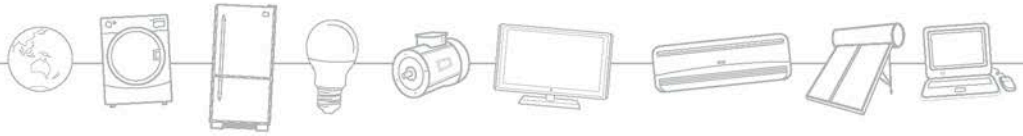
E3
Equipment Energy Efficiency

Consultation Regulation Impact Statement – Swimming Pool Pumps

Proposed Energy Labelling and Minimum Energy Performance Standards

November 2016



A joint initiative of Australian, State and Territory and New Zealand Governments.

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Executive Summary

The E3 Program is considering the introduction of regulations in Australia to reduce the energy consumption of pumps used in residential pools and spas ("pool pumps"). Following initial market analysis New Zealand has decided that pool pumps are not a priority, due to fewer installed pools and low annual sales of pool pumps.

This consultation Regulation Impact Statement (RIS) presents proposals for the Australian market and invites comment and discussion by consumers, industry and other interested stakeholders. The period for comment is from 10 November 2016 to 21 December 2016. Please refer to the consultation section (page ix) for information on public meetings to discuss the RIS and information on how to make a submission. The Department of Environment and Energy (DEE) has prepared this RIS on behalf of the E3 Program.

The electricity costs of running a pool pump can comprise around 18 per cent of the energy bills for households. These costs are unnecessarily high because people continue to buy, install, and use pool pumps that are not the most energy efficient on the market. Modelling by the Department of the Environment and Energy (DEE) indicates that pool pumps in Australia are costing consumers $224 million per year in avoidable electricity consumption costs.[1]

This RIS presents research, modelling and analysis showing that market failures and consumer behaviour in the pool pump market are acting to constrain the uptake of energy efficient pool pumps and are imposing higher than necessary costs on consumers and society more broadly. These barriers and behaviours are preventing the pool pump market from moving naturally to more efficient technologies and are contributing to unnecessarily high externality costs from greenhouse gas emissions, peak loads on electricity distribution networks and residential noise pollution.

Various efforts have been made by governments, electricity network operators, and the private sector to promote the use of more energy efficient pool pumps and to overcome these market barriers. The Voluntary Energy Rating Labelling Program, household rebate schemes and businesses offering bundled electricity retailing and energy efficient pool maintenance services, highlight that there is the opportunity to reduce the energy consumption of pool pumps. Despite these efforts, this RIS suggests that these existing efforts are not overcoming the market failures and barriers in the pool pump market. Section 2 discusses this issue in more detail.

This RIS presents some proposals that could be introduced under the *Greenhouse and Energy Minimum Standards Act 2012* to resolve these market failures and increase the uptake of energy efficient pool pumps on a national scale. This process is working towards the introduction of any new regulations in 2018.

[1] Based on calculated benefits for a Minimum Energy Performance Standard equivalent to 4 Star Rating plus Mandatory labelling - av. p.a. 2018-30 or a total of $2.9 billion over 2018-2030].

The options considered are for regulation that could introduce and enforce:

1. *Mandatory energy efficiency labelling* of all pool pumps imported or sold in Australia. The label would show each model's energy efficiency rating or 'star rating' (see Section 4). The labels could also provide information on the noise output of different pool pump models.

2. *Minimum Energy Performance Standards* (MEPS), where pool pumps below a minimum energy performance standard would not be allowed to be imported or sold in Australia (see Section 5).

Summary of cost-benefit analysis

Below are the central estimates from the cost benefit analysis for the measures proposed in this RIS.

AUSTRALIA	*Discount rate 7 per cent*		*Electricity tariff $0.266 per kWh*		
Policy option	Energy saved (cumulative GWh to 2030)	Emission reduction (cumulative Mt to 2030)	Total benefits (NPV, $M)	Total Cost (NPV, $M)	**Net Benefit (NPV, $M)**
Label only	1416.88	1.19	$281.39	$7.18	**$274.21**
Label + 2 Star MEPS	1470.11	1.23	$291.96	$7.10	**$284.86**
Label + 4 Star MEPS	10472.58	8.78	$2,079.86	$1,013.63	**$1,066.23**
Label + 5.5 Star MEPS	10994.41	9.22	$2,183.49	$1,141.45	**$1,042.04**

Mandatory labelling

Mandatory labelling would mean:

- Manufacturers would be required to have all models of pool pumps tested and rated under an approved test method (such as AS5102.1 (2009)), or a replacement test method designed by a technical committee (see Appendix C - Standards for Measurement).
- Manufacturers and retailers would have to disclose information about the relative energy efficiency of all pool pumps to consumers and display the label.
- Manufacturers would be required to register all pool pumps within the scope of the regulation for sale in Australia and would be subject to standard compliance and fee arrangements.
- The voluntary energy rating label scheme for pool pumps would close.

Minimum Energy Performance Standards

Minimum energy performance standards would mean:

- Pool pumps that do not meet the minimum energy performance standard, as set out in the regulations, would not be able to be supplied for sale in Australia.
    - Any MEPS proposal would be introduced along with mandatory labelling.

The introduction of mandatory labelling or MEPS would require a review of the existing test standards (AS5102.1 and 2)[2] and consideration of an appropriate standard to support the star rating for mandatory labelling and minimum energy performance standards (MEPS). DEE, on

[2] AS5102.1 and 2 - 2009 Performance of household electrical appliances – Swimming pool pump units. Part 1 Energy consumption and performance. Part 2 Energy labelling and minimum energy performance standard requirements

behalf of the E3 Program, is keen to work with industry on this issue and will support the establishment of a technical committee to review and develop an appropriate standard.

DEE is also keen to establish a policy advisory group with industry to work through issues raised by the consultation process on this RIS.

Mutual recognition arrangements

Mutual recognition arrangements facilitate trade between Australia and New Zealand. If mandatory labelling or MEPS for pool pumps are adopted in Australia alone, this may have implications for trans-Tasman trade in these products (see Appendix G – New Zealand). DEE considers that the effects of different requirements in Australia and New Zealand on trans-Tasman trade are likely to be small, but the department is keen to get industry and stakeholder views on this.

Consultation

Please provide feedback on this RIS, or any matter referred to in it. This will help the Department of the Environment and Energy (DEE) to develop options in an open and consultative manner. The department would also be grateful for any relevant data or evidence to support your submissions, as well as any data that would add to the accuracy of the modelling and assumptions made.

The closing date for submissions is 21 December 2016.

Submissions can be made by:

Email: poolpumps@environment.gov.au

Mail: Pool Pumps Team

Appliance Energy Efficiency Branch

Department of the Environment and Energy

GPO Box 787

Canberra ACT 2601

Online Submission: You can find out more about making a submission online on the Energy Rating website.

Note: submissions will be published on the energy rating website, as will the names of stakeholders who provide submissions. If you do not want your submission to be published, please advise DEE in writing that your submission is confidential.

Schedule of public meetings:

- Melbourne – 3pm, 29 November 2016
- Adelaide – 1 December 2016 TBC
- Perth – 2 December 2016 TBC
- Sydney – 5:30pm, 5 December 2016
- Brisbane – 7 December 2016 TBC

If you wish to attend a meeting please email poolpumps@environment.gov.au. Details of meetings will be emailed to the department's pool pump contact list.

DEE intends to establish two working groups to support the consultation process.

- A technical working group of pump and hydraulic industry experts to advise on the usefulness of standards (eg. AS5102.1) for regulatory testing.
- A policy advisory group (Pool Industry Advisory Group or PIAG) to represent members of the pool industry in the development and discussion of policy.

We are seeking expressions of interest from members of industry and the community to be a part of these working groups. Please email poolpumps@environment.gov.au, if you wish to know more or you would like to join either working group.

Questions on which DEE is seeking responses from stakeholders

1. Do you support the proposal to introduce mandatory energy labelling of pool pumps (Section 4)?
2. Do you support the introduction of a Minimum Energy Performance Standards (MEPS) level for pool pumps (options are set out in Section 5)? Which option would you prefer? If none, please explain.
3. Do you have views on the scope of new labelling and MEPS requirements in terms of the types or size of pool pumps that should be covered (wattage, types of pump, application of pump)?
4. What opportunities or difficulties could mandatory labelling or MEPS for pool pumps create for your company?
   - Would your company be able to adjust to any change, if given sufficient time?
   - How much time would your company need to adjust to a change?
5. Do you have view on when any new requirements should be introduced or what transition arrangements or steps should be considered in introducing new regulations?
6. Do you agree with the data and assumptions made in this RIS? Please provide data and evidence to support your position, especially relating to:
   - capital and running cost estimates for swimming pool pumps
   - sales and price information about different types of pool pump
   - the market split between single speed and other pump types, and
   - any regional or state-level differences.
7. Can you think of any other measures that would help to overcome the problem identified in section 2?
8. Do you foresee any implications of New Zealand opting out of the regulation of pool pumps?

Structure

The document is divided into six sections:

1. Background to the issue of pool pump energy efficiency
2. Statement of the problem to be solved by the proposed regulatory changes
3. The Voluntary Energy Rating Label Program
4. Proposal to introduce Mandatory Energy Efficiency Labelling
5. Proposal to introduce Mandatory Energy Performance Standards
6. A series of technical appendices, including detailed results of cost benefit analyses and technical discussions about pool pump energy efficiency testing results, and standards for pump testing methods.

1. Background

The Equipment Energy Efficiency (E3) Program sets Minimum Energy Performance Standards (MEPS) and applies Energy Rating Labels (ERLs) to household and commercial appliances and equipment. The program brings together the Commonwealth, State, and Territory governments of Australia with the government of New Zealand to apply consistent energy efficiency requirements across all jurisdictions.

The E3 Program is overseen by the Council of Australian Governments' (COAG) Energy Council, which is advised on energy efficiency matters by the Energy Efficiency Advisory Team (EEAT) of officials from all participating jurisdictions.

The E3 Program operates under the *Greenhouse and Energy Minimum Standards Act 2012* ("the GEMS Act") in Australia and the Energy Efficiency (Energy Using Products) Regulations 2002 ("the EEEUP Regulation") in New Zealand, which promote the development and adoption of energy efficient products to reduce energy use and lower emissions of greenhouse gases.

Following a review of program priorities, the COAG Energy Council directed EEAT to examine the costs and benefits of introducing ERLs and MEPS on pumps used in swimming pools and spas ("pool pumps"). The Commonwealth Department of the Environment and Energy (DEE), reporting to EEAT, has prepared this consultation Regulation Impact Statement (RIS) as a basis for public discussion of options for improving the energy efficiency of pool pumps.

This RIS considers options for the Australian market only and excludes New Zealand. Initial market enquiries and data analysis were undertaken for both the Australian and New Zealand pool pump markets. On the basis of this analysis, New Zealand decided that energy efficiency regulation of pool pumps would have minimal benefits due to the small number of residential pools in New Zealand and the consequent low number of sales of pool pumps.

If regulation of pool and spa pumps proceeds in Australia only, the Australian market could be exposed to non-compliant products imported from New Zealand under the Trans-Tasman Mutual Recognition Arrangement (TTMRA)[3]. DEE is seeking feedback during consultation process on the likelihood of this occurring. The department's initial view is that the risk of this occurring is minimal.

See Appendix G for more information on the market analysis for New Zealand and the potential implications of regulation proceeding in Australia only.

1.1 Overview of the pool industry

The Australian pool pump market is part of a large and dynamic pool, spa and pool equipment industry. Major segments in the industry include:

[3] The TTMRA provides that any goods legal for sale in New Zealand can be sold legally in Australia (and vice versa).

- National and international pool pump and pool equipment manufacturers and assemblers based in Australia, which also supply the New Zealand market
- Six large manufacturers supply the majority of pool pumps to the Australian market. All six supply a full range of pump sizes, types and technologies to the market. These firms are: Astral, Davey, Hayward, Pentair, WaterCo and Zodiac
- There are also a number of small and medium sized pool and spa pump manufacturers and wholesalers active in the Australian market. These firms include manufacturers and assemblers of motors and pumps and distributors for well-known international brands. Some companies also sell branded products designed in-house for both the spa and pool markets with some or all components manufactured overseas
- In-ground and above ground swimming pool manufacturers and installers
- Specialist pool and spa product manufacturers, equipment suppliers and installers, including suppliers and manufacturers of pool heating equipment, such as solar thermal or heat pump products
- Specialist retail pool shops and businesses selling pool equipment, chemicals and pool services, including maintenance and cleaning services
- There are at least four large franchise networks operating in Australia with well over 200 "branded" retail outlets, in addition to branded mobile maintenance businesses.

The Australian swimming pool and spa pump industry has become increasingly globalized since the early 2000s[4]. This has resulted in:

- a shift to domestic assembly of imported pool pump components (motors and pumps) by some pool pump manufacturers, wholesalers and suppliers;
- some consolidation amongst Australian pool pump manufacturers and suppliers.

Pool pump and pool equipment manufacturers often have close links with pool manufacturers and installers, pool maintenance and equipment suppliers, and pool equipment distributors and wholesalers (Figure 1.1).

DEE commissioned a national survey of pool owners in 2016 to better understand how consumers select a pool pump. Alongside the survey, Woolcott Research and Engagement conducted focus group interviews with 30 pool industry professionals. These focus groups reported[5] that many pool industry professionals had set arrangements with manufacturers (volume deals, incentive packages), demonstrating the strong, commercial links and relationships between pool pump and pool equipment manufacturers and other industry segments. The importance of these business and market relationships was also reported by Winton in 2009[6].

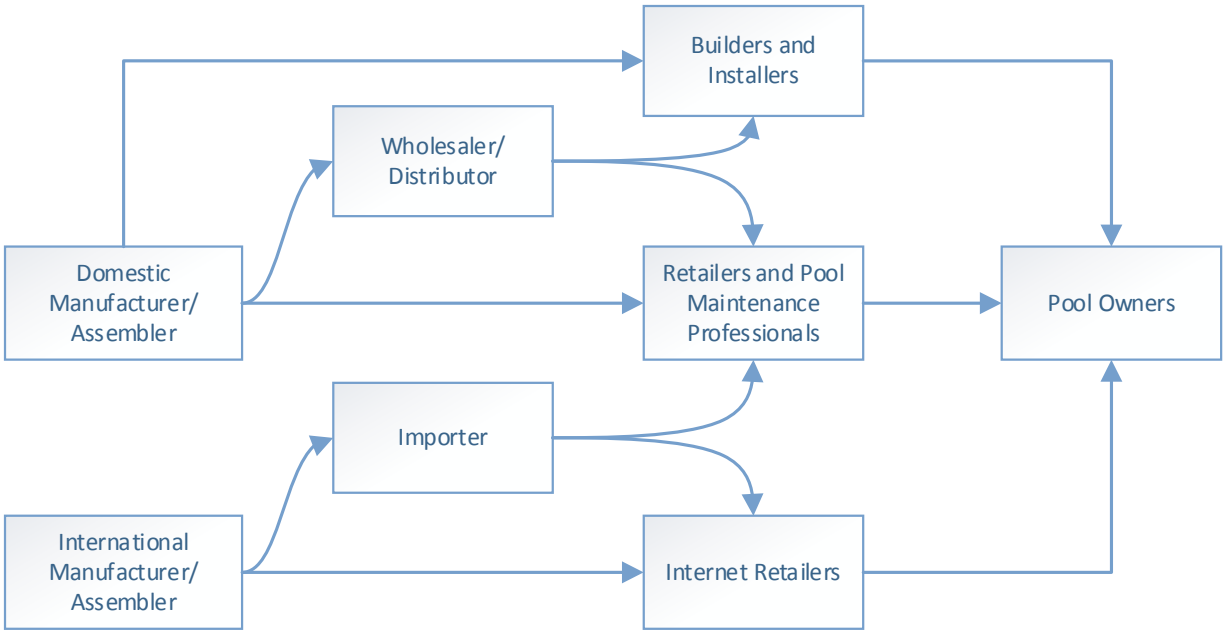
Pool equipment, including pool pumps, are also available over the internet from domestic and international suppliers. Industry advice to DEE is that internet sales do not account for a significant share of the pool pump market. (Internet sales are discussed in more detail in subsection 1.5.)

[4] See the Energy Rating website for example
Report Nos: 2004/12: National Appliance and Equipment Energy Efficiency Program. Minimum Energy Performance Standards - Swimming Pools and Spa Equipment.

[5] National Pool Owner Survey (2016), Woolcott Research and Engagement, energyrating.gov.au/document/report-pool-pump-market-research-2016.

[6] June 2009 – Winton Sustainable Research Strategies. Report to the Department of the Environment, Water, Heritage and the Arts - Energy Efficiency Labelling of Swimming Pool Pumps: Report on market research.

Figure 1.1: Pool pump industry and market from production to consumers



1.2 Swimming pool pumps[7]

The purpose of a pool pump is to circulate the entire body of water in a pool at least once a day to maintain sanitation and clarity of the pool or spa water. To do this, the pool pump moves water through a filter and ensures adequate chemical dosing through a chlorinator or other sanitising system. The filter removes dirt, leaves, hair, insects and other detritus. The chlorinator or other sanitising technology adds disinfectants, oxidisers and algaecides to keep the water clean and safe for human use. The pool pump can also be used to circulate water through a pool's heating system.

The pool pump is made up of an electric motor and a pump. The motor converts electrical energy into rotational energy and may provide single speed, dual speed, multiple speed or variable speed operation, depending on the motor design.

The pump converts mechanical energy to hydraulic energy (pool pumps are end-suction centrifugal pumps). The pump draws water through the centre of the impeller, or rotor, of the pump and generates a pressure force sufficient to overcome the flow resistance in the plumbing system. The pressure head forces the water through the pool plumbing, filtering equipment and heater.

The pool pump's task is broken into filtering and cleaning (backwash) applications. Filtering is the primary task of the pool pump and a filtering time needs to be selected to ensure adequate water turnover (that is, the complete turnover of the pool's water volume). The cleaning or backwashing function requires high speed pump operation for a small period of time to "flush" the filter media.

1.3 Operating time and efficiency

Substantial energy and costs savings can be achieved by operating a pool pump at the lowest speed needed to meet its filtering requirement, even though the pump needs to run for a longer time at this reduced speed to move the total volume of water.

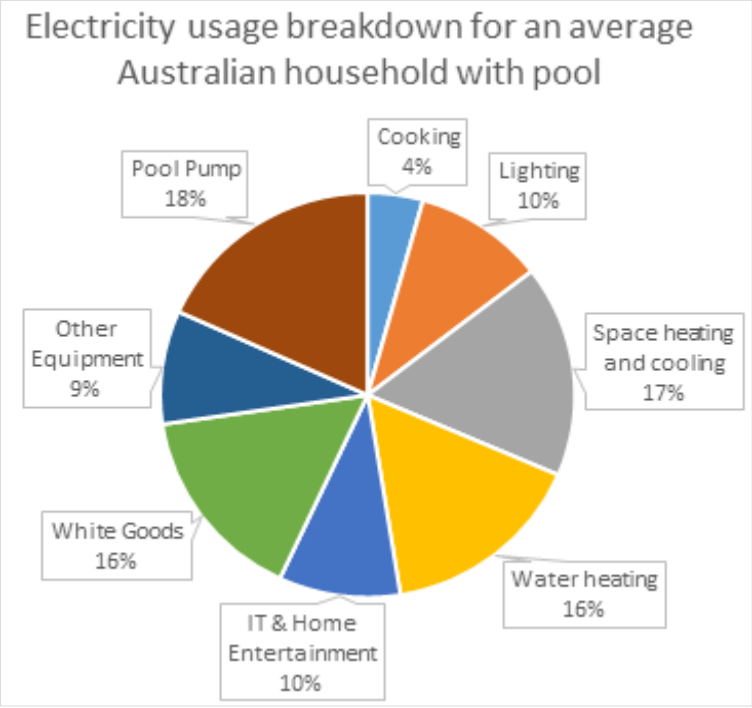
[7] This section draws on Chapter 3 of the Californian Energy Commission: 2016 staff report- *Revised Analysis of Efficiency Standards for Pool Pumps and Motors, Spas – Draft Staff Report*. The report provides an accessible overview of pool pump technologies, uses and energy efficiency principles including the Affinity Laws.

By operating at lower flow rates, the overall flow resistance is reduced, which results in substantial energy and cost savings. This phenomenon is described by the pump Affinity Laws. For example, where a pump rotor speed reduces by one-half of maximum speed, the electrical power demanded by the motor is reduced to one-eighth of its maximum. In turn, the flow through the pump would reduce by one half, requiring the pump to run twice as long at half speed to meet the filtration task (volume flow) for the pool system. The total power used, however, would only be 25 per cent of the energy needed to move the same quantity of water at full speed.

The issue common among single speed pumps is that they operate at a constant speed, which must be powerful enough to meet high speed flow requirements. They cannot then drop to a more efficient operating speed for filtration. For this reason, single speed pumps are significantly less efficient in terms of energy use, compared with other pool pumps.

In Australia, pool pump operation can comprise around 18 per cent of the energy bill[8] for households with swimming pools (Figure 1.2), which means that consumers can get big savings on electricity by choosing a more efficient pump. In addition, about one in nine households have a swimming pool, and the prevalence of single speed pumps (around 70 per cent of current sales), means that there are large gains possible across Australia, if pool owners install more efficient pumps on their pools.

Figure 1.2: Average electricity consumption for a household with a pool (DEE analysis)



1.4 Stock and sales of pool pumps

There are approximately 1.1 million residential pools in Australia. There are, on average, 1.5 pool pumps for each swimming pool or spa and DEE estimates that the stock of pool pumps is growing by approximately 1.5 per cent per year. This means that, by 2030, the total number of pool pumps in operation could be around 2.2 million. At present, pool pumps use over 1500 GWh of electricity

[8] DEE analysis - Australian households with a pool use on average 1352KWh per year powering pool pumps used for filtration.

per year in Australia. The amount of electricity consumed by pool pumps is likely to rise as the number of pools installed and pool pumps increases.

Pool pumps are usually bought at the time a pool is installed or as a replacement when a pump fails. A new pool is often sold as a package comprising the pool build, pump, water features and other equipment. The industry divides the new pool installation market into three segments:

- Concrete in ground pools with three broad price brackets – pools costing over $100,000; pools costing between $50,000 and $100,000 and pools costing less than $50,000.
- In-ground concrete pools are the most popular with around 59 per cent of survey respondents owning a pool of this type.[9]
- Fibreglass in-ground pools – typically priced at $30,000 or less; and
- Above ground pools, which can range in price from $6,000 to $20,000.

