

EXPLANATORY STATEMENT

Issued by the authority of the Minister for Energy and Emissions Reduction

Greenhouse and Energy Minimum Standards Act 2012

*Greenhouse and Energy Minimum Standards (Air Conditioners above 65kW)
Determination 2020*

Purpose and Operation

The *Greenhouse and Energy Minimum Standards (Air Conditioners above 65kW) Determination 2020* (Determination) introduces Minimum Energy Performance Standards (MEPS) level and testing requirements for air conditioners above 65 kilowatts (kW) rated capacity for the first time. MEPS levels are also referred to in the Determination as Greenhouse and Energy Minimum Standards (GEMS) level requirements. The majority of the requirements established in the Determination are set by reference to the *Greenhouse and Energy Minimum Standards (Air Conditioners up to 65kW) Determination 2019* (Air Conditioners up to 65kW Determination).

Background

The *Greenhouse and Energy Minimum Standards Act 2012* (Act) established a national framework for regulating the energy efficiency of products supplied or used within Australia, implementing Australian Government and Commonwealth, State and Territory Energy Ministers commitments to establish national legislation to regulate energy efficiency and labelling standards for appliances and other products. The national legislation permits the Australian Government to set mandatory minimum efficiency requirements for products, to drive greater energy efficiency for regulated products. The Act also allows the Australian Government to set nationally-consistent labelling requirements, to increase Australians' awareness of options to improve energy efficiency and reduce energy consumption, energy costs and greenhouse gas emissions. The national framework replaced seven state and territory legislative frameworks, harmonising the regulation of equipment energy efficiency. Other regulatory requirements possible under the Act include requirements relating to energy labelling, product performance, and the impact of the product on the environment or the health of human beings.

Authority

Under subsection 23(1) of the Act, the Minister may, by legislative instrument, make a determination (a GEMS determination) that specifies one or more classes of products if the products in those classes use energy or affect the amount of energy used by other products. A GEMS determination is the vehicle by which energy efficiency requirements (GEMS level requirements), energy labelling requirements (GEMS labelling requirements), and other requirements for a product class are established.

Under section 25 of the Act, the GEMS level requirements specified in a GEMS determination may be:

- requirements relating to one or more of the following:
 - the amount of energy used in operating products in the relevant product classes;
 - the amount of greenhouse gases resulting from operating products in the relevant product class;
 - the effect of those products on the amount of energy used by operating other products; and
- requirements for conducting tests in relation to products in the relevant product class in order to determine whether the products meet the specified requirements.

Under section 26 of the Act, the GEMS labelling requirements for a product class specified in a GEMS determination are:

- requirements relating to the information that must be communicated in connection with supplying or offering to supply products in the relevant product class;
- requirements relating to the manner in which that information must be communicated; and
- requirements for conducting tests in relation to products in the relevant product class in order to determine whether the products meet the specified requirements.

Under section 27 of the Act, other requirements that may be specified in a GEMS determination are:

- requirements for products in the relevant product class to meet a specified level (the high efficiency level) at a particular time;
- requirements relating to the performance of products in the relevant product class;
- requirements relating to the impact of products in that product class on the environment or on the health of human beings;
- requirements for conducting tests in relation to products in the relevant product class in order to determine whether the products meet the specified requirements; and
- requirements of a kind specified in the regulations for the purposes of that paragraph.

Incorporated material

The Determination references the Air Conditioners up to 65kW Determination, with several sections calling up requirements from the Air Conditioners up to 65kW Determination, and then setting out any modifications that apply for the purposes of this Determination. The Air Conditioners up to 65kW Determination may be obtained from the Federal Register of Legislation, <https://www.legislation.gov.au/>, free of charge.

The Determination references, through the requirements called up from the Air Conditioners up to 65kW Determination, standards published by the European Committee for

Standardisation (EN standards), the International Organisation for Standardisation (ISO), the Air-Conditioning, Heating and Refrigerating Institute (AHRI), as well as Australian/New Zealand standards (AS/NZS). These standards are incorporated as at 25 March 2019, the date the Air Conditioners up to 65kW Determination was made. Commercial users who have ascertained that they are likely to be covered by the Determination (which is possible from reading the Determination in isolation) would be expected to purchase the relevant referenced standards in order to comply with the Determination.

Some of the standards are specific to particular types of air conditioners and other standards are referenced as alternatives to reduce costs for members of the regulated community who already have access to these standards. For an air conditioner that is a cooling only product reference to three standards would be necessary to comply with the Determination. Reference to four standards would be necessary for a reverse cycle air conditioner (which heats as well as cools).

EN standards are available for purchase from European Committee for Standardisation (CEN) National Standards Bodies, including the British Standards Institution. AHRI standards are available as free downloads from the AHRI website (currently www.ahrinet.org). AS/NZS standards can be purchased from Standards Australia Ltd, currently through their licensed distributors SAI Global and Techstreet. ISO standards are also available from Standards Australia or can be purchased directly through the ISO.

In its new Distribution and Licensing Policy Framework, published in November 2019, Standards Australia committed to striving to maximise the availability of public library reading room access, such that Australian Standards can be accessed by the general public in physical public library reading rooms for personal, domestic and household use. It also committed to funding and providing this type of access by other means, currently anticipated to be online provision directly by Standards Australia, by no later than December 2023.

The Department continues to engage with Standards Australia while this work is underway, regarding options for non-commercial users to access standards incorporated in this Determination without charge. During this period, interested non-commercial users may be able to access standards without cost through the National Library of Australia, including via interlibrary loans. In addition, should requests to view standards be received from non-commercial users, the Department will work with the requesting party to provide appropriate access to any standard referenced in the Determination on a case-by-case basis.

Consultation

The Australian Government has worked extensively with industry and other stakeholders on the development of the new requirements for air conditioners.

A consultation Regulation Impact Statement (RIS) was released in February 2016 and public meetings were held in Sydney, Melbourne, Brisbane, Adelaide, Perth and Wellington. Around 100 people attended the meetings, with 30 submissions received in response. Submissions were largely supportive of the introduction of the new requirements, including the new energy rating label.

Several additional rounds of consultation were then undertaken to address concerns raised in response to the consultation RIS. A supplementary consultation paper was published in November 2016 in response to feedback on the consultation RIS. This paper was released to provide the opportunity for further feedback where proposals had been modified or were not

recommended to continue. Face to face sessions were held in Sydney and in Wellington. Around 50 people attended the meetings, with 31 submissions received in response. Four submissions requested more information on how and when changes would take effect.

An exposure draft of the Determination was released for public consultation on 7 August 2019. The proposed introduction date and testing requirements were amended following industry feedback during the consultation period. The proposed arrangements have support from industry stakeholders.

Regulatory Impact

A comprehensive Decision RIS was prepared for air conditioners following the completion of the Consultation RIS process. In December 2018, Commonwealth, State and Territory Energy Ministers agreed to the preferred option in the Decision RIS. The Decision RIS covered both air conditioners up to 65kW capacity, and over 65kW capacity. The preferred option included the introduction of MEPS for air conditioners over 65kW.

The Office of Best Practice Regulation assessed the RIS as meeting the former Council of Australian Governments' best practice regulation requirements. The RIS is set out in full at Attachment C.

Compliance with legislative preconditions

Section 33 of the Act specifies that, before making a GEMS determination, the Minister must obtain consent from participating jurisdictions to the terms of the determination. This is the only statutory precondition specified in the Act that must be satisfied for the instrument to be lawfully made.

Consent from participating jurisdictions was sought, consistent with the methods established in the Inter-governmental Agreement for the GEMS Legislative Scheme, in January 2020. All participating jurisdictions gave their consent.

Details of the Determination are set out at Attachment A and a statement of compatibility with human rights for the purposes of Part 3 of the *Human Rights (Parliamentary Scrutiny) Act 2011* is set out at Attachment B.

Attachment A

Details of the Determination

PART 1—PRELIMINARY

Section 1—Name

This section sets out the title of the Determination.

Section 2—Commencement

This section provides that the Determination commences and comes into force on 1 April 2022.

Section 3—Authority

This section identifies the section of the Act which authorises the Minister to make the Determination.

Section 4—Interpretation

Section 4 provides guidance for interpreting certain aspects of the Determination.

Subsection 4(1) provides that, subject to the following subsections, an expression used in this Determination has the same meaning as in the Air Conditioners up to 65kW Determination.

Subsection 4(2) defines ‘Air Conditioners up to 65kW Determination’ to mean the *Greenhouse and Energy Minimum Standards (Air Conditioners up to 65kW) Determination 2019*, and points readers to section 9 for the meaning of the term ‘product class’.

Subsection 4(3) clarifies the circumstances in which a reference to ‘this Determination’ in the Air Conditioners up to 65kW Determination is taken to be a reference to this Determination. These are in relation to the definitions of ‘tested’ and ‘energy label’, in sections 10 and 26 respectively, of the Air Conditioners up to 65kW Determination.

Section 5—Applicable definitions and applicable versions of standards and documents incorporated into standards

Section 5 provides guidance for interpreting certain further aspects of the Determination.

Applicable definitions of terms or phrases

Subsection 5(1) sets out the order in which priority should be taken in the interpretation of relevant provision if there are any inconsistencies between the Act, the Determination and the standards.

Applicable versions of standards and documents incorporated into standards

The purpose of subsection 5(2) is to make clear that the applicable version of any standard referenced in the Determination, or other relevant document that is referred to in a standard, is the version that existed on 25 March 2019, which is the date the Air Conditioners up to 65kW Determination was made.

Section 6—Families of models

Section 28 of the Act provides that a GEMS determination must specify, for each product class covered by the Determination, the circumstances in which two or more models in that product class are in the same family of models.

Section 6 specifies that for two or more models to be in the same family of models they must be in the same product class, have the same energy performance and relevant physical characteristics, and rely on a single test report.

A family must contain no more than ten models.

These are the same arrangements as for the Air Conditioners up to 65kW Determination.

Section 7—Product category

Section 29 of the Act requires that a GEMS determination specify whether the products it covers are category A or category B products. Different penalty levels apply for certain offences under the Act, depending on whether a product is a category A product or a category B product for a product class.

Section 7 specifies that air conditioners covered by the Determination are category A products. This is the same as for the Air Conditioners up to 65kW Determination.

PART 2—PRODUCTS COVERED BY DETERMINATION

Section 8—Purpose of Part

This section indicates that this Part specifies the product classes that are and are not covered by the Determination.

Section 9—Classes of products that are covered by this Determination

Section 9 provides that the classes of products covered by this Determination are established in the numbered product classes set out in Schedule 1.

There are 4 product classes established in Schedule 1, numbered 24 to 27. This numbering follows on from the product class numbering in the Air Conditioners up to 65kW Determination.

The product classes cover a range of air conditioner types including unitary (or packaged), split system, and the outdoor units of single-split and multi-split systems, with rated capacities of greater than 65 kilowatts. In contrast to the Air Conditioners up to 65kW Determination, no distinction is made between products that operate on single-phase or three-phase power. The covered products are regulated for the first time by this Determination.

Section 9 notes that the products covered by this Determination are ones that are designed primarily for human comfort, and clarifies that such products are covered irrespective of the context in which they are used. This is to aid affected parties to understand that it is the technical features of the product and the application for which it is designed, rather than the actual end-use application of individual units of the product, that determine whether or not a product is obliged to comply with the requirements of this Determination. The example given is that the Determination applies to products designed primarily for human comfort which fall into the specified product classes even if they are used in a close control context (which would for instance include the cooling of data centres).

Section 10—Classes of products that are not covered by this Determination

Section 10 sets out the classes of products that are not covered by the Determination. These are:

- close control air conditioners and liquid-chilling packages (these are covered by other GEMS determinations);
- evaporative coolers or any other cooling systems that are not of the vapour compression type (vapour compression type air conditioners that have an enhancement or option to assist the operating energy efficiency, e.g. solar-boosted air conditioners, are covered by the Determination);
- water-to-air air conditioners;
- dehumidifiers;
- air conditioners powered by mains electricity specifically designed and sold only for installation in end-use mobile applications, such as caravans, mobile homes, camper vans, boats and rail cars (these have design specifications and test evidence of complying with Australia/New Zealand or IEC Standards requirements under conditions of mobile use. Units installed in portable buildings are covered by this Determination);

- air conditioners powered by mains electricity specifically designed and sold only for installation in specialised high temperature industrial applications, such as crane cabins used over blast furnaces; and
- air conditioners that do not condition air sourced from within the conditioned space, but instead condition air sourced from outside the conditioned space, and deliver that air to the conditioned space.

PART 3—GEMS LEVEL REQUIREMENTS

Section 11—Purpose of Part

This section indicates that the purpose of Part 3 of the Determination is to specify GEMS level requirements (also known as minimum energy performance standard or MEPS levels) under section 25 of the Act for air conditioners covered by the Determination.

Section 12—GEMS level requirements (MEPS levels)

Section 12 specifies GEMS level requirements for products covered by this Determination by reference to the applicable provisions of the Air Conditioners up to 65kW Determination, as if references to the ‘relevant MEPS level’ in those provisions were to the amounts specified for the product class in Schedule 1 to this Determination.

Paragraph 12(a) of this Determination indicates that products which do not have variable capacity must comply with the applicable provisions of section 22 of the Air Conditioners up to 65kW Determination.

That section requires that:

- products capable of cooling must have a rated and tested Annual Energy Efficiency Rating (AEER) at full load greater than or equal to the relevant MEPS level; and
- products capable of heating must have a rated and tested Annual Coefficient of Performance (ACOP) at full load greater than or equal to the relevant MEPS level.

The section also notes that reverse cycle products must meet the relevant MEPS level for both cooling and heating (AEER and ACOP).

Paragraph 12(b) of this Determination indicates that products which have variable capacity must comply with the applicable provisions of section 23 of the Air Conditioners up to 65kW Determination.

Section 23 of the Air Conditioners up to 65kW Determination establishes the same GEMS level requirements at full load as for products without variable capacity under section 22 of that Determination. Unlike section 22, however, section 23 also provides alternative (part-load) requirements for cooling and heating for products that are not quite able to meet the full load requirements, in recognition of the fact that variable capacity air conditioners are sometimes optimised for performance at part-load rather than full load.

The part-load requirements are only available for a product if its AEER or ACOP at full load is at least 95 percent of the relevant MEPS level. Where this is the case, the product must also be tested at a part-load point nominated by the manufacturer. If the nominated part-load point is between 83.3 per cent and 100 per cent of full load, the tested AEER or ACOP at that point must meet the relevant MEPS level.

For circumstances where the nominated part-load point is between 50 per cent and 83.3 per cent of full load, the formula specified at subsection (4) is used to calculate the AEER or ACOP with which the product must comply at that point (known as AEER_{part-load} or ACOP_{part-load}).

Section 23 of the Air Conditioners up to 65kW Determination notes that reverse cycle products must meet the requirements of the section for both cooling and heating. This could result in a product complying by:

- meeting the relevant MEPS level at full load for both cooling and heating;
- meeting the relevant MEPS level at full load for cooling and meeting the part-load requirements for heating, or vice-versa;
- meeting the part-load requirements at the same part-load point for both cooling and heating; or
- meeting the part-load requirements at different part-load points for cooling and heating.

Example

Two variable capacity reverse-cycle ducted single split systems (product A and product B) have a 75kW rated standard cooling full capacity. They are both in Product Class 25, as per Schedule 1, and the relevant MEPS level is 2.90.

Full load compliance

When rated and tested at full load, product A achieves both an AEER (for cooling) and an ACOP (for heating) of 2.90. It complies with section 23 of the Air Conditioners up to 65kW Determination without the need for further testing.

Part-load compliance

When rated and tested at full load, product B achieves neither an AEER nor ACOP of 2.90, but achieves 2.755 for both (95 per cent of 2.90). The part-load compliance pathway is open to product B.

The manufacturer nominates part-load points of 85 per cent of full load for cooling, and 50 per cent of full load for heating. Product B's standard heating part-load capacity at that point is assumed to be 50% of its standard heating full load capacity. To comply under the part-load requirements of section 23 of the Air Conditioners up to 65kW Determination, the product would need to:

- have a rated and tested AEER at 85 per cent of full load of greater than or equal 2.90; and
- have a rated and tested ACOP at 50 per cent of full load of greater than or equal to $[1.25 - 0.3 \times 0.5] \times 2.90 = 3.19$.

Note: In this part-load compliance example, the only additional test required is the cooling test at 85 per cent of full load, because the testing requirements for all variable capacity units in Product Class 25 include heating and/or cooling tests at 50 per cent of full load. Another additional test would be required if the manufacturer had nominated a different part-load point for heating.

Section 13—Testing requirements

Section 13 specifies that the testing requirements for the purposes of Part 3 are set out in Schedule 2 to the Air Conditioners up to 65kW Determination except as modified by Schedule 2 to this Determination.

PART 4—GEMS LABELLING REQUIREMENTS

Section 14—Purpose of part

This Part specifies GEMS labelling requirements for products covered by the Determination under paragraph 24(1)(b) and section 26 of the Act.

This Part applies only in relation to retail supplies and offers of retail supply.

Note that none of the air conditioners covered by this Determination are required to display energy rating labels. While this is the case, some suppliers may choose to include rating information in advertising material, and such information is subject to the requirements of section 15 of the Determination.

Section 15—Advertising material—references to SEER ratings

Section 15 provides that section 34 of the Air Conditioners up to 65kW Determination, which relates to references to Seasonal Energy Efficiency Ratio (SEER) and star ratings in advertising material, applies to products covered by this Determination.

Section 34 specifies that sales literature may include SEER ratings and/or star ratings. Such ratings must indicate which temperature zone it applies (hot, average or cold). If SEER ratings are included, the sales literature must specify whether the SEER rating is a residential or commercial rating.

Section 16—Impact of replacement determination

Section 16 provides a mechanism, in the event that this Determination is replaced in the future, to allow a transitional labelling provision to be specified in that replacement determination (the new determination) with the effect that complying with its requirements will be taken to be compliance with the labelling requirements of this Determination. This is to prevent the situation arising, in circumstances where a registrant chooses to register to the new determination between the time it is made and when it comes into force (as allowed by section 44 of the Act), of a product needing to comply with the labelling requirements of both determinations.

Section 17—Testing requirements

Section 17 provides that testing requirements for the purposes of this Part are set out in Schedule 2 to the Air Conditioners up to 65kW Determination, subject to the modifications set out in Schedule 2 to this Determination.

PART 5—OTHER REQUIREMENTS

Section 18—Purpose of Part

This section indicates that the purpose of Part 5 of the Determination is to specify other requirements, that is, requirements other than GEMS level requirements or GEMS labelling requirements, under section 27 of the Act for air conditioners covered by the Determination.

Section 19—Product performance—average true power factor

Section 19 states that section 40 of the Air Conditioners up to 65kW Determination applies in relation to products covered by this Determination. The paragraph of that section that applies to products of a size relevant to this Determination, specifies a tested average true power factor greater than or equal to 0.80. ‘Average true power factor’ is defined to mean the average ratio over a given time of the tested kilowatt hours (kWh) divided by the tested kilo volt ampere hours (kVAh), which is different to the average of regular instantaneous power factor measurements.

The purpose of setting a requirement for average true power factor is to prevent negative impacts on the quality of the power supply, both for individual products at the household level and in the aggregate at the network level, which can arise when the average true power factor is too low.

Section 20—Testing requirements

Section 20 specifies that the testing requirements for the purposes of Part 5 are those set out in Schedule 2 to the up to Air Conditioners up to 65kW Determination, as modified by Schedule 2 to this Determination.

SCHEDULE 1—PRODUCT CLASSES AND MINIMUM ENERGY PERFORMANCE STANDARDS

This Schedule specifies 4 numbered product classes that are covered by this Determination, for the purposes of section 9, and the MEPS level that applies to each of them. The product classes are set out in a table, and grouped according to the kind of product (for example, air-to-air unitary air conditioners or air-to-air single-split systems). The capacity is determined on the basis of their rated standard cooling full capacity, unless they are heating only products, in which case their rated standard heating full capacity must be used.

When read in conjunction with section 10, which identifies classes of products that are excluded from the coverage of the Determination, Schedule 1 provides sufficient information to allow a member of the regulated community to determine if a particular product is in scope and, if so, which MEPS level applies to it.

SCHEDULE 2—MODIFICATION OF TESTING REQUIREMENT PROVISIONS

Section 1—Modification of testing requirement provisions of the Air Conditioners up to 65kW Determination

This section specifies that Schedule 2 to the Air Conditioners up to 65kW Determination applies in relation to this Determination as if:

- it referred to the relevant parts of this Determination instead of the Air Conditioners up to 65kW Determination;
- it provided instead that any of the test methods identified in the table at subsection 4(3) may be used;
- section 9, which relates to testing for noise (sound power) that is not required for products covered by this Determination, were omitted;
- the note after the heading of section 10, which refers to the relevant product classes for multi-split outdoor units, instead referred to product class 27, which is the product class for multi-split outdoor units in this Determination;
- the note following subsection 10(3), which relates to energy rating labels and is not relevant to products covered by this Determination, were omitted; and
- paragraph 15(2)(a), which relates to a requirement for representative indoor units in testing that is not relevant to products covered by this Determination, were omitted.

Text from the Explanatory Statement to the Air Conditioners up to 65kW Determination, for the relevant provisions of Schedule 2 to that Determination, is reproduced below for ease of reference (with some minor editing to aid clarity in this context).

Section 2—General

Section 2 of Schedule 2 to the Air Conditioners up to 65kW Determination sets out a number of general rules for how tests for the purposes of the Determination are to be conducted.

The rules cover:

- how numbers derived from tests are to be rounded;
- the prohibition of circumvention devices, that is, devices or controls that alter the behaviour of the product under test such that the test results are unrepresentative of how the product would perform in normal use; and
- the testing of solar-boosted air conditioners, so that consumers can be confident that a solar-boosted air conditioner will meet the MEPS requirements if it is receiving little or no solar input.

Definitions are provided for the terms ‘circumvention device’ and ‘solar-boosted air conditioner’ to assist readers to understand how and to what the rules are applied.

Section 3—Test simulation software

Section 3 of Schedule 2 to the Air Conditioners up to 65kW Determination sets out a framework for permitting the use of test simulation software instead of physical

testing for some of the required tests set out later in Schedule 2. This approach can reduce the overall cost of testing required for an applicant to demonstrate compliance with the requirements of the Determination. The framework is intended to provide confidence that the results provided by test simulation software are robust and repeatable, and similar to those that would be provided by the relevant physical test.

The tests for which test simulation software must not be used are set out in subsection 3(4) – these are the tests for average true power factor, and tests conducted for heating performance at H2 and H3 temperature conditions.

The GEMS Regulator may authorise particular test simulation software for products of a particular type if satisfied that the software package has an accuracy equivalent to the relevant physical test standard for products of that type. The following are the types of products for the purposes of this section:

- ducted split systems;
- non-ducted split systems;
- multi-split systems;
- ducted unitary systems;
- non-ducted unitary systems.

Evidence of accuracy to this level may include (but is not limited to) a full physical test report and a full simulation test report on the same product, or a smaller model in the same product range. Other information may be required to demonstrate the accuracy of the software to the GEMS Regulator's satisfaction, depending on the circumstances, but given the intention of this section is to provide some relief from the burden of physical testing, such additional information requirements should not impose unreasonable additional burden. Such evidence may be required for each product class/type combination for which the supplier wishes to use test simulation software.

Once test simulation software has been authorised, it may be used for products that:

- are of the same type as the product for which the software has been authorised; and
- are in the product classes specified in the authorisation.

Section 4—Use of calorimeter and air enthalpy test methods

Section 4 of Schedule 2 to the Air Conditioners up to 65kW Determination establishes requirements for which products, and what physical tests, a calorimeter room test method must be used, and for which an indoor air enthalpy test method may be used.

A calorimeter room measures the performance of the equipment under test conditions by measuring and accounting for all of the energy flows on both sides of the equipment's refrigeration cycle. It uses a minimum of two precisely controlled chambers to simulate the indoor and outdoor environments. It is considered the most accurate measuring device, and while it is relatively simple and cost effective for small, simple equipment such as non-ducted single-split systems, testing large and complex equipment can become difficult and costly.

Air enthalpy tests measure the temperature and humidity of air entering and leaving the equipment under test. From this, cooling or heating performance can be calculated. The setup of this test is relatively easy and inexpensive, even for large or complex equipment.

Note: Paragraph 1(b) of Schedule 2 to this Determination modifies the application of this section of the Air Conditioners up to 65kW Determination, to allow an indoor enthalpy test or a calorimeter room test method for any test, as well as allowing a shortened calorimeter room test spanning three complete defrost cycles for an H2 or an H3 heating test. It is also noted that H2 and H3 tests are not mandatory for air conditioners above 65kW.

Section 5—Use of default test values in AS/NZS 3823.4.1:2014

Section 5 of Schedule 2 to the Air Conditioners up to 65kW Determination specifies that for Part 4 of the Determination, fixed capacity products have the option to use the default values of Table 1 of AS/NZS 3823.4.1:2014 for the low temperature cooling capacity test, rather than perform a physical test at these conditions. These defaults are based on tested values from the standard cooling full capacity test. The standard cooling full capacity is multiplied by 1.077 and the power input is multiplied by 0.914.

Section 6—Rating variable capacity products as fixed capacity products

Section 6 of Schedule 2 to the Air Conditioners up to 65kW Determination specifies that for Part 4 of that Determination, variable capacity, two-stage capacity, and multi-stage capacity units (which are defined in section 5 of the Air Conditioners above 65kW Determination 2020) can be tested and rated as a fixed capacity product for the purposes of testing to Table 1 of AS/NZS 3823.4.1:2014 and/or AS/NZS 3823.4.2:2014. This could be achieved by using the manufacturer's compressor locking instructions for the standard heating full capacity and/or standard cooling full capacity test (as applicable), which are done at the H1 and T1 temperature conditions respectively, for the other heating and cooling test temperatures.

The default values specified in section 5 of Schedule 2 to the Air Conditioners up to 65kW Determination may be used as an alternative to performing the low temperature cooling capacity test, with the capacity locked according to the instructions provided by the manufacturer.

Note: The requirements of this section generally relate to testing conducted for the purposes of calculating SEER and star ratings for energy rating labels. While energy rating labels are not required for products above 65kW, SEER and star ratings may be communicated in advertising material for these products (see section 15 of the Determination).

Section 7—Degradation coefficient of AS/NZS 3823.4

Section 7 of Schedule 2 to the Air Conditioners up to 65kW Determination specifies that for Part 4 of that determination, the value for the Degradation Coefficient (C_D) of Table 1 in both AS/NZS 3823.4.1:2014 and AS/NZS 3823.4.2:2014 may not be changed from the default value of 0.25.

While the standards permit the applicant to change the default degradation coefficient via a specified test procedure, there have been reproducibility issues with this optional test. This section locks the degradation coefficient value at 0.25, which is the same default value used in the European Union's seasonal testing and labelling standard EN 14825:2012.

Section 8—Seasonal rating tests

Section 8 of Schedule 2 to the Air Conditioners up to 65kW Determination specifies the required cooling and/or heating test points to which products must be tested in relation to a SEER rating, by reference to the relevant Australian/New Zealand standards. Air conditioners covered by the Determination have the option of being tested to the relevant heating test points identified in Table 1 in AS/NZS 3823.4.2:2014 or being tested and rated as per the standard heating full capacity test.

Subsection 8(5) clarifies that any of the optional tests under the standards may also be performed.

Section 9—Noise (sound power) testing

Section 9 of Schedule 2 to the Air Conditioners up to 65kW Determination is not relevant to products covered by this Determination.

Section 10—Specific requirements for multi-split outdoor units

The revoked Determination (the *Greenhouse and Energy Minimum Standards (Air Conditioners and Heat Pumps) Determination 2013*) regulated multi-split systems by identifying the system as a whole as the regulated product, that is, each unique combination of indoor and outdoor units. This proved to be problematic and administratively burdensome, due to the large number of potential combinations, some of which sold only in very small volumes.

The Air Conditioners up to 65kW Determination addresses this issue by identifying the multi-split outdoor unit as the regulated product (product classes 18 to 21). A multi-split outdoor unit may be supplied or offered for supply in relation to any appropriate system of outdoor and indoor units (including a system with a single indoor unit). Outdoor units are also sometimes offered for sale individually rather than as part of a system, such as for use as replacements for damaged or non-functioning outdoor units.

Section 10 of Schedule 2 to the Air Conditioners up to 65kW Determination specifies that test results for multi-split outdoor units are on the basis of a tested multi-split system, consisting of a representative combination of indoor units. The section specifies the physical and documentary requirements for the representative combination. The section applies to all tests for such units undertaken for the purposes of Part 3 and Part 5 of the Determination. Tests for Part 4 (GEMS labelling requirements) are not relevant because multi-split outdoor units are not permitted to be labelled.

Section 11—Alternative test methods for VRF type multi-split outdoor units and products > 30kW

Section 11 of Schedule 2 provides alternative options for tests undertaken for Part 3 and Part 5 of the Air Conditioners up to 65kW Determination for variable refrigerant flow multi-split outdoor units and products with a capacity greater than 30kW, that are not unitary single duct air conditioners or water-to-air air conditioners.

Testing may be conducted to specified alternative test methods. These are:

- EN 14511:2018;
- a standard based on ISO 5151:2017 (non-ducted air conditioners, any VRF multi-split and fixed head multi-split outdoor unit);
- a standard based on ISO 13253:2017 (ducted air conditioners);
- a standard based on ISO 15042:2017 (multi-split outdoor units);
- AHRI 1230:2010.

In addition to these alternative test methods, certified test certificates from the Air-Conditioning, Heating, and Refrigeration Institute (AHRI), or the European Association of Air Handling and Refrigerating Equipment Manufacturers (Eurovent), may be relied upon without the need for further testing to be conducted.

Each of the alternatives outlined above may only be relied on in relation to testing at an electrical supply voltage of 230V single-phase or 400V three-phase, a frequency of 50Hz, and the H1, H2, H3 or T1 temperature conditions.

The use of these standards is consistent with the Australian Government's policy of harmonisation with international standards where appropriate.

Sections 12, 13 and 14 of Schedule 2 to the Air Conditioners up to 65kW Determination provide specific requirements for classes of air conditioners that are not covered by this Determination.

Section 15—Specific requirements for single-split outdoor units

Section 15 of Schedule 2 to the Air Conditioners up to 65kW Determination specifies requirements for the testing of single-split outdoor units for all tests undertaken for the purposes of Part 3 and Part 5 of the Determination, where they are not supplied or offered for supply as part of a single-split system, in much the same way as section 10 does for multi-split outdoors units. Single-split outdoor units may be sold as a replacement part for an existing single-split system,

This section specifies that single-split outdoor units must be tested with a representative indoor unit, and specifies requirements for the indoor unit.

Section 16—Specific requirements for testing for average true power factor

Section 16 of Schedule 2 to the Air Conditioners up to 65kW Determination specifies that the average true power factor must be determined in a physical test over a period of not less than 5 minutes of operation, and be based on the results of a full load heating or cooling (or both) capacity test. The values must not be calculated through simulation testing.

Statement of Compatibility with Human Rights

Prepared in accordance with Part 3 of the Human Rights (Parliamentary Scrutiny) Act 2011

Greenhouse and Energy Minimum Standards (Air Conditioners above 65kW) Determination 2020

This Legislative Instrument is compatible with the human rights and freedoms recognised or declared in the international instruments listed in section 3 of the *Human Rights (Parliamentary Scrutiny) Act 2011*.

Overview of the Legislative Instrument

The *Greenhouse and Energy Minimum Standards (Air Conditioners above 65kW) Determination 2020* prescribes matters relating to minimum energy efficiency requirements for air conditioners under the *Greenhouse and Energy Minimum Standards Act 2012*. The Determination establishes requirements for energy use, including requirements for conducting tests in order to demonstrate compliance with the energy use requirements. The Determination also sets out the circumstances in which two or more models in a product class may be a family of models, and establishes the applicable product category for the purposes of calculating certain penalties under the Act.

Human rights implications

This Legislative Instrument does not engage any of the applicable rights or freedoms.

Conclusion

This Legislative Instrument is compatible with human rights as it does not raise any human rights issues.

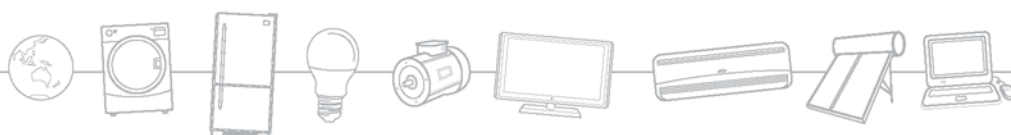
The Hon Angus Taylor MP
Minister for Energy and Emissions Reduction



Decision Regulation Impact Statement: Air conditioners

Regulatory reform opportunities and improving energy efficiency outcomes

December 2018



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

Authorised Version Explanatory Statement registered 06/01/2021 to F2021L00038

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Executive summary

Background

Air conditioners provide a cooling and heating (or cooling only) service to improve the thermal comfort of an indoor space—such as a room, house or apartment building. Air conditioners are also used in commercial and industrial buildings, such as offices, shopping centres and manufacturing premises. This Regulation Impact Statement (RIS) considers changes to the energy efficiency regulations for air source air conditioners that use the vapour compression refrigeration cycle (refrigerative air conditioners).

Around one million air conditioners of this type are sold in Australia each year, with a total stock of almost 12.5 million in 2016. A further 100 000 air conditioners (also referred to as heat pumps) are sold in New Zealand each year, with a total stock of 1.2 million in 2016.

The Equipment Energy Efficiency (E3) program applies Minimum Energy Performance Standards (MEPS) and Energy Rating Labels (labels) to a range of air conditioners sold in Australia and New Zealand.

The MEPS for air conditioners increased through the 2000s. This was in response to the increase in the proportion of households with air conditioners (from 24 per cent in 1999 to 52 per cent in 2008) and the subsequent increase in electricity demand, particularly peak electricity demand.

Problem

These regulations have promoted the development and adoption of energy efficient air conditioners in Australia and New Zealand. There is scope, however, to improve the energy efficiency of air conditioners sold in both countries by removing the shortcomings with the regulations, which have not kept pace with technology and changes in the market.

Objective

The objective of the proposed government action is to resolve issues with the regulations that impede the supply and purchase of energy efficient or effective air conditioners. Without government action, these market distortions and unnecessary costs would continue. Resolving the issues would also contribute to government objectives to improve energy productivity and reduce greenhouse gas emissions.

Policy options

Three policy options (Options A, B and C) have been identified to resolve these problems. The options bring together seven policy proposals. The proposals have been grouped so that they progressively involve more intervention in the market. A summary of the proposals is provided in Table 1, with details provided in the body of the RIS.

Table 1 Policy options

Policy Proposal	Option A	Option B	Option C
1. Energy efficiency information: Adopt the Seasonal Energy Efficiency Ratio (SEER ¹) standard for rating air conditioner energy efficiency. Remove the existing Energy Rating Label and replace it with the Zoned Energy Rating Label.	X	X	X
2. Portable air conditioners: For double duct portable air conditioners, reduce the Minimum Energy Performance Standard (MEPS) and apply the Zoned Energy Rating Label. For single duct portable air conditioners, apply the Zoned Energy Rating Label (tested to AS/NZS 3823.1.5).	X	X	X
3. Commercial and industrial air conditioners: include MEPS for air conditioners >65 kW capacity under the energy efficiency regulations (currently specified in Australia under the National Construction Code (NCC)).	X	X	X
4. Technical fixes: Resolve minor technical issues with air conditioner regulations.	X	X	X
5. Align Australia and New Zealand MEPS: Increase New Zealand's residential cooling MEPS to Australia's levels.	X	X	X
6. MEPS for single duct portable air conditioners: Apply MEPS to single duct portable air conditioners.		X	X
7. MEPS for commercial and industrial air conditioners: Increase MEPS for air conditioners >65 kW capacity.			X

The policy proposals would introduce new regulatory costs, through testing, re-tooling of production and other compliance costs. If implemented, the cost impacts would be constrained by removing unnecessary costs imposed by the existing regulations. While the cost increases would generally be borne by businesses, they are likely to be passed on to consumers through increases in the price of air conditioners. The higher costs are expected to be more than offset by the energy and greenhouse gas emission savings the changes to the regulations are projected to deliver.

¹ The commonly used term 'SEER' is not mentioned in AS/NZS 3823.4. The Total Cooling Seasonal Performance Factor (TCSPF, or F_{TCSP}) of AS/NZS 3823.4.1 and the Heating Seasonal Performance Factor (HSPF, OR F_{HSP}) of AS/NZS 3823.4.2 would be the rating metrics (see Attachment B for further details), but for simplicity are referred to as SEER ratings.

Cost benefit estimates

A summary of the estimated costs and benefits of the policy options is shown in Table 2 and Table 3.

Table 2 Cost benefit estimates - Australia

Option	Energy Saved (cumulative to 2030 - GWh)	GHG Emission Reduction (cumulative to 2030) Mt	Total Benefit (A\$M)	Total Cost (A\$M)	Net Benefit (A\$M)	BCR
Option A	2,329	1.8	\$651	\$153	\$498	4.2
Option B	2,432	1.8	\$673	\$159	\$515	4.2
Option C	2,554	1.9	\$705	\$163	\$543	4.3

Note: This table uses a discount rate of 7%.

Table 3 Cost benefit estimates - New Zealand²

Option	Energy Saved (cumulative to 2030- GWh)	GHG Emission Reduction (cumulative to 2030) kt	Total Benefit (NZ\$M)	Total Cost (NZ\$M)	Net Benefit (NZ\$M)	BCR
Option A	455	44.0	\$42	\$15	\$27	2.8
Option B	456	44.2	\$42	\$15	\$27	2.8
Option C	457	44.3	\$42	\$15	\$27	2.8

Note: This table uses a discount rate of 6%.

The cost benefit estimates indicate Option C would provide the largest net benefit in both Australia and New Zealand at A\$543 million and NZ\$27 million respectively. Option C would also provide the largest energy and greenhouse gas savings, but also has higher costs than Options A and B.

For Australia, the benefit cost ratios are similar across the policy options, with Option C having the highest benefit cost ratio at 4.3:1. For New Zealand, the benefit cost ratios for the three options are the same. There is little difference between the options for New Zealand, because the two product categories (single duct portable air conditioners and air conditioners greater than 65 kW in capacity) that separate Option A from Options B and C are only a small component of the New Zealand market.

The cost benefit estimates by policy proposal are shown in Tables 4 and 5.

² National benefits are assessed using the avoided long run marginal cost of electricity (as required by New Zealand's cost benefit methodology). Accordingly, resource costs are used to assess the cost of efficiency improvements (assumed to be 50 per cent of the product's retail price). The benefits for New Zealand also include financial benefits associated with greenhouse gas abatement.

