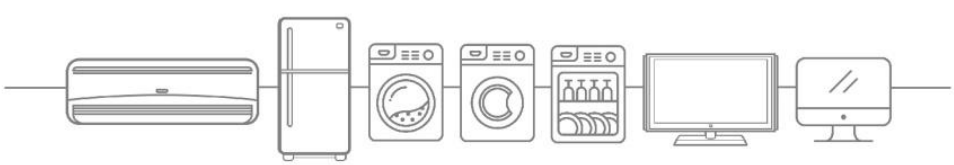
E3
Equipment Energy Efficiency

Australian Government

New Zealand Government

Decision Regulation Impact Statement
Three Phase Cage Induction Motors



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Contents

Figures

Tables

Executive Summary

This Decision Regulation Impact Statement (DRIS) has been prepared to recommend regulatory policy options to improve the energy efficiency of three phase cage induction motors supplied in Australia and New Zealand. Three phase electric motors are used in commercial and industrial applications with common examples being pumps, compressors, and conveyor belts. Three phase electric motors and the systems they drive are estimated to account for 38% and 34% of electricity use in Australia and New Zealand respectively. Given the large amount of energy use, small efficiency gains can have a large impact.

Bare three phase electric motors and three phase electric motors embedded in or packaged with machines are regulated in Australia and New Zealand and have been since 2001 and 2002 respectively.

A range of regulatory policy options were considered and consulted on for the development of the DRIS including increasing the scope of products regulated and increasing the Minimum Energy Performance Standards (MEPS). Less significant changes considered include registration changes and new labelling requirements where information must be disclosed on technical datasheets. In addition to this, there were more technical changes proposed to align with the European Union ecodesign requirements and to improve international alignment.

The New Zealand Energy Efficiency and Conservation Authority (EECA) has prepared this DRIS on behalf of the Equipment Energy Efficiency (E3) Programme. The purpose of this document is to explain the barriers to the uptake of more efficient three phase electric motors, the regulatory options considered to address them, the benefits and costs of each option, the consultation that occurred, and a final recommended approach.

This DRIS will be considered by the Energy and Climate Change Ministerial Council (ECMC) in Australia and the New Zealand Government.

Some of the barriers preventing the uptake of more efficient three phase electric motors are information asymmetry and split incentives. 65% of three phase electric motors are estimated to be embedded in or packaged with machines, meaning the purchaser does not have the information available on the efficiency of the three phase electric motors contained in the machines. In some cases, the operating costs and capital costs of the business are managed by different departments meaning, while a more efficient three phase electric motor may have a lower lifetime cost, they may not be purchased as they have a higher upfront capital cost.

The policy options for scope and MEPS are presented below. There were three options considered:

- Option 0: BAU - no changes to the current regulations in Australia and New Zealand: MEPS remain at IE2[1] level for three phase electric motors between 0.73kW (inclusive) to less than 185kW.

[1] IE2, IE3, and IE4 refer to the International Electrotechnical Commission (IEC) Efficiency Classes for motors, see Table 2.

- Option 1 (referred to as Level 1 in this DRIS), where the scope of the regulations is increased from three phase electric motors with an output power between 0.73kW and 185kW to three phase electric motors with an output power between 0.12kW and 375kW. Efficiency levels for small three phase electric motors would be set at IE2, and for medium motors and large motors it would be IE3. Level 1 would be introduced in 2027.
- Option 2 (referred to as Level 2 in this DRIS) builds on Level 1 to be introduced in 2027, and for a set range (75kW (inclusive) to 200kW (inclusive), 2, 4 and 6 poles) the MEPS requirements would be increased to IE4 from 2029.

The benefits of these options are presented below. The cost benefit analysis includes bare three phase electric motors and machines with three phase electric motors (embedded in or packaged with).

Level 1: Australia

	Small 0.12kW (inclusive) to less than 0.75kW	**Medium** 0.75kW (inclusive) to less than 185kW	**Large** 185kW (inclusive) to less than 375kW	**Total**
Total Benefits (NPV, $M) AUD	$50	$264	$45	$359
Total Costs (NPV, $M) AUD	$19	$68	$10	$96
Net Benefits (NPV, $M) AUD	**$31**	**$196**	**$35**	**$263**
Benefit Cost Ratio	2.7	3.9	4.7	3.7
Emissions reduction (cumulative kt CO_2-e)	61	316	55	431
Cumulative Energy Savings (GWh)	732	3,845	705	5,282

7% discount rate, cumulative savings to 2060, installed stock to 2050

Level 2: Australia

Total Benefits (NPV, $M) AUD	$460
Total Costs (NPV, $M) AUD	$158
Net Benefits (NPV, $M) AUD	**$302**
Benefit Cost Ratio	2.9
Emissions reduction (cumulative kt CO_2-e)	547
Cumulative Energy Savings (GWh)	6,934

7% discount rate, cumulative savings to 2060, installed stock to 2050

Level 1: New Zealand

	Small 0.12kW (inclusive) to less than 0.75kW	**Medium** 0.75kW (inclusive) to less than 185kW	**Large** 185kW (inclusive) to less than 375kW	**Total**
Total Benefits (NPV, $M) NZD	$23	$53	$7	$83
Total Costs (NPV, $M) NZD	$6	$11	$1	$18
Net Benefits (NPV, $M) NZD	**$17**	**$42**	**$6**	**$65**
Benefit Cost Ratio	3.9	4.7	6.3	4.5

	Small 0.12kW (inclusive) to less than 0.75kW	**Medium** 0.75kW (inclusive) to less than 185kW	**Large** 185kW (inclusive) to less than 375kW	**Total**
Emissions reduction (cumulative kt CO_2-e)	11	27	3	41
Cumulative Energy Savings (GWh)	229	532	63	823

2% discount rate, cumulative savings to 2060, installed stock to 2050

Level 2: New Zealand

Total Benefits (NPV, $M) NZD	$93
Total Costs (NPV, $M) NZD	$22
Net Benefits (NPV, $M) NZD	**$71**
Benefit Cost Ratio (BCR)	4.3
Emissions reduction (cumulative kt CO_2-e)	46
Cumulative Energy Savings (GWh)	916

2% discount rate, cumulative savings to 2060, installed stock to 2050

The results show for both option 1 and option 2 that there is significant benefit in increasing the scope and MEPS requirements of three phase electric motors in Australia and New Zealand. A sensitivity analysis has been performed on the basis of only including bare three phase electric motors in the modelling, which results in the benefit cost ratio increasing by 6% for Australia and 31% for New Zealand for Level 2. Also, the cumulative energy savings would be 17% lower for Australia and 26% lower for New Zealand, if only bare three phase electric motors are included in the modelling for Level 2.

The Consultation Regulation Impact Statement (CRIS) applied a different approach for the cost benefit analysis (CBA) and did not include the benefits of the MEPS or the increased costs of higher efficiency three phase electric motors which are packaged with or embedded in machines in the base case. Therefore, the DRIS CBA shows significantly increased total costs and benefits of the MEPS options in the base case due to the larger number of packaged/embedded three phase electric motors included in the scope of the analysis. Also, the discount rate for the analysis of costs and benefits for New Zealand changed from 5% in the CRIS to 2% in the DRIS in accordance with NZ Treasury guidance.

EECA and the Australian Department of Climate Change, Energy, the Environment and Water (DCCEEW) consulted on a CRIS between 17 March 2025 and 29 April 2025 (6 weeks). This included a consultation forum (online) that provided an overview of the policy options and the cost benefit analysis. A total of 17 stakeholders (mostly manufactures and importers) attended the online forum, and 12 written submissions were received on the CRIS.

Submissions were received from importers and manufacturers of three phase electric motors and from importers and manufacturers of equipment containing regulated three phase electric motors. Three industry associations: the Compressed Air Association of Australasia (CAAA), the Fan Manufacturers Association of Australia and New Zealand (FMAANZ), and the Australian Industry Group (Ai Group) also provided submissions.

Overall, stakeholders supported the proposal to increase MEPS to align with international requirements (EU ecodesign) for three phase electric motors. There were concerns raised on the proposed policy

options for registration, labelling, and compliance requirements. Based on feedback from stakeholders, it is recommended that the option 2 (Level 2) is implemented, with the following change to the secondary policy options:

- Do not introduce the requirement to provide an image of the nameplate at point of registration.

Further details of the submissions are presented in Section 4 Consultation and revisions to policy proposals.

Recommendations

This DRIS recommends the following policy be implemented to address the market failures identified. More details are provided in Section 4 Consultation and revisions to policy proposals.

1. **Increase the scope of three phase electric motors regulated and MEPS to align internationally:**
    - In 2027
        - Introduce MEPS for small three phase electric motors (0.12kW inclusive to less than 0.75kW) at IE2 levels.
        - Introduce MEPS for large three phase electric motors (185kW inclusive to less than 375kW) at IE3 levels.
        - Increase MEPS for medium three phase electric motors (0.75kW inclusive to less than 185kW) to IE3 levels.
        - Allow a minimum 12-month transition from when the legislation is published until it commences and comes into force.
    - In 2029
        - Increase MEPS to IE4 for medium to large three phase electric motors (75kW inclusive to less than 200kW, in 2 ,4 and 6 pole).
2. **Enable information disclosure requirements to be introduced that align internationally and enable further consideration during the legislation development phase:**
    - Introduce information display requirements in line with EU ecodesign 2019/1781 - 2023 amendment requirements (Annex 1 point 2). These ecodesign requirements include several data fields:
        - Efficiency level: ‘IE2’ ‘IE3’ or ‘IE4’,
        - Manufacturer’s name or trade mark, commercial registration number and address,
        - Product’s model identifier,
        - Number of poles of the motor,
        - Rated power output(s) or range of rated power output (kW),
        - Rated input frequency(s) of the motor (Hz),
        - Rated voltage(s) or range of rated voltage (V),
        - Rated speed(s) or range of rated speed (rpm).

- Enable the specific data fields included in the information display requirement to be confirmed as part of the legislation development process.
- Enable further consideration (as part of the legislation development phase) of the introduction of a registration number display requirement (Australia only).

3. **Implement the minor technical changes proposed in the CRIS:**
    - Exclude from scope three phase electric motors whose efficiency cannot be measured independently of the Variable Speed Drive to which they are integral,
    - Exclude from scope three phase electric motors with integral brakes,
    - Exclude from scope three phase electric motors that are designed for use with traction electric vehicles,
    - Allow the use of test method IEC 60034-2-1 (edition 3):2024 Method 2-1-1B, as well as any others that are identified as part of the development of the legislation, and
    - Align duty types from regulating all but S2, to regulating S1, S3>=80%, and S6>=80% (same as EU).
4. **Implement provisions to reduce compliance costs and burden:**
    - Do not regulate three phase electric motors that are supplied within a regulated product under the legislation.
    - Expand the family of models definition and allow for technical feedback during the creation of the legislation.
5. **Enable further technical detail to be refined as part of the development of the legislation that does not change the policy intent, which is to align with the EU requirements for three phase electric motors.**
6. **For Australia only, delegate any approval of a new GEMS determination for three phase electric motors to the Energy Efficiency Working Group.**

1. Background

Electric motors and their uses in society

There are many different types of electric motors. They work by converting electrical energy into mechanical energy to create rotational motion. Electric motors are used extensively throughout Australia and New Zealand in many sectors including residential, commercial, and industrial applications. Some examples in the residential space are extractor fans used in kitchens and bathrooms, and motors that drive whiteware appliances. Examples in commercial and industrial settings are workshop machinery, pumps for irrigation, compressors, and manufacturing plants.

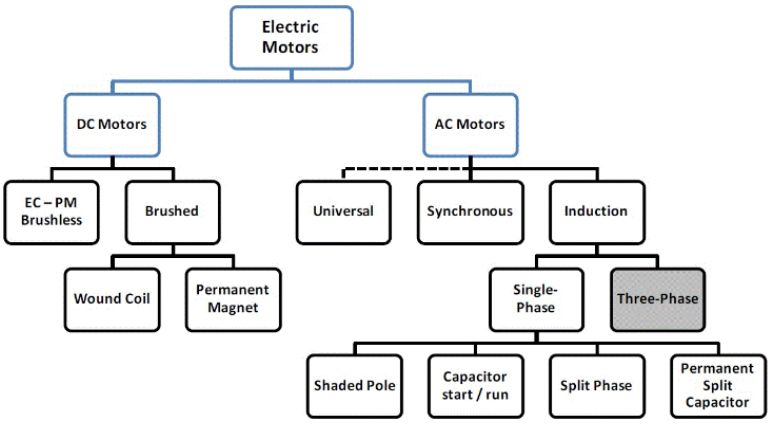
Globally, electric motors and electric motor systems[2] account for over 40% of electricity consumption[3]. In Australia and New Zealand, electric motors account for 47% and 43% of total electricity demand. It is estimated that around 80% of this electricity consumption by motors is from three phase electric motors[4], with the remaining 20% consumed by smaller, but more numerous, single phase electric motors in both markets. Three phase electric motors and systems are estimated to account for 38% and 34% of electricity use in Australia and New Zealand respectively.

Three phase cage induction motors, referred to as three phase electric motors in this document, are a subset of electric motors, and are the most widely used type of electric motors in commercial and industrial applications. Pumps, compressors, fans and conveyers found in workshop and manufacturing machinery are common examples of where this type of electric motor can be found.

Given the wide range of applications and the significant electricity consumption, proposals to improve the energy efficiency of three phase electric motors is the focus of this Decision Regulation Impact Statement (DRIS).

Figure 1 shows the types of electric motors and the scope of this DRIS.

Figure 1: Motor types (scope of DRIS in grey)



[2] Electric motors in this context include single and three phase electric motors used across industrial, commercial, and residential sectors.
[3] International Energy Agency (IEA), 2011
[4] E3 Product Profile, 2006

The images in Figure 2 and Figure 3 show examples of three phase electric motors and their application, including three phase electric motors packaged with machines.

Figure 2: Three phase electric motor example

Figure 3: Pump with a three phase electric motor

Three phase electric motors market

Three phase electric motors are a globally traded product. There are no three phase electric motor manufacturing operations in Australia or New Zealand. However, some Australian and New Zealand businesses use parts manufactured elsewhere to assemble motors and motor-gearbox units. The majority of three phase electric motors imported into Australia and New Zealand originate from China, Germany, Italy, Republic of Korea, Brazil, Taiwan, United States of America, Japan, India and France. Major brands include ABB, Baldor, Brook Crompton, CEG, Monarch, Regal Beloit (including Marathon and CMG), Rotek, SEW-Eurodrive, Siemens, Techtop, TECO, Toshiba and WEG).

As stated in the section above, three phase electric motors account for a large amount of electricity consumption, but there are no commercially available sources of detailed (regulated and unregulated) three phase electric motors sales and stock levels for the Australian and New Zealand markets. For regulated three phase electric motors, the New Zealand Regulations require that importers and manufacturers provide annual sales data on each regulated motor. In Australia, the Commonwealth has previously obtained some partial sales information. The Equipment Energy Efficiency (E3) programme[5] acknowledges that this data has limitations but has used it alongside import-export data to undertake the analysis for this DRIS.

Table 1 shows the estimated annual sales of bare three phase electric motors in scope of the current Australian/New Zealand regulations, and the expanded scope considered in the DRIS.

Table 1: Estimated sales of three phase electric motors for 2024

Country	Current scope 0.73kW (inclusive) to 185kW)	Larger motors 185kW (inclusive) to 375kW	Smaller motors 0.12kW (inclusive) to 0.73kW	Total
New Zealand	19,270	100	18,021	37,391
Australia	116,396	1,072	63,109	180,577

Adding to the complexity, motors can be supplied into the market as individual motors (known as bare motors) or integrated into other equipment (packaged with or embedded within). The challenges associated with embedded motors and compliance are described in the Problem section.

Appendix 3: Motor energy use by sector and end use contains a list of industries that use three phase electric motors.

Local regulations

Australia and New Zealand regulate three phase electric motors for energy efficiency and have done so since 2001 and 2002 respectively. These requirements were revised for Australia in 2006 and again in 2019.

Both countries have legislation that sets out the requirements for regulated parties and requirements the products must meet before supply[6]. These include Minimum Energy Performance Standards (MEPS), labelling requirements, and testing requirements. Regulated parties are required to register their products and ensure they meet any MEPS and labelling requirements.

The requirements for Australia are described in the Greenhouse and Minimum Energy Standards (GEMS) Act 2012 and Greenhouse and Energy Minimum Standards (Three Phase Cage Induction Motors)

[5] The Equipment Energy Efficiency (E3) programme is an initiative of the Australian Government, states and territories and the New Zealand Government to improve the energy efficiency of appliances and equipment.
[6] The meaning of supply differs between Australia and New Zealand. In New Zealand the regulations cover sale, lease, hire, and hire-purchase. In Australia the GEMS Act covers offer to supply which includes make available, expose, display, or advertise the product for supply. It also includes commercial use.

Determination 2019, while New Zealand uses the Energy Efficiency and Conservation (EEC) Act 2000, and Energy Efficiency (Energy Using Products) Regulations 2002.

New Zealand and Australia have different testing, MEPS, and labelling requirements for three phase electric motors, with New Zealand lagging behind Australia and having lower MEPS and older test standards. From 1 May 2026 the New Zealand Energy Efficiency (Energy Using Products) Amendment Regulations 2025 will come into force and will bring New Zealand into alignment with Australia. This DRIS is written assuming these requirements are in place in New Zealand.

The regulations cover three phase electric motors in 2, 4, 6 or 8-pole configurations with a rated output power between 0.73kW (inclusive) to less than 185kW, and with a rated voltage up to 1100 V AC. Both bare three phase electric motors and three phase electric motors packaged with or embedded in other equipment are covered by the regulations.

There are a number of three phase electric motors which are not covered by the regulations, and they include[7]:

- submersible (sealed) motors specifically designed to operate wholly immersed in a liquid,
- motors that are integral to, and not separable from, a driven unit,
- multi-speed motors,
- motors to be used only for short-time duty cycle applications[8], which have a duty type rating of S2,
- rewound motors (unless it claims to meet IE2, IE3, or IE4 efficiency levels),
- motors that are supplied exclusively to third parties who will incorporate the motors into equipment that will be exported to another country, and
- high slip motors (torque motors).

Currently the MEPS (GEMS level requirement in the Determination) are set at IE2, using the International Electrotechnical Commission (IEC) Efficiency Classes presented in Table 2. Motors that meet IE3 can be marked as “high efficiency” under the Australian legislation, which is referred to as “Premium efficiency” under IEC.

