacturers to promote low emitters
Recourse to legal action available for non compliance	Does not provide consumers with emissions information
Significant quantifiable health benefits	Cost of enforcement borne by taxpayers
Requires compliance by all industry	High cost to government
Regulation Option 2 – Tiered Benchmarks	
Provides consumers with emissions information but does not limit choice	Significant administration and compliance costs to Government
Incentives for manufacturers to sell low emitters	High cost to government and will increase retail price of engines
Potentially significant quantifiable health benefits	Does not ban high emitters

7.7 Preferred Approach

As a result of stakeholder consultation OEDA has taken the initiative and embarked on a market driven self regulatory approach. Without Government support it will take considerable strength by the industry to ensure that the scheme is supported, promoted and that OEDA members continue to fully participate.

At the other end of the options spectrum is regulation which puts more of the onus on program administration and enforcement by Government. With regulations optimum emissions reduction are achievable especially by combining minimum emissions standards with tiered product labelling. Whether this approach is justifiable on economic grounds, that is, the benefits outweigh the costs; can only be determined through a detailed impact assessment.

Taking into account the degree outboard engines contribute to air and water pollution and the likely program cost the optimum approach, where the benefit cost ratio is maximised, is likely to be either an industry government partnership or co-regulation. Either of these approaches has the advantage of building on VELS, gaining formal support from government, including monitoring and review components plus they maintain a continual dialogue between industry and government. Crucial to both of these approaches is a requirement for a negotiated reduction target for high emitting engines.

The commitment to progressively reduce emissions can be reflected in a Memorandum of Understanding with OEDA to provide aggregate sales figures for outboards by stroke induction technology (2c, 2i, 2di, 4c, 4i) to increase the sales of outboards sold in Australia that meet an agreed clean outboard benchmark. Industry would report annually and the success of the agreement reviewed after 2 years.

Personal watercraft have not been formally included into VELS however the option is open for manufacturers to use VELS labels on PWCs. With relatively small annual sales and PWCs shifting to low emission engines the impact personal watercraft make on air quality is very small therefore no action is considered necessary other than periodic review.

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Appendix 1: Examples of Current Australian Benchmarking Programs

The following describes, in varying degrees of detail, a number of current Australian benchmarking schemes, classified by program type: simple bench mark approaches, tiered benchmarks, and government industry partnerships. This appendix concludes with a summary table of these programs with an assessment of their effectiveness.

1. Introduction

Simple benchmark schemes (described below) such as the woodheater standards set a single point hurdle rate whereas the green vehicle guide use tiered benchmarks. The new water efficiency labelling scheme and minimum energy efficiency performance standards uses both a simple benchmark through minimum performance requirement plus tiered benchmarks incorporated into labels as 'stars'. Other approaches such as the stand-by power program and the Victorian Altona Complex VOC reduction target, set goals for achievement within a specified time period. Other approaches taken to reduce environmental impacts include the National Packaging Covenant which uses a program based on individual companies developing tailored approaches to suit their circumstances and is supported by enforcement capability through the National Environment Protection (Used Packaging Materials) Measure (the NEPM).

2. Simple Benchmarks

2.1 Minimum Energy Performance Standards (MEPS)

Purpose

MEPS prescribe a minimum allowed energy performance for specific appliances. Appliances that are less efficient than the relevant standard are excluded from the market.

Background and Strategy

In October 1999, as part of the *National Greenhouse Strategy* (1998), nationally consistent MEPS and labelling schemes were adopted across Australia.

Independent NATA accredited laboratories undertake product compliance checks to see whether products perform in compliance with MEPS requirements. For example:

- In 2003, the government conducted check tests on eight appliance models, all of which were found not to meet the claims made on the energy performance labels. Two products were deregistered, one was found to have not been registered, and action was pending on the remaining five products (AGO 2003b).
- Other regulatory actions undertaken in 2003 included fines of $3000 and $8000 against two Western Australian retailers who were found to have sold appliances

without energy performance labels. Queensland and Victorian retailers received infringement notices and fines totalling $10 000 (AGO 2003b).

Summary
Regulated minimum performance standards based on an Australian Standard

2.2 Energy Star

Purpose

An endorsement label that indicates an electronic product has achieved a specified standard when it is not performing its core function (i.e. on stand by).

Background and Strategy

Energy Star is a voluntary endorsement labelling program developed by the US Environmental Protection Agency (US EPA). It has been operating in the USA since 1992, and has been adopted by a number of countries, including Australia. Energy Star sets voluntary standards for reducing the electricity consumption of electronic equipment when it is not performing its core function.