Table 4 Australia - cost benefit estimates by policy proposal

Policy proposal	Energy Saved (cumulative to 2030 - GWh)	GHG Emission Reduction (cumulative to 2030) kt	Total Benefit (A\$M)	Total Cost (A\$M)	Net Benefit (A\$M)	BCR
Energy efficiency information (Zoned Label)	1,271	962	351	101	250	3.5
Energy efficiency information (SEER mandatory disclosure)	856	641	254	42	212	6.0
Portable air conditioners (Zoned Label plus lower MEPS for double ducts)	143	107	31	6	25	5.1
Commercial/industrial air conditioners (NCC MEPS levels)	111	83	15	2	14	9.3
Total (Option A)	2329	1755	651	151	500	4.3
MEPS for single duct portables only	103	77	22	5	17	4.2
Total (Option B)	2432	1832	673	157	517	4.3
MEPS for commercial/industrial air conditioners (2.90 MEPS level only)	122	96	33	4	29	8.8
Total (Option C)	2554	1928	706	160	546	4.4

Note: In this table the costs do not include the administrative costs of business compliance or government administration. This means that compared with the summary table, the total costs are slightly lower and the NPVs and BCRs are slightly higher. The proposal to align New Zealand MEPS has no impact in Australia, so is not presented.

For Australia, the cost benefit estimates by policy indicate that each of the proposals would deliver a net benefit. The majority of the net benefit (A\$461m) is projected to be delivered through the improved energy efficiency information provided by adopting the SEER standard and Zoned Energy Rating Label.

The proposals for portable air conditioners are projected to provide a net benefit of between A\$25 million (Option A) and A\$42 million (Option B). The proposals for air conditioners greater than 65 kW capacity are projected to provide a net benefit of between A\$14 million (Option A) and A\$43 million (Option C). The higher benefit cost ratio for air conditioners greater than 65 kW is because they are installed in commercial or industrial premises and operate two to three times longer than household air conditioners.

Table 5 New Zealand - cost benefit estimates by policy proposal

Policy proposal	Energy Saved (cumulative to 2030- GWh)	GHG Emission Reduction (cumulative to 2030) kt	Benefit (NZ\$M)	Cost (NZ\$M)	Net Benefit (NZ\$M)	BCR
Energy efficiency information (Zoned Label)	392	38	35	13	22	2.8
Energy efficiency information (SEER mandatory disclosure)	54	5	5	2	4	3.3
Portable air conditioners (Zoned Label plus lower MEPS for double ducts)	2	0.2	0.1	0.0	0.1	2.8
Commercial/industrial air conditioners (Australian NCC MEPS levels)	1	0.1	0.1	0.0	0.0	3.3
Align Australia/New Zealand cooling MEPS	6	1	0.4	0.2	0.2	2.2
Total (Option A)	455	43	41	15	26	2.8
MEPS for single duct portables only	1	0.1	0.1	0.0	0.1	2.4
Total (Option B)	456	44	41	15	26	2.8
MEPS for commercial/industrial air conditioners (2.90 MEPS level only)	1	0.1	0.1	0.0	0.1	3.2
Total (Option C)	457	44	41	15	27	2.8

Note: In this table the costs do not include the costs of business compliance or government administration. This means that compared with the summary tables, the total costs are slightly lower and the NPVs and BCRs are slightly higher.

For New Zealand, the cost benefit estimates by policy also indicate that all of the proposals would deliver a net benefit. Almost all of the net benefit (NZ\$26 million of the NZ\$27 million) is projected to be delivered through the improved energy efficiency information provided by adopting the SEER standard and Zoned Energy Rating Label.

Sensitivity testing was conducted on the cost benefit estimates to test the implications of different assumptions for product costs and discount rates. This analysis indicates there is still a net benefit for each of the options, if the costs were increased by 50 per cent, if the learning rates (the rate at which costs decline over time) are reduced by 50 per cent or if the discount rate is increased. If the learning rates are reduced to zero, the policy options still provide a net benefit in Australia, but not in New Zealand. A scenario where the costs of the energy efficiency improvement do not reduce at all over the 12 year projection period is not considered likely.

Consultation

The final proposals are the result of extensive stakeholder consultation, including:

- the development of two standards that underpin the proposed changes
- a Consultation RIS, which included six meetings across Australia and New Zealand
- a supplementary consultation paper modifying the proposals following feedback and discussed at two meetings in Australia and New Zealand
- a consultation paper and meeting on the timing for introducing any new regulations
- ongoing discussions through the E3 program's Air Conditioner and Commercial Refrigeration Advisory Committee (ACRAC).

There was wide support from industry associations and individual companies for the proposals common to Options A, B and C. The Australian/New Zealand standards that underpin the proposed new energy efficiency rating method and the regulation of portables were developed at the request of industry stakeholders. There was also support for including air conditioners greater than 65 kW capacity under the E3 program.

New Zealand stakeholders supported the proposal to align with the Australian MEPS levels for cooling, indicating that it would have a minor effect on the market. Consultation on the technical fixes also identified a preferred option for each fix to simplify the regulations and remove regulatory burden where possible.

For the proposal to introduce a MEPS on single duct portable air conditioners (included in Options B and C), there was unanimous support once the proposed MEPS level was reduced to 2.50 following stakeholder feedback. The proposal to increase the MEPS for 65 kW air conditioners to 2.90 (included in Option C only) was also generally supported, provided sufficient time was provided for suppliers to meet the higher MEPS levels.

There were, however, some areas of disagreement with specific proposals from some companies. For example, one supplier of portable air conditioners did not agree with the energy labelling proposal; while another supplier of large capacity air conditioners did not agree with increasing the MEPS levels.

Consumer groups were invited to attend consultation meetings and to provide feedback, but did not respond. The consumer group Choice is a member of ACRAC and is also represented on the standards committee that developed the standards that underpin the main proposals and is supportive of the changes. According to Choice, "These steps are likely to have significant benefits for consumers, in particular ... helping to reduce household energy consumption and costs, by helping consumers to choose more efficient air conditioner models and therefore encouraging the production and sale of same."

Evaluation and Conclusion

Option C is the preferred option. It is estimated to provide the largest net benefit in Australia and New Zealand, and would also provide the largest energy and greenhouse gas emission savings.

Implementation and Review

The main implementation risk from the proposals is suppliers having insufficient time to adjust to the proposed new regulations. This could affect the availability of products, market competition, or compliance with the new regulations. This risk has been mitigated by having different start dates for the proposals, taking into account the amount of time suppliers would require to adjust.

If the COAG Energy Council approves one of the policy options, the *Greenhouse and Energy Minimum Standards (Air Conditioners and Heat Pumps) Determination 2013* would be revised for approval by the Commonwealth Minister for the Environment and Energy. In New Zealand, a policy option needs to be approved by Cabinet before being adopted under the *Energy Efficiency (Energy Using Products) Regulations 2002*. If approved, the updated regulations would be subject to compliance monitoring and review in both countries.

1. Background

Market

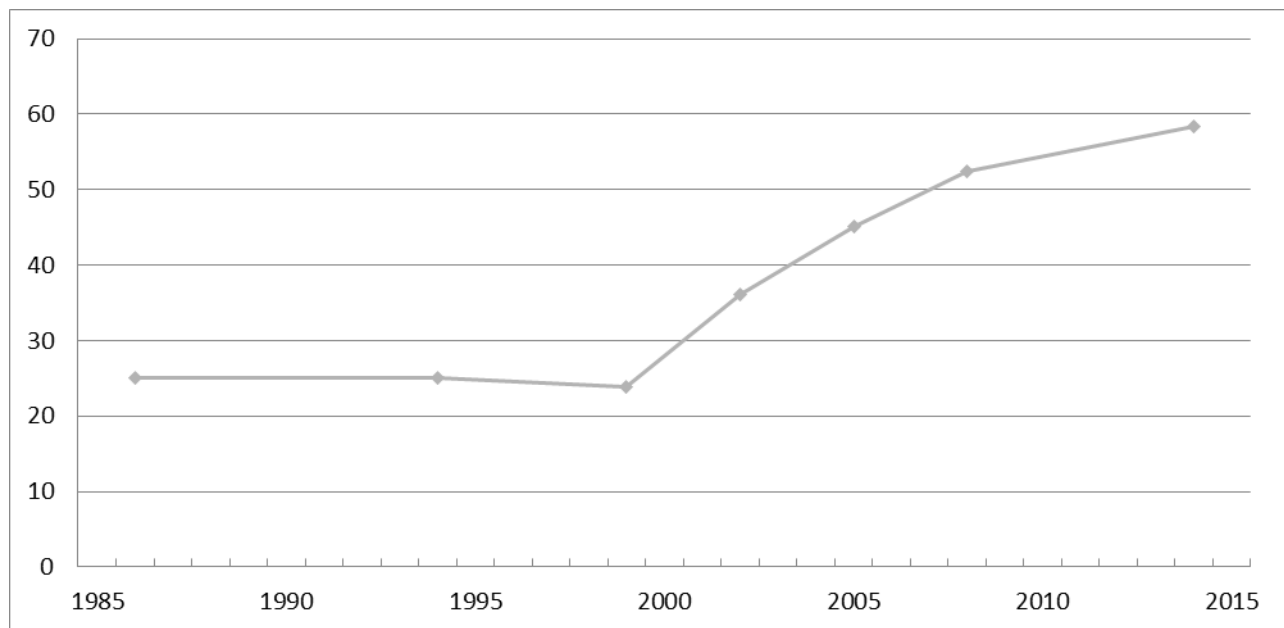
Air conditioners provide a cooling and heating (or cooling only) service to improve the thermal comfort of an indoor space, such as a room, house or apartment building. Air conditioners are also used in commercial and industrial buildings, such as offices, shopping centres and manufacturing premises.

This RIS considers air source³, refrigerative air conditioners. These air conditioners use a technique called the vapour compression cycle to move heat from one space to another. This is an efficient process and the amount of heat moved is typically three or more times the energy required to run the compressor system. This means the cooling or heating output provided by an air conditioner is three or more times greater than the electrical input—an efficiency of 300 per cent or more. This compares to other types of electric heaters (e.g. radiant, oil-filled or fan heater) that are no more than 100 per cent efficient.

One million air conditioners using the vapour compression refrigeration cycle were sold in Australia in 2016, with a total stock of almost 12.5 million. A further 100 000 were sold in New Zealand in 2016, with a total stock of 1.2 million. Figure 1 shows the proportion of Australian households with at least one refrigerative air conditioner (simply referred to as air conditioners hereafter).

³ Air source air conditioners extract or expel heat directly from or to the outdoor air and represent most of the air conditioning market. Water source air conditioners extract or expel heat from or to water and are mainly installed in commercial buildings or apartment complexes. The regulations for water source air conditioners and heat pumps within the scope of AS/NZS 3823.1.3:2005 would remain unchanged. Evaporative air conditioners (which do not have compressors) are not subject to energy efficiency requirements and are not within the scope of this RIS.

Figure 1 Percentage of Australian households with a refrigerative air conditioner, 1985 to 2014



Source: ABS Environmental Issues: Energy use and Conservation, March 2014 and June 1994, cat. no. 4602.0; ABS National Energy Survey 1985-86, cat. no. 8212.0.

Australian Bureau of Statistics (ABS) data shows the percentage of households with air conditioners in Australia was steady at around 25 per cent from the mid-1980s through the 1990s. The proportion of households with air conditioners increased through the 2000s to reach 58 per cent in 2014. This does not include evaporative air conditioners—ownership of these products increased from 6 to 14 per cent between 1994 and 2014.

Ownership of multiple air conditioners is common in some areas of Australia. Almost 60 per cent of Queensland homes have at least two air conditioners, with the proportion in northern Queensland even higher at 90 per cent⁴.

In New Zealand, around 38 per cent of households had an air conditioner (where they are referred to as heat pumps) in 2015, up from 25 per cent in 2010⁵. Eighty per cent of these households have only one air conditioner.

Rising incomes, declining price, higher expectations of thermal comfort and the increasing size of new homes are driving the increasing use of air conditioners⁶. Increasing household

⁴ Highlights from the 2015 Energex Queensland Household Energy Survey. [Energex website](#)

⁵ Buckett NR (Ed), Marston NJ (Ed), Saville-Smith, K, Jowett, J.H., Jones, M.S. 2011. *Preliminary BRANZ 2010 House Condition Survey Report – Second Edition. BRANZ Study Report 240*. BRANZ Ltd, Judgeford, New Zealand.

penetration of air conditioning has been a major contributor to the growth of electricity demand⁷.

There are 50 registered air conditioner suppliers in Australia and New Zealand⁸. The majority of air conditioners are imported, mainly from China, Thailand, Japan, Korea and Malaysia. There are also some local assemblers, particularly of ducted split systems (which are installed as whole building air conditioners in homes and in commercial premises) and ducted packaged units (mainly installed in commercial premises).

Regulations

The E3 program applies MEPS and labels to a range of air conditioners sold in Australia and New Zealand.

Residential air conditioners were first required to carry a label in 1987 and have been subject to MEPS requirements since 2004. Larger three-phase air conditioners (which are often used in non-residential buildings, but include large ducted household units) have been subject to MEPS since 2001 and can use the label on a voluntary basis.

MEPS on air conditioners increased through the 2000s in response to the rapid increase in use and the subsequent increase in electricity demand, particularly peak demand.

Residential air conditioners account for 38 per cent of peak demand in Australia⁹. Peak demand represents the highest point of electricity demand over a given period, such as a day or year.

The regulations are aimed at promoting the development and adoption of energy efficient air conditioners. They are given effect under the *Greenhouse and Energy Minimum Standards Act 2012* (GEMS Act) in Australia and the *Energy Efficiency (Energy Using Products) Regulations 2002* in New Zealand. Air conditioners above 65 kilowatt (kW) capacity are subject to energy efficiency requirements under the Australian NCC, which covers new buildings or significant new works in existing buildings. These large capacity units are not regulated in New Zealand.

⁶ Dear R. and White S. 'Residential air conditioning, thermal comfort and peak electricity demand management' Proceedings of Conference: Air Conditioning and the Low Carbon Cooling Challenge, Cumberland Lodge, Windsor, UK, 27-29 July 2008.

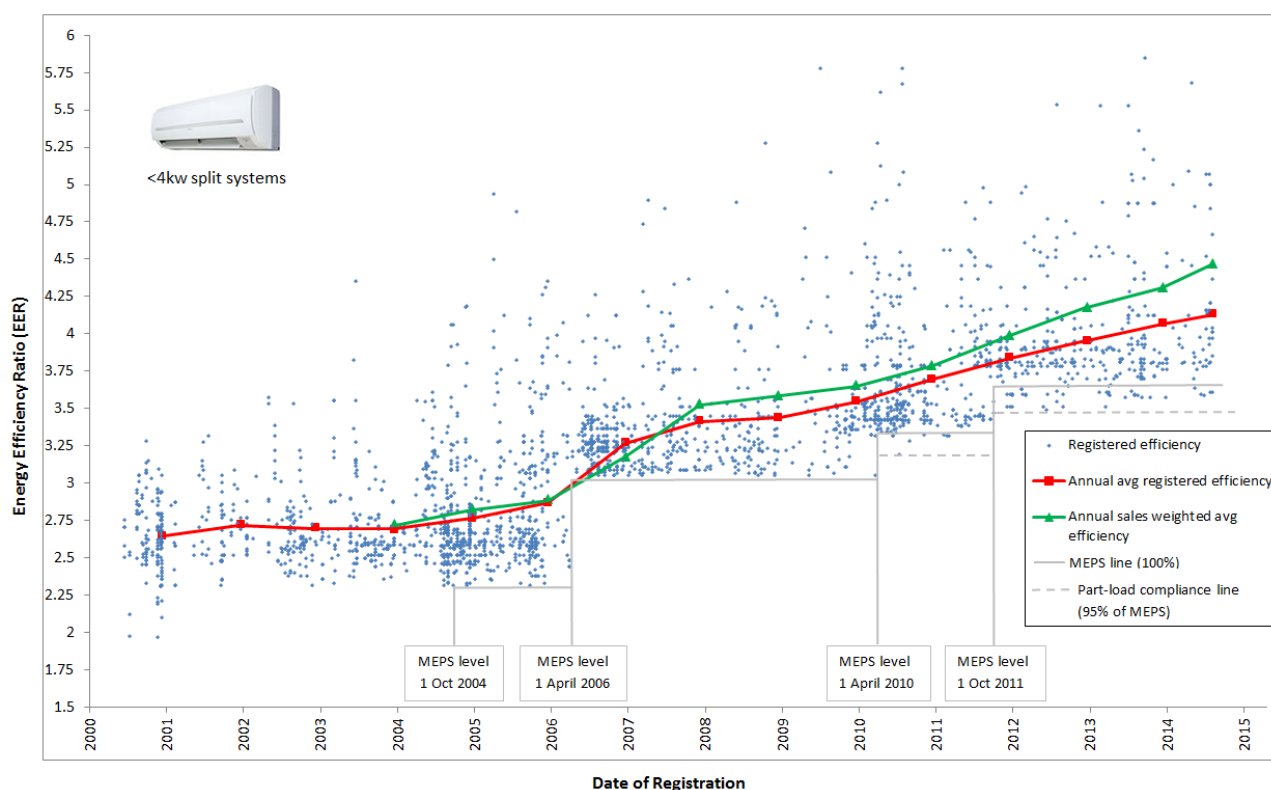
⁷ Department of the Environment, Water, Heritage and the Arts 'Energy use in the Australian Residential Sector: 1986 to 2020', 2008.

⁸ Energy Rating database at 10 January 2017 [Energy Rating website](#)

⁹ Saman W, et al. 'A framework for adaptation of Australian households to heat waves', 2013.

There have been significant improvements in the energy efficiency of air conditioners, due to both natural market improvement and regulatory intervention.

Figure 2 Cooling energy efficiency ratings – Australian air conditioners less than 4 kW capacity, 2000 -2014



Source: [Energy Rating](#) database at August 2014.

Figure 2 above shows the cooling energy efficiency improvement of non-ducted air conditioners with an output of 4 kW¹⁰ or less since 2000:

- The blue dots indicate the cooling efficiency ratings of individual product models.
- The red line shows the average annual registered efficiency of these products.
- The green line shows average annual efficiency weighted for sales.

Figure 2 indicates that since the last MEPS increase in 2011, the least efficient air conditioner under 4 kW on the market was more efficient than the most efficient model released in 2001—a 50 per cent improvement in a decade. Between 2004 and 2014, the sales weighted price of air conditioners decreased from \$1220 to \$854 (in 2013 Australian dollars). The 4 kW category represents around a third of air conditioners sold each year.

Figure 2 also indicates since 2008, the energy efficiency of air conditioners sold has been higher than the average efficiency of the products available. This is the point at which the

¹⁰ This category is presented as the parameters (0 to 4 kW) have remained constant over time in energy efficiency regulations. Further, a time series of sales data is available for the category in Australia.

green line (average efficiency weighted for sales) crosses the red line (average registered efficiency). This change in the market could be a response to above average increases in electricity prices that began around 2007. Sales were 0.34 above the registered average in 2014 (based on the Energy Efficiency Ratio (EER)—the ratio of cooling output to electrical input), which equates to over half a star on the energy efficiency rating scale for this size category.

In New Zealand, air conditioners have been subject to increasing MEPS and energy rating label revisions, most recently in 2013, with a resulting increase in heating and cooling performance. New Zealand also promotes the ENERGY STAR label for air conditioners with high heating performance, and their performance in cold temperatures is tested (the ENERGY STAR program was retired at the end of 2017). In 2016, 45 per cent of sales were for products with a high Coefficient of Performance (COP or heating energy efficiency), with 21 per cent of air conditioners ENERGY STAR qualified.

Figure 3 Efficiency of all New Zealand air conditioners 2004-2014

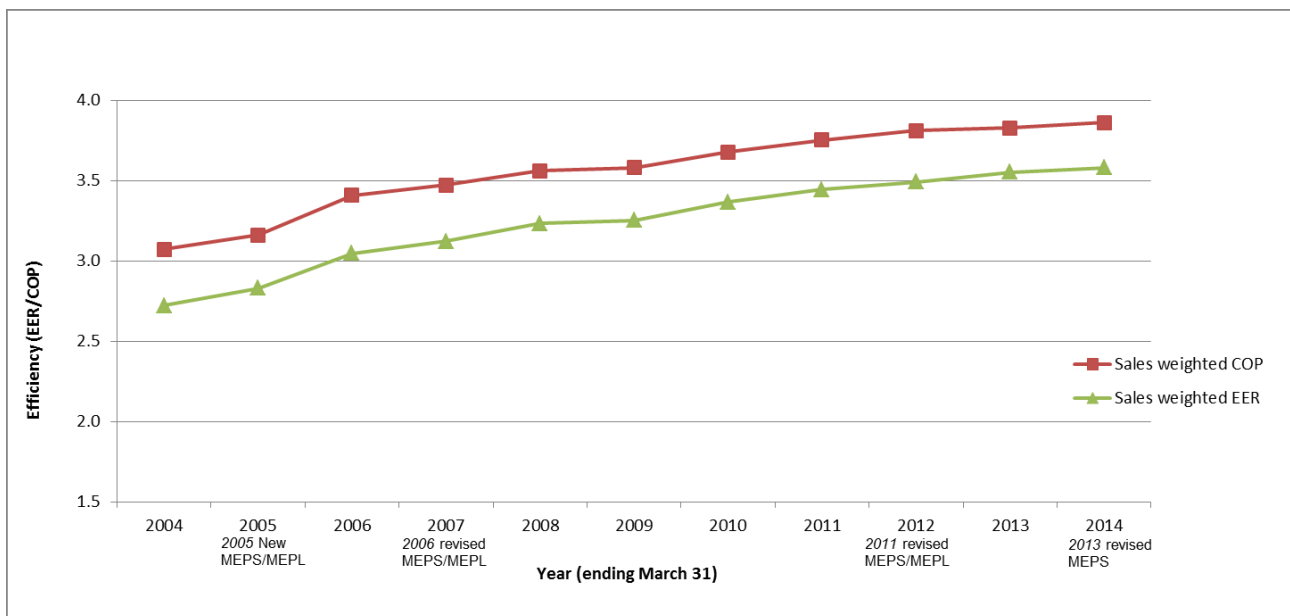


Figure 3 above shows the energy efficiency improvement of air conditioners in New Zealand between 2004 and 2014¹¹. This sales data shows that heating and cooling energy efficiency has improved 26 and 32 per cent respectively over the period.

¹¹ Sales data is collected by EECA for all air conditioners covered by the regulations. Sales data is not collected in Australia.

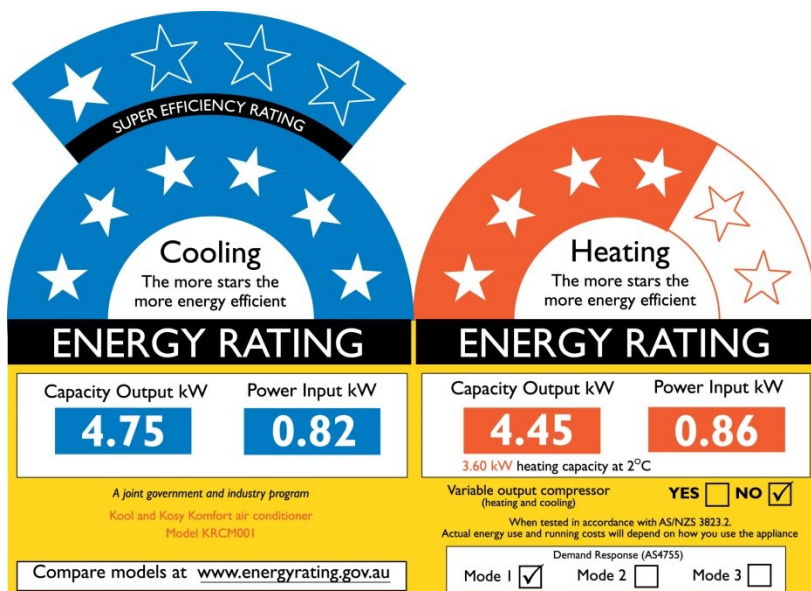
2. The problem

Problems with the regulations

While the regulations have promoted the development and adoption of energy efficient air conditioners, some shortcomings exist. These *regulatory failures* are outlined in this section.

Australia/New Zealand specific efficiency rating method

Figure 4 Energy Rating Label



Source: Energy Rating website

The Energy Rating Label shown in Figure 4 above rates energy efficiency performance based on the Australian/New Zealand test standard AS/NZS 3823.2 *Performance of electrical appliances – Air conditioners and heat pumps*. The tests are performed at ‘full load’ (100 per cent of rated capacity) conditions at the two test points of 35 °C for cooling and 7 °C for heating. These temperature points have been the international rating points for air conditioners since the 1970s, with residential air conditioners first required to carry a label in Australia in 1987 (based on these rating points¹²).

¹² The heating rating point changed slightly in 1998, when the previously Australian only test standard was superseded by an Australian/New Zealand version of an International Standards Organisation test standard.

This rating method has become outdated. Air conditioning technology has changed markedly and variable speed air conditioners (generally referred to as inverters) now dominate the market. Inverters are more energy efficient over the course of a season than fixed speed air conditioners (which can only turn on and off) because they have the ability to run at a reduced capacity.

The label, designed to inform consumers of efficiency and running costs, cannot reflect this difference between inverter and fixed speed air conditioners. This was not a problem when fixed speed air conditioners were the main product type when the label was conceived in the late 1980s, but today variable speed products represent over 90 per cent of sales.

The second major failing of the rating standard is that the heating test point of 7 °C is not a reliable indicator of an air conditioner's energy efficiency or capacity at low temperatures. At temperatures below about 5.5 °C, ice builds up on the outdoor heat exchanger (the part of an air conditioner that sits outside of a building) and some units have inadequate defrosting systems to deal with this. The capacity of the unit—and therefore the area or amount of space that it can heat—is thus reduced.

For most air conditioners, the heat output drops below the rated capacity at 7 °C, which is the main figure used to size products for installation, while the efficiency of the unit also falls. When the test point was established, air conditioners that function as heaters (generally referred to as reverse cycle air conditioners in Australia or heat pumps in New Zealand) were much less common than they are now.

Heating capacity at a second test point of 2 °C can be voluntarily declared on the label (see on Figure 4 **3.60 kW** heating capacity at 2°C), however equivalent energy efficiency (i.e. electrical input at 2 °C, from which energy efficiency can be calculated) can only be found in the Energy Rating registration database.

Only one per cent of models make the voluntary declaration on the label¹³. Around four per cent of units voluntarily declare capacity at 2 °C on the [Energy Rating](#) website, as part of their registration¹⁴. Information for these models is available online on downloadable spreadsheets, but most consumers would not have the time or understanding of the technical detail to comprehend the information, were they to know to look for it.

The changes in energy efficiency and heating capacity from 7 °C to 2 °C are significant. Of the 114 models that provide data, changes in heating capacity from the 7 °C to 2 °C test

¹³ These 28 units are supplied by two manufacturers. The manufacturer that supplies the majority of these products (24 of the 28) informed E3 in mid-2014 that they will be ceasing to make this declaration. No reason was provided.

¹⁴ [Energy Rating website](#) – 114 of 2,939 registered models provided 2 °C data at 10 January 2017.

points range from a decrease of 33 per cent to an increase of 109 per cent.¹⁵ Sixty-nine per cent of models show a decrease in capacity. Energy efficiency reductions range from 6 per cent to 42 per cent, with an average reduction of 26 per cent. The available 2 °C data is likely to reflect the better performing products, because the models that experience significant drops in efficiency or output are less likely to declare performance at this test point.

Consumers are unable to obtain information on cold weather output or energy efficiency performance for over 95 per cent of air conditioners. Companies may choose not to declare performance in cold conditions because:

- of the cost of testing
- their products may look ‘worse’ (i.e. their output would be lower), when compared with competing products that do not provide this information
- to declare capacity at 2 °C, a model has to meet a MEPS level that some products do not achieve.

There is anecdotal evidence on product review websites and numerous threads on forums, such as Whirlpool, that consumers are critical of the performance of air conditioners in cold temperatures. Comments on these forums from consumers suggest that some installers do not select products suited to the local climate conditions. The Australian Competition and Consumer Commission has also received a small number of complaints about air conditioner performance in cold regions in recent years¹⁶.

In response to the last RIS in 2011, ten submissions from industry associations and suppliers requested a move to an alternate standard for rating the energy efficiency of air conditioners. This standard is outlined in the ‘Options’ section.

Energy efficiency labelling

There is scope to improve the information on the energy efficiency of air conditioners that is provided on the label. The label is:

- mandatory for non-ducted single-phase¹⁷ units
- voluntary for ducted, commercial use and three-phase systems¹⁸.

¹⁵ This can occur for variable speed air conditioners, where the inverters can run ‘over speed’ in cold conditions to maintain or increase capacity.

¹⁶ Email correspondence, 25 January 2017.

¹⁷ Single-phase is the type of electrical connection generally used in household situations. As a general rule, this is capable of powering products below approximately 15 kW capacity. Units larger than this use more electricity and would generally require a three-phase electricity connection.

¹⁸ These categories are not mutually exclusive—for instance a ducted product would often require a three-phase electrical connection. A ducted air conditioner has a unit that sits outside of the conditioned space and sends conditioned air through ductwork. For the purposes of the current labelling requirements, a

Testing requirements

Where the label is applied, calorimeter room testing¹⁹ is required. This can be difficult and costly for ducted and some commercial use products (e.g. ceiling cassettes), due to the large size of these air conditioners. Further, while calorimeter room testing is around five per cent more accurate than the alternate air enthalpy method²⁰, it is also around three times more expensive. Non-labelled products can demonstrate compliance with MEPS using the air enthalpy test method. The requirement for calorimeter room testing is a reason why only five per cent of ducted products provide a label²¹.

Scope

It has been argued that because three-phase, ducted or commercial use air conditioners are sold by specialist retailers less likely to display products in a showroom or are provided by builders or installers, consumers may not see a label prior to purchase. There are indications that the scope of energy efficiency labelling is not meeting the needs of consumers or the industry.

- Ducted air conditioners are often installed with little information provided to allow the owner or user to assess their energy efficiency. If the unit had to be supplied with an energy efficiency label, builders and installers would be more likely to take energy efficiency and location specific performance into account in supplying or recommending products to their customers.
- Sections of the air conditioner industry have indicated support for labelling domestic ducted units. They point to split incentives that see builders seeking less expensive (and often less energy efficient) products, while owners or users are indicating a preference for higher efficiency products.

Website analytics reveal that the information about air conditioners is the second most popular page on the [Energy Rating](#) website²². Seventeen per cent of consumers who purchased an air conditioner used the Energy Rating website before making their decision, compared with seven per cent of purchasers of all other appliances²³.

‘commercial use’ product is a single-phase, non-ducted unit that is designed and promoted for non-residential applications only.

¹⁹ A calorimeter room measures the performance of an air conditioner by measuring and accounting for all of the energy flows on both sides of the equipment’s refrigeration cycle. It uses a minimum of two precisely controlled chambers to simulate the indoor and outdoor environments. It is considered the most accurate measuring device, and while it is relatively simple and cost effective for small equipment such as non-ducted single split systems, testing large and complex equipment can become difficult and costly.

²⁰ Air enthalpy tests measure the temperature and humidity of air entering and leaving the equipment under test. From this, cooling or heating performance can be calculated. The setup of this test is relatively easy and inexpensive, even for large or complex equipment.

²¹ [Energy Rating website](#) as at 10 January 2017. 60 of the 1113 registered ducted models (5 per cent) voluntarily provide a label.

²² Google analytics report, 20 February 2017.

²³ Energy Rating Labels Review, ACIL Allen Consulting, 2014.

About 40 per cent of consumers used the internet (including supplier and retailer websites) to research ducted air conditioners, before making a purchase in 2016. (An increase from below 10 per cent in 2010)²⁴. While it is not mandatory under the GEMS Act or New Zealand Regulations for manufacturers or installers to provide energy rating information on their websites, many suppliers do.

Noise

The noise generated by air conditioners is a consideration for some consumers. Consumer research indicates noise ranks alongside energy efficiency and capacity as considerations for labelled air conditioners²⁵. Recent research of air conditioner consumers by Instinct and Reason²⁶ has shown product noise is the third consideration after efficiency and capacity. In the quantitative segment of the research, 78 per cent of consumers either strongly agreed or agreed that noise was a key consideration when purchasing an air conditioner, with only six per cent disagreeing. The ACCC has also received a small number of complaints about air conditioner noise in recent years²⁷.

The noise produced by air conditioners is a negative externality, because it is a cost of air conditioner use that may be borne by another party (e. g. a neighbour) that did not choose to incur that cost. A 2011 survey reported that five per cent of the population had been annoyed or bothered by air conditioner noise with the average duration of each incident being around six hours²⁸.

Preliminary work was undertaken on developing a noise labelling scheme in Australia for air conditioners, but has since stalled. As a result, the Chair and Chief Executive Officer of the New South Wales (NSW) Environmental Protection Agency, who was leading work on a national scheme, wrote to the Secretary of the then Department of Industry in August 2014 and requested that the noise produced by air conditioners be considered by the E3 program. Separately, suppliers have approached E3 requesting that the GEMS Act unify the disparate state and local government requirements into a coherent approach. NSW and Western Australia have noise labelling schemes for air conditioners. Queensland and Victoria had noise labelling schemes, but removed them in anticipation of a national scheme.

²⁴ The Household Appliance Market in Australia: climate control, BIS Shrapnel, 2016, page 56 and 2010, page 53.

²⁵ The Household Appliance Market in Australia: climate control, BIS Shrapnel, 2016, page 31.

²⁶ [Testing New Zoned Energy Efficiency Label for Air Conditioners](#), Instinct and Reason, 2017

²⁷ Email correspondence, 25 January 2017.

²⁸ Unpublished draft Consultation RIS: Noise Impacts from Air Conditioners and Portable Gardening Equipment, page iii, for the former Council of Australian Government's Standing Council on Environment and Water. Copy available on request.

In New Zealand, Section 16 of the *Resource Management Act 1991* makes every occupier of land responsible for adopting the best practicable option to limit noise from their property to a reasonable level. Local governments then specify noise limits based on these requirements, which vary according to the time of day and day of the week. Providing information about the noise produced by air conditioners would assist households and installers in New Zealand to comply with the regulations. Some suppliers already provide noise information in brochures or online, or apply their own noise label.

The energy efficiency regulations have scope to deal with product performance issues, like noise, that are related to the energy efficiency of products. This is to mitigate the risk of an unintended consequence (for example, manufacturers could develop products that are more energy efficient, but also produce more noise).

Portable air conditioners

Around 100 000 portable air conditioners have been sold in Australia in recent years. They provide air conditioning (mainly cooling) to the 25 per cent of Australian households that rent and may not be in a position to install a fixed air conditioner. Portable air conditioning options are also important for low income households that may not be able to afford the higher upfront cost (including installation) of a fixed air conditioner. They are also popular as supplementary cooling in periods of extreme heat, because they do not require professional installation and can be taken home and used immediately. Portables represent a small component of the New Zealand market, with sales of less than 1000 per year.

Double duct²⁹ portable air conditioners are subject to energy efficiency regulations, while single duct³⁰ portables are not. A perverse outcome of these regulations is that the more energy efficient double duct portable air conditioners appear unable to meet the MEPS levels set in 2011. Their compact, portable size means that they have small heat exchangers³¹ and are unlikely to be able to meet existing MEPS, which is designed for unitary (window/wall) systems. Yet double duct portables are more effective and energy efficient than single duct portables—the other main portable option.

²⁹ Double duct air conditioners are a unitary (i.e. encased in a single assembly) product that sit wholly within the conditioned space. They use one duct to draw outside air into the casing to cool the condenser and a second duct to expel that air back outside. They may be portable or wall mounted.

³⁰ Single duct air conditioners are a unitary product that sit wholly within the conditioned space. They draw conditioned inside air through their casing to cool the condenser and then expel that hot air outside through their single duct. They are generally portable in nature, but wall mounted models are possible and could be tested the same way.

³¹ The size of the heat exchanger is an important determinant of an air conditioner's energy efficiency.

This issue was not considered in the previous RIS process through 2010 and 2011, because it does not appear to have been an issue raised in consultation with stakeholders. Instead of improving the energy efficiency of double duct portables to meet the new MEPS, relevant suppliers appear to have switched to supplying other products (such as single duct portables). E3 became aware of the absence of double duct portables through work on developing the test standard for single duct portables.

Single duct portables were excluded from earlier RIS assessments because a suitable test standard was not available, and they were new to the Australian and New Zealand markets, with minimal sales recorded as recently as the early 2000s. The E3 program's ACRAAC (primarily made up of industry stakeholders) wrote to the E3 Committee (the E3 program's governing body) in March 2013 requesting that a test standard for single duct portables be developed and the products considered in the next air conditioner RIS. Work was undertaken to develop the standard and it was published in August 2015.

There are a range of regional standards that have been used to test and rate single duct portable air conditioners prior to the publication of the new Australian/New Zealand test standard. These tests were designed by the portable air conditioner industry to present their products as favourably as possible. This makes it difficult for regulators to take any action on the performance claims of these products, because they will perform differently in consumer use than when measured according to a test designed by the industry.

Internationally, the EU implemented energy efficiency labelling for portable (single and double duct) air conditioners in 2002, with MEPS introduced in 2013 and increased in 2014. The USA is also investigating energy efficiency regulations for these products.

Single duct portables can be less expensive than competing products, but are also much less efficient and in some circumstances may warm, rather than cool, a room. Despite this, these products are often advertised with strong claims of effectiveness and efficiency, based on unverified performance declarations. Information about single duct portables in stores and product literature cannot be compared with alternative air conditioning products.

It is common for sales catalogues,³² shop displays and websites to display single duct portable and fixed air conditioners side-by-side. But while most of the performance information for the fixed air conditioner is standardised to allow consumer comparisons within this category, there are no requirements for the consistent and accurate disclosure of single duct air conditioner performance.

³² Aldi Australia supermarket catalogue, October 2015. An advertisement for the same products was also included in the October 2016 catalogue.

Figure 5 Air conditioning advertisement

The advertisement is split into two main sections. The left section features a white split system air conditioner mounted on a blue background. It includes a 'LED display settings' label pointing to the control panel. Below the unit, there are energy rating labels for Cooling (2.30) and Heating (2.60), a price tag of \$599, and a 5-year warranty badge. The right section features a white portable air conditioner on a light-colored floor. It includes a price tag of \$379, a 3-year warranty badge, and a 32kg weight badge. The portable unit has a 'LED control panel' and '4 castor wheels for easy moving'. A 'Window kit included' badge is also present. A link to 'stirlingappliances.com.au' is provided at the bottom.

Split System Air Conditioner:

- Suitable for room size 9-18m²
- LED display settings
- 5 YEAR WARRANTY
- 38KG
- 14KG
- \$599**
- REVERSE CYCLE INVERTER SPLIT SYSTEM AIR CONDITIONER • 9000 BTU • Dehumidifying function
- Cooling and heating • Temperature sensing • Anti-mildew system • Auto power off • Defrost outdoor condenser • LCD backlit remote control • Indoor unit dimensions: 280(H) x 898(W) x 200(D)mm
- Outdoor unit dimensions: 552(H) x 760(W) x 256(D)mm • Installation required by a licensed installer
- See stirlingappliances.com.au for more details

Portable Air Conditioner:

- \$379**
- 3 YEAR WARRANTY
- 32KG
- PORTABLE AIR CONDITIONER
- 12,000 BTU • 3 modes: auto, cooling and dehumidifying • LED display with remote control
- Dimensions: 721(H) x 415(W) x 291(D)mm
- LED control panel
- Window kit included
- 4 castor wheels for easy moving

The advertisement in Figure 5 above indicates that the single duct portable costs A\$220 less than the fixed unit, is 52 per cent more powerful, will cool twice the space and does not require a qualified installer. The performance (output and efficiency) claims, however, for the single duct portable are not comparable to the fixed air conditioner, despite both products claiming to provide a similar service.