Table 2: IEC Efficiency Classes[9]

Class Number	Class Type	Term used in the Australian/New Zealand legislation
IE1	**Standard efficiency**	**Not applicable**
IE2	**High efficiency**	**MEPS**
IE3	**Premium efficiency**	**High Efficiency**
IE4	**Super premium efficiency**	**Not applicable**
IE5	**Ultra premium efficiency**	**Not applicable**

[7] See Section 12 of the Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2019 and Energy Efficiency and Conservation Authority, 2024 for full details concerning all exclusions
[8] Refer to Electrical Engineering Portal, 2022 for further information on duty types.
[9] From IEC 60034-30-1 Rotating electrical machines - Part 30-1: Efficiency classes of line operated AC motors (IE class)

Three phase electric motors are required to have specific information on their nameplate as per clause 10 of IEC 60034-1 Ed 13 2017[10]. The information they need to be marked with includes maker's name or mark, serial number or identification mark, output, voltage, efficiency class (e.g. IE2 or IE3) and the rated efficiency. Typically, about 15 fields are required to be marked on the rating plate(s).

In 2019 Australia referenced (in the Determination) international test standards (IEC and IEEE) which can be used to show compliance with the regulation requirements. The acceptable test standards are IEC 60034-2-1 Ed 2.0 (2014)[11] (Method 2-1-1B), IEEE 112:2004[12] and IEEE 112:2017[13] and cover the major test standards used in both the European Union (EU) and United States of America (USA).

To supply three phase electric motors in Australia or New Zealand, suppliers must register their products online in the E3 registration system. Registrations need to be accompanied by a test report to one of the three approved test standards that demonstrates that products meet the MEPS.

New Zealand Regulations state that three phase electric motors registered in Australia[14] do not need to be registered in New Zealand but must meet New Zealand MEPS and labelling requirements.

The Greenhouse and Energy Minimum Standards (Three Phase Cage Induction Motors) Determination 2019 introduced an ability to group multiple three phase electric motor models on a single registration, known as a Family of Models. A Family of Models is intended to reduce testing and registration costs[15], provided the models in the family meet specific requirements, namely:

- be of the same brand, and
- have the same frame size, and
- have the same characteristics for each of the following:
    - number of poles,
    - the duty type, as specified in clause 4 of IEC 60034-1, assigned in accordance with clause 5 of IEC 60034-1,
    - rated output power (in kilowatts), and
- rely on a single test report that was prepared prior to the application for registration for the model being made under section 41 of the Act, and
- the rated voltage and the rated current must be the same, and
- not contain more than 10 models.

[10] Full standard name: IEC 60034-1 Ed 13 2017: Rotating electrical machines - Part 1: Rating and performance
[11] Full standard name IEC 60034-2-1 Ed. 2.0 (Bilingual 2014) Rotating electrical machines – Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles).
[12] Full standard name: IEEE 112:2004 IEEE Standard Test Procedure for Polyphase Induction Motors and Generators
[13] Full standard name: IEEE 112:2017 IEEE Standard Test Procedure for Polyphase Induction Motors and Generators
[14] On the E3 registration system
[15] Registration costs include the application fee in Australia (no application fee in New Zealand) and a person's time to complete the application form.

International regulations

A number of countries have energy efficiency (MEPS) requirements for three phase electric motors. Table 3 shows that 10 of the 12 (83%) have higher energy efficiency requirements than New Zealand and Australia.

Table 3: Energy efficiency requirements by country[16]

Country or Region	Energy Efficiency requirement (MEPS)
EU/Switzerland/Turkey/UK/Israel/Ukraine	**IE3/IE4[17]**
USA, Canada, Mexico	**~IE3[18]**
South Korea	**IE3**
Japan	**IE3**
China	**IE3[19]**
Singapore	**IE3**
Brazil	**IE3**
Saudi Arabia	**IE3**
Taiwan	**IE3**
Australia and New Zealand	IE2
Colombia	**IE3**
Chile, Ecuador	IE2
India	IE2

In addition to the higher MEPS requirements, major economies (USA and EU) also have a wider scope. For example, the EU regulates smaller three phase electric motors down to 0.12kW (inclusive) instead of 0.73kW (inclusive), and larger three phase electric motors up to 1000kW (inclusive), while the USA regulates up to 559kW (750hp)[20]. Table 4 shows the output power range of regulated three phase electric motors by country.

[16] International Energy Agency (IEA), 2024
[17] IE2 0.12kW <= x < 0.75kW; IE4 75kW <= x <= 200kW (2, 4, and 6 pole). IE3 for 0.75kW <= x < 75kW and 200kW < x <= 1000kW
[18] The USA will adopt IE3/IE4 equivalent to the EU in 2027: Department of Energy (DoE), 2023
[19] China is in the process of aligning their standards more with the EU and is increasing the minimum standard for three phase motors larger than 75kW to IE4.
[20] This is based on the regulation to apply from 2027: Department of Energy (DoE), 2023

Table 4: Output power regulated by country[21]

	Rated Output (kW)	Rated Output (kW)	Rated Output (kW)
Country	**2 & 4 Pole**	**6 Pole**	**8 Pole**
Australia and New Zealand (current scope)	0.73 - <185	0.73 - <185	0.73 - <185
EU/Switzerland/Turkey[22]	0.12 - 1000	0.12 - 1000	0.12 - 1000
Singapore	0.75 - 375	0.75 - 375	n.a.
Japan	0.75 - 375	0.75 - 375	n.a.
China	0.75 - 375	0.75 - 375	n.a.
USA	0.75 - 559	0.75 - 261	0.75 - 186
Canada	0.75 - 559	0.75 - 260	0.75 - 185
Mexico	0.746 - 373	0.746 - 261	0.746 - 186
South Korea	0.75 - 375	0.75 - 200	0.75 - 200
Brazil	0.75 - 370	0.75 - 370	0.75 - 370
Taiwan	0.75 - 200	0.75 - 200	0.75 - 200

There are also other differences including the duty class of motor regulated (Table 5):

Table 5: Duty types covered country

Country	Duty Types Covered
Australia and New Zealand	All but S2
USA, Canada, Mexico, South Korea, Brazil	S1
Japan, China	S1, S3 [≥ 80%]
EU/Switzerland/Turkey	S1, S3 [>=80%] or [S6 >=80%] and others[23]
Singapore	S1, S3 [≥80%], S6, S9

In addition to the specific types of three phase electric motors excluded in the regulations, the following types of three phase electric motors are excluded by international regulations:

a) Motors with integral Variable Speed Drive (VSD) whose performance cannot be measured independently of the drive,

b) Integral brake motors, and

c) Motors designed specifically for the traction of electric vehicles.

[21] International Energy Agency (IEA), 2022

[22] EU countries have amended their Ecodesign requirements to extend the scope of their motors regulation to include motors rated at 0.12kW to less than 0.75kW at the IE2 level, include 8-pole motors; and extend their upper scope to 1,000kW. Changes commenced on 1 July 2021.

[23] European Commission, 2019 deems motors capable of *continuous operation* in scope. The tabulated classes are sufficient but not necessary to fall into this category. Continuous operating is also taken to mean *capable of continuous operation at rated power with a temperature rise within the specified insulation temperature class*.

2. Problem

There is a combination of regulatory and market failures in the energy efficiency of three phase electric motors that are contributing to unnecessary electricity use in Australia and New Zealand. These failures are described in the sections below.

The operation of inefficient electrical appliances and equipment increases electricity demand above what it otherwise would be. This increased demand requires increased investment in electricity generation, transmission and distribution, which increases the cost of electricity supplied to all households and businesses. Increased electricity use also contributes to increased greenhouse gas (GHG) emissions, which contributes to climate change. At a consumer level, increased electricity use increases utility bills. Reductions in electricity consumption can lower GHG emissions and help to meet government GHG emission commitments. Reduced electricity use can also reduce stress on electricity grids and reduce the risk of load shedding and blackouts. Energy efficiency can help reduce the need to add expensive new power generation or transmission capacity and reduce pressure on energy resources.

Energy efficient appliances use less electricity to achieve the same level of performance as similar models with the same size or capacity. The more energy efficient a model, the less energy it will use and the less it will cost consumers to run. While in Australia the emissions intensity of electricity has been steadily decreasing with the gradual decarbonisation of the electricity grid, significant emissions reductions can still be made from energy efficiency improvements, particularly where regulatory and market failures exist.

In Australia, the GEMS Act[24] objectives include promoting the development and adoption of products that use less energy or produce less GHG. In New Zealand, the purpose of the Energy Efficiency and Conservation (EEC) Act[25] 2000 includes the promotion of energy efficiency and energy conservation.

Low uptake of energy efficient products, despite their availability

Energy efficient three phase electric motors are available in the market, but are not widely used in Australia and New Zealand. Using registration information from the current regulated scope (0.73kW [inclusive] to 185kW) Figure 4 shows that from 2020 to 2023, 60% of three phase electric motor registrations were IE3, and 12% were IE4. Figure 5 shows 62% of sales in New Zealand are IE3, with very few IE4 sales (1.7%), leaving 36% of energy inefficient motors in the market.

This is more of an issue for three phase electric motors, as this equipment uses a lot of electricity (34% and 38% in New Zealand and Australia respectively)[26] and more than they should, due to the operation of inefficient three phase electric motors. This leads to higher electricity costs for society.

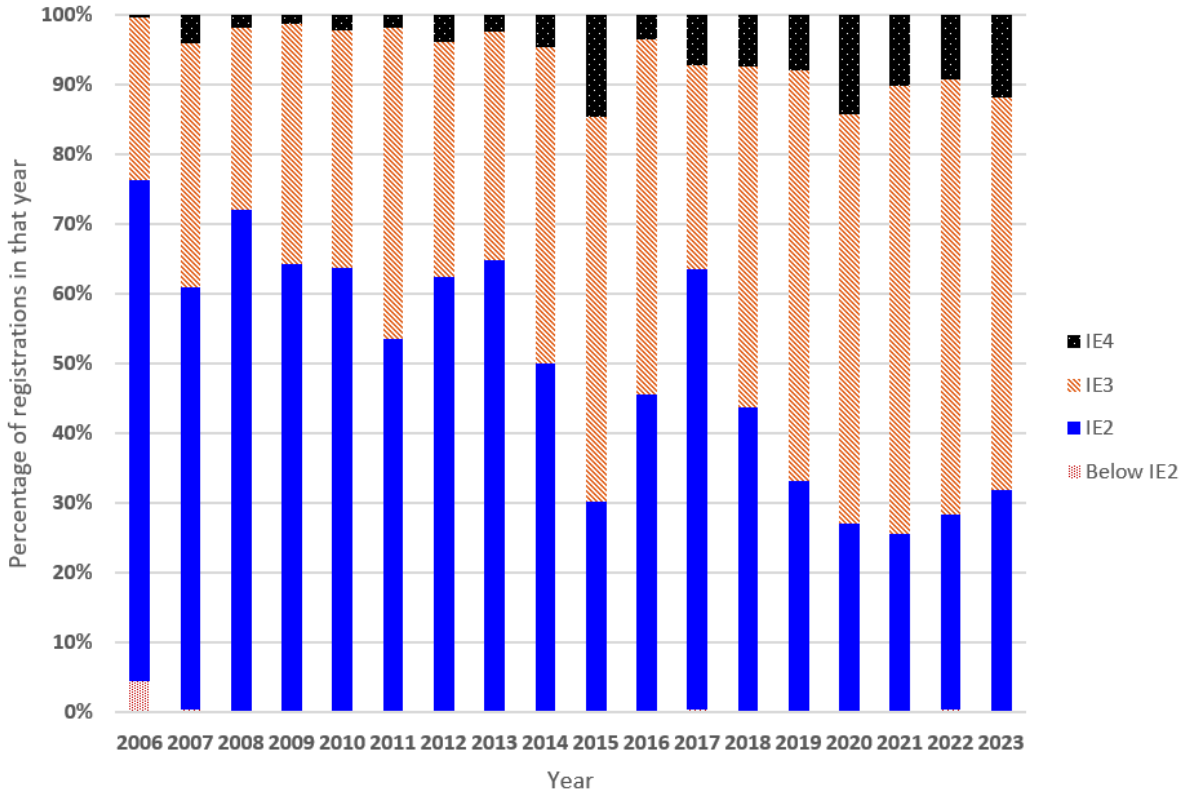
There are several factors that could be contributing to the low uptake of energy efficient three phase electric motors. These factors include availability, suitability, cost, information asymmetry, and split

[24] Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2012
[25] Energy Efficiency and Conservation Authority (EECA), 2000
[26] Calculations by authors based on E3 Product Profile, 2006 and International Energy Agency (IEA), 2011

incentives. These factors particularly come into play where a three phase electric motor is supplied packaged with or embedded in a machine. In such cases:

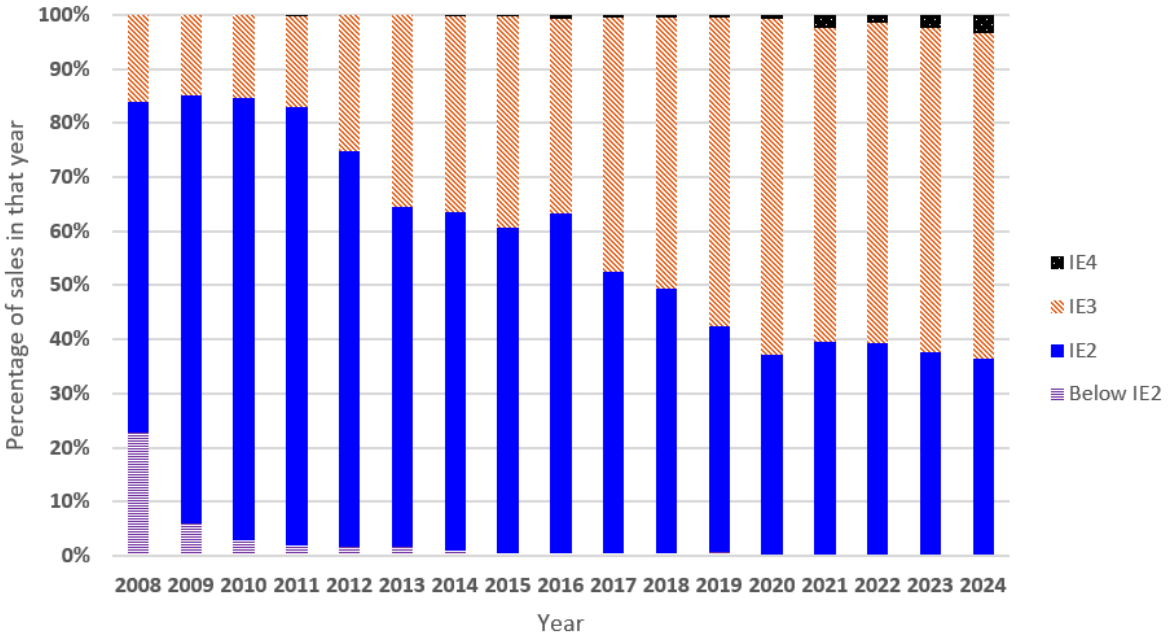
- The purchaser of the machine does not necessarily have information on the efficiency of the machine, let alone the efficiency of the three phase electric motor(s) within the machine. This means that the energy efficiency or the ongoing running costs and lifetime costs of the three phase electric motors may not be considered as part of the purchase decision. Depending on the use of the machine, the upfront purchase cost can be a small part of the lifetime cost of ownership.
- The purchaser of the machine may not be the end user of the machine e.g. for tender contracts, which may mean that the running costs and lifetime cost of the machine (and three phase electric motors) are not considered.
- The three phase electric motor(s) is only one component of the machine and it may not be possible to get the same machine with more efficient three phase electric motor(s).
- The capital expenditure may be managed in a different part of the business to the ongoing running cost (e.g. electricity cost), and so three phase electric motors with lower capital cost (but higher running and lifetime costs) may be preferred.

Figure 4: Annual E3 (Australia and New Zealand) three phase electric motor registrations by efficiency class[27]



[27] Source: E3 registration data 2024

Figure 5: Annual three phase electric motors sold in New Zealand by efficiency class[28]



The introduction of three phase electric motors MEPS in Australia and New Zealand has compelled market participants to supply three phase electric motors with improved energy efficiency, because it is a breach of the regulations to supply three phase electric motors with an efficiency below IE2 level. However, without regulatory intervention IE2 three phase electric motors will continue to be available and supplied in Australia and New Zealand in significant quantities as shown in Figure 4 and Figure 5. For three phase electric motors outside of the current scope their efficiency may be lower than the MEPS requirement.

Alignment with international regulations

Australia and New Zealand three phase electric motor requirements are not aligned with international regulations. In most developed countries, as discussed in the International regulations section above, MEPS for three phase electric motors are set at IE3 levels or above in most cases[29]. From July 2023, the EU mandated IE4 levels for three phase electric motors from 75kW to 200kW (2, 4, and 6 pole), which means New Zealand and Australia are now lagging further behind other countries in terms of performance standards for these products. Failure to increase efficiency levels risks Australia and New Zealand becoming a market for dumping low efficiency three phase electric motors that have long lifetimes and cannot be sold into many other countries; locking in efficiency losses for many years and putting unnecessary load on the electricity system.

Australia and New Zealand have a long-standing policy of harmonising with international energy efficiency standards, wherever it is possible and reasonable to do so. This reduces trade barriers as well as costs to industry and consumers.

[28] Source: New Zealand sales data collected under the Energy Efficiency (Energy Using Products) Regulations 2002.
[29] See pages 17 and 18 of this DRIS.

There are a range of benefits when Australia and New Zealand align with international markets on energy efficiency, such as reduced compliance cost for industry:

- Alignment with international efficiency requirements supports free trade agreements and makes it easier for suppliers to comply with New Zealand and Australian requirements.
- Use of international test methods can reduce testing costs and complexity and remove barriers to trade.

The requirements introduced in Australia in the 2019 Determination focused on international alignment, which included using the IEC Efficiency Classes to set MEPS, and the use of IEC and IEEE test Standards to show compliance. There are further international alignments that could be introduced such as:

- Increasing the scope of three phase electric motors regulated from the narrow range of 0.73kW (inclusive) to 185kW, to the wider range of three phase electric motors covered by both the EU ecodesign requirements[30] and US DoE requirements[31].
- The duty type of motors regulated in Australia and New Zealand is significantly wider than international regulation.