The Government stand – by program which is outlined below complements the energy star labelling program.

Summary
Voluntary endorsement label

2.3 Woodheater Standards

Purpose

To reduce particle emissions through Australian Standard compliant woodheaters.

Background and Strategy

Since 1992, Australian Standard/New Zealand Standards have been introduced to improve the performance of wood heaters.

The first standard for wood heater emissions, AS4013 (1992), was published in 1992 and was revised and published as a joint Australian/New Zealand Standard in 1999; AS/NZS4013 (1999) *Domestic solid fuel burning appliances - Method for determination of flue gas emission*. This Standard provides a test method to measure particles emitted by residential solid-fuel burning heating appliances.

The 1992 Standard included an upper limit for acceptable particle emissions of 5.5 grams of particles per kilogram (oven-dry weight) of fuel burnt. This emission factor was reduced to 4 g/kg in the 1999 revision of the Standard. The Standard applies to solid-fuel burning space-heating appliances (including those fitted with water heating devices) with a heat output of 25KW or less. It does not apply to masonry fireplaces, cooking stoves, central heating appliances or water-heating-only appliances.

AS 4013 (1999) is complemented by AS/NZS4014 (1999) *Domestic solid fuel burning appliances - Test Fuels*, and AS/NZS4012 (1999) *Domestic solid fuel burning appliances - Method for determination of power output and efficiency*.

The woodheater industry was instrumental in initiating the development of standards and it lobbied states and territories to enact legislation to mandating that woodheaters be required to meet the standards. As the health affects of particle pollution have become more apparent and as some jurisdictions are having difficulty in meeting national particle standards Government has become more proactive in controlling woodheaters and more supportive of tighter standards.

All states and territories with the exception of South Australia have regulations that restrict emissions from new woodheaters although Victoria, for example, only introduced its regulations in 2004 compared to Tasmania who introduced regulations in 1993. These regulations require that new woodheaters comply with the Australian Standard AS/NZS 4013. The State regulations however are not uniform.

Many woodheaters that are currently certified for sale do not comply with the revised standard as verified in a National Woodheater Audit Program undertaken in 2004. Seven of the 12 wood heaters tested failed to meet the AS/NZS 4013 particle emission limit. In addition, 55% of heaters were found to have deviations from the original designs and 72% had labelling faults that could adversely affect emissions performance.

Testing and certification are administered by the industry association.

Summary
State and regulations requiring compliance with Australian Standards. Certification administered by industry association.

2.4 Standby Power

Purpose

To reduce ‘excessive’ energy consumed in electrical appliance standby mode sold in Australia through, in the first instance, voluntary targets. Appliances covered by the program range from information technology equipment such as PCs and photocopiers, entertainment equipment such as TVs, DVDs and sound systems, major appliances such as water heaters, dishwashers and refrigerators and small appliances such as smoke detectors and bread makers.

Background and Strategy

In 2000, standby power was estimated to constitute 11.6 per cent of Australia’s residential energy use, costing households over $500 million and leading to the emission of over 5 million tonnes of carbon dioxide equivalent (AGO 2002c). Holt and Harrington (2004) estimated that standby power consumption in Australia could be reduced by 56 per cent by 2020 (Productivity Commission 2005)

In August 2000, all Australian jurisdictions agreed to "...pursue efficiencies in standby power consumption of energy-consuming products, through support for the

International Energy Agency's One -Watt program, and endorse its incorporation into the...program of work."

Australia reportedly has taken the lead on implementing the One- Watt program even though many of the products sold in Australia are imported

During 2002 government agencies consulted with stakeholders about ideas to reduce standby. The standby strategy which proposed a list of targeted potential product types was presented to the Ministerial Council on Energy.

In September 2003 an interim test method for the measurement of standby power AS/NZS 62301-2003 (int.), based on an internationally recognised standard, was published. Also during this period work commenced on developing draft product profiles for high priority targeted products.

Once product profiles are completed interim voluntary date-specific targets are made. The product sales are then monitored to determine progress towards the interim target If it is then determined that inadequate progress is being achieved by a significant number of suppliers then government will regulate.