This is because portable air conditioners are tested differently to other air conditioners. The single duct portable's performance information is likely to have been obtained from a test that measured the cold air produced. Fixed air conditioners, conversely, are tested to measure their cooling effect on an enclosed space. While a single duct portable may blow cold air onto a person, if its performance was tested in the same way as a fixed air conditioner, it could have a net heating effect on the room it was supposed to cool³³.

Laboratory testing of ten single duct portable air conditioners was undertaken by E3 in early 2014 to inform development of the portables test standard. This testing found both the cooling output and energy efficiency of these models was around 25 per cent below supplier claims. This does not take into account the additional performance and capacity reduction that occurs from air outside the conditioned space being drawn in to replace the air expelled through the single exhaust duct. This factor undermines the ability of these products to provide an effective air conditioning service.

³³ See for instance '[Energy Conservation Program for Consumer Products: Test Procedure for Portable Air Conditioners](#)', USA Department of Energy, 10 CFR Part 430, 5 May 2014.

In a recent study, the USA's Department of Energy (DoE) estimated that simply upgrading a single duct portable to a double duct configuration would dramatically increase the performance at little cost³⁴. The DoE found the addition of a second duct that uses outdoor air to cool the condenser would yield an efficiency gain of 103 per cent for a retail price increase of around US\$8 (from US\$534 to US\$542)—a price/efficiency ratio of 1:103 (i.e. a one per cent increase in price provides a 103 per cent increase in efficiency). Because double duct portables are no longer available on the Australian and New Zealand markets, suppliers are unable to communicate their benefits compared with single duct products.

The existing energy efficiency regulations on portable air conditioners appear to have had the perverse effect of removing the more energy efficient product (double duct portables) from the market, while encouraging the marketing of single duct portables, by allowing unverified claims to be made about the effectiveness and efficiency of these products. This RIS considers options to resolve this perverse situation.

Requirements split between GEMS and NCC framework in Australia and absent in New Zealand

Energy efficiency regulations for air conditioners are not applied cohesively. In Australia, they are divided between the GEMS Act and the NCC.

- Systems up to 65 kW are regulated under the GEMS Act in Australia and by New Zealand's regulations.
- For systems above 65 kW, MEPS are specified in the NCC in Australia (which applies only to new buildings and significant renovations) and are not regulated in New Zealand.

Initial consultation on MEPS for air conditioners in 1994 recommended that the regulations apply up to 50 kW capacity, subject to further consultation and review³⁵. Units beyond this size were deemed unsuitable for inclusion, due to the variety of configurations that made setting MEPS difficult. In 1998, the possible scope was expanded to include larger products³⁶ and MEPS for products up to 65 kW were introduced under the E3 program in 2001.

International test standards (and Australian/New Zealand adoptions) were released after 2001 that allowed larger air conditioners to be tested and rated. When MEPS requirements were introduced for larger air conditioners (i.e. greater than 65 kW capacity) in 2006, the

³⁴ Technical support document: Energy efficiency program for consumer products and commercial and industrial equipment: portable air conditioners, February 2015, page ES-8.

³⁵ 'Energy Performance Standards And Energy Labelling For Industrial And Commercial Equipment' Energetics Pty Ltd and George Wilkenfeld and Associates, April 1994.

³⁶ Proposed energy efficiency program for packaged air conditioners; Final report. Unisearch Limited and George Wilkenfeld and Associates. June 1998.

most convenient way to regulate this equipment was through the NCC, which already specified installation requirements for air conditioners.

This was not an ideal solution, because the NCC is designed to regulate the construction of buildings and is better suited to setting regulations governing the method of installation of fixed appliances, rather than the appliances themselves. In 2012, the GEMS Act was established with the specific purpose of improving the energy efficiency of appliances and equipment nationally (prior to 2012, the regulations were state-based).

The NCC covers new construction and not the replacement of air conditioners, whereas both are covered under the GEMS Act. Because of this, the NCC applies to only around 50 per cent of installations in the 65 kW plus category. Products are available for use in the replacement market that do not meet the NCC MEPS levels, including products that are just above the 65 kW threshold where E3 regulations no longer apply (e.g. 65.5 kW capacity).

The MEPS requirements under the E3 program were increased in 2010 and 2011, while the NCC MEPS levels have not changed since their introduction. Industry stakeholders have informally indicated at consultation meetings they also regard the E3 program's registration and check testing requirements as providing more effective compliance.

It is more likely for lower efficiency products to be installed as replacement products than in new buildings, due to a tendency for 'like for like' installations (i.e. purchasing the same or similar product, rather than considering the pros and cons of alternatives). While a like for like installation may be a valid market response when it is not cost effective to invest in other more energy efficient options, it could also be an adverse consequence of the replacement market being outside the scope of the NCC energy efficiency requirements.

Specifying the MEPS requirements in Australia in separate regulations may also have created additional regulatory costs, particularly where some product ranges are spread across both GEMS and NCC requirements. For instance, the ActronAir Tri-Capacity series of packaged commercial air conditioners has models from 47 to 96 kW, splitting this range across both pieces of legislation³⁷.

The dual legislative frameworks are also complex for commercial multi-split systems. The outdoor unit of these systems is rated using the specific combination of indoor units required for each application, each with a different capacity. A multi-split system outdoor unit could then be subject to the GEMS Act for one installation (e.g. 60 kW) and the NCC for another (e.g. 70 kW). This creates an inefficient regulatory environment for those affected.

³⁷ [ActronAir website](#)

Using the NCC to set energy efficiency levels for air conditioners above 65 kW capacity was an ad hoc response to a policy void. This RIS considers whether to rectify this historical anomaly.

Changes to Minimum Energy Performance Standards

Inconsistent MEPS levels

There are various areas of misaligned MEPS levels, due to energy efficiency requirements being set inconsistently.

- MEPS are applied to double duct portable air conditioners, but appear to have been set too high and removed them from the market.
- MEPS are not applied to single duct portables, because a suitable test standard was not available.
- Air conditioner MEPS levels are inconsistent across the separate GEMS and NCC legislative requirements.
- New Zealand's residential air conditioning MEPS for cooling are lower than Australia's. The previous reviews of MEPS levels were undertaken separately, and New Zealand decided not to align to Australia's cooling MEPS in some categories, due to concerns on the effects of products designed primarily for heating. There are now only two models sold in New Zealand (with low sales) that do not meet Australian MEPS, so there is a stronger case for alignment between Australian and New Zealand MEPS.

These inconsistencies can add regulatory costs to business. They can also result in less energy efficient products being selected by consumers or provided by agents (builders and installers) as a result of the differing regulations, rather than on the merits of the competing products.

Other policies that impact these problems

The problems outlined above relate to the regulatory failures or burden arising from the energy efficiency regulations for air conditioners. Although these issues may not be resolved by other policy measures, other government programs exist to promote the adoption of more energy efficient air conditioners and are relevant to the question of whether to make changes to the regulatory framework for energy efficiency.

Commercial Building Disclosure program (Australia)

The Commercial Building Disclosure (CBD) program requires energy efficiency information to be provided when commercial office space of 1000 square metres or more is offered for sale or lease. The aim of the CBD program is to improve the energy efficiency of Australia's large office buildings by ensuring prospective buyers and tenants are informed about the building's energy efficiency performance. The information disclosed is based on measured and verified energy performance data, such as utility bills, and converted into a rating scale from one to six stars.

By providing this rating information, CBD influences the energy efficiency performance of air conditioners installed in commercial buildings that are within the program's scope. This is likely to be air conditioning systems with an output of 90 kW or more. The CBD

program also does not affect air conditioners above the (approximately) 90 kW threshold that are installed in industrial buildings, such as factories and warehouses.

National Electricity Market rule change for cost reflective network prices (Australia)

Network businesses have introduced new electricity pricing structures on a voluntary basis in National Energy Market jurisdictions. This was in response to an Australian Energy Market Commission (AEMC) rule change that requires regulated network companies to structure their prices to better reflect the consumption choices of individual users. Under the changes, network prices will better reflect the actual costs of providing electricity to consumers at different times. These changes will help consumers to see the value of their choices—such as decisions to purchase more energy efficient appliances, particularly energy intensive appliances like air conditioners. The AEMC rule change supports the objectives of this RIS.

Emissions Reduction Fund (Australia)

The Emissions Reduction Fund (ERF) commenced in 2014. The ERF provides incentives for low cost emissions reductions across the Australian economy. A range of methods have been approved for use under the ERF, including the Industrial Energy and Fuel Efficiency method, which allows for upgrades to heating, ventilation and cooling systems, and the High Efficiency Commercial Appliances method, which allows for the installation of new, high efficiency air conditioners.

State-based energy savings schemes (Australia)

State-based schemes that aim to reduce the consumption of electricity by encouraging the implementation of energy saving activities operate in New South Wales, Victoria, South Australia and the Australian Capital Territory. These schemes generally oblige electricity retailers and other large energy users to meet energy savings targets by purchasing and surrendering tradeable energy savings certificates. These certificates are created by energy savings projects, such as the bulk purchase and installation of appliances like air conditioners or lighting, which are more energy efficient than those that would otherwise have been installed. Projects such as these are often undertaken by third parties.

Building energy ratings and audits (New Zealand)

Energy Efficiency and Conservation Authority (EECA) in New Zealand operates the NABERSNZ™ (National Australian Built Environment Rating System New Zealand) program. Commercial buildings can gain a certified rating to benchmark the building or tenancy for its energy efficiency. Along with energy audits, this can encourage building owners to improve the energy efficiency of their air conditioning systems.

3. Objectives

Why is government action needed?

The objective of the proposed government action is to resolve issues with the regulations that impede the supply and purchase of energy efficient or effective air conditioners.

- The energy efficiency rating method, used for the label, has not kept pace with technology changes and does not provide sufficient information about the relative energy efficiency and running costs of different air conditioners.
- Consumers are being supplied with or are purchasing air conditioners that may not be suited to their location, even though they may be presented with a high star rating or capacity output figure on the label.
- The regulations impede the supply of energy efficient portable air conditioners.
- Consumers are unable to compare portable air conditioners with other types of air conditioners.
- MEPS requirements for some air conditioners are specified in the NCC in Australia, which does not apply to the replacement market or in New Zealand.
- MEPS requirements for air conditioners are inconsistent across portable products, the GEMS Act and NCC, and Australia and New Zealand.

Without government action, these market distortions and unnecessary costs would continue.

Improving the energy efficiency regulations for air conditioners would contribute to the Council of Australian Governments' (COAG) Energy Council's National Energy Productivity Plan. This plan aims to improve Australia's energy productivity by 40 per cent by 2030. Improving the regulations would also contribute to the Australian Government's target to reduce greenhouse gas emissions to 26 to 28 per cent below 2005 levels by 2030.

For New Zealand, improving energy efficiency regulations for air conditioners contributes to the innovative and efficient use of energy, which is a priority under the *New Zealand Energy Strategy 2011-2021* and the *New Zealand Energy Efficiency and Conservation Strategy 2017-2022*³⁸. It also contributes to the New Zealand Government's post-2020 climate change target to reduce greenhouse gas emissions to 30 per cent below 2005 levels by 2030, as well as the *Business Growth Agenda*'s objective of promoting energy efficiency and the use of renewable energy to build a more competitive and productive economy.

³⁸ See [MBIE website](#)

The objectives of this RIS are consistent with Principle 6 of the COAG RIS Guidelines. This principle seeks the review of regulation “with a view to encouraging competition and efficiency, streamlining the regulatory environment, and reducing the regulatory burden on business arising from the stock of regulation”.

4. Policy options

Policy options under consideration

This RIS considers policy options to resolve problems identified with the regulations. The original proposals have been modified after feedback on both the Consultation RIS and the supplementary consultation document. The individual policy proposals are bundled into three groups: Options A, B and C.

- **Business as usual (BAU)** – no changes to the regulations.
- **Option A** involves reforming the regulations to resolve the problems and inconsistencies identified. The focus of this option is to improve the provision of energy efficiency information and simplify the regulations. Option A includes:
 - Remove the current Australia/New Zealand specific rating method AS/NZS 3823.2 and adopt the SEER standard AS/NZS 3823.4:2014 Amendment 1³⁹.
 - Replace the Energy Rating Label with the Zoned Label.
 - Expand the scope of the provision of energy efficiency information (including star ratings), while limiting the associated compliance costs.
 - Lower the MEPS on double duct portable air conditioners.
 - Apply the Zoned Label to single and double duct portable air conditioners.
 - Include MEPS for air conditioners greater than 65 kW capacity (currently specified in Australia under the NCC).
 - Increase New Zealand's cooling MEPS to Australia's levels.
- **Option B** includes all of the elements of Option A, but also introduces a MEPS level for single duct portable air conditioners. In doing this, Option B is likely to involve higher costs than Option A, but it would also provide greater benefits in terms of energy savings and greenhouse gas emission reductions.
- **Option C** builds on Option B by increasing MEPS for air conditioners that are greater than 65 kW capacity, which are used in commercial and industrial premises. As with Option B, this results in higher costs and greater benefits.

The Consultation RIS proposed to remove the part load compliance option for variable speed air conditioners (see the end of this section for details). Based on feedback, this proposal has been removed from the Decision RIS. The options are summarised in Table 6.

Table 6 Policy Options

Policy Proposal	Option A	Option B	Option C
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³⁹ The new SEER standard is essentially a calculation standard that uses test results from the three existing Australian/New Zealand test standards (AS/NZS 3823.1.1 for non-ducted air conditioners, AS/NZS 3823.1.2 for ducted air conditioners and AS/NZS 3823.1.4 for multi-split air conditioners).

Policy Proposal	Option A	Option B	Option C
1. Energy efficiency information: Adopt the Seasonal Energy Efficiency Ratio (SEER ⁴⁰) standard for rating air conditioner energy efficiency. Remove the existing Energy Rating Label and replace it with the Zoned Energy Rating Label.	X	X	X
2. Portable air conditioners: For double duct portable air conditioners, reduce the Minimum Energy Performance Standard (MEPS) and apply the Zoned Energy Rating Label. For single duct portable air conditioners, apply the Zoned Energy Rating Label (tested to AS/NZS 3823.1.5).	X	X	X
3. Commercial/industrial air conditioners: include MEPS for air conditioners >65 kW capacity under the energy efficiency regulations (currently specified in Australia under the National Construction Code (NCC)).	X	X	X
4. Technical fixes: Resolve minor technical issues with air conditioner regulations.	X	X	X
5. Align Australia/New Zealand MEPS: Increase New Zealand's residential cooling MEPS to Australia's levels.	X	X	X
6. MEPS for single duct portable air conditioners: Apply MEPS to single duct portable air conditioners.		X	X
7. MEPS for commercial/industrial air conditioners: Increase MEPS for air conditioners >65 kW capacity.			X

Business as usual

Under BAU, the energy efficiency benefits of the regulations continue to accrue as the existing stock of air conditioners is turned over and replaced by more energy efficient products. Further, the natural improvement in the average energy efficiency of air conditioners is expected to continue, as well as increases in energy efficiency regulations overseas that flow through to the stock of air conditioners in Australia and New Zealand.

The BAU option assumes no changes to the regulations in Australia and New Zealand. Details of the existing regulations are set out below, so they can be compared with the proposed changes in the policy reform options.

Air conditioners

- Requirements are specified under the GEMS Act in Australia and by New Zealand's regulations for units up to 65 kW capacity.

⁴⁰ The commonly used term 'SEER' is not mentioned in AS/NZS 3823.4. The Total Cooling Seasonal Performance Factor (TCSPF, or F_{TCSP}) of AS/NZS 3823.4.1 and the Heating Seasonal Performance Factor (HSPF, OR F_{HSP}) of AS/NZS 3823.4.2 would be the rating metrics (see Attachment B for further details), but for simplicity are referred to as SEER ratings.

- Units above 65 kW capacity are not regulated in New Zealand. In Australia, energy efficiency requirements are specified in the NCC, which only applies to new buildings or new works in existing buildings. There are two options for demonstrating compliance to the NCC:
 - Deemed-to-Satisfy Solution: provisions include prescriptive examples of materials, products and design factors that are deemed to comply. Minimum EERs are contained in these provisions.
 - Performance Solution: uses a method other than a Deemed-to-Satisfy Solution to achieve compliance. For example, a Performance Solution may allow for a reduction in the energy efficiency of the building's services below the minimum specified in the Deemed-to-Satisfy Provisions by increasing the performance of the building fabric. This provides flexibility in achieving the overarching mandatory requirements for building energy performance. A combination of these solutions may also achieve compliance.
- MEPS requirements for units up to 65 kW capacity are based on a full load Annual Energy Efficiency Ratio (AEER) for cooling at 35 °C (T₁) and a full load Annual Coefficient of Performance (ACOP) for heating at 7 °C (H₁). The 'Annual' refers to the average of a year's worth of hourly inoperative power (standby and crankcase heater power), which is added to the power input of the EER and COP ratios. This effectively raises the MEPS for a unit's operating efficiency. MEPS requirements in the NCC for >65 kW units do not include inoperative power (EER and COP only).
- A part load MEPS compliance option is provided for variable speed models. This means suppliers only have to achieve 95 per cent of the full load (100 per cent capacity) MEPS level, if the unit demonstrates good energy efficiency at part load (i.e. 50 to 99 per cent capacity).
- New Zealand's cooling MEPS requirements for most domestic sized units remain unchanged from their 2009 levels and are not aligned with Australia's.
- The label is mandatory for non-ducted single phase units (excluding those deemed for commercial use), but prohibited for multi-split systems.
- The label is voluntary for ducted units, commercial use units and three-phase units. If the label is applied, the information provided must be based on calorimeter room testing. This is often impractical for units of this type, due to their large size.

Portable air conditioners

- Single duct units are not subject to any energy efficiency regulations.
- Double duct units are subject to MEPS and labelling requirements. These units can be tested to the non-ducted test standard AS/NZS3823.1.1 (similar to a window/wall air conditioner). Due to their compact size, they have small heat exchangers and appear unable to meet the current MEPS levels.

Option A

Option A would simplify the regulations and improve the available energy efficiency information through the adoption of new testing requirements.

1. Adopt SEER standard and Zoned Energy Rating Label

Adopt SEER rating standard

Adopt the Seasonal Energy Efficiency Ratio (SEER) standard AS/NZS 3823.4:2014 Amendment 1 for rating purposes. Cooling and heating SEER for products <30 kW capacity. Mandatory cooling SEER for products ≥30 kW capacity with voluntary heating (based on a physical test).

Option A would replace the current rating method with the SEER test method. A SEER test method is used in the United States of America (USA), China, the European Union (EU), Japan, South Korea and Canada and is being introduced or under consideration in Taiwan, Thailand, India, Vietnam, Philippines, Singapore, Malaysia, Indonesia and Hong Kong. This covers all of the countries that export air conditioners to Australia and New Zealand. Alignment with the SEER test method would also provide the opportunity to improve the provision of energy efficiency information to consumers by replacing the existing energy label with the proposed Zoned Energy Rating Label (Zoned Label).

The SEER standard AS/NZS 3823.4⁴¹ was first published in October 2014. It improves on the Australia/New Zealand specific rating method of AS/NZS 3823.2 by taking into account the effect of climate on the efficiency and output of an air conditioner. It does this by assessing efficiency across all temperatures and weighting it against a climate file⁴² for a given location. The SEER standard is based on testing at several temperatures at both full and part loads and extrapolating this into a curve of performance that covers all temperature points.

The SEER standard is an adoption of an International Organisation for Standardisation (ISO) standard 16358:2013 *Air-cooled air conditioners and air-to-air heat pumps – Testing and calculating methods for seasonal performance factors*. The Australian/New Zealand version defines three local climate zones to rate performance against (to represent cold, mixed and hot/humid). Overseas versions of this standard use the same test points, but weight the results against their own climate files.

In 2015, the air conditioner industry requested E3 modify AS/NZS 3823.4:2014 to make the operational hours for the local climate files more realistic. On 4 April 2016, E3 convened a working group to create a draft incorporating the required changes. This was given to Standards Australia in June 2016. The amendment was published on 8 May 2017.

Adopting the SEER standard aligns with the Australian Government Industry Innovation and Competitiveness Agenda⁴³. This policy commits Australian regulators not to impose any additional requirements if a system, service or product has been approved under a trusted international standard, unless a good reason can be demonstrated. As the only significant change in the Australia/New Zealand version of the ISO SEER standard was to

⁴¹ [SAI Global store](#)

⁴² A climate file consists of historic, hourly weather observation data e.g. dry bulb temperatures. SEER standards around the world use Typical Meteorological Year (TMY) files for a given locality. These are obtained by analysing historical weather data and choosing the most typical, or average, monthly file and combining them into a year. This climate data is then used to weight the efficiency of an air conditioner, against the time spent at each temperature point for that location.

⁴³ [Prime Minister and Cabinet website](#)

include the necessary local climate information, when a SEER test has been conducted overseas, suppliers would not need to repeat the test for Australia or New Zealand.

Adoption of the SEER standard is the only available option to resolve the problems with the existing rating method. Mandatory adoption of the SEER standard is necessary to ensure all products are able to be compared. Otherwise, it is likely that suppliers would only make information available for their most energy efficient products.

Strong support was received from industry for the adoption of a SEER test standard in response to the RIS process undertaken in 2010. This suggestion was not adopted because the international SEER standard was still being drafted. The feedback resulted in a recommendation to investigate adopting the SEER standard in the next review of the regulations.

The Consultation RIS asked if the SEER standard would be suitable to apply to products greater than 30 kW capacity (originally designated as Option B2), because there were some concerns on its practicality. Feedback confirmed that while a SEER rating was desirable, there are practical barriers to its full implementation. There is no accurate way to simulate cold performance (the H2 test at 2 °C) and a lack of test facilities capable of physically testing large products at 2 °C.

Option A in the supplementary consultation document was modified so cooling and heating SEERs apply to all products (except single duct portable air conditioners) below 30 kW capacity and cooling only above 30 kW. SEER ratings can voluntarily apply to the heating cycle, but must be physically tested. Otherwise, the existing heating rating method would still apply.

The supplementary consultation document asked if stakeholders believed that the SEER calculations for these >30 kW systems should use different temperature bins more relevant to commercial use patterns. Two submissions supported the development of commercial use temperature bins. The only other response suggested that the online rating tool could re-rate products to commercial or domestic usage patterns without the need to make a second amendment to AS/NZS 3823.4:2014.

E3, in conjunction with the Standards Committee, developed temperature bins and operating hours based on a commercial use pattern for the three climate zones of AS/NZS 3823.4:2014. These are available in [Attachment A](#).

Industry has continued to indicate strong support for the adoption of a SEER rating method, including through submissions to the Consultation RIS and supplementary

consultation document. In the consultation RIS, every submission that responded to this option supported the adoption of the standard.

Some submissions raised concerns with the higher testing costs of the SEER standard. To help overcome this, E3 recommends a series of measures that are detailed in the Managing testing costs section of Attachment A. These measures would mean that suppliers can elect to do no more testing of a cooling only product than under BAU and only one more test for a reverse cycle product. With the removal of the maximum cooling test, for some products⁴⁴ it could mean less testing is required than under BAU.

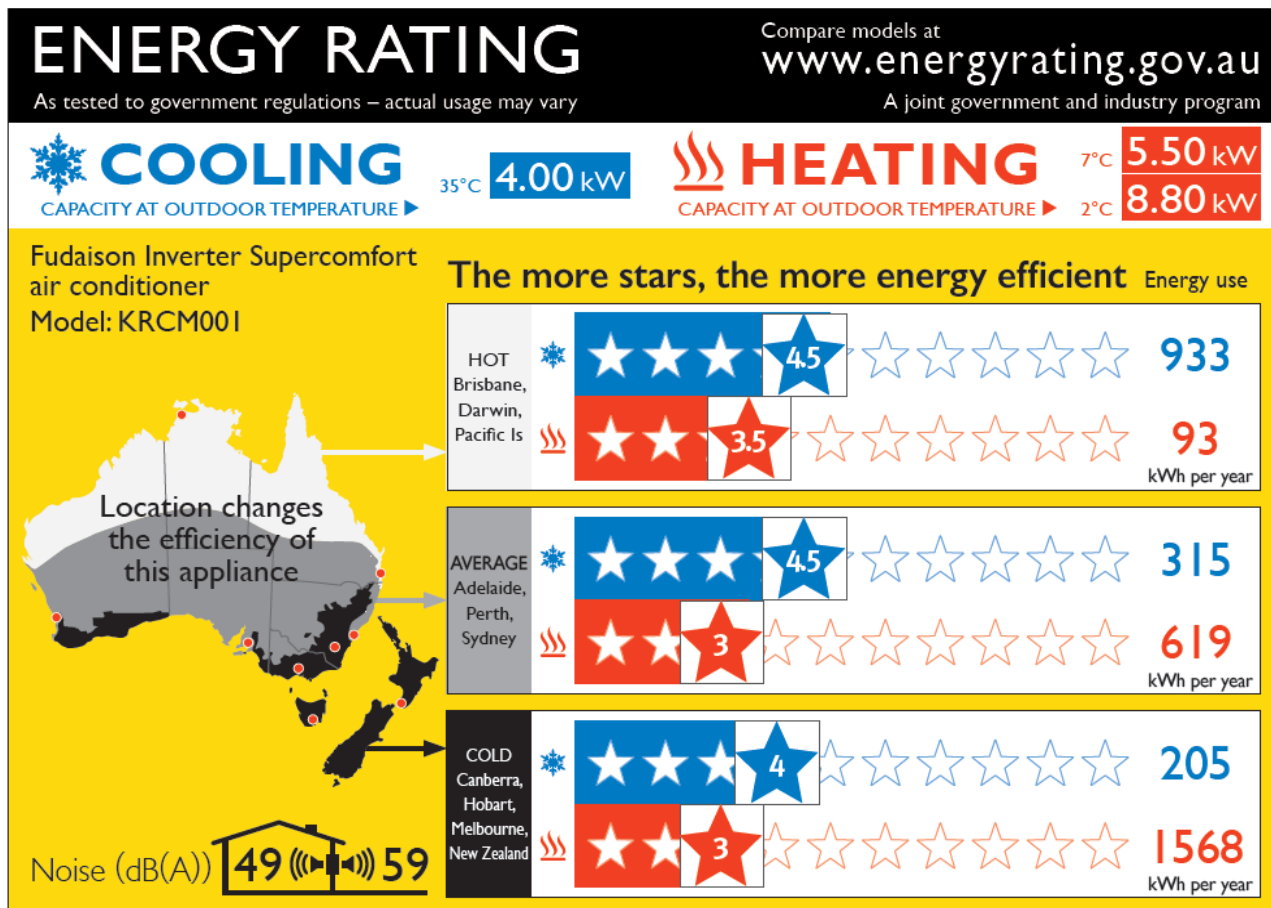
Replace Energy Rating Label with Zoned Label

Remove the existing Energy Rating Label and replace it with a Zoned Energy Rating Label that provides energy efficiency information for three distinct climate zones across Australia and New Zealand as per the existing scope of mandatory energy efficiency labelling.

Adoption of the SEER test standard provides the opportunity to improve the provision of energy efficiency information to consumers and installers using the proposed Zoned Label (see Figure 6). The Zoned Label shows the effect of climatic conditions on the energy efficiency and performance (i.e. capacity) of air conditioners. It displays the SEER based efficiency, heating capacity and annual energy consumption of a product across three distinct climate zones in Australia and New Zealand. This policy option received strong support in both the Consultation RIS and the supplementary consultation document.

⁴⁴ This applies to products required to display the label.

Figure 6 Zoned Energy Rating Label



Energy labels incorporating maps and climate specific information are in use internationally. The EU introduced their SEER label for air conditioners in January 2013⁴⁵ and for all space heating⁴⁶ and water heating⁴⁷ products in September 2015. In January 2015, the USA implemented a map-based label to display SEER ratings, as well as their regional performance standards⁴⁸. This international adoption acknowledges the importance of displaying the effect climate can have on the energy efficiency and performance of air conditioners.

The Zoned Label is intended to provide consumers, retailers and installers with information provided by the adoption of the SEER standard.

⁴⁵ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32011R0626>

⁴⁶ <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1440476886208&uri=CELEX:32013R0811>

⁴⁷ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013R0812>

⁴⁸ https://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/75

This would improve on the information available on the current label (full load performance at 35 °C and 7 °C or the T1 and H1 test points) by giving a star rating that takes into account the varied efficiencies of products at full and part load across an average year, using the relevant representative climate files. The Zoned Label:

- indicates the differences in energy efficiency depending on installed location, discouraging products not suited to certain climates from being marketed there, and promoting manufacturer innovation in designing products to be efficient and perform effectively in warmer and colder climates
- shows annual energy consumption in a consistent way
- allows covered appliances providing a space conditioning service to be compared on a consistent basis
- provides opportunities for additional information, including an online calculator.

For the Zoned Label, the locations that would represent the three climate zones are those specified in AS/NZS 3823.4:

- the 'hot/humid' zone is based on the TMY file for Rockhampton, Queensland
- the 'mixed' zone is based on the TMY file for Richmond, New South Wales
- the 'cold' zone is based on the TMY file for Canberra, Australian Capital Territory.

Declaration of product capacity at 2 °C as well as 7 °C (H1) would be mandatory to ensure consumers in cold areas can select a product able to maintain a sufficient capacity in their conditions.

The Zoned Label would also be able to estimate a meaningful annual energy consumption figure (in kWh) for the three zones. The current label supplies only a kW electricity input figure as it is relying solely on the full load single temperature point testing, whereas the Zoned Label would draw on the more comprehensive testing data from the SEER standard, as well as the climate zones. The zones would also separate products used mainly for cooling from those used mainly for heating or for both heating and cooling. The energy consumption figures take into account efficiency at different temperature points and the hours of use data from the SEER standard, calculated by specifying the annual number of hours at various temperature points for the three zones. A certain load is assigned to each temperature point to reflect that an air conditioner is not required to work as hard when the outside temperature is, for example, 25 °C, rather than 35 °C.

Providing this information simplifies the task for consumers of estimating lifecycle (purchase and running) costs and would convey the lower running costs that a higher efficiency model would provide (and vice versa). This has not been possible under the existing rating and labelling scheme, so providing this information would enable consumers to better understand the energy consumption of comparable products.

For consumers and advisers with the interest, an online tool would enable them to use GPS or a postcode to use climate data more specific to the location of their home or business. This data is available for each of the 69 Nationwide House Energy Rating Scheme (NatHERS) zones for Australia and 18 Home Energy Rating System (HERS) zones for New Zealand. Electricity tariffs and location optimised operating hours would pre-fill, but be

editable for those seeking greater insight. A feature like this would make decisions between a cheaper, less efficient model and a more expensive, but more efficient option easier, by estimating lifecycle costs and taking account of a household's specific situation. The online tool would also allow running cost comparisons with other heating options, such as electric and gas heaters.

The Zoned Label, as proposed, would require the disclosure of noise⁴⁹ levels, which are also required in the EU's air conditioner label. This would help consumers compare the noise levels of different products. It would also assist consumers, who consider noise to be an important consideration in the choice of an air conditioner, or to meet body corporate, local or state government requirements.

Some suppliers requested a consistent approach to disclosing noise information across Australia. They are already required to provide this information by regulations in New South Wales and Western Australia. New South Wales has indicated it will seek to remove these regulations if sound power disclosure is required on the Zoned Label or on the Energy Rating website. The Department of Environment Regulation in Western Australia advised that their noise regulations have limited or no effect, as they only apply to products below 12 kW that are manufactured in or imported into Western Australia⁵⁰. E3 is also unaware of any products that meet this criteria. New Zealand has no requirements to provide a noise declaration on air conditioners, although some suppliers do this for marketing purposes or through brochures or websites. A standardised approach to noise disclosure would also assist local government to enforce noise laws more effectively.

The Consultation RIS proposed that the scope of physical labelling be extended to all products <30 kW capacity, but allow air enthalpy tests to be used. This would cover most air conditioners marketed to households. Furthermore, suppliers of products above 30 kW are able to demonstrate compliance with MEPS by using simulation testing. Feedback indicated concerns with expanding the scope of physical labelling, because ducted outdoor units may be paired with multiple indoor units, making supplying the correct label in the box difficult. Additionally, because three phase and ducted units are rarely on display in retail stores, submissions were concerned that labels would not be seen by consumers until after they are purchased.

This option has been amended so that energy efficiencies (including star ratings) and noise information would be made available on the Energy Rating website for products outside the current labelling scope, with voluntary labelling for these products maintained. Air

⁴⁹ The noise metric is sound power, which is the acoustical energy emitted by the sound source, and is an absolute value. It is not affected by the environment.

⁵⁰ Email correspondence, 3 April 2017.

enthalpy tests would be accepted for three phase and ducted products, even if a voluntary physical label is applied. More details are in [Attachment B](#).

The Zoned Label aligns with the Australian Energy White Paper policy position that “Consumers should be empowered to make better choices to manage their energy costs and use”⁵¹. It would help to ensure consumers are able to easily compare the energy costs of different air conditioning options. The label also fits with achieving overall economic efficiency:

- Productive efficiency: while the Zoned Label would involve some regulatory costs, it does not impose increased production costs.
- Allocative efficiency: by improving the allocation of air conditioners across different climate zones.
- Dynamic efficiency: it provides an incentive for manufacturers to develop products optimised for particular climates.

The development of the Zoned Label has involved extensive design and research work. Label design options were drafted and tested in a range of locations across Australia and New Zealand. This work has examined the best way to display the climate information to consumers and the range of advisers, who supply or recommend these products.

Following several rounds of qualitative and quantitative testing, which involved approximately 4 500 appliance installers, retailers and consumers, a single draft design was selected and has since been approved by the E3 Committee. The reports from this research are available on the [Energy Rating website](#). The label would be supported by an extensive education campaign focusing on consumers and retailers, to ensure that the label is understood and is effective as possible. More detail on the work to develop the Zoned Label is at [Attachment B](#).

Air conditioners greater than 30 kW capacity

As outlined in policy proposal one, products with a rated cooling capacity >30 kW would receive a SEER rating based on a commercial operating schedule and would not be directly comparable with smaller products using SEER ratings or the Zoned Label. To minimise the potential for confusion, products of this size would be prohibited from physical labelling (which is aimed at the domestic market). SEER ratings based on either the domestic or commercial operating schedules would be available on the Energy Rating registration database. Comparisons using either operating schedule would be possible through the online calculator tool.

2. SEER label for all portable air conditioners, reduced MEPS for double duct portables

Double duct portable A/C subject to the SEER standard, Zoned Energy Rating Label and

⁵¹ 2015 Energy White Paper, page 16.

a reduced MEPS level of 2.50 based on Energy Efficiency Ratio/Coefficient of Performance (EER/COP). Single duct portable A/C tested to AS/NZS 3823.1.5 subject to Zoned Energy Rating Label (with proxy for operating time data).

Double ducts

In the Consultation RIS, the MEPS for double duct portable air conditioners were proposed to be lowered from an AEER/ACOP of 3.10 to 2.60, matching the EER levels of the European Union⁵². This was deemed necessary because double duct portable air conditioners have not been available on the Australian and New Zealand market since the last MEPS increase in 2011.

This is a perverse outcome, because double duct portables are more efficient and effective than the single duct portables, which now dominate this segment of the air conditioner market. Portable air conditioners are suitable for renters who are not allowed to install a fixed air conditioner, and low income households who are unable to afford the higher upfront capital cost (including installation costs) of a fixed air conditioner.

Feedback supported the adoption of the SEER standard and Zoned Label for double duct portables, with no submissions disagreeing.

While some feedback (largely from manufacturers of fixed products) supported maintaining the higher MEPS levels applicable to other air conditioners, E3 recognises that these products are constrained by physical size limitations on efficiency. Other feedback questioned the need to use the annualised MEPS metric, which incorporates inoperative power, because portable products tend not to be left plugged in. Evidence was also received suggesting the EU MEPS of 2.60 may still be too high, given the tighter testing tolerances of Australian/New Zealand regulations, compared with the EU.

The MEPS for double duct portables is therefore proposed to be set at an EER/COP of 2.50. The option to meet 95 per cent of the relevant MEPS for variable speed products (referred to as part load compliance) would not be available for portable products, because the MEPS is proposed to be reduced. Double duct portable air conditioners would be rated using the new SEER standard with the new Zoned Label applied.

The reduced MEPS would not apply to double duct products that are intended to be wall mounted during operation. Wall mounted double duct products are a small segment of the overall market, with estimated sales of less than 1,000 units per year. Eight of ten submissions, including submissions from two suppliers of wall mounted double ducts, argued the reduced MEPS should not be applied to these products. Wall mounted double duct products that claim to meet the existing MEPS are already available, both in Australia and overseas.

⁵² Commission Regulation (EU) No 206/2012 of 6 March 2012.

A reduced MEPS could provide wall mounted double ducts with an unfair competitive advantage compared with direct substitutes, such as window/wall air conditioners, that have to meet the existing MEPS. Wall mounted double ducts are direct substitutes as they generally involve similar fixed installation to window/walls, and are also suitable for installation in portable buildings where window/walls are prevalent.

Wall mounted double ducts are not direct substitutes for double duct portables, as they involve fixed installation (e.g. by drilling holes through a wall), so are not suitable for renters or low income households that don't have permission to install them or that don't want to incur the additional cost of a fixed installation. The wall mounted double ducts are also less flexible, as they can't be readily moved from room to room, house to house or put into storage during winter.

Single ducts

Single duct portables are not subject to any energy efficiency regulations. Under Option A, it is proposed they be required to be tested to the new standard AS/NZS 3823.1.5⁵³ (published in August 2015) and to display the Zoned Label. There was broad support received through the RIS processes for applying the Zoned Label to single duct units. The Australian/New Zealand test standard accounts for the unit leaking hot air and radiating heat into the room. This provides a more meaningful measurement of the cooling output of a single duct portable than the various regional test standards. The standard also applies the principles used in two European test standards to disregard the effect of hot outside air being drawn into the cool inside room to replace the air expelled through the duct, which is the main drawback of single duct portables. The Consultation RIS suggested a capacity correction technique could be applied to deduct the heat drawn into the room. This was not included in the test standard, and was opposed by portable suppliers and the Consumer Electronics Suppliers Association (CESA). It has been excluded from this proposal.

The test standard for single duct portables is not compatible with the SEER standard. The portables standard only tests full load performance at 35 °C for cooling and 20 °C for heating, while the SEER standard tests at different loads and temperatures. In addition, the SEER standard applies a load to each temperature based on how hard the air conditioner will have to work to meet the load. In order to ensure the label is comparable across product types, running hours for portable products would be based on the same total cooling and heating hours in each zone and would be multiplied by the rated power input to estimate Annual Energy Consumption (AEC). All single duct portable products would be rated at zero stars, allowing their relative efficiencies to be compared through the AEC figures. See [Attachment B](#) for more details.

⁵³ [SAI Global store](#)

These steps would ensure that the inferior performance (in terms of efficiency, output and running costs) of single duct portables is reflected on the Zoned Label, so they can be compared with other air conditioners subject to labelling requirements. While portable air conditioners remain the only cooling option for some people, there are also some consumers who purchase these products believing they provide a comparable service to fixed air conditioners, such as small split system and window/wall units. The label would show their inefficiency compared with other small air conditioners.