Compliance is a challenge for both the governments and industry

The GEMS Regulator in Australia has faced ongoing challenges with checking the compliance of three phase electric motors with the GEMS determination, particularly with market surveillance and the lack of National Association of Testing Authorities (NATA) accredited laboratories in Australia available for check testing. The only NATA accredited laboratory available in Australia to undertake check testing for three phase motors closed in 2024. In 2025, the GEMS Regulator engaged a NATA-accredited laboratory in New Zealand to source, ship and check test three phase electric motors. However, this laboratory can only test small motors up to 10kW. Larger motors (>10kW up to 185kW) covered by the current GEMS determination cannot be check tested by a NATA accredited laboratory in Australia or New Zealand.

The GEMS Regulator is aware of these compliance issues and options for addressing them may be explored through the GEMS program in future, in line with a risk-based approach. This may include considering the feasibility of extending check testing capability to International Laboratory Accreditation Cooperation (ILAC) accredited overseas laboratories. The check testing process in GEMS uses a risk-based approach to selecting models to test. Motors are difficult to regulate in the GEMS framework because, unlike whitegoods, such as refrigerators, three phase electric motors are a component that is fitted to or incorporated into other equipment. The compliance issues include the inability to confirm registration status and identity of a three phase electric motor, not being able to easily check nameplates on three phase electric motors embedded in machinery, and ongoing issues with difficulty in sourcing three phase electric motors for check testing.

Embedded three phase electric motors

Three phase electric motors that are supplied as a component of a larger piece of equipment are within the scope of Australia's and New Zealand's regulations. However, the identification of the type of three

[30] European Commission, 2019
[31] Department of Energy (DoE), 2023

phase electric motors packed with or embedded in complex machines remains a challenge for both government and industry. It should be noted that the challenges below for three phase electric motors are not limited to Australia and New Zealand:

- In some cases it is a complex task identifying if a three phase electric motor in a machine is covered by the scope of the Australian and New Zealand regulations, because three phase electric motors can be installed behind covers or in locations or orientations whereby it is impossible to either access or read motor nameplates, unless the equipment is disassembled.
- It is also difficult for GEMS officers to conduct compliance check testing of embedded three phase electric motors if it is determined that the motors are in scope of the GEMS regulation. Disassembly of complex machinery may be required to remove three phase electric motors for check testing, then the three phase electric motors would need to be reinstalled.
- The same machine may contain a different three phase electric motor depending on when it was manufactured, which results in additional administration for equipment suppliers.
- Three phase electric motors are also often inadequately marked (on the product, and in an advertisement), which makes identifying a model and matching it to a possible registration difficult.

Australian equipment suppliers have stated they are generally unable to obtain from their suppliers the specifications or test reports for three phase electric motors that are incorporated into many types of equipment. This includes whether the three phase electric motors are in scope of Australia's regulations and whether the three phase electric motors meet MEPS requirements. A particular machine could carry a different model of three phase electric motor with each batch imported (depending on supply availability), which can result in complicated and onerous administration obligations for equipment suppliers. The GEMS Regulator is aware of these complexities for products with embedded three phase electric motors, which could be considered in the options for a risk-based approach to compliance and improving implementation of the GEMS regime.

In Australia, for the reasons outlined above, GEMS compliance officers find it difficult to determine whether equipment contains in-scope three phase electric motors, and whether any in-scope three phase electric motors meet all the requirements. This issue was identified in the review of the GEMS Act[32].

Nameplate information

As described in the Local regulations section, three phase electric motors are required to have specific information on their nameplate as per clause 10 of IEC 60034-1 Ed 13 2017.

Nameplate markings can be used to easily determine three phase electric motor characteristics, which can be useful when looking to replace or change them. They can also be used to assist in compliance with the identification of the three phase electric motor and what performance requirements it meets.

Compliance activities in Australia have revealed that not all three phase electric motors are complying with the nameplate requirements, as shown in Table 6:

[32] Department of the Environment and Energy, 2019

Table 6: Observed marking from compliance activity (n=62)

Marking	Percentage carrying marking
Phases	100%
Frequency	100%
Output	98%
Voltage	97%
Speed	94%
Manufacturer	89%
Poles[33]	37%
Efficiency Class and Rated Efficiency	40%

Other implementation issues

The current Family of Models definition is narrow, meaning that while the legislation says 10 three phase electric motors can be registered under the same family, in practice this does not occur, and far fewer models can be grouped together. This increases the burden on suppliers with additional testing and registration required, compared with the previous Australian GEMS determination, which allowed a wider range of motors to be covered by a single registration.

As three phase electric motors are sold packaged with or embedded within machines there are some cases where both the three phase electric motor and the machine are regulated for energy efficiency in Australia and New Zealand. This mostly arises for three phase air conditioners and chillers used for heating and cooling large buildings.

The current scope of regulated air conditioners covers products that can run on mains power, use the vapour compression cycle, are used for space conditioning for human comfort, and can be any capacity[34]. Chillers covered by energy efficiency regulation must have a capacity of 350kW or more, use the vapour compression cycle, and meet specific temperature requirements for inlet and outlet water temperature. There is a proposal to regulate smaller chillers as small as 100kW, which was approved by ECMC.

This situation creates potentially unnecessary regulation, which can lead to unintended consequences like unnecessary burden on industry. By regulating the overall product rather than the individual components, energy efficiency can be achieved without restricting designer choice or adding unnecessary burden.

The three phase electric motors regulation scope already excludes three phase electric motors when they are integral to a product, including situations such as where they:

- share common components, apart from connectors such as bolts, with the driven unit, and
- cannot operate as a motor if separated from the driven unit, even if a temporary end shield or a drive end bearing is fitted.

[33] Poles can usually be inferred from supply frequency and operating speed.

[34] New Zealand currently only regulates air conditioners with a capacity up to 65kW, but will regulate air conditioners with a capacity above 65kW from 1 May 2026

For example: A motor constructed on the same shaft as a compressor for an air-conditioning unit.

Global commitments and targets to be met

Both New Zealand and Australian governments have signed up to the recent COP28 pledge[35] to double energy efficiency and triple renewable energy by 2030. Both countries look to reduce GHG emissions by 2030 (by 43%[36] in Australia and 50%[37] in New Zealand), and to achieve net zero by 2050. Due to the widespread use of three phase electric motors and the systems they drive and the associated electricity consumption across Australia and New Zealand (38% and 34% respectively), increased three phase electric motor efficiency will contribute to achieving these targets in a cost-effective manner. As the transition to net zero in 2050 will no doubt see a large increase in electricity use, there is a general need to manage this increase in demand to support the transition.

The International Energy Agency (IEA) has highlighted the importance of energy efficiency in supporting the required energy transition, including the role of standards and labelling regulations. The IEA has called on all member states to ensure that "all industrial motor sales" are best in class by 2035.

[35] The United Nations Climate Change Conference, 2023.
[36] Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2023
[37] Ministry for the Environment, 2023

3. Options considered and projected costs, benefits and impacts

Rationale for government action

Government action may be needed when the market fails to provide the most efficient and effective solution to a problem. A range of regulatory and market failures exist for the energy use of three phase electric motors in Australia and New Zealand. These were described in the Problem section.

The MEPS levels of three phase electric motors in Australia and New Zealand are much less stringent than those in major international markets. This will cost the Australian community up to $60 million in 2050 in additional energy costs and $9 million in 2050 in New Zealand, if no changes are made to the current regulations. Annual electricity consumption in 2050 will be 451 GWh higher in Australia and 55 GWh higher in New Zealand than it otherwise would be.

In Australia, the GEMS Act objectives include promoting the development and adoption of products that use less energy and produce less GHG. In New Zealand, the purpose of the EEC Act 2000 includes the promotion of energy efficiency and energy conservation. Improved energy efficiency reduces energy consumption, energy costs and GHG emissions for consumers and businesses.

Without government action, the regulatory and market failures identified in the Problem section will persist and worsen over time and the objectives of the GEMS and EEC Acts will not be met.

This section has updated the cost benefit analysis from the CRIS, but also presents all options shown in the CRIS for clarity.

Policy options

The policy options to address these market and regulatory failures are categorised into two levels, primary and secondary. Primary changes include scope and MEPS options, with secondary changes being changes to registration, labelling requirements, and minor technical changes.

A cost benefit analysis has been completed for the proposed scope and MEPS changes, and the registration and labelling options.

The cost benefit analysis includes bare three phase electric motors and machines with three phase electric motors (embedded in or packaged with). As 65% of three phase electric motors are estimated to be packaged or embedded within machines[38], an analysis of only including the impacts of bare motors has also been performed and is shown in Appendix 2: Sensitivity analysis.

The modelling approach and assumptions are detailed in Appendix 1: Cost benefit approach and parameters.

[38] EnergyConsult, 2023

Scope and MEPS

Internationally and in Australia and New Zealand MEPS are set using the IEC Efficiency Classes (IE1, IE2, IE3, IE4, and IE5), and can be set at different levels for different sizes of three phase electric motors. Three categories have been created for the primary policy options analysis. These categories consider the current scope of the Australian and New Zealand regulations and the broader scope in international regulations such as in the EU.

- Small: 0.12kW (inclusive) to less than 0.75kW
- Medium (current scope): 0.75kW (inclusive) to less than 185kW
- Large: 185kW (inclusive) to less than 375kW

Table 7 shows the proposed MEPS options for each of the three categories. These have been chosen to align with international markets and to address the market failures and the low uptake of more energy efficient products, despite their availability.

Table 7: MEPS options

Option	**Small** 0.12kW (inclusive) to less than 0.75kW	**Current scope (medium)** 0.75kW (inclusive) to less than 185kW	**Large** 185kW (inclusive) to less than 375kW
Business As Usual (BAU)	No MEPS	IE2	No MEPS
Level 1	IE2	IE3	IE3
Level 2	IE2	IE4 for 2, 4, and 6 pole, 75kW (inclusive) to 185kW, otherwise IE3	IE4 for 2, 4, and 6 pole, 185kW (inclusive) to 200kW (inclusive), otherwise IE3

The BAU option means no changes to the current regulations in Australia and New Zealand: MEPS remain at IE2 level, and only for three phase electric motors 0.75kW (inclusive) to less than 185kW.

The Level 1 option introduces MEPS at IE2 for small three phase electric motors in Australia and New Zealand in line with the EU ecodesign 2019/1781 - 2023 amendment requirements. This option also brings MEPS levels for the current scope (0.75kW inclusive to less than 185kW) and the extended scope covering larger three phase electric motors (185kW inclusive to less than 375kW) to IE3 – one step closer to the EU ecodesign requirements (IE4 for 75kW-200kW motors in 2, 4, and 6 pole configurations).

The Level 2 option is similar to the Level 1 option, with the addition of a more stringent MEPS level (IE4) for 2, 4, and 6 pole 75kW (inclusive) to 200kW (inclusive) three phase electric motors, to align New Zealand and Australian regulations with the EU ecodesign requirements.

While the EU regulates three phase electric motors up to 1000kW, this is not being considered in this decision document because larger three phase electric motors (above 375kW) have different market dynamics than smaller three phase electric motors. Three phase electric motors at these large sizes have very large energy consumption meaning the running cost and energy efficiency is likely considered as part of the purchasing decision. They also are sold in far smaller volumes due to their cost and limited applications.

Another important factor is laboratory capability to test regulated products. Regulating products that are difficult and expensive to test can have significant unintended market consequences. This can include unintended reduction in market size and competitiveness, and increased non-compliance. Given these factors, regulating three phase electric motors above 375kW is unlikely to have the energy savings impact to justify a regulatory intervention.

Increasing the scope and MEPS requirements to Level 1 and Level 2 will also address the market failures outlined in the Problem section, because low efficiency three phase electric motors will not be supplied in the Australian and New Zealand markets. It will also help to bring New Zealand and Australia into international alignment and help to support the energy transition.

A cost benefit analysis has been completed to show the impact (benefit, cost, and benefit to cost ratio of each MEPS level), in Table 8, Table 9, Table 10, and Table 11, based on cumulative savings to 2060 and installed stock to 2050. Level 1 is assumed to be introduced in 2027, while Level 2 is assumed to be introduced 2 years later - in 2029. Note that the results for Level 2 include the impacts of Level 1.

The CRIS applied a different approach for the CBA and did not include the benefits of the MEPS or the increased costs of higher efficiency three phase electric motors for embedded three phase electric motors in the base case. Therefore, the DRIS CBA shows significantly increased total costs and benefits of the MEPS options in the base case due to the larger number of motors included in the scope of the analysis. Also, the discount rate for the analysis of costs and benefits for New Zealand changed from 5% in the CRIS to 2% in the DRIS in accordance with NZ Treasury guidance. Full details of the methodology are detailed in the appendix.

Table 8: MEPS options cost benefit Australia - Level 1

	Small 0.12kW (inclusive) to less than 0.75kW	**Current scope (medium)** 0.75kW (inclusive) to less than 185kW	**Large** 185kW (inclusive) to less than 375kW	**Total**
Total Benefits (NPV, $M) AUD	$50	$264	$45	$359
Total Costs (NPV, $M) AUD	$19	$68	$10	$96
Net Benefits (NPV, $M) AUD	**$31**	**$196**	**$35**	**$263**
Benefit Cost Ratio	2.7	3.9	4.7	3.7
Emissions reduction (cumulative kt CO_2-e)	61	316	55	431
Cumulative Energy Savings (GWh)	732	3,845	705	5,282

7% discount rate[39], cumulative savings to 2060, installed stock to 2050

Table 9: MEPS options cost benefit Australia - Level 2

Total Benefits (NPV, $M) AUD	$460
Total Costs (NPV, $M) AUD	$158
Net Benefits (NPV, $M) AUD	$302
Benefit Cost Ratio	2.9
Emissions reduction (cumulative kt CO_2-e)	547

[39] Office of Impact Analysis, 2023

Total Benefits (NPV, $M) AUD	$460
Cumulative Energy Savings (GWh)	6,934

7% discount rate, cumulative savings to 2060, installed stock to 2050

Table 10: MEPS options cost benefit New Zealand - Level 1

	Small 0.12kW (inclusive) to less than 0.75kW	**Current scope (medium)** 0.75kW (inclusive) to less than 185kW	**Large** 185kW (inclusive) to less than 375kW	**Total**
Total Benefits (NPV, $M) NZD	$23	$53	$7	$83
Total Costs (NPV, $M) NZD	$6	$11	$1	$18
Net Benefits (NPV, $M) NZD	$17	$42	$6	$65
Benefit Cost Ratio	3.9	4.7	6.3	4.5
Emissions reduction (cumulative kt CO_2-e)	11	27	3	41
Cumulative Energy Savings (GWh)	229	532	63	823

2% discount rate, cumulative savings to 2060, installed stock to 2050

Table 11: MEPS options cost benefit New Zealand - Level 2

Total Benefits (NPV, $M) NZD	$93
Total Costs (NPV, $M) NZD	$22
Net Benefits (NPV, $M) NZD	$71
Benefit Cost Ratio	4.3
Emissions reduction (cumulative kt CO_2-e)	46
Cumulative Energy Savings (GWh)	916

2% discount rate, cumulative savings to 2060, installed stock to 2050

The results show that there is benefit in increasing the regulated scope and MEPS requirements of three phase electric motors. Level 1 has a total net benefit of AUD$263 million for Australia and NZ$65 million for New Zealand. Level 2 builds on this and results in a higher net benefit of AUD$302 million for Australia and NZ$71 million for New Zealand.

The introduction of MEPS for small three phase electric motors at IE2 levels is cost effective with a Benefit Cost Ratio (BCR) of 2.7 in Australia and 3.9 in New Zealand. For large three phase electric motors the Level 2 options have lower BCRs than for Level 1 in both New Zealand (4.3 and 6.3 for Level 2 and 1 respectively), and Australia (2.9 and 4.7 for Level 2 and 1 respectively).

While Level 2 has a lower BCR than for Level 1 (2.9 and 3.7 for Australia, and 4.3 and 4.5 for New Zealand) it provides the highest net benefit AU$302 million and NZ$71 million for Australia and New Zealand respectively. It also provides the greatest international alignment of the policy options examined.

The estimated peak demand reduction from the above options is 48 MW in Australia and 5 MW in New Zealand in 2050. These values are minimal compared to the energy savings and, hence, have not been quantified in the Cost Benefit Analysis (CBA), but are provided here for context.

The modelling above includes both bare three phase electric motors and three phase electric motors embedded in machinery. Appendix 2: Sensitivity analysis for only bare three phase electric motors (Level 2) results in a 6% increase in the BCR for Australia and 31% for New Zealand while lowering the estimated savings (Table 13). This shows that including three phase electric motors embedded in or packaged within machines in the base modelling case is cost effective and provides a reasonable estimate of the savings, with the conservative assumptions of:

- Three phase electric motor sales embedded in or packaged with machines are 50% of the sales of bare three phase electric motors. It is assumed that a proportion of the embedded three phase electric motors captured in the analysis of the Australian import data are
    - included in the scope of other MEPS products (i.e., air conditioners, chillers);
    - or are already included in the bare three phase electric motors data (most large air compressors), or
    - will be not within the scope of the three phase electric motors MEPS (i.e., not able to be removed from the machine and still operate), hence the use of 33%[40] of sales compared to 65% of sales. Therefore, to represent the total sales (embedded + bare), the sales of bare three phase electric motors are multiplied by 1.5 in these categories.
- The models that are not currently registered would incur two times the administrative burden of bare three phase electric motor registration (testing, time to complete registration, etc.)
- The benefits claimed for embedded three phase electric motors are 50% of those claimed for bare three phase electric motors.

This ensures a conservative approach is taken, as the majority of three phase electric motors sales are embedded in or packaged with machines. Tables 12 and 13 show the cumulative results of the sensitivity analysis (embedded three phase electric motors only) compared to the base case (bare and three phase electric motors).