The replacement market is driven by pump failure at the end of a pump's useful life. While there is some variation, DEE's assessment is the average life expectancy of pool pumps sold in Australia is about 7 years. (See Appendix A – Assumptions applied to modelling for details.)

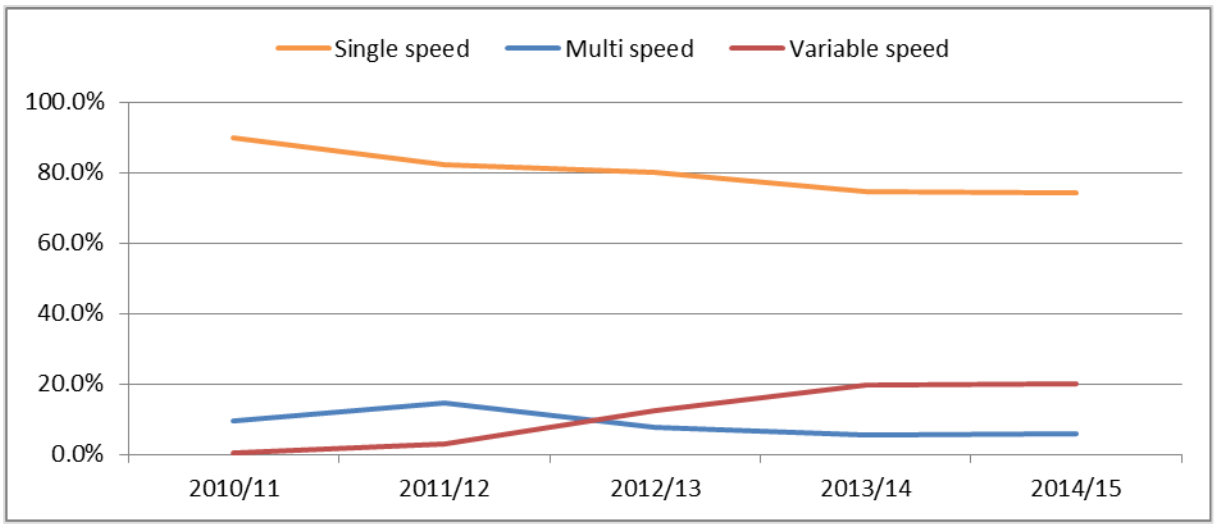
The Australian pool pump stock comprises low energy efficiency, single speed pumps and higher efficiency, multi and variable speed pumps.

Energy efficient multi and variable speed pumps were first introduced to the Australian market in the mid-2000s. Energy efficient pumps started to become widely available from 2010-11 onwards. Several things came together to support this change in the market:

- Development of an Australian test method and star rating system for pumps
- Establishment of the Voluntary Energy Rating Program for pool pumps
- Interest from two Queensland energy utilities in supporting the uptake of energy efficient pool pumps, which led them to run successful rebate programs.

Initial strong growth has now tapered off with both single speed and higher energy efficient pumps continuing to show growth of around one per cent per annum, while maintaining approximately their respective market shares (Figure 1.3).

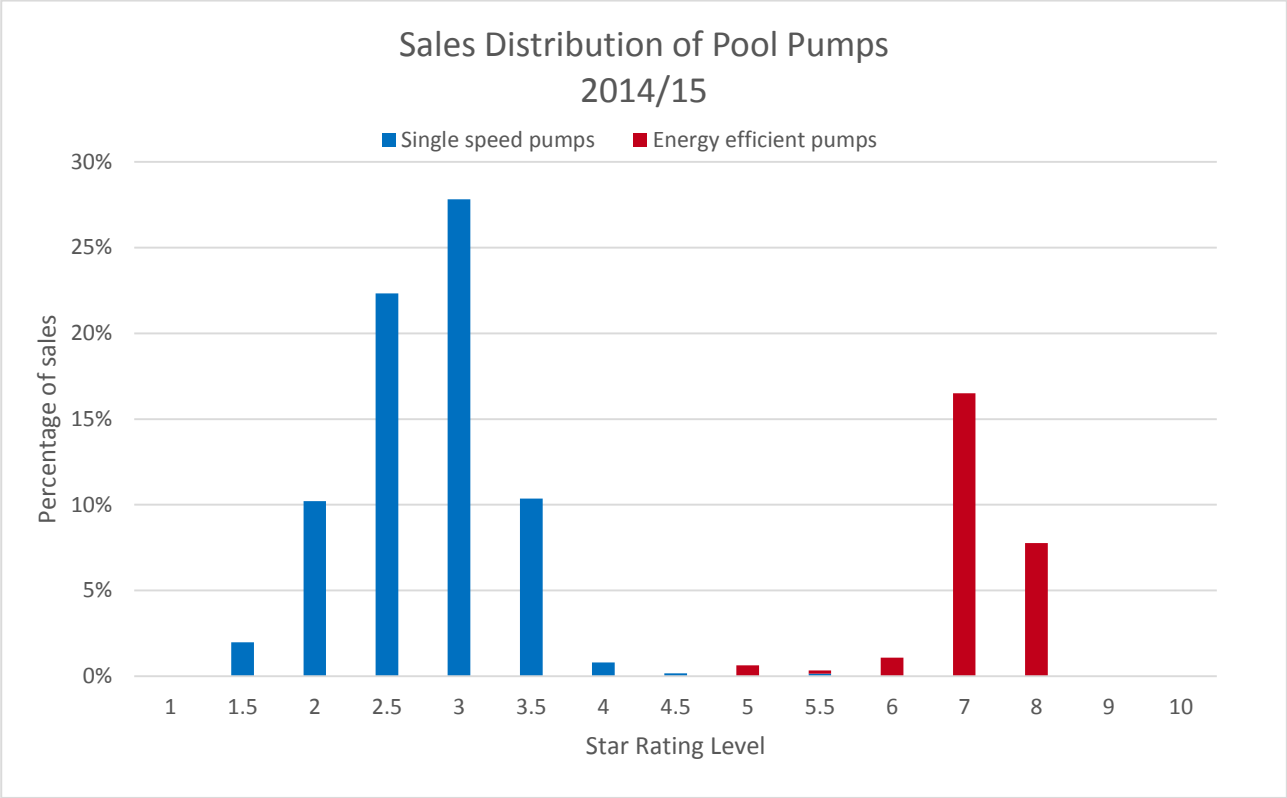
Figure 1.3: Percentage of pool pump sales by technology type



[9] National Pool Owner Survey 2016

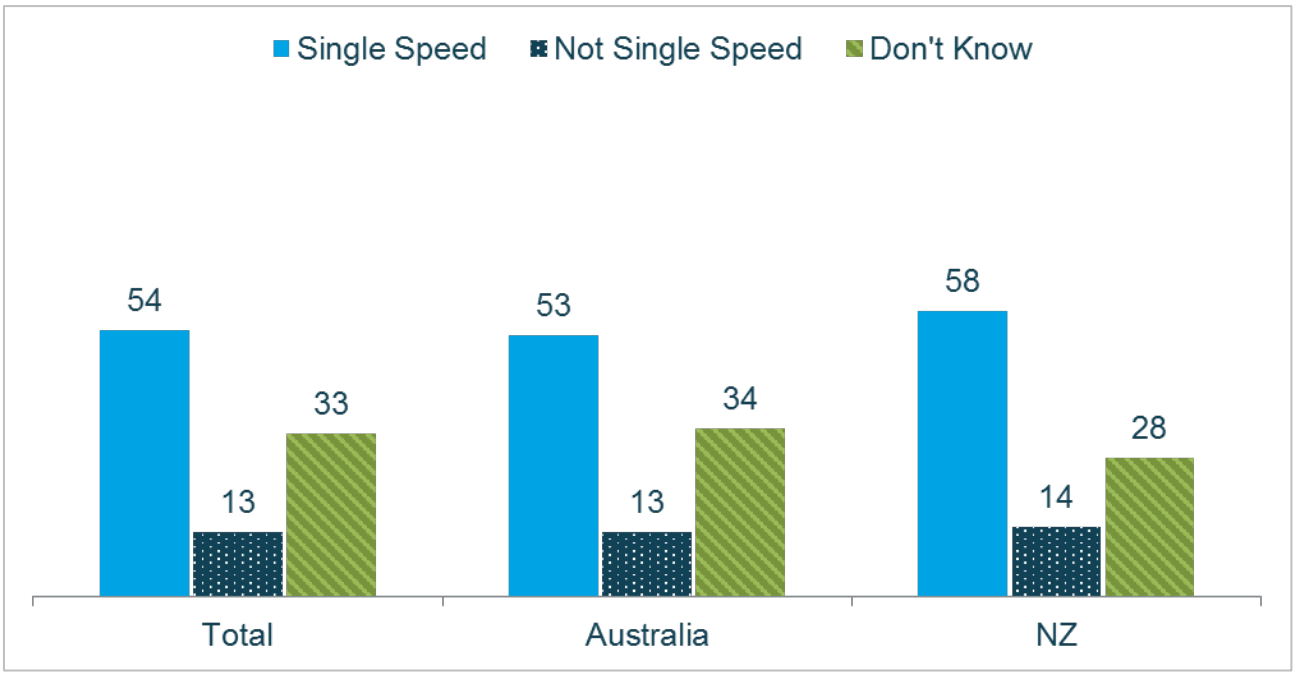
Sales data from major manufacturers show that energy efficient pumps (multi or variable speed pumps rated at or above 5 Stars) made up approximately 26 per cent of total sales in the Australian market over the five years to 2014-15. Over this period, the majority of sales (70 per cent) were of single speed pumps with star ratings below 5. The average number of stars, weighted by sales in 2014-15 (the 'sales weighted efficiency'), was 3.5 stars (Figure 1.4). This picture is supported by data from a national pool survey in 2016 with some 53 per cent of respondents across Australia reporting they own single speed pumps, while a further 34 per cent did not know the type of pump that they had (Figure 1.5).[10]

Figure 1.4: The distribution of pool pump sales in 2014-15 by star rating



[10] National Pool Owner Survey 2016

Figure 1.5: Type of pump by speed[11]



For Australia, national sales data and the results from the national survey of pool and spa owners indicate that:

- Energy efficient pumps comprise around 25-27 per cent of current pool pump sales market;
- This proportion is not growing as a share of national pool pump sales; and
- Early growth in sales of energy efficient pumps has tapered off.

There is some unevenness in the distribution or take up of energy efficient, variable speed pumps. Queensland consumers appear to be more receptive and have a greater uptake of variable speed pumps, compared with consumers in other states.

The Queensland pool industry and the evaluation of the Queensland rebate programs indicate that there has been a shift in the Queensland market and energy efficient pumps have become the "new normal" and sales are at "saturation levels". DEE does not have regional sales data, but, if correct, this would mean that the sales of energy efficient pumps in other parts of the country may be below the level to be expected in an efficient market.

Assuming pool pump consumers are similar across the country, the data implies that a strong market intervention may be needed to achieve efficient rates of sales of energy efficient pumps. Using national sales data for 2014-15, DEE examined several scenarios for high levels of sales of energy efficient pumps in Queensland, consistent with industry comments. What this work showed is that, if sales of energy efficient pumps make up a large share of all pump sales in Queensland, then sales of energy efficient pumps in the rest of the country are likely to be well below the national average.

[11] National Pool Owner Survey 2016

1.5 Internet sales and markets

There is no sales data and limited price information available for the internet sales of pool pumps. A review of internet price data for swimming pool pumps shows that the majority on offer are priced significantly below retail prices in Australia at specialist pool retail outlets, and that most are single speed pumps of various sizes and power.

A national survey in 2016 shows that about 10 per cent of respondents from Australia were buying their pool pumps online. In contrast, almost 80 per cent of people reported that they buy their pumps from a specialist pool shop or from a pool maintenance professional. Major manufacturers also report that they do not see internet sales as a major feature of the Australian market.

Pool pumps are also sold by large, diversified retailers, such as Bunnings, Masters and ALDI, but the pool industry reports that these outlets are not a major pathway for sales. This is supported by a national survey in 2016, where approximately 4 per cent of respondents in Australia reported having bought their pool pump at a diversified retailer.

1.6 Energy efficiency regulations

Pool pumps are not regulated for energy efficiency. Instead, the E3 program administers the Voluntary Energy Rating Labelling Program (VERLP), which enables suppliers of energy efficient pumps to register their products for an ERL. This program is discussed in Section 3.

Pool pumps must, however, be installed with a timer. This is a requirement of the Building Code of Australia. The national pool owner survey in 2016[12] showed around one in five respondents operate pumps without timers.

1.7 Comparing energy consumption of pool pumps

The pool pump market offers pumps with varying levels of energy efficiency, with some using more energy than others, to perform the same function. Prior to 2009, there was no means of formally comparing the relative energy efficiency of different models. In 2009, Standards Australia released the Australian Standard AS 5102.1 and 2: 2009 *Performance of household electrical appliances – Swimming pool pumps*. The standard describes a set of formal methodologies that allow for the testing of the energy efficiency of different pool pumps for comparison. The standards also established an index for allocating 'star ratings' for pool pumps, where pumps of different energy efficiencies are given a rating from 1 – 10 (1 being least efficient and 10 being the most efficient).

The relative energy efficiency of pumps with different star ratings is illustrated in figure 1.6. The standard was reviewed in 2012-13 by a Standards Australia working group, with a draft of a modified standard prepared, but not released. The standards and technical measurement methods are discussed further in Appendix C.

The 2016 national survey of pool owners reported a high level of interest in "energy efficiency" among those that had replaced their pool pump (Table 1.1). Of these, less than a third drew a link between the energy efficiency of the pool pump and opportunities to make cost and energy savings. This is consistent with other responses in the survey, which, taken together, suggest that pool owners have low levels of knowledge about pool systems and pool pumps.

[12] National Pool Owner Survey 2016 – see footnote 3

Figure 1.6: The annual energy consumption of pool pumps by star rating (DEE analysis)

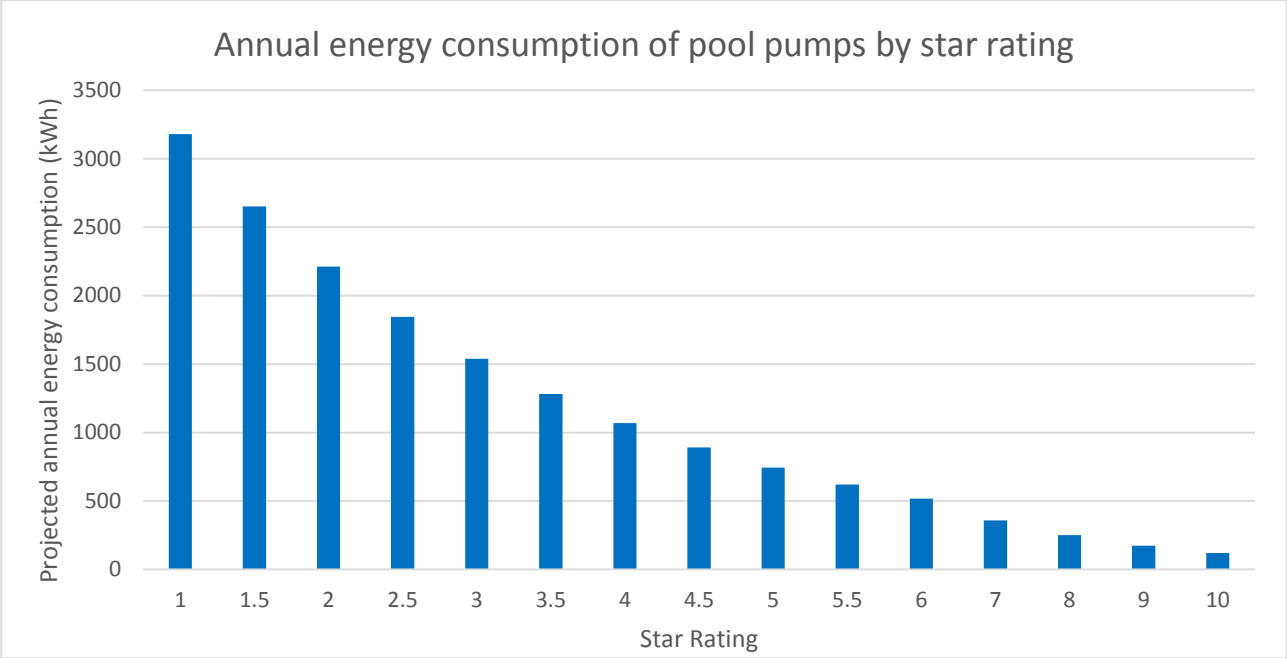


Table 1.1: Concern with pump electricity use by region

Location	*NSW (n=543) per cent*	*Victoria (n=236) per cent*	*South Australia (n=87) per cent*	*Western Australia (n=213) per cent*	*Queensland (n=416) per cent*	*Australia (n=1531) per cent*
Concerned about energy efficiency	61	55	66	62	63	61
Identified an energy efficient pump as a way of reducing energy use	25	25	34	28	32	27

1.8 Purchase and operating costs

Electricity used by pool pumps is primarily for the circulation of water through the filtration, water treatment and water heating systems. The filtration function accounts for between 70 and 90 per cent of total pool electricity consumption for pools without water heating. Pool pumps can also perform other functions, including: running spa jets, water features, or high pressure cleaning systems.

The amount of electricity used by a pool pump is measured in units of Watt hours (Wh) or Kilowatt hours (kWh), where 1 kilowatt = 1,000 watts. Different types and models of pool pumps have different operating costs. The amount of electricity a pool pump uses depends on:

- How many hours a day the pump is run and for how many days per year;
- The size of the pool; and
- The power consumption of the pump, measured in watts.

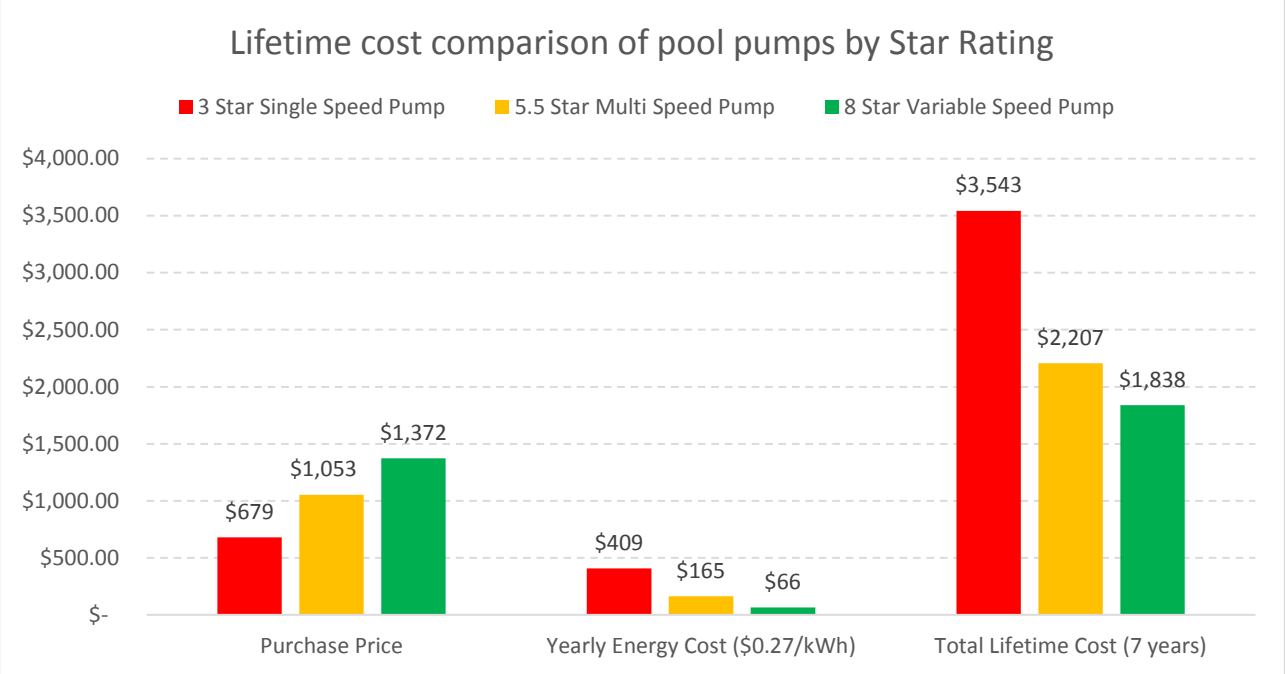
Apart from pool water heating systems, the energy consumption of a pool is affected by:

- the plumbing set up (the number of bends in the piping and the diameter of the pipe);
- the number of pumps installed:
- how much wind-borne detritus and other matter is carried to the pool;
- the use of the pool; and
- how well and how often pool maintenance is carried out.

Depending on the model and type, a pool pump can use anywhere between 100 kWh and 3,500 kWh of electricity per year (Figure 1.6). For an average household with a pool, pool pumps account for about 18 per cent of the total electricity costs of the household.

In Australia, the most commonly sold pool pumps have a retail price between $500 and $1500[13]. In general, the more energy efficient a pool pump is, the more expensive it will be to purchase (the capital cost). In contrast, the cost of the electricity to run a pool pump for filtration (the operating cost) can range between $60 and $700 per year in Australia. Operating costs can be several multiples of the upfront capital cost over the expected life of a pump. The running costs and upfront capital costs of different pumps are presented in Figure 1.7 (modelled performance based on AS5102.1).

Figure 1.7: The purchase and lifetime costs of pool pumps by star rating



[13] Department of the Environment and Energy modelling (2016) – See Appendix A

2. Statement of the problem

2.1 Overview

The benefits of energy efficient pumps include: reduced operating costs, reasonable payback periods that offset higher purchase prices, improvements in pool water quality, and noise reduction. Given these benefits, we would expect to see continuing growth in sales of energy efficient pumps, as a share of the national pool pump market.

National sales data, however, does not show this. Instead, after an initial period of strong growth from around 2010, sales of energy efficient pumps as a proportion of total sales plateaued, around 2013. Most pool owners have, or continue to buy, more energy intensive, single speed pool pumps.

Based on a national survey in 2016, it is clear that consumers are interested in reducing energy costs for their pools, but they have limited knowledge about the role of pumps and what are the best or most energy efficient pump for their pool or spa. There do not appear to be any quality or technical barriers limiting greater use of energy efficient pumps that would explain the predominance of single speed pumps in national sales, even though, in some specific circumstances, single speed pumps may be more suitable for some purposes.

Overall, the lack of growth in market share of energy efficient pumps and the resulting lower benefits obtained by pool owners is best explained by market arrangements, including industry practices.