For example the interim 2007 target for clothes washers is as follows:

Product Off mode power	End of program mode
< 1W	< 4 W

The National Standby Strategy Target to be achieved by 2012 for clothes washers is as follows:

Off mode power	**End of program mode**
< 0.3 W	< 1 W

In support of the clothes washer program Government will:

- consider creating a Government Purchasing Policy to buy low standby clothes washers, where available and fit for purpose.
- collect data on all modes for new clothes washers and analyse trends
- highlight the range of performances by publishing performance data on clothes washers on a website or by other means.
- progressively include standby energy consumption into the Comparative Energy Consumption for labelled products such as, clothes washers and clothes dryers.
- work with the Standards Committees to finalise the details of modes and test methods for the relevant standards.
- determine in 2008 if progress is inadequate and if regulation is required.

Summary
Industry targets /possible future regulation

3. Tiered Benchmarks

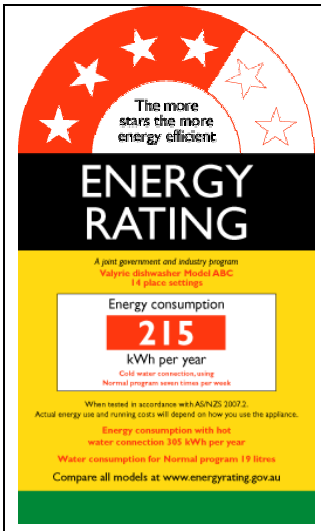
3.1 Mandatory Energy Efficiency Label – the Energy Star Programs

Purpose

To enable consumers to easily compare the energy performance of electrical appliances used by households and firms, through a labelling scheme.

Background and Strategy

Several Australian states commenced mandatory energy efficiency labelling for major appliances in the mid-1980s. In 1992 it became mandatory across Australia for initially refrigerators and later freezers, clothes washers, clothes dryers, dishwashers and air-conditioners (single phase only) to carry the label when they are offered for sale. This labelling program is regarded as one of the most successful in the world (Wilkenfeld and Assoc, 2003). It is administered through the Australian Greenhouse Office.



The energy rating label for dishwashers

The Energy Rating Label includes an endorsement ("a joint government and industry program") and a website address (www.energyrating.gov.au) and has two main features:

- the star rating which gives a quick comparative assessment of the model's energy efficiency; and
- the comparative energy consumption (usually kilowatt hours/year) which provides an estimate of the annual energy consumption of the appliance based on the tested energy consumption and information about the typical use of the appliance in the home. These values are measured under Australian Standards which define test procedures for measuring energy consumption and minimum energy performance criteria. Appliances must meet these criteria before they can be granted an Energy Rating Label.

Since its introduction the star rating label seems to have established a high level of recognition with consumers. Consumer research (Artcraft, 2003) indicates that the different information on the label appeals to different consumer segments interested in purchasing an appliance.

When a manufacturer gains approval to use the label they pay for and produce the label in accordance with specifications on size, colours, fonts, layout and design. A similar colour scheme and design to the energy consumption label is also used for the compulsory fuel consumption label on new passenger and light commercial vehicles.

The labelling scheme is underpinned by regulation whereby regulated Minimum Energy Performance Standards (MEPS) provide the environmental benchmarks that the appliances are required to meet. Appliances that do not meet the minimum energy performance standards can be withdrawn from the Australian market.

When the energy rating program was reviewed in 2000 technology had advanced to the point where a large percentage of appliances had achieved the maximum number of stars so the rating system was tightened. It is estimated that over the 25 year period, 1980 to 2005, there will have been an overall reduction in energy consumption of around 70% by the most popular sized refrigerators (with freezers) (Harrington L and Holt S, 2002).

In addition to the energy consumption label there is a website (www.energyrating.gov.au) with a comprehensive database of all appliances, their star rating and energy consumption. In 2002 there were around 220,000 hits on the program's various websites and 523,000 in 2003, reportedly representing 80,000 visits by individual inquirers. The website hit rate is estimated to represent almost 10% of consumers who are considering purchasing an appliance (Holt et al, 2003).

Awards	Brand	Model	Installation Type	Phase	Available	10 Yr Energy Cost	Cooling		
							Star Rating	Output (kW)	Energy Input (kW)
	TOSHIBA	Digital Inverter Series Air Conditioner RAV-SM1102BT-E/RAV-SP1102AT-E (RAV-SM1102BT-E/RAV-SP1102AT-E)	Single Split System, Ducted	Single		$1500		10.00	2.50
	CHUNLAN	KFR-32GW/VWa (NO)	Single Split System, Ducted	Single		$645		3.23	1.04

Figure B: Excerpt from Energy Rating web page for Air Conditioners (cooling cycle only shown)

When the energy rating program was reviewed in 2000 technology had advanced to the point where the Scheme had to be tightened because a large percentage of appliances had achieved the maximum number of stars. For example energy use by refrigerators was around 70% compared to that used when the scheme started (Harrington L and Holt S, 2002).