Table 12: Bare three phase electric motor sensitivity analysis – Level 1

	Australia - Bare Motors Scenario	Australia - Base Case	New Zealand - Bare Motors Scenario	New Zealand - Base Case
Total Benefits (NPV, $M)	$274	$359	$59	$83
Total Costs (NPV, $M)	$59	$96	$9	$18
Net Benefits (NPV, $M)	$215	$263	$50	$65
Benefit Cost Ratio	4.6	3.7	6.6	4.5

Australia discount rate is 7%, New Zealand discount rate is 2%

Table 13: Bare three phase electric motor sensitivity analysis – Level 2

	Australia - Bare Motors Scenario	Australia - Base Case	New Zealand - Bare Motors Scenario	New Zealand - Base Case
Total Benefits (NPV, $M)	$374	$460	$69	$93
Total Costs (NPV, $M)	$121	$158	$12	$22

[40] Sales of bare three phase electric motors = 35% of total three phase motor sales. 50% of 35% = 17.5%. 17.5%/(35%+17.5%) = 33%. CBA assumed percentage of embedded motors = 33%, assumed percentage of bare motors = 67%.

Net Benefits (NPV, $M)	$253	$302	$57	$71
Benefit Cost Ratio	3.1	2.9	5.7	4.3

Australia discount rate is 7%, New Zealand discount rate is 2%

It is known that some three phase electric motors are supplied in Australia and New Zealand that do not comply with the current requirements, but the extent cannot be confidently quantified. There is no certainty that 100% compliance with a higher (IE3 or IE4) MEPS could be enforced. To understand the impact of non-compliance a sensitivity analysis of 10% non-compliance is shown (Table 14 and Table 15). This reduces the costs and benefits by 10%.

Table 14: Non-compliant three phase electric motor sensitivity analysis – Level 1

	Australia - 10% non-compliance	**Australia - Base Case**	**New Zealand - 10% non-compliance**	**New Zealand - Base Case**
Total Benefits (NPV, $M)	$323	$359	$75	$83
Total Costs (NPV, $M)	$87	$96	$17	$18
Net Benefits (NPV, $M)	$236	$263	$58	$65
Benefit Cost Ratio	3.7	3.7	4.5	4.5

Australia discount rate is 7%, New Zealand discount rate is 2%

Table 15: Non-compliant three phase electric motor sensitivity analysis – Level 2

	Australia - 10% non-compliance	**Australia - Base Case**	**New Zealand - 10% non-compliance**	**New Zealand - Base Case**
Total Benefits (NPV, $M)	$413	$460	$83	$93
Total Costs (NPV, $M)	$142	$158	$19	$22
Net Benefits (NPV, $M)	$271	$302	$64	$71
Benefit Cost Ratio	2.9	2.9	4.3	4.3

Australia discount rate is 7%, New Zealand discount rate is 2%

This shows that there is still significant benefit after accounting for possible non-compliance.

Registration

Family of Models

The definition of Family of Models in the current regulation is narrow. Although the current regulation allows registration of up to 10 models in a family, this rarely occurs due to the requirements placed on models to be in a family.

Table 16 shows the current Family of Models definition, and the proposed changes to this definition that were presented in the CRIS, including the removal of the requirement of the same brand and frame size, and the addition of models to have the same efficiency level, stator, rotor and winding insulation.

Table 16: Current and proposed Family of Models Definition

Current Family of Models definition	Proposed Family of Models definition in the CRIS

• Be the same brand,
• Have the same frame size,
• Have the same characteristics,
  ○ Number of poles,
  ○ Duty type,
  ○ Rated output (in kilowatts),
• Rely on single test report,
• Not contain more than 10 models,
• Have the same rated voltage and rated current.
	• Have the same characteristics,
	  ○ Number of poles,
	  ○ Same efficiency level,
	  ○ Duty type,
	  ○ Rated output (in kilowatts),
	  ○ Have the same stator, rotor and same winding insulation temperature class
	  ○ Have the same rated voltage and rated current
	• Rely on a single test report,
	• Not contain more than 10 models.

Removing brand and frame size would enable more three phase electric motors to be registered under a single family, which would reduce the registration burden on industry. It will also ensure that a Family of Models does not include three phase electric motors that have different energy performance characteristics. This definition has been further refined and is presented in Section 4 Consultation and revisions to policy proposals.

Nameplate

To improve compliance with the nameplate marking requirements, it was proposed in the CRIS to require a picture of the nameplate to be provided at the point of registration. This would enable assessment of the nameplate to ensure compliance with the legislation and also provide compliance officers with a point of reference to link three phase electric motors with registrations. This has been implemented for other regulated products, such as external power supplies which have nameplate marking requirements and are required to provide an image of the nameplate at point of registration. After consultation with stakeholders, this is not proposed to be implemented due to the additional cost and burden it would place on industry. This is discussed further in Section 4 Consultation and revisions to policy proposals.

Labelling

Compliance officers often have difficulty linking three phase electric motors with product registrations. This hinders compliance activities to ensure that all three phase electric motors are registered (including three phase electric motors within machines [embedded or packaged with]). To enable clear linking of three phase electric motors to product registrations, it was proposed in the CRIS to introduce a requirement to display the current registration number of the three phase electric motor when the motor is offered for supply. This requirement would cover in store offers, digital (online) offers, and print-based offers of three phase electric motors. It would also be required where a machine that contains regulated three phase electric motors is offered for supply. After consultation with stakeholders, further consideration will be given as part of the legislation development as to the introduction of this requirement.

In addition, under the EU ecodesign 2019/1781 - 2023 amendment requirements (Annex 1 point 2), certain information about three phase electric motor products is required to be visibly displayed in the following places:

- Technical data sheet or user manual supplied with the three phase electric motor, and
- Manufacturers, importers, and authorised representative websites, and
- Technical data sheet supplied with the product which contains a regulated three phase electric motor.

It is proposed that the above requirements are introduced in Australia and New Zealand to help overcome the market failures of lack of information and awareness for the purchaser of the three phase electric motors. The relevant information to be included would be:

- Efficiency level: 'IE2' 'IE3' or 'IE4',
- Manufacturer's name or trade mark, commercial registration number and address,
- Product's model identifier,
- Number of poles of the motor,
- Rated power output(s) or range of rated power output (kW),
- Rated input frequency(s) of the motor (Hz),
- Rated voltage(s) or range of rated voltage (V),
- Rated speed(s) or range of rated speed (rpm).

While the current New Zealand and Australian legislation has nameplate marking requirements, this alone does not resolve the market failures above. It is only required on the nameplate of the three phase electric motor, which may not be seen until it has been purchased, or may not be seen at all, if the three phase electric motor is embedded within a machine without easy access. Requiring this information upfront would provide the information to the purchaser (of either bare motors or motors embedded or packaged with machines), raising the awareness of its efficiency and assisting purchasers to consider this as part of the purchasing process. Introducing this requirement would also assist compliance officers in identifying motors and linking them to product registrations, because the three phase electric motor information will be more readily available.

The above changes to labelling requirements would be in addition to the existing nameplate marking requirements, which would remain.

Minor technical changes

The CRIS proposed several minor regulatory changes that would align New Zealand and Australia with the EU ecodesign 2019/1781 - 2023 amendment requirements. These include:

- Decreasing the input voltage range of three phase electric motors covered from 1100V to 1000V (there are no registrations with a rated input voltage above 1000V, meaning this change would not affect the market).
- Aligning the duty types regulated from all but S2, to only S1, S3>=80%, and S6>=80% (the majority of the market is S2, S1 and S6, meaning this change will only slightly reduce the scope of products covered). The other duty types are used for less time, meaning their

energy savings are minimal. They are also not used in a way that enables them to reach a stable temperature.

- Add the exclusions of motors:
    - with integral variable speed drive whose performance cannot been measured independently of the drive, or
    - that incorporates integral brakes, or
    - designed specifically for the traction of electric vehicles.

In addition to the above, a new version of the currently cited IEC 60034-2-1 Ed 2.0 2014 test standard has been published. A technical comparison of *Method 2-1-1B – Summation of losses, additional load losses according to the method of residual loss* has been completed to compare the version cited in legislation with the latest version. This review concludes that for the purposes of the energy efficiency test they are equivalent, and so it is proposed that the IEC 60034-2-1 (Edition 3):2024 Method 2-1-1B be added as a fourth possible test standard to show compliance.

The EU has chosen to regulate Variable Speed Drives (VSDs) using IEC 61800-9-2 Ed 2.0 2017.[41] The DRIS does not propose to regulate VSDs at this time. However, the three phase electric motor that is supplied with a VSD whose performance can be measured independently of the drive is required to comply, which aligns with the EU ecodesign approach.

Analysis of secondary options

A summary of the cumulative costs and benefits of the secondary options that are proposed to be implemented is shown in Table 17 and Table 18. This covers the proposed registration changes relating to Family of Models, and the labelling changes relating to technical information. It does not include the minor technical changes proposed to scope e.g. duty or testing (IEC 60034-2-1 Method 2-1-1B) as these are considered to have a small monetary benefit and cost but have the benefit of improving international alignment.

Table 17: Results of Secondary Analysis Registration Changes

Registration Changes	Australia (AU$)	New Zealand (NZ$)
Industry Benefits	$2,780,000	$1,250,000
Industry Costs	$0	$0
Net Benefit industry	$2,780,000	$1,250,000
Government Benefits	$0	$0
Government Costs	$0	$0
Net Benefit government	$0	$0

Australia discount rate is 7%, New Zealand discount rate is 2%

[41] Full standard name: IEC 61800-9-2:2017 Adjustable speed electrical power drive systems - Part 9-2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications - Energy efficiency indicators for power drive systems and motor starters

Table 18: Results of Secondary Analysis Labelling Changes

Labelling Changes	Australia (AU$)	New Zealand (NZ$)
Industry Benefits	$0	$0
Industry Costs	$130,000	$50,000
Net Benefit industry	-$130,000	-$50,000
Government Benefits	$80,000	$30,000
Government Costs	$0	$0
Net Benefit government	$80,000	$30,000

Australia discount rate is 7%, New Zealand discount rate is 2%

Registration changes are expected to have benefits to industry (AU$2.78 million in Australia and NZ$1.25 million in New Zealand), through the reduction of testing and registration costs. The labelling changes include reduced costs of compliance for government. The increased energy efficiency of three phase electric motors due to labelling has not been quantified and is conservative as there will be some benefit.

4. Consultation and revisions to policy proposals

EECA and DCCEEW consulted using a CRIS from 17 March 2025 to 29 April 2025 (6 weeks). This included a consultation forum (online) on 2 April 2025 which provided an overview of the policy options, and cost benefit analysis. A total of 17 people attended (not including EECA or DCCEEW staff), which included:

- Importers/manufacturers of three phase electric motors
- Importers/manufacturers of equipment that contains regulated three phase electric motors
- Government officials from Queensland, Victoria, and New Zealand

At the forum, stakeholders supported aligning with the EU ecodesign 2019/1781 - 2023 amendment requirements. There were concerns raised about the proposed requirement to provide an image of the nameplate registration, especially with the revised Family of Models definition. Under this proposal, if a supplier had ten different brands of three phase electric motors under a single registration, they would be required to provide a nameplate image of each. Industry feedback also stated that changes to international nameplate requirements would make it difficult to keep nameplate information up to date in the registration system, particularly for three phase electric motors embedded in machinery. Stakeholders want a simplified registration process.

The CRIS contained 26 consultation questions covering the key areas: cost benefit and modelling assumptions, minor technical changes, MEPS, scope, implementation, registration, labelling, and compliance.

12 Submissions[42] were received from importers and manufacturers of three phase electric motors and from importers and manufacturers of equipment containing regulated three phase electric motors. Three industry associations: the Compressed Air Association of Australasia (CAAA), the Fan Manufacturers Association of Australia and New Zealand (FMAANZ) and the Australian Industry Group (Ai Group) also provided submissions.

Overall, stakeholders supported the proposal to increase MEPS and change the scope to align with international requirements (EU ecodesign) for three phase electric motors.

Concerns were raised regarding the proposed registration, labelling and compliance requirements. Most submissions showed a strong opposition to the expansion of nameplate requirements for embedded three phase electric motors. Several stakeholders mentioned the potential risks associated with "doubling-up" regulations in cases where motors are embedded in products that already have their own MEPS requirements, while other submitters supported regulating them to ensure a level market. Some revisions around the definition of a Family of Models were suggested, with many stakeholders showing interest in seeing an increased focus on features affecting energy efficiency. Additionally, a few comments were noted about the cost benefit and modelling assumptions, mostly around the cost differences between energy efficiency classes and estimated GHG reductions. The topic of variable speed drives (VSDs) and whether motors provided for use with these products should have separate regulations was also discussed, as were the views on the regulation of motors with integral VSD/brakes and motors specifically designed for the traction of Electric Vehicles (EVs).

Stakeholders were asked how non-compliance could be addressed for three phase electric motors and suggested the following points for improvement:

- Increasing the number of random audits, inspections, and testing programs.
- Raising awareness of importers, suppliers and manufacturers regarding the energy efficiency requirements.
- More rigorous enforcement of compliance with penalties given where appropriate, and a process to report non-compliance to the relevant authorities.
- Providing clearer documentation for embedded three phase electric motors' efficiency,
- Legislating the mandatory, on-site retention of test reports for three phase electric motors fitted to machines, so they are readily available for inspection.

Points to clarify to stakeholders and revised policy proposals

The meaning of supply (and scope of legislation) differs between Australia and New Zealand. In New Zealand the regulations cover sale, lease, hire, and hire-purchase. In Australia the GEMS Act covers offer to supply which includes make available, expose, display, or advertise the product for supply. It also includes commercial use. This means that suppliers importing for their own commercial use in Australia are covered by the legislation and must comply with the requirements e.g. met MEPS, register etc. However, this is not the case in New Zealand and poses a risk to New Zealand suppliers who would

[42] Published submissions: E3 Three Phase Cage Induction Motors Consultation Regulation Impact Statement - Department of Climate Change, Energy, Environment and Water

be required to comply with the requirements, while direct imports which are not on supplied would not have to comply. This could be particularly detrimental to machine suppliers.

Determinations and Regulations cannot be applied retrospectively. Three phase electric motors imported into Australia or New Zealand before the legislation takes effect can be supplied without complying with the new determination or amended regulation, but must comply with the previous determination and regulations.

The revisions to the preferred policy option and CBA in the CRIS are listed below (changes are bold and italic). Further minor technical changes may be considered as part of the drafting process.

Table 19: Policy changes

Topic	CRIS proposed approach	Revised DRIS proposed approach
Cost benefit analysis	• Australian CO_2-e value estimation	• Revised CBA using valuing emissions factors approved by the Energy and Climate Change Ministerial Council. • Including three phase electric motors packaged or embedded in machine in the base case. • Updated discount value for New Zealand 5% -> 2%.
Scope and MEPS	• In 2027, introduce MEPS at IE2 for small three phase electric motors 0.12kW (inclusive) to less than 0.75kW	• In 2027 ***(subject to transition timeframes),*** introduce MEPS at IE2 for small three phase electric motors 0.12kW (inclusive) to less than 0.75kW. ***With a minimum of 12 months transition time from when legislation published.***
Scope and MEPS	• In 2027, increase MEPS to IE3 for medium three phase electric motors 0.75kW (inclusive) to less than 185kW	• In 2027 ***(subject to transition timeframes),*** increase MEPS to IE3 for medium three phase electric motors 0.75kW (inclusive) to less than 185kW. ***With a minimum of 12 months transition time from when legislation published.***
Scope and MEPS	• In 2027, introduce MEPS at IE3 for large three phase electric motors 185kW (inclusive) to less than 375kW	• In 2027 ***(Subject to transition timeframes)***, introduce MEPS at IE3 for large three phase electric motors 185kW (inclusive) to less than 375kW. ***With a minimum of 12 months transition time from when legislation published.***
Scope and MEPS	• In 2029, increase MEPS to IE4 for medium to large three phase	• In 2029, increase MEPS to IE4 for medium to large three phase

	electric motors 75kW (inclusive) to less than 200kW in 2, 4, and 6 pole configurations.	electric motors 75kW (inclusive) to less than 200kW in 2, 4, and 6 pole configurations, ***with a suitable transition time.***
Replacement motors for existing machines (spare parts)	• No exclusion	• ***No exclusion, but exemption process as per legislation.***
Motors that are already in a regulated product e.g. air conditioners or chillers	• No proposal, but asked as part of consultation questions	• ***Do not regulate three phase electric motors that are supplied within a regulated product under the legislation. Supply of bare three phase electric motors in scope would be covered. See exemption process for spare parts.***

Family of Models[43]	Proposed definition:
	• Have the same characteristics,
	  ○ Number of poles,
	  ○ Same efficiency level,
	  ○ Duty type,
	  ○ Rated output (in kilowatts),
	  ○ Have the same stator, rotor and same winding insulation temperature class
	  ○ Have the same rated voltage and rated current
	• Rely on a single test report,
	• Not contain more than 10 models.
		Proposed definition:
		• Have the same characteristics ***that effect energy efficiency,***
		  ○ Number of poles,
		  ○ Have ***the same tested efficiency.***
		  ○ ~~***Duty type,***~~
		  ○ Rated output (in kilowatts),
		  ○ Have the same stator, rotor, and windings. ~~***insulation temperature class***~~
		  ○ Have the same rated voltage and rated current ***(range and combinations)***
		  ○ Rely on a single test report,
		  ○ Not contain more than 10 models.

Nameplate image at point of registration	• Propose to add a requirement to provide an image of the nameplate at point of registration.	• ***Not proposed to be implemented at this time.***
Secondary nameplate on a machine that contains a three phase electric motors	• Not proposed, but asked as part of consultation questions	• Not proposed to be implemented at this time.
Registration number display requirement	• Introduce a requirement to display the current registration number of the three phase electric motor when the motor is offered for supply. This	• ***Further consideration during legislation development. Not proposed to be introduced in***

[43] The Family of Models definition will be further refined during the development of the legislation. Note that if one model in the family is deemed not to comply (through check test or otherwise) then all models on the registration are deemed not to comply.

	requirement would cover in store offers, digital (online) offers, and print-based offers of three phase electric motors. It would also include where a machine that contains regulated three phase electric motors is offered for supply	***New Zealand as legislation does not allow it.***
Information display	• Introduce requirements in line with EU ecodesign 2019/1781 requirements (Annex 1 point 2)	• Introduce requirements in line with requirements EU ecodesign 2019/1781 - 2023 amendment (Annex 1 point 2) including the items specified on page 32/33 of this DRIS. • ***Product information requirements shall be visibly displayed on the technical data sheet or user manual supplied with the motor (or machines that contains the regulated three phase electric motor).*** • ***Must provide the information that will be displayed at point of registration.*** • ***Claims may be made about a motor meeting efficiency levels above MEPS during supply e.g. IE3, IE4, and IE5 as applicable, but the motor must meet this efficiency level.*** • ***Enable document used in the EU that complies with*** EU ecodesign 2019/1781 - 2023 amendment ***requirements (Annex 1 point 2) to be used.***
Minor technical changes	• Lowering input voltage range from 1100V to 1000V	• Lowering input voltage range from 1100V to 1000V, ***but clarify that this includes three phase electric motors that have an input voltage range that is less than 1000V.***
Minor technical changes	• Aligning duty types from regulations all but S2, to S1, S3>=80%, and S6>=80% (same as EU)	• Aligning duty types from regulations all but S2, to S1, S3>=80%, and S6>=80% (same as EU).