- It took a major market intervention in the form of high cost rebate programs to overcome existing market problems in Queensland.
- Once the rebate programs ended, the underlying market features have come into play and these act to limit efficient investment by consumers in multi-speed and variable speed pumps.

The problems in the pool pump market are:

- The lack of good quality information for consumers on the comparative energy efficiency of different types of pool pumps.
- This lack of information is exacerbated by consumers' strong reliance on industry professionals and retail outlets.
- Industry has divergent views and knowledge about the relative energy efficiency of different pool pumps.[14]
- There are also commercial tie-ins with specific brands and product types.
- The existence of split incentives, particularly in the building and installation sector and for tenants and landlords, where the decision makers' interests do not align with the user of the pool pump.
- Costs from externalities, such as greenhouse emissions and electricity peak loads, which are not included in the costs of buying pumps with differing levels of energy efficiency.

[14] National Pool Owner Survey 2016, pp 86-8.

There also consumer behaviours that can lead consumers to making less than optimal choices.

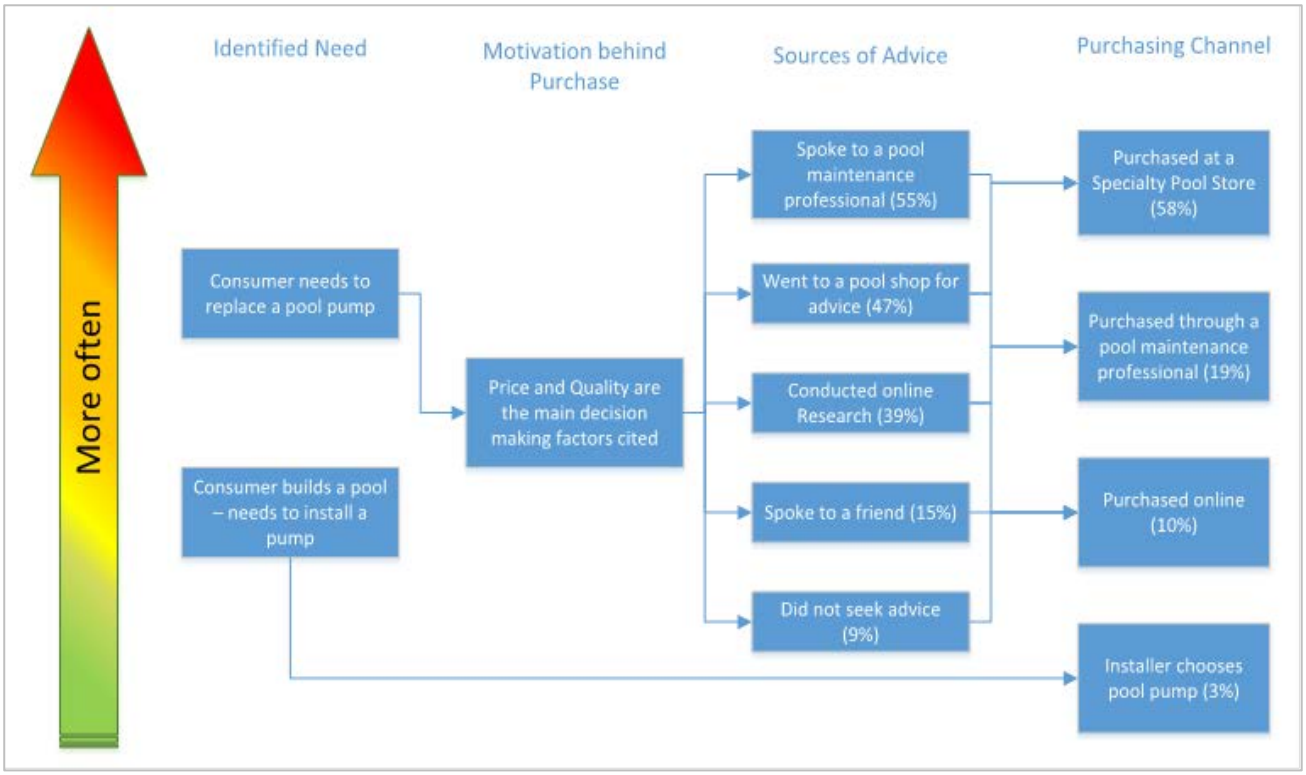
This section discusses the market failures and aspects of consumer behaviour in the pool pump market that are constraining the uptake of energy efficient pool pumps, driving higher than necessary costs for consumers and for society more broadly.

2.2 Consumer pathways for buying a pool pump

Consumers rely on advice from industry professionals when selecting a pool pump. Figure 2.1 is based on the results of a national pool owners' survey in 2016 and industry focus group discussions. It shows important features of the pool pump market and the considerations consumers make when buying a pump. The picture highlights:

- Most consumers of pool pumps rely on intermediaries to guide them in buying a pool pump.
- Intermediaries include: pool builders and installers; pool retailers and pool maintenance and service people
- Intermediaries may not have the best interests of the pool owner in mind, in terms of balancing the upfront costs with ongoing operating costs, when advising a consumer on the selection of a new pool pump
- Commercial tie-ins with manufacturers and supplier pathways are common and an important feature of the pool industry
- These tie-ins and pathways strengthen the controls intermediaries have over information flows to consumers and reinforce the primary advisory role of pool industry professionals.

Figure 2.1: Purchase decision tree



Alongside a national survey of consumers, DEE commissioned focus group interviews with 30 pool industry professionals. These focus group interviews revealed that the pool industry has a wide

range of views on the energy efficiency of different pool pumps.[15] This suggests that consumers are relying on advice from experts that is inconsistent, because the experts lack clear knowledge themselves about the energy efficiency of different pumps.

2.3 Information failure

There is a lack of consistent, reliable and independent information for consumers on the energy consumption and comparative energy performance of competing pool pumps on the market.

Since 2010, a voluntary energy rating labelling scheme has been available for pool pumps. DEE estimates that registered models (52) made up around 25 per cent of total pool pump sales in 2014-15. This leaves a large number of high selling pumps not labelled for their energy efficiency. It also mirrors the split of sales in the market, between the dominant single speed pumps (around 70 per cent of sales) and the more energy efficient multi or variable speed pumps (around 30 per cent). Anecdotal evidence also indicates that the display of the energy rating label on the physical product is inconsistent, which contributes further to the information failure and asymmetries between consumers and pool professionals. (See Section 3 for more information on the VERLP.)

Consumers do not have easy access to information about how they can reduce the electricity used by their pool pumps. The national pool owners' survey in 2016 showed 60 per cent of people were concerned about the amount of electricity their pool pump used and around 90 per cent reported taking at least one action to reduce energy use by their pool. At the same time, 53 per cent of respondents had a single speed pump installed and 34 per cent did not know what type of pump they had. Only around 30 per cent of respondents identified energy efficient pool pumps as a measure they took to make their pool or spa more energy efficient.

In terms of people's perceptions of pool pumps and the relative energy efficiency of different types of pumps, 60 per cent did not know what type of pump was the most efficient (among single speed, variable speed, dual speed and multi speed). Among respondents who indicated they did know:

- 14 per cent thought variable speed pumps were the most efficient
- 13 per cent thought single speed pumps were the most efficient
- 7 per cent thought multi speed pumps were the most efficient, and
- 6 per cent thought dual speed pumps were the most efficient.

This lack of information on the relative energy efficiency of pool pumps limits the opportunity for consumers to take the ongoing running costs (up to 80 per cent of the total lifetime cost of the product) of different pumps into account in their purchasing decisions. This leads to a greater and disproportionate emphasis on the upfront (known) cost of pool pumps, the cheaper of which, are often the least energy efficient (Figure 1.7).

2.4 Split incentives

The kinds of information failures and gaps discussed above can exacerbate the effect of split incentives. A split incentive arises when the interests of the final user of the pool pump differ from those of the intermediary or agent, who either decides on the pump to be installed or is influential in the final decision.

[15] Ibid.

Most consumers of pool pumps rely on intermediaries to guide them when buying a pool pump. Intermediaries, however, may or may not have in mind the best interests of the pool owner, when balancing the upfront costs with the ongoing operating costs. As indicated above, commercial tie-ins with manufacturers or a group of pump suppliers are common in the pool industry, increasing the scope for split incentives between pool industry experts and consumers.

The price of the pool pump is also only a small component of the final cost of a new pool. In these circumstances, the pool buyer is in the hands of the builder or installer, in terms of what pump is selected for the pool. While some builders may promote energy efficient pumps as part of their business, it is clear that not all do.

For households that are renting, it is usually the landlord's responsibility to replace a pool pump. The landlord does not pay the operating costs of the pump and is indifferent to the effect of different pumps on a tenant's electricity bill. In deciding between pumps, a landlord is likely to focus on the upfront capital cost of a replacement pump and its reliability and durability, rather than energy efficiency.

2.5 Consumer behaviour and bounded rationality

Even where people have access to sufficient information, they may make decisions that are not optimal from an economic point of view. In buying a pool pump, this could occur when a consumer knowingly chooses a pump that will cost them more over the life of the pump, than the more energy efficient model beside it on the shelf. This bounded rationality could stem from:

- The consumer not being able to afford the cost of the more energy efficient pump
- The consumer considering the effort required to obtain and to understand information about energy efficiency of different pumps to be too great to be worth the savings they would derive from a more efficient pump, or
- The consumer being biased toward the 'status quo' or the risk averse option.
    - For example, the replacement of a pool pump with the same model would be a more comfortable decision, than switching to an unfamiliar pump.

2.6 Externalities

Pool pump use creates externalities or indirect costs that are not borne by the owner of the pool. These externalities include greenhouse gas emissions, 'peak loads' on the electricity networks and residential noise pollution.

These costs are higher than they need to be, due to the prevalence of less energy efficient pool pumps and the resulting higher costs that are borne by the wider community and the environment, not by pool owners alone. Multi-speed and variable speed pumps have significantly lower power consumption and noise levels when run on their lowest speed settings.

2.6.1 Greenhouse emissions

The greenhouse gas emissions from the use of a pool pumps depend on the source of electricity used. In Australia, approximately 0.83 kilograms of greenhouse gases are produced on average for each KWh of electricity consumed. Applying this figure, DEE estimates that 1.3 million tonnes of greenhouse gases were released in 2015 from the generation of electricity to support the operation of pool pumps in Australia. DEE modelling (see Appendix A) for the period 2018 – 2030 projects

that Australia could save 9.2 million tonnes of greenhouse gas emissions, if no pumps below a 4 star rating were sold.

2.6.2 Peak load costs for electricity networks

Pool pumps also add to electricity network costs through their contribution to peak demand. Heat waves, cold snaps and other short-lived and infrequent spikes in electricity use create peak demand on the electricity network.[16] Despite these spikes in demand occurring for short periods of time, they can make up a significant element of consumer bills. In NSW, the Productivity Commission reported that the capacity to cater for less than 40 hours a year of electricity consumption (less than 1 per cent of time), accounted for around 25 per cent of retail electricity bills.[17] The investment required to establish this capacity increases the price of electricity for all consumers.[18]

The significance and cost of peak load conditions to a network depends on the nature of the network, the degree of congestion or load, the effect on services under peak load conditions and the cost of available response measures.

Ergon and Energex, two electricity network operators serving Queensland, ran extensive demand management programs between 2011 and 2013 to reduce the contribution to peak load from pool pumps. The companies found that investment in pool pump energy efficiency rebates was effective and delivered strong value in terms of reductions in network management costs.[19]

The Ergon Energy program evaluation:

- Calculated the value of avoided costs of almost 30% against long-term marginal costs per kW of electricity demand.
- Estimated that in the first seven months of the program, 47 per cent of participants were in network constrained areas, implying a higher value and more immediate value in terms of network infrastructure costs.

In contrast, Ausgrid[20], an electricity network operator in New South Wales, found that:

- An estimated 180,000 residential customers on their network have pools, and approximately 40 per cent of these are on a time of use tariff.
- Pool pumps contribute to peak load conditions, which occur between 2.00pm and 8.00pm on the Ausgrid network.
- But pool pump loads are too disbursed within sub-zones to warrant investment by Ausgrid in specific peak load measures targeted at pool pumps.

Research by DEE suggests that nearly all networks allow for pool pumps to access a concessional electricity tariff, either through a time of use tariff or a dedicated controlled load tariff, as exists in Queensland. It appears, however, that the use of concessional tariffs or controlled load tariffs by pool owners is negligible across most electricity networks (albeit with greater use in NSW and Queensland) and pool pumps are not seen as a priority by network companies for demand management.

[16] Electricity Network Regulatory Frameworks Volume 2 2013.

[17] Productivity Commission 2013, Electricity Network Regulatory Frameworks, Report No.62.

[18] Ibid.

[19] Confidential evaluation program reports: Ergon and Energex – provided to DEE in April 2016.

[20] Confidential research report - Ausgrid, October 2016.

2.6.3 Noise pollution

Discussions with state and territory agencies in Australia indicate that pool pumps are a source of noise pollution, but not a major cause of noise complaints. Local or residential noise pollution can reduce the quality of life and amenity for those affected, as well as undermining good relations between neighbours.

Pool pumps are included in state, territory or local government regulation in Australia governing the time of use of residential equipment and acceptable noise limits and effects on neighbours. While the details vary, a common approach to noise regulation is that the specified equipment cannot be heard in a room of a neighbouring house. Other regulatory approaches include noise reading limits at the boundary of properties or banning the use or operation of specified equipment between certain hours.

Pool pumps are often sold with noise information contained in the manufacturers' brochures or model materials. The VERLP allows a noise rating to be included in the label for a registered pump, at the discretion of the manufacturer, although only 2 out of 52 registered models do so.

Anecdotal evidence from the pool industry indicates that some consumers value information about the noise produced by different pool pumps. Low noise pumps may also be advertised as being suitable for night time or off-peak use, which may attract lower electricity tariffs.

There is no single test standard for measuring pool pump noise, nor are there comprehensive noise labelling requirements. The Australian standard for pool pumps (AS5102) allows for several different test methods for measuring and reporting noise from pool pumps, although the results from these different tests are not necessarily comparable. For more information about noise pollution see Appendix E - Noise.

2.7 What has been tried previously?

Pool pumps have been a focus for energy efficiency, emissions reduction and energy demand management programs of governments and electricity providers at different times and in different areas (see table 2.1 below).

Standards. An Australian Standard was developed in 2009 to measure the energy efficiency of pool pumps, including a system of 'star ratings' and the development of an energy efficiency label.

Rebates. Queensland energy companies Energex and Ergon, which serve southeast Queensland and regional Queensland respectively, offered rebate programs between 2011 and 2013 giving customers cash incentives to purchase energy efficient pumps that were registered on the VERLP, or to connect their pool pumps to a 'controlled load' tariff.

- Energex and Ergon found these programs to be cost effective and resulted in drops in energy consumption and a shift in electricity demand from peak load periods.
- The rebates were supported by effective information campaigns in Queensland.
    - The effect, however, of the rebates and the information campaigns on consumer perceptions and understanding of the relative energy efficiency of different pool pumps appears to have fallen, now that the rebates and campaigns have ended.[21]

Energy efficiency programs. Energy efficient pool pumps are included in energy efficiency schemes in the Australian Capital Territory, New South Wales, Victoria and South Australia. For

[21] National Pool Owner Survey 2016.

example, under the Victorian Energy Efficiency Target (VEET) scheme, households can earn Victorian Energy Efficiency Certificates (VEECs) by switching to energy efficient pool pumps.[22]

Labelling. A voluntary energy rating labelling program operates under the E3 Program and is administered by DEE. The program captures approximately 25-28 per cent of models on the market, but generally only the most energy efficient models are registered. In particular, there are no pumps rated below five stars on the register. (See Section 3 for more information on the VERLP).

Studies and trials. Sustainability Victoria and Ausgrid (NSW) conducted studies into the energy efficiency of pool pumps in 2013 and 2015 respectively. The Sustainability Victoria trial showed that most participating households made considerable energy savings by retrofitting higher energy efficient pumps. More details about these studies are at Appendix F – Other studies and trials.

Other solutions. After-market products and services are available to pool owners, such as variable frequency devices[23] and a growing set of smart information technology and communications products, platforms and software, which integrate and better manage pool systems and components.

- Pooled Energy in Sydney has started providing electricity retail services bundled with pool maintenance and management services.
    - The company's focus is on consumers willing to pay for energy savings and pool maintenance cost reductions.

Table 2.1: Current and previous measures to improve energy use by pool pumps

Program/Activity	*Why it doesn't solve the problem*
Voluntary Energy Rating Labelling Program (VERLP)	The VERLP covers just 25 per cent of the market. It does not resolve information failures because only energy efficient pumps participate.
State Energy Savings Efficiency Incentive Schemes	There has been limited take-up of pool pump installations under these schemes. They are not available in all jurisdictions and do not overcome information failures.
Ergon/Energex Rebate Programs (Queensland)	While these rebates were successful in reducing peak load, they have now run their course. They were also expensive compared with other measures and unlikely to be cost effective for other networks.
Ausgrid Study (Sydney, NSW)	This study showed pool pumps do contribute to peak load costs, but were not significant and widespread enough to warrant Ausgrid taking action.
Sustainability Victoria Pool Pump Retrofit Trial (Victoria)	This study was on a micro scale and would be costly to implement more broadly, despite proving that retrofitting pumps saved consumers money.
Aftermarket and Emerging Private Sector Activity	Private sector initiatives appear to have limited take up and target market segments, rather than the national product market.

2.8 Conclusion

The programs and studies above highlight that there are potential benefits from intervening in the market to improve the energy efficiency of pool pumps. Despite the success that has been obtained

[22] Victorian Energy Efficiency Target website, accessed 17 May 2016.

[23] Variable Frequency Devices allow consumers to adjust the speed of their single speed pump.

in some areas, none of the programs above have been successful on a national scale. They have inherent limitations in program objectives and design, cost effectiveness, and an uneven or lack of general relevance in all jurisdictions. In particular, none of the programs examined overcome the market barriers and failures active in the pool pump market, nor do they offer comprehensive or sustained solutions to reducing the wider social costs and inefficiencies of the pool pump market. The limitations of existing and past programs include:

- The information produced by the standard and the VERLP are not provided to all consumers purchasing a pool pump.
- The various energy efficiency programs are limited to just one state or region, as are the rebate programs for pool pumps.
- The measures are voluntary, or are implemented without ongoing compliance and enforcement capacity.
- Rebates are difficult to target to consumers who would otherwise not replace their pool pump with an energy efficient model.
- The measures are intended to remove particular market failures and barriers at one time, such as peak electricity demand or energy efficient pumps being too expensive for some consumers, rather than dealing comprehensively with all the market barriers and failures limiting the use of energy efficient pumps.

Governments have had success overcoming market barriers facing energy efficient products and equipment with two measures:[24]

1. Mandatory Energy Efficiency Labelling (ERL) - the requirement for the disclosure of energy efficiency information by sellers or producers of certain products; and
2. Minimum Energy Performance Standards (MEPS) - the prevention of access or sale of products below a specified level of energy efficiency.

These two policy interventions have not been applied to pool pumps. This RIS examines these options as two interventions that could provide a solution to the problem described in this section. The details of the proposals for ERLs and MEPS are presented in Sections 4 and 5.

[24] For example:

- International Energy Agency, *4E Program Report: Achievements of appliance energy efficiency standards and labelling programs – A Global Assessment*.
- GEMS Impacts Analysis – 2016 (Confidential report to jurisdictions).

Main Points

The Voluntary Energy Rating Labelling Program (VERLP) is not sustainable, has limited benefits and does not solve the problems limiting consumer uptake of energy efficient pumps.

- After six years of operation, most pumps sold in Australia are not registered with the program and are not labelled with energy performance information.
- Although the VERLP provides some information to consumers and, therefore, some broader community benefits, the primary effect of the program is to support industry advertising and marketing.
- The VERLP has not increased the uptake of energy efficient pumps in Australia.
- Administrative arrangements for the program do not align with broader GEMS legislation and program arrangements.
- The most important gaps are the absence of sound compliance arrangements and cost recovery mechanisms.

3.1 Origins of the program

The VERLP began in April 2010 and is administered by DEE for the E3 Program. It was intended as a transitional step leading to the introduction of mandatory labelling and MEPS requirements, which were expected to come into force in 2012. The VERLP at this time was seen as a means to:

- Establish an independent and credible energy rating label scheme for pool pumps.
- Use the government backed star label (Figure 3.1) to promote the uptake of energy efficient pumps by providing comparative information to consumers on relative energy efficiency of pumps being sold in Australia and New Zealand.
- Introduce the use of a new testing method (AS5102) for pool pumps.
- Obtain detailed market and performance information, through the registration process, which would assist in the development of new mandatory MEPS for pool pumps.

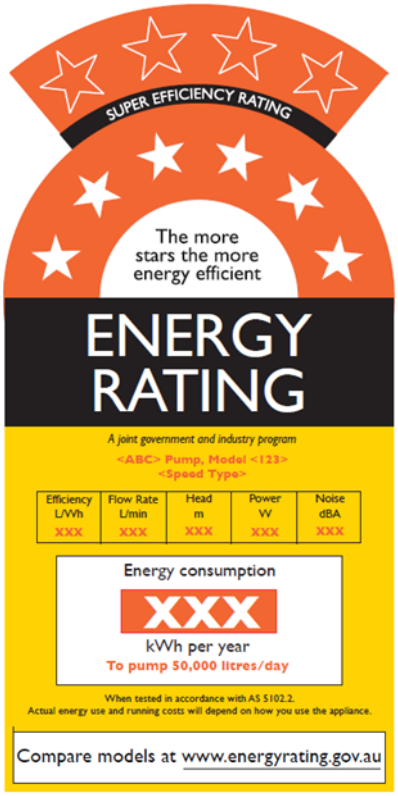
3.2 Benefits of the program

Although the VERLP has been in existence for over six years, the benefits of the program are limited.

- Industry players with higher energy efficient pool pumps register under the VERLP and use the label to promote their products in print and in online advertising and marketing material.
- The rebate and pool pump subsidy programs operated by Queensland energy companies Ergon and Energex used registration under the VERLP as an eligibility requirement.
- Governments have used VERLP registration as part of the eligibility requirements for pool pumps under various energy efficiency programs.
- The VERLP is also referenced in energy efficiency information and educational material, such as Ausgrid's pool pump energy calculator.