Regulations

State and Territory legislation refer to the relevant Australian Standards. This approach simplifies the State and Territory legislation, and makes it relatively straightforward to maintain national consistency of appliance and equipment energy efficiency standards, even when standards are continually being revised

The testing procedures and technical requirements for the label and also Minimum Energy Performance Standards (MEPS, see below) are incorporated into the

applicable Australian Standards. Products for sale must be registered with one of the State regulators.

Program Administration

The labelling program and MEPS program are administered by the National Appliance and Equipment Energy Efficiency Committee (NAEEEC), which is ultimately directed by the Ministerial Council on Energy.

Requirements for Appliance Suppliers

Appliance suppliers are required to

- Submit applications for product registration and these must include a test report or other data to demonstrate that the appliance meets the relevant Australian Standard.

- While test reports on three separate units are required for most products there is no particular requirement for test laboratories to be accredited or products certified for registration for energy labelling and MEPS in Australia. Test reports from the manufacturer's laboratory are satisfactory. However, if there is evidence that results from a particular laboratory are unsatisfactory, regulators can mandate test reports from an accredited laboratory.

Summary
Mandatory labelling scheme backed by regulations and an Australian Standard

3.2 Water Appliances: Water Efficiency Labelling and Standards (WELS) Scheme

Purpose

A labelling scheme backed by legislation to promote domestic water efficient appliances.

Background and Strategy

A voluntary water efficiency industry administered labelling scheme has been in existence since 1988. The water efficiency ratings and details on the label design are covered in AS/NZS 6400. The main incentive of the voluntary 'AAAAA' scheme has been the publicity and cash rebates offered by water utilities. However the coverage, water efficiency performance requirements and impact of this program have been limited.

In 2003 the Environment and Heritage Ministers agreed to implement a national Water Efficiency Labelling Scheme (WELS) for products such as shower heads, washing machines, dishwashers and toilets. Consultation with industry and stakeholders was undertaken in 2003 with a strategic study published that identified the products to be included in the new labelling Scheme. A Regulation Impact Statement (RIS) which identified the costs and benefits of various options and made

various recommendations was published in March 2004. Following public review of the RIS some modifications were made to WELS.

The WELS Scheme is backed by the following legislation and standard:

- Water Efficiency Labelling and Standards Act 2005 which establishes

  - the products subject to the Scheme and the requirements for registration and labelling
  - the standards to apply to WELS products, setting requirements for water efficiency, performance, registration and labelling of these products
  - enforcement provisions including penalties
  - the appointment of inspectors to investigate possible contraventions and sets out their powers and obligations
  - review and dispute resolution
  - a program Regulator
  - the making of regulations
  - a requirement for annual reports and for an independent review after five years

- Water Efficiency Labelling and Standards Regulations 2005 which

  - prescribes the circumstances in which a person other than the manufacturer of a WELS product may be taken to be the manufacturer of the product (e.g. an importer)
  - sets out procedures for the issuing, and the payment of, penalty infringement notices as an alternative to prosecution for offences against the WELS Act
  - specifying the information to be included on an identity card issued to a WELS inspector

  Water Efficiency Labelling and Standards Determination 2005 amongst other things, determines and establishes product registration fees and calls up the Australian Standard *AS/NZS6400: 2005 Water-efficient products - Rating and labelling* which:

  - defines the products
  - specifies the assessment procedures (i.e. identifies test procedures in other Australian Standards)
  - provides the formulas to give products their star rating
  - specifies the labels and their application to products

Approximately twenty organisations were represented on the Standards Committee that developed the Standard.