Some portable air conditioners (both single and double duct) have a supplementary water evaporation feature to increase energy efficiency and capacity. While the Consultation RIS proposed this feature not be used for MEPS and labelling purposes, based on the feedback received, it is proposed that the evaporation feature be permitted, subject to meeting the operating time requirements of AS/NZS 3823.1.5:2015⁵⁴. Capacity outputs both with and without the use of this feature would be required to be included on the label.

Feedback on this modified proposal was generally supportive, although one company did not accept that single duct products were always going to be the least efficient product and should therefore not receive a zero star rating or high annual energy consumption figure. This company also suggested that these products warranted their own star rating scale. For reasons outlined throughout the RIS process and supported by the majority of submissions, this would not help consumers compare the efficiency of different air conditioners. A particular aim of the Zoned Label is to ensure products providing the same service (cooling or heating) can be compared accurately. Providing a separate rating scale for less efficient products could have a perverse outcome and may result in consumers purchasing inefficient and ineffective air conditioners, believing they have bought an efficient product.

3. Include air conditioners >65 kW capacity under E3 regulation

Include the energy efficiency requirements for A/C >65 kW capacity under GEMS/New Zealand regulations and in Australia remove these from the NCC. Maintain NCC MEPS levels.

Under this proposal, the MEPS for air conditioners with a capacity greater than 65 kW would be removed from the NCC in Australia and included under the GEMS Act. In New Zealand, they would be included for the first time under energy efficiency regulations.

Consultation with industry prior to the Consultation RIS indicated wide support for this proposal. While Consultation RIS feedback indicated general support for the proposal in

⁵⁴ Water evaporation functions must operate for a minimum of four hours to meet the standard's requirements. If the product cannot operate without water, they would be tested only on their water evaporation performance, with no standard air source testing required. Units able to operate with or without water must test using both features and state capacity output on the label for both functions.

terms of simplifying the regulations (with no one disagreeing), the feedback provided only anecdotal reports that the proposed change would provide regulatory cost savings or energy efficiency benefits. The supplementary consultation paper of November 2016 sought further information and evidence. Feedback unanimously supported this proposal, with stakeholders providing information and data indicating the proposal would deliver energy savings and that it would be more efficient and effective to specify MEPS requirements under the E3 program.

MEPS

Under Option A, air conditioners >65 kW would be regulated by E3, with the MEPS levels specified in the NCC only changing to incorporate the annualised metrics (AEER/ACOP), instead of the existing EER/COP requirements. No submissions raised concerns with this change to the metric, which would have minimal effect on these large capacity products. These revised MEPS levels are specified in Table 7 below.

Table 7 Proposed MEPS levels for air conditioners >65 kW (Option A)

Rated cooling capacity	Cooling only AEER	Reverse Cycle AEER/ACOP
65-95 kW	2.70	2.60
>95 kW	2.80	2.70

4. Resolve technical issues with air conditioner regulations

The Consultation RIS sought feedback on proposals to resolve a range of technical issues with the regulations. Feedback was also received on other technical issues in addition to those raised in the Consultation RIS. The final position on these issues is summarised in Table 8 below and set out in [Attachment A](#).

Table 8 Overview of technical changes

Proposal	Outcome
Remove H2 MEPS	Meeting a separate H2 MEPS level would no longer be required.
Multi-split registration	Systems comprising of multiple, already registered outdoor units would no longer be required to register the combined systems.
Supply of outdoor units only	MEPS requirements would apply to the supply of outdoor units that are not sold as a system.
Noise test standard for products <30 kW	EN 12102:2013 Air conditioners, liquid chilling packages, heat pumps and dehumidifiers with electrically driven compressors for space heating and cooling. Measurement of airborne noise. Determination of the sound power level.
Noise rating test points	Rated capacity cooling test at T1 (35 °C) test point or H1 (7 °C) for heating only units.
Noise test requirements	Non-ducted split systems: indoor and outdoor noise levels. Ducted units (both split and unitary units): outdoor noise levels only. Non-ducted unitary units (e.g. window/wall units): indoor and outdoor noise levels.

Proposal	Outcome
	Single and double duct portable unitary units that sit wholly within the conditioned space: indoor noise levels only. Multi-split systems: outdoor noise level of single outdoor units, based on the representative combination used for registration.
Changing the SEER degradation coefficient	The degradation coefficient from AS/NZS 3823.4 would be fixed at the default value of 0.25.
Measurement of non-operative power	Non-operative power (e.g. standby) for the MEPS metric would change to the weighted average power consumption (P_{io}) of AS/NZS 3823.4.
Inverter over-capacity	Would be considered as part of any future MEPS changes subject to a further RIS process.
H2 and H3 testing	Air enthalpy tests or a shorter calorimeter room test would be accepted for H2/H3 (2 °C/-7 °C) tests for all air conditioners.
Use of default SEER values	Fixed speed products would be able to use the default values for the 29 °C cooling test and variable speed products would be allowed to use the fixed speed test points.
Certifying test results for >30 kW products.	Eurovent, and AHRI certification and regional adoptions of ISO test standards would be able to be used.
Simulation testing of >30 kW products	Simulation software that can be demonstrated to yield equivalent results to a physical test would be able to be used.
Maximum cooling test	Would no longer be a requirement for labelled products.
Rating commercial products	Products may be rated on either a commercial or domestic operating basis.

5. Align New Zealand's cooling MEPS to match Australia's levels

This proposal would align New Zealand and Australian cooling MEPS for air conditioners. Cooling MEPS levels for some New Zealand domestic categories are lower than for heating, which are aligned with Australia. New Zealand's decision in 2013 not to align cooling MEPS with Australia was based on:

- New Zealand being predominately a heating market.
- Imposition of costs on the New Zealand industry to source and test new products to meet the higher standards.
- The risk of excluding some efficient heating products from the New Zealand market.

While New Zealand remains a predominately heating market, preliminary findings from a recent household survey by BRANZ (for EECA) show that approximately one third of households used their air conditioners for cooling as well as heating.⁵⁵

⁵⁵EECA Householder Survey Supplement to the BRANZ House Condition Survey 2016. [results still in draft]

In addition, analysis of air conditioners sold in New Zealand in 2015-16 showed only two models with less than 0.5 per cent of the total market would be affected by aligning the cooling MEPS with Australia. Neither supplier of these products raised concerns with the proposal in response to the supplementary consultation paper. The two affected models also do not have exceptional heating efficiency. Aligning with Australian MEPS requirements would improve the average heating as well as the cooling energy efficiency of air conditioners available in New Zealand.

Aligning New Zealand's cooling MEPS with Australia's levels would also simplify regulatory requirements for companies that supply air conditioners to both countries, and remove any potential issues under the Trans-Tasman Mutual Recognition Arrangement. While there were two suppliers who disagreed with this proposal in the Consultation RIS, again arguing aligning cooling MEPS wasn't justified given New Zealand is mainly a heating market, the majority of submissions agreed. There were no objections raised in the supplementary consultation paper.

Option B

In addition to the reform proposals outlined for Option A, Option B includes a proposal to introduce a MEPS level for single duct portable air conditioners.

6. Single duct portable air conditioners subject to a MEPS level of 2.50 based on EER/COP

The Consultation RIS suggested a MEPS of 2.60 AEER/ACOP be applied to single duct portable air conditioners (nominally matching the EU cooling level). It was also proposed that this must be met without the use of supplementary water evaporation features. Feedback from industry groups (CESA and the Australian Industry Group (Ai Group)) and portables suppliers indicated:

- an EER/COP metric would be more appropriate
- supplementary water evaporation is an energy efficient feature that should be recognised
- differences between EU and Australian/New Zealand test tolerances mean a MEPS of 2.60 may be too high.

In response to this feedback, the proposal has been modified to set the MEPS at an EER/COP of 2.50 as tested by AS/NZS 3823.1.5:2015. As with double ducts, there will be no part load compliance available.

Submissions supported this modified proposal, although one submission suggested a lower MEPS for hermetically sealed products (in both their formal submissions), because they are unlikely to leak refrigerant (a powerful greenhouse gas) and that lower MEPS levels for products containing low global warming potential refrigerants be considered. These suggestions were not adopted, because there are separate regulations that deal with refrigerants.

Option C

Option C builds upon Option B by including a proposal to increase the MEPS levels for air conditioners with a capacity over 65 kW.

7. Increase MEPS levels for air conditioners >65 kW

This option would increase the MEPS levels of these products to match the 39 to 65 kW levels specified under the GEMS Act in Australia (i.e. AEER/ACOP of 2.90). All but one submission supported this proposal, on the condition that adequate time is allowed for reengineering products that would not meet the increased levels. One supplier of products from the USA was not in favour of imposing MEPS above the equivalent levels applying in the USA.

Higher levels are set to commence in the USA from January 2018 and be increased again in 2023 (the US will also move to a seasonal metric in 2018). These are final regulations and will become effective as scheduled. The new US MEPS levels for heating (a COP of 3.20 to 3.30, depending on the product type) are above the proposed increase to 2.90 based on ACOP. This is likely to lead to a small improvement in the average efficiency of products greater than 65 kW in Australia and New Zealand, due to imports of products that have been designed to meet the new US MEPS levels. It is expected to have minimal effect on the Australian and New Zealand markets, because products of this size are mainly manufactured or assembled locally.

In January 2017, a request was sent to sixteen companies for sales and efficiency data to update the cost benefit estimates of the proposal. This data did not identify a relationship between price and efficiency for these products, so the Consultation RIS assumption about the cost of the proposal has been used in the Decision RIS.

Abandoned proposal

Align the MEPS levels for fixed and variable speed air conditioners by removing the 'part load' compliance option.

The Consultation RIS considered removing the option to register variable speed products that only meet 95 per cent of the MEPS at full load if they have good part load performance.

Feedback was mixed on this proposal, with around the same number of submissions opposed as supportive. Some submissions pointed to the likelihood of perverse outcomes, such as increased annual energy consumption, if fixed speed models displaced part load compliant variable speed air conditioners on the market. As a result, this proposal has been abandoned.

SEER based MEPS

Five submissions, including three industry bodies, requested a move to MEPS based on the SEER standard, rather than an AEER/ACOP metric. E3 recommends a move to a SEER based MEPS, or an additional SEER based MEPS, be considered in the next review of the regulations. Implementation of AS/NZS 3823.4 would mean SEER data is collected through the registration process, which would allow the merits of, and options for, a SEER based MEPS system to be investigated.

5. Cost benefit analysis

This section outlines the costs and benefits of the policy options and who will be affected.

Business as usual

Evaluation

Under BAU, there is no change to the regulations. This means that energy efficiency savings continue to accrue—the service life of air conditioners means that older, less energy efficient products are being replaced over time with newer products that meet the higher MEPS. Further, the label, despite its shortcomings, is generally still enabling consumers, installers and manufacturers to buy or supply increasingly energy efficient products. Table 9 shows an evaluation of the benefits, costs and energy and emissions savings associated with the regulations⁵⁶.

Table 9 Evaluation of impacts⁵⁷

Indicator	2009 to 2015		2009 to 2020	
Country	Australia	New Zealand	Australia	New Zealand
Energy Savings (GWh cumulative)	1,258	142	4,454	480
Emissions Savings (CO ₂ -e cumulative)	1.2Mt	22kt	4.3Mt	69kt
Benefits	A\$0.6bn	NZ\$86m	A\$1.1bn	NZ\$154m
Costs	A\$0.4bn	NZ\$37m	A\$0.8bn	NZ\$74m
Net Benefit	A\$0.2bn	NZ\$48m	A\$0.3bn	NZ\$79m
Benefit cost ratio	1.4	2.3	1.4	2.1

⁵⁶ The evaluation is in 2014 dollars - it covers the decision to introduce new or updated energy efficiency regulations for air conditioners in 2009 and 2010. NZ values are shown in NZ dollars, calculated with an exchange rate of 1.08 NZD to 1 AUD.

⁵⁷ Evaluation estimates from EnergyConsult.

The evaluation indicates that up to 2015, significant energy and emissions savings have been realised. The policy interventions are estimated to have delivered a net benefit of around \$200 million in Australia and \$48 million in New Zealand at a benefit cost ratio of 1.4. The cumulative emissions savings up to 2015 are estimated at around 1.2 million tonnes CO₂-e in Australia and 22 kilotonnes CO₂-e in New Zealand. Based on sales trends, these benefits are projected to increase to 2020.

The evaluation made use of the cost assumptions in previous RISs. It is difficult to establish a relationship between price and efficiency, which could be used to calculate any increase in product costs due to increased MEPS levels. Yet it seems reasonable to assume some costs exist. The inability to find a relationship is likely to be because the price of air conditioning has declined over time, a trend unrelated to the improvement in the average efficiency of products.

Compared to what was projected in the RIS documents, the benefits are projected to be around 30 per cent lower in Australia. Sales in the 2009 and 2010 RISs were projected to be around 1.25 to 1.3 million units per annum in 2020, while the sales in 2020 are now projected to be lower. The sales of air conditioners in the period 2007 to 2010 were growing at 5 to 6 per cent per annum and the projections in the RISs were based on these high levels of sales growth. However, sales growth has decreased or flattened, so this lower growth trend has been factored into the evaluation.

As the benefits and costs of the existing regulations accrue under BAU, they do not form part of the cost benefit analysis of the policy options in this RIS.

Reform opportunities

Under BAU, the opportunity to resolve the problems with the regulations is not taken up. These problems include:

- The existing label continues to apply. For consumers, retailers and installers, the label does not provide some important information, such as energy efficiency performance more relevant to a particular location and indicative annual energy consumption. The rating method used on the label will continue, which means there is no mandatory cold temperature performance test and it continues to favour fixed speed products over inverter products.
- Double duct portable air conditioners are unlikely to be available on the Australian and New Zealand markets. For suppliers, this means they are unable to import or sell these products, because they would not meet the applicable MEPS. Customers, such as renters and low income households, who do not have the option or ability to install a fixed air conditioner, are restricted to inefficient and ineffective single duct portable products. Other consumers that would like to purchase a double duct portable product are unable to do this.
- The NCC energy efficiency requirements for air conditioners only cover new buildings and major new works in existing buildings. Replacement air conditioners are not within the scope of the NCC MEPS requirements and building owners may be supplied with a less efficient product and therefore face lower

upfront costs, but higher running costs⁵⁸. Suppliers of products in the scope of the NCC will incur lower costs, compared with products covered by the E3 program.

- The inconsistent MEPS levels that apply will continue. Customers that purchase or are supplied with products that are subject to the inconsistencies in the regulations may purchase a less efficient product and face lower upfront costs, but higher running costs than necessary. For suppliers of products not within the scope of the regulations or suppliers of products that will need to take action to comply with any revised MEPS levels, costs will remain unchanged.

This RIS, therefore, considers policy options to resolve these issues and improve the regulations, consistent with COAG Best Practice Regulation Principle 6 “ensuring that regulation remains relevant and effective over time”.

Option A

Replace Energy Rating Label with the Zoned Label

For consumers, the Zoned Label would improve the information available about the energy efficiency of air conditioners, by displaying the seasonal energy efficiency and energy consumption of products across three climate zones in Australia and New Zealand. The Zoned Label would also provide standardised information about the noise produced by air conditioners.

The Zoned Label is likely to result in an increase to the upfront cost of air conditioners, in the short term, due to implementation costs borne by suppliers. These costs are likely to be passed onto consumers. As the underpinning SEER standard aligns with the approach used for rating air conditioners in most other countries, it is not expected to involve significant new costs for most suppliers. Where a SEER test has already been conducted for another market, suppliers would not need to repeat the test for Australia or New Zealand. This includes noise tests, which are already undertaken by some suppliers to meet EU requirements. For the SEER, cost increases would also be limited by a series of flexible testing arrangements (see [Attachment A](#) for details)

Adoption of the SEER standard and the Zoned Label is likely to give suppliers of energy efficient and quieter products an advantage in the market, while disadvantaging suppliers of energy inefficient and noisy products. By disclosing capacity and energy efficiency in cold temperatures, the Zoned Label would also favour suppliers of better performing products in cold conditions (and vice versa).

SEER ratings for products up to 30 kW capacity

⁵⁸ This is in line with standard economic analysis, which suggests that energy efficiency policy interventions bring the market to a new equilibrium where appliances have higher upfront prices and lower operating costs. However, some studies suggest that often prices do not increase as forecast due to regulation (e.g. MEPS) inducing innovation by suppliers. See for instance ‘A retrospective investigation of energy efficiency standards: policies may have accelerated long term declines in appliance costs’, Buskirk, Kantner, Gerke and Chu, 2014.

For consumers, SEER ratings would improve the information available about the energy efficiency and noise of air conditioners up to 30 kW. This would also increase the upfront costs of these products, as suppliers respond to the new requirements. Applying SEER ratings to these products would also be likely to increase the sales of products that are more energy efficient (and vice versa).

Single duct portable air conditioners subject to a Zoned Label

For consumers, labelling of single duct portables would improve the information available about the energy efficiency of these products, but it would also increase upfront costs, due to the new requirement for suppliers to conduct energy efficiency and noise tests and apply the Zoned Label. For suppliers, applying the Zoned Label would increase costs and is expected to reduce sales by highlighting the poor energy efficiency of single duct portables, compared with other air conditioning options. Suppliers with higher efficiency products may be able to market them more effectively and differentiate themselves.

Double duct portable air conditioners subject to a Zoned Label and reduced MEPS

Double duct portables are likely to re-enter the market, providing consumers, in particular renters and low income households, with better access to affordable and energy efficient and effective portable cooling options. The Zoned Label would improve the information available to consumers about the energy efficiency of these products. The requirement to apply the Zoned Label may increase the upfront cost of double duct portables. For suppliers, reducing the MEPS level to allow double duct portables to re-enter the market would increase their sales.

Include MEPS for air conditioners greater than 65 kW

For businesses that purchase or are supplied with products that would now be within scope, the MEPS requirements would improve the energy efficiency of products, which would increase upfront costs, but lower running costs. For suppliers, this change would increase costs for those businesses supplying products that would come within the scope of the GEMS Act or the New Zealand regulations. E3 is not aware of any air conditioner suppliers in Australia that deal with the NCC, but not with the GEMS Act.

Options A, B and C – MEPS increases

In addition to the effects above, Options A, B and C include:

- increase New Zealand's residential cooling MEPS to match Australia's level
- apply MEPS to single duct portable air conditioners
- include MEPS for >65 kW air conditioners and increase the MEPS levels.

The effects of these policy proposals would be similar. Where MEPS levels are introduced or increased, the proposals would increase costs for suppliers that do not meet the MEPS by requiring them to source or import more efficient products or to re-tool and manufacture products that comply. For customers, the proposals are likely to reduce

running costs for affected products, through improved energy efficiency, but increase purchase costs.

Cost benefit estimates

The cost benefit estimates of the policy options were prepared by the consultancy firm EnergyConsult, who have expertise in the air conditioning sector. The full methodology and analysis is available at [Attachment C](#).

Method for calculating energy and greenhouse gas effects

Energy consumption

The energy used by air conditioners is a function of average electrical input power, the number of operating units and the average number of hours of operation.

EnergyConsult developed a stock model of units installed and operating to calculate the energy consumption under the BAU and policy scenarios. The number of operating units in a particular year is a function of existing stock, replacements and new sales.

EnergyConsult estimated the stock and sales of air conditioners in Australia and New Zealand. Units were retired from operation according to a 'survival function', which reflected the life span of typical equipment. EnergyConsult developed a complete stock model of the air conditioner market by region and year, with additional details, such as category, capacity range, average efficiency (at multiple load points and standby power) and year of purchase or installation. These units were multiplied by BAU and policy average power input figures at various load points and corresponding average number of hours of operation for each category or load point to obtain the total energy consumption by state, category and capacity range. Operating hours were varied according to the region and whether a unit is operating in the business or residential sector. The proportion of time operating at various load points was also varied, depending on the region where the equipment is installed.

Data on the rated efficiency of the units was used to determine the average BAU input power to the air conditioners. The input power is a function of the Coefficient of Performance (COP, the ratio of heating output to electrical input) or Energy Efficiency Ratio (EER, the ratio of cooling output to electrical input) of the air conditioner. The COP, EER and cooling capacity in kW are the commonly used technical attributes of air conditioners. The input power in kW for each load point can be calculated as:

$$\text{Input power (kW)} = \frac{\text{Cooling/heating capacity (kW)}}{\text{EER or COP}}$$

EnergyConsult also included the standby and crankcase power consumption (or non-operational power) in the calculations of total annual energy consumption for air conditioners.

The BAU average efficiency was determined from sales weighted average or model weighted average EER/COP over the last ten years (or from when the products were registered), and projected to 2030 with an autonomous annual efficiency improvement of between 0.25 per cent and 0.5 per cent. Efficiency increases due to the existing Australian and New Zealand MEPS and label were included in the BAU average efficiency. The average efficiency of the units as a result of the policy options being assessed was determined on the basis of the increase in sales weighted average EER or COP at each load point. Energy consumption was determined for the BAU and policy scenarios. The difference in the projections of energy consumption provided the net energy savings used to calculate the effects of each option.

Greenhouse gas emissions were determined by multiplying the energy used by air conditioners by the relevant emission factor for where they operate. The emission factor refers to the amount of emissions produced from the supply of a given unit of electricity. In the model, the emissions savings were estimated by using the region energy calculations combined with greenhouse gas emissions factors.

EnergyConsult conducted a financial analysis on the societal costs and benefits of the proposals being reviewed, with the analysis conducted at the state and national level.

Costs

- To businesses for complying with the new or modified regulations (e.g. sourcing or re-designing more efficient products, testing costs, and administrative costs).
- To consumers, due to increases in the upfront price of products reflecting costs passed on by suppliers.
- To government, for implementing and administering the regulations.

Benefits

- To consumers, due to improving the information available for comparing the energy efficiency of products and the improved energy efficiency of available products, resulting in reduced electricity costs.
- To suppliers from removing unnecessary costs from the regulations.

A consumer approach is used for the cost benefit analysis. An analysis from a consumer perspective involves the use of retail product prices and marginal retail energy prices. Since the objective is to assess whether product buyers (consumers) as a group would be better off, transfer payments such as taxes are included. The analysis includes retail mark-ups and taxes that are passed onto the consumer and including these in the costs will simplify the analysis process, while still remaining appropriate.

For New Zealand, national benefits are assessed using the avoided long run marginal cost of electricity and accordingly, resource costs are used to assess the cost of efficiency improvements (assumed to be 50 per cent of the product's retail price). The benefits for New Zealand also include financial benefits associated with greenhouse gas abatement.

All costs and benefits are estimated in Net Present Value (NPV) terms and are stated in real 2016 dollars⁵⁹.

Inputs

The inputs to the model are outlined in [Attachment C](#). They include information on product categories, sales and stock data; the BAU and policy energy efficiency and cost assumptions; government and regulatory costs; electricity prices, emissions factors, product life, operating hours and sensitivity tests.

Cost and benefits of options

The effects of the policy options are shown in Tables 10 and 11.

Table 10 Cost benefit estimates – Australia

Option	Energy Saved (cumulative to 2030 - GWh)	GHG Emission Reduction (cumulative to 2030) Mt	Total Benefit (A\$M)	Total Cost (A\$M)	Net Benefit (A\$M)	BCR
Option A	2,329	1.8	\$651	\$153	\$498	4.2
Option B	2,432	1.8	\$673	\$159	\$515	4.2
Option C	2,554	1.9	\$705	\$163	\$543	4.3

Note: This table uses a discount rate of 7%.

Table 11 Cost benefit estimates - New Zealand

Option	Energy Saved (cumulative to 2030- GWh)	GHG Emission Reduction (cumulative to 2030) kt	Total Benefit (NZ\$M)	Total Cost (NZ\$M)	Net Benefit (NZ\$M)	BCR
Option A	455	44.0	\$42	\$15	\$27	2.8
Option B	456	44.2	\$42	\$15	\$27	2.8
Option C	457	44.3	\$42	\$15	\$27	2.8

Note: This table uses a discount rate of 6%.

The cost benefit estimates indicate that Option C would provide the largest net benefit to Australia and New Zealand at A\$543 million and NZ\$27 million respectively. Option C would also provide the largest energy and greenhouse gas savings, but has higher costs than Options A and B.

⁵⁹ NPV is a calculation that allows decision makers to compare the costs and benefits of various alternatives on a similar time scale by converting all options to current dollar figures. NZ values are shown in NZ dollars, calculated with an exchange rate of 1.18 NZD to 1 AUD (the long term average).

For Australia, the benefit cost ratios are similar across the policy options, with Option C having the highest benefit cost ratio of 4.3:1. For New Zealand, the benefit cost ratios for the three options are the same. There is little difference between the options for New Zealand, because the two product categories (single duct portable air conditioners and air conditioners greater than 65 kW capacity) that separate Option A from Options B and C are only a small component of the New Zealand market. Option A is projected to provide a net benefit due to an:

- improvement in the part load efficiency and heating efficiency of air conditioners
- increase in the efficiency of portable air conditioning products
- improvement in the average efficiency of >65 kW capacity air conditioners
- increase in the efficiency of air conditioners in New Zealand from the adoption of Australia's MEPS levels.

These benefits are reduced by increased costs (mainly increases in the price of air conditioners), with the modelling results indicating a benefit cost ratio of 4.2:1 for Australia and 2.8:1 for New Zealand.

Option B provides a greater amount of net benefit than Option A (A\$22 million in Australia and around NZ\$50,000 in New Zealand) due to the introduction of a MEPS for single duct portable air conditioners. The extra energy savings provided by the MEPS levels more than offsets the increase in the price of portable air conditioners in both countries.

Option C provides a greater amount of net benefit than Option B (A\$32 million in Australia and around NZ\$90,000 in New Zealand) due to the higher MEPS level for air conditioners greater than 65 kW capacity. The extra energy savings provided by the MEPS levels more than offsets the increase in the price of these large air conditioners. In Australia the benefit cost ratio for Option C increases marginally compared with Option B (from 4.2:1 to 4.3:1), but remains the same in New Zealand.

EnergyConsult analysed the sensitivity of the results to higher costs and higher discount rates. This analysis indicates that, if the costs were increased by 50 per cent, the policy options would remain cost effective. Sensitivity analysis also indicates that if the discount rate is increased to 11 per cent in Australia or 8 per cent in New Zealand, the policy options remain cost effective.

While the cost increases would generally be borne by businesses, they are likely to be passed on to consumers through increases in the price of air conditioners. The higher costs are expected to be more than offset by the energy and greenhouse gas emission savings the changes to the regulations are projected to deliver. The policy options also provide reductions in greenhouse gas emissions at a negative cost. For Australia this is estimated to be around \$-280/tonne.

Details of the cost benefit analysis, energy savings and emissions reductions by region and sensitivity scenarios are in [Attachment C](#).

6. Consultation

Consultation forums

E3 has ongoing engagement with stakeholders through several forums, which have helped develop and refine the policy proposals.

Air-conditioner and Commercial Refrigeration Advisory Committee

E3 officials meet with air conditioning industry representatives in the ACRAC. ACRAC comprises around 55 members. The committee allows industry members to review and inquire into E3 work, discuss issues and provide feedback to E3. The ACRAC Committee's Terms of Reference and meeting minutes can be found on the [Energy Rating](#) website.

E3 Review Committee

E3 representatives meet with stakeholder groups (industry and consumer bodies) in the E3 Review Committee. The E3 Review Committee is a forum for stakeholder groups to provide advice to government across the E3 program and meets twice a year.

Standards Committees

E3 works with industry to develop relevant standards through a range of Standards Australia committees. The Room Air Conditioner Committee (EL-056) has developed a test standard for single duct portable air conditioners, as well as the local adoption of the international SEER test standard, ISO 16358. These two standards underpin the proposed changes to the regulations. Drafts of these standards were open for public comment prior to being finalised. E3 is also contributing to the domestic cooling and heating appliances installation standard through committee EE-001.

Consultation Regulation Impact Statement

Workshop and interviews – data and assumptions

EnergyConsult interviewed 25 suppliers from Australia and New Zealand in 2013 and 2014 to identify the data inputs and develop assumptions for the cost benefit analysis. E3 also held a workshop with 50 industry participants in April 2014, where the preliminary results of the modelling were presented and feedback sought. This was followed by further

consultation at the Air Conditioning, Refrigeration and Building Services conference in May 2014. In New Zealand, EnergyConsult interviewed stakeholders to obtain feedback on the preliminary modelling results for New Zealand.

RIS information sessions and formal submissions

The Consultation RIS was published in February 2016 on the Energy Rating, COAG Energy Council and EECA websites. It was distributed to around 1000 stakeholders by email and consultation sessions were advertised in *The Australian* newspaper.

Consultation sessions on the RIS were held in Sydney, Melbourne, Brisbane, Adelaide, Perth and Wellington between 15 and 23 February 2016. Around 100 people attended the consultation sessions, with 30 written submissions received in response from a range of manufacturers, industry groups and individuals. The submissions provided policy input and technical information about the proposals. Little feedback was received on the data or assumptions that underpin the cost benefit estimates.

Supplementary consultation paper

E3 published a supplementary consultation paper on the Energy Rating website in November 2016, in response to feedback on the Consultation RIS. The paper was released to provide the opportunity for further feedback where the Consultation RIS proposals had been modified or were not recommended to continue and to seek additional information on specific issues. It was also distributed to approximately 1000 stakeholders by email.

Consultation sessions were held on 6 December 2016 in Sydney and 9 December 2016 in Wellington (with a teleconference link to Auckland). Around 50 people attended the two sessions. Separate meetings were held with three stakeholders in Sydney, Melbourne and Canberra in January 2017, while a further teleconference was held with an overseas based supplier in March. Thirty written submissions were received in response.

Stakeholders provided feedback on whether a policy proposal was supported or whether it was feasible. Again, little feedback was received on the data or assumptions that underpin the cost benefit estimates.

Both the Consultation RIS and supplementary consultation paper covered both air conditioners and chillers (air conditioning systems used in large buildings). This Decision RIS only covers air conditioners, because the chiller proposals require more work and further consultation.

Implementation paper

Four submissions to the supplementary paper requested more information on how and when the changes would take effect, if a decision is made to implement them. In response,

a consultation paper on implementing the changes was prepared and initial discussions held with representatives from CESA and AREMA. The paper was released on 15 March 2017. A meeting and teleconference was held in Sydney on 17 March 2017 to discuss the implementation of the proposals, with around 40 people attending or listening on the phone.

Double ducts paper

In June 2017, the department circulated an initial draft of the proposed GEMS Determination to seek feedback on technical issues. Feedback on this draft showed there were different views on which products are covered by the proposal to lower the MEPS for double duct portable air conditioners. The department convened a meeting with stakeholders on June 30 to discuss the issue and released a paper seeking views on the issue. Ten submissions were received in response.

Consumer feedback

Various non-government organisations and consumer groups are included on contact lists and were invited to provide formal feedback and attend consultation sessions throughout the RIS process. None responded, however.

Consumer group CHOICE has a member in ACRAC, the E3 Review Committee and the air conditioner standards committee EL-056 and as a result, is kept well informed of changes as they are proposed and consultation progresses. CHOICE supports the proposed changes to air conditioner regulations.

E3 representatives made contact with CHOICE following the release of the implementation paper to seek formal feedback on the policy options proposed. Their response is as follows.

“CHOICE agrees that these steps are likely to have significant benefits for consumers, in particular in helping to reduce household energy consumption and costs, by helping consumers to choose more efficient air conditioner models and therefore encouraging the production and sale of same.

To comment more specifically:

- a) The proposed new label, while it is rather busy with information, nevertheless provides a lot more useful information than the current label. CHOICE believes that with suitable education, the new label will be accepted and used by consumers and should help them to select the best air conditioner model for their needs.
- b) Retail sales of portable air conditioners in the recent summer heat waves have shown that consumers will still readily buy these models when there's no other option, even though these models are less efficient and effective than split-systems. Therefore it is important that these models are subject to energy labelling to help consumers choose the best models, and to understand how these models compare to split-systems and other types. For the same reason it's certainly a good idea to

adjust the MEPS rules for double-duct portable models to allow these back into the market.

- c) Ducted air conditioners are a small but significant part of the market and are a significant investment for consumers, and therefore should certainly require star ratings to help consumers choose the most efficient models.
- d) As the gas and electricity retail markets are in some turmoil and future retail prices of these commodities are uncertain, it's important to be able to easily compare the cost of gas heating versus heating using electricity (such as with a reverse cycle air conditioner). We agree that the proposed new label, with its additional information on cold climate energy usage, will help towards that end."

7. Evaluation and conclusion

Recommended option

Option C is the recommended policy option. This option is estimated to provide the largest net benefit to both Australia and New Zealand at A\$543 million and NZ\$27 million respectively. Option C would also provide the largest energy and greenhouse gas savings. Option C remains cost effective if the costs of the proposals are increased by 50 per cent, or if the discount rate applied is increased to 11 per cent in Australia or 8 per cent in New Zealand.

Option C

Option C includes the following changes to the regulations:

- **Energy efficiency information:** Adopt the SEER standard (AS/NZS 3823.4) for rating air conditioner energy efficiency. Remove the existing Energy Rating Label and replace it with the Zoned Label.
- **Portable air conditioners:** For double duct portable air conditioners, reduce the MEPS to 2.50 (EER/COP) and apply the Zoned Label. For single duct portable air conditioners, apply a MEPS of 2.50 (EER/COP) and the Zoned Label (tested to AS/NZS 3823.1.5).
- **Increase New Zealand MEPS:** Increase New Zealand's residential cooling MEPS to Australia's levels.
- **Commercial/industrial air conditioners:** include MEPS for air conditioners >65 kW capacity and apply a MEPS level of 2.90 (AEER/ACOP).
- **Technical fixes:** Resolve minor technical issues with the regulations.

8. Implementation and review

Implementation

New regulations

If one of the policy options is approved by the COAG Energy Council, the *Greenhouse and Energy Minimum Standards (Air Conditioners and Heat Pumps) Determination 2013* would be revised for approval by the Commonwealth Minister for the Environment and Energy. In New Zealand, any policy proposals would be approved by Cabinet before being adopted under the *Energy Efficiency (Energy Using Products) Regulations 2002*.

In Australia, the new MEPS and labelling requirements (previously incorporated in AS/NZS 3823.2) would be referenced directly in the new GEMS Determination in Australia. Stakeholders would be invited to comment on at least one draft of the GEMS Determination before it is finalised. In New Zealand, these same technical requirements will be referenced. Most likely this will be by referencing parts or all of the Australian Determination in the *Energy Efficiency (Energy Using Products) Regulations*. Separate sections follow detailing the timeframes and transitional arrangements for each country.

Timeframes - Australia

E3 will recommend the new requirements for most air conditioners start on 1 April 2020 for new products that need to be registered or re-registered, subject to consultation with industry stakeholders on the practicality of this date. Transitional arrangements would apply to products that are already registered. The exceptions to the 1 April 2020 start date would be double duct portable air conditioners (estimated start date of 1 April 2019 for application of lowered MEPS) and air conditioners greater than 65 kW capacity (1 October 2021, also subject to consultation with industry stakeholders).

- Previously unregistered products imported into or manufactured in Australia from the relevant start date would be required to comply with the new requirements.
 - The proposed 1 April 2020 start date would provide suppliers with a 12 month lead time to undertake the additional testing and prepare the Zoned Label.
 - This timing is based on a COAG Energy Council decision in late 2018 with a revised GEMS Determination approved in the first half of 2019.
- Transitional arrangements would apply to products that are registered prior to the start date.
 - Suppliers would also be able to voluntarily register products to the new regulations, prior to the mandatory start date.
 - Not requiring all products to be registered to the new requirements from the start date recognises industry requests for a sufficient lead time to conform with the new requirements.
 - This approach allows the benefits of the new regulations to begin as soon as is practical, while minimising disruption and costs to industry.

The exceptions to the proposed 1 April 2020 start date would be:

- A start date of 1 October 2021 for the proposals covering air conditioners greater than 65 kW.
 - This date recognises the proposal would require the re-design of some products, subject to consultation with industry stakeholders on the practicality of this date.
- A start date of the day after a revised GEMS Determination is signed, for the proposal to lower the MEPS for double duct portable air conditioners⁶⁰.
 - E3 is proposing to reduce the MEPS for double duct portables as soon as is practical in Australia, because the absence of these products from the market is an unintended consequence of the regulations and should be rectified as soon as possible⁶¹.
 - SEER testing and application of the Zoned Label to double duct portable air conditioners would not be required until 1 April 2020.
 - For administrative reasons, the estimated 1 April 2019 date would not apply in New Zealand.
 - The regulations for double duct portables would be changed at the same time as other products.

Timeframes - New Zealand

New Zealand will aim to align start dates with Australia. New and revised MEPS for most proposals discussed in this RIS will come into force no earlier than 1 April 2020. However:

- For all air conditioners greater than 65 kW capacity:
 - A start date of no earlier than 1 October 2021 applies.
 - All aspects of this proposal are the same as for Australia.
 - All products manufactured in New Zealand on, or imported after 1 October 2021, will be required to comply with the new requirements.
- For double duct portable air conditioners, the earliest these MEPS changes can be made in New Zealand regulation is likely to be 1 January 2020, because of the time required to change primary legislation. Stakeholders will be advised of an exact date closer to the time.
 - For all double duct portable air conditioners in New Zealand:
 - A start date approximately 1 January 2020 applies (to be notified).
 - Apart from the start date, all aspects of this proposal are the same as for Australia.
 - All products manufactured in New Zealand on, or imported after the notified start date will be required to comply with the new requirements.
- For all other air conditioners in scope of the new requirements:
 - A start date of no earlier than 1 April 2020 applies.
 - All products manufactured in New Zealand on, or imported after 1 April 2020, will be required to comply with the new requirements.
 - New cooling requirements for New Zealand from 1 April 2020: New Zealand will increase the cooling MEPS requirements for residential air conditioners, to align with Australia's cooling levels. This will apply from 1 April 2020.

Registration and fees

In Australia, suppliers would be able to update existing registrations that go beyond 1 April 2020 to include the new mandatory information, such as an updated test report, with additional test points for the Zoned Label or the SEER rating. Suppliers updating an

⁶⁰ That is, if the new regulations are signed on 30 April 2019, the lower MEPS would apply from 1 May 2019.

⁶¹ EER/COPs of 2.50 to 2.99 for these products would result in half a star on the existing label.

existing registration would pay a fee of \$250, which reflects the administrative cost to the GEMS Regulator of processing the information.⁶²

- A reduced registration fee leading up to the start date was considered, but this approach would not cover the administrative costs of processing a registration application.
- If the registration is varied, all products covered by the registration would be required to comply with the new GEMS Determination, which includes display of the Zoned Label on products already for sale in shops.

In New Zealand no fees are payable for registration.

Transition arrangements

Products newly in scope

Products newly in scope of the GEMS Act and New Zealand regulations (i.e. single duct portables and air conditioners >65 kW) that have been manufactured in or imported into Australia or New Zealand prior to the relevant start date and are unable to meet the new requirements (i.e. fail to meet the new MEPS) would be grandfathered. These products may be offered for sale until sold out. Products able to comply with the new requirements (i.e. can meet the new MEPS) would have to be registered, before they could be offered for sale. The Zoned Label would not be required for single duct products manufactured in or imported into Australia prior to 1 April 2020.