Minor technical changes	• Exclude from the scope
	  ○ Motors with integral VSDs
	  ○ Motors with integral brakes
	  ○ Motors for traction electric vehicles
		• Exclude from the scope
		  ○ Motors with integral VSDs. ***However, a motor that is supplied with a variable speed drive whose performance can be measured independently of the drive (i.e. non-integral) is required to comply, which aligns with the EU ecodesign approach.***
		  ○ Motors with integral brakes
		  ○ Motors for traction electric vehicles

Minor technical changes	• Allow IEC 60034-2-1 (edition 3):2024 Method 2-1-1B to be used to demonstrate compliance	• Allow IEC 60034-2-1 (edition 3):2024 Method 2-1-1B to be used to demonstrate compliance <u>in addition to the test methods listed in the current three phase electric motors determination</u> • ***Enable additional test methods to be considered as part of legislation development.***

5. Conclusion and recommended approach

Three phase electric motors consume a significant amount of electricity in Australia (38%) and New Zealand (34%) and as a result small improvements in energy efficiency can result in large energy savings. There is a range of regulatory and market failures that are preventing the uptake of more efficient motors, including information asymmetry, and lack of international alignment. These problems can be addressed through updated regulatory measures.

Two policy options have been presented for updating the MEPS and scope:

- Option 1 (referred to as Level 1 in this DRIS), where the scope of the regulations is increased from three phase electric motors with an output power between 0.73kW and 185kW to three phase electric motors with an output power between 0.12kW and 375kW. Efficiency levels for small three phase electric motors would be set at IE2, and for medium motors and large motors it would be IE3. Level 1 would be introduced in 2027.
- Option 2 (referred to as Level 2 in this DRIS) builds on Level 1 to be introduced in 2027, and for a set range (75kW (inclusive) to 200kW (inclusive), 2, 4 and 6 poles) the MEPS requirements would be increased to IE4 from 2029.

While Level 1 has a large net benefit of AU$263 million in Australia and NZ$65 million in New Zealand, the Level 2 option delivers a greater net benefit of AU$302 million for Australia and NZ$71 million in New Zealand. The Level 2 option also achieves greater international alignment and so is the preferred policy option.

Stakeholders generally supported Level 2, as this aligns with larger international markets (EU ecodesign requirements), and so Level 2 is the recommended approach for Energy and Climate Change Ministerial Council (ECMC) and the New Zealand Government.

Some of the secondary policy options (policy options not related to MEPS or scope), which included registration, labelling, and other minor technical changes, have been reviewed after feedback from industry and will continue to be developed as part of any legislation development.

This preferred approach will reduce the incidence of inefficient electrical equipment and the level of electricity demand in Australia and New Zealand. High electricity demand requires increased investment in electricity generation, transmission and distribution, which increases the cost of electricity supplied to all households and businesses. Increased electricity use also contributes to increased GHG emissions, which contributes to climate change.

6. Implementation and timing

This DRIS will be considered by ECMC in Australia and the New Zealand Government. In New Zealand, the Energy Efficiency and Conservation Act 2000 and Energy Efficiency (Energy Using Products) Regulations 2002 are used to implement MEPS and labelling requirements, while in Australia the *Greenhouse and Energy Minimum Standards Act 2012* and GEMS determinations are used.

If ECMC and the New Zealand Government agree to changing the requirements for three phase electric motors, then the decision would be implemented as set out below.

Australia

The Commonwealth would prepare a new determination and publish this as an exposure draft for stakeholders to review and provide comments and submissions. The Commonwealth would review the comments and submissions received and revise the draft determination to resolve any issues raised. If necessary, the Commonwealth would circulate a revised determination as a second exposure draft for comments and submissions from stakeholders.

Once all issues are resolved, the draft determination would be submitted to the Energy Efficiency Working Group (EEWG) for final review and approval, provided ECMC agrees to delegate the approval of any GEMS determination to the working group to enable faster, expert-led decisions on energy efficiency reforms, while maintaining alignment with ministerial priorities and oversight. If ECMC does not delegate approval of the new determination, the draft would be submitted for the approval of the Energy and Climate Change Senior Officials Group (ECSOG) and ECMC, once approved by EEWG.

Once the determination is approved by all E3 jurisdictions, the determination would be submitted to the Commonwealth Assistant Minister for Climate Change and Energy for signature. Once signed, the new determination would be published on the Federal Register of Legislation. This process is expected to take twelve months to complete.

Once a new GEMS determination is in place in Australia:

- Three phase electric motors (including those embedded or packaged with machines) imported or manufactured prior to the determination coming into effect that don't meet the new requirements may still be supplied until stock is depleted. Their registrations would be grandfathered (status changed to "Superseded" in the registration system). Evidence of date of import or manufacture in Australia or New Zealand may be requested for compliance purposes. New import or manufacture of this equipment from the date of the determination coming into effect would not be permitted, unless the equipment meets the specified requirements.
- Registered three phase electric motors (including those included those embedded or packaged with machines) imported or manufactured prior to the determination coming into effect that already meet the new requirements may continue to be supplied. Their registrations will be re-validated and updated to the new GEMS determination.
- Suppliers wishing to import or manufacture products that are in scope and do not have an approved registration, will need to complete a registration application, pay the registration fee and lodge the application with the GEMS Regulator.

- Unregistered three phase electric motors that fall within the scope of the determination in Australia would not be permitted to be supplied or used for any commercial purpose at any time.

New Zealand

In New Zealand, policy decisions and amendments to the Regulations are subject to New Zealand government approval, which is a separate process to determinations under the Australia's GEMS Act. The process involves policy approval, drafting of regulations, and approval of regulations. The transition to new requirements may be different, including registration requirements.

Once a new regulation is in place in New Zealand:

- The regulations the three phase electric motor (including those embedded or packaged with machines not being regulated for energy efficiency) must comply with are dependent on the date of importation or manufacture in New Zealand.
- If the three phase electric motor is imported or manufactured in New Zealand before the into force date of the amended regulations it must comply with the regulations in force prior to the amendment.
- If the three phase electric motor is imported or manufactured in New Zealand from the into force date of the amended regulations it must comply with the amended regulations.
- All currently registered three phase electric motors will be assessed against the new requirements and, if they comply, they will be upgraded to the new regulations. If the three phase electric motor registration does not comply, its status will change to superseded, meaning that existing stock imported or manufactured in New Zealand before the enforcement date can be made for sale, lease, hire, or hire-purchase, but no new stock may be imported or manufactured in New Zealand and on supplied.
- Three phase electric motors captured by the expanded scope and are imported or manufactured in New Zealand from the enforcement date, will need to comply with the amended requirements.

It should be noted that the Trans-Tasman Mutual Recognition Agreement (TTMRA) applies to products supplied in Australia or New Zealand: Trans-Tasman Mutual Recognition Agreement and Free Trade Agreements | EECA. The TTMRA is a cooperation and trading agreement between Australia and New Zealand, which recognises the relationship of the two countries.

Competition effects of MEPS

The E3 Steering Committee does not expect the introduction of the proposed requirements to affect competition in the three phase cage induction motor market, given that many of the motors on the market in Australia and New Zealand meet the proposed higher MEPS and there are products that are made for international markets where these higher standards apply. Harmonisation with international standards, as proposed in this RIS, is also likely to help prevent Australia and New Zealand from becoming a dumping ground for lower efficiency products and thereby help to prevent more efficient motors being undercut by cheaper, less efficient products.

Product registration – Australia

In accordance with the Australian Government Charging Framework[44], the GEMS Regulator charges fees for the registration of products. These fees recover the costs incurred in processing registration applications and monitoring compliance with the GEMS Act.

When developing new GEMS determinations, the GEMS Regulator would determine the appropriate registration fees[45]. This would be based on analysis of expected registration volumes and likely compliance activities and may include consultation with industry to ensure the analysis and proposed fees are a reasonable estimate of the cost of administering the new determination.

Products required to be registered under the GEMS Act are grouped into one of four fee bands[46,] ranging from $440 to $780, depending on the product type. Registrations in Australia are for a period of five years and the applicable fee is payable on lodgement of the application to register the product. GST does not apply to these fees.

The current fee for motors is $670 per registration. This figure has been used as an indicative value for modelling purposes to support this DRIS. It does not indicate that the application fees would continue to be $670 per registration. In setting the fee of registration of products under any determinations, the GEMS Regulator would consider the expected costs of registration and testing products and the number of models that would need to be registered.

Registration of models in New Zealand is free, but models registered only in New Zealand cannot be supplied in Australia, unless they are manufactured in or exported from New Zealand as per the Trans-Tasman Mutual Recognition Agreement (TTMRA).

Public information

As part of the registration process, some information about registered three phase electric motors would become public and some information would be kept confidential, such as applicant details and test information. However, energy performance and product information would be available to the public. Information about proposed changes resulting from new regulations would be provided to suppliers, industry groups and consumers to explain the new regulations.

Timing in Australia

The E3 Steering Committee expects that it would take twelve months from a decision by ECMC on this DRIS (aiming for May 2026) until a new GEMS determination is published on the Federal Register of Legislation. There is likely to be approximately one year from the determination being published on the Federal Register of Legislation before the determination comes into effect, with grandfathering periods to be determined following the publication of the DRIS. The Commonwealth will consult with three phase electric motor suppliers on the timeframe for any new determination coming into effect as part of consultation on the exposure draft. In general, new GEMS determinations come into effect around twelve months after publication on the Federal Register of Legislation.

[44] Australian Government Charging Framework
[45] Greenhouse and Energy Minimum Standards (Registration Fees) Instrument (No. 1) 2025 - Federal Register of Legislation
[46] Registration fees and payments webpage

Three phase electric motors manufactured in Australia or imported prior to any new GEMS determination coming into effect, can be supplied until the stock is exhausted, without being registered under the new determination. The scope for this grandfathering of existing product may be limited under the determination and will be subject to consultation with suppliers as part of consultation on the exposure draft of the determination.

Compliance monitoring

All products that fall within the scope of the determination would need to be registered by the commencement of the legislation. The GEMS Regulator is responsible for monitoring and enforcing compliance of GEMS products in Australia. The Regulator works with industry groups and informs manufacturers, distributors and suppliers of their obligations under the GEMS Act. The GEMS Regulator undertakes compliance and monitoring activities such as:

- Assisting industry with understanding the requirements of the GEMS Act
- Monitoring compliance
- Check testing products to verify MEPS energy efficiency claims and other performance measures are met
- Conducting market surveillance of products to verify models are correctly registered
- Responding to any allegations of non-compliance
- Pursuing those who contravene the Act.

EECA has a similar responsibility for New Zealand.

Evaluation and review

GEMS determinations and MEPS settings are evaluated and reviewed from time to time. This DRIS recommends that the E3 Steering Committee review the efficiency regulations applying to motors three years after any new GEMS determination has come into force to ensure continued alignment with international regulations.

Appendix 1: Cost benefit approach and parameters

A financial analysis model has been built to review the overall costs and benefits related to each policy option. Proposals are compared to business as usual (BAU) where there is no change to the existing three phase electric motor's energy efficiency regulatory requirements. The approach to the cost benefit analysis has been conservative and the benefits are likely undercounted. The modelling in this DRIS includes the following benefits and costs:

Benefits

- Energy saving for consumers/the economy due to improved efficiency of three phase electric motors.
- Reduced emissions as a result of energy savings from policy.
- Regulatory benefits to industry and government including any saved administrative resources, test costs and registration costs resulting from changed regulatory settings.
- Peak demand reduction (minimal in this case).

Costs

- Higher capital cost of more energy efficient three phase electric motors.
- Regulatory costs to industry and government including any additional administrative resources resulting from changed regulatory settings.

Parameters and assumptions

Table 20: Primary modelling assumptions and parameters

Assumptions	Parameters
Scenarios	• BAU • Level 1: MEPS to be set at IE2 for 0.12 to <0.75kW three phase electric motors, and IE3 for 0.75 to <375kW three phase electric motors in 2027 • Level 2: MEPS to be set at IE2 for 0.12 to <0.75kW three phase electric motors, IE3 for 0.75 to <75kW three phase electric motors (2, 4, and 6 pole), IE4 for 75 to 200kW three phase electric motors (2, 4, and 6 pole), and IE3 for greater than 200kW to < 375kW three phase electric motors in 2029
Sales	• Australian historical sales data based on limited industry-supplied data and Australian trade data from 1997 to 2019 • New Zealand historical sales data based on EECA data • Forecast sales based on projected trends
Scope	The analysis presented has been based on bare three phase electric motors and three phase motors embedded in or packaged with machines. Data on stocks of three phase electric motors embedded in or packaged with machines is limited and assumptions have been made in relation to these embedded motors as detailed in Appendix 2: Sensitivity analysis. A sensitivity analysis has been carried out excluding the costs and benefits associated with embedded motors.

Assumptions	Parameters
Stock	Australian and New Zealand motor stock levels have been estimated by EnergyConsult using: • In Australia, trade data for three phase electric motors net imports from 1997 • In New Zealand, EECA sales data collected from suppliers since 2003. Motors are retired from the stock according to a survival function, with the average (50%) life of the different types of motors ranging from 10 to 25 years.
Projection period	Impacts have been modelled to 2060 (installed stock to 2050)
Industry costs	All incremental capital/development costs are assumed to be passed on to consumers
Product prices	Australia: Retail product prices were used New Zealand: Wholesale product prices were used It is assumed that IE3 three phase electric motors generally cost 10% more than IE2 three phase electric motors and this margin has been assumed in consultation with industry. It is assumed that IE4 three phase electric motors generally cost 30% more than IE3 three phase electric motors as a conservative assumption at the top end of the 22.5% to 30% premium range identified in the references. These assumptions were generally supported by stakeholders in the CRIS consultation process.
Registration administration costs and compliance costs	• Government administration costs are made up of salary, program administration and check testing • Industry administration costs made up of time to complete registration, testing of products. • As three phase electric motors are already regulated for MEPS and labelling, only small increases in government costs are assumed in proportion to the increased scope of the various options
Energy consumption	• Historic and future trends in energy efficiency for three phase electric motors is based on the trends found by analysing the New Zealand EECA data over the last 15 years. • The stock model used contains information on the numbers, capacity, efficiency and energy consumption of motors. Energy consumption estimates for the BAU baseline are established, and then the energy consumption under different policy options are calculated and compared to the BAU consumption. • Products are retired from the stock according to a survival function which includes some early breakdowns, most motors retiring around the average and some motors having an extended life. • Energy prices used are: ○ Australia: based on state/territory electricity price index, from Australian Energy Market Operator (AEMO 2024), and Australian Competition and Consumer Commission, December 2023 (ACCC 2023). ○ New Zealand: based on long-run marginal electricity cost (8.79 c/kWh) as advised by EECA, April 2025
GHG emissions	GHG emissions have been accounted for as CO_2 equivalent units (CO_2-e) • **Australia:** Projected factors from 2025 to 2040 - Australian Government[47] by state and assumed to decline to close to zero from 2040 to 2050, as shown in Appendix 6 • **New Zealand:** as advised by EECA April 2025.
Sensitivity analysis (NPV)	**Australia:** 7% real discount rate, with sensitivity tests at 0%, 3% and 10%. **New Zealand:** 2% real discount rate, with sensitivity tests at 0%, 1% and 8%.
Key assumptions	• Reduction in energy use is due to new policy options described above. • GHG abatements have been estimated and the financial/economic benefits of lower levels of GHG emissions have been quantified in the analysis, with sensitivity analysis conducted.

[47] Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2024

Table 21: Assumptions used in analysis of secondary options

Scenarios:	• Registration changes: changes to families of models that will allow suppliers to register from 2 to 10 models on a single registration. • Labelling changes: technical information to be included on motor documents, supplier website and technical data sheet.

Table 22: Primary modelling assumptions and parameters continued

Item	Quantity	Reference/comment
Value of industry/Government staff time	$85 per hour	OIA 2024
Unit cost for changes to technical data sheets	$170 per registration	Based on 2 hrs per data sheet
Number of new motor registrations	952 per annum	Average over last ten years
Saving in annual motor testing/administration cost by industry. This is a saving as the expanded family of model's definition will enable more motors to be grouped under a single registration reducing testing and admin costs for industry.	$308,500	10% of current annual cost of $3.085m (0.75 – 40kW range)
Reduced Government compliance effort. Reduced Government compliance effort is now reduced (when compared to the CRIS) as the registration display requirement is not being proposed, which would have reduced government compliance effort.	100 hours per annum @$85	Estimate agreed with EECA
% of motor registrations incurring no additional data sheet cost as they are already sold in the EU	40%	Estimate

Calculation of sales and stock

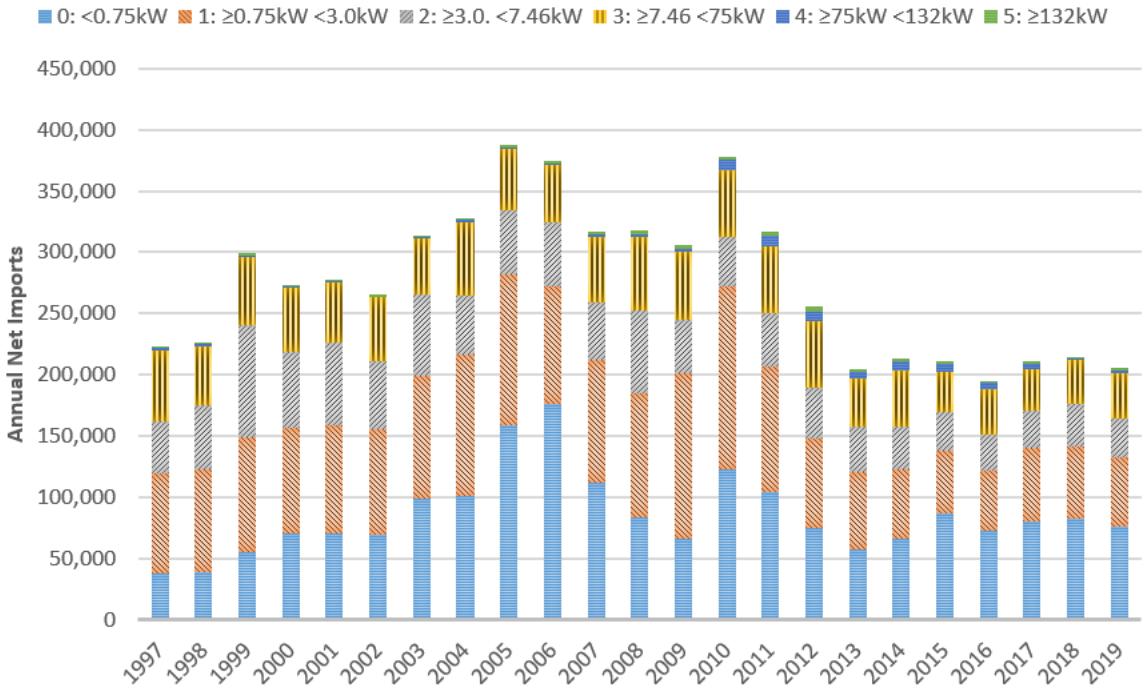
Australian Sales

Sales are based on import and export data in Australia 1997 – 2019, to obtain net imports (DFAT 2020). It is assumed that net imports of bare motors represent the number of motors installed in Australia. The import data were divided into 6 size categories, as follows:

- Size 0: ≥0.0375kW <0.75kW
- Size 1: ≥0.75kW <3.0kW
- Size 2: ≥3.0. <7.46kW
- Size 3: ≥7.46 <75kW
- Size 4: ≥75kW <132kW
- Size 5: ≥132kW

There is considerable variation in net imports by category over this period as shown in Figure 6.