With experience in administering the program, the VERLP has been valuable in identifying limitations and opportunities to improve technical test standards, particularly AS5102.1 2. (More information on the standard is in Appendix C)

Figure 3.1: The energy rating label used under the VERLP



3.3 Limitations of the program

The VERLP has limited application in terms of the number of models and the types of pool pumps that are registered under the program. Typically, higher energy efficient pumps are labelled, leaving around 75 per cent without a label. Limited registration of products is a common feature of voluntary labelling or rating schemes, both in Australia and overseas.[25]

Due to the partial coverage of pumps on the market, the consumer benefits of the labelling scheme are muted:

- Consumers' face a range of claims about energy efficiency from pool stores and manufacturers.
- This information is not comparable, nor are the claims based on a single test methodology.
- Retailers and other sales channels rely on product brochures and advertising material from the manufacturer or wholesaler, rather than independent and transparent claims based on repeatable test standards.
- There is no trusted or authoritative basis for consumers to compare pump efficiency within price bands, particularly for single speed pumps.

The VERLP sits outside the compliance structure for products regulated under the GEMS Act. The program predates the introduction of the GEMS Act in 2012 and administrative arrangements are different. The practical effect is that the voluntary scheme's star label is not backed by independent compliance and reporting requirements. This presents broader program risks and allows industry

[25] For example, the Water Efficiency Labelling and Standards (WELS) scheme which rates the water efficiency of products started as a voluntary scheme. Following a review, the partial coverage and limited take up by industry was one factor leading to the adoption of the current mandatory legislated WELS scheme.

to gain the advantage of a star rating label, which is less rigorous and robust than normally applies to labelled products.

Review of energy efficiency labelling by DEE[26] suggests that they are most effective when consumers are able to compare products within specific price ranges. The partial coverage of the VERLP prevents this from occurring, because only the most efficient products are labelled, leaving less energy efficient products unlabelled in lower price bands.

3.4 Standards

The Australian standard for pool pumps (AS5102) may contribute to the lack of support for energy efficient variable pumps and the ineffectiveness of the voluntary label. AS5102 allows manufacturers to claim a star rating level for multi- and variable speed pumps based on continuously running at low speed. This means the rating makes no allowance for the greater energy use needed for higher speed operation that occurs from time to time .e.g. for backwashing or to operate manual cleaning equipment. Even though manufacturers' claims of energy and cost savings are consistent with the test method, the experience of actual savings can easily diverge from claimed energy cost savings. Any discrepancy in savings promised and the pump's actual performance detracts from the integrity of the VERLP.

3.5 Conclusion

Under a business as usual scenario, there is no reason to expect a change in the energy efficiency of pool pumps on the market, or in buyer preferences. The way industry has used the VERLP over six years is consistent with the experience of similar voluntary labelling schemes. Partial coverage of the pool pump market registered under the VERLP limits its value for consumers and industry in terms of understanding and getting access to reliable, comparative information on the energy efficiency of different pool pumps. The compliance, reporting and cost recovery arrangements for the VERLP are also not consistent with the practice in the GEMS program. Overall, voluntary labelling schemes are limited in their ability to overcome information failures. For these reasons, DEE does not support retention of the VERLP.

[26] GEMS Impacts Analysis – 2016 (Confidential report to jurisdictions)

4. Mandatory Energy Efficiency Labelling

Main points

An option is to adopt Mandatory Energy Rating Labels for all pool and spa pumps. This would:

- Apply to all swimming pool and spa pumps under a certain size on the market.
- Help to overcome information gaps and problems facing consumers in an easy to understand format.
- Provide transparent, robust and independent performance testing and reporting.
- Help deal with some of the shortcomings in regulation on noise from pool pumps.
- Build on the existing voluntary scheme and the work already done to improve the test standard.

Mandatory labelling will not, however fix all the problems that limit the uptake of energy efficient pool pumps.

4.1 Introduction

Section 2 sets out the main steps and actors involved in how a consumer buys a pool pump (Figure 2.1). In summary:

- Consumers have low levels of knowledge about their pools, their pool pumps, and which pumps are more efficient and best meet their needs.
- Consumers are interested in price (foremost), quality and energy efficiency (especially ongoing energy costs) and many will undertake research, before buying a new pool pump.
- Overwhelmingly, the purchase decision is made on the advice of a pool professional, where the importance of this relationship is reinforced by the focus of retailers on maintaining 'poolside' connections with customers.

Mandatory Energy Rating Labels (ERLs) are designed to overcome an information failure where consumers have only inaccurate, incomplete or ambiguous information about the energy consumption of a product, by requiring the label to be used for all products sold. Selecting a pool pump on the basis of its purchase price, without considering running costs, may be an example of information failure, particularly where operating costs are much larger than the upfront price of a product. Without an ERL, information on the energy used by an appliance may be unavailable, inconsistent or difficult to obtain. Mandatory ERLs allow a fair comparison across all products sold.

Lack of accurate information limits efficient decision making by consumers. Furthermore, disparate information sources and varying levels of technical knowledge mean that industry professionals play a crucial role as advisers to consumers, but industry professionals have differing views on the benefits of higher energy efficient pool pumps.

A mandatory ERL allows comparison of like products by providing a rating of their energy efficiency between one and ten stars. The greater the number of stars on the ERL, the more efficient the appliance is, compared with appliances of the same type with fewer stars. By providing consumers and industry experts with comprehensive, transparent and credible information of an appliance's relative efficiency, the consumer is provided with a tool to factor energy efficiency into their purchasing decision. Improved energy efficiency information also sends a market signal to manufacturers to develop more efficient products.

4.2 Effectiveness of Energy Rating Labels

DEE has reviewed the effectiveness of ERLs applied to products regulated under the GEMS Act to see whether they are effective in shifting consumer purchases to more energy efficient products.[27] The review found that ERLs work best when consumers are required to make a decision between two or more similarly priced products (or price bands). The review also showed that, for some appliances, labels and MEPS measures working in tandem can produce better results. An example of this are the MEPS and labelling requirements for air-conditioners.

For pool pumps, modelling has shown two distinct price bands around single speed and variable speed pumps. Figure 5.3 plots pool pump prices[28] by type of pump and energy efficiency (star rating levels).

- Over 50 per cent of sales of pumps cost over $800, with varying efficiency and wattage levels between 1.5 and 8 stars.
- The second price band, which clusters around energy efficient multi and variable speed pumps, is for pumps over $1500 with high star rating levels and a maximum price of $3500.

4.3 Implementation

For pool pumps, a printed label would be required to be affixed to every pump before sale and the label would be required to be used in online product information. A mandatory labelling scheme under the E3 program for pool pumps would include:

- The development of a robust, transparent and repeatable test method.
- Mandatory labelling for all products covered by the regulation.
- Registration requirements, including performance information against an agreed test method.
- Penalties may apply, if incorrect information is provided to the regulator.
- Labelled products would be subject to compliance testing to confirm that claimed performance is realised.
- Partial recovery of registration costs by DEE.

4.4 Noise

The introduction of ERLs provides an opportunity to include information for consumers on the noise produced by different pool pumps. While noise from pumps is not a major concern, it is relevant for some consumers and would provide a means for manufacturers to highlight the performance benefits of their pumps. More information about noise is at Appendix E.

[27] GEMS Impacts Analysis – 2016 (Confidential report to jurisdictions)

[28] Based on manufacturers' recommended prices

4.5 Label design

The E3 program is investigating the development of energy rating labels that incorporate maps and climate specific information, such as are used in Europe. The program is also reviewing the star rating arch and has found that a horizontal bar displaying the stars is easier for consumers to understand, than the arch. Either the arch layout or the horizontal star layout could be used for pool pumps. Examples of two options using the horizontal display of stars are at Figures 4.1 and 4.2 below.

Figure 4.1: Energy Rating Label option 1

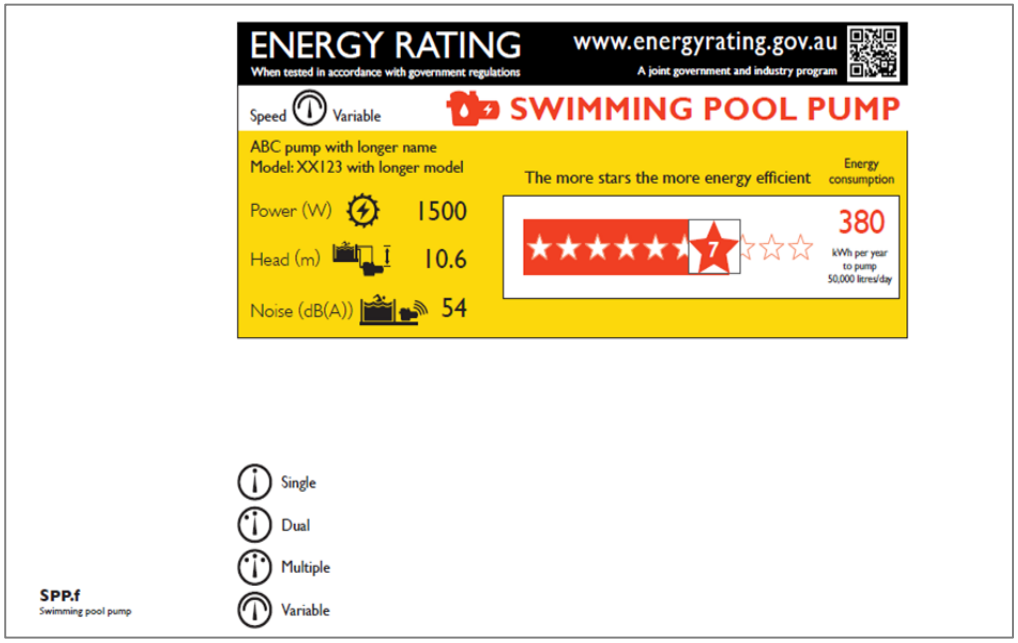
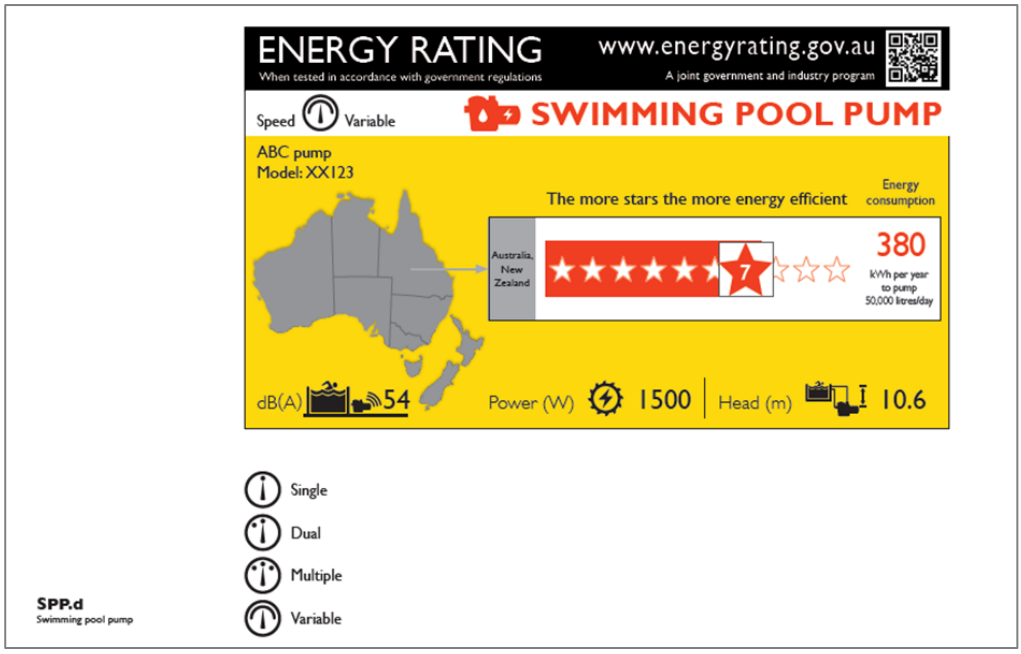


Figure 4.2: Energy Rating Label option 2



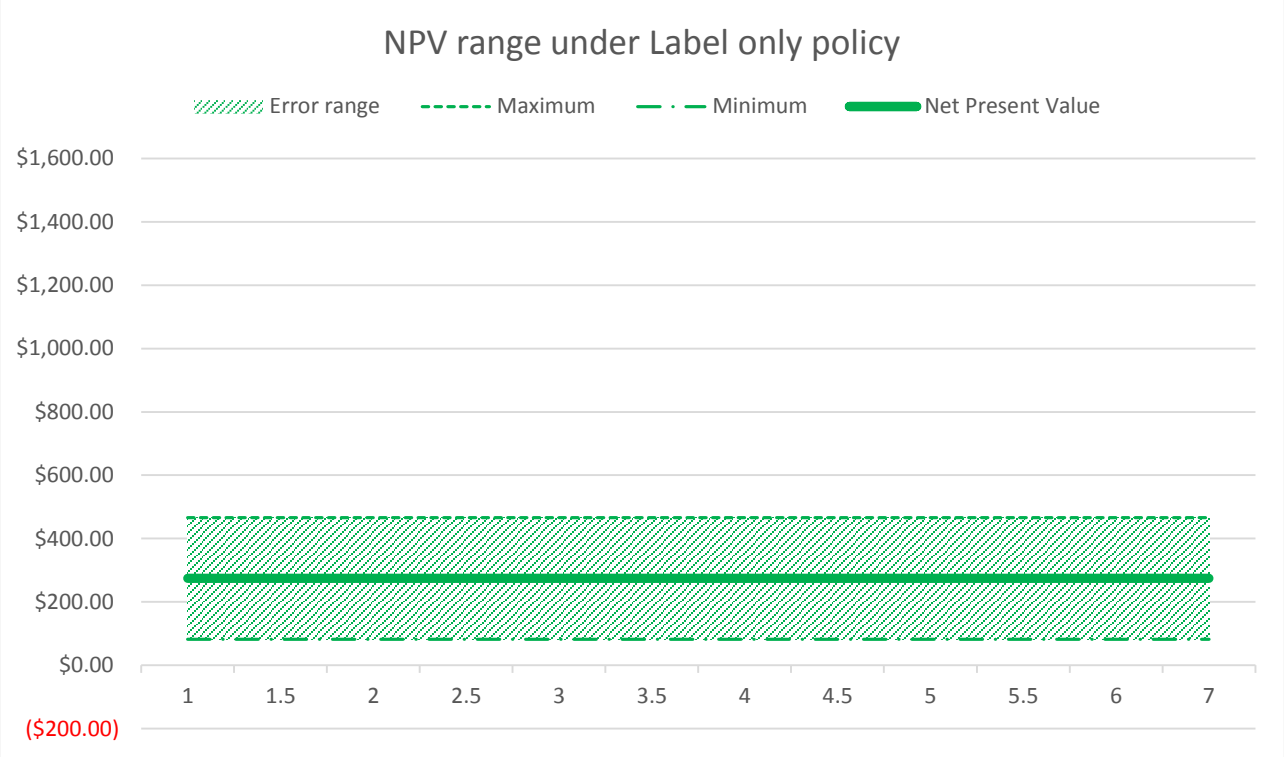
4.6 Cost benefit analysis

Analysis by DEE for this consultation RIS estimates that there are overall benefits from introducing mandatory ERLs for pool pumps. For Australia, the mid-point estimate shows total consumer net benefits of $274 million over the forecast period from 2018 to 2030, with a reduction in greenhouse gas emissions estimated at 1.19 million tonnes of CO2 equivalent.

Table 4.1: Mandatory labelling cost benefit analysis (2018-2030)

AUSTRALIA		*Discount rate AUS 7 per cent*		*Electricity tariff AUS $0.266 per kWh*		
Policy option Label only		Energy saved (cumulative GWh to 2030)	Emission reduction (cumulative Mt to 2030)	Total benefits (NPV, $M)	Total Cost (NPV, $M)	Net Benefit (NPV, $M)
	Upper	2383.16	2.00	$473.32	$7.18	$466.14
	Lower	450.60	0.38	$89.47	$7.18	$82.29
	Central	1416.88	1.19	$281.39	$7.18	$274.21

Figure 4.3: NPV range under label only policy (2018-2030)



These estimates of consumer net benefits do not include the monetary benefits of:

- Improvements in neighbourhood amenity from providing noise performance information on labels.
- The value of reductions in peak load management costs for electricity networks through an improvement in the average energy intensity of pool pumps.
- The value of reductions in greenhouse gas emissions.

4.7 Conclusion

A mandatory pool pump labelling scheme applied to all pool pumps sold in Australia would provide consumers and industry with benefits:

- It would tackle information barriers, gaps and failures facing consumers.
- It would replace the partial coverage provided by the VERLP with comprehensive coverage of all pool pumps sold in Australia.
- Formal compliance and registration requirements would create a level playing field for manufacturers and distributors.

5. Minimum Energy Performance Standards

Main points

Minimum Energy Performance Standards (MEPS) are likely to be the most efficient and effective way to increase the energy efficiency of pool and spa pumps in Australia and to support efficient decision making by consumers.

Analysis is presented on three efficiency levels to help discussion and inform public consultations. No specific MEPS level is recommended for energy efficiency levels for pumps.

The benefits for consumers and the broader community in Australia are greater, the higher the level of MEPS, up to around 4.0 star equivalent level.

- This reflects differences in energy use of single, multi and variable speed motor and pump technologies.

There are two main costs from the introduction of MEPS:

- consumers may face higher purchase prices for new pool pumps; and
- smaller manufacturers producing mostly single speed pumps may face higher adjustment costs.

For this reason, DEE is keen to discuss with pump manufacturers the implications of introducing MEPS on pool pumps for their businesses, particularly the implications for smaller manufacturers and how they could adjust to any new requirement.

5.1 Introduction

Mandatory minimum energy performance standards (MEPS) would remove underperforming pool pumps from the market, where they fail to meet minimum standards; and thereby remove market barriers that limit efficient levels of investment by consumers in energy efficient pumps.

DEE considers that ERLs, by themselves, will not remove the major market barriers (externalities and split incentives) affecting the purchase of higher energy efficient pumps. In particular, a mandatory ERL is unlikely to:

- Remove split incentives that operate within the market, noting in particular, the role of industry professionals and the split incentives involving landlords and tenants
- End divergent views within the industry around the value and suitability of variable speed pumps.
- Reduce the large price differentials between more energy efficient and less energy efficient pool pumps
- Reduce the externalities (greenhouse gas emissions, peak electricity demand and noise) arising from the use of less efficient pool pumps.

5.2 Market analysis

DEE has reviewed pool pump performance and analysed pump sales and price data provided by manufacturers. This information forms the basis for the cost benefit analysis in Appendix B – Cost Benefit Analysis Summary Results. The main findings of this review are:

- The energy efficiency of pool pumps reduces in line with the size or wattage of the pump.
- Consumers can choose from a range of pool pumps with different energy efficiencies at most wattage points and sizes.
- Within price bands, there are a range of pool pumps with differing energy efficiency.
- Prices for pool pumps tend to follow pump size, that is, the higher the wattage of the pump, the more expensive it tends to be.
- There is a group of more energy efficient and higher cost variable speed pumps available on the market.
- The least efficient variable speed pump achieves a star rating of 5.5 under the current standard.
- No single speed pool pump sold in Australia would achieve a star rating above 5.5 under the current standard.
- Single speed pumps made up approximately 70 per cent of sales in 2014-15.
- Approximately 80 per cent of pool pumps sold in 2014-15 had a wattage between 750 and 1300 W.
- Most pumps sold in 2014-15 (71 per cent) were priced between $500 and $1,000.

These findings are depicted in Figures 5.1, 5.2 and 5.3 below. The graphs highlight the strong separation in the market in terms of the energy efficiency of different types of pool pumps. This separation reflects the underlying motor and pump technologies of single speed pumps, compared with dual speed, multi speed and variable speed pumps.