Products currently in scope

In Australia, the MEPS level requirements for products within the scope of the GEMS Determination have not changed, so these products cannot be grandfathered (i.e. offered for sale indefinitely until sold out). Transitional arrangements would allow existing products to continue to be sold for the remainder of their registration period (e.g. a product registered on 1 July 2015 could continue to be sold until 30 June 2020), if they have been imported into or manufactured in Australia prior to 1 April 2020. This would include continued use of the Energy Rating Label for labelled products. Following expiry of the current registration, registration to the new Determination would be required.

In New Zealand, any product that meets the current requirements and is manufactured in New Zealand or imported before any change in the law may continue to be sold until stock runs out. This would include continued use of the Energy Rating Label for labelled products. Any products that are manufactured in New Zealand or imported after the law change must meet the new requirements and use the new labels.

Transition to the Zoned Label - Australia

Under the GEMS Act, the GEMS Regulator can provide a transition period for the new Zoned Label.

⁶² Note the fees charged under the GEMS Act in Australia are under review. These fees do not apply to registrations with the New Zealand regulator.

- E3 proposes to allow products to continue to use the previous Energy Rating Label for the remainder of their five year registration in Australia.
 - This includes the ability to manufacture and import into Australia for the full five year registration period.
 - Use of transitional arrangements would minimise the cost to suppliers and retailers.
 - This approach recognises the difficulty for suppliers in re-labelling products that have moved through the supply chain and are being sold through retail stores and other channels.
- While there is some risk of consumer confusion, due to the previous label and the Zoned Label being displayed at the same time, it is not expected to be prolonged, because many suppliers have indicated they would like to move to the Zoned Label as soon as they can.
 - Training and education material would be made available to retailers and consumers to help explain the Zoned Label changes and reduce any confusion.
 - The Energy Rating website would provide a calculator to estimate the conversion of a star rating on the previous label to the Zoned Label.
 - This conversion would only apply to the cooling cycle of a product. The estimates would use the registered T1 cooling performance and cooling inoperative power consumption figure (P_{noc}) and apply the default values for a fixed speed product (as per Table 1 of AS/NZS 3823.4.1) to yield the Total Cooling Seasonal Performance Factor (TCSPF) and its corresponding star rating.
- Suppliers would be able to voluntarily apply the Zoned Label the day after the Determination is signed, prior to the mandatory 1 April 2020 start date for new registrations or re-registrations.
 - If the Zoned Label is applied, the existing Energy Rating Label would not be required.

The implementation approach is summarised in Table 12 below.

Table 12 Implementation approach

Product	Start date	Label	Grandfathering
Double duct portable air conditioners	1 October 2019 (estimated) for lower MEPS 1 April 2020 for Zoned Label/SEER rating	From 1 April 2019 (estimated), may apply either the existing Energy Rating Label or the Zoned Label. From 1 April 2020, the Zoned Label must be applied for new registrations.	No, but the transitional arrangements would allow products registered prior to 1 April 2020 to continue to be sold for the remainder of their registration period, including continued use of the existing label.
Other air conditioners already in scope – Zoned Label/ SEER rating	1 April 2020 for products that need to be registered or re-registered	Products registered prior to 1 April 2020 may continue to use the existing label for the duration of their registration.	
Single duct portable air conditioners	1 April 2020	Zoned Label mandatory from 1 April 2020 (voluntary from 1 April 2019 - estimated)	Products newly in scope that have been manufactured in or imported into Australia or New Zealand prior to the relevant start date and are unable to meet the new requirements (i.e. fail to meet the new MEPS) would be grandfathered. These products may be offered for sale until sold out. Products able to comply with the new requirements (i.e. can meet the new MEPS) must be registered before they can be
Air conditioners >65kW	1 October 2021	Not applicable	

Product	Start date	Label	Grandfathering
			offered for sale. The Zoned Label would not be required for single duct products manufactured in or imported into Australia prior to 1 April 2020.

Transition to the Zoned Label – New Zealand

Voluntary registration to new requirements:

- Before the new laws take effect, suppliers can voluntarily update their registration to the new requirements, or register new models in order to use the new zoned energy rating label. A test report will be required.
- Note: both 'old' (current, existing) labelled models and the new labelled models will be visible in the market. An education campaign will inform buyers of the new label.

After the start dates:

- In New Zealand, suppliers may continue to use the old label on existing stock (imported or manufactured before the law comes into force) until that stock has run out, even if this extends beyond the date when the new MEPS comes into force.
- However if suppliers wish to continue importing batches of that model after the start date - these must comply with the new requirements. This means their registration must show that the models pass the new MEPS specifications, using the new method of test, displaying the new label and accompanied by a test report.

Implementation risks

Implementation risks associated with the proposed new regulations include:

- Suppliers have insufficient time to adjust to the new testing, labelling or MEPS requirements. This could affect the availability of products, market competition, or compliance with the regulations. The implementation approach detailed above reduces this risk.
 - The proposed start dates are based on an understanding of the production and ordering cycle for air conditioners. (Most companies operate on an 18 month lead time).
 - The start dates for the requirements vary according to the amount of work required to conform.
 - Stock imported into or manufactured in Australia or New Zealand prior to the relevant start date can continue to be sold until supplies are exhausted.
 - A SEER calculator tool was released in April 2017 to assist companies to develop their products in preparation for the Zoned Label.
 - The new Zoned Label would be automatically generated as part of the updated registration process.
 - This would save companies money and resources from developing their own label generating procedures, which is the case now.
- Confusion between the current and new label.
 - Training and education material would be made available to retailers and consumers to help explain the label changes.
 - The Energy Rating website would provide a calculator to estimate the conversion of a cooling star rating on the previous label to the Zoned Label.
 - Providing an adequate lead time prior to the start of the new requirements allows suppliers to factor the new labelling requirements into their production and ordering cycles.
 - This would minimise the period where both the old and new label are displayed when consumers and retailers are comparing products.
 - It would be unreasonable to require retailers to re-label all products with the new label on the start date.
 - This would significantly increase the regulatory costs associated with the change to the new label.

Review

Compliance monitoring

In Australia, the GEMS Regulator is responsible for monitoring and enforcing compliance with the GEMS Act. In doing so, the GEMS Regulator is committed to:

- assisting responsible parties to understand the requirements of the GEMS Act
- monitoring responsible parties' compliance with the requirements
- pursuing those who opportunistically or deliberately contravene the Act.

If the policy changes are adopted, the GEMS Regulator would, as part of the GEMS Compliance Monitoring program, monitor compliance with the new requirements by:

- check testing to verify MEPS, energy efficiency claims and other performance measures are met
- market surveillance to verify models are correctly registered and display the appropriate energy rating label
- responding to allegations of non-compliance.

In New Zealand, education and compliance activities are undertaken by the Energy Efficiency and Conservation Authority.

Evaluation

The E3 program uses various sources of information to evaluate the effectiveness of the program and product category requirements. These sources include:

- retrospective reviews to compare the effect of policies, versus what was projected
- analysing sales data to understand consumer awareness and use of energy efficiency information and labelling
- monitoring activity on the [Energy Rating](#) website.

Attachment A – Technical details and changes

Overview

The Consultation RIS asked a series of technical and administrative questions regarding issues with both the regulations and potential issues with implementing the new proposals. They had been identified and/or raised through a number of sources, including:

- the ACRAC
- the GEMS Regulator function (Registration and Compliance Teams)
- the Air Conditioning Team in the Appliance Energy Efficiency Branch (responsible for policy development)
- the Standards Australia Room Air Conditioner Committee (EL-056).

Further issues were raised through subsequent submissions. The supplementary consultation document detailed the feedback received and the proposed E3 responses for further comment. E3's final recommendations are outlined below.

Remove H2 MEPS requirements

The regulations stipulate MEPS requirements for products making a voluntary heating capacity declaration at H2 (2 °C). If it is decided to adopt the SEER testing and rating standard AS/NZS 3823.4 and the Zoned Label, the H2 test point will become mandatory with the performance reflected in the SEER rating (and hence, the star rating). Do you agree that if a SEER rating is implemented, a separate H2 MEPS is no longer required?

Feedback:

Of the submissions that responded to this issue, all but one supported removal of the H2 MEPS requirements. Some mentioned the need to ensure this change considers the effect on New Zealand's ENERGY STAR program (which endorses the most energy efficient heating products). To be eligible for ENERGY STAR, air conditioners must meet or exceed particular requirements at the H2 test point⁶³.

Some submissions only supported this change if the cold climate rating on the Zoned Label provides differentiation between good and poor product performance at H2. Another did not support removing the H2 MEPS requirements, due to a concern that a product that

⁶³ Since this consultation was carried out, EECA has announced the retirement of the ENERGY STAR program in New Zealand. [EECA media release](#)

fails the current MEPS requirements at H2 conditions could still achieve a good energy efficiency rating.

Position:

E3 recommends removing the H2 MEPS requirements.

The H2 MEPS requirements appear to be an impediment to providing information about the efficiency and capacity of air conditioners in cold climates. The amendment to AS/NZS 3823.4 ensures that the temperature bins that underpin the Zoned Label will demonstrate product performance (in terms of both heating capacity and efficiency) in cold climates. This change does not adversely affect the ENERGY STAR program in New Zealand, as the SEER H2 data will be available for all air conditioners up to 30 kW.

Multi-split registration

Multi-splits systems are registered on an outdoor unit basis, rather than as a matched 'system' of indoor and outdoor units. This interpretation is necessary due to the regulatory burden that would be created by requiring registration of the large number of possible indoor unit combinations. The regulations for air conditioners therefore need to be clarified to reflect that for registration purposes, a multi-split system is only comprised of an outdoor unit. Note that the current testing arrangements, whereby a representative combination of indoor units is nominated will be maintained.

Furthermore, modular VRF multi-split systems are being registered as both a base outdoor unit module and in systems that rely on multiple outdoor unit modules. This can result, for example, in a 20 kW module being registered as a 20 kW system and a 40 kW system that comprises of two 20 kW modules. This is likely to create unnecessary regulatory burden. Therefore, it is proposed to clarify in the next update of air conditioner regulations that only the base modules of a VRF multi-split system require registration. Do you agree with this proposal?

Feedback:

All of the submissions that provided feedback agreed with the proposal.

Position:

E3 recommends this change, so that only the base model outdoor units of a VRF multi-split system require registration.

Supply of outdoor units only

The requirements make it difficult to supply MEPS compliant outdoor units for the replacement market because they treat air conditioner systems as an indoor and matched outdoor unit. However, given that most of the system's working parts are contained in the outdoor unit, supplying MEPS compliant outdoor units only is a common request. It is proposed that the next air conditioner GEMS Determination/New Zealand regulations will specify the outdoor units of split systems as separate categories, matching the size classes and MEPS levels of the requirements. Registration would still

require a test report using a nominated indoor unit that is both readily available for possible check testing purposes and matches refrigeration capacities and configurations (i.e. is 'like for like', as per the requirements for multi-splits specified in clause 3.11 of AS/NZS 3823.2:2013). Do you have any comments on this proposal?

Feedback:

There was wide support for this proposal, though some submissions suggested it requires further discussion. Fujitsu supported this option to prevent companies advertising outdoor units not designed to operate with another brand's indoor unit. They state there are safety concerns if refrigerants different to what the indoor unit is designed for—specifically where an A3 refrigerant (flammable) is being promoted as a direct replacement for an A1 or A2 refrigerant (not flammable or slightly flammable)—are used. Another submission noted the US market has standards and processes to address this, and these should be considered for inclusion under the regulations.

Position:

E3 recommends implementing these changes to improve the ability of suppliers to provide MEPS compliant outdoor units.

The intent is to cover outdoor units retrofitted to air conditioners supplied by different suppliers, not suppliers keeping outdoor units to supply their own products for warranty replacement or spare parts. These changes would be implemented in consultation with industry representatives to avoid any unintended consequences.

Noise test standard

The CRIS asked which noise test standard stakeholders would prefer.

Feedback:

Of those submissions that expressed a view, almost all preferred the European test standard, EN 12102:2013 *Air conditioners, liquid chilling packages, heat pumps and dehumidifiers with electrically driven compressors for space heating and cooling. Measurement of airborne noise. Determination of the sound power level*. This is the same test standard used by the EU for their air conditioner and heat pump water heater energy labelling schemes. Only one submission preferred the ISO 3741 standard. One submission to the supplementary consultation document pointed out the complexities of how noise and vibrations are perceived and suggested that ISO 3744 and ISO 3743 would be more appropriate. Other submissions had no preference beyond ensuring all suppliers would be required to use the same standard and thus creating a level playing field.

The NSW Environment Protection Agency was supportive of the proposal to include noise data on the Zoned Label and indicated that if the proposal was implemented, it would

review its existing noise labelling requirements. One submission questioned the value of including noise data on the Zoned Label and, given their experience, recommended an education campaign for consumers if the proposal is adopted.

Position:

Given the strong preference for the European test standard from both suppliers and the NSW Environment Protection Agency, E3 recommends the European test standard EN 12102:2013 be used for noise declarations on the Zoned Label.

Noise rating test points

Air conditioner noise levels (especially those of variable capacity units) can vary greatly depending on outdoor temperature, indoor temperature and a variety of user-defined settings. For practicality and comparability, it is proposed to follow the EU's practice of testing at the standard full load T1 (35 °C) test point or H1 (7 °C) for heating only units. Do you agree with this proposal?

Feedback:

All submissions agreed with this proposal, though one sought to clarify the definition of “full load”.

Position:

E3 recommends the noise tests be based on rated capacity at T1 or H1 as applicable.

Noise test requirements

It is proposed that indoor/outdoor testing requirements will apply to different categories of air conditioners <30 kW cooling capacity in the following way:

- *Non-ducted split systems: indoor and outdoor noise levels*
- *Ducted units (both split and unitary units): outdoor noise levels only*
- *Non-ducted unitary units (e.g. window/wall units): indoor and outdoor noise levels*
- *Single and double duct portable unitary units that sit wholly in the conditioned space: indoor noise levels only*
- *Multi-split systems: outdoor noise level of single outdoor units, based on the representative combination used for registration.*

Do you agree with this proposal?

Feedback:

All submissions supported the approach.

Position:

E3 recommends noise declarations for the various air conditioning products <30 kW as per the proposal above.

Fixed speed air conditioners – degradation coefficient

The seasonal test standard ISO 16358 (AS/NZS 3823.4) recognises that fixed speed air conditioners use a certain amount of electricity turning on and off to meet part load conditions. This is reflected in the calculation of seasonal performance through a degradation coefficient (CD) with a default value of 0.25. The EU's seasonal testing and labelling standard EN 14825:2012 uses the same default value. While ISO 16358 (AS/NZS 3823.4) allows an applicant to change the default CD value via a test procedure in Annex C of the test standard, E3's experience of this optional test encountered reproducibility issues. This RIS is therefore proposing that the default CD value of 0.25 is used for all registrations and will not be able to be changed by the applicant. Do you have any comments on this proposal?

Feedback:

Submissions either supported this proposal or offered no comment.

Position:

E3 recommends that the degradation coefficient cannot be changed.

Measurement of non-operative power consumption

Australia and New Zealand were amongst the first jurisdictions in the world to incorporate a measurement of non-operative power (e.g. standby, crankcase heaters) into the energy efficiency metric in 2009. It is incorporated into the Annual Energy Efficiency Ratio to assess compliance with MEPS and calculate the star rating algorithm (see Clause 2.4 of AS/NZS 3823.2:2013 for details). The proposed SEER standard, AS/NZS 3823.4:2014 (the local adoption of ISO 16358) describes a different method for measuring non-operative power for incorporating into the seasonal metric, which in turn would be used for a new star rating algorithm. It requires a unit to be tested at two to four temperature points for a minimum of 10 to 16 hours (see Annex B of AS/NZS 3823.4:2014, noting that the recent amendment updated this Annex for local weighting factors and hours). It should be noted that exploratory tests conducted by E3 in 2013 found that the two methods yielded similar results (i.e. within a few watts for the products tested). Given that the AEER/ACOP and the new SEER metric both need a measurement of non-operative power, E3's preference is to fully align with the new ISO SEER standard (AS/NZS 3823.4:2014) and therefore use it for both AEER/ACOP and SEER. Do you agree with this proposal?

Feedback:

Some submissions supported this proposal to align with the new SEER standard AS/NZS 3823.4:2014, while others suggested that both methods should be applicable (provided the two measures yield similar results).

Position:

E3 recommends only the AS/NZS 3823.4:2014 method be used in the updated regulations for both the MEPS metric and the SEER rating. This will transition the regulations for

obtaining and incorporating inoperative power usage to a new, internationally aligned method.

This means the current cooling/heating inoperative power figures (P_{noc} and P_{noh}) will be replaced by the weighted average power consumption figure (P_{ia}) of AS/NZS 3823.4:2014 for the MEPS metric. The current annual efficiency equations (Clause 2.5 of AS/NZS 3823.2:2013), including assumed hours of operation, will otherwise be unchanged.

The recent amendments to AS/NZS 3823.4:2014 include a change to the measurement of standby power. It allows standby power to be calculated (rather than tested and measured), to provide a less onerous option for suppliers. The proposed calculation method is similar to the existing method that is specified in clause 3 of AS/NZS 3823.2:2013 and relies on a supplier understanding a unit's inoperative power use at different ambient temperatures. If these parameters are not understood, or in the case of a compliance check-test, the physical test from AS/NZS 3823.4:2014 can be performed.

E3 previously found the results of average standby power calculated from AS/NZS 3823.2:2013 (the current method) and AS/NZS 3823.4:2014 (the proposed new method) yield results within 10 per cent of one another (both higher and lower). There is a slight possibility that a product exactly on the MEPS line using the current method of incorporating standby power no longer meet MEPS using the new method, however the likelihood of this occurring is low.

Inverter over-capacity

It has been noted by several authors that some inverter air conditioners have the ability to significantly increase their capacity above rated at the expense of energy efficiency. This could be a particular problem for some units that are installed in situations where their rated capacities are insufficient to meet the cooling/heating requirements and during extreme weather events. E3 performed initial investigations on eight inverter air conditioners in 2013 and found that a number of these do perform less than optimally under certain test scenarios. Do you agree that this issue warrants further investigation by E3, to inform whether any policy action is needed to address the issue?

Feedback:

A number of submissions suggested this issue is encountered due to inappropriate application and sizing of air conditioners, rather than a general product issue. Some submissions indicated the current situation and practice could be improved by finalising the installation standard under development through Standards Australia. Some submissions suggested the benefits of sizing air conditioners appropriately could also be promoted through the Australian Refrigeration Council (ARC administers refrigerant handling licences on behalf of the Australian Government).

ActronAir stated “this issue should be further investigated and new policy should be implemented to address this issue. A new MEPS rating should be introduced for all

inverters with over-capacity to meet a certain level of efficiency at maximum capacity. All manufacturers are capable of locking in the compressor from running at over capacity so there is no reason why they can't cap it at an acceptable MEPS level."

Position:

E3 recommends that the existing MEPS requirements, and the case for any new MEPS requirements, be considered in the next review of the air conditioner regulations.

Managing testing costs and time

A range of other technical testing issues and requirements arose during consultation. These recommendations are aimed at making the adoption of the new requirements practical and achievable and are outlined below.

H2 and H3 testing

E3 acknowledges that H2 testing (i.e. testing performance at an outdoor temperature of 2 °C) is challenging. In an effort to manage the time and cost of this crucial test without overly compromising its accuracy, the following two H2 testing options will also be permitted for any size, configuration and electrical phased product:

- Air enthalpy method: This method is outlined in AS/NZS 3823 parts 1.1, 1.2 and 1.4.
- A shorter calorimeter test method: A standard calorimeter test runs for six hours or six complete defrost cycles. Tests that cover three complete defrost cycles will be accepted.

These methods will also be accepted for voluntary H3 testing at -7 °C. When practical, E3 will still use a full calorimeter room test for compliance purposes.

Mandatory versus optional testing in the SEER standard

The SEER test standard AS/NZS 3823.4:2014 contains a number of mandatory and voluntary test points. For example, a variable speed, reverse cycle unit has five mandatory tests (at least two of which are already required) and nine optional ones. Only the mandatory tests will be required for registration. For a variation fee, registrations can be updated with optional test data at any stage of the five year registration period.

Using default SEER values

Fixed speed products will have the option of using the default values for the 29 °C SEER test point of AS/NZS 3823.4.1. These defaults are based on the 35 °C capacity multiplied by 1.077 and the 35 °C power input multiplied by 0.914.

Variable speed products will also have the option of registering for a cooling SEER as a fixed speed product using the default values for the 29 °C SEER test point. Products <30 kW will also have the option of being treated as a fixed speed for the heating cycle. This means that the H2 test at 2 °C can be performed using the same locking instructions as the H1 test at 7 °C.

Using these methods, any cooling only product can be registered using just the already required T1 35 °C test. A reverse cycle product <30 kW can be registered using the current T1 and H1 results and a new physical test for H2. The SEER results obtained by doing this will understate the performance of these products, so it is likely to be in a supplier's interest to test their products more thoroughly.

Certifying performance for products >30 kW

Eurovent certification covers 'comfort air conditioners' (including multi-splits) up to 100 kW and 'rooftop' air conditioners up to 200 kW. Eurovent certificates display a range of performance criteria for each registered model based on the European test standard, EN 14511. This includes standard T1 cooling performance and H1 heating performance data.

Along with declarations of inoperative power consumption and true power factor, a Eurovent certificate could be used to register a product >30 kW.

AHRI certification covers VRF multi-splits, unitary and split systems up to approximately 222 kW. While chiller certification verifies a manufacturer's simulation and selection software, air conditioner certificates verify each model's performance to AHRI Standard 340/360. This US test standard uses different rating conditions to the international test points of T1 and H1 used by E3. The US cooling test conditions are very close to T1 conditions⁶⁴, so E3 will accept this for products >30 kW. Heat pumps will have to be re-rated to H1 conditions as the US values differ significantly⁶⁵. Otherwise, along with declarations of inoperative power consumption and true power factor, an AHRI certificate could be used for registering a product >30 kW.

E3 will also accept other regional test standard results alongside EN 14511 and AHRI Standard 340/360 for products greater than 30 kW. Any regional adoptions of the ISO test standards ISO 5151:2010 (non-ducted), ISO 13253:2011 (ducted) and ISO 15042:2011 (multi-split) along with declarations of inoperative power consumption and true power factor will be acceptable.

Note all registered performance must be based on Australia and New Zealand's electrical supply voltage and frequency of 230 V single phase or 400 V three phase at 50 Hz and the T1/H1 rating conditions.

Simulation testing of >30 kW products

E3 recognises that the Australian simulation test standard AS/NZS 3823.3:2002, applicable to products >30 kW is now unsuitable. The software it stipulates (based on the Oak Ridge Heat Pump Model, such as HPRATE) is outdated in a number of areas, including the refrigerants it can model. E3 also recognises that there is a range of sophisticated commercial and proprietary simulation software that can produce accurate simulated test results.

Companies will be able to demonstrate the software they use can yield comparable results to the applicable physical test. Companies could achieve this by submitting full simulation and physical test reports on a product for comparison. Once E3 is satisfied these tests yield similar results, the simulation software could be authorised for all future use on products in that category (i.e. unitary or split with ducted or non-ducted, or multi-split indoor units). Separate evidence would be required for each different category, and compliance

⁶⁴ Indoor dry bulb/wet bulb (DB/WB) of 26.7 °C/19.4 °C and outdoor DB/WB of 35 °C/23.9 °C versus T1 values of 27 °C/19 °C and 35 °C/24 °C.

⁶⁵ Indoor DB/WB of 21 °C/15.5 °C and outdoor DB/WB of 8.3 °C/6.1 °C versus H1 values of 20 °C/15 °C and 7°C/6 °C.

testing would be performed using physical tests. Sub-section 6(4) of the *Greenhouse and Energy Minimum Standards (Air Conditioners and Heat Pumps) Determination 2013* already provides this option for multi-split air conditioners.

Removing the maximum cooling test requirement

The supplementary consultation paper suggested the maximum cooling test for labelled products was no longer necessary. The only feedback on this matter was from CESA. They agreed it could be removed and suggested that if a product failed to operate under the type of conditions used by the test that Australian Consumer Law could deem the product not fit for purpose.

E3 recommends the maximum cooling test be removed from the regulations.

Rating commercial products <30 kW

Upon registration, all products will receive SEER ratings based on both the ‘domestic’ hours of use (which includes a star rating) and ‘commercial’ hours of use (which will not include a star rating). Suppliers will be able to choose which rating they use in promotional material, as long as this is clearly stated. When using online tools to compare products, users will be able to select between commercial and domestic operating schedules to ensure all displayed results will be comparable.

Commercial products within the scope of labelling will still be able to seek an exemption for being ‘commercial use’ only.

Commercial operating hours

E3, in conjunction with the Standards Committee, developed temperature bins and operating hours based on a commercial use pattern for the three climate zones of AS/NZS 3823.4:2014. The bins are based on an operating schedule of 7:00 am to 7:00 pm, Monday to Saturday (i.e. 72 hours per week) and are shown in Tables 13 and 14 below.

The temperature bins and operating hours would be specified in the updated regulations and published on the Energy Rating website. At the request of industry stakeholders, they will also be included as a second amendment to the SEER standard at the earliest opportunity.

Table 13 Commercial use cooling temperature bins

Outdoor temperature t_o °C	Hot/humid zone hours	Mixed zone hours	Cold zone hours
15	0	0	181
16	0	0	183
17	0	0	170

18	100	229	177
19	117	238	175
20	141	251	185
21	185	225	165
22	235	242	143
23	256	208	118
24	282	185	112
25	290	178	82
26	306	129	72
27	304	125	69
28	265	89	45
29	271	70	66
30	219	39	40
31	137	52	45
32	101	39	32
33	85	21	22
34	57	21	11
35	30	18	6
36	17	17	5
37	13	14	0
38	4	14	0
39	0	2	0
40	0	3	0
41	0	2	0
Totals	3415	2411	2104

Table 14 Commercial use heating temperature bins

Outdoor temperature t_j °C	Hot/humid zone hours	Mixed zone hours	Cold zone hours
-6	0	0	2
-5	0	0	4
-4	0	1	4
-3	0	0	8

-2	0	1	11
-1	0	2	17
0	0	6	14
1	0	6	17
2	0	9	28
3	0	18	29
4	0	16	38
5	3	15	48
6	4	23	62
7	7	29	122
8	14	33	127
9	15	48	176
10	18	52	163
11	15	77	222
12	28	87	197
13	27	126	184
14	30	170	0
15	38	210	0
16	62	221	0
Totals	261	1150	1473

Summary of rating, labelling and testing requirements

The updated requirements for rating, labelling and testing products are summarised in Table 15. Ducted, three phase and commercial use products will be able to use a less costly air enthalpy test, rather than a calorimeter room test, even if they voluntarily apply a Zoned Label (where applicable).

Table 15 Rating and labelling requirements

Product category	Labelling requirements	Online Rating	Minimum test permitted
Non-ducted splits, single phase	Mandatory	SEER	Calorimeter
Non-ducted splits, three phase, <30 kW	Voluntary	SEER	Air enthalpy
Unitary, single phase	Mandatory	SEER	Calorimeter
Unitary, three phase <30 kW	Voluntary	SEER	Air enthalpy
Ducted single split, <30 kW	Voluntary	SEER	Air enthalpy

Product category	Labelling requirements	Online Rating	Minimum test permitted
Ceiling cassettes, <30 kW	Voluntary	SEER	Air enthalpy
Water source within scope of AS/NZS 3823.1.3	Prohibited	AEER/ACOP	Air enthalpy
Multi-splits <30 kW	Prohibited	SEER on registered combination	Air enthalpy
All other products > 30 kW	Prohibited	Cooling SEER, heating ACOP	Simulation, certification or air enthalpy
Single duct portables	Mandatory	EER/COP	Calorimeter

Suitable test labs and reports

All registrations will require supporting material to substantiate the registered performance claims. This can be in the form of a full test report, test summary, certification summary or simulation/selection software report, as applicable.

As with the existing regulations, test labs do not need to be based in Australia or New Zealand nor do they need to be National Association of Testing Authorities Australia (NATA) accredited. Suppliers will need to be comfortable that the lab they use produces credible and reproducible results, as any check testing performed by E3 will be through a NATA accredited laboratory.

Attachment B – Zoned energy rating label

Background

Air conditioning industry representatives first proposed the E3 Committee examine a move a SEER based rating scheme several years ago. To support the move to seasonal rating, a zone-based energy efficiency labelling system that takes account of the wide difference in climate conditions across Australia and New Zealand is logically required. Enhanced, climate zone based labelling is also supported by consumer groups such as Choice.

The E3 Committee agreed to commit resources to examine a Zoned Energy Rating Label (initially referred to as the climate rating label) in March 2013. While the existing Energy Rating Label provides information to consumers and users of labelled products, industry have identified opportunities to improve energy efficiency information in the market. This can be achieved by incorporating enhanced information that provides ratings and energy consumption information for three distinct climate zones.

Space conditioning can account for around 35 to 40 per cent of the average household's energy use. The energy efficiency of air conditioners is heavily impacted by the climate in which they are installed. Currently there is no easily accessible information available to consumers to help them select models most suited to their local climate, or other requirements such as cold weather performance and noise. This is impeding consumers' and installers' ability to select a comparably priced appliance that can provide energy and cost savings. By improving the information available and enabling appliances to be installed in the location they are most suited to, consumers will be able to save money on their power bills.

The local climate can influence the performance of appliances in a range of ways. Variations in air temperature, water temperature, frosting, humidity and cloud cover can all influence the energy efficiency of appliances, often quite dramatically. For example, the energy efficiency of reverse cycle air conditioners can be significantly lower below approximately 5.5 °C when ice forms on the outdoor heat exchanger. Systems without appropriate defrost functions can result in very poor heating energy efficiency or significantly reduced capacity output. While this feature is important in cold regions, in warmer areas where temperatures will not drop below 5.5 °C, it is unnecessary.

While air conditioners have carried energy efficiency labels since 1987, in their current form they are unable to convey some important appliance performance information. Features such as noise, sizing information for cold climates and estimated annual energy use are all important factors to consumers and installers, yet there is no consistent or comparable way this information is made available. Manufacturers are not currently required to supply cold weather performance information. As such, consumers may believe the stars on the label reflect performance in all conditions they are likely to experience. Introducing a label that incorporates this information, along with location-based energy efficiency ratings, is likely to benefit consumers.

As a zoned energy label merely improves the potential for existing appliances on the market to be installed in locations where they will operate efficiently, it requires no physical changes to existing products. While the costs are small, the potential energy savings or improved comfort arising from more appropriate models being installed in each climate are likely to be substantial.

Providing a label that demonstrates energy efficiency in a range of climate zones will provide manufacturers with a greater incentive to innovate and target models to individual climates (e.g. tropics, temperate, alpine). Further, suppliers have an incentive to stock only suitable models for their climate. This is likely to result in greater consumer satisfaction with available products.

The label development process has been underpinned by three key objectives:

1. Changes to the label should be driven by user preferences, not decision makers' preferences. Users of this label are broad and include consumers, retailers and installers.
2. Design options must be enable users to better compare different technology types.
3. Changes to the label must be underpinned by evidence that changes will improve user understanding of the information and increased label recognition.

To ensure that the users have the largest role in the development of the labels, the development process involved three stages:

- | | |
|----------|--|
| Stage 1: | Design of a broad range of layout and content options, using international experiences and then test these options on users through focus groups. |
| Stage 2: | Re-development of a refined set of options based on the most positively received features suggested by stage one focus groups, and additional testing on a second round of focus groups.

Refine the map of Australia and New Zealand to ensure the best possible separation of climate zones. |
| Stage 3: | Finalise the most positively received option, with quantitative testing and further qualitative testing to refine particular elements as applicable. |

Stage 1

The initial design process

The graphic designers selected to undertake the work have a specialty in presenting scientific concepts in simplified ways. They were asked to design layout options (concepts) that met the following specifications:

- Adapt the existing label to incorporate necessary climate and other performance information with minimal other changes.
- Designs that incorporate some elements of the existing label (colours, fonts etc.) while changing other features that were expected to improve user interpretation.
- Complete new versions, based on designer's knowledge and understanding of the overall goal of the label, with no requirement to tie in with existing label.

Apart from these broad instructions, the designers were encouraged to use their own expertise for the label layout decisions, including colours, fonts, amount of white space and text. This was to ensure that the information could be presented in the most effective way.

Three appliance technologies (reverse cycle air conditioners, gas space heaters and heat pump water heaters) were considered initially to ensure that a broad range of systems can be integrated into a consistent label design. These particular appliance groups allowed for the variances in requirements between appliance and fuel type to be tested in the initial stages.

In addition to the zone specific information, other key performance features were required to be included on the labels, including noise, sizing and an annual energy consumption figure (which is present on most existing appliance labels but not for air conditioners).

In total, ten labels in four concept layouts were finalised for focus group testing. As well as the necessary differences between appliance types (e.g. different capacity/sizing information for water heaters than space heaters, different symbols for electricity than gas), some variations within the concepts were made; including the way the star ratings were represented, layout of maps for climate zones and colours.

Details on the labels tested and more comprehensive feedback are available in the focus group report found on the [Energy Rating](#) website.

In addition to the zoned rating labels, the existing label was tested as a reference for assessment.

The testing process

A series of focus groups were held in Sydney, Melbourne and Auckland in July 2013. A total of nine sessions took place, with two consumer groups and one industry group (including retailers and installers) per city.

All consumer participants were household appliance decision makers, who had either recently (within the past 6 months) purchased, or were actively planning to purchase a water heater, air conditioner or space heater. Prior to the focus groups, each participant

was asked to complete a questionnaire to find out more information about the way they make purchase decisions for appliances.

For the industry groups, participants were selected from a range of areas, including retailers (of relevant appliances), plumbers and installers. This was to target the members of industry who provide advice to consumers on which appliances to purchase. For water heaters particularly, this is often the sole source of research for a purchase.

The focus groups consisted of two main stages, an initial discussion about purchase processes and decision making, followed by testing and examination of the label designs.

Consumer decision process

The preliminary discussion in the consumer sessions centred around the decision making process for these types of appliances, what research (if any) was undertaken, whether (and when) energy efficiency was taken into account, and other factors that impacted on purchase decisions.

Broadly it was found that consumers rely heavily on advice from experts for these types of appliances. This included tradespeople friends, retailers and friends and family who have made similar purchases. This echoes previous research on these types of purchases.

Energy efficiency was found to be a consideration when making appliance purchases, but is generally not a primary requirement. The main question related to energy efficiency asked by consumers is the product's star rating. Information provided on the label beyond this is rarely asked, or seemed to be misunderstood or not noticed by consumers. Some retailers were found to volunteer information about energy efficiency, though this information is not regularly offered in the early process of advising a consumer.

It was found that labels tend not to be used by consumers as part of their initial decision making, but rather to help make the final choice between narrowed down options. So while the label and energy efficiency in general is not a first order consideration when selecting an appliance, once key features have been decided, the label assists in the decision between similar products.

Industry advice process

The industry focus groups found that retailers are perceived as having the highest level of influence over consumer purchases. As purchase decisions are often made in a retail environment, staff can help consumers understand the information they have gathered, and may be able to recommend particular options.

The focus groups found that plumbers and installers do not see themselves as the main source of information for consumers, and their recommendations tend to be based on ease of installation and confidence in particular products. Reasons given were that if there is an issue with the product later on, it will be their responsibility to deal with. They tended to

pay less attention to a label, and they base their opinions on actual experiences with products. In general they are reluctant to have conversations with customers regarding energy ratings and believe that their role should not be an advisory one.

The retailers in the focus group commented that they are cautious in suggesting particular products based on their energy rating, and tend to base recommendations on their knowledge of quality and reliability of models, using the rating more as a comparison later in the decision process.

Additionally, the main concern regarding the new labels in the industry group was the likelihood that providing a label would ultimately lead to them having to explain more information to consumers and spend more time to make a sale or installation. They also believed that additional information risks confusing people. While there was an appreciation of the importance in demonstrating differences in efficiencies between the climate zones, generally the industry members were concerned that the provision of additional information would result in more questions and time taken for a sale.

Consistent focus group feedback

Label opinions across all focus groups were fairly consistent, with few variances between the consumer and industry sessions. The main differences occurred between the Australian and the New Zealand attendees. Adaptations of the existing label were not well received or interpreted. Two label variants were agreed as the most viable to undergo small amendments and continue for further testing.

Stage 2

Map/zone development

The map used in the initial label development and focus group testing was a rough amalgamation of existing climate zones (including the Australian and New Zealand building code zones) to give an approximation of likely zone boundaries. Feedback from the focus group testing identified that more than three climate zones on a map was likely to be too complex for consumers and this is reinforced internationally with three zones used in the EU and in the USA.

The University of Queensland was contracted to develop methodologies to establish climate zones appropriate for a heat pump appliance (air conditioners and heat pump water heaters). This project included the examination of a range of climatic data and conditions balanced with population data to determine the best distribution of climate zones. The heat pump device maps separate:

- a heating zone, which includes areas that have a much larger heating season when compared to the cooling season, as well as areas prone to frosting (Cold Zone)

- a cooling zone, which includes areas with a much larger cooling season when compared to the heating season, including areas with high levels of humidity where an evaporative device will not be suited (Hot-Humid Zone)
- a mixed zone, where both heating and cooling seasons are more similar (Mixed Zone)

While the map for space heating and most water heater labels is to only have three zones, the analysis of data and conditions will include other existing climate data sources (including that of the Nationwide House Energy Rating Scheme, or NatHERS for Australia and the similar Home Energy Rating System in New Zealand) to enable a more high resolution set of performance results to be available through a smart phone application in the future. This will allow consumers and advisors to access more localised climate conditions to give a better estimation of running costs and energy usage.

More information is available in a report ‘Climate Zone Mapping – Air Conditioners and Heat Pumps’ available on the [Energy Rating](#) website.

Second round of testing

Based on the feedback from the focus groups, a range of decisions were made on changes to be tested on a further round of qualitative testing. The most significant change made to both label concepts was to adjust the physical size of the labels, to ensure their overall dimensions would be no larger than the current air conditioner label (the reverse cycle label with heating and cooling ratings is 130mm high and 180mm wide). This was an important change to ensure manufacturers would not be required to make any changes to existing printing systems, and also to ensure that labels would not reach such a size where they would no longer physically fit on an appliance. Other minor amendments were made in line with feedback from the focus groups.

Following the revisions, the two label concepts were tested again in focus groups across Australia and New Zealand. Groups were held in Sydney, Brisbane, Perth and Christchurch to cover all climate zones, with two groups in the mixed zone where the greatest number of people live.

For the mixed zone, Perth was selected due to its geographical separation to assess if this impacts on the interpretation of the map on the label. Sydney was selected again for this zone due to its large population. Christchurch was chosen to represent New Zealand and the cold zone, due to increased sales of water heaters and reverse cycle air conditioners in the city following earthquake reconstruction work. For its large population, Brisbane represented the hot-humid zone.