Figure 6: Annual net imports from Australian trade data by size category

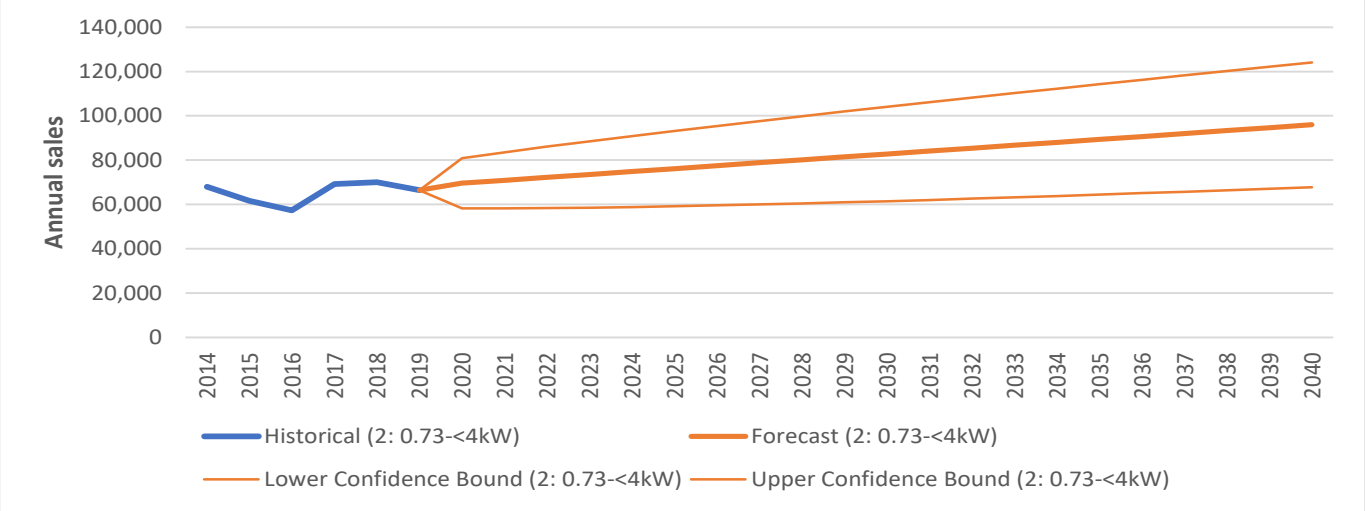


To derive the sales by MEPS category, the share of sales by MEPS category of motors from the survey of Australian suppliers[48] was used to segment the trade data categories into MEPS categories. The survey data was found to represent about 40% of total net imports in 2019, which considering the companies that responded, provided a representative sample to enable this re-categorisation.

Forecast sales are based on historical trends to 2019 for each MEPS category, with the starting trend year chosen to reflect realistic later decade trends (i.e. generally from 2014 to 2019). For example, category 2: 0.73-<4kW, shown in Figure 7 used the historical sales from 2014 to 2019 as the input data.

[48] Confidential surveys were undertaken with Australian motor industry stakeholders during 2020, and these were completed by companies responsible for around 40% of the motors sold in 2019.

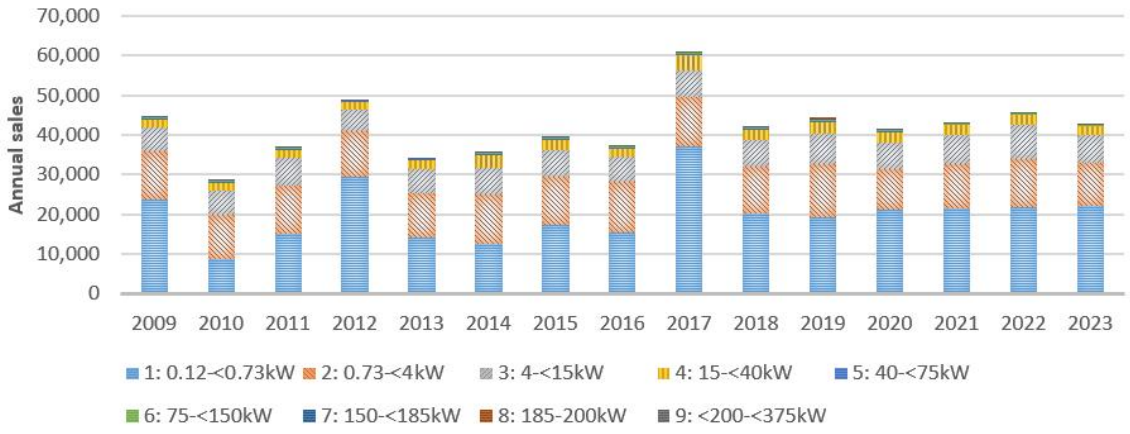
Figure 7: Example of historical and forecast sales of category (2: 0.73-<4kW)



New Zealand Sales

The sales by MEPS category were based on EECA sales data 2009 to 2023 (earlier years were not segmented by category). The estimated sales by size category for the historical years is shown in Figure 8. The EECA sales data was categorised by size for those segments covered by the MEPS, and estimated in proportion to the shares by sales category for Australia for those categories not included in the EECA sales data (i.e. sizes 0.12-<0.73kW and > 185kW).

Figure 8: Annual net sales by size category New Zealand



The forecast sales are based on historical trends from 2009 to 2023 for each MEPS category.

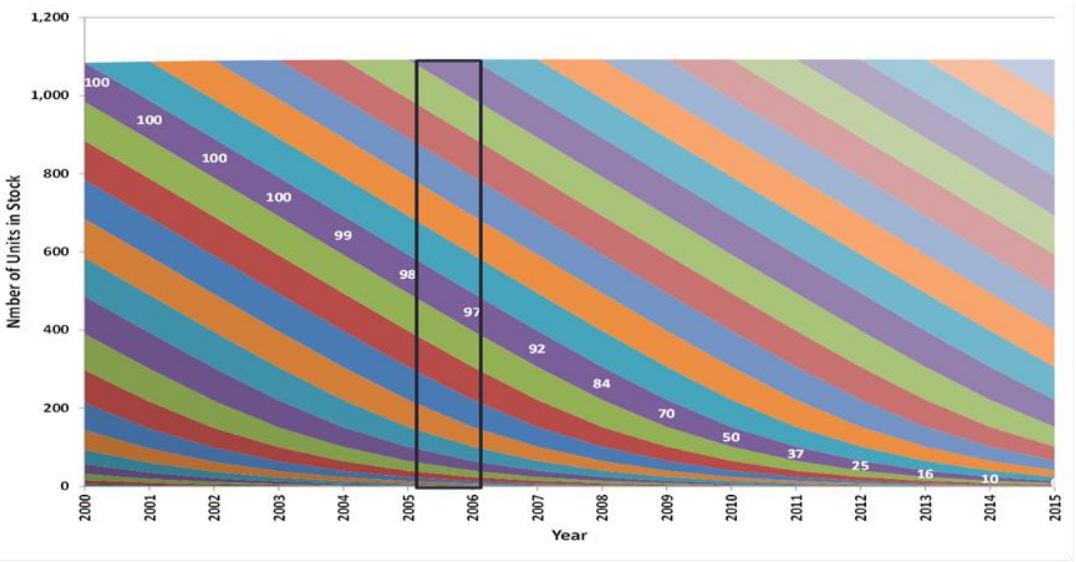
Stock and energy modelling approach

The stock model used for the modelling is effectively a database that keeps a running tally of the numbers of each product in the stock in any year, and the average characteristics of each product in any

year. The stock in any year is the sum of all past sales, less retirements of equipment at their end of life, and the sales of new equipment in that year.

Figure 9 provides a graphic illustration of how the stock model works. It shows that the product stock is added to by the cohort of sales in each year, and these products remain part of the stock into the future, but gradually reduce in number as they are retired. If the average energy efficiency of the products sold from a particular date increases as a result of the policy options modelled, these efficiency improvements will gradually flow through the entire stock so that overall it becomes more efficient than in the BAU scenario.

Figure 9: Example - graphic representation of stock model



In each year the new cohort of products entering the stock are subjected to appropriate "survival functions" for each category. Examples of the different survival functions are shown in Figure 10 and Figure 11 where a graphical view is presented of the percentage of motors (Rt) in useful service over the life in years from purchase (t). As can be seen from Figure 9 a considerable proportion of each cohort remains in place well after the half-life date.

Figure 10: Examples of survival functions 20-year half life

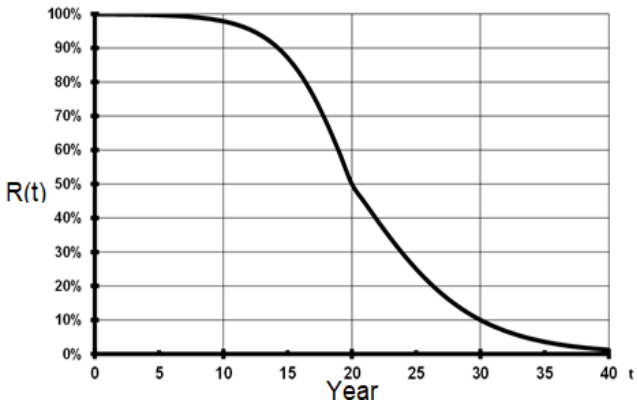
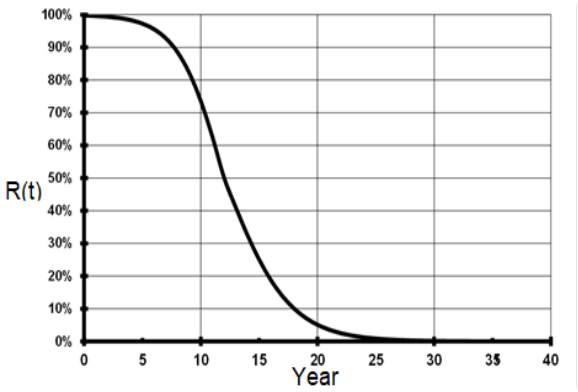


Figure 11: Examples of survival functions 12-year half life



The IEA 4E, 2015 report estimates the average expected life of motors by size based on a sample of over 4,000 motors. This data was used to estimate the half-life, in years, of the motors by size category as shown in Table 23.

Table 23: Expected half-life for motors by size category

Size Category	1: 0.12-<0.73kW	2: 0.73-<4kW	3: 4-<15kW	4: 15-<40kW	5: 40-<75kW	6: 75-<150kW	7: 150-<185kW	8: 185-200kW	9: >200-<375kW
Life (Years) used in Model (50% life)	10	12	12	15	15	20	20	20	25
Life (Years) from IEA 4E (2015)	10	12	15	15	15	15-20	20	20	20

Other factors related to stock modelling

The stock is calculated from the sales inputs and life assumptions as described earlier (Table 20). There is a requirement for the energy modelling to separate the installations attributed to the industrial sector and commercial sector as the hours of operation are typically different. The proportion of sales attributed to the industrial sector is estimated for each size category. As the majority of three phase electric motors are utilised in the industrial sector (Pitt & Sherry, 2009), the assumptions provided in Table 24 are used. Commercial sector shares are found by deducting the industry share (e.g. 100% minus 80% industry share leaves 20% commercial share). It is assumed that generally, very few three phase electric motors of larger size are installed in the commercial sector. However, in the smallest size range (0.12 - <0.73 kW), three phase electric motors are mostly used in industry (conveyors, chemical processes, machinery, etc).

Table 24: Share of sales attributed to industrial sector (Australia and New Zealand)

Size/ Poles	1: 0.12-<0.73kW	2: 0.73-<4kW	3: 4-<15kW	4: 15-<40kW	5: 40-<75kW	6: 75-<150kW	7: 150-<185kW	8: 185-200kW	9: >200-<375kW
2	80%	60%	70%	80%	85%	90%	100%	100%	100%

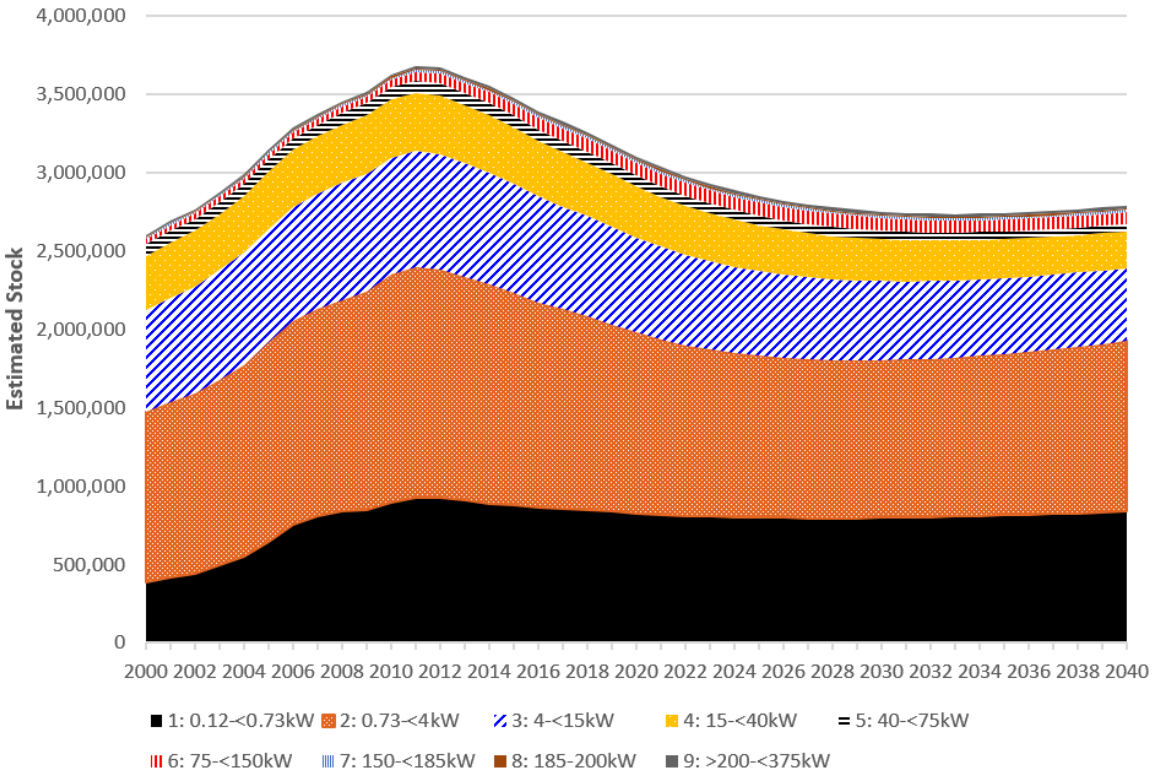
Size/ Poles	1: 0.12-<0.73kW	2: 0.73-<4kW	3: 4-<15kW	4: 15-<40kW	5: 40-<75kW	6: 75-<150kW	7: 150-<185kW	8: 185-200kW	9: >200-<375kW
4	80%	60%	70%	80%	85%	90%	100%	100%	100%
6	80%	60%	70%	80%	85%	90%	100%	100%	100%
8	80%	60%	70%	80%	85%	90%	100%	100%	100%

In addition, the energy modelling assumes that the motor is installed and operating, however there is typically a proportion of motors that are sold, but not installed immediately, and kept as spares in case of breakdowns or held in stock (in the case of using import trade data). Therefore, to model the operating motors, an assumption is also made that effectively reduces the import/sales number of motors. The share of motor sales held in storage would be expected to be higher for smaller, less costly motors and virtually zero for larger motors. The assumed share of sales held in store is estimated to be 20% for Size 1: 0.12-<0.73kW, decreasing to 0% for three phase electric motors greater than 150kW.

Australian stock

The resulting Australian stock of motors by size category and year is shown in Figure 12. It is noted that the overall stock is increasing until 2012 and then declining until 2030 with a slight increase over the next decade. This is largely due to the rapid increase in the period 2000 to 2012 of motors under 4kW.