Figure 5.1: Wattage spread in each star rating by pump speed

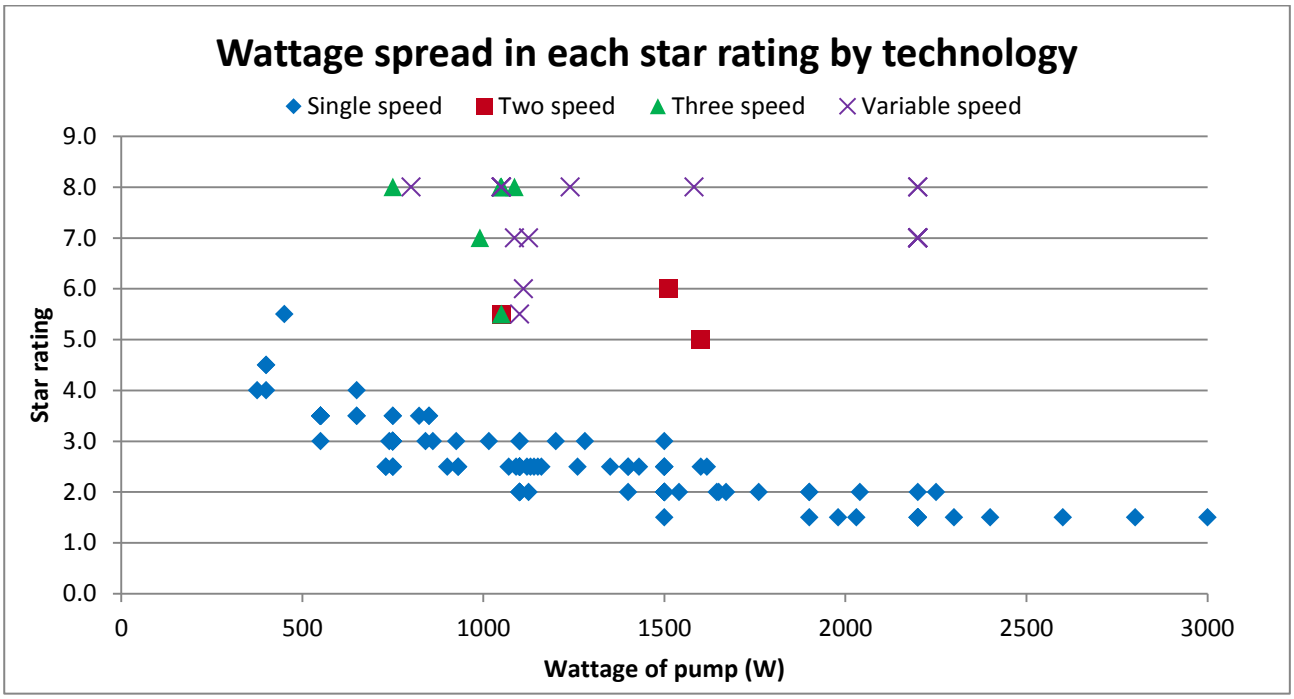


Figure 5.2: Retail price range in each wattage range by pump type

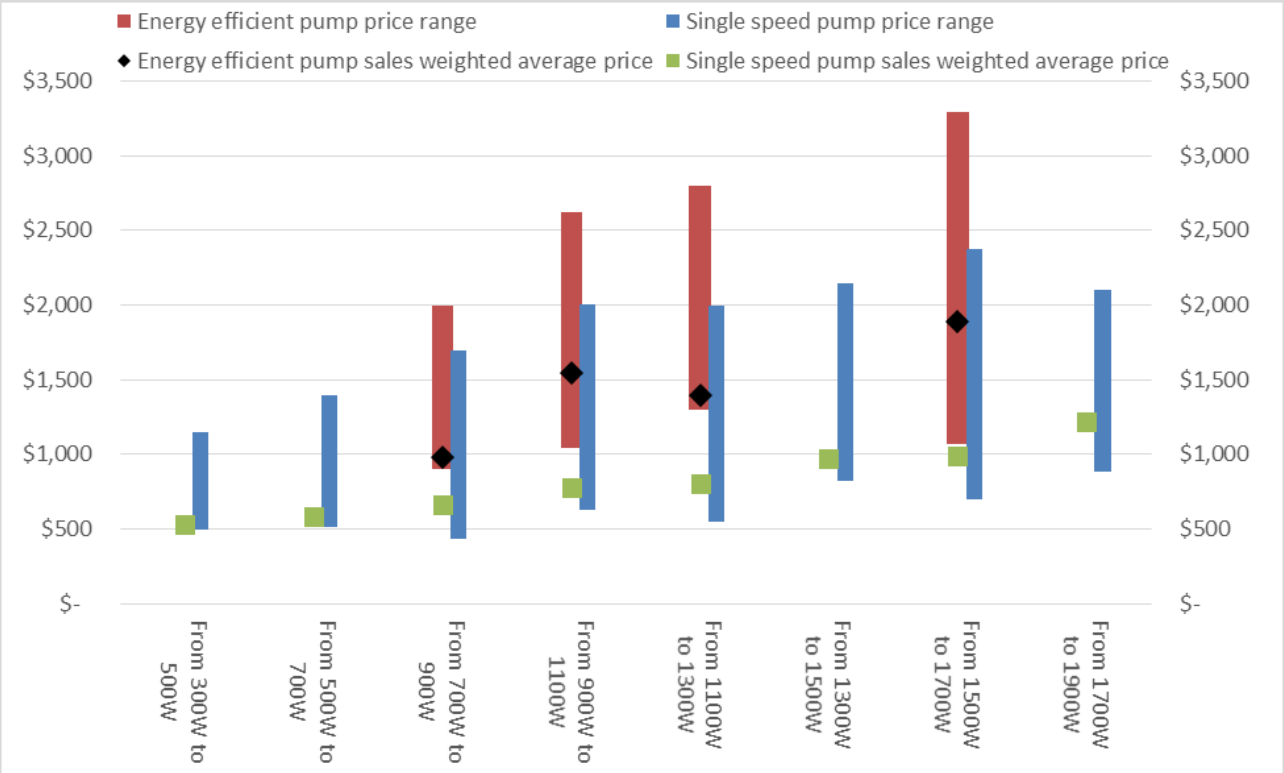
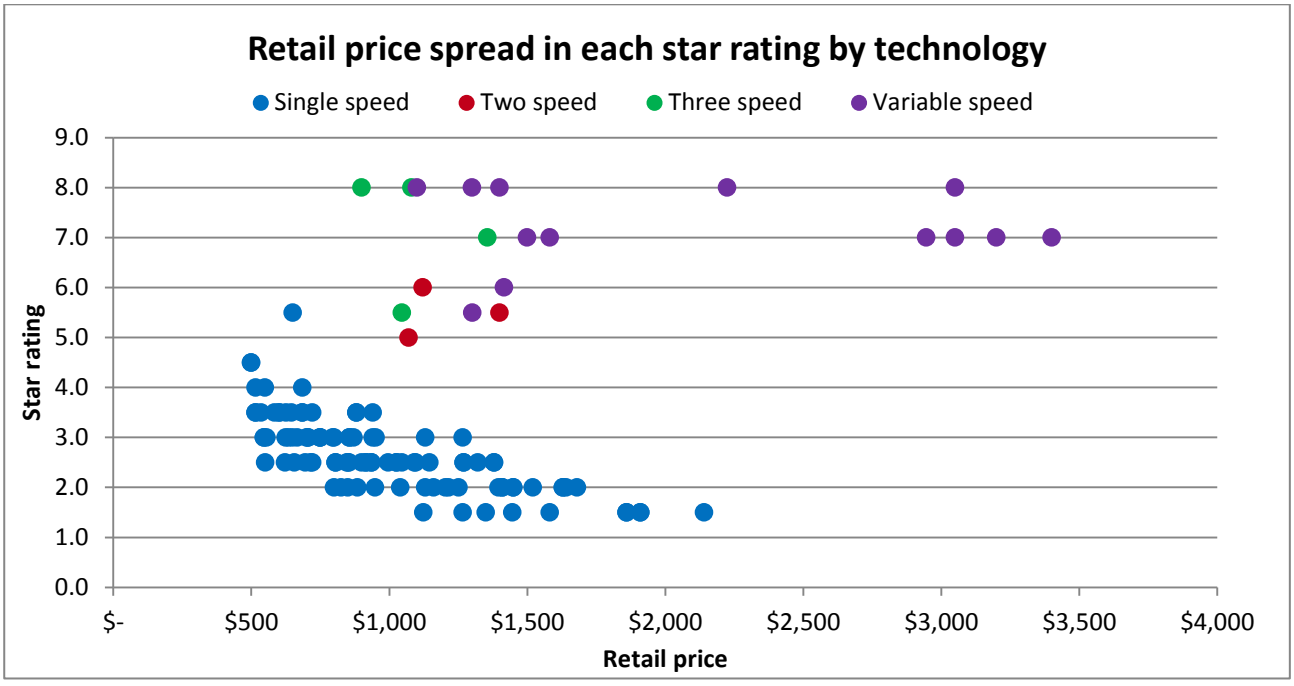


Figure 5.3: Retail price spread in each star rating by pump speed

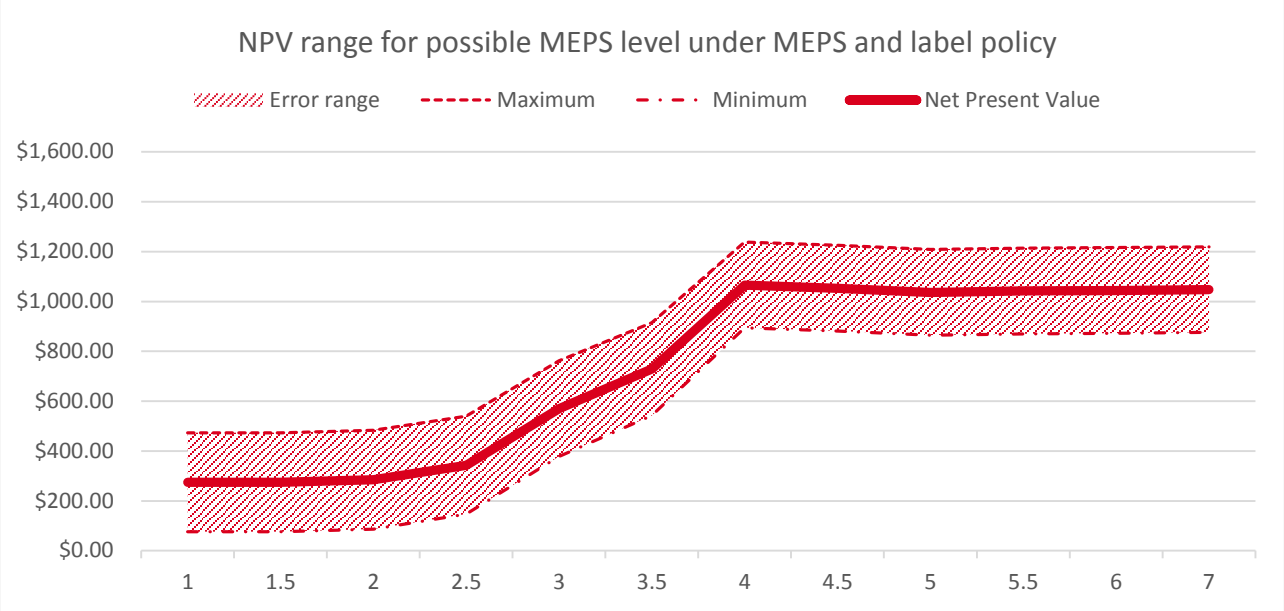


5.3 Cost benefit analysis

Introducing a MEPS for pool pumps needs to balance the benefits and costs to consumers and society. Figure 5.4 overleaf summarises the estimates of the net present value (NPV) of setting MEPS at different levels, along with the introduction of mandatory labelling. The analysis uses the existing Star Ratings Index to express MEPS levels for ease of understanding (see Appendix B).

The estimates show that there are substantial and increasing benefits from stronger MEPS levels, starting at around a two star rating equivalent though to four stars and these benefits outweigh the estimated costs of introducing MEPS and labelling regulation.

Figure 5.4: NPV range under MEPS and Label Policy by MEPS level (2018-2030)



5.4 Basis for cost-benefit calculations

This analysis is based on industry sales data, pump energy efficiency data and internally derived estimates of pump performance. With more sales and testing data, it is possible that better estimates of costs and benefits at various MEPS levels can be established.

The analysis assumes the introduction of MEPS with mandatory labelling. In practice, the introduction of MEPS is unlikely, unless supported by ERLs. At low levels, MEPS are unlikely to have much effect, if not supported by mandatory labelling. At higher levels, MEPS will remove lowest energy efficiency pumps, but there will still be benefits for consumers and industry in being able to compare performance of different pumps at different price points.

For the purpose of this cost benefit analysis, the costs of introducing a MEPS were calculated on the basis of higher capital costs for consumers and higher regulatory costs for businesses, due to test and registration requirements.

We assume that industry and manufacturers will adjust to new regulatory settings and pass any cost increases onto consumers. On this basis, consumer capital costs act as a proxy for industry adjustment costs.

The introduction of MEPS may also give rise to other cost considerations for companies, depending on:

- the level of MEPS adopted
- the size and types of pool pumps covered by the MEPS requirement;
- the labelling requirements
- the timetable for the introduction of the MEPS, and
- an individual company's capacity to adjust to the new regulatory settings.

Under the CBA, monetary benefits have not been estimated for:

- The value of reductions in greenhouse gas emissions.
- The value of reductions in peak load management costs for electricity networks.
- Improvements in neighbourhood amenity from providing noise performance information on labels.

5.5 Possible MEPS levels

This consultation RIS reviews three possible MEPS levels: low, medium and high.

A low level MEPS would be equivalent to a minimum performance standard of two stars under the current standard.

- This low level MEPS would replace and increase the minimum performance standard of one star applying under the VERLP.
- An equivalent performance level of two stars was also adopted by the committee that prepared a revised version of the AS5102.1 and 2 in 2012-13 (noting this revised standard was not published or adopted).

A medium level MEPS would be equivalent to a minimum performance standard of four stars under the current standard.

- This level of MEPS would drive substantial improvements in the energy efficiency of pool pumps purchased and installed by consumers over time.
- Based on the data available, it reflects the point of maximum benefit, relative to estimated costs.

A high level MEPS would be equivalent to a minimum performance standard of 5.5 stars under the current standard.

- This level matches the lowest efficiency variable speed pump on the market, for which data is available through the VERLP.

A high MEPS level is presented for completeness as a basis for considering the range of options.

5.6 Low level MEPS

Table 5.1 below sets out the estimates for the costs and benefits from the introduction of MEPS set at a level equivalent to a two star rating. The central estimate shows total consumer net benefits of $285 million over the forecast period 2018 to 2030. Greenhouse gas emissions are expected to fall by 1.23 million tonnes over the forecast period from 2018 to 2030 but, as noted above, the monetary value of these emissions reductions are not included in the figures in Table 5.1.

DEE estimates that around 2 per cent of the pool pumps sold in 2014-15 would not meet a MEPS level of two stars. Such pumps would all be single speed pumps. The modelled effect in terms of energy savings and use of pool pumps is set out in Figure 5.5 overleaf.

A low level MEPS set at two stars equivalent would:

- Provide some benefits for consumers by removing the worst performing ten per cent of pumps from the market.
- Support the benefits provided by a mandatory ERL.
- Have only a marginal effect on pool pumps suppliers.
- Establish the administrative framework and testing methodologies for regulated products under the GEMS Act, with corresponding compliance and assurance around claimed performance.

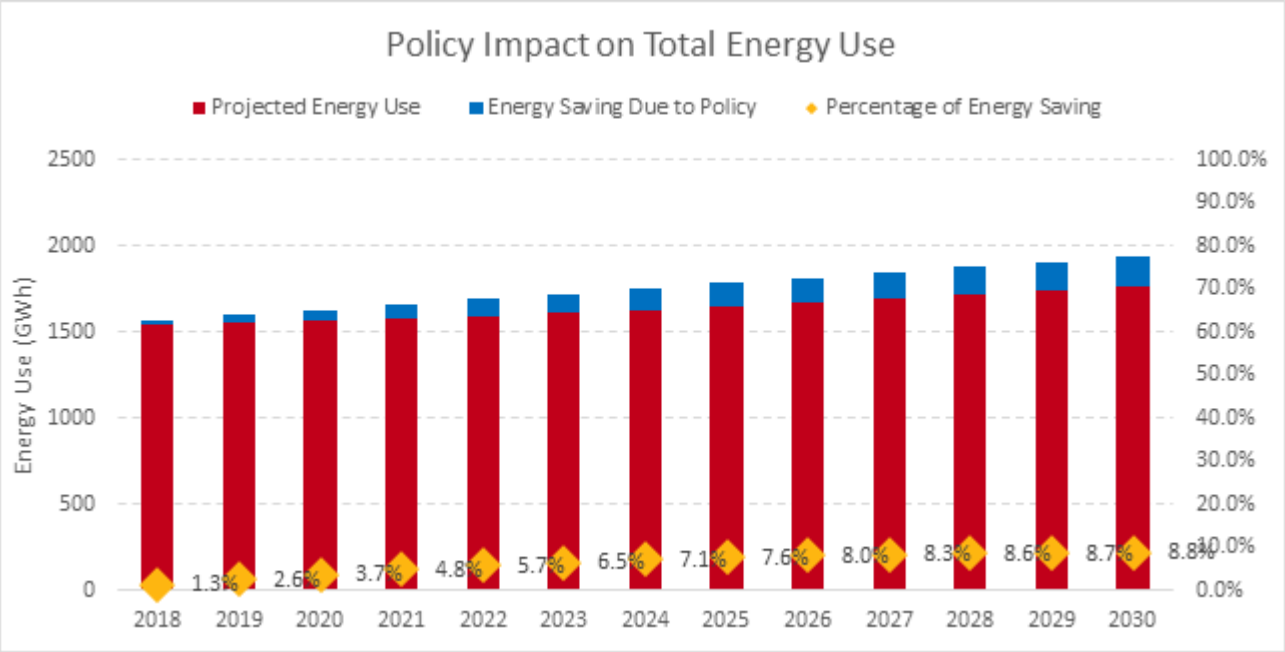
- Introduce new regulatory costs to industry, although suppliers would be able to pass on these costs to consumers.
- Allow for a stepped or progressive increase in MEPS levels in future.
- Provide a modest signal to industry on future requirements to provide more energy efficient products to the market.

A low level MEPs would only remove a few pool pumps from the market. As such, the benefits in terms of removing market barriers and reducing externalities are limited.

Table 5.1: Low level MEPS cost-benefit analysis (2018-2030)

AUSTRALIA	*Discount rate AUS 7 per cent*			*Electricity tariff AUS $0.266 per kWh*		
Policy option *MEPS & Label* *2 Star MEPS*		Energy saved (cumulative GWh to 2030)	Emission reduction (cumulative Mt to 2030)	Total benefits (NPV, $M)	Total Cost (NPV, $M)	Net Benefit (NPV, $M)
	Upper	2467.29	2.07	$490.02	$7.10	$482.92
	Lower	472.93	0.40	$93.90	$7.10	$86.80
	Central	1470.11	1.23	$291.96	$7.10	$284.86

Figure 5.5: Low level MEPS impact on total energy use (2018-2030)



5.7 Medium level MEPS

A MEPS level set at four stars would have major benefits for consumers and the wider community. Table 5.2 overleaf sets out the results from the cost benefit analysis for the Australian market. At a MEPS level of four stars, the central estimate shows total consumer net benefits of $1,066 million over the forecast period 2018 to 2030. Greenhouse emissions are forecast to reduce by 8.78 million tonnes over the same period.

In addition to having a large positive NPV, a four star equivalent MEPS would deal directly with market barriers, such as split incentives, that are limiting the uptake of energy efficient pumps by consumers.

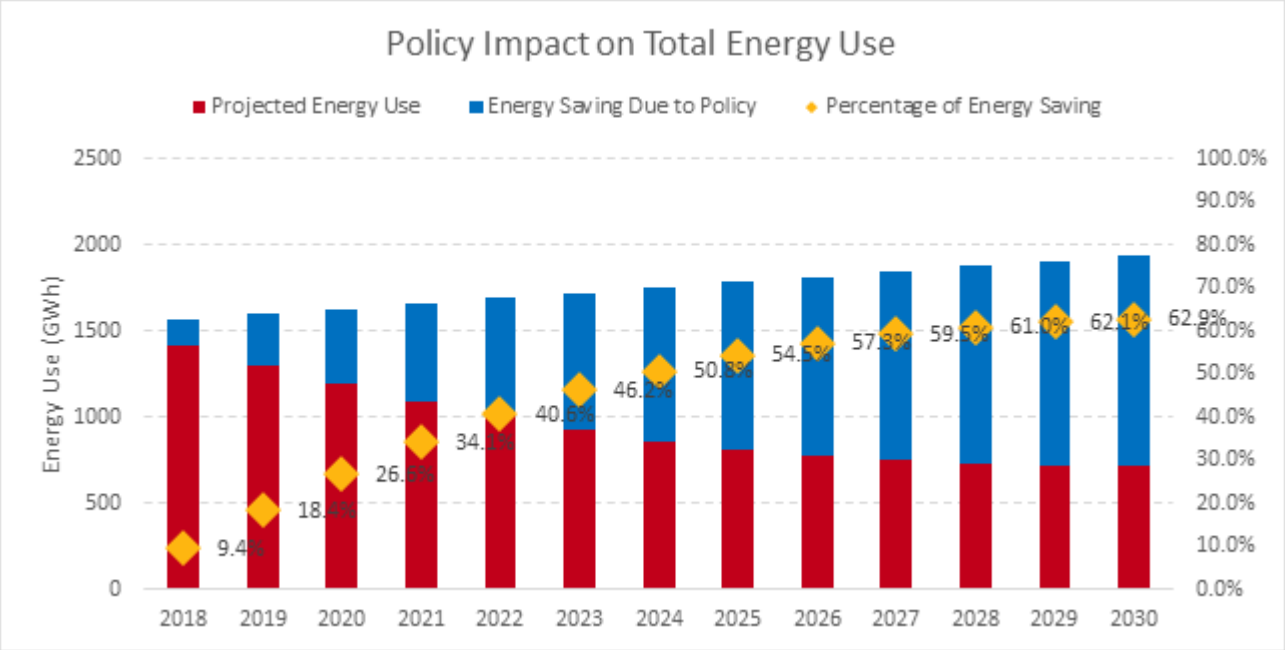
A four star MEPS implies a substantial lift in the energy efficiency of the pool pumps in use in Australia, with substantial reductions in externalities, such as peak load on the electricity network, the benefits of which are not included in this cost benefit analysis.

Table 5.2: Medium level MEPS cost-benefit analysis (2018-2030)

AUSTRALIA	*Discount rate AUS 7 per cent*			*Electricity tariff AUS $0.266 per kWh*		
Policy option *MEPS & Label* *4 Star MEPS*		Energy saved (cumulative GWh to 2030)	Emission reduction (cumulative Mt to 2030)	Total benefits (NPV, $M)	Total Cost (NPV, $M)	Net Benefit (NPV, $M)
	Upper	11279.88	9.46	$2,240.20	$1,025.70	$1,238.64
	Lower	9665.28	8.10	$1,919.51	$1,001.56	$893.81
	Central	10472.58	8.78	$2,079.86	$1,013.63	$1,066.23

Figure 5.6 below plots total energy use by pool pumps under a 4 Star MEPS, compared with the base case of energy use with no new energy efficiency standards. Under 4 star MEPS, total energy use by pool pumps is estimated to fall by 50 per cent after seven years (2025) and by 60 per cent after ten years. Adopting this option would be consistent with Australia's national goal of doubling energy productivity by 2030.

Figure 5.6: Medium level MEPS impact on energy use (2018-2030)



Market information provided to DEE indicates that there are a range of pump sizes at different price levels on the market that would meet a MEPS level of four stars (see Figure 5.3, page 29).

DEE estimates that 72 per cent of the pool pumps sold in 2014-15 would not meet a MEPs level of four stars. These pumps would all be single speed pumps at various wattages or sizes. By way of

comparison, the proposed US national energy standard for pool pumps is expected to have a similar effect of replacing most single speed pool pumps with variable speed units from 2021.[29]

A MEPS set at four stars would be below the performance level of the worst performing variable speed pump and the worst performing multi speed pump on the Australian market (Figure 5.3).

Large manufacturers, who market a range of pool pumps of different types and technologies, are unlikely to be hurt by a MEPS of four stars, as long as they are given sufficient time to adjust production schedules and product ranges ahead of the change.

Small manufacturers, however, may have greater difficulty. They may produce only single speed pumps and so may need more time to develop higher energy efficient pumps and bring these to market. The effect of a four star MEPS on small manufacturers would depend on the capacity of these businesses to adjust, the time frame for the introduction of the new regulation and the scope and coverage of the MEPS regulation.

5.8 High level MEPS

A MEPS on pool pumps set at a minimum level of 5.5 stars would produce a marginally higher benefit, than a MEPS of four stars, but this is offset by higher estimated costs resulting in a lower NPV. Table 5.3 below sets out the costs and benefits of a MEPS level of 5.5 stars on pool pumps for the Australian market. The central estimate shows a total consumer net benefit of $1,042 million over the forecast period from 2018 to 2030, with greenhouse gas emissions forecast to be reduced by 9.22 million tonnes.