Considering the reliance on intermediaries for the advice on the climate influenced appliances, the focus groups again included one group of industry, encompassing retailers and installers, and one group of consumers in each city. Each group was given labels for either heat pump water heaters or air conditioners. This was to allow for better concentration on the label design itself, without causing additional confusion from

differing elements between appliances, which occurred in the initial round of testing. By limiting the number of physical labels and options each group was to examine, it allowed for a more thorough and in-depth discussion, and also reduced the potential for information overload for the participants.

Further care was taken in the selection process in the second round to ensure all participants have or would have a greater role in the actual selection or recommendation of products. This was particularly important for the selection of participants in the industry groups. In the first round, some of the installers in the industry group mostly installed appliances supplied to them from builders or other third parties, rather than having any real input into the selection process. A label would play no part in the decision making process for people in these situations and thus their input would be less important in the refining process. This round ensured that participants would have an active recommendation or decision making role and be in a position where a label could potentially impact their roles and the products they install and suggest to customers.

The consumer groups were also more carefully selected, with particular care taken to ensure all participants had personally participated in the selection of a new appliance (or were planning on doing so). This was to ensure that consumers who had recently purchased a new home would be excluded as in most cases appliances are selected by builders or third parties without input from the occupant.

The second round of focus groups showed that retailers had noted more of an interest from consumers in appliance running costs. Consumers were said to be showing more of a willingness to pay a higher initial purchase cost if the appliance will be cheaper to operate over its lifetime. The retailers did note that their advice was not always trusted so would be supportive of a reliable source of this information and a label to make explaining options to customers easier.

Generally results on purchasing decisions and processes, along with general label feedback reflected outcomes from the initial groups. One design was selected comprehensively as the preferred option which would be the final layout. More detail on these focus groups is available on the [Energy Rating](#) website.

In addition to the focus groups, a series of in-depth interviews were held with retailers in each of the four cities. This was to allow additional questioning to members of industry likely to be using these labels on a regular basis and to get a good idea of how they and their customers may use the label now (for air conditioners and gas products, as applicable). The interviews were held with a mix of specialist and general retailers of air conditioners and water heaters. The results from the interviews reinforced opinions from the focus groups and did not diverge significantly in any area.

In general, the outcomes from the interviews were similar to the outcomes from the focus groups. Retailers were particularly supportive of the label and generally thought its

implementation would be positive and helpful for them in selling and explaining particular products. This is because the information is government backed and theoretically more trustworthy. This can help in providing confidence in the energy efficiency information and remove some potential of retailers attempting to shift particular products for their own reasons—higher margins, shifting old stock etc.

Stage 3

Quantitative testing

After the completion of the second round of qualitative focus groups, a selection of label options were finalised by the graphic designer. Having been reduced to a single design concept, there were several elements that were not conclusively decided in qualitative testing. These involved some minor icon and positioning options but the general ‘look and feel’ was the same. The primary purpose of the testing was to ensure that increasing the available information did not significantly decrease understanding. To test this, the existing label was included in the survey questions.

Approximately 1500 consumers across all three zones in Australia and New Zealand undertook the survey. In addition, 50 consumers were tested in in-store locations in Melbourne and a small number of industry members (primarily installers) also took part.

The survey consisted of eight ‘test’ questions, where there were right and wrong answers. The remaining questions were seeking opinions on design and other label features. The survey found:

- The Zoned Label performed as effectively, and in some cases, significantly *more* effectively than the existing label—despite it substantially increasing the amount of information being presented.
- Consumer comprehension ranged from 50 to 80 per cent in the online survey, with 70 to 80 per cent finding the correct ‘more efficient’ product.
 - These figures are of similar magnitude to results from EU label testing in 2012.
- No significant differences were noted between gender, age and employment status.
 - The only notable factor was educational level—those educated at university were more likely to correctly answer six of the eight ‘test’ questions.
- Installers generally scored better, though correct answers still ranged between 50 and 100 per cent.
 - 16 per cent of consumers scored 100 per cent, with 64 per cent getting at least 2/3 correct.

- 53 per cent of installers got all answers right and 72 per cent got at least 2/3.

For comprehensive results and explanation of the survey and questions asked, the report is available on the [Energy Rating](#) website.

Design approval

The E3 Committee approved the design of the Zoned Label in October 2014, following the favourable quantitative testing results.

Label finalisation

Several rounds of qualitative and quantitative research were undertaken between 2015 and 2017 to finalise details of the label. This research focused on ensuring each element was displayed in such a way that would maximise comprehension. This included additional focus groups, interviews, online forums and surveys to examine the noise declaration symbol, the descriptive text and the display of capacity output figures. Reports from these projects can be found on the [Energy Rating](#) website. In total, approximately 4 500 consumers, retailers and installers provided feedback on the label through focus groups, interviews and online surveys and forums.

Below are examples of the labels, including the zero star version for single duct portable air conditioners.

Figure 7 Zoned Label for non-ducted product

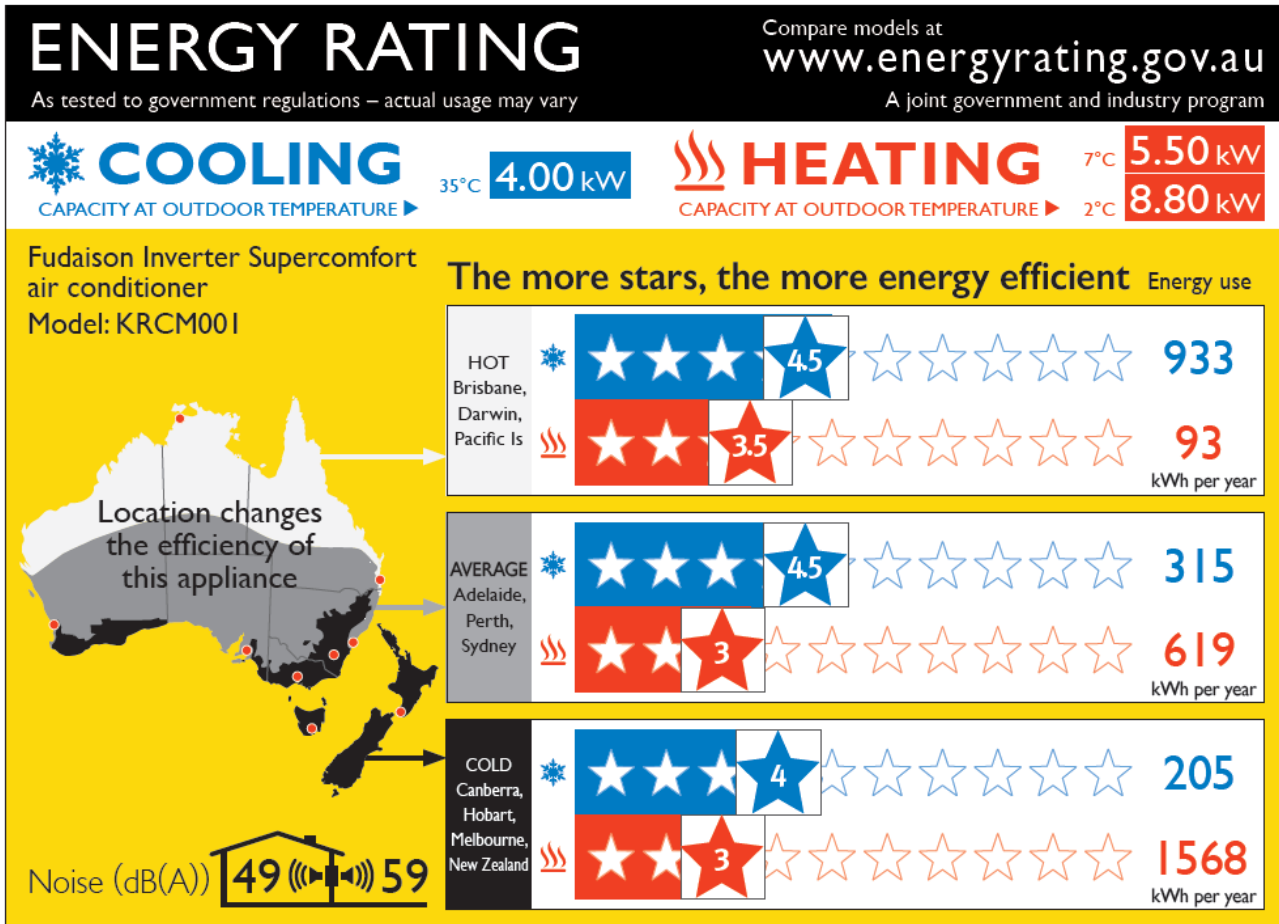
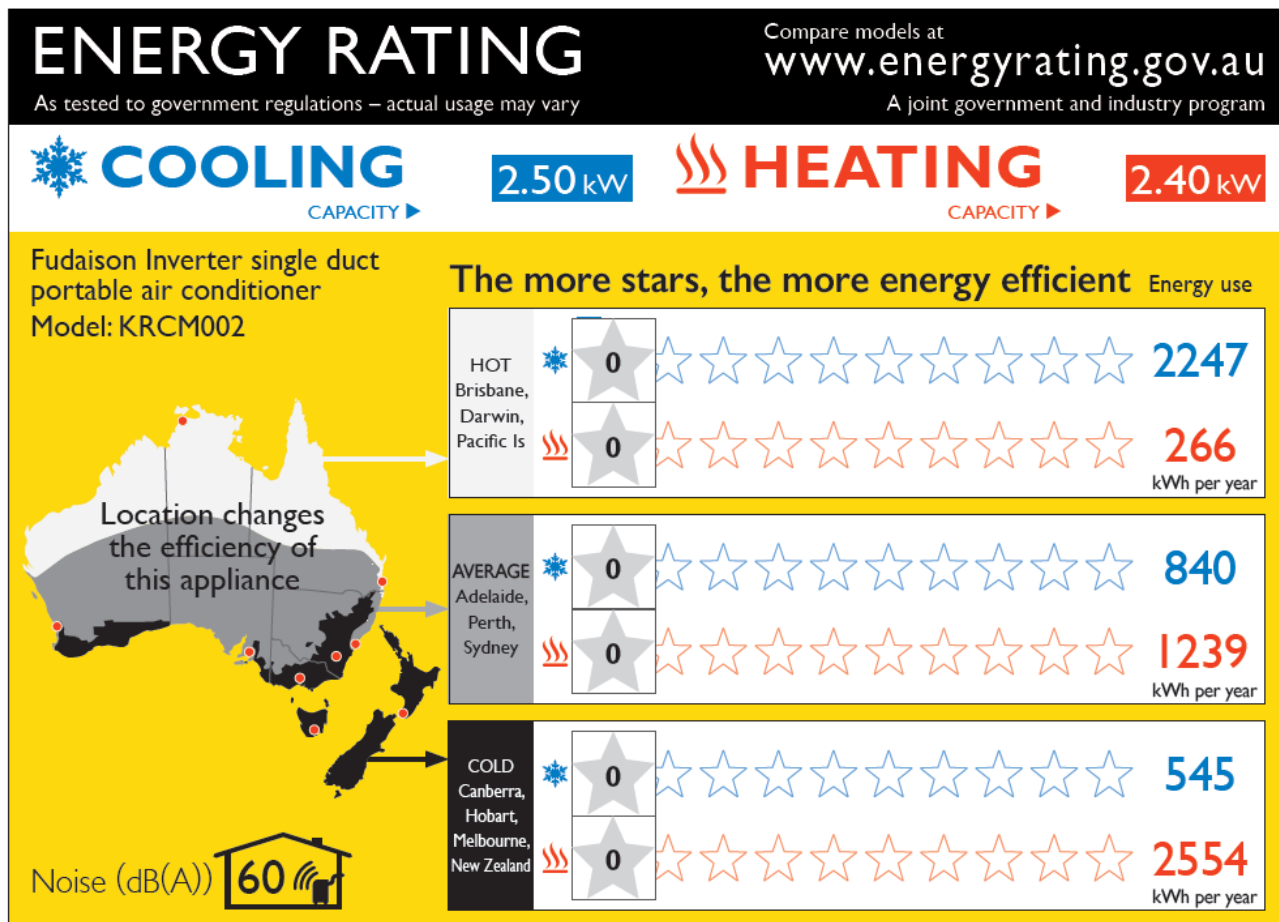
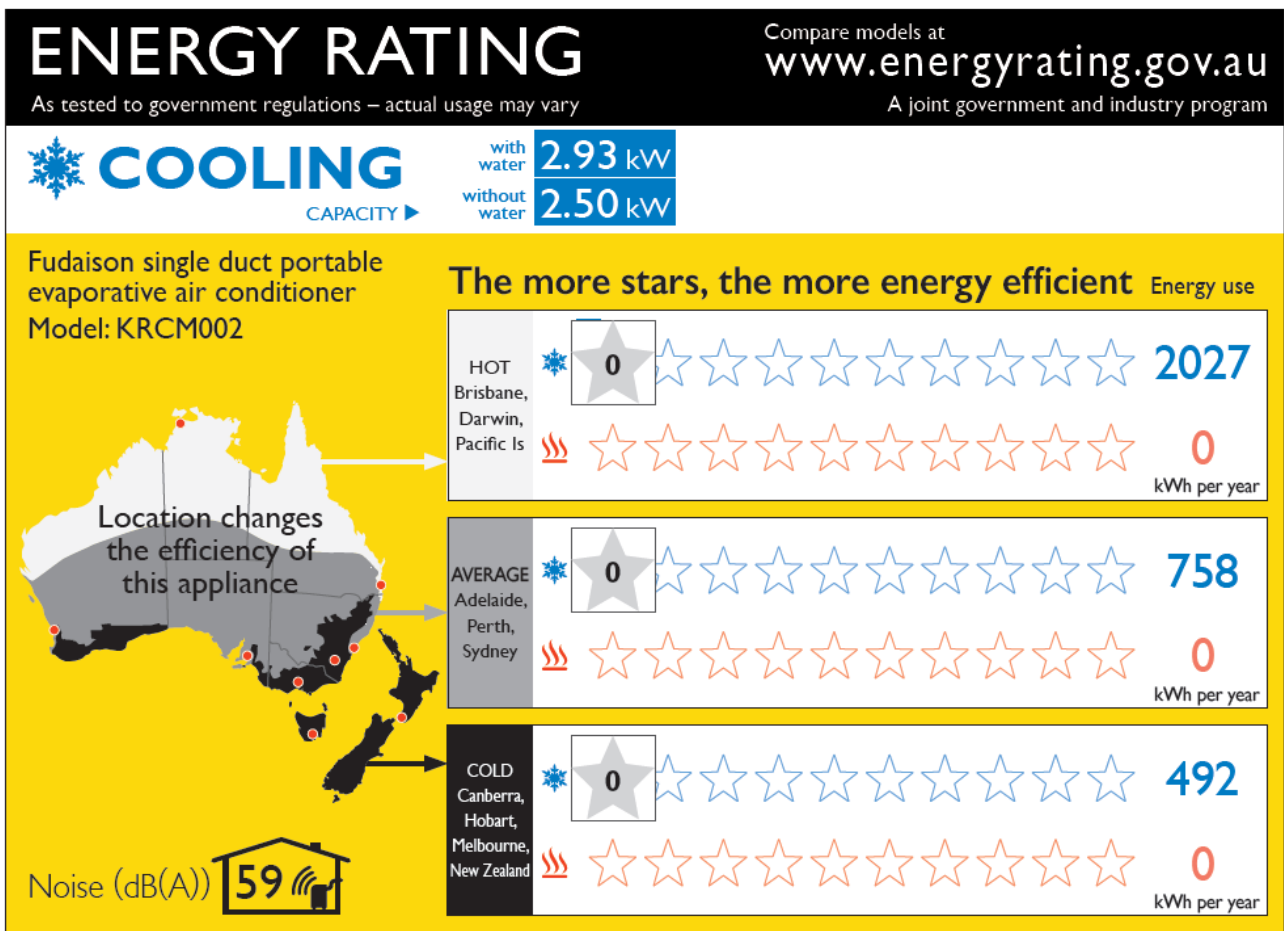


Figure 8 Zoned Label single duct reverse cycle portable



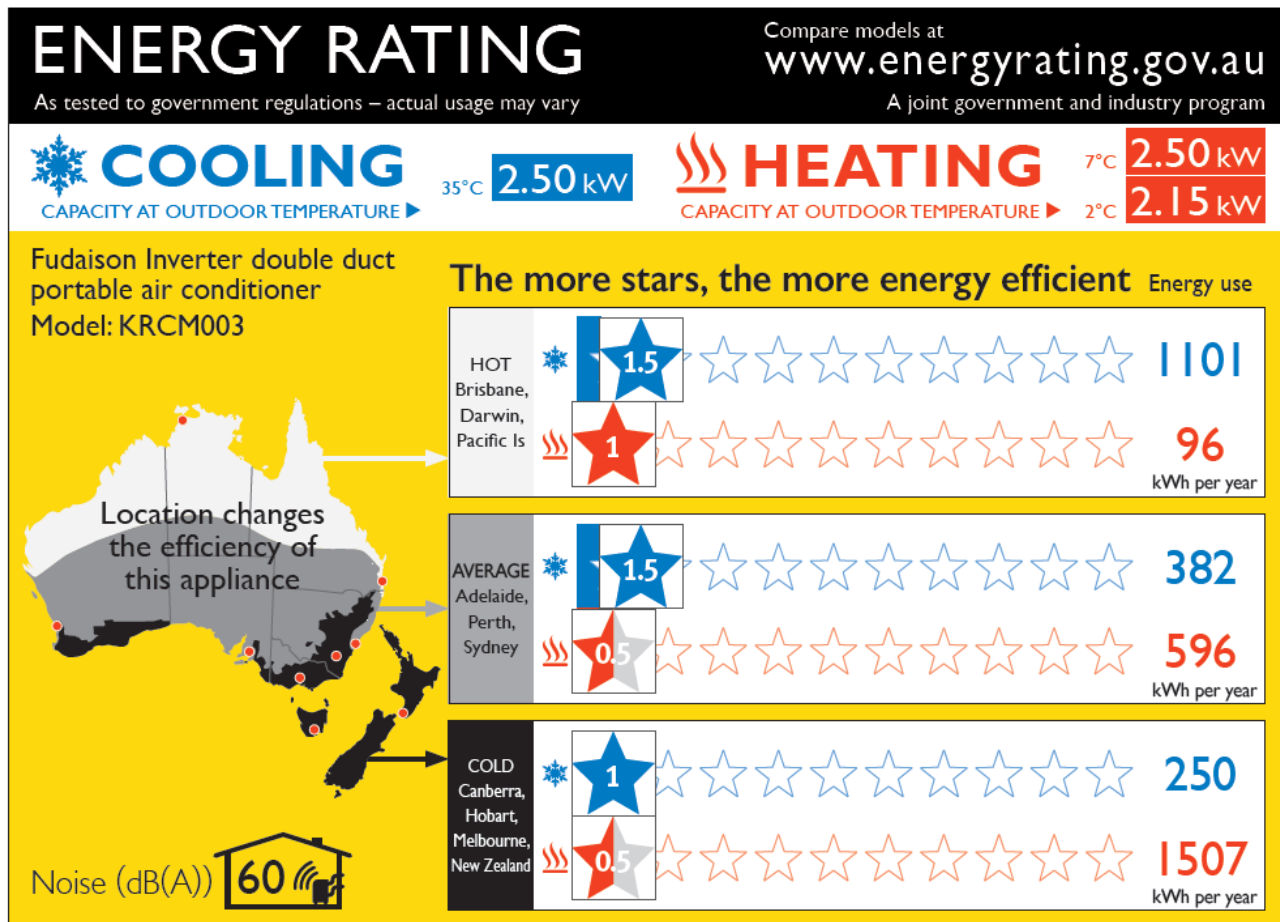
Note the indoor only noise declaration symbol.

Figure 9 Zoned Label for cooling only single duct portable with supplementary water evaporation feature



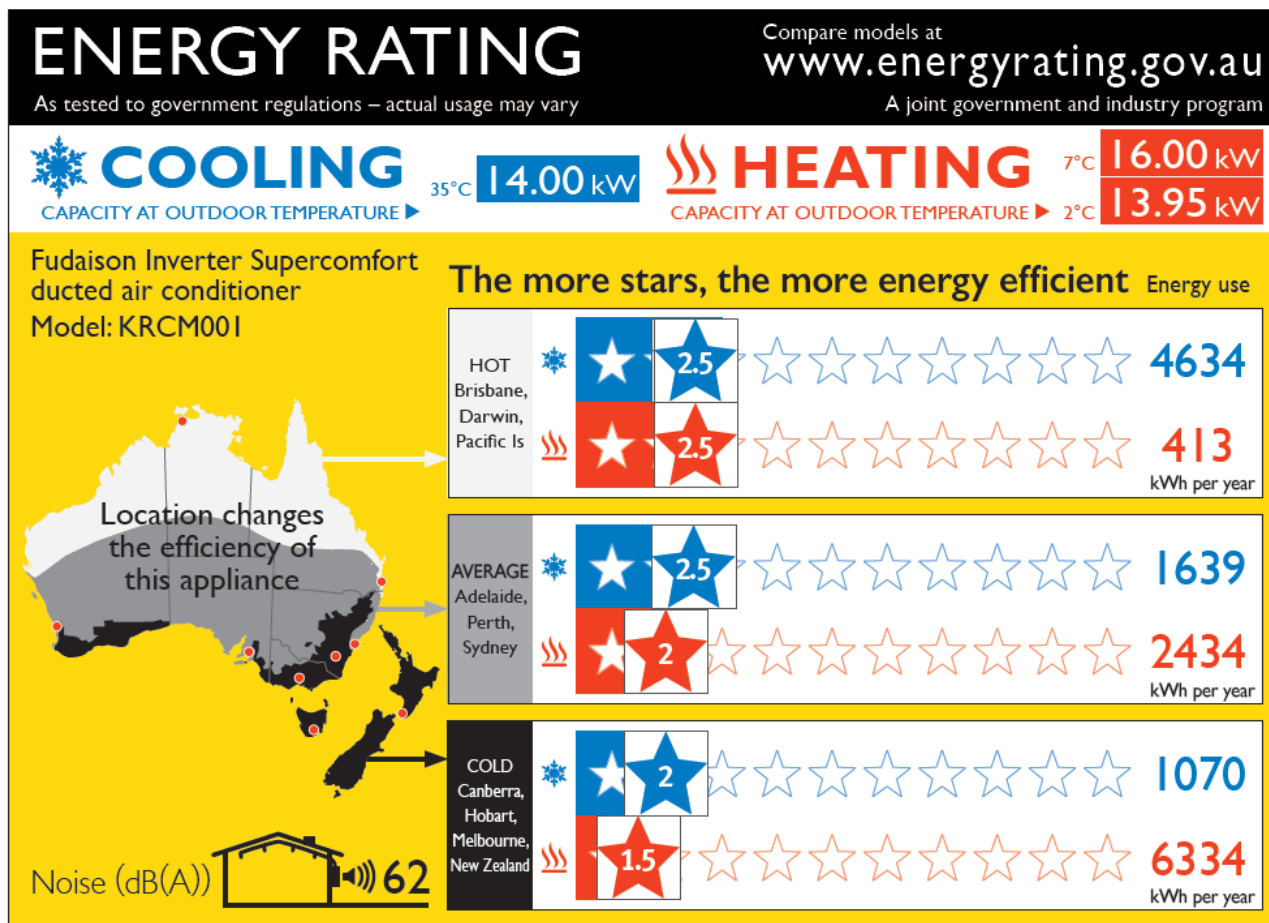
Note that capacities both with and without the use of the supplementary water evaporation feature are included.

Figure 10 Zoned Label for double duct portable



Note the double duct portable version has a different noise symbol to the single duct version.

Figure 11 Zoned Label for ducted air conditioner



Note the noise symbol for the ducted product does not include an indoor declaration.

Online rating tool

While the Zoned Label provides greatly enhanced efficiency ratings compared to the existing label, the SEER standard and underlying data allows for a plethora of information to be accessed. Alongside the Zoned Label, an online calculator tool is being developed to allow users to access:

- rating information more closely tailored to their location
 - The application will allow access to the 69 NatHERS zones for Australians and the 18 HERS zones for New Zealand. This will update the annual operating kilowatt hours based on a separate set of temperature bins.
- more accurate running costs
 - By using local temperature data and electricity tariffs selected based on location (though can be entered manually for those who know their exact tariff), consumers can get a better estimation of the lifecycle costs of the products they are considering.
- options to increase or decrease default operating hours (and thus annual energy consumption)
 - This allows engaged consumers to alter the existing temperature bin allocation to better suit their estimated usage patterns.
- display of greenhouse gas emissions, using localised emissions intensity data
- comparisons between air conditioners, gas heaters and electric resistance heaters
 - The SEER standards allows estimation of seasonal efficiency for these product types and with relevant tariffs applied, users could compare the air conditioner they were considering with similarly sized gas or electric resistance products to help select the most appropriate option.

For portable air conditioners, an hourly operating cost could be provided. This may be useful for those considering purchasing a portable product for extreme conditions only and not intending regular usage. Average hourly operating cost at rated capacity could also be provided for all product types.

Star rating algorithm

Much of the feedback on the Consultation RIS released in February 2016 specific to the introduction of AS/NZS 3823.4 and the Zoned Label requested additional information and consultation on the proposed new star rating algorithm. As a result, E3 undertook a range of product testing. The star rating index was developed using results from this testing as well as theoretical products and specific parameters (detailed below) to ensure the label will be informative, comparable and not require regrading in the near future. The new star rating index was included in the supplementary consultation paper that was published in November 2016.

Key parameters

The guiding principles for the development of the star rating algorithm on the Zoned Label were:

- The label will have a 10 star scale, with half stars from 0.5 to 9.5 (the current scale only allows full stars from 7 to 10).
- Stars will progress on a lineal basis.
- Ratings shall be provided for the three climate zones of AS/NZS 3823.4.
- E3 will develop an online consumer calculator capable of re-rating products to the other 66 Australian and 18 New Zealand climate zones.
- Single duct air conditioners (within the scope of AS/NZS 3823.1.5:2015) cannot be properly rated for seasonal performance because they are tested differently to other air conditioners. As was outlined in the Consultation RIS, these products will always deliver inferior energy efficiency to other regulated air conditioners and their ratings on the Zoned Label are designed to reflect this performance.

Test data for Zoned Label (excluding single duct portables)

Air conditioners (excluding single duct portables within the scope of AS/NZS 3823.1.5:2015) shall be labelled based on test data from AS/NZS 3823.4.1 for cooling and AS/NZS 3823.4.2 for heating (if applicable). The April 2017 amended standard is available on the [Standards Australia](https://standards.australia.org.au/) website. The data will be based on the following criteria:

- Cooling capacity: rated T1 capacity.
- Heating capacity: rated H1 capacity and either 'extended' H2 capacity when possible, otherwise 'full' H2 capacity for products not capable of 'extended' mode (see AS/NZS 3823.4.2:2014 Amd 1 for further details).
- Cooling stars: an algorithm using the Total Cooling Seasonal Performance Factor (TCSPF, or F_{TCSP}). This incorporates standby power.

- Heating stars: an algorithm using the Heating Seasonal Performance Factor (HSPF, or F_{HSP}). This does not incorporate standby power.⁶⁶
- Cooling Annual Energy Consumption (kWh per year): Cooling Seasonal Energy Consumption (CSEC, or C_{CSE}), plus, 60 per cent⁶⁷ of the annual Inactive Energy Consumption (IAEC, or C_{IAE} from Annex B of AS/NZS 3823.4.1).
- Heating Annual Energy Consumption (kWh per year): Heating Seasonal Energy Consumption (HSEC, or C_{HSE}), plus, 40 per cent of the annual Inactive Energy Consumption (IAEC, or C_{IAE} from Annex B of AS/NZS 3823.4.2).

Star rating algorithm (excluding single duct portables)

- A 2.5 kW Daikin US7 air conditioner was tested at all the mandatory and voluntary test points of AS/NZS 3823.4.1. It is assumed this model is the most efficient on the market (it is the only product that achieves 7 stars on the existing scale), and by performing all optional tests, the highest possible SEER value was calculated. It should be noted that optimisation of the optional rated test points could see a further improvement in the SEER values. The highest of its three different tested cooling SEERs has been set at 8 stars. This will allow room for innovation and improvement so that the algorithm remains relevant and effective into the future.
- Investigative tests and theoretical modelling revealed a unit's cooling cycle generally achieves higher SEER values than its heating cycle. This appears to be because heating conditions within the frosting zone present relatively more challenging operating conditions than any of the cooling conditions encountered in the local climate files. Furthermore, units with large capacity drops within these frosting conditions can incur an energy penalty for not being able to meet the calculated heating load.
- A theoretical fixed speed double duct product with a rated EER/COP of 2.5 and a weighted average inactive power consumption (P_{ia} or standby) of 5 watts yields amongst the lowest possible SEER values. A fixed speed ducted unit or window/wall unit with an AEER/ACOP value of 3.1 and large standby power consumption can actually achieve worse cooling SEER values. These values have been used to set the benchmark for half a star (see Table 16 for further details).

The SEER standard effectively applies an energy penalty to fixed speed units at part load conditions due to the energy lost when they turn off and on, whereas variable speed products become most efficient in these circumstances. Therefore, it is expected that a part load compliant variable speed product will gain more stars than fixed speed products with similar or slightly better full load performance. Theoretical investigation comparing products with the same AEER/ACOP values shows inverters can easily achieve between 10 and 30 per cent higher SEER values and 11 and 28 per cent lower Annual Energy Consumption (AEC) figures, depending on the climate zone. The star rating scale is shown in Table 16 below.

Table 16: Star rating scale

⁶⁶ Standby power impacts on the *Total* Heating Seasonal Performance Factor heavily. The calculations assign an entire year's worth of standby to both the cooling and the heating performance factors. There is a particularly negative effect on ratings for the hot/humid zone, where approximately 8500 hours of standby are applied. Removing it from the heating factor means standby is not counted twice (i.e. for both heating and cooling) and lessens the disparity between a product's cooling and heating stars. This difference has been modelled as high as 140 per cent. It also removes the likelihood of a window/wall or ducted unit with moderate standby levels achieving lower heating stars than an otherwise less efficient double duct product.

⁶⁷ The SEER standard assesses a unit's standby power usage as a combined annual total. Analysis shows that for each zone's cooling/heating seasons, approximately 60 per cent of standby hours fall in the cooling season and 40 per cent in the heating season. The annual standby totals will therefore be allocated this way.

SEER value (TCSPF or HSPF)	Stars
SEER < 2	0
2 ≤ SEER < 2.5	½
2.5 ≤ SEER < 3	1
3 ≤ SEER < 3.5	1½
3.5 ≤ SEER < 4	2
4 ≤ SEER < 4.5	2½
4.5 ≤ SEER < 5	3
5 ≤ SEER < 5.5	3½
5.5 ≤ SEER < 6	4
6 ≤ SEER < 6.5	4½
6.5 ≤ SEER < 7	5
7 ≤ SEER < 7.5	5½
7.5 ≤ SEER < 8	6
8 ≤ SEER < 8.5	6½
8.5 ≤ SEER < 9	7
9 ≤ SEER < 9.5	7½
9.5 ≤ SEER < 10	8
10 ≤ SEER < 10.5	8½
10.5 ≤ SEER < 11	9
11 ≤ SEER < 11.5	9½
11.5 ≤ SEER	10

Single duct portables

Single duct portable air conditioners within the scope of AS/NZS 3823.1.5:2015 will be labelled with total cooling capacity and heating capacity (if applicable). The use of supplementary water evaporation features will be allowed (subject to the requirements of Appendix B of the standard), and rated capacities both with and without use of this function (if applicable) must be declared on the label.

Single duct portables are the least efficient air conditioning product to be covered by E3 regulations. They will receive zero stars, as even a model able to achieve an EER/COP of 3.1 would not be as efficient as other air conditioners, due to the single exhaust duct leading to unconditioned air being drawn into the conditioned space. Equally, they are also less efficient than a double duct portable meeting the same EER/COP.

Despite their differences, retailers and consumers inevitably compare single duct products to other air conditioners. The Zoned Label will demonstrate these products are less efficient (via zero stars) and are therefore more expensive to run (through the AEC figure). Consequently, it will be necessary to apply an operating schedule (hours of use) reflecting

what is used in the SEER standard, to ensure they are shown to be a less efficient option. The online calculator tool could provide a cost per hour figure to help consumers understand their operating costs should they plan to only use the product in limited circumstances.

AS/NZS 3823.4 lists total heating and cooling hours for three climate zones. These hours will be multiplied by the rated power input to yield an AEC figure (in kWh) to apply to the Zoned Label. Non-operative power will not be incorporated. The cooling/heating hours are:

- hot zone – 2247 hours of cooling, 277 hours of heating
- mixed zone – 840 hours of cooling, 1291 hours of heating
- cold zone – 545 hours of cooling, 2660 hours of heating.

This approach is simple to apply, and while it will not take account of the outdoor air infiltration effect of single duct products, it will enable consumers to see they are less efficient than other air conditioners. Although this may reflect a higher than reality usage for some consumers, it is important that the label demonstrates these products' lower efficiency. Using a reduced number of hours could lead to some consumers mistakenly assuming the efficiency is similar to that of a similarly sized fixed product.

This approach will still allow the more efficient single duct products to be discerned from less efficient ones through the AEC figure and through a dollar operating total, including an optional hourly running cost, using online tools.

Attachment C – Cost benefit estimates and regulatory burden measure

Method for calculating energy and greenhouse gas impacts

The cost benefit estimates of the policy options were prepared by the consultancy firm EnergyConsult, who have expertise in the air conditioning sector.

Energy consumption

The energy used by air conditioners is a function of average electrical input power, the number of operating units and the average number of hours of operation.

EnergyConsult developed a stock model of units installed and operating to calculate the energy consumption under the BAU and policy scenarios. The number of operating units in a particular year is a function of existing stock, replacements and new sales. The stock and sales of air conditioners in Australia and New Zealand were modelled. Units were retired from operation according to a 'survival function', which reflected the life span of typical equipment.

A complete stock model of the air conditioner market by state/region and year was developed, with additional details such as category, capacity range, average efficiency (at multiple load points and standby power) and year of purchase or installation. These products were multiplied by BAU and policy average power input figures at various load points and corresponding average number of hours of operation for each category or load point to obtain the total energy consumption by state, category and capacity range. Operating hours were varied according to the region and whether a unit is operating in the business or residential sector. The proportion of time operating at various load points was also varied, depending on the region where the equipment is installed.

Data on the rated efficiency of the units was used to determine the average BAU input power to the air conditioners. The input power is a function of the COP and/or EER of the air conditioners. The COP/EER and cooling capacity in kW are the commonly used technical attributes of air conditioners. The input power in kW for each load point can be calculated as:

$$\text{Input power (kW)} = \frac{\text{Cooling/heating capacity (kW)}}{\text{EER or COP}}$$

EnergyConsult also included the standby and crankcase power consumption (or non-operational power) in the calculations of total annual energy consumption for air conditioners.

The BAU average efficiency was determined from sales weighted average or model weighted average EER/COP over the last ten years (or from when the products were registered), and projected to 2030 with an autonomous annual efficiency improvement of between 0.25 per cent and 0.5 per cent. Efficiency increases due to the existing Australian and New Zealand MEPS and label were included in the BAU average efficiency. The average efficiency of the units as a result of the policy options being assessed was determined on the basis of the increase in sales weighted average EER or COP at each load point. Energy consumption was determined for the BAU and policy scenarios. The difference in the projections of energy consumption provided the net energy savings used to calculate the effects of each option.

Greenhouse gas emissions

GHG emissions can be determined by multiplying the energy used by the air conditioners by the relevant emission factor for where they operate. The emission factor refers to the amount of emissions produced from the supply of a given unit of electricity. In the model, the emissions savings were estimated by using the region energy calculations combined with greenhouse gas emissions factors.

Cost benefit methodology

EnergyConsult conducted a financial analysis on the societal costs and benefits of the proposals, with analysis conducted at the state and national level. The following costs and benefits are included:

Costs:

- to businesses for complying with the new or modified regulations (e.g. sourcing or re-designing more efficient products, testing costs, and administrative costs)
- to consumers, due to increases in the upfront price of products reflecting costs passed on by suppliers
- to government for implementing and administering the regulations.

Benefits:

- to consumers, due to improving the information available for comparing the energy efficiency of products and the improved energy efficiency of available products, resulting in reduced electricity costs
- to businesses from removing unnecessary costs from the regulations.

It is necessary to approach the cost-benefit analysis from either a consumer or societal perspective. The social approach is the appropriate methodology for the analysis, but the

consumer approach can be used where it approximates the results that would be obtained from the societal perspective. An analysis from a consumer perspective involves the use of retail product prices and marginal retail energy prices. Since the objective is to assess whether product buyers (consumers) as a group would be better off, transfer payments such as taxes are included. The analysis includes retail mark-ups and taxes that are passed onto the consumer and including these in the costs will simplify the analysis process, while still remaining appropriate. The New Zealand analysis has been undertaken to also approximate the societal perspective, using the long run marginal cost of electricity (required by their cost benefit methodology) and wholesale product prices (including quantifying the benefits of reduced emissions).

All Net Present Value (NPV) figures are real 2016 dollars⁶⁸.

Inputs

The inputs to the model are detailed below and are derived from available data, industry feedback and realistic assumptions where necessary.

The data was obtained from multiple sources (past RIS analysis, industry data/interviews, published sources such as ABS, and unpublished industry data) and checked with industry in a series of interviews and a workshop. The interviews were conducted with over 25 suppliers from Australia and New Zealand during late 2013 and 2014. They followed a structured interview guide to obtain information on the market trends, lifetimes of products, shares of sales to business vs residential sectors, efficiency trends, price trends, size trends and technological barriers to greater energy efficiency.

An industry workshop was also held in April 2014, where feedback was sought on the preliminary stock and sales numbers for the modelling. This workshop was attended by 50 stakeholders and feedback was obtained over the day, and during discussions by telephone and in person at the Air Conditioning, Refrigeration and Building Services conference in May 2014.

In the case of New Zealand stakeholders, another set of interviews were conducted in 2014 to obtain feedback on the preliminary modelling results for New Zealand. The model parameters were adjusted as a result of these findings.

The Consultation RIS cost benefit estimates were presented at a series of public consultation meetings held across Australia and New Zealand in February 2016 and

⁶⁸ NPV is a calculation that allows decision makers to compare the costs and benefits of various alternatives on a similar time scale by converting all options to current dollar figures. NZ values are shown in NZ dollars, calculated with an exchange rate of 1.18 NZD to 1 AUD (the long term average).

December 2016. Submissions in response to the Consultation RIS and supplementary consultation paper generally focused on the appropriateness of the policy rather than the cost benefit estimates.

For the Decision RIS, updated price, sales and efficiency data have been included in the modelling where possible. New product categories were also created to allow the impact of the final policy proposals to be modelled according to the product type they will affect (e.g. units above and below 30 kW capacity).

Sales

For Australia, GfK sales data from 2003 to 2015 was used where available, with data supplied by industry used for remaining categories. For New Zealand, sales data was used for most categories up to 2016. Forecast sales are based on projected trends and industry feedback on these trends presented at workshops and by interviews conducted for the Consultation RIS in 2014, updated to take account of the additional sales data obtained in the period since.