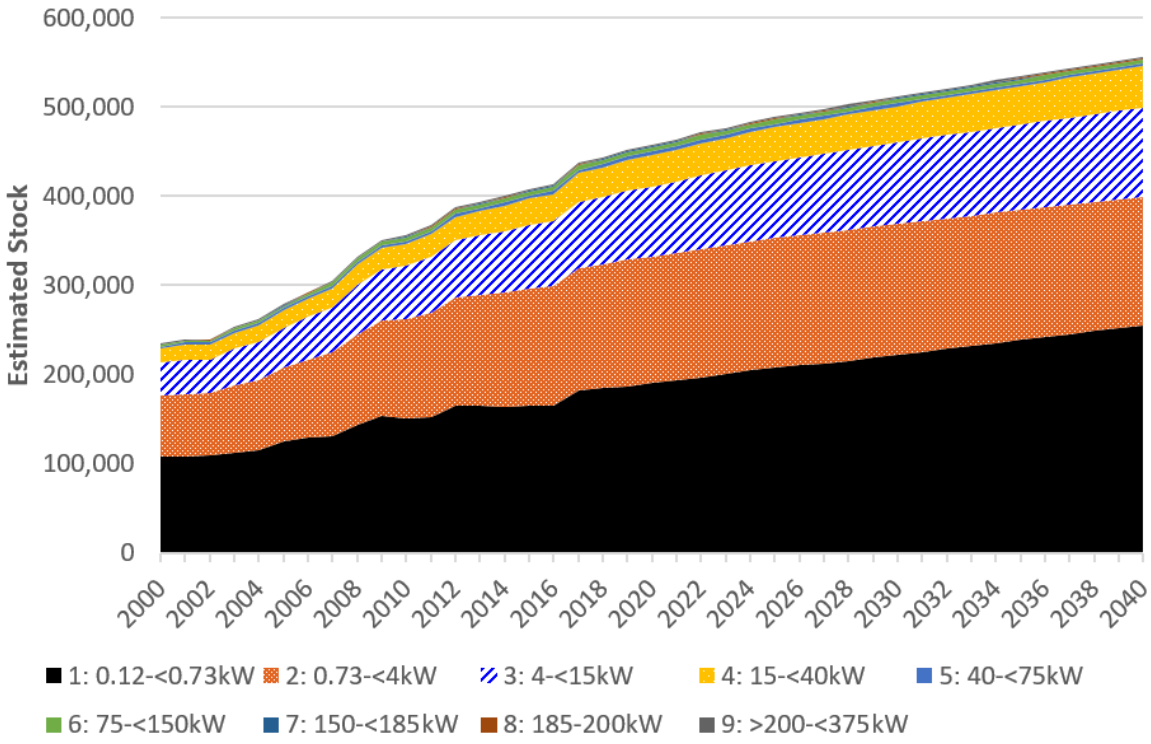
Figure 12: Estimated stock by size category by year (historical to 2019, forecast post 2020): Australia



New Zealand Stock

The estimated stock of motors in New Zealand is shown in Figure 13. The overall growth of stock is increasing.

Figure 13: Estimated stock by size category by year (historical to 2020, forecast post 2020): New Zealand



Calculation of energy consumption

The energy consumption of motors is calculated using an international approach (EU, 2019), as follows:

*Energy use (kWh) =Output Power (kW) * Hours * Load factor / (motor efficiency).*

Where:

- *Output power* is the average sales weighted output power for each size category/poles
- *Hours* is the estimated annual operating hours for category and sector
- *Load factor* is estimated to be 0.6 for all categories (EU, 2019)
- *Motor efficiency* is the average sales weighted efficiency for each size category/poles, at 75% load, when measured using IEC 60034-2-1 Ed. 2.0 test standard (Method 2-1-1B) or equivalent.

Values for average output power are shown in Table 25. These are derived from the average sales weighted output power for each size of motor by category and pole sold in Australia and New Zealand.

Table 25: Average output power by size category and poles (kW)

Size/Poles	1: 0.12-<0.73kW	2: 0.73-<4kW	3: 4-<15kW	4: 15-<40kW	5: 40-<75kW	6: 75-<150kW	7: 150-<185kW	8: 185-200kW	9: >200-<375kW
2	0.4	1.8	6.7	21.3	49.7	89.6	154.6	194.8	277.7
4	0.4	1.6	6.5	22	49.9	93	153.4	192.1	276.4
6	0.4	1.6	6.5	23.5	50.7	91.2	155.1	188.3	272.1
8	0.4	1.7	7.2	21.8	49.4	95.6	150.0	198.8	232.0

The average hours of operation are estimated from similar motor MEPS impact studies in the EU (EU, 2019, University of Coimbra, 2008) and adjusted so that energy outputs are reconciled with total estimated energy consumption by sector in Australia and New Zealand. The average annual operating hours by size category and sector are shown in Table 26. The average load factor was set to 0.6, based on the similar motor MEPS impact studies in the EU (EU, 2019, University of Coimbra, 2008).

Table 26: Average hours of operation by size category and sector (annual hours)

Size Category	1: 0.12-<0.73kW	2: 0.73-<4kW	3: 4-<15kW	4: 15-<40kW	5: 40-<75kW	6: 75-<150kW	7: 150-<185kW	8: 185-200kW	9: >200-<375kW
Industry	2000	2800	2800	3500	3500	4000	4000	4000	4000
Commercial	2000	2000	2000	2000	2000	2000	2000	2000	2000

Three phase electric motor efficiency is determined by analysis of the New Zealand sales data from EECA (2009 -2023) and compared to the results of similar analysis of motor sales survey data for Australia (2019 year).[49] The analysis involved:

- Using the 75% load efficiency, as this is closest to the load used for modelling energy consumption
- Converting efficiency of motors measured using Australian Standard method B to method A[50]
- Using the sales to weight the efficiency for each motor size and combining sizes to calculate the average efficiency for each category.

The BAU average sales weighted efficiency for each category and by pole is shown in Table 27 for 2023 and is derived from EECA sales data. The survey data from Australian suppliers was used for the categories that are not included in the EECA sales data (i.e. sizes 0.12-<0.73kW and > 185kW). The annual BAU efficiency improvement over the last five years for each of the categories is very small based on the EECA data, ranging from -0.22% to 0.26% per annum (Compound Annual Growth Rate). For modelling future annual improvements in efficiency, the values for the last three years were used, except those with negative improvement were set to zero percentage change.

[49] Confidential surveys were undertaken with motor industry stakeholders during 2020, and these were completed by companies responsible for around 40% of the motors sold in 2019.

[50] The Regulations before the 2019 Determination referred to local Australian and New Zealand Standards. AS/NZS 1359.102.3 and AS 1359.102.1

Table 27: Average efficiency by size category and poles (75% load)

Size/Poles	1: 0.12-<0.73kW	2: 0.73-<4kW	3: 4-<15kW	4: 15-<40kW	5: 40-<75kW	6: 75-<150kW	7: 150-<185kW	8: 185-200kW	9: >200-<375kW
2	70.58%	85.00%	89.80%	92.66%	94.28%	94.95%	95.01%	95.54%	95.58%
4	69.77%	84.74%	89.60%	93.21%	94.73%	95.36%	96.33%	95.86%	95.86%
6	66.60%	81.79%	88.44%	92.61%	94.35%	95.72%	95.93%	95.81%	95.96%
8	58.02%	78.34%	89.81%	91.20%	93.50%	95.50%	94.19%	94.25%	94.69%

Average efficiency increase due to policy options

In practice, as there is a range of motor efficiencies available for each motor size/type, the average efficiency of the motors sold is likely to be higher than the minimum efficiency levels specified. For the cost-benefit modelling, the sales-weighted efficiency for each product category has been determined by a proportional relationship based on the difference of the MEPS efficiency levels compared to the BAU efficiency levels. This increase is based on how stringent the MEPS efficiency level is compared to the BAU efficiency. The cost-benefit model calculates the difference and utilises a normal distribution function to calculate the effect of the MEPS. This methodology ensures that average efficiency increases account for the likely realistic impact of the policy options for each motor category. Using this method, the absolute sales weighted average motor efficiency above the MEPS level (IE3) ranges from 0.5% for size category 1 (0.73- 4kW) to less than 0.2% for size category 9 (200-375kW).

Average motor cost increase due to policy options

A key input for the modelling of the costs of the proposed policy options is the impact of the options on the price of the product to the buyer. The assumption used in the modelling is that more efficient equipment is more expensive than a similar performing product with lower efficiency. This approach has been used for past RISs to determine the relative costs of the efficiency improvements due to the policy options modelled.

A range of options exists for determining the potential price changes as a result of the policy options, such as engineering/cost deconstruction, surveys of the suppliers to obtain price increments vs efficiency performance, analysis of the price vs efficiency relationship from model prices and technical data. The latter two approaches were used in this modelling exercise. The aim of this price vs efficiency research is to obtain a value for the price efficiency (PE) ratio that can be used to assess the cost impacts of the policy option, such as every 1% increase in the average efficiency of the products being sold/installed the average price increases by 1.0% (a PE ratio of 1.0).

In consultation with motor suppliers, it has been assumed that the average increase in price is 10% for a motor when choosing an IE3 motor compared to an IE2 motor. This incremental price increase is the basis of the input for the cost benefit modelling. To obtain the inputs for the modelling, the PE ratio will vary depending on size of the incremental efficiency change from IE2 to IE3. The analysis shows that the smaller the incremental difference, using a constant 10% price increase, the larger the PE ratio. This is expected, as the IE3/IE2 difference decreases for larger sizes of motors. For example, the PE ratio that

results from a 10% increase (IE3 vs IE2) is 3.2 for size category 1 (0.73- 4kW) to 10.5 for size category 9 (250-375kW).

For the option of increasing MEPS to IE4, the average price is assumed to increase by 30%, which is based on the average price increase for three phase electric motors from IE3 to IE4 for the size range 75 – 200kW from a UK published price list[51]. This average price increase is higher than that used in the EU study of 22.5%.

Where the proposed policy options resulted in an increase in the average efficiency of motors sold compared to BAU, the PE ratio was applied to the prices shown in Table 28 to calculate the average purchaser price increase for these motors.

Table 28: Average purchaser price by size category and poles (AUD)

Size/ Poles	1: 0.12-<0.73kW	2: 0.73-<4kW	3: 4-<15kW	4: 15-<40kW	5: 40-<75kW	6: 75-<150kW	7: 150-<185kW	8: 185-200kW	9: >200-<375kW
2	$119	$270	$719	$1,702	$3,292	$5,838	$11,011	$12,019	$19,327
4	$122	$310	$697	$1,852	$3,541	$6,466	$10,740	$12,371	$18,829
6	$160	$378	$960	$2,421	$4,921	$10,638	$16,036	$20,092	$23,418
8	$335	$822	$2,088	$4,544	$9,772	$21,710	$30,496	$37,647	$41,647

Source: Supplier survey and published prices (AIM 2020). For New Zealand, the EECA-provided exchange rate A$1=NZ$1.10 is assumed.

Government and industry costs

The costs to government and industry for these policy options are described below. For both levels there is an assumed establishment cost to government of $250,000, which includes research, consultation, survey, analysis and revisions to the GEMS legislation/implementation procedures.

Level 1: Increase scope to cover three phase electric motors from 0.12kW to <375kW; with MEPS set at IE2 for 0.12 to <0.75kW motors and IE3 for 0.75 to <375kW motors.

Under this option, there will be additional government and industry costs as the scope is changed.

The government costs include additional administration and check testing. The industry costs are described in Table 29. The additional costs are:

- No additional education costs, as it is assumed the same motor suppliers included in the scope of Level 1 will be supplying the motors included in the scope of Level 2
- There are additional testing costs as it is assumed a proportion of motors supplied in the new scope are not supplied in the EU or US.
- The additional permission costs (those to complete registration) are estimated at $43 per model for those registered.
- The additional permission costs (registration fee) are as published by the GEMS Regulator A$670 per model registered for those in the scope of the option.

[51] AC electric motors, 2024

Level 2: MEPS set at IE4 for 75kW (inclusive) to 200kW (inclusive) three phase electric motors.

It is assumed that there are no incremental government costs in addition to the existing MEPS program as the scope is not changing. Similarly, there are no industry costs, as suppliers are already required to register these products within the scope.

For Level 1, the industry costs are the registration fees, testing of motors that have not already been tested, and the effort/time costs of submitting registrations, maintaining records and keeping up to date with regulatory requirements. These costs are calculated on the following basis:

Table 29: Government and industry costs (AUD)

Costs	Type	Level 1	Level 2
Government costs	Administration	$100,000 p.a.	Included in Level 1.
Government costs	Check testing	$100,000 p.a.	Included in Level 1.
Industry costs	Education - Train staff, keep up-to-date with regulations (per supplier)	$6,814	Included in Level 1.
Industry costs	Record Keeping - Maintain documents for five years (per supplier)	$681	Included in Level 1.
Industry costs	Permission - Test product in laboratory (per model varies see below)	Assume that 30% of models will need to be tested in the 0.12kW to <0.75kW category and all models over 185kW will be tested already for EU and USA markets	Included in Level 1.
Industry costs	Permission - Complete MEPS registration (per model)	$170	Included in Level 1.
Industry costs	Permission - Registration fee (per model)	$536 (based on 80% of the fee, assuming 20% are registered in New Zealand)	Included in Level 1.

Data on the number of companies and the number of motors models on the market was obtained from the E3 registration database. For costing purposes, it has been assumed that only models that would be impacted by the increased scope of MEPS policy options would incur costs. For the new scope this means that approximately 2,000 models are estimated to be registered in the first year and then 400 models are registered per year for Level 1.

Timeframe and discount rates

It is assumed that Level 1 policy options will be introduced in 2027 and Level 2 options in 2029, with the expected date for calculating impacts beginning in 2027 and 2029 respectively.

All the outputs in the cost-benefit analysis were assessed in Australia at a 7% discount rate, with sensitivity tests at 0%, 3% and 10%. For New Zealand a 2% discount rate is used, with sensitivity tests at 0%, 1% and 8%.

Electricity prices

The electricity prices and forecasts used in the modelling are taken from documented research:

In Australia they are based on Large Business Customers electricity price from the ACCC[52] and the forecast is made using the wholesale price index, from AEMO 2024 Draft ISP (Step change scenario)[53].
In New Zealand electricity prices are the long-range marginal cost provided by the Energy Efficiency and Conservation Authority.

Greenhouse gas emission factors

The GHG emission factors and forecasts used in the modelling are taken from published sources[54], with the Australian factors assumed to decline to close to zero over the period from 2041 to 2050. The New Zealand factors are sourced from EECA in 2025, and are based on the scenarios produced by the Climate Change Commission's 2021 Final Advice[55].

Value of greenhouse gas emissions avoided

The benefits include a value for the reduction of GHG in accordance with CBA methodologies. The emissions reduction value is calculated by multiplying the carbon reduction by the carbon price in each year. For Australia, the carbon price ranges from $70/tonne in 2024 to $420/tonne in 2050 (AU$ real, AEMC 2024), and in New Zealand, the carbon price ranges from $105/tonne in 2024 to $309/tonne in 2050 (New Zealand Treasury 2023, New Zealand dollars real, central scenario).

Sensitivity tests are undertaken as follows:

Australia: Zero, and 50% lower and 50% higher than the central carbon price[56].
New Zealand: Zero, low and high recommended emission values[57].

Peak demand reduction

The estimated peak demand reduction from the above options is 48 MW in Australia and 5 MW in New Zealand in 2050. These values are minimal compared to the energy savings and, hence, have not been quantified in the CBA, but are provided here for context.

[52] Australian Competition and Consumer Commission (ACCC), 2023
[53] Australian Energy Market Operator (AEMO), 2023
[54] Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2024
[55] New Zealand Climate Change Commission, 2021
[56] Australian Energy Market Commission (AEMC), 2024
[57] New Zealand Treasury, 2023

Appendix 2: Sensitivity analysis

The CBA is based on a number of assumptions, which can be sensitive to change. Several sensitivity analyses were undertaken to examine the impact of various factors on the costs and benefits arising from the modelling. These sensitivity analyses were:

- Discount rate
- Carbon price
- Three phase electric motors embedded or packaged with machines
- Non-compliant motors

The various discount rates impact the cost benefit ratios, total benefits, and total costs. The highest discount rate for both Australia and New Zealand results in the lowest benefit, lowest cost, and lowest benefit to cost ratio, but these are still substantial.

The DRIS CBA is different to the CRIS CBA and is explained in detail below.

Table 30: Discount rate sensitivity analysis – Australia Discount rate (real) – Level 1

Discount rate (real)	0 per cent	3 per cent	7 per cent	10 per cent
Level 1				
Total Benefits (NPV, $M)	$1,209	$685	$359	$238
Total Costs (NPV, $M)	$201	$142	$96	$75
Net Benefits (NPV, $M)	$1,008	$543	$263	$163
Benefit Cost Ratio	6.0	4.8	3.7	3.2

Table 31: Discount rate sensitivity analysis – Australia Discount rate (real) – Level 2

Discount rate (real)	0 per cent	3 per cent	7 per cent	10 per cent
Level 2				
Total Benefits (NPV, $M)	$1,605	$895	$460	$300
Total Costs (NPV, $M)	$351	$241	$158	$120
Net Benefits (NPV, $M)	$1,254	$654	$302	$180
Benefit Cost Ratio	4.6	3.7	2.9	2.5

Table 32: Discount rate sensitivity analysis – New Zealand Discount rate (real) – Level 1

Discount rate (real)	0 per cent	1 per cent	2 per cent	8 per cent
Level 1				
Total Benefits (NPV, $M)	$122	$100	$83	$31
Total Costs (NPV, $M)	$23	$20	$18	$10
Net Benefits (NPV, $M)	$99	$80	$65	$21
Benefit Cost Ratio	5.3	4.9	4.5	3.0

Table 33: Discount rate sensitivity analysis – New Zealand Discount rate (real) – Level 2

Discount rate (real)	0 per cent	1 per cent	2 per cent	8 per cent
Level 2				
Total Benefits (NPV, $M)	$137	$112	$93	$35

Discount rate (real)	0 per cent	1 per cent	2 per cent	8 per cent
Total Costs (NPV, $M)	$27	$24	$22	$12
Net Benefits (NPV, $M)	$110	$88	$71	$23
Benefit Cost Ratio	5.0	4.6	4.3	2.9

Table 34: Carbon price sensitivity analysis – Australia (Discount rate 7% real) – Level 1

Level 1	None	Low	Central (Base Case)	High
Total Benefits (NPV, $M)	$318	$338	$359	$379
Total Costs (NPV, $M)	$96	$96	$96	$96
Net Benefits (NPV, $M)	$222	$242	$263	$283
Benefit Cost Ratio	3.3	3.5	3.7	3.9

Table 35: Carbon price sensitivity analysis – Australia (Discount rate 7% real) – Level 2

Level 2	None	Low	Central	High
Total Benefits (NPV, $M)	$407	$433	$460	$486
Total Costs (NPV, $M)	$158	$158	$158	$158
Net Benefits (NPV, $M)	$249	$275	$302	$328
Benefit Cost Ratio	2.6	2.7	2.9	3.1

Table 36: Carbon price sensitivity analysis – New Zealand (Discount rate 2% real) – Level 1

Level 1	None	Low	Central (Base Case)	High
Total Benefits (NPV, $M)	$73	$79	$83	$86
Total Costs (NPV, $M)	$18	$18	$18	$18
Net Benefits (NPV, $M)	$55	$61	$65	$68
Benefit Cost Ratio	4.0	4.3	4.5	4.7

Table 37: Carbon price sensitivity analysis – New Zealand (Discount rate 2% real) – Level 2

Level 2	None	Low	Central	High
Total Benefits (NPV, $M)	$82	$89	$93	$97
Total Costs (NPV, $M)	$22	$22	$22	$22
Net Benefits (NPV, $M)	$60	$67	$71	$75
Benefit Cost Ratio	3.8	4.1	4.3	4.5

Appendix 1: Cost benefit approach and parameters, the analysis includes both bare three phase electric motors and three phase electric motors incorporated into a machine (embedded in or packaged with). The majority of three phase electric motors, approximately 65% according to an analysis of Australian

2021 import data[58], will be imported as part of an integrated product or as part of an item of equipment as shown in Figure 14.