Table 5.3: High level MEPS cost-benefit analysis (2018-2030)

AUSTRALIA	*Discount rate AUS 7 per cent*			*Electricity tariff AUS $0.266 per kWh*		
Policy option *MEPS & Label* *5.5 Star MEPS*		Energy saved (cumulative GWh to 2030)	Emission reduction (cumulative Mt to 2030)	Total benefits (NPV, $M)	Total Cost (NPV, $M)	Net Benefit (NPV, $M)
	Upper	11791.75	9.89	$2,341.86	$1,155.05	$1,214.01
	Lower	10197.07	8.55	$2,025.13	$1,127.85	$870.07
	Central	10994.41	9.22	$2,183.49	$1,141.45	$1,042.04

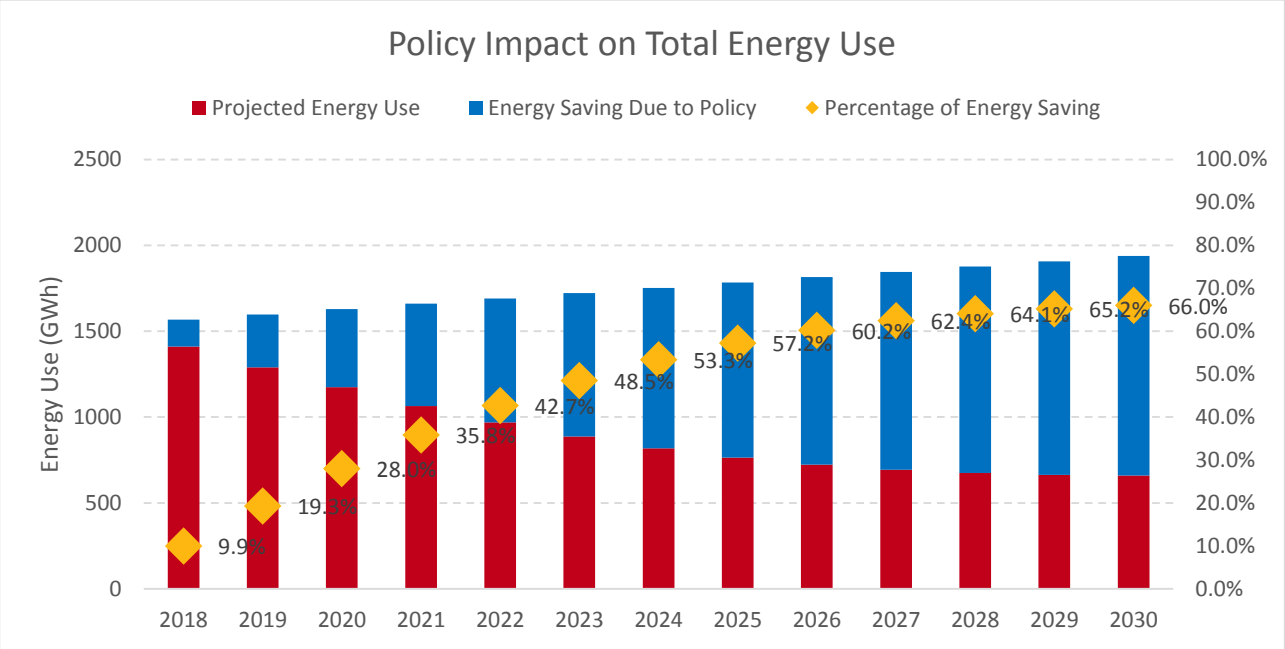
A MEPS level of 5.5 stars is in line with the least energy efficient variable speed pump sold in Australia. On the information available to DEE, no single speed pump would be able to meet this standard. The market information available to DEE indicates that approximately 75 per cent of pool pumps sold in Australia would fall below a MEPS level of 5.5 stars.

The total energy use and reductions in energy use under a 5.5 star MEPS, compared with the base case of no change, are similar to the results for a MEPS set at 4 stars. The major difference is that

[29] Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Dedicated-Purpose Pool Pumps: https://www.regulations.gov/docket?D=EERE-2015-BT-STD-0008

under a MEPS of 5.5 stars, reductions in total energy use are delivered earlier, but at a higher estimated cost, than under a four star MEPS.

Figure 5.7: High level MEPS impact on energy use (2018-2030)



5.9 Timing of the introduction of MEPS

As indicated above, the cost and difficulty for pool pump manufacturers and suppliers of adjusting to any MEPS requirement is dependent, in part, on the timing of any new regulation. One possible approach may be to introduce MEPS or mandatory labelling in a series of steps. This could involve beginning with a low level MEPS with mandatory labelling and moving to a higher level MEPS over time. DEE is keen to hear the views of the pool industry on the timing of any new regulations, particularly the views of small manufacturers and suppliers of pool pumps.

5.10 Scope of MEPS

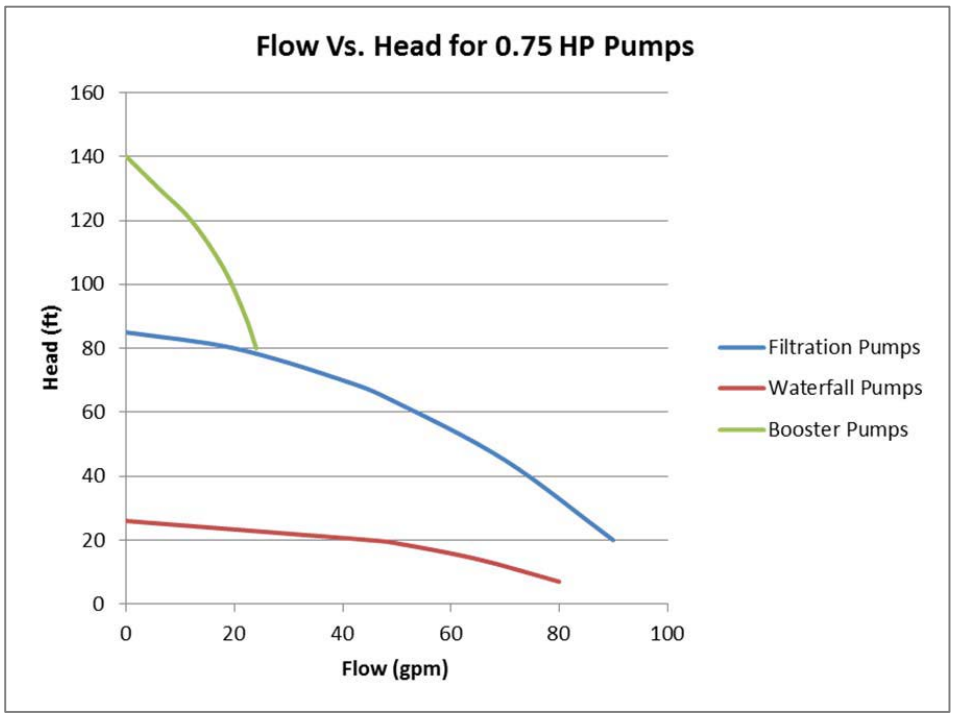
The focus of this consultation RIS is to improve the energy efficiency of pumps used in residential swimming pools and spas. The largest benefits come from improving the energy use required for water filtration and where pumps are run for extended periods of time over the course of a day.

It may be possible to fine tune the application of MEPS to maximise the benefits in terms of energy savings and energy efficiency for consumers, while limiting costs for manufacturers and consumers. For example, it may be possible to align regulation to pool pump types and sizes to capture the largest benefit and avoid imposing unnecessarily high energy performance requirements for low volume specialist pumps that are needed for specific applications.

The majority of pool pumps sold in Australia for the residential pool market are sized between 750 W and 1800 W and operate on single phase power. This reflects the basic filtration requirements for a typical residential pool. There are also a range of smaller, single speed pumps that are used for specific purposes, such as some spa or swim jet pumps, waterfall pumps or cleaner booster pumps. Manufacturers have designed specific combinations of motors and pumps optimized for the intended use of these pumps. Such pumps may not be interchangeable with

filtration pumps and may not provide satisfactory performance for some tasks. (This effect is shown in figure 5.8 below, which plots performance curves for different types of pool pumps.) Such pumps may not run for extended periods and typically have lower wattage. Overall, these functions represent a small part of the total energy used by pool pumps. Similarly, pool pumps sized over 2400 W tend to service larger, commercial pools and are sold in low volumes.

Figure 5.8: Performance curves for different pump applications



5.11 Solar pool heating systems

There may also be specific purpose pumps that are designed and intended to be used for purposes, other than water filtration. For example, some companies have suggested that pumps used specifically for solar pool heating systems need to run at a continuous speed to deliver sufficient head to meet system requirements. If this is the case, the gains from using a more efficient variable speed pump may be limited.

This issue was considered by the committee that prepared the draft, unpublished revision to standard 5102:2009. The committee considered that solar heating pumps should be labelled separately from filtration pumps and not subject to energy performance standards. Recent academic research, however, suggests that large energy and costs savings can be achieved by using variable speed pumps with a solar heating system, without compromising functionality.[30] For this reason, DEE would like to explore with the industry whether:

- A solar water heating pump is different from or interchangeable with a pool pump used for water filtration.
- Excluding pumps for solar water heating systems risks creating a loophole that would allow suppliers to get around a MEPS for pool pumps.
- There is a valid technical reason to exclude a pool pump type based on the intended final use.

[30] J. Zhao & A. Sproul (2016), UNSW Research note – submitted for publication 2016

5.12 Competition effects of MEPS

DEE does not expect the introduction of mandatory MEPS and labelling requirements to hurt competition in the pool pump market. There are a large number of firms supplying the market and a range of products sold, sourced both domestically and from international suppliers in Asia, Europe and the US. There may be some reduction in contestability, if smaller or medium sized firms withdraw from supplying the market because are unable to meet any new MEPS levels. This reduction, however, is unlikely to have a material effect on competition.

There is some analysis to suggest that that the introduction of MEPS for appliances has supported reductions in prices of higher energy efficient products, along with an increase in the quality and features of the regulated products.[31] The introduction of MEPS, while precluding some products from sale, has not prevented sustained reductions in the prices of other MEPS-compliant products; nor has it prevented suppliers from improving the quality or other features of their products.

The introduction of mandatory labelling and the associated costs of testing and registering products might discourage some suppliers from offering products for sale, particularly where the market potential is small or unknown, such as special offerings by chain retailers.

5.13 International developments

In considering the introduction of MEPS, there may be an opportunity to harmonise Australian standards with developments in the United States. The US Department of Energy (DOE) has prepared a proposal to introduce national energy efficiency performance standards for pool pumps, along with a national test method.[32] As proposed, the standard would apply to all pool pumps between 750 W and 2,500 W in size and establishes an efficiency level that would remove most single speed pumps from the US market. If adopted, the standard would apply nationally from 2021.

The US DOE proposal is the first time national standards have been considered for the United States and is in addition to state based regulation in the US. The Californian Energy Commission (CEC) has led the development of energy efficiency standards for pool pumps in the United States and is also looking to increase efficiency standards under their regulations. The scope of the CEC proposals aim to complement the DOE proposals.[33] CEC is proposing minimum motor efficiency standards for smaller, single speed pool pumps (0-0.99 hp) and all dual, multi and variable speed pool pump motors, along with prescriptive motor timer requirements for integrated cartridge filters and integral sand filters.

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[31] A survey of this work is at: Houde, S, & Spurlock, C.A. (2016). Minimum Energy Efficiency Standards for Appliances: Old and New Economic Rationales. *Economics of Energy and Environmental Policy, 5(2)*

[32] Details of the DOE test method proposal is at the Test Procedures for Dedicated Purpose Pool Pumps (DPPP) on the Regulations website; details of energy efficiency proposals for swimming pool pumps are at the Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Dedicated-Purpose Pool Pumps on the Regulations website and https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=67#rulemaking_standards

[33] See Chapter 6: Revised Analysis of Efficiency Standards for Pool Pumps and Motors and Spas – Docket number 15-AAER-02

The European Union is reviewing its approach to the development of energy efficiency standards for swimming pool pumps. Detailed technical analysis has been undertaken and various reports released as part of the Eco-design regulation development framework.34 Various reports and timeline for EU approach to energy efficiency regulation of various pump types.

5.14 Conclusion

The introduction of a MEPS for pool pumps would provide substantial benefits for consumers. The introduction of a MEPS, however, has significant implications for the pool industry, particularly for manufacturers and suppliers of pumps. DEE is keen to hear industry views on MEPS, including:

- The level of MEPS (two stars or greater).
- The timeframe for introducing MEPS or mandatory labelling (ERLs).
- The scope of any MEPS requirement (size of pump, type of pump, use of pump).
- The time needed for the industry, particularly pump manufacturers and suppliers, to adjust to any new regulation.

The introduction of mandatory labelling or MEPS would require a review of the existing test standards (AS5102.1 and 2) and consideration of an appropriate standard to support the star rating for ERLs and MEPS. DEE is keen to work with industry on this issue and will support the establishment of a technical committee to review and develop an appropriate standard.

DEE is also keen to establish a policy advisory group with industry to work through issues raised by the consultation process on this RIS.

[34] See various reports on the Eco Pump Review website, Lot 29 preparatory studies cover swimming pool pumps

Appendix A – Assumptions applied to modelling

Methods and key inputs for cost benefit analysis

This appendix presents the methods used for the cost benefit analysis (CBA) for the policy options proposed. It documents the data sources and analytical steps used for analysis in this pool pumps Consultation Regulation Impact Statement (RIS).

A financial analysis model has been built to review the overall costs and benefits related to each proposal being considered in this RIS document. The model includes data and reports on both the Australian and New Zealand markets to meet EEAT member requirements. Only data relevant to Australia is reported on in this RIS.

Proposals are compared to 'business as usual' where there is no policy intervention to the pool pump market. Both costs and benefits are evaluated from 2018 (the likely starting date for measures proposed in RIS) to 2030. They include the following:

Benefits

- Energy saving for consumers due to improved efficiency of pool pumps and the resulting avoided electricity cost
- Reduced emissions as a result of energy savings from intervention (these benefits are not monetized as part of the CBA)

Costs:

- Extra upfront capital cost for consumer to purchase energy efficient pumps when regulation restricts sales of single speed pumps
- Regulatory cost for the industry (including additional administrative resources and registration cost)

Data sets and reference materials used in this CBA include:

- Five years of pool pump sales data collected from 2010 onwards, from four manufacturers (Astral, Davey, Pentair and Zodiac) which covers around half of the estimated pool pump sales.
- Pool pump test reports from Vipac laboratory, Austest laboratory and Waterco.
- Woolcott swimming pool pump survey conducted in 2016.
- Household pool penetration survey published by Roy Morgan Research Group (2015).
- Australian Bureau of Statistics (ABS) household pool penetration survey in 2001, 2004 and 2007.
- ABS household number projection and measurements from 2001 to 2016.
- Pool and spa penetration rate in New Zealand from BRANZ HEEP 2005 report.
- *Energy use in the Australian residential sector* 1986 – 2020 by the Department of the Environment, Water, Heritage and the Arts (2008).
- *2015 residential electricity price trends* by Australian Energy Market Commission (2015)
- Ergon Energy pool pump program post implementation review by Ergon Energy (2016).

Other key inputs and list of assumptions

Discount rate

All outputs of cost benefit analysis for Australia are assessed at 7per cent discount rate, with sensitivity tests at 0per cent, 3per cent and 11per cent. For New Zealand, the baseline discount rate is 5per cent, with sensitivity tests at 0per cent, 3per cent and 8per cent.

Electricity prices

A constant electricity price of 26.6 cents/kWh is used for analysis in the consultation stage. These figures are derived from:

- The projected 2018 Australian average retail tariff rate of 29 cents/kWh (Residential electricity price trends, AEMC 2015).
- A controlled load tariff of 17 cents/kWh (quoted from Ergon Energy pool pump program post implementation review 2016).
- The share of consumers on a controlled load tariff being 20per cent (figure from Woolcott survey).

For the decision RIS, separate retail tariff rates for each Australian state and territory and New Zealand – along with projected tariff values – will be applied to energy savings to calculate the benefits.

Emission factors for grid electricity use

Emission factors for each state and territory in Australia and New Zealand are taken from the National Greenhouse Accounts Factor published by the Department of the Environment and Energy, and official published emission factors provided by New Zealand Ministry of Business, Innovation and Employment. These figures are summarised in table 6.1 below.

Table 6.1: Emission Factors for Grid Electricity Use (Australia)

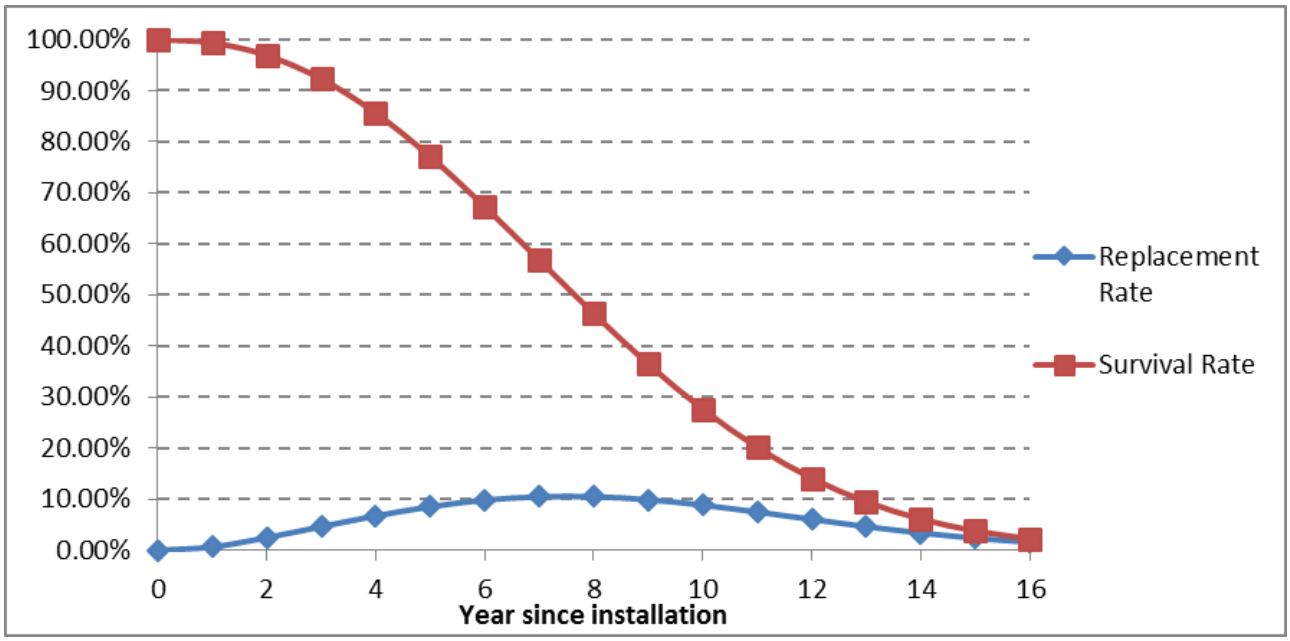
Region	*Greenhouse gas emission factor estimate for years from 2017 to 2030 (tonne/MWh)*
NSW	0.84
VIC	1.12
QLD	0.79
SA	0.56
WA	0.76
TAS	0.12
NT	0.67
ACT	0.84
NZ	0.138

Lifetime of a pool pump

The average lifetime of a pool pump is estimated based on the findings of the Woolcott consumer survey. By fitting a Weibull distribution curve to the survey findings for age of pump when replaced, a survival rate curve can be produced for pool pumps (shown below in Figure 6.1). This survival rate is an important input for the cost benefit analysis, because it is used to calculate the pool pump replacement rate and the size of tailing benefits. On average a pool pump will have a lifetime of 7.25 years.

Based on the Woolcott survey, among respondents in Australia who were replacing their pool pumps, 20 per cent were replacing pumps 0 – 5 years old, 42 per cent were replacing pool pumps 5 – 10 years old, 23 per cent were replacing pool pumps that were more than 10 years old. The remaining 15 per cent did not know the age of the pump they were replacing. In New Zealand, while 74 per cent of respondents provided no answer, of those who did, most were replacing pool pumps that were between 5 and 10 years old (37 per cent) or replacing pool pumps that were more than 10 years old (29 per cent).

Figure 6.1: Replacement of Pool Pumps



Assumptions

1. Sales distribution within each star rating band from collected sales data (more than 50 per cent of the entire market) is representative for the entire filtration pool pump sales market and the BAU distribution will plateau around current levels.

2. Pool filtration pumps available to consumers in the market are similar in performance when compared to those tested by Vipac Testing Laboratory (utilising AS1502:2009) i.e. pumps sold in the market and tested pumps form the same regression in terms of Pd vs SRI, Qd vs Pd and Pd vs SRI.

3. Measured Qd from the pump performance curves is used to estimate the SRI and Pd of each pump model using regression relationships derived from the Vipac tests. These estimated SRI and Pd values are used for the analysis.

4. Sales distribution for pool pumps in terms of star rating is assumed to be same between different regions in Australia and New Zealand.

5. The sales growth rate in New Zealand is assumed to be the same as the projected sales growth rate in Australia.

6. Retail price of pool pumps will remain static in real terms. (This is likely to be a conservative assumption).

7. The percentage of pool pump buyers who will have exposure to the energy rating label while purchasing is 70 per cent.

8. The energy rating label will not promote more sales in variable or multi speed pumps due to a large upfront cost difference between single speed pumps and variable and multi speed pumps (approximately $700).

9. Consumers who are exposed to and can understand the energy rating label will maximise the effect of the label by choosing the most efficient model, where excess extra capital investment is not required.

10. Benefits due to reduced peak demand for transmission networks due to lower power consumption have not been modelled in this analysis.