State and Territory legislation

The States and Territories have also enacted, or agreed to enact complementary legislation to ensure that the WELS Scheme has comprehensive national coverage.
State and Territory legislation which is almost a mirror of the Commonwealth's Water Efficiency Labelling and Standards Act 2005 enables the States and Territories to, for

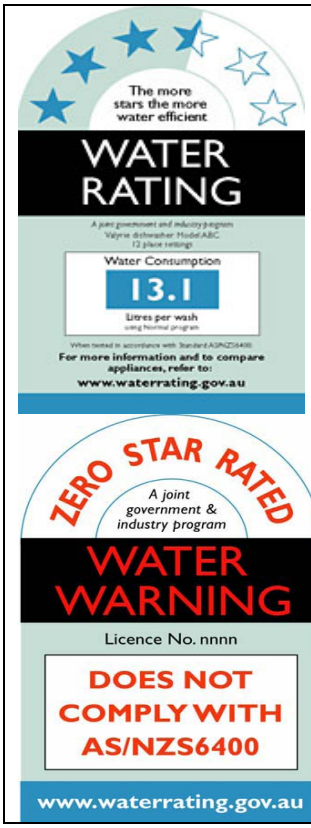
example, undertake certain responsibilities delegated to them by the Commonwealth Regulator, appoint their own inspectors and enforce the WELS.

Other features of WELS include:

- A product web database
- With the exception of toilets, no other products are required to meet mandatory water efficiency requirements (WES), but this may change over time. The introduction of mandatory WES means that products not meeting the minimum performance requirements can not legally be sold.
- Products must be tested in accordance with the relevant Standard and must meet any minimum performance and water efficiency requirements in the Standard before they can be granted a WELS Water Rating label.
- It is up to manufacturers or their agents (e.g. importers in the case of imported products) to ensure that their products are correctly registered and labelled and comply with any other requirements of the Standard.

There is a transition phase which gives manufacturers and importers time to test, register and label products and to sell pre-existing stock. From 1 January 2008 all products are required to display the WELS Water Rating labels, irrespective of their date of supply.

The WELS Water Rating label

<table>
<tr>
<td> 
</td>
<td>Label Features

• A star rating for a quick comparative assessment of the model's water efficiency.
• Labels with 1 to 6 stars.
• Some products may also be labelled with a 'Zero Star Rated' label, which indicates that the product is either not water efficient or does not meet basic performance requirements.
• A product’s water consumption figure
• There are provisions for swing tags if there is inadequate surface area for label or the item is likely to be marked by sticking the label on the product.</td>
</tr>
</table>

Summary

Mandated product labelling using ‘star’ rating system. Has a disendorsement label and has provisions to ban products.

3.3 Gas Appliance Rating Scheme

Purpose

A gas labelling program to improve the energy efficiency of gas powered products.

Background and Strategy

The Gas and Fuel Corporation of Victoria introduced energy labelling for gas water heaters in 1981. This scheme was taken over by the AGA in 1985 who, in 1988, introduced a six star energy performance label. This label was intended to be visually consistent with the star rating labels already familiar to consumers of electrical appliances.

The labelling scheme is currently voluntary and still administered by the industry body.

A range of gas appliances have been subject to minimum energy performance standards (MEPS) since the 1960s. The current MEPS levels were set in 1983 and 'the majority of models currently on the market appear to exceed current requirements by a comfortable margin' (SEAV 2003, p. 23).

Gas space heater label

The gas energy labels are similar in format to those found on electrical appliances, except they are blue and show annual energy use in MJ.

A trial web site listing gas water heaters available in Australia is also available (see below).

Brand	Model	Type	Mj/year	Star Rating	SRI	Storage Capacity (ltrs)	Indoor/Outdoor	Natural Gas	Bottle Gas
Rinnai Infinity "V" Series	REU-V2632FFU-A (Infinity 26 plus internal)	Instantaneous	18969		5.9		I	N	P
Rinnai Infinity "V" Series	REU-V2632FFUC-A (HD2001 internal)	Instantaneous	18969		5.9		I	N	P

A joint review of the scheme is under way by the Gas Industry and Governments and regulation is under consideration. A three year work plan has been published under

the Australian and New Zealand Appliance and Equipment Energy Efficiency Program.

Summary
Currently voluntary labelling using 'star' rating system with mandatory minimum energy performance standards. Future regulation is under consideration.

3.4 Green Vehicle Guide

Purpose

To provide web-based comparable and accessible environmental data on new motor vehicles

Background and strategy

The Commonwealth government started publishing a booklet of fuel consumption data for new passenger and light commercial vehicles in the early 1980s and a low cost web database in more recent years.

In 2004 the Government through the Department of Transport and Regional Services (DOTARS) expanded the fuel consumption guide into the Green Vehicle Guide. The Green Vehicle Guide is a web based database that rates new passenger and light commercial vehicles on air pollution, greenhouse emissions and fuel consumption and gives an overall 'star' rating for each vehicle within each vehicle category (small, medium, luxury, sports, etc).