Projection period

The projection period is 12 years (2019-2030, cohort ending in 2050). This was chosen as the modelling period as the policy changes will significantly affect product purchases for at least 5 years after implementation and have a continuing effect over the following years. Cohort modelling has been used, which refers to tracking the products installed up to 2030 for their remaining lifespan, which ranges from 10 to 20 years. This approach has been used to capture the ongoing savings of the policy induced technology changes for products installed in the period up to 2030.

For modelling purposes the start date (when benefits and cost start to occur) is 2019 for the proposals, except for the air conditioners greater than 65kW capacity which is 2021. For double duct portables (included in Option A) the modelling assumes this change would start in 2019. Present value real values (in 2016-17 dollars) are used.

Electricity prices

The electricity prices and forecasts are based on:

- (Residential + Business) Electricity price index for Australia, from the Australian Energy Market Operator (AEMO). These were updated to 2016/17 real dollars, based on AEMO projections.
- Energy Information & Modelling Group's Reference Scenario for New Zealand, from the Ministry of Business, Innovation and Employment.

Greenhouse gas factors

Updated projected emission factors for Australia and New Zealand have been included. In Australia they are based on the Scope 3 emission factors for the consumption of electricity by the consumer. The projected Scope 1 emission factors (of electricity sent out by State) were provided by the Department of the Environment and Energy (March 2017). The New

Zealand estimates were provided by the Ministry of Business, Innovation and Employment.

For New Zealand, a carbon price of \$25 per tonne of CO₂-e has been used to estimate the benefits of lower levels of greenhouse gas emissions.

Government costs

Government administration costs include salary, program administration, check testing and consumer information/education. As most of the product categories are already regulated for MEPS and labelling, there is likely to be only a small increase in government costs.

The incremental administration costs for Australia and New Zealand are assumed to be A\$100,000 per annum. An additional establishment cost of A\$400,000 is included in the first year for implementation. New Zealand's share of the establishment and ongoing costs is estimated to be NZ\$80,000 and NZ\$20,000 per year respectively.

Regulatory costs

Costs of compliance (for example testing, staff education and record keeping) are estimated using the Regulatory Burden Measurement tool and included as a component of the cost benefit analysis.

Registration costs for new products within the scope of the proposals are \$670/model, which is treated as an income to the government for modelling purposes as partial cost recovery for administering the regulations in Australia. There are no registration fees in New Zealand.

Sensitivity tests

The outputs of the CBA were assessed in Australia at a 7 per cent discount rate, with sensitivity tests at 0, 3 and 11 per cent. For New Zealand, a 6 per cent discount rate is used, with sensitivity tests at 0, 3 and 8 per cent. Average incremental costs due to efficiency increases were increased and decreased by 50 per cent. The learning rates were also reduced by 50 per cent and to zero.

Other assumptions

Rebound (take back) is treated as zero in relation to energy use. Rebound occurs where the increased energy efficiency of a product results in a consumer making greater use of the product. Any rebound would occur through the conversion of potential energy savings into increased thermal comfort (i.e. if consumers spend some of the energy savings to cool or heat their home more). This does not decrease the total benefit the consumer receives, it is simply a conversion of the energy savings benefit into another form. This means there is no reduction in benefits from the consumers' perspective.

For Australia, benefits due to reduced peak demand from lower power consumption are intrinsically included in the electricity prices used for the cost benefit analysis.

For New Zealand, national benefits are assessed using the avoided long run marginal cost of electricity and accordingly, resource costs are used to assess the cost of efficiency improvements (assumed to be 50 per cent of the product's retail price)⁶⁹. The benefits for New Zealand also include financial benefits associated with greenhouse gas abatement.

Product categories and rated capacity

For each class of equipment, multiple product categories were used to ensure the impacts of potential policy changes are assessed. Table 17 shows the product categories that were used, along with the average rated output.

Table 17 Product categories

Product Category	Heating Capacity (kW)	Cooling Capacity (kW)
Ducted 0-20 kW - RES & BUS	12.7	12.0
NDucted Split 0-4 kW - RES & BUS	3.2	2.9
NDucted Split 4-6 kW - RES & BUS	5.5	5.0
NDucted Split 6-10 kW - RES & BUS	8.0	7.3
NDucted Split 10-20 kW: 1-phase - RES & BUS	13.0	11.8
NDucted Split 10-20 kW: 3-phase - RES & BUS	13.8	12.6
Multi Splits - RES & BUS	9.4	8.5
Portables - RES	2.8	2.4
NDucted Unitary 0-10 kW - RES & BUS	3.8	4.0
Ducted 20-30 kW - BUS	24.4	23.9
Ducted 30-40 kW - BUS	34.8	34.1
Ducted 40-65 kW - BUS	51.0	50.0
Ducted >65 kW - BUS	91.8	90.0
NDucted 20-40 kW - BUS	28.9	27.5
NDucted >40 kW - BUS	52.5	50.0
Multi Splits - VRF - BUS	28.4	27.0
NZ non-AU Compliant Split - RES	7.2	6.5

BAU efficiency

The average efficiency of products sold in a particular year was determined from sales of models matched with the EER/COP from the Energy Rating registrations database (all

⁶⁹ [Reserve Bank of Australia](#)

products that have MEPS or Energy Rating Labels are registered and the technical characteristics recorded in this database).

The registration data up to January 2017 was used to update the model weighted EER, COP and non-operational power (NOP) values for all ducted categories (to 2016) and multi-split categories (to 2015) below 65 kW. For non-ducted products under 10 kW, the GfK sales weighted values were updated for 2014 and 2015 for Australia. The New Zealand BAU efficiency was derived from the sales weighted average efficiency to 2016, as EECA collect sales data from suppliers. Where sales data was not available, the model weighted average efficiency was determined from the registration database.

The BAU operational EER/COP at full load is shown in Tables 18 and 19 below for Australia and New Zealand, with most categories derived from sales weighted average data, and other categories derived from model weighted data. The BAU efficiency of portable and ducted >65 kW were derived from available test data and discussions with industry stakeholders. Values were calculated for most products from 2003 to 2016, with some data being available from 2000.

Table 18 Product categories and average efficiency in 2015 – Australia

Product Category	Heating COP (W/W)	Cooling EER (W/W)
Ducted 0-20 kW - RES & BUS	3.61	3.45
NDucted Split 0-4 kW - RES & BUS	4.57	4.48
NDucted Split 4-6 kW - RES & BUS	3.93	3.88
NDucted Split 6-10 kW - RES & BUS	3.67	3.46
NDucted Split 10-20 kW: 1-phase - RES & BUS	3.52	3.36
NDucted Split 10-20 kW: 3-phase - RES & BUS	3.49	3.37
Multi Splits - RES & BUS	4.02	3.71
Portables - RES	2.44	1.73
NDucted Unitary 0-10 kW - RES & BUS	3.39	3.30
Ducted 20-30 kW - BUS	3.50	3.33
Ducted 30-40 kW - BUS	3.49	3.37
Ducted 40-65 kW - BUS	3.35	3.09
Ducted >65 kW - BUS	3.12	2.73
NDucted 20-40 kW - BUS	3.84	3.48
NDucted >40 kW - BUS	3.47	3.15
Multi Splits - VRF - BUS	3.77	3.40

Table 19 Product categories and average efficiency in 2016 - New Zealand

Product Category	Heating COP (W/W)	Cooling EER (W/W)
Ducted 0-20 kW - RES & BUS	3.63	3.28
NDucted Split 0-4 kW - RES & BUS	4.38	4.21
NDucted Split 4-6 kW - RES & BUS	3.80	3.53
NDucted Split 6-10 kW - RES & BUS	3.64	3.40
NDucted Split 10-20 kW - RES & BUS	3.67	3.38
NDucted Split 10-20 kW: 3-phase - RES & BUS	3.73	3.27
Multi Splits - RES & BUS	3.45	3.35
Portables - RES	2.44	1.73
NDucted Unitary 0-10 kW - RES & BUS	3.10	3.20
Ducted 20-30 kW - BUS	3.43	3.17
Ducted 30-40 kW - BUS	3.59	3.24
Ducted 40-65 kW - BUS	3.38	3.00
Ducted >65 kW - BUS	3.12	2.73
NDucted 20-40 kW - BUS	3.84	3.48
NDucted >40 kW - BUS	3.47	3.15
Multi Splits - VRF - BUS	3.84	3.47
NZ non-AU Compliant Split - RES	3.25	2.93

The model separates the calculations of energy consumption into six loads for each of heating and cooling modes as follows: 125 per cent, 100 per cent, 75 per cent, 50 per cent, 25 per cent and minimum. The NOP (standby + crank case) is also calculated separately. The average NOP is derived from the registrations database.

A total of 13 points are calculated for each product category. This separation allows the impact of the Zoned Label and SEER rating on the part load characteristics of the equipment to be assessed. The part load efficiency values are calculated from the use of the default ratios of efficiency of part load to full load applied in the SEER testing and rating standard, ISO 16358 (AS/NZS 3823.4), in combination with the average efficiency at full load and 50 per cent load recorded in the registrations database for applicable models.

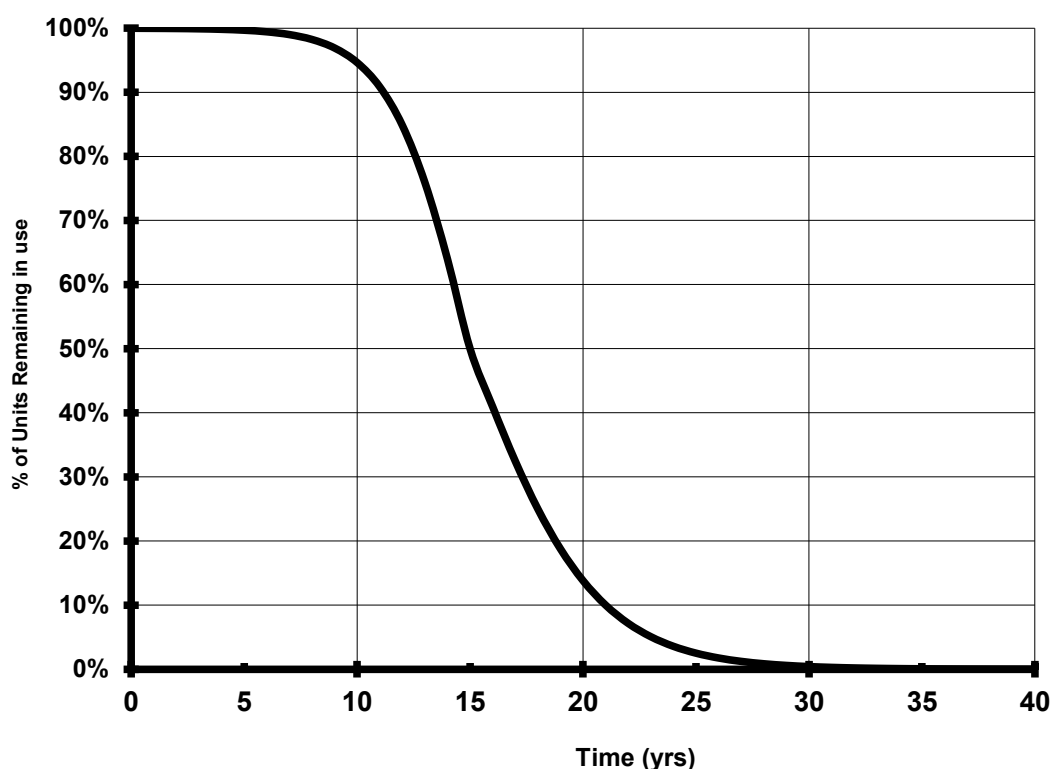
The average forecast autonomous efficiency improvement was calculated from past periods of no policy action and found to be 0.5 per cent per annum. This increase in efficiency was applied to the forecast BAU and policy options.

Life of equipment

The forecasts of stock were subjected to appropriate 'survival functions' for each category and size. An example of the survival functions is shown in Figure 12, where a graphical

view is presented of the percentage of air conditioners (R_t) in useful service over the life in years from purchase (t).

Figure 12 Survival function



For air conditioning equipment, the 50 per cent life assumptions were:

- ducted – 15 years
- non ducted and multi split – 12 years
- VRF – 15 years
- non ducted unitary – 15 years for residential and 8 years for business
- portable – 8 years.

These life assumptions were developed in consultation with the Australia and New Zealand suppliers in workshops and interviews.

Operating hours

The operating hours for all products were the estimated operating hours of the equipment at various load points. The following data and calculations were used to calculate the operating hours.

The operating hours were derived from the Australian Bureau of Statistics Household Energy Consumption Survey (ABS 2012) and are shown in Table 20.

Table 20 State/zone average annual operating hours - residential

State/zone Operating Hours Factor	Heat	Cool
NSW	378	503

State/zone Operating Hours Factor	Heat	Cool
ACT	877	346
NT	20	1577
QLD	303	707
SA	378	493
TAS	1516	394
VIC	533	364
WA	345	631
NZ	1516	394

Note: NZ was assumed to be approximately the same as Tasmania, and this is supported by interviews in NZ.

The operating hours were adjusted by a number of factors to account for occupied households, percentage of households using the heating functions of the air conditioner and the number of air conditioners in the house. As approximately 10 per cent of households are unoccupied, the hours of use were first multiplied by 0.9. To account for the number of air conditioners used for heating, the ABS HEC (ABS 2012) survey was used to derive the adjustments shown in Table 21.

Table 21 State/zone heating and cooling operating hours adjustment - Residential

State/zone Operating Hours Factor	Heat	Cool
NSW	70%	100%
ACT	70%	100%
NT	10%	100%
QLD	60%	100%
SA	70%	100%
TAS	95%	100%
VIC	45%	100%
WA	70%	100%
NZ	95%	100%

Note: NZ was assumed to be approximately the same as Tasmania, and this is supported by interviews in NZ

These operating hours were then adjusted to account for more than one product in the household and user specific behaviour when operating different types of air conditioning systems. The adjustments are shown in Table 22.

Table 22 Equipment zoning and product adjustment to average annual operating hours - residential

Product Category	Factor - Cooling	Factor - Heating
Ducted 0-20 kW - RES - Exist	1.00	1.00
Ducted 0-20 kW - RES – Post 2005	1.00	1.00
NDucted Split 0-4 kW - RES - Exist	0.75	0.75
NDucted Split 0-4 kW - RES – Post 2005	0.75	0.75

Product Category	Factor - Cooling	Factor - Heating
NDucted Split 4-6 kW - RES - Exist	0.75	0.75
NDucted Split 4-6 kW - RES – Post 2005	0.75	0.75
NDucted Split 6-10 kW - RES - Exist	0.75	0.75
NDucted Split 6-10 kW - RES – Post 2005	0.75	0.75
NDucted Split 10-20 kW - RES - Exist	0.75	0.75
NDucted Split 10-20 kW - RES – Post 2005	0.75	0.75
Multi Splits - RES	0.75	0.75
Portables - RES	0.50	0.10
NDucted Unitary 0-10 kW - RES	0.60	0.20

Business operating hours were estimated for each state based on the previous 2011 RIS, which assessed the likely business operating hours in each zone. This assessment found that most commercial buildings require cooling (due to the higher loads) more than heating, and that many commercial buildings have gas heating. The values used are shown in Table 23.

Table 23 State/zone average annual operating hours - Business

State/zone Operating Hours Factor	Heat	Cool
NSW	438	1753
ACT	438	1753
NT	0	2192
QLD	26	2192
SA	175	1753
TAS	1578	482
VIC	88	1753
WA	44	1929
NZ	1578	482

The heating and cooling operating hours were then allocated to each of the six load points for each state/zone. The basis of this allocation was modelling commissioned by E3 for the development of the Zoned Label. The modelling provided the amount of time an air conditioner would be operating in various temperature ranges for both heating and cooling. The proportion of time in each temperature range was allocated to the six load points. The non-operational time was determined as the remaining time in the year when the heating and cooling modes were not operating.

Price efficiency ratio

A key input for the modelling of the costs of the policy options is the cost impact of the efficiency improvement on the price of the product (to the consumer). The assumption used in the modelling is that more efficient equipment is more expensive than a similar

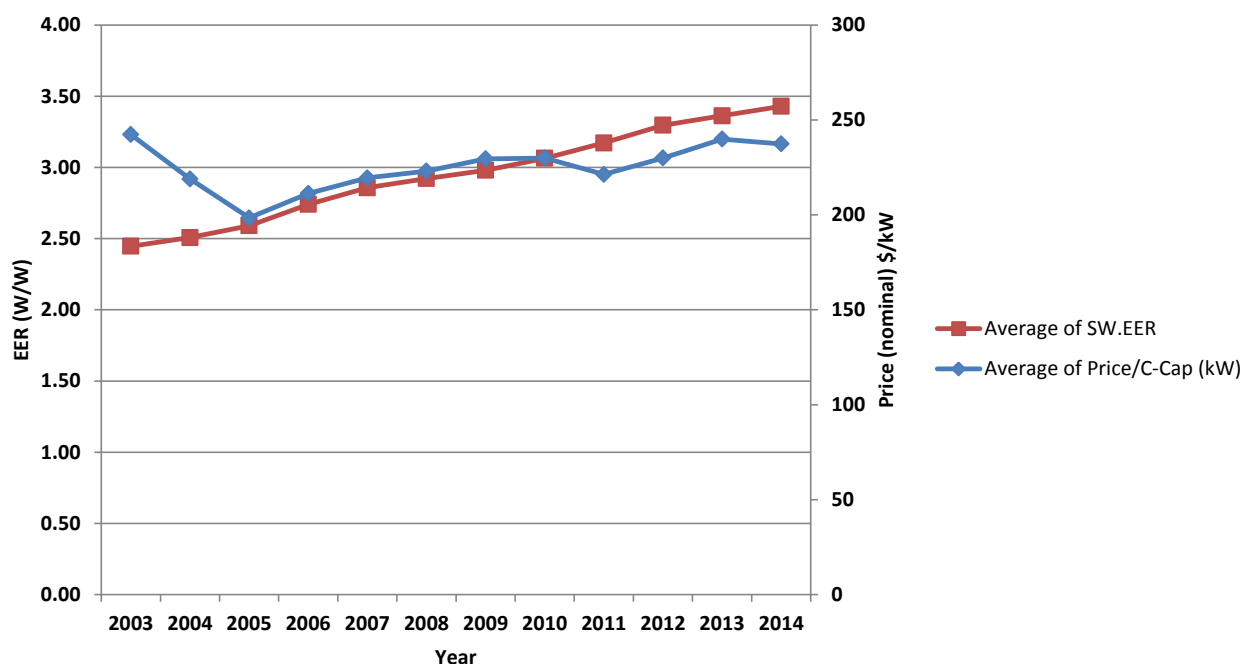
performing product with lower efficiency. This approach has been used for past RISs in determining the relative costs of energy efficiency policy.

A range of options exist for determining the potential price changes as a result of the policy, such as engineering/cost deconstruction, surveys of the suppliers to obtain price increments vs efficiency performance and analysis of the price versus efficiency relationship from matched model sales and technical data. The latter two approaches were used in this modelling exercise.

The aim of this price versus 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. For example, if a 1 per cent increase in the average efficiency of the products being sold/installed is achieved with an average price increase of 1.5 per cent, this results in a PE ratio of 1.5:1.

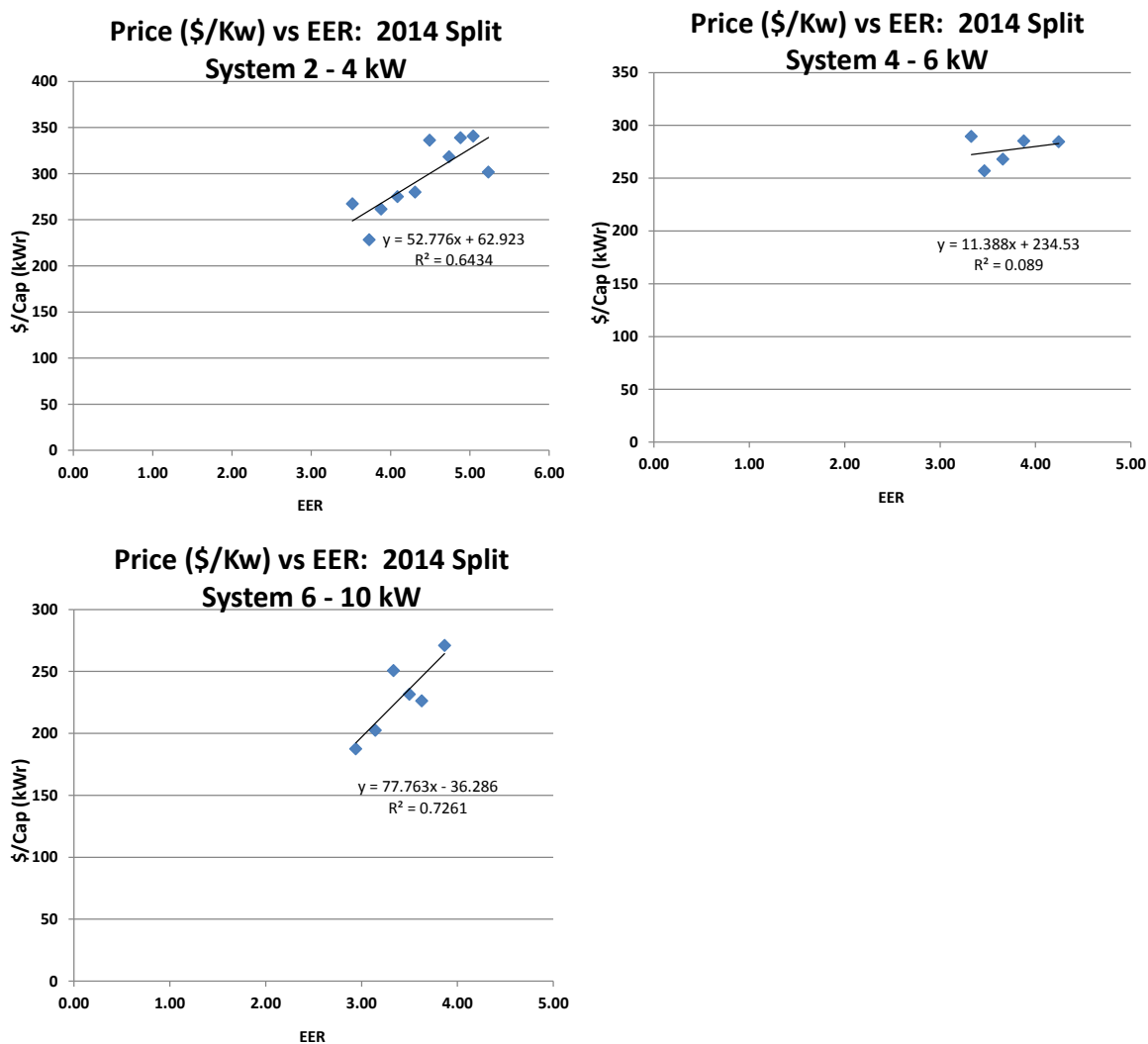
GfK data on the sales of non-ducted air conditioners from 2003 to 2014 was matched with models registered in the energy rating database. This enables a detailed assessment of the price versus efficiency of products over time and by efficiency cohorts in particular years. Figure 13 shows the results of the efficiency versus price over time for non-ducted 6–10 kW split AC over the period 2003–2014. This graph shows that there is not a strong relationship between nominal prices (\$/kW) and EER. In fact, if inflation is taken into account, prices have actually decreased.

Figure 13 Price per kW of output capacity vs efficiency (EER) over 2003 – 2014



However, the analysis of various cohorts of efficiency for the 2014 financial year shows some relationship in price versus efficiency. The PE ratio ranges from 0.14:1 to 1.2:1 when examining all the 2014 data with sufficient sales by EER bins of 0.2, as shown in Figure 14 (the slope of the line when normalised to percentage of efficiency and price provides the PE ratio)⁷⁰. The average PE ratio is 0.6:1, however there is a wide range of R² and correlation coefficient.

Figure 14 Price v EER for non-ducted split systems



When examining the higher EER cohorts (those units with EERs of about 10 per cent or higher than the current MEPS levels), the PE ratio ranges from 0.33:1 to 1.84:1 with an average of 0.9:1. However, there are less data points and therefore lower confidence in the strength of the relationship.

⁷⁰ The PE ratio is the ratio of the percentage increase in both price and efficiency. The figures show the non-normalised actual costs (in \$ per kWh vs EER).

Nevertheless, this does suggest that the relationship may not be linear over the range of efficiency and that the PE ratio used to assess the costs of policy options should increase with the more stringent policy (where only high efficiency units are available).

To reflect the results of this analysis, the PE ratio used for the CBA in the Consultation and Decision RIS range from 0.5:1 to 2.0:1. For the least stringent policy options (e.g. aligning New Zealand and Australian MEPS), a PE ratio of 0.5:1 was used to represent the cost of efficiency improvements and for the MEPS proposals for 65 kW plus air conditioners. A PE ratio of 2.0:1 was used for the stringent MEPS levels recommended by the 2011 Decision RIS (adopting these MEPS levels was analysed for the Consultation RIS, but as they were not found to be cost effective they were excluded from consideration).

For the Zoned Label policy option, the increase in costs is assumed to be an average 5 per cent increase in price to account for the costs of suppliers optimising the current variable capacity output products or adding these features to their products. Considering the majority of products on the market already feature variable capacity outputs, this assumption is considered conservative, and was tested during interviews with suppliers.

In the portable product category, the price of the products reflect changes to the market share of double duct and single duct portable units (where single duct units are assumed to have lower market shares due to either the Zoned Label requirements or MEPS requirements). This approach is conservative, as the price difference between the two product categories is likely to reflect features in addition to the improved energy efficiency provided by the additional duct.

Energy efficiency – policy proposals

Historical EER and COP values are sales weighted or model weighted from 2000 to 2015/16, based on the registration database and categorised by product type. Non-operating power is also weighted by sales or models registered and modelled separately to obtain the AEER and ACOP.

BAU efficiency projections are based on historical trends during non-policy periods and found to increase by 0.5 per cent per annum (p.a.) at full load. Part load BAU efficiency is assumed to increase at a greater rate, in proportion to the number of variable capacity models being installed. The efficiency changes induced by the policy proposals are outlined below.

Option A

1. Energy efficiency information - adopt SEER standard and Zoned Label

Zoned Label

Assumes that the Zoned Label will increase the sales weighted average part load efficiency of air conditioners in label scope (single phase non-ducted) below 30 kW. This is

implemented in the model by increasing the ratio of part load to full load EER/COP for variable speed products by 1 per cent p.a. in 2019 for 5 years following the implementation, and then reverting to the BAU assumed increase of 0.2 per cent p.a. The label change is assumed to transform the market to more efficient part load models, as they will rate higher.

The average price increase for those product categories affected by the Zoned Label was assumed to be 5 per cent, to account for product modifications that would increase the part load efficiency of the air conditioner, either by upgrading to a variable speed (or multi-stage) compressor and associated controls, or optimising an existing variable speed (or multi-stage) compressor.

As this technology is currently widely used, the costs are therefore estimated to be small and involve research/testing and optimising the control strategies for most air conditioners — variable speed compressors are now in almost 100 per cent of non-ducted air conditioners and in 2014 were present in 75 per cent of ducted (0-20 kW) and 50 per cent of ducted (>20 kW).

The average price increase was reduced by 33 per cent p.a. following implementation due to rapid learning. This means that the costs will quickly decline to close to zero as the changes are mostly software related, with a high learning effect. There has been rapid uptake of variable speed technology in the air conditioning market over the last 10 years, while at the same time there has been a real decline in the retail price.

In cold climates (Victoria, Tasmania, Australian Capital Territory and New Zealand), the Zoned Label is also assumed to increase the purchase of higher efficiency heating products. This is modelled as a 1 per cent increase in full load COP in the year of implementation for the Australian jurisdictions and a 0.5 per cent increase in New Zealand, using a PE ratio of 0.5. The heating efficiency improvement in New Zealand is assumed to be lower, as ENERGYSTAR (a voluntary program that endorses energy efficient products) targets cold weather performance.

Mandatory disclosure of SEER rating up to 30 kW

Assumes that SEER rating will increase the sales weighted average part load efficiency of air conditioners below 30 kW i.e. ducted and three phase. This is implemented in the model by increasing the ratio of part load to full load EER/COP for variable speed products by 0.5 per cent p.a. in 2019 for 5 years following the implementation, and then to revert to the BAU assumed increase of 0.2 per cent p.a. The label change is assumed to transform the market to more efficient part load models, as they will rate higher.

The average price increase for those product categories affected was assumed to be 2.5 per cent, to account for the product modifications (such as optimisation of variable speed compressors, implementation of variable speed drives, etc.). As this technology is currently

widely used, the average price increase was reduced by 33 per cent p.a. following implementation due to rapid learning.

In cold climates (Victoria, Tasmania, the Australian Capital Territory and New Zealand), the mandatory SEER rating is also assumed to increase the purchase of higher efficiency heating products. This is modelled as a 0.5 per cent increase in full load COP in the year of implementation for the Australian jurisdictions and a 0.25 per cent increase in New Zealand, using a PE ratio of 0.5. The heating efficiency improvement in New Zealand is assumed to be lower, as ENERGY STAR targets cold weather performance.

Mandatory disclosure of cooling cycle SEER above 30 kW

Assumes that cooling SEER rating will induce an increase in the sales weighted average part load efficiency of air conditioners above 30 kW. This is implemented in the model by increasing the ratio of part load to full load EER/COP for variable speed products by 0.4 per cent p.a. in 2019 for 5 years following the implementation, and then to revert to the BAU assumed increase of 0.2 per cent p.a. The label change is assumed to transform the market to more efficient part load models, as they will rate higher. No COP impact is modelled, as the heating cycle is unchanged.

The average price increase for those product categories affected was assumed to be 2 per cent, to account for the product modifications (such as optimisation of variable speed compressors, implementation of variable speed drives, etc.). As this technology is currently widely used, the average price increase was reduced by 33 per cent p.a. following implementation due to rapid learning. Table 24 shows the cost and efficiency improvement assumptions for each category.

Table 24 - Cost and efficiency assumptions

Category	Part load efficiency improvement	Cost factor	Notes
Ducted 0-20 kW - RES	0.5%	2.5%	Mandatory disclosure
NDucted Split 0-4 kW - RES	1.0%	5.0%	Label scope
NDucted Split 4-6 kW - RES	1.0%	5.0%	Label scope
NDucted Split 6-10 kW - RES	1.0%	5.0%	Label scope
NDucted Split 10-20 kW: 1-phase - RES	1.0%	5.0%	Label scope
NDucted Split 10-20 kW: 3-phase - RES	0.5%	2.5%	Mandatory disclosure
Multi Splits – RES	0.5%	2.5%	Mandatory disclosure
Portables – RES	NA	20%	40% proportion of double duct sales share due to label and reduce MEPS
NDucted Unitary 0-10 kW - RES	1.0%	1.0%	Only a small proportion are variable capacity units

Category	Part load efficiency improvement	Cost factor	Notes
NDucted Unitary 0-10 kW - BUS	1.0%	1.0%	Only a small proportion are variable capacity units
Ducted 0-20 kW - BUS	0.5%	2.5%	Mandatory disclosure
Ducted 20-30 kW - BUS	0.5%	2.5%	Mandatory disclosure
Ducted 40-65 kW - BUS	0.4%	0.2%	Only cooling Mandatory
Ducted >65 kW - BUS	0.4%	0.2%	Only cooling Mandatory
NDucted Split 0-4 kW - BUS	1%	5.0%	Label scope
NDucted Split 4-6 kW - BUS	1%	5.0%	Label scope
NDucted Split 6-10 kW - BUS	1%	5.0%	Label scope
NDucted Split 10-20 kW: 1-phase - BUS	1%	5.0%	Label scope
Multi Splits – BUS	0.5%	2.5%	Mandatory disclosure
Multi Splits - VRF – BUS	0.025%	0.1%	Mandatory disclosure (VRF already very efficient at part load)
Ducted 30-40 kW – BUS	0.4%	2.0%	Only cooling Mandatory
NDucted Split 10-20 kW: 3-phase - BUS	0.5%	2.5%	Only cooling Mandatory

Notes: Ducted = ducted air conditioner, NDucted = non-ducted air conditioner, BUS = Business sector, RES = Residential sector.

2. Portable air conditioners

Double duct portables subject to Zoned Label and reduced MEPS of 2.50 EER

Single duct portables subject to Zoned Label

For portable air conditioners, assume the Zoned Label will encourage sales of double duct units and they will represent 40 per cent of sales in the portables market (50 per cent was assumed in the Consultation RIS—the share has been reduced due to the MEPS being lower than the Consultation RIS proposal). Portable costs increase in proportion to the double duct sales share (the average weighted price increase is 7 per cent).

3. Include 65 kW plus air conditioners in scope

Apply NCC MEPS levels to the replacement market (estimated as 50 per cent). Increase in sales weighted efficiency due to MEPS is estimated from the average assumed efficiency of 2.5 EER (based on performance information of common models) for these non-regulated products that would have to comply with the new requirement of 2.7 AEER. The average increase to the sales weighted EER is calculated as 1.8 per cent. A PE ratio of 0.5 was used, reduced by 10 per cent per annum to account for learning.

4. Technical fixes

Any cost impacts are captured by the Regulatory Burden Measure, which has been included as an input to the cost benefit estimates.

5. Increase New Zealand's cooling MEPS to Australia's level

Assumes that two products (a 4 kW and 9 kW system) have an EER that is at the NZ MEPS level of 2.93 (EECA cannot provide details of the actual models that are not complying with the Australian MEPS levels for cooling, due to confidentiality of sales figures). The policy change will require that new models purchased will be at least at the Australian MEPS level of 3.22 EER. Assumes the weighted average capacity is 6.5 kW and the weighted average ratio of COP to EER of all products in the 4 to 10 kW range is 1.11. This ratio was applied to obtain the BAU COP of 3.25 for these units. A PE ratio of 0.5 was used, reduced by 10 per cent per annum to account for learning.

Option B

6. Single duct portables subject to MEPS of 2.50 EER

For portable air conditioners, assumes that the MEPS level will shift 75 per cent of the sales to double duct units, as many single duct units will re-tool to become double duct units or will not be able to comply with the MEPS. The CRIS assumed 95 per cent of sales shift to double ducts—this has been reduced to account for the proposed lower MEPS of 2.50 EER (reduced from an AEER of 2.60).

Portable costs increase in proportion to the double duct sales share (effectively the average weighted price increase is 13 per cent). Double duct portables are assumed to cost approximately \$100 more than single duct portables in year one, due to both the increase in cost from the extra ducting and the efficiency improvements necessary to meet the MEPS. The average price increase was reduced by 33 per cent per annum to account for learning, as the incremental improvements to improve energy efficiency are low cost items, such as additional ducting and fittings. Data from the USA suggests the retail price increase of the energy efficiency improvement is US\$15⁷¹.

Option C

7. Increase greater than 65 kW MEPS to 2.90 AEER

The increase in sales weighted efficiency due to MEPS is estimated from the 75 per cent of sales that would have to comply with the new requirement of 2.90 AEER (from a range of EER BAU assumed efficiency for these non-regulated and NCC regulated products). The

⁷¹ Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Portable Air Conditioners, page 8 (table ES.4.3.3)

www.regulations.gov/document?D=EERE-2013-BT-STD-0033-0007

average increase to the sales weighted EER is calculated as 5.9 per cent. A PE ratio of 0.5 was used, with the price increase reduced by 10 per cent per annum to account for learning.

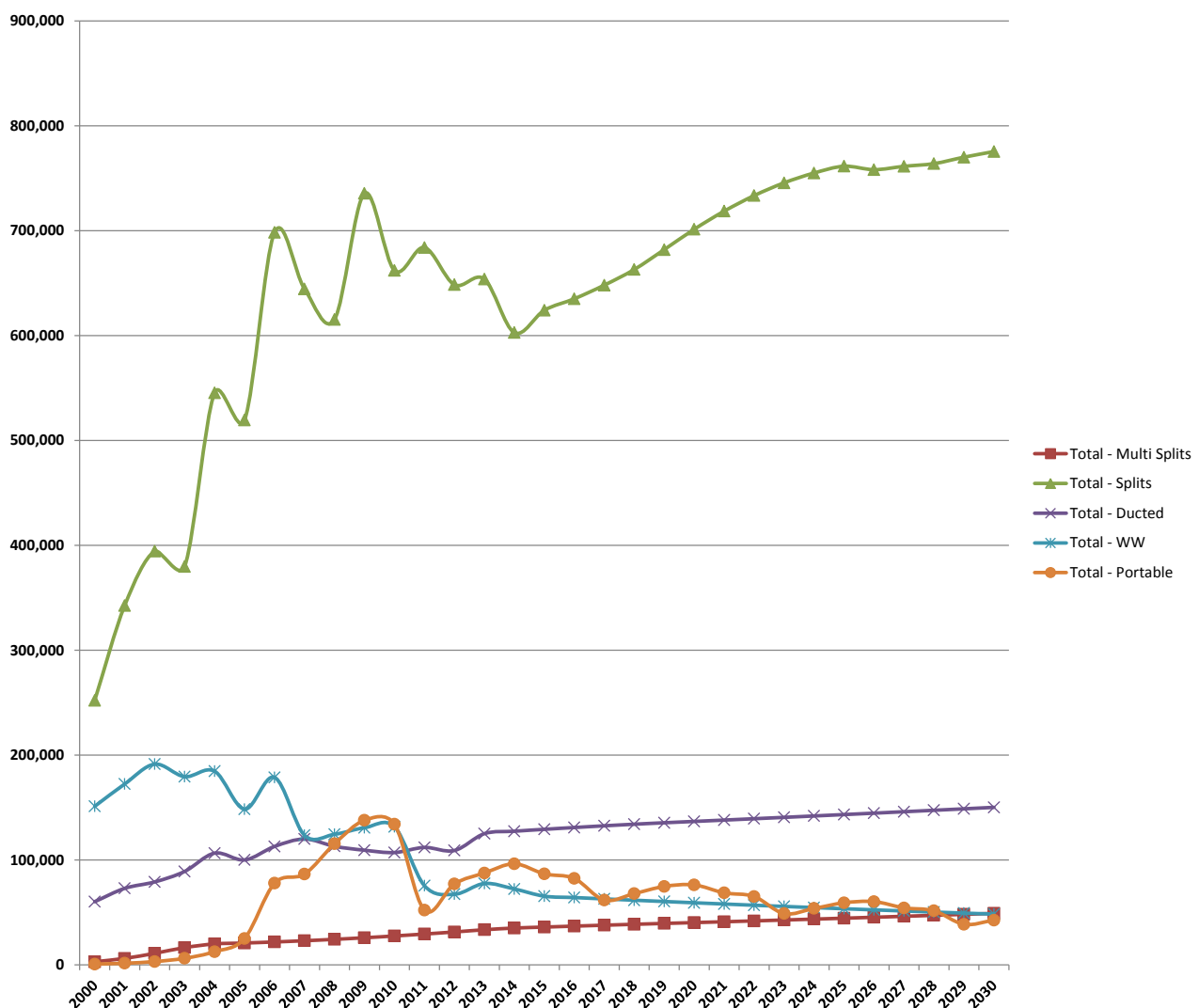
Sales and stock

Sales trends

The sales of air conditioners are a function of economic growth and consumer/business product preferences. The sales data has been used to determine the most probable forecast that matches the historic data and trends. The sales forecasts were developed in consultation with industry stakeholder workshops and interviews in Australia and New Zealand during 2014. The sales data used for the Consultation RIS has been updated to include data up to 2015 for Australia and 2016 for New Zealand.