It is considered that the best modelling approach to three phase electric motors embedded in or packaged with machines is to include them in the base or central case and carry out a sensitivity analysis showing the potential impact if only bare three phase electric motors were included. As there is less reliable information for embedded motors, the bare motors data is utilised and adjusted to represent the total impacts of the policy options.

The CRIS applied a different approach for the CBA and did not include the benefits of the MEPS or the increased costs of higher efficiency three phase electric motors for embedded applications in the base case. Therefore, the DRIS CBA shows significantly increased total costs and benefits of the MEPS options in the base case due to the larger number of three phase electric motors included in the scope of the analysis.

Key assumptions used to include electric three phase electric motors embedded in or packaged with machines are:

- The categories of three phase electric motors that are likely to be embedded in or packaged with machines and therefore applicable are less than 40kW (i.e., size categories 1, 2, 3 and 4)
- Three phase electric motor embedded in or packaged with machines are 50% of the sales of bare three phase electric motors. It is assumed that a proportion of the embedded three phase electric motors captured in the analysis of the Australian import data are included in the scope of other MEPS products (i.e., air conditioners, chillers); or are already included in the bare three phase electric motors data (most large air compressors), or will be not within the scope of the three phase electric motors MEPS (i.e., not able to be removed from the machine and still operate), hence the use of 33%[59] of sales compared to 65% of sales. Therefore, to represent the total sales (embedded + bare), the sales of bare three phase electric motors are multiplied by 1.5 in these categories.
- The models of embedded motors that are not currently registered will incur two times the administrative burden of bare three phase electric motor registration (testing, time to complete registration, etc.). The CRIS assumed three times the administrative burden for three-phase electric motors embedded in or packaged with machines which was an overly conservative estimate, and was lowered to a more realistic two times for the DRIS.
- These three phase electric motor embedded in or packaged with machines have the same technical and energy efficiency characteristics as bare three phase electric motors. Therefore, the total energy savings impacts, benefits and associated incremental product costs to meet the policy options are 1.5 time higher than those of bare motors for these categories (i.e., less than 40kW).

[58] EnergyConsult, 2023

[59] Sales of bare three phase electric motors = 35%. 50% of 35% = 17.5%. 17.5%/(35%+17.5%) = 33%. CBA assumed percentage of embedded motors = 33%, assumed percentage of bare motors = 67%.

Table 38: Bare three phase electric motors sensitivity analysis – Australia and New Zealand – Level 1

Level 1	Australia - Bare Motors Scenario	Australia - Base Case	New Zealand - Bare Motors Scenario	New Zealand - Base Case
Total Benefits (NPV, $M)	$274	$359	$59	$83
Total Costs (NPV, $M)	$59	$96	$9	$18
Net Benefits (NPV, $M)	$215	$263	$50	$65
Benefit Cost Ratio	4.6	3.7	6.6	4.5
Emissions reduction (cumulative kt CO2-e)	330	431	29	41
Cumulative Energy Savings (GWh)	4,069	5,282	587	823

Australia discount rate is 7%, New Zealand discount rate is 2%

Table 39: Bare three phase electric motors sensitivity analysis – Australia and New Zealand – Level 2

Level 2	Australia - Bare Motors Scenario	Australia - Base Case	New Zealand - Bare Motors Scenario	New Zealand - Base Case
Total Benefits (NPV, $M)	$374	$460	$69	$93
Total Costs (NPV, $M)	$121	$158	$12	$22
Net Benefits (NPV, $M)	$253	$302	$57	$71
Benefit Cost Ratio	3.1	2.9	5.7	4.3
Emissions reduction (cumulative kt CO2-e)	445	547	34	46
Cumulative Energy Savings (GWh)	5,720	6,934	679	916

Australia discount rate is 7%, New Zealand discount rate is 2%

As can be seen from the table above, the benefit cost ratio increases by 6% for Australia and 31% for New Zealand if only bare three phase electric motors are included in the modelling for Level 2. Also, the cumulative energy savings would be 17% lower for Australia and 26% lower for New Zealand if only bare three phase electric motors are included in the modelling for Level 2.

There is also uncertainty about the effect of non-compliant three phase electric motors that are imported and used in Australia and New Zealand. It is known that there is non-compliance with the energy efficiency requirements for three phase electric motors, but the extent cannot be confidently quantified. There is no certainty that 100% compliance with a higher (IE3 or IE4) MEPS could be enforced. To understand the impact of non-compliance an assumed 10% non-compliance is shown in Table 40 and Table 41. This reduces the costs and benefits by 10%.

Table 40: Non-compliant three phase electric motors sensitivity analysis - Australia and New Zealand – Level 1

Level 1	Australia - 10% non-compliance	Australia - Base Case	New Zealand - 10% non-compliance	New Zealand - Base Case
Total Benefits (NPV, $M)	$323	$359	$75	$83
Total Costs (NPV, $M)	$87	$96	$17	$18
Net Benefits (NPV, $M)	$236	$263	$58	$65
Benefit Cost Ratio	3.7	3.7	4.5	4.5

Australia discount rate is 7%, New Zealand discount rate is 2%

Table 41: Non-compliant three phase electric motors sensitivity analysis - Australia and New Zealand – Level 2

Level 2	Australia - 10% non-compliance	Australia - Base Case	New Zealand - 10% non-compliance	New Zealand - Base Case
Total Benefits (NPV, $M)	$413	$460	$83	$93
Total Costs (NPV, $M)	$142	$158	$19	$22
Net Benefits (NPV, $M)	$271	$302	$64	$71
Benefit Cost Ratio	2.9	2.9	4.3	4.3

Australia discount rate is 7%, New Zealand discount rate is 2%

Appendix 3: Motor energy use by sector and end use

Electric motors account for a large share of electricity consumption in Australia and New Zealand using an estimated 47% and 43% of total electricity demand across Australia and New Zealand.

It is estimated that around 80% of this electricity consumption by motors is from three phase electric motors, with the remaining 20% consumed by smaller, but more numerous, single phase electric motors in both markets. Three phase electric motors and systems are estimated to account for 38% and 34% of electricity use in Australia and New Zealand respectively.

Fans, pumps and compressors use about 75% of the electricity consumption of three phase electric motors in Australia, as shown in Table 42:

Table 42: Product's share of motors' electricity consumption[60]

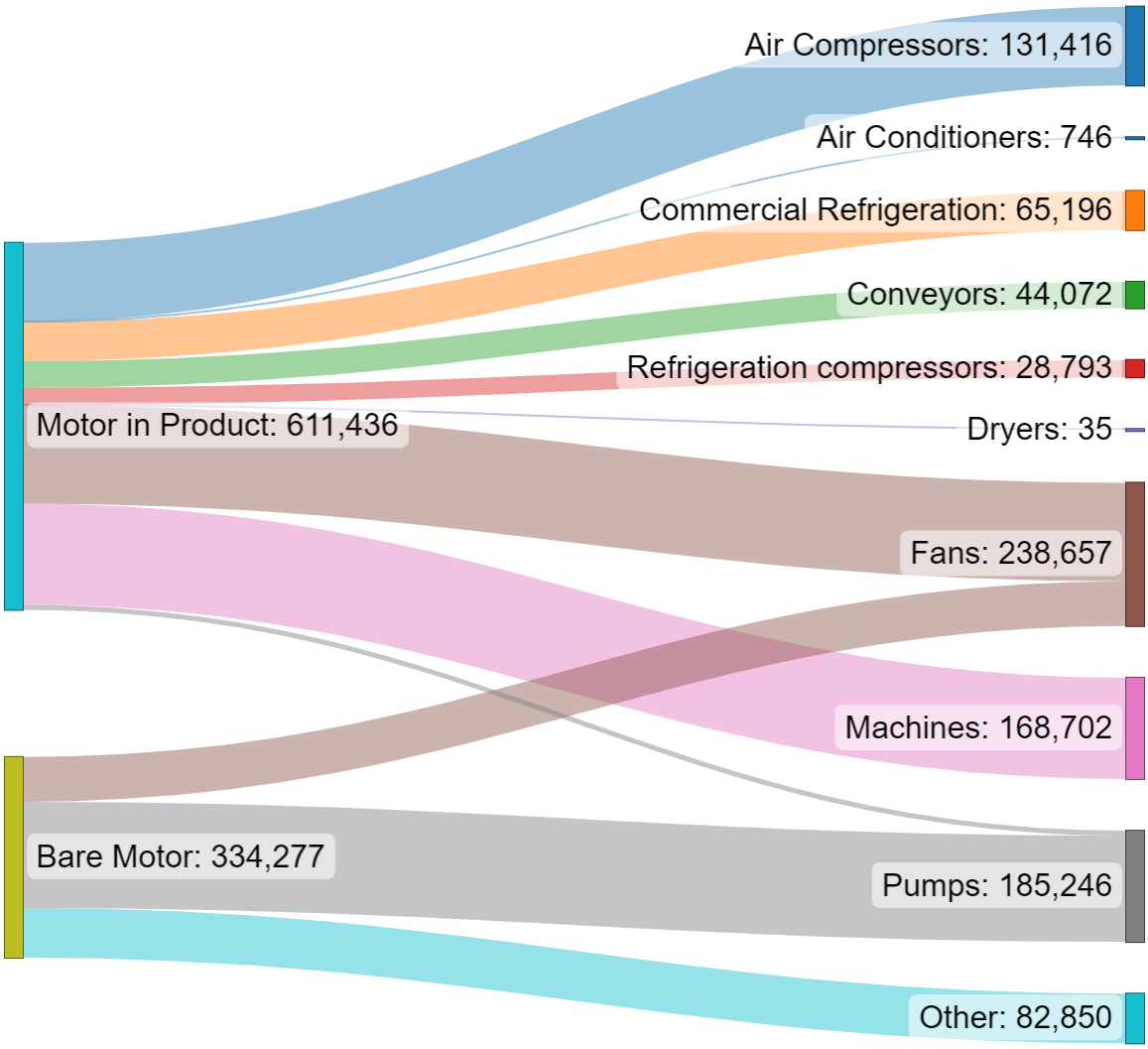
Product	Share
Pumps	40%
Fan units	20%
Compressors	15%
Conveyors	15%
Miscellaneous	10%

Source: Industry consultation for Consultation RIS by E3 for Australia and New Zealand, 2019

The distribution of three phase electric motors into different applications is shown in Figure 14 for 2021 imports to Australia, and clearly shows the different role bare motors play in three phase electric motor imports, with over a third of three phase electric motors arriving as bare motors. Fans, machines, pumps and air compressors dominate the applications where three phase electric motors are imported as part of equipment. Though the motors of these systems will be required to meet MEPS requirements, the overall products/systems are not regulated under GEMS.

[60] Data is for three phase electric motors in Australia, but believed to be similar for New Zealand

Figure 14: Three phase electric motor imports, Australia by application



Notes: This shows imports for 2021, and is not net imports (i.e., excluding exports). The imports of bare motors are higher in 2021 than the 2019 net imports (approx. 200,000) used in the CBA model, as the 2021 bare motors imported included size categories below 0.12kW and motors exported. The other category includes bare motors that are exported and those used in many of the applications, but cannot be disaggregated. EnergyConsult, 2023

Motor import data supplied for New Zealand contained apparent errors and inconsistencies and was not able to be analysed in a similar way to the Australian import data. However, data was extracted from EECA's Energy End Use Database and analysed to show the following breakdown in energy consumption by sector and end use in Table 43. This is based on electricity used in all motors for New Zealand in 2022 and incudes single phase as well as three phase electric motors. However, on the basis that approximately 80% of motors' electricity consumption is used in three phase electric motors, it should be a useful guide to consumption by end use and sector.

Table 43: Electricity consumed by all motors in New Zealand: 2022

End Use	Sector	Sector Group	Elec cons GWh	Total for end use GWh	% of grand total
Compressed Air	Dairy Product Manufacturing	Industrial	70.6		
Compressed Air	Food and Beverage Product Manufacturing (excluding Dairy, Meat, Seafood)	Industrial	23.6		
Compressed Air	Pulp, Paper and Converted Paper Product Manufacturing	Industrial	3.3		
Compressed Air	Wood Product Manufacturing	Industrial	58.1		
Compressed Air - Total for end use		Industrial		**156**	**6%**
Fans	Dairy Product Manufacturing	Industrial	373.6		
Fans	Pulp, Paper and Converted Paper Product Manufacturing	Industrial	11.1		
Fans	Wood Product Manufacturing	Industrial	514.2		
Fans – Total for end use				**899**	**32%**
Pumping	Dairy Cattle Farming	Agriculture, Forestry and Fishing	367.8		
Pumping	Non-Dairy Agriculture	Agriculture, Forestry and Fishing	221.7		
Pumping	Building Cleaning, Pest Control and Other Support Services	Commercial	7.5		
Pumping	Dairy Product Manufacturing	Industrial	332.2		
Pumping	Electricity, Gas, Water and Waste Services	Industrial	602.5		
Pumping	Food and Beverage Product Manufacturing (excluding Dairy, Meat, Seafood)	Industrial	86.7		
Pumping	Non-Metallic Mineral Product Manufacturing	Industrial	2.2		
Pumping	Pulp, Paper and Converted Paper Product Manufacturing	Industrial	40.8		
Pumping	Wood Product Manufacturing	Industrial	96.9		
Pumping – Total for end use				**1758**	**63%**
Grand total				**2812**	

Source: EECA's Energy End Use Database – 2022 data

Appendix 4: Glossary

Term	Definition
$M	Million dollars
AS/NZS	Australian / New Zealand standard
BAU	Business as usual
BCR	Benefit Cost Ratio
CO_2-e	Carbon dioxide equivalent
COP28	28th session of the Conference of the Parties (COP28) to the UN Framework Convention on Climate Change
CRIS	Consultation Regulation Impact Statement
DRIS	Decision Regulation Impact Statement
Determination	Greenhouse and Energy Minimum Standards (Three Phase Cage Induction) Determination 2019 (Australia)
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Australia)
E3 Program	Equipment Energy Efficiency Program (Australia and New Zealand)
EC	European Commission
ECMC	Energy and Climate Change Ministerial Council
EEC Act	Energy Efficiency and Conservation Act (New Zealand)
EECA	Energy Efficiency and Conservation Authority (New Zealand)
ESCOG	Energy and Climate Change Senior Official Group
EU	European Union
Family of Models	A Family of Models is intended to group together a number of models of three phase electric motors that share the same fundamental design and performance characteristics (such as rated output and duty type), but may differ in minor variations like mounting configuration. This grouping allows reduced costs as a representative model can be tested, and a single registration with all models can be completed.
GEMS	Greenhouse and Energy Minimum Standards (Australia)
GHG	greenhouse gas emissions
GWh	gigawatt hour – unit of electrical energy
IE2	International Efficiency Level 2 (high efficiency)
IE3	International Efficiency level 3 (premium efficiency)
IE4	International Efficiency level 4 (super premium efficiency)
IE5	International Efficiency level 5 (ultra premium efficiency)
IEA	International Energy Agency
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
kt	kilotonnes (thousand tonnes)
kWh	kilowatt hour – unit of electrical energy
MEPS	minimum energy performance standards
NPV	Net present value

Term	Definition
OIA	Official Information Act 1982
OEM	Original equipment manufacturer
Regulations	Energy Efficiency (Energy Using Products) Regulation 2002 (New Zealand)
S1 – S9	Duty cycle designations to describe electrical motor operating conditions
VAC	Volts alternating current
VSD	Variable frequency drive, also known as a variable speed drive

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Appendix 6: Electricity emissions factors

Table 44: GHG emission factors for electricity (kg CO_2-e/kWh) for Australia and New Zealand

Region/ year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
NSW	0.550	0.500	0.430	0.360	0.230	0.160	0.160	0.140	0.090	0.090	0.080	0.070	0.060	0.060	0.060	0.030
ACT	0.550	0.500	0.430	0.360	0.230	0.160	0.160	0.140	0.090	0.090	0.080	0.070	0.060	0.060	0.060	0.030
NT	0.610	0.560	0.470	0.440	0.440	0.430	0.390	0.390	0.390	0.380	0.380	0.380	0.380	0.370	0.370	0.370
QLD	0.740	0.670	0.620	0.550	0.370	0.190	0.200	0.150	0.160	0.170	0.140	0.130	0.120	0.110	0.120	0.110
SA	0.240	0.250	0.230	0.230	0.170	0.110	0.090	0.060	0.070	0.070	0.070	0.070	0.060	0.050	0.060	0.060
TAS	0.220	0.210	0.210	0.040	0.040	0.020	0.040	0.040	0.050	0.060	0.010	0.010	0.010	0.010	0.010	0.010
VIC	0.840	0.770	0.750	0.560	0.380	0.270	0.240	0.200	0.200	0.190	0.020	0.020	0.010	0.010	0.010	0.010
WA	0.560	0.530	0.480	0.340	0.260	0.140	0.130	0.140	0.140	0.130	0.130	0.120	0.120	0.120	0.110	0.140
NZ	0.040	0.043	0.046	0.049	0.051	0.054	0.056	0.056	0.055	0.055	0.055	0.054	0.054	0.054	0.053	0.052

Sources: DCCEEW (2024) Table 46 Indirect scope 2 and 3 combined emissions factors in the baseline scenario and EECA provided (2025).