The data on which the scores are derived are provided voluntarily by the vehicle manufacturers, however this data is based on mandatory Australian Design Rule certification test data.

The Guide uses a 5 star rating system however it also assigns half stars resulting in a total of 10 levels.

The Greenhouse Ratings are based on carbon dioxide emissions and the Air Pollution Ratings take into account the relative environmental impact of oxides of nitrogen, hydrocarbons and particles. The relative harmfulness of the pollutants (shown in table below) has been quantified based on the allowable concentrations under the Ambient Air Quality National Environment Protection Measure (NEPM).

Green Vehicle Guide Weighting of Regulated Vehicle Emissions

Vehicle Emission (equivalent pollutant under Air NEPM)	**Calculated Relative Harmfulness**	**Final Weighting**
Carbon Monoxide (CO)	0.088	Not included
Oxides of Nitrogen (NO_x) (based on Nitrogen Dioxide)	4	1
Hydrocarbons (HC) (based on photochemical oxidants as ozone)	5	1
Particulate Matter (PM) (based on PM_{10})	20	5

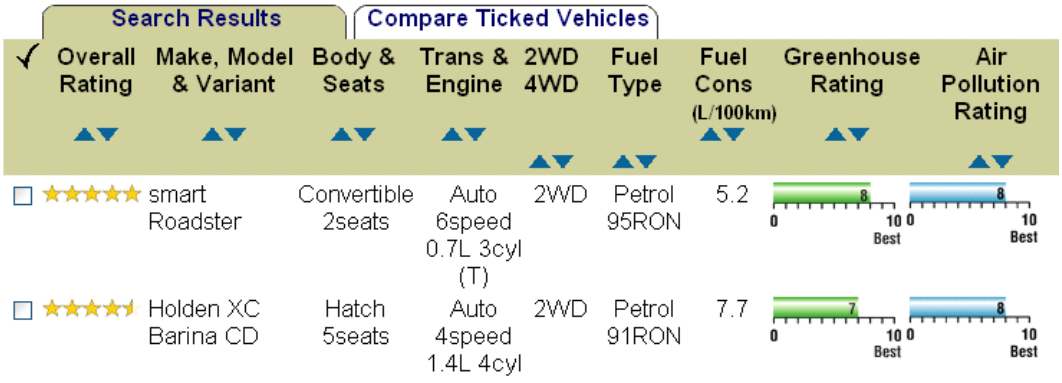
Source: Real and Jones, 2005

NOx and HC were given equal final weightings despite the slight difference in the calculated relative harmfulness, primarily because under ADR79/00 a combined HC+NOx limit is prescribed rather than individual limits for each pollutant.

The higher weighting for particulate matter recognises its significant health impacts. The Air Pollution rating scale was devised in such a way that a 'typical' car (that is, most petrol engined passenger cars meeting the current emission standard at the time) receives a mid-point rating (5 out of 10).

The overall rating, or stars, is derived from the sum of the air pollution and greenhouse scores i.e. they are equally weighted.

Development of the Green Vehicle Guide (see extract below) involved extensive consultation with vehicle manufacturers.



Website Costs

The new highly automated web database which contains data on approximately 1400 vehicles and has sophisticated search facilities cost approximately $200,000 to develop plus around $100,000 was spent recently to improve the site's usability. This

compares to the previous low cost database, which together with the printed guide cost less than about $80,000 per annum. The low cost version lacked the automation, was only updated annually and did not have the ability to compared vehicles.

The manufacturers provide the data on line using special access codes. This data is checked by DOTARS before it is uploaded onto the website. It takes close to a full time position within DOTARS to administer the website and respond to website related queries.

Market Research and Marketing

Before the new greenvehicleguide.gov.au website was launched DOTARS commissioned consumer surveys to determine the level of knowledge about the environmental impacts made by vehicles. This research showed that around half of those surveyed had the belief that "all new cars have the same level of impact on the environment".

It became apparent through the surveys that there was a need to provide consumers with meaningful information on the relative performance of different vehicles. This was a view shared by the Productivity Commission who said that while markets provide extensive information to consumers regarding fuel consumption of motor vehicles "the Australian Government's Fuel Consumption Labelling Scheme and Green Vehicle Guide provide relatively low cost, accessible and comparable information to consumers, and may be justified as part of the more fundamental objective of encouraging consumers to reduce the adverse environmental impacts of motor vehicle use." The Productivity Commission also commented that government sources of information of this type were seen as credible and reliable and held in higher regard than information provided by others.