11. The additional financial benefits of greenhouse gas emission reductions are not considered in this analysis.

12. The rebound effect is assumed to be not applicable to pool pump use.

Understanding the Current Pool Pump Market

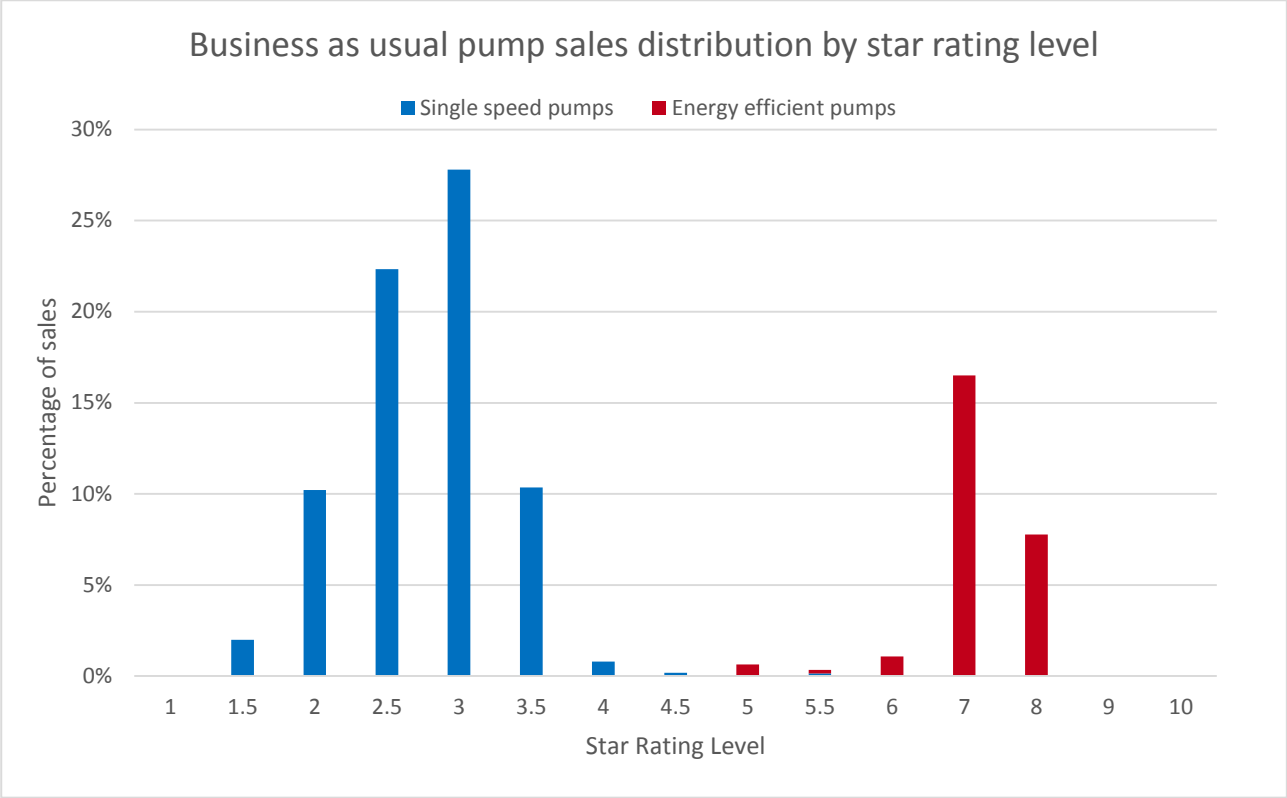
The only publicly available information about pool pump energy consumption comes from manufacturer guides and products that are covered by the Voluntary Energy Rating Labelling Scheme (VERLP). Participation in the VERLP is voluntary and registered models (mostly energy efficient multi speed or variable speed pumps) can only provide energy efficiency specifications for a small fraction of the collected sales data, as most of the sales are single speed pumps. This prompted the department to commission more laboratory tests to understand the energy efficiency distribution of pool pumps sold in the market.

Between 2014 and 2016, the department commissioned Vipac laboratory to conduct 54 pool pump tests according to *AS5102.1 Performance of household electrical appliances – Swimming pool pump-units Part 1: Energy consumption and performance*. The tested pumps were:

- 28 models with the most sales from collected sales data,
- 15 models to verify reported data on the voluntary register,
- 11 models selected to provide a representative sample of the proportion of the market that did not provide sales data (including three New Zealand manufactured pumps).

The test reports provided energy efficiency data corresponding to around 85 per cent of collected sales data for pool pumps. For the remaining models without tested data, the energy efficiency specification is assigned by finding Q_d through the product performance curve and Pd through the relationship between P_d and Q_d (taken from regression analysis from 54 tested models). After assigning efficiency specifications for all models, either through direct testing or estimation through regression, a market sales distribution by efficiency level was produced below:

Figure 6.2: Pump sales distribution – Business as usual



Energy efficiency specification for a pool pump is measured in terms of Energy Factor (EF), which is energy consumed per litre of water pumped (derived from Q_d and P_d). To present energy efficiency specification in a manner that is easily understandable for consumers, *AS5102.2 Performance of household electrical appliances – Swimming pool pump-units Part 2: Energy labelling and minimum energy performance standard requirements* assigns a star rating to a pump according its EF value. For the purpose of this RIS, DEE has chosen to use the star rating of a pump to represent its energy efficiency level, in order to present the data in a simple and uniform manner.

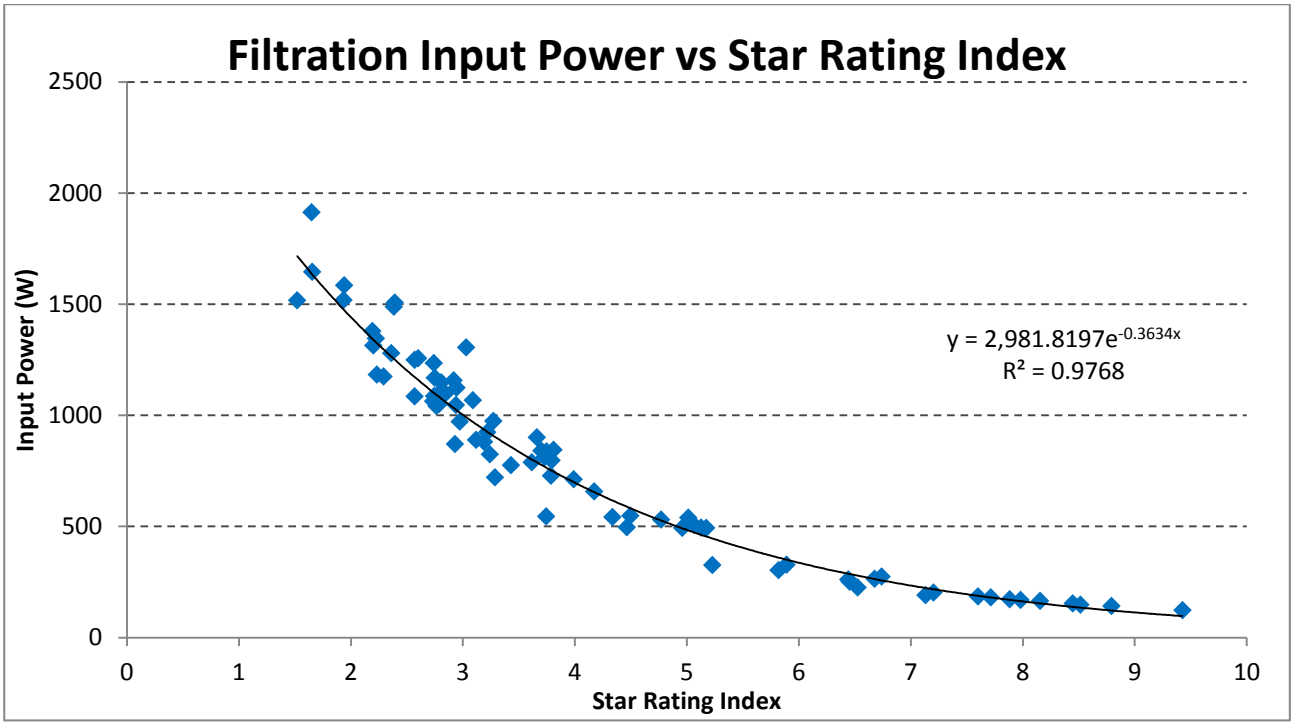
Calculating energy consumption of pool pumps used for filtration

The total annual energy consumption of pool pumps used for filtration is the product of the electrical power input of pool pumps used in Australia, multiplied by the total number of hours of operation in a year, then multiplied by the total number of pool pumps in use. The approach for calculating each of these inputs is set out below.

Input power

The input power of pool pumps during filtration varies by its star rating, which is a system to rank energy efficiency of a filtration pump set out in AS5102.2 2009 [Performance of Household electrical Appliances – Swimming Pool Pumps]. The chart below depicts pump filtration input power in terms of star rating. It is based on 54 sets of individual pump specifications tested by Vipac laboratory and 6 sets of additional pump specifications tested by Austest laboratory and Waterco. It illustrates a clear trend between the star rating of a pump and its input power while filtering. The trend line in the chart is used to estimate input power of a pool pump during filtration for all star rating ranges.

Figure 6.3: Power of pumps by star rating



Hours of operation

From the Woolcott consumer survey, it is clear that operating hours for household pool filtration pumps vary by season, with more hours of use in summer and less in winter. This seasonal variation is aggregated into an annual daily average hours of operation distribution, applied to all filtration pool pumps in Australia and New Zealand. This approach sets the daily average hours of operation for a filtration pump at 4.2 hours.

Note that AS5102.1 calculates run time and estimates annual energy use of a pump by requiring it to circulate 50,000 litres of water daily. This does not produce a fixed run time and requires the owner of a pool to calculate run time according to the pump flow rate. In these calculations, the number of hours used is the number of hours owners claimed to operate their pumps across Australia and New Zealand, according to Woolcott survey data from 2016.

Sales volume for pool pumps used for filtration

The annual sales volume of pool pumps used for filtration is derived from:

- household number projections by the Australian Bureau of Statistics (ABS),
- penetration of household pools in the each capital city and state (surveyed by Roy Morgan Research Group in 2015),
- historic Australian household pool penetration (ABS survey in 2001, 2004 and 2007),
- average lifetime of filter pumps (7.2 years) and
- the ratio of sales between newly installed pool pumps and replacement pool pumps (extracted from historic pool numbers surveyed by ABS).

The New Zealand sales volumes are calculated similarly, with pool penetration numbers from BRANZ HEEPs report (2005) and Woolcott survey (2016). According to this model, the projected 2017 sales of filtration pumps will be 170,300 in Australia and 10,800 in New Zealand, with an

Australian annual rate of growth of 1.8per cent in 2017, tapering to 1.5per cent in 2030. The same growth rate is applied to New Zealand.

Figure 6.4: Projected annual filtration pool pump sales

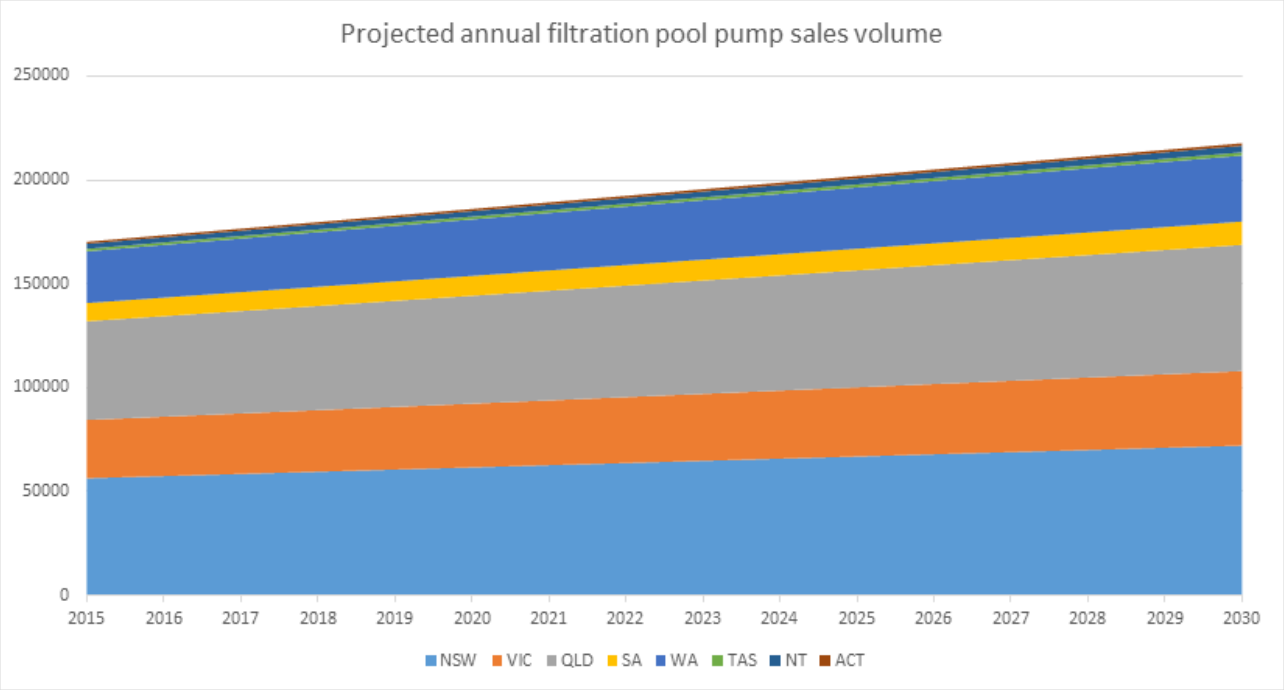


Table 6.2: State and Territory share of national pool pump sales

State or Territory	*Percentage of total Australian pool pump sales*
NSW	33.1 per cent
VIC	16.5 per cent
QLD	27.9 per cent
SA	5.1 per cent
WA	14.6 per cent
TAS	0.7 per cent
NT	1.4 per cent*
ACT	0.6 per cent*

*Roy Morgan survey did not cover household pool pump sales in the ACT or NT, figures from these two territories are estimated based on Energy Use in the Australian Residential Sector, published in 2008.

The 2015 survey on household pools conducted by Roy Morgan Research Group reveals the percentage of household pool penetration in each Australian state and territory. Combined with the 2015 ABS household data projections, the percentage share of household pools in each state and territory (thus percentage of total pool pump sales by state or territory) can be produced, as shown in the table above.

The sales distribution of pool pumps by star rating level is calculated by analyzing sales data collected from four large pool pump manufacturers (Astral, Davey, Pentair and Zodiac), and has been presented earlier in this appendix. This distribution is applied to the total projected annual

sales to obtain estimated annual pump sales within each star rating category. The share of energy efficient pumps increased steadily from 2010 to 2013, possibly due to rebate programs in Queensland for energy efficient pumps. Over the past two years, however, the shift in sales distribution by star rating has been minimal following the close of rebate programs. It has been assumed that these small shifts will stabilise around the current level without any further policy intervention.

Calculating energy and greenhouse gas emissions savings from the measures

Annual pool pump energy consumption for filtration under the 'business as usual' (BAU) scenario can be derived by using the method above. Annual energy consumption for pumps within each star rating level is calculated by multiplying the number of pump sales within each star by the corresponding filtration power input, average daily operation hours and days in a year. Total BAU annual pump filtration energy consumption for all filtration pumps is the sum of all energy consumption within each star rating. Annual sales figures are used rather than total stock in calculations, because any proposed measure will not be retrospective and hence only affects future sales, not any existing pool pump stock.

When a new policy proposal is considered, such as labelling of pumps or MEPS, the policy will have little to no effect on total volume of sales or average hours of operation. Both labelling and MEPS, however, will have significant influence on the percentage distribution of sales of pool pumps by star rating level. Each policy proposal will have its own pump sales distribution by star rating, and thus a different annual total energy consumption (using the same method for calculation as BAU). The difference between total BAU energy consumption and energy consumption under the proposed measure will be the projected annual energy saving under that measure. By multiplying projected energy savings by the electricity price used for the CBA, a monetary value is applied to energy saving and this value becomes the 'financial benefit' of each proposal.

Knowing the percentage of pump sales by state, the annual energy savings of a measure can be split between each state and territory in Australia and New Zealand. Emissions savings in each state or territory are the result of multiplying energy savings in each state by the electricity emissions factors in each region, as listed above in table 6.1 (National Greenhouse Accounts Factor, 2015).

Calculating the costs of the proposed measures

The costs considered in this CBA include:

- Extra capital costs for consumers when they purchase an energy efficient pump.
- Regulatory costs for manufacturers and retail suppliers of pool pumps, including additional administrative costs attributed to understanding and complying with proposed policies, paying registration fees and purchasing copies of standards.

Additional capital cost of energy efficient pumps compared to single speed pumps

From sales data collected, there is a clear price difference between single speed pumps and energy efficient pumps, which include dual speed, multi speed and variable speed pumps. The sales weighted average price for a single speed pump is $775, whereas the sales weighted average price for an energy efficient pump is $1492. This means an average energy efficient pump costs almost twice as much as a typical single speed pump.

Due to this large initial investment difference and consumer's preference for cheaper pumps when looking for a replacement (findings from Woolcott survey, 2016), it is reasonable to assume that the labelling proposal for pool pumps will not shift consumer behaviour away from purchasing a cheaper single speed pump. Instead, the labelling proposal is likely to encourage more consumers to purchase a more efficient single speed pump. The initial purchase price difference will not be a burden on consumers in a labelling only scenario, because the price difference between single speed pumps of similar wattage is insignificant, despite the variation in energy efficiency within this category.

In the MEPS scenarios, each proposed minimum energy performance level constrains the market to a certain level of performance. Depending on the level of MEPS, a quantity of single speed pumps will be excluded from sale, and hence replaced by energy efficient models. Each different MEPS level will incur a capital cost burden for consumers based on the proportion of single speed pump sales affected by MEPS, and the price difference between single speed and energy efficient pumps within the affected category. Both of these quantities are calculated from sales data analysis. The extra capital cost burden will be accounted every year after the introduction of regulation, according to the proportion of the sales market to be replaced by energy efficient pumps. This is the dominant component of the cost of introducing MEPS.

Regulatory cost on industry

By introducing regulation for the pool pump industry, businesses involved in pool pump supply and sales will be required to meet the cost of complying with the program, such as testing and registering products, administration and additional training. These costs are also deemed as costs of introducing new regulation.

Appendix B – Cost Benefit Analysis Summary Results

Proposal 1 – Labelling Only

AUSTRALIA	*Discount rate 7 per cent*			*Electricity tariff $0.266 per kWh*		
Policy option		Energy saved (cumulative GWh to 2030)	Emission reduction (cumulative Mt to 2030)	Total benefits (NPV, $M)	Total Cost (NPV, $M)	Net Benefit (NPV, $M)
Label only	Upper	2383.16	2.00	$473.32	$7.18	$466.14
	Lower	450.60	0.38	$89.47	$7.18	$82.29
	Central	1416.88	1.19	$281.39	$7.18	$274.21

Proposal 2 – MEPS at 2 Star with Labelling

AUSTRALIA	*Discount rate 7 per cent*			*Electricity tariff $0.266 per kWh*		
Policy option		Energy saved (cumulative GWh to 2030)	Emission reduction (cumulative Mt to 2030)	Total benefits (NPV, $M)	Total Cost (NPV, $M)	Net Benefit (NPV, $M)
MEPS and Label	Upper	2467.29	2.07	$490.02	$7.10	$482.92
2 Star MEPS	Lower	472.93	0.40	$93.90	$7.10	$86.80
	Central	1470.11	1.23	$291.96	$7.10	$284.86

Proposal 3 – MEPS at 4 Star with Labelling

AUSTRALIA	*Discount rate 7 per cent*			*Electricity tariff $0.266 per kWh*		
Policy option		Energy saved (cumulative GWh to 2030)	Emission reduction (cumulative Mt to 2030)	Total benefits (NPV, $M)	Total Cost (NPV, $M)	Net Benefit (NPV, $M)
MEPS and Label	Upper	11279.88	9.46	$2,240.20	$1,025.70	$1,238.64
4 Star MEPS	Lower	9665.28	8.10	$1,919.51	$1,001.56	$893.81
	Central	10472.58	8.78	$2,079.86	$1,013.63	$1,066.23

Proposal 4 – MEPS at 5.5 Star with Labelling

AUSTRALIA	*Discount rate 7 per cent*			*Electricity tariff $0.266 per kWh*		
Policy option		Energy saved (cumulative GWh to 2030)	Emission reduction (cumulative Mt to 2030)	Total benefits (NPV, $M)	Total Cost (NPV, $M)	Net Benefit (NPV, $M)
MEPS and Label	Upper	11791.75	9.89	$2,341.86	$1,155.05	$1,214.01
5.5 Star MEPS	Lower	10197.07	8.55	$2,025.13	$1,127.85	$870.07
	Central	10994.41	9.22	$2,183.49	$1,141.45	$1,042.04

Appendix C – Standards for measurement

Pump-Unit Technology and Measuring Energy Efficiency

This RIS considers the energy efficiency of the pump-unit assembly as a motor and pump combination, rather than the efficiency of the motors and wet-ends separately.

This RIS uses the Energy Factor (EF) as a measure of energy efficiency which is defined as the energy required to move one litre of water. The Energy Factor is discussed in terms of "Star Rating Index" set out in the Australian Standard and is discussed further below.

All else being equal, the energy used by a pump-unit decreases as motor rotational speed decreases. This is mainly due to the reduced resistance-to-flow experienced by slower moving water. In a swimming pool system there is generally considerable scope to perform the required filtering over a longer period of time by moving the water more slowly which can result in considerable improvements in efficiency.

Hence, the formula for calculating star ratings (as documented in the Australian Standard AS5102.2 – see Appendix 2) has been designed to reflect this and the energy labelling program gives higher star ratings to pumps capable of low-speed operation (provided that suppliers choose to label at the lowest speed at which the pump meets the minimum flow rate).

The Australian Standard AS5102-2009

Prior to 2009, there was no standard method of measuring the energy consumption or the energy-efficiency of swimming pool pump-units. The E3 Program supported the development of Standards for this purpose by a new committee of Standards Australia, EL-015-25, comprising industry and government representatives. *AS 5102:2009 Performance of household electrical appliances — Swimming pool pump-units* follows the two-part structure that is designed to be suitable for calling up in State and Territory energy labelling regulations:

- Part 1 (AS5102.1): Energy consumption and performance; and
- Part 2 (AS5102.2): Energy labelling and minimum energy performance standard requirements.

In summary, the existing standard has the following scope:

- Single-phase pump-units intended for use in the operation of residential swimming pools and spa pools, and which are capable of a flow rate equal to or greater than 120 L/min when connected to a typical pool (as defined by Curve D in AS5102:2009;
- Single-speed, dual-speed, multi-speed and variable-speed pump-units with an input power of less than or equal to 2,500 W for any of the available speeds;
- Pump-units intended for the circulation of water through filters, sanitisation devices, cleaning devices, water heaters (including solar), spa or jet outlets or other features forming part of the pool; and
- Pump-units supplied as part of a complete new swimming pool or spa pool installation, as well as pump-units supplied as replacements for existing pools.

AS5102.2 defines pump-unit efficiency in terms of an Energy Factor (EF), which is the volume of water pumped (in litres) per Watt-hour of electrical energy consumed by the pump motor. The star rating index (SRI) is calculated from the EF as follows:

$$SRI = 1 + \frac{\ln\left(\frac{EF}{9.0}\right)}{\ln(1.25)} \qquad (1)$$

A SRI derived from the EF provides the basis for the energy star rating label. Under the current standard an EF of 9 produces a SRI of 1.0 and each additional star represents an additional 20 per cent reduction in energy use. The relationship between the EF, SRI and Star rating are given in Table 6.3.

Table 6.3: Energy Factor, Star Rating Index and Star Rating.

Energy Factor (EF)	Star Rating Index (SRI)	Star rating
EF < 10.1	SRI < 1.5	1.0
10.1 ≤ EF < 11.3	1.5 ≤ SRI < 2.0	1.5
11.3 ≤ EF < 12.6	2.0 ≤ SRI < 2.5	2.0
12.6 ≤ EF < 14.1	2.5 ≤ SRI < 3.0	2.5
14.1 ≤ EF < 15.7	3.0 ≤ SRI < 3.5	3.0
15.7 ≤ EF < 17.6	3.5 ≤ SRI < 4.0	3.5
17.6 ≤ EF < 19.7	4.0 ≤ SRI < 4.5	4.0
19.7 ≤ EF < 22.0	4.5 ≤ SRI < 5.0	4.5
22.0 ≤ EF < 24.6	5.0 ≤ SRI < 5.5	5.0
24.6 ≤ EF < 27.5	5.5 ≤ SRI < 6.0	5.5
27.5 ≤ EF < 34.3	6.0 ≤ SRI < 7.0	6.0
34.3 ≤ EF < 42.9	7.0 ≤ SRI < 8.0	7.0
42.9 ≤ EF < 53.6	8.0 ≤ SRI < 9.0	8.0
53.6 ≤ EF < 67.1	9.0 ≤ SRI < 10.0	9.0
67.1 ≤ EF	10.0 ≤ SRI	10.0

Development of a Revised Draft Standard for the Test Method for Pool Pump Energy Efficiency Performance

Pool pump manufacturers and testing houses identified a number of concerns when applying the standard in seeking registration under the Voluntary Energy Rating Label Program. The E3 Program supported the Standards Committee and industry in reviewing the test standard. Activity included:

- Round robin testing of selected pumps;
- Expert review of laboratory procedures and standard documentation;
- Development of a new system performance curve (Curve G) to against which pump energy performance would be assessed.

During 2013 the Standards Committee prepared a draft of a revised standard. This revised standard has not been released formally nor approved consistent with Standards Australia processes for public review, comment and adoption.

In summary the changes set out in the draft revised standard included:

- Redefined the scope of the standard to apply more tightly to models sold for residential pool use
- Revision to the system curve against which pool pump performance is measured to better reflect industries' understanding of pool and pump characteristics as it relates to energy use
- Tightened a range of technical items and test procedures to improve robustness and reproducibility of the test standard
- Proposed labelling requirements for pumps used for solar thermal water heating systems and exclusion from the test procedure on this basis
- Proposed to increase the voluntary minimum energy performance standard to level equivalent to 2 Stars (compared to 1 star under the current standard).

Pool Pump Testing Program 2016

Pool pump testing was undertaken in 2016 to:

1. Provide energy efficiency and performance information for the cost benefit analysis and for use in conjunctions with market sales information
2. Apply various noise test standards to inform decisions on adopting a single test for noise labelling for swimming pool pumps, and
3. Provide information on the existing test methods and test standards and their suitability for use if it is decided to adopt mandatory labelling or MEPS requirements for swimming pool pumps.

Energy performance testing of 20 pool pumps currently on the market was completed by two separate and independent laboratories. The pumps were tested against two test methods:

- The existing test standard (AS5102 2009) and
- The revised unpublished swimming pool pump test standard

Energy performance testing of a further 11 pumps was undertaken under the two standards. This round of testing was intended to provide data on:

- Performance data on pool pumps supplied via internet sales alone;
- A selection of pool pumps produced by New Zealand firms;
- Commonly sold pumps for which performance data was not elsewhere available

The results from this round of energy performance testing were incorporated into the consultation RIS and supporting cost benefit financial model.

In addition to energy performance testing, 12 pumps under the round robin process where tested against four noise test procedures. This was done to provide an information base for consultations with industry on adopting a single noise testing method under a labelling proposal (see Appendix E for further detail).

We are also proposing to undertake further in-house analysis of pool pump performance using the newly developed US DOE test approach.

Next Steps

The E3 Program is proposing to establish a technical working group to consider test methods for swimming pool pumps. Robust and agreed test methods are needed as part of any decision to adopt mandatory labelling or MEPS as part of a regulatory regime.

We have used the existing published method of test in undertaking market performance analysis for this consultation RIS. This approach was adopted because it provided common and existing platform used by industry, it is a familiar method and provides reasonably accurate results for the current purposes.

However a number of issues need to be considered before finalising a test method to support any new energy efficiency standard for swimming pool pumps. The testing work done to date will be used by the technical group. By way of example and without intending to be exhaustive, issues for consideration include:

- Robustness, transparency and repeatability of the test method
- Adoption of a noise test standard to support labelling of noise labelling
- Whether a weighted energy factor should be used to better model practical performance of variable speed pumps
- Consideration of definitions and implications for the scope of a regulation
- Opportunities for harmonisation with international test standards and approaches including associated technical issues.

Appendix D – Sensitivity Analysis

Discount Rate Sensitivity Analysis – Policy Options

Summary Australia	*0 per cent discount rate*	*4 per cent discount rate*	*7 per cent discount rate*	*11 per cent discount rate*
Proposal 1 - Labelling Only				
Total Benefits (NPV, $M)	$579.81	$375.96	$281.39	$199.20
Total Costs (NPV, $M)	$11.17	$8.58	$7.18	$5.80
Net Benefits (NPV, $M)	$568.64	$367.39	$274.21	$193.41
Benefit Cost Ratio	51.9	43.8	39.2	34.4
Proposal 2 - MEPS at 2 Star with Labelling				
Total Benefits (NPV, $M)	$601.59	$390.09	$291.96	$206.69
Total Costs (NPV, $M)	$11.05	$8.49	$7.10	$5.74
Net Benefits (NPV, $M)	$590.54	$381.60	$284.86	$200.95
Benefit Cost Ratio	54.5	46.0	41.1	36.0
Proposal 3 - MEPS at 4 Star with Labelling				
Total Benefits (NPV, $M)	$4,285.52	$2,778.87	$2,079.86	$1,472.37
Total Costs (NPV, $M)	$1,695.90	$1,248.65	$1,013.63	$787.74
Net Benefits (NPV, $M)	$2,589.62	$1,530.21	$1,066.23	$684.63
Benefit Cost Ratio	2.5	2.2	2.1	1.9
Proposal 4 - MEPS at 5.5 Star with Labelling				
Total Benefits (NPV, $M)	$4,499.06	$2,917.33	$2,183.49	$1,545.73
Total Costs (NPV, $M)	$1,909.87	$1,406.14	$1,141.45	$887.05
Net Benefits (NPV, $M)	$2,589.20	$1,511.19	$1,042.04	$658.68
Benefit Cost Ratio	2.4	2.1	1.9	1.7

NOTE : A discount rate of 7 per cent is used for the CBA for Australia

Sensitivity Analysis: Australia - Electricity Network Tariff Rates – Policy Options

Summary Australia	*Tariff rate 10 per cent reduction*	*Standard tariff rate*	*Tariff rate 10 per cent increase*
Proposal 1 - Labelling Only			
Total Benefits (NPV, $M)	$253.25	$281.39	$309.53
Total Costs (NPV, $M)	$7.18	$7.18	$7.18
Net Benefits (NPV, $M)	$246.08	$274.21	$302.35
Benefit Cost Ratio	35.3	39.2	43.1
Proposal 2 - MEPS at 2 Star with Labelling			
Total Benefits (NPV, $M)	$262.77	$291.96	$321.16
Total Costs (NPV, $M)	$7.10	$7.10	$7.10
Net Benefits (NPV, $M)	$255.67	$284.86	$314.06
Benefit Cost Ratio	37.0	41.1	45.2
Proposal 3 - MEPS at 4 Star with Labelling			
Total Benefits (NPV, $M)	$1,871.87	$2,079.86	$2,287.84
Total Costs (NPV, $M)	$1,013.63	$1,013.63	$1,013.63
Net Benefits (NPV, $M)	$858.24	$1,066.23	$1,274.21
Benefit Cost Ratio	1.8	2.1	2.3
Proposal 4 - MEPS at 5.5 Star with Labelling			
Total Benefits (NPV, $M)	$1,965.14	$2,183.49	$2,401.84
Total Costs (NPV, $M)	$1,141.45	$1,141.45	$1,141.45
Net Benefits (NPV, $M)	$823.69	$1,042.04	$1,260.39
Benefit Cost Ratio	1.7	1.9	2.1
			Discount Rate: 7 per cent

Appendix E – Noise

This consultation RIS is presenting the proposal that the mandatory energy efficiency labels also include information on the level of noise made by different models of pool pump. Increasing consumer awareness (through labelling) of the relative noise impacts of different pool pumps could have several benefits including:

- reduced neighbourhood noise pollution;
- empowerment of consumers to choose quieter models of pump to avoid potential fines or conflict with neighbours from noisy pool pumps; and
- informing consumers early on in the installation process of the level of noise their pump is likely to make, so they can take steps to reduce noise pollution (e.g. by housing the pump in a casing, away from windows, or set up on a timer that avoids sensitive times of day).

State and local Government Noise Regulations

The department contacted state Environmental Protection Authority's (EPAs) and local councils about noise pollution and pool pumps specifically. In most states, environment protection acts and regulations are set and usually enforced by either the Environment Protection Authorities, or local councils. Penalties set out in noise regulations vary from mediation approaches, to fines of up to $11,000. A snapshot of selected state laws and regulations around noise is at Table XX.

In Tasmania, New South Wales and the ACT noise of pool pumps was considered by the EPA as a serious issue. It was thought that labelling of noise levels on pool pumps would be useful for consumers and the community, as consumers could be made more aware of the potential noise pollution implications of different types of pool pump.

Noise Testing of Pool Pumps

The Department is currently undertaking work to decide on the noise testing standard that would be applied if mandatory noise labelling was to be regulated. The Department engaged an independent testing house to test 12 pumps against the following noise testing methodologies: AS1217.2, ISO 3741, ISO 9614, and ISO 3743.

Recommendations from the testing house suggest the use of ISO 3741 and ISO 3743 because:

- ISO 3741 offers greater precision than AS1217.2. It measures in third octave band spectrum which is a requirement for some state EPA's noise regulations.
- While not one of the initial standards agreed for testing, ISO 3743 provided more accurate readings than ISO 9614, and was much easier to set up for testing. ISO 9614 provided several invalid results, resulting from an unsteady sound intensity field.

Based this round of testing the proposed Technical Working Group will be asked to consider adoption of a single test method and standard as a basis for labelling pool pump noise emissions.

Table 6.4: Noise Testing Results - Comparison against the VERLP and Product claims[35]

Pump	Type	Product Claims	AS1217.2 dB(A)	ISO 3741 dB(A)	ISO 9614-2 dB(A)	ISO 3743-1	VERLP dB(A)
1	Variable	'QUIET' – 'very low sound level, adjustable speeds 600-3450 RPM	57	57	Not measurable to this standard	Not Tested	Not on label.
2	Multiple	'Ultra Quiet' – 66.5	ECO 66 Med 68 High 72	ECO 65 Med 67 High 72	ECO 69 Med 71 High 75	ECO 65 Med 68 High 72	66.5 Tested to ISO 3744
3	Variable	'low noise operation allows you to take advantage of off-peak hours'	62	63	Not measurable to this standard	64	Not on label.
4	Dual	55 dBA	Low 53 High 67	Low 52 High 67	Low 61 High 66	Not Tested	Not on label.
5	Variable	57.5 on low speed and 'Super Quiet'	61	61	Not measurable to this standard	60	Not on label.
6	Variable	48.7	47	48	Not measurable to this standard	Not Tested	48.7 Tested to ISO 3741
7	Single	-	47	48	Not measurable to this standard	Not Tested	60 Standard not stated
8	Dual	Low 57 High 63	Low 67 High 77	Low 67 High 77	Low 73 High 78	Not Tested	Not on label.
11	Single	<70	69	69	74	71	Not on Label.
9	Single	54-56 dBA (AS5102.2)	71	70	69	Not Tested	Not registered on the VERLP
10	Variable	-	51	51	Not measurable to this standard	Not Tested	Not registered on the VERLP
12	Single	57	66	66	67	Not Tested	Not registered on the VERLP

[35] Results in red indicate test readings that included 'large and unacceptable' errors due to interference in the sound intensity field.

Appendix F – Other Studies and Trials

Swimming Pool Pump Retrofit Trial (Sustainability Victoria).

During 2013 and 2014, Sustainability Victoria ran a small Swimming Pool Pump Retrofit Trial. In the trial, eight households in Melbourne had their existing single-speed pool pump (for filtration) replaced with a high efficiency (8-Star), three-speed pump. The pumps that were replaced were between five and 30 years old. Power and energy consumption and operating time of the pool pumps before and after the retrofits was measured using detailed interval metering. Householders were also surveyed about usage patterns and other factors before and after the retrofits.

The results of the trial showed the energy efficient pumps delivering annual pump energy savings to households of up to 73 per cent in the best cases, although in some houses the savings where somewhat less. Once one outlier household was removed from the analysis, the average saving was 50%[36]. Overall, the trial found the replacement of inefficient pool pumps with higher efficient pool pumps to be a cost effective approach for reducing household energy use and associated costs. The trial also illustrated the importance of consumer behaviour. Some houses operated the pumps for most of the time on their lowest speed setting, some on a combination of the low and medium settings, and some mainly on the highest speed setting. Operating the pumps for extended periods on the medium and/or high speed settings reduced the energy savings achieved.

Ausgrid

Ausgrid is the network operator that provides electricity to Sydney and the surrounding region. In 2015-16, Ausgrid undertook an investigation into the potential for a pool pump rebate program for their customers. Ausgrid found that the option for a rebate program was not the most cost effective demand option available. Ausgrid, however, recognises the benefits of reducing loads from pool pumps, and the lack of information available to customers. Ausgrid provides a 'pool pump calculator'[37] that can provide an estimate of the annual cost of running a pool and an *Ausgrid Guide to Pool Efficiency*[38], which gives advice on how to save energy from pool pumps and how to use the VERLP to choose higher energy efficient models.

[36] For unknown reasons this household operated the pump for much longer hours after the retrofit and ran the pump almost entirely on the highest speed setting.

[37] Pool Pump Calculator, Ausgrid website.

[38] Swimming pool efficiency brochure, Ausgrid website.

Appendix G – New Zealand

New Zealand participates in the Equipment Energy Efficiency (E3) program with Australia to align energy efficiency requirements as closely as possible across both markets, and thereby uphold the principles of the trans-Tasman Mutual Recognition Arrangement (TTMRA) and the Australia New Zealand Closer Economic Relations Trade Agreement (ANZCERTA).

New Zealand has reached the view that regulation for swimming pool pumps is not warranted at this stage, based on the available evidence. Therefore this RIS considers options for the Australian market only, noting that New Zealand's participation is open to review at a later stage.

Background

To inform development of this proposal, estimates were made about the New Zealand pool pump market based on consumer surveys and discussions with several New Zealand industry stakeholders. The available data was then analysed using the same assumptions developed for the Australian market wherever New Zealand inputs and assumptions were not available.

The data and modelling showed that benefits for New Zealand were likely to be marginal due to the low number of pools installed and pool pumps sold annually. It also showed that spas are more prevalent than pools in New Zealand. On review, New Zealand has therefore decided that energy efficiency regulation of pool pumps is not a priority at this stage.

Below is a summary of the New Zealand pool and spa pump market, regulatory and policy context.

New Zealand Pool and Spa Pump Market:

It is estimated that there are around 40,000 residential pools in New Zealand, around one in every 40 households[39]. According to surveys by the Australian Department of the Environment and Energy, pool ownership is less common in New Zealand than Australia; however, there are a higher proportion of spa owners. The vast majority of pools and spas in New Zealand are located on the North Island, with the regions of Auckland, Waikato and the Bay of Plenty accounting for 50 per cent of all pools and spas in the country.

Sales of filtration pumps in New Zealand are estimated at 6,400 per year. New Zealand pool owners are more likely to possess a single speed pump than Australians, but also tend to have smaller pools with shorter swimming seasons[40].

The pool and spa pump market in New Zealand is comprised of domestic pump manufacturers/assemblers, in addition to imported products. *Paramount Pools* and *Filtermaster* are the only two domestic New Zealand manufacturers/assemblers, and produce a small range of

[39] *Dwelling and Household Estimates: June 2016 quarter* (07 July 2016), Statistics New Zealand. Site Accessed 1 August 2016.

[40] The percentage of pool and spa owners with single speed pumps is slightly higher than in Australia, with 58 per cent of respondents to the national pool survey 2016 indicating that they have a single speed pump.

single speed pumps and one multi-speed model between them. Despite the presence of local manufacturing, the majority of pumps sold in New Zealand are imported from Australia.

Current regulations and requirements:

New Zealand's Energy Efficiency and Conservation Authority (EECA) collaborates in the cross jurisdictional Equipment Energy Efficiency (E3) Program to deliver a single, integrated approach to energy efficiency standards and energy labelling for equipment and appliances in Australia and New Zealand. Energy Rating Label and MEPS requirements are regulated in New Zealand through the Energy Efficiency (Energy Using Products) Regulations 2002 administered by EECA. New Zealand does not currently mandate any energy efficiency regulation of pool and spa pumps.

EECA awards the ENERGY STAR® mark to products and appliances with superior energy efficiency within their category. It is a voluntary program where industry partners identify and promote superior energy efficient products. ENERGY STAR® is not available for pool pumps.

The Australian Government's Voluntary Energy Rating Labelling Program (VERLP) for pool pumps requires pump manufacturers to test their pump to the Australian Standard AS 5102.1 and AS 5102.2 in order to obtain a star rating label. As New Zealand is a close trading partner of Australia, it is likely that products rated under this program are sold in New Zealand.

Policy Context

A suite of policies signal the long-term direction for New Zealand's energy sector:

The New Zealand Energy Strategy 2011-2021 (NZES) outlines priorities and strategic direction across New Zealand's energy sector, including the efficient use of energy and better consumer information to inform energy choices.

The New Zealand Energy Efficiency and Conservation Strategy (NZEECS): A companion document to the NZES, the NZEECS is a five-year strategy for the promotion of energy efficiency and renewable energy that sets the overarching policy direction for government support and intervention and guides the development of the EECA's work programme. The NZEECS 2011-2016 expired in August 2016 and is being replaced the by NZEECS 2017-2022, which is scheduled to be released for public consultation by the end of the year. The replacement NZEECS will have a focus on emission reductions and energy productivity.

Emission reduction targets: In October 2016, the New Zealand Government ratified the Paris agreement and confirmed its post-2020 climate change target is to reduce greenhouse gas emissions to 30 per cent below 2005 levels by 2030. The Government has also set a target of a 50 per cent reduction in their greenhouse gas emissions from 1990 levels by 2050. The Government's primary response to climate change mitigation is the Emissions Trading Scheme (NZ ETS), which is currently under review.

The Business Growth Agenda has a priority to build a more competitive and productive economy, by improving energy efficiency and use of renewable energy to raise productivity, reduce carbon emissions and promote consumer choice (as outlined in the Business Growth Agenda).[41]

The Government is also considering new energy targets.

[41] Business Growth Agenda, Ministry of Business, Innovation & Employment website

Risks

If regulation is adopted in one country only, then there are potential implications under the Trans-Tasman Mutual Recognition Arrangement (TTMRA). The TTMRA provides that any goods legal for sale in New Zealand can be legally sold in Australia (and vice versa). If regulation of pool and spa pumps proceeds in Australia only, the Australian market and Australia's regulatory objectives could potentially be undercut by non-compliant products being legally exported to Australia from New Zealand under the provisions of the TTMRA.

However, there are precedents for one party opting out of regulation under the E3 Programme and successfully monitoring and managing potential risks. For instance, New Zealand opted out of measures for incandescent lighting and adopted television MEPS and labelling a couple of years after these measures were introduced in Australia.

Feedback is sought from stakeholders on whether any market implications will result from New Zealand opting out of the regulation of pool and spa pumps.

Data and assumptions for New Zealand

Refer to Appendix A to see the data and assumptions that were applied to New Zealand market analysis (key modelling inputs are summarised in table 6.7 below). Note that in New Zealand only the generation cost, a small proportion of the transmission costs, and some of the distribution costs of electricity are avoidable. The other costs reflected in the residential price for electricity are largely fixed. Therefore, New Zealand applies a wholesale electricity price to assess the benefit of regulatory proposals. A summary of the cost-benefit analysis for New Zealand in tables 6.5 and 6.6:

Table 6.5: cost-benefit analysis for New Zealand with retail electricity rate

NEW ZEALAND	***Discount rate 5 per cent***		***Electricity tariff $0.266 per kWh***		
Policy option	Energy saved (cumulative GWh to 2030)	Emission reduction (cumulative Mt to 2030)	Total benefits (PV, $M)	Total Cost (PV, $M)	Net Benefit (NPV, $M)
Label only	84.56	0.01	$20.28	$8.07	$12.21
2 Star MEPS and Label	87.74	0.01	$21.04	$7.98	$13.06
4 Star MEPS and Label	625.03	0.07	$149.90	$80.23	$69.68
5.5 Star MEPS and Label	656.17	0.07	$157.37	$89.41	$67.97

Table 6.6: cost-benefit analysis for New Zealand with wholesale electricity rate

NEW ZEALAND	***Discount rate 5 per cent***		***Electricity tariff $0.086 per kWh***		
Policy option	Energy saved (cumulative GWh to 2030)	Emission reduction (cumulative Mt to 2030)	Total benefits (PV, $M)	Total Cost (PV, $M)	Net Benefit (NPV, $M)
Label only	84.56	0.01	$6.56	$8.07	-$1.51
2 Star MEPS and Label	87.74	0.01	$6.80	$7.98	-$1.18
4 Star MEPS and Label	625.03	0.07	$48.47	$80.23	-$31.76
5.5 Star MEPS and Label	656.17	0.07	$50.88	$89.41	-$38.53

Table 6.7: Summary of modelling inputs/assumptions for New Zealand

Data Item	*Description*
Electricity Tariff	8.6 cents
Discount Rate	5 per cent (NZ government rate)
Emission Factor	0.138 (applied over modelling period 2017-2030)
Total pool stock	Total estimated stock in 2015 estimated at 67,000 swimming pools.
Annual increase in pools	Based on annual increase trend in Australian data
Distribution of pool pump efficiencies in NZ market	Australian efficiency distribution used (in absence of NZ sales data by pool type)
Market share of spas/pools	Per cent distribution based on national pool and spa owners survey 2016
Pump sales rates	Replacement rate – based on average product lifetime of 7 years New pumps installation rate – based on new pool installation rates which in turn are based on Australian rates of new builds.

Swimming Pool Pumps

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