DOTARS has scheduled some follow up consumer research for 20006/2007.

DOTARS has spent about $600,000 in marketing the Green Vehicle Guide. This has included advertising in weekend guides in newspapers, developing facts sheets plus targeted marketing to motor vehicle journalists.

Summary

Website - voluntary but legislative base

4. Government-Industry Partnership programs

Government-Industry Partnerships are the basis of many environmental initiatives and can take a number of forms. Industry and government negotiate the terms of the program which are normally detailed in a formal agreement which sets out the environmental objectives and the responsibilities of each party towards their achievement.

The Government/Industry Partnership programs outlined below indicate the varied nature of these initiatives.

4.1 The National Packaging Covenant

The National Packaging Covenant (the Covenant) commenced in 1999 and is a voluntary agreement between all levels of government and companies throughout the packaging chain, including raw material suppliers, packaging producers and retailers. The Covenant commits signatories to the implementation of best practice environmental management in areas such as packaging design, production and distribution and research into life cycle issues. Signatories to the Covenant produce action plans on the measures they will implement to reduce packaging waste and they report annually on their progress. In this sense the Covenant provides flexibility to signatories to develop plans suitable to their own circumstances. The Covenant's success, (it currently has over 600 signatories) is due to the active promotion of it by Government and key industry players.

The Covenant is complemented by a regulation, the National Environment Protection (Used Packaging Materials) Measure (the NEPM), which enables states and territories to use enforcement action to require companies that don't sign the agreement to take steps to reduce their packaging waste. Preceding the Covenant and the NEPM were a number of voluntary industry agreements but these were limited in scope and largely focused on companies in the beverage industry.

4.2 National Industry Reduction Agreement

The Publishers National Environment Bureau (PNEB) was formed in 1990 as an association of the major publishers of newspapers and magazines in Australia to promote the recovery and recycling of old newspapers and old magazines, primarily from community kerbside collections organised by local councils.

The PNEB and a newsprint manufacturer have voluntarily entered into a series of five-year Industry Waste Reduction Agreements with the Commonwealth and State Governments. Under the current (third) plan, 2001-2005, newsprint recycling in Australia has grown to 75.4% nationally in 2005, from the 28% level when the PNEB was formed in 1990.

State/Local target based programs

There have been a number of agreements signed by state government departments and an industry group where there is a stated goal to reach a specific environmental target. For example in the early 1990s there was a voluntary agreement with the EPA Victoria and companies in the Altona Chemical Complex in the western suburbs of Melbourne (which includes Australian Vinyls, BASF, Dow Chemicals and Qenos) to reduce hydrocarbon emissions by 50% within a specified timeframe. The target was met and further emissions reductions were negotiated. The NSW EPA-Oil industry petrol volatility agreement outlined below is another example of a target based program.

4.3 NSW EPA-Oil Industry Memorandum of Understanding on Summer Petrol Volatility

In 1998, NSW established arrangements for the supply of low volatility petrol in summer in the Sydney Greater Metropolitan Region, implemented through a Memorandum of Understanding between the then EPA and oil companies. The

principal reason for controlling petrol volatility in summer is to reduce evaporative emissions of VOCs (from vehicles and production and storage sites) which contribute to ozone formation.

The Memorandum of Understanding operated over four summer periods from 1998 to 2002 and involved companies voluntarily reducing petrol volatility (measured in kilopascals (kPa) of vapour pressure) over three summer periods from a base of 76kPa to 70kPa in the first summer, 67kPa in the second and 62 kPa in the last two years.

Although the Memorandum of Understanding was successful in progressively reducing petrol volatility over the period of its operation, it was not supported by all industry members. Consequently, agreement was reached with industry that summer petrol volatility limits should be regulated to ensure a level playing field for all industry participants and regulated limits will apply from the summer of 2004/05.

5. Summary of Australian Benchmark Programs

Program	National/ State	Summary of Approach	Impact *
Voluntary Programs			
Altona Chemical Complex (Vic).	Local	Small industry group worked towards self determined targets	Very high
Energy Star	National	Standards based label	Limited
Gas appliance Rating Scheme	National	Industry operated labelling scheme, with stars assigned therefore has graded benchmarks/minimum performance standards / out dated/ web database being developed	Low
National Industry Reduction Agreement	National	Small industry group worked towards negotiated targets	High
NSW EPA-Oil Industry MOU	State	Small industry group worked towards negotiated targets but not all involved – lead to regulations	Moderate
Top Energy Saver Award	National	Achievement based label	Limited
Quasi Regulatory			
Green Vehicle Guide	National	Well promoted web database/ star ratings assigned therefore has graded benchmarks / data provided voluntarily but backed by ADR requirements/	High?
Stand-by power	National	Required to achieve voluntary targets or regulation will be introduced	Unknown
National Packaging Covent	National	Performance based targets backed by legislation	High
Regulatory			
Energy Efficiency Labels	National	Labelling scheme, with stars assigned therefore has graded benchmarks/based on Australian Standard/ web database	High
MEPS	National	Sets base benchmark and works with energy rating	High
WELS Scheme	National	Labelling scheme, with stars assigned therefore has graded benchmarks/based on Australian Standard/web database	High
Wood heaters	State	Only one benchmark assigned/ regulations are not uniform	Moderate

* author's assessment based on direct or indirect knowledge of these programs

Appendix 2. Productivity Commission Comments on Labelling and Minimum Performance Standards

The Productivity Commission, an independent agency which is the Australian Government's principal review and advisory body on microeconomic policy and regulation recently examined the cost effectiveness of improving energy efficiency. As part of its review, 'The Private Cost Effectiveness of Improving Energy Efficiency', it examined labelling programs, minimum mandatory energy efficiency requirements and other means of providing consumer information. The final report contains some highly relevant material that is applicable to establishing a benchmarking scheme for small engines.

The following is a summary of relevant conclusions from the Inquiry.

Government Operated Labelling Schemes

From consumer research provided to the Commission, it concluded that "there is some evidence to suggest that consumers are now paying more attention to labels than they have in the past".

The Commission was positive about labelling programs as labels:

- directly address "a source of market failure — the asymmetry of information between buyers and sellers of energy-using products."
- provide information to the consumer that is readily-accessible and easily-understood and therefore can assist in helping the consumer make better-informed choices.
- are likely to have produced net benefits for consumers.
- do not directly limit consumer choice.
- could provide a greater incentive for suppliers to sell products that use energy cost effectively.
- probably produced net social benefits.
- are most suited where there is a wide spread in the range of performances of comparable appliances and where information failures are most pronounced."
- can be used to warn consumers that an appliance is very inefficient (through a disendorsement label) which could be effective in discouraging, but not preventing, consumers from buying the poor performing product.

The Commission was supportive of Government's role of drawing together and packaging information through labelling programs as this ensures that "relevant and trusted information gets to those who would otherwise not get it". In material reviewed by the Commission George Wilkenfeld and Associates and Energy Efficient Strategies (1999) claimed that labelling is unlikely to be effective if: purchasers rarely inspect appliances in a showroom where they can compare performance across

different models; or the purchaser is not the ultimate user, and so has little interest in operating costs.

Labelling programs involves both administration and compliance costs, such as those incurred by suppliers in having their products tested but the Commission considered that labels should be more actively considered as an alternative to minimum performance standards.

Minimum Performance Standards

Governments can prevent the sale of inefficient products by using minimum standards, for example the Minimum Energy Performance Standards (MEPS) that apply to appliances such as refrigerators and freezers, air conditioners and electric water heaters. If appliances do not meet the minimum standard they cannot be sold in Australia. Some appliances are covered by both MEPS and by labelling (for example, refrigerators).

The Commission considered that MEPS and labels can be complementary as MEPS act to penalise the worst energy performers whereas labels rewarding the better performers.

Costs comparisons of schemes

The then Department of the Environment and Heritage provided details about the costs involved in administering both the labelling scheme and the minimum performance standards for energy programs. It stated that:

- the administration costs of MEPS are substantially lower than for labelling, but the compliance costs can be higher.
- MEPS can have a greater cost for suppliers than labelling, since suppliers must adjust their model ranges to meet the MEPS levels by the given date. These compliance costs are however influenced by the 'lead in' time between the introduction of the regulatory proposal and the implementation of the MEPS.
- it is estimated that the administration costs for MEPS would be $3 million over the period 2000–15, compared to $39 million for labelling (in present value terms) (George Wilkenfeld and Associates and Energy Efficient Strategies 1999). Furthermore it was assumed that 84 per cent of administration costs were borne by appliance purchasers, with the remainder borne by governments.

It estimated that MEPS would increase the cost of appliances by $266 million over 2000–15, compared to $688 million for labelling (the latter cost being due to consumers voluntarily purchasing more efficient appliances).