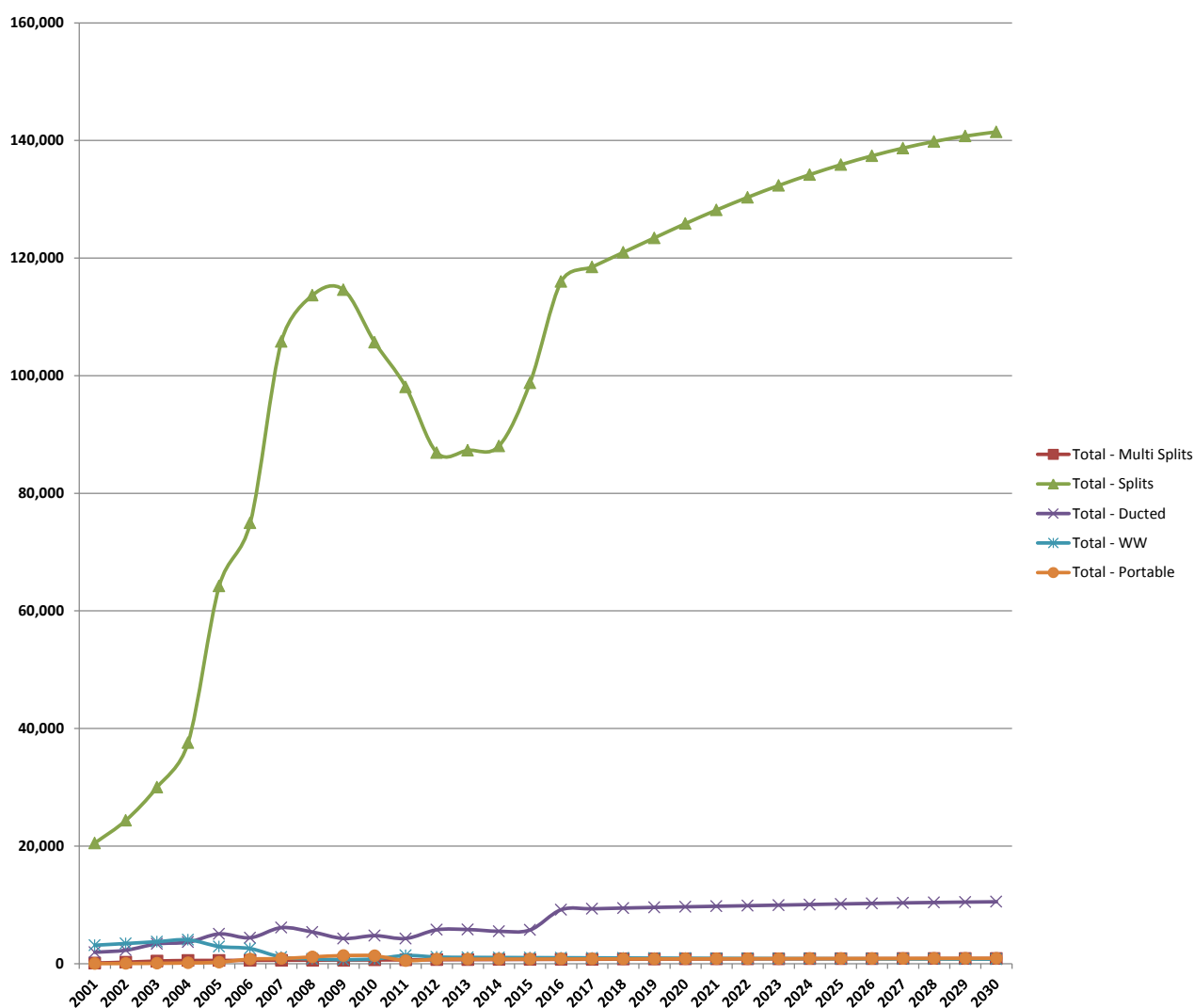
Figure 15 shows the resulting historical and forecast sales of air conditioners to 2030 in Australia by aggregated category. Figure 16 shows the resulting historical and forecast sales of air conditioners to 2030 in New Zealand by aggregated category.

Figure 15 Forecast annual sales by category: Australia



Notes: WW – window/wall.

Figure 16 Forecast annual sales by category: New Zealand



Sales projections by state/territory and for New Zealand for the period 2015 to 2030 are shown in Table 25.

Table 25 Annual sales projections 2015 - 2030, by state/region

Year	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	AU Total	NZ
2015	11,794	235,338	19,318	259,057	66,568	13,657	191,247	144,661	941,639	107,187
2016	12,014	239,733	19,781	264,971	66,795	14,004	190,439	141,835	949,573	127,874
2017	12,032	240,084	20,123	268,959	65,993	14,068	185,593	136,329	943,180	130,519
2018	12,461	248,647	20,768	277,962	67,156	14,719	188,287	135,396	965,396	133,133
2019	12,956	258,520	21,471	288,509	68,563	15,493	191,875	134,741	992,128	135,709
2020	13,384	267,073	22,122	298,634	69,587	16,192	193,938	132,947	1,013,876	138,244
2021	13,516	269,697	22,431	302,990	70,107	16,402	195,507	133,778	1,024,427	140,647

Year	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	AU Total	NZ
2022	13,675	272,872	22,761	307,279	70,792	16,629	197,682	135,104	1,036,794	142,907
2023	13,614	271,658	22,939	308,693	70,434	16,525	195,805	134,004	1,033,672	145,017
2024	13,819	275,747	23,305	312,635	71,410	16,767	199,040	136,254	1,048,977	146,969
2025	13,992	279,210	23,650	315,777	72,266	16,940	201,785	138,330	1,061,949	148,756
2026	13,976	278,886	23,840	315,076	72,299	16,783	201,365	138,804	1,061,030	150,354
2027	13,947	278,297	24,003	315,286	72,179	16,663	200,411	138,608	1,059,393	151,756
2028	13,959	278,547	24,173	315,810	72,259	16,605	200,272	138,903	1,060,529	152,954
2029	13,877	276,902	24,256	315,827	71,821	16,449	198,182	137,761	1,055,075	153,941
2030	14,027	279,904	24,477	318,260	72,516	16,622	200,511	139,381	1,065,698	154,713

The sales projections differ by state/territory. Sales data from GfK has been included up to 2016, which impacts on the projected forecast growth rates. The projected sales are adjusted to ensure that there are sufficient units to replace retiring stock, and in some earlier years for certain categories there were large increase in sales, which impacts on sales some 12 years out. The sales projections by state also depend on the composition of different categories of air conditioners—for example there is a shift occurring from 6–10 kW units (generally declining sales) to small non-ducted units (0–4 kW). The sales of multi-splits will also generally decrease the need to install more individual units, which has an impact on the sales projections.

Stock trends

The estimated stock for Australia and New Zealand by category over the period 2000 to 2030 is shown in Figures 17 and 18.

Figure 17 Forecast stock by category – Australia

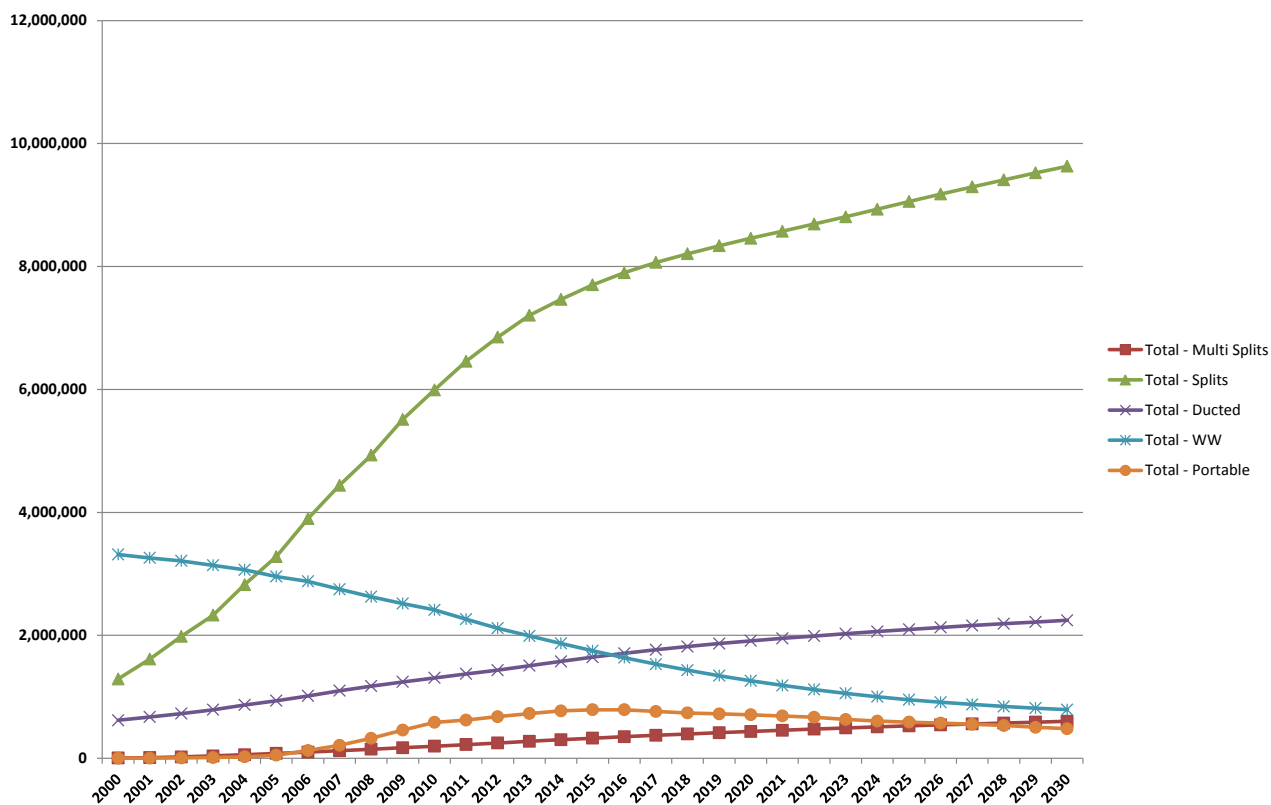
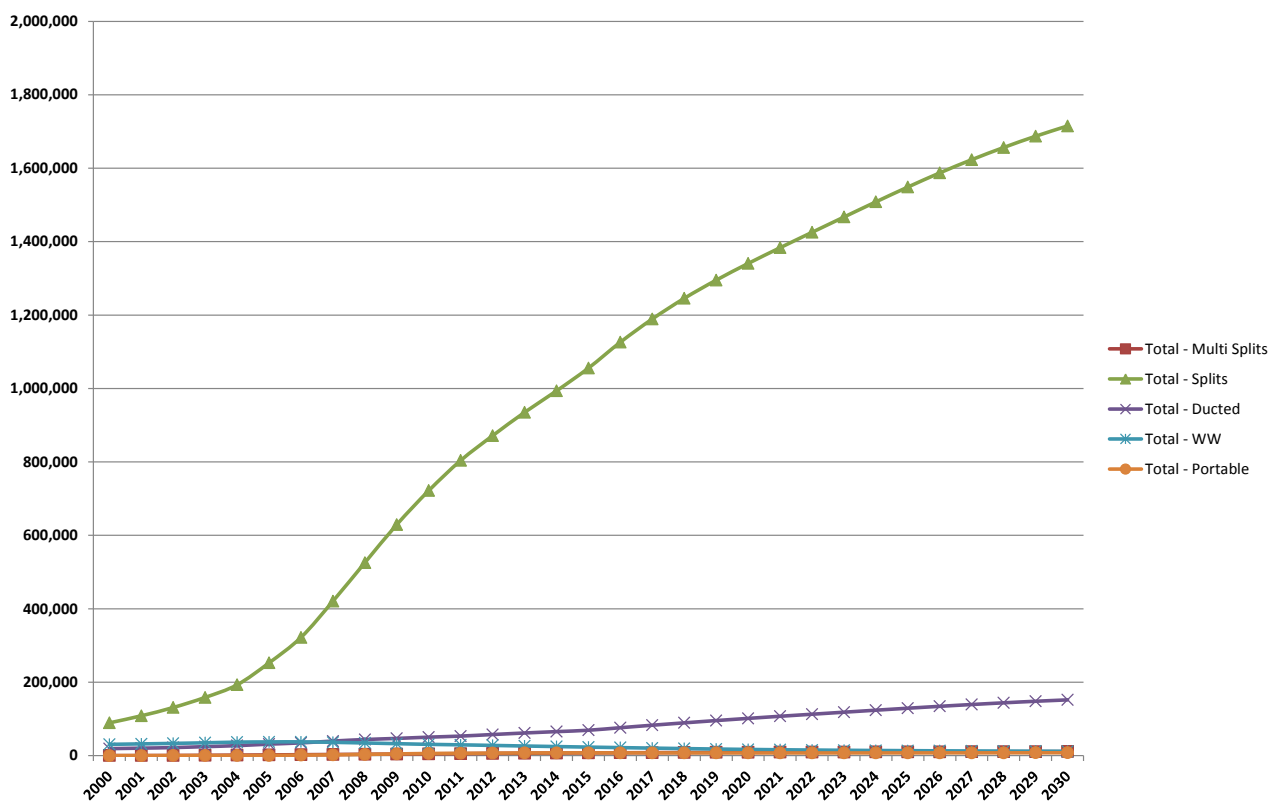


Figure 18 Forecast stock by category – New Zealand



The projections of air conditioner stock from 2015 to 2030 by state/territory and for Australia and New Zealand are shown in Tables 26 and 27.

Table 26 Stock 2015-2030, by state/territory

Year	ACT	NSW	NT	QLD	SA	TAS	VIC	WA
2015	160,379	3,200,260	232,276	3,409,674	966,013	168,329	2,385,588	1,689,570
2016	161,765	3,227,921	238,378	3,456,491	966,257	171,718	2,427,044	1,733,907
2017	162,526	3,243,121	243,827	3,492,874	962,633	174,186	2,452,838	1,765,373
2018	163,218	3,256,912	248,922	3,525,564	957,827	176,501	2,472,182	1,789,187
2019	164,185	3,276,211	253,955	3,561,636	953,490	179,146	2,489,177	1,807,196
2020	165,376	3,299,985	258,841	3,600,662	949,277	182,027	2,501,715	1,817,536
2021	166,557	3,323,552	263,302	3,637,975	944,930	184,753	2,510,039	1,822,983
2022	167,963	3,351,613	267,654	3,678,118	941,823	187,622	2,518,091	1,825,849
2023	169,391	3,380,091	271,786	3,718,641	939,019	190,351	2,522,377	1,824,189
2024	171,151	3,415,210	276,044	3,763,704	938,247	193,352	2,529,599	1,822,718
2025	173,188	3,455,861	280,470	3,812,652	939,515	196,527	2,540,020	1,822,375
2026	175,258	3,497,171	284,929	3,861,212	941,981	199,509	2,550,959	1,822,574
2027	177,259	3,537,098	289,270	3,908,173	944,989	202,235	2,561,114	1,822,482
2028	179,185	3,575,535	293,493	3,953,166	948,542	204,732	2,571,423	1,823,136
2029	180,925	3,610,257	297,504	3,995,278	952,074	206,866	2,580,126	1,823,676
2030	182,676	3,645,193	301,409	4,036,136	956,519	208,926	2,591,407	1,826,980

Table 27 Stock 2015-2030, Australia and New Zealand

Year	AU Total	NZ
2015	12,212,087	1,164,258
2016	12,383,480	1,240,869
2017	12,497,379	1,309,797
2018	12,590,312	1,371,456
2019	12,684,996	1,426,354
2020	12,775,419	1,476,922
2021	12,854,091	1,524,992
2022	12,938,734	1,572,062
2023	13,015,845	1,618,877
2024	13,110,024	1,665,480
2025	13,220,608	1,710,977
2026	13,333,592	1,754,629
2027	13,442,620	1,795,453
2028	13,549,212	1,833,190
2029	13,646,705	1,868,123
2030	13,749,247	1,899,868

Cost benefit estimates and energy/emission impacts

The summary impacts of the proposals are shown in Tables 28 and 29 below in terms of costs, benefits, energy savings and emission reductions.

Impacts – Australia and New Zealand

Table 28 Australia - summary of cost benefit estimates and energy/emission impacts

Option	Energy Saved (cumulative to 2030 - GWh)	GHG Emission Reduction (cumulative to 2030) Mt	Total Benefit (A\$M)	Total Cost (A\$M)	Net Benefit (A\$M)	BCR
Option A	2,329	1.8	\$651	\$153	\$498	4.2
Option B	2,432	1.8	\$673	\$159	\$515	4.2
Option C	2,554	1.9	\$705	\$163	\$543	4.3

Note: This table uses a discount rate of 7%

Table 29 New Zealand - summary of cost benefit estimates and energy/emission impacts

Option	Energy Saved (cumulative to 2030- GWh)	GHG Emission Reduction (cumulative to 2030) kt	Total Benefit (NZ\$M)	Total Cost (NZ\$M)	Net Benefit (NZ\$M)	BCR
Option A	455	44.0	\$42	\$15	\$27	2.8
Option B	456	44.2	\$42	\$15	\$27	2.8
Option C	457	44.3	\$42	\$15	\$27	2.8

Note: This table uses a discount rate of 6%

Impacts by state/territory

The impacts of the proposals are shown in Tables 30, 31 and 32 by state/territory.

Table 30 Option A – cost benefit estimates and energy/emission impacts by state/region

Impact	ACT	NSW	NT	Qld	SA	TAS	Vic	WA	Australia (total)	New Zealand
Total Benefit (\$m)	10.2	188.3	20.5	165.7	44.8	14.0	95.4	112.2	651.1	42.2 (NZ\$)
Total Cost (\$m)	2.4	43.9	2.6	39.4	10.5	2.7	32.3	19.7	153.4	15.3 (NZ\$)
Benefit Cost Ratio	4.3	4.3	7.9	4.2	4.3	5.2	3.0	5.7	4.2	2.8
Energy Saved (GWh cumulative)	39.5	723.0	60.6	633.1	151.6	49.6	356.7	314.7	2,329	455
Greenhouse gas emission	31.2	569.3	52.5	553.3	32.5	0.2	301.1	214.8	1,755	44

Impact	ACT	NSW	NT	Qld	SA	TAS	Vic	WA	Australia (total)	New Zealand
reduction (kt CO2-e cumulative)										

Note: This table uses discount rates of 7% for Australia and 6% for New Zealand

Table 31 Option B – cost benefit estimates and energy/emission impacts by state/region

Impact	ACT	NSW	NT	Qld	SA	TAS	Vic	WA	Australia (total)	New Zealand
Total Benefit (\$m)	10.3	194.0	21.1	170.2	46.7	14.4	99.7	117.0	673.4	42.3 (NZ\$)
Total Cost (\$m)	2.5	45.4	2.6	40.3	10.8	2.8	33.7	20.6	158.8	15.3 (NZ\$)
Benefit Cost Ratio	4.2	4.3	8.0	4.2	4.3	5.1	3.0	5.7	4.2	2.8
Energy Saved (GWh cumulative)	40.6	751.5	63.5	654.2	158.5	51.6	376.5	335.6	2,432	456
Greenhouse gas emission reduction (kt CO2-e cumulative)	32.0	592.0	55.0	571.8	33.9	0.2	318.0	229.1	1,832	44

Note: This table uses discount rates of 7% for Australia and 6% for New Zealand

Table 32 Option C – cost benefit estimates and energy/emission impacts by state/region

Impact	ACT	NSW	NT	Qld	SA	TAS	Vic	WA	Australia (total)	New Zealand
Total Benefit (\$m)	11.1	205.9	21.7	175.6	48.7	14.5	104.2	123.5	705.1	42.4 (NZ\$)
Total Cost (\$m)	2.5	46.9	2.7	40.9	11.1	2.8	34.4	21.2	162.5	15.3 (NZ\$)
Benefit Cost Ratio	4.4	4.4	8.1	4.3	4.4	5.1	3.0	5.8	4.3	2.8
Energy Saved (GWh cumulative)	43.0	799.5	64.8	679.7	167.4	52.0	395.2	352.5	2,554	457
Greenhouse gas emission reduction (kt CO2-e cumulative)	33.9	629.8	56.2	594.1	35.9	0.2	333.8	240.7	1,924	44

Note: This table uses discount rates of 7% for Australia and 6% for New Zealand

Impacts by policy proposal

The impacts by policy proposal are shown in Tables 33 and 34.

Table 33 Australia - cost benefit estimates and energy/emission impacts by proposal

Option	Energy Saved (cumulative to 2030 - GWh)	GHG Emission Reduction (cumulative to 2030) kt	Total Benefit (A\$M)	Total Cost (A\$M)	Net Benefit (A\$M)	BCR
Energy efficiency information (Zoned Label)	1,271	962	351	101	250	3.5
Energy efficiency information (SEER mandatory disclosure)	856	641	254	42	212	6.0
Portable air conditioners (Zoned Label plus lower MEPS for double ducts)	143	107	31	6	25	5.1
Commercial/industrial air conditioners (NCC MEPS levels)	111	83	15	2	14	9.3
Total (Option A)	2329	1755	651	151	500	4.3
MEPS for single duct portables only	103	77	22	5	17	4.2
Total (Option B)	2432	1832	673	157	517	4.3
MEPS for commercial/industrial air conditioners (2.90 MEPS level only)	122	96	33	4	29	8.8
Total (Option C)	2554	1928	706	160	546	4.4

Note: In this table the costs do not include the costs of business compliance or government administration. This means that compared with the summary tables, the total costs are slightly lower and the NPVs and BCRs are slightly higher.

Table 34 New Zealand - cost benefit estimates and energy/emission impacts by proposal

Option	Energy Saved (cumulative to 2030- GWh)	GHG Emission Reduction (cumulative to 2030) kt	Benefit (NZ\$M)	Cost (NZ\$M)	Net Benefit (NZ\$M)	BCR
Energy efficiency information (Zoned Label)	392	38	35	13	22	2.8
Energy efficiency information (SEER mandatory disclosure)	54	5	5	2	4	3.3
Portable air conditioners (Zoned Label plus lower	2	0.2	0.1	0.0	0.1	2.8

Option	Energy Saved (cumulative to 2030- GWh)	GHG Emission Reduction (cumulative to 2030) kt	Benefit (NZ\$M)	Cost (NZ\$M)	Net Benefit (NZ\$M)	BCR
MEPS for double ducts)						
Commercial/industrial air conditioners (Australian NCC MEPS levels)	1	0.1	0.1	0.0	0.0	3.3
Align Australia/New Zealand cooling MEPS	6	1	0.4	0.2	0.2	2.2
Total (Option A)	455	43	41	15	26	2.8
MEPS for single duct portables only	1	0.1	0.1	0.0	0.1	2.4
Total (Option B)	456	44	41	15	26	2.8
MEPS for commercial/industrial air conditioners (2.90 MEPS level only)	1	0.1	0.1	0.0	0.1	3.2
Total (Option C)	457	44	41	15	27	2.8

Note: In this table the costs do not include the costs of business compliance or government administration. This means that compared with the summary tables, the total costs are slightly lower and the NPVs and BCRs are slightly higher.

Costs and benefits by policy proposal by year

The costs and benefits by policy proposal by year are shown for Australia in Tables 35 and 36.

Table 35 Australia – benefits by policy proposal by year (A\$ million – no discount rate)

Year	Zoned Label (Energy efficiency information – Option A)	SEER mandatory disclosure (Energy efficiency information – Option A)	Portable air conditioners (Option A)	Air conditioners >65 kW (Option A)	Portable air conditioners (Option B)	Air conditioners >65 kW (Option C)
2019	0.55	0.27	0.73	0.00	1.26	0.00
2020	1.97	1.06	1.46	0.00	2.50	0.00
2021	4.87	2.67	2.16	0.23	3.72	0.71
2022	9.74	5.44	2.86	0.47	4.91	1.47
2023	17.05	9.70	3.40	0.73	5.85	2.29
2024	24.76	14.34	3.98	1.00	6.84	3.16
2025	32.97	19.47	4.58	1.30	7.87	4.09
2026	41.38	24.98	5.09	1.61	8.76	5.07
2027	49.90	30.84	5.38	1.93	9.26	6.08
2028	58.29	36.91	5.53	2.26	9.51	7.09
2029	66.47	43.10	5.45	2.57	9.37	8.09

Year	Zoned Label (Energy efficiency information – Option A)	SEER mandatory disclosure (Energy efficiency information – Option A)	Portable air conditioners (Option A)	Air conditioners >65 kW (Option A)	Portable air conditioners (Option B)	Air conditioners >65 kW (Option C)
2030	74.77	49.81	5.38	2.91	9.26	9.16

Note: this table does not include the energy savings benefits for products installed up to 2030 that accrue beyond 2030.

Table 36 Australia – costs by policy proposal by year (A\$m – no discount rate)

Year	Zoned Label (Energy efficiency information – Option A)	SEER mandatory disclosure (Energy efficiency information – Option A)	Portable air conditioners (Option A)	Air conditioners >65 kW (Option A)	Portable air conditioners (Option B)	Air conditioners >65 kW (Option C)
2019	44.95	19.03	2.99	0.00	5.61	0.00
2020	31.03	12.88	2.04	0.00	3.83	0.00
2021	21.32	8.71	1.23	0.43	2.31	1.42
2022	14.57	5.90	0.78	0.39	1.47	1.29
2023	9.90	3.99	0.39	0.36	0.74	1.17
2024	6.70	2.70	0.29	0.33	0.54	1.07
2025	4.50	1.83	0.21	0.30	0.40	0.97
2026	2.98	1.24	0.15	0.27	0.27	0.88
2027	1.99	0.84	0.09	0.25	0.17	0.80
2028	1.33	0.57	0.06	0.22	0.11	0.73
2029	0.90	0.38	0.03	0.20	0.05	0.66
2030	0.61	0.26	0.02	0.18	0.04	0.60

Sensitivity test – discount rates

The impact on the cost benefit estimates of varying the discount rate are shown in Tables 37 and 38.

Table 37 Australia - discount rates (A\$m)

Summary Australia	NPV Nil (0%)	NPV Low (3%)	NPV Med (7%)	NPV High (11%)
Option A				
Total Costs	\$214	\$184	\$153	\$129
Total Benefits	\$1928	\$1179	\$651	\$382
Net Benefits	\$1714	\$994	\$498	\$253
Benefit Cost Ratio	9.0	6.4	4.2	3.0
Option B				
Total Costs	\$221	\$191	\$159	\$134
Total Benefits	\$1978	\$1213	\$673	\$397

Summary Australia	NPV Nil (0%)	NPV Low (3%)	NPV Med (7%)	NPV High (11%)
Net Benefits	\$1757	\$1023	\$515	\$264
Benefit Cost Ratio	8.9	6.4	4.2	3.0
Option C				
Total Costs	\$228	\$196	\$163	\$137
Total Benefits	\$2075	\$1272	\$705	\$416
Net Benefits	\$1848	\$1076	\$543	\$279
Benefit Cost Ratio	9.1	6.5	4.3	3.0

Table 38 New Zealand - discount rates (NZ\$m)

Summary New Zealand	NPV Nil (0%)	NPV Low (3%)	NPV Med (5%)	NPV High (8%)
Option A				
Total Costs	\$20	\$18	\$15	\$14
Total Benefits	\$105	\$65	\$42	\$32
Net Benefits	\$84	\$48	\$27	\$18
Benefit Cost Ratio	5.1	3.7	2.8	2.3
Option B				
Total Costs	\$20	\$18	\$15	\$14
Total Benefits	\$105	\$65	\$42	\$32
Net Benefits	\$84	\$48	\$27	\$18
Benefit Cost Ratio	5.1	3.7	2.8	2.3
Option C				
Total Costs	\$21	\$18	\$15	\$14
Total Benefits	\$105	\$65	\$42	\$32
Net Benefits	\$85	\$48	\$27	\$18
Benefit Cost Ratio	5.1	3.7	2.8	2.3

Sensitivity test – costs

The impact on the cost benefit estimates of varying the direct incremental costs of each option were tested. These costs are the incremental product costs required to meet the efficiency improvements associated with the policy proposals. This is shown in Tables 39, 40, 41 and 42 below.

Table 39 Australia – 50 per cent increase in incremental costs

Option	Energy Saved (cumulative GWh to 2030)	GHG Emission Reduction (cumulative) Mt	Total Benefit (A\$m)	Total Cost (A\$m)	Net Benefit (A\$m)	BCR
A	2,329	1.8	\$651	\$229	\$422	2.8
B	2,432	1.8	\$673	\$237	\$436	2.8
C	2,554	1.9	\$705	\$243	\$462	2.9

Note: This table uses a discount rate of 7%

Table 40 New Zealand – 50 per cent increase in incremental costs

Option	Energy Saved (cumulative GWh to 2030)	GHG Emission Reduction (cumulative) kt	Total Benefit (NZ\$M)	Total Cost (NZ\$M)	Net Benefit (NZ\$M)	BCR
A	455	44.0	\$42	\$23	\$20	1.9
B	456	44.2	\$42	\$23	\$20	1.9
C	457	44.3	\$42	\$23	\$20	1.9

Note: This table uses a discount rate of 6%

Table 41 Australia – 50 per cent decrease in incremental costs

Option	Energy Saved (cumulative GWh to 2030)	GHG Emission Reduction (cumulative) Mt	Total Benefit (A\$M)	Total Cost (A\$M)	Net Benefit (A\$M)	BCR
A	2,329	1.8	\$651	\$78	\$573	8.4
B	2,432	1.8	\$673	\$80	\$593	8.4
C	2,554	1.9	\$705	\$82	\$623	8.6

Note: This table uses a discount rate of 7%

Table 42 New Zealand – 50 per cent decrease in incremental costs

Option	Energy Saved (cumulative GWh to 2030)	GHG Emission Reduction (cumulative) kt	Total Benefit (NZ\$M)	Total Cost (NZ\$M)	Net Benefit (NZ\$M)	BCR
A	455	44.0	\$42	\$8	\$34	5.3
B	456	44.2	\$42	\$8	\$34	5.3
C	457	44.3	\$42	\$8	\$34	5.3

Note: This table uses a discount rate of 6%

The impact on the cost benefit estimates from lowering the learning rates (the rate at which costs reduce) was also tested.

Table 43 Australia – 50 per cent reduction in learning rate

Option	Energy Saved (cumulative GWh to 2030)	GHG Emission Reduction (cumulative) Mt	Total Benefit (A\$M)	Total Cost (A\$M)	Net Benefit (A\$M)	BCR
A	2,329	1.8	\$651	\$250	\$401	2.6
B	2,432	1.8	\$673	\$258	\$415	2.6
C	2,554	1.9	\$705	\$262	\$443	2.7

Note: This table uses a discount rate of 7%

Table 44 New Zealand – 50 per cent reduction in learning rate

Option	Energy Saved (cumulative GWh to 2030)	GHG Emission Reduction (cumulative) kt	Total Benefit (NZ\$M)	Total Cost (NZ\$M)	Net Benefit (NZ\$M)	BCR
A	455	44.0	\$42	\$23	\$20	1.9

Option	Energy Saved (cumulative GWh to 2030)	GHG Emission Reduction (cumulative) kt	Total Benefit (NZ\$M)	Total Cost (NZ\$M)	Net Benefit (NZ\$M)	BCR
B	456	44.2	\$42	\$23	\$20	1.9
C	457	44.3	\$42	\$23	\$20	1.9

Note: This table uses a discount rate of 6%

Table 45 Australia – no learning rate

Option	Energy Saved (cumulative GWh to 2030)	GHG Emission Reduction (cumulative) Mt	Total Benefit (NZ\$M)	Total Cost (NZ\$M)	Net Benefit (NZ\$M)	BCR
A	2,329	1.8	\$651	\$494	\$157	1.3
B	2,432	1.8	\$673	\$509	\$165	1.3
C	2,554	1.9	\$705	\$514	\$191	1.4

Note: This table uses a discount rate of 7%

Table 46 New Zealand – no learning rate

Option	Energy Saved (cumulative GWh to 2030)	GHG Emission Reduction (cumulative) kt	Total Benefit (NZ\$M)	Total Cost (NZ\$M)	Net Benefit (NZ\$M)	BCR
A	455	44.0	\$42	\$51	-\$8	0.8
B	456	44.2	\$42	\$51	-\$9	0.8
C	457	44.3	\$42	\$51	-\$8	0.8

Note: This table uses a discount rate of 6%

Greenhouse gas emissions

The impact on the cost benefit estimates of monetising the benefit from reduced greenhouse gas emissions for Australia is shown in Tables 47 and 48 (New Zealand's cost benefit estimates include a NZ\$25/tonne carbon price).

Table 47 Australia - \$11.82/tonne

Option	Energy Saved (cumulative GWh to 2030)	GHG Emission Reduction (cumulative) Mt	Total Benefit (A\$M)	Total Cost (A\$M)	Net Benefit (A\$M)	BCR
A	2,329	1.8	\$666	\$153	\$512	4.3
B	2,432	1.8	\$688	\$159	\$529	4.3
C	2,554	1.9	\$721	\$163	\$558	4.4

Note: This table uses a discount rate of 7%. \$11.82 was the market price in the April 2017 emissions reduction fund auction.

Table 48 Australia - \$35/tonne

Option	Energy Saved (cumulative GWh to 2030)	GHG Emission Reduction (cumulative) kt	Total Benefit (A\$M)	Total Cost (A\$M)	Net Benefit (A\$M)	BCR
A	2,329	1.8	\$694	\$153	\$540	4.5
B	2,432	1.8	\$717	\$159	\$559	4.5
C	2,554	1.9	\$751	\$163	\$589	4.6

Note: This table uses a discount rate of 7%. \$A35 has been used by the US EPA in assessing the costs and benefits of new policies.

Electricity prices

Table 49 shows the electricity prices used in the model.

Table 49 Residential electricity prices (real 2015-16 cents/kWh)

Year	NSW	ACT	NT	QLD	SA	TAS	VIC	WA	NZ (NZ\$)
2015	28.02	18.78	25.60	31.53	38.62	29.3	28.77	24.60	8.79
2016	26.20	17.56	25.57	31.44	35.1	29.33	29.78	25.86	8.79
2017	25.77	17.27	25.54	30.2	36.6	31.2	29.59	26.86	8.79
2018	25.54	17.11	26.43	30.15	37.05	30.93	29.26	27.81	8.79
2019	25.40	17.01	27.09	29.25	37.55	30.08	28.71	28.5	8.79
2020	25.29	16.94	27.77	28.5	36.87	28.18	27.70	29.21	8.79
2021	26.19	17.55	28.47	29.38	36.36	28.74	28.40	29.94	8.79
2022	27.04	18.12	29.18	30.08	37.19	29.50	29.04	30.69	8.79
2023	27.92	18.71	29.91	30.64	38.10	30.42	29.92	31.46	8.79
2024	28.76	19.27	30.66	30.91	39.04	31.42	30.85	32.25	8.79
2025	29.66	19.88	31.42	31.24	40.18	32.81	32.08	33.05	8.79
2026	30.38	20.35	32.21	31.70	41.32	34.04	33.11	33.88	8.79
2027	31.17	20.89	33.01	32.24	41.89	34.3	33.45	34.72	8.79
2028	31.78	21.29	33.84	32.66	42.03	34.04	33.57	35.59	8.79
2029	31.97	21.42	34.68	32.87	42.28	33.92	33.98	36.48	8.79
2030	32.33	21.66	35.55	33.05	42.94	34.23	34.73	37.39	8.79

Greenhouse gas emissions factors

Table 50 shows the emissions factors used in the model⁷².

Table 50 Emission factors for electricity (kg CO₂-e/kWh) - Australia and New Zealand

Year	NSW	ACT	NT	QLD	SA	TAS	VIC	WA	NZ
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⁷² Scope 3, full fuel cycle emissions factors, which are applied to calculate the emissions from electricity purchased by end users. Based on National Greenhouse Account Factors, August 2016 [Department of the Environment and Energy](#)

Year	NSW	ACT	NT	QLD	SA	TAS	VIC	WA	NZ
2015	0.96	0.96	0.77	0.94	0.64	0.13	1.19	0.79	0.1299
2016	0.902	0.902	0.901	0.918	0.619	0.038	1.116	0.769	0.1405
2017	0.921	0.921	0.791	0.947	0.347	0.01	1.077	0.748	0.1428
2018	0.894	0.894	0.888	0.941	0.304	0.004	0.976	0.751	0.1501
2019	0.856	0.856	0.959	0.919	0.228	0.003	0.94	0.741	0.1509
2020	0.841	0.841	0.929	0.901	0.195	0.003	0.896	0.706	0.1343
2021	0.84	0.84	0.905	0.899	0.196	0.003	0.886	0.698	0.1347
2022	0.831	0.831	0.888	0.892	0.192	0.003	0.88	0.694	0.1289
2023	0.812	0.812	0.883	0.89	0.208	0.003	0.877	0.691	0.1045
2024	0.796	0.796	0.878	0.885	0.206	0.003	0.867	0.689	0.0997
2025	0.792	0.792	0.874	0.885	0.204	0.003	0.859	0.688	0.1003
2026	0.791	0.791	0.87	0.879	0.203	0.003	0.849	0.686	0.0963
2027	0.785	0.785	0.867	0.877	0.206	0.003	0.84	0.684	0.0929
2028	0.781	0.781	0.862	0.869	0.214	0.003	0.832	0.682	0.0918
2029	0.777	0.777	0.858	0.867	0.226	0.003	0.829	0.677	0.0924
2030	0.776	0.776	0.851	0.859	0.231	0.003	0.827	0.672	0.0912

References - modelling

Consultation Regulation Impact Statement: Air Conditioners and Chillers, February 2016.

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Evaluation of Energy Efficiency Policy Measures for Household Air Conditioners in Australia, EnergyConsult, Prepared for the Department of Climate Change and Energy Efficiency, November 2010.

Decision Regulatory Impact Statement: Minimum Energy Performance Standards for Air Conditioners: 2011, prepared by EnergyConsult for the Equipment Energy Efficiency Committee under the auspices of the Ministerial Council on Energy, Canberra, Australia, December 2010.

Decision Regulatory Impact Statement: Minimum Energy Performance Standards and Alternative Strategies for Chillers, prepared by EnergyConsult for the Equipment Energy Efficiency Committee under the auspices of the Ministerial Council on Energy, Canberra, Australia, July 2008.

Regulatory Burden Measure - updated cost estimates

The regulatory costs associated with the policy options were estimated for Australia using the Australian Government's Regulatory Burden Measurement Framework (RBM). Regulatory costs counted under the RBM include the administrative costs incurred complying with the regulations, along with any increase in the purchase price of air conditioners due to design changes that are made to meet MEPS or other regulatory requirements.

The differences from the costs presented in the cost benefit estimates are that the RBM costs are nominal (not discounted) and cover the ten year period from 2019 to 2028 (not 2030). As the E3 program operates under the COAG, the RBM costs have also been reduced to the Commonwealth's 43 per cent share of the E3 program's funding agreement. The RBM is not required for New Zealand, however similar regulatory costs would be incurred by businesses, consumers and government in both countries.

Business As Usual

Under BAU, there were estimated to be 45 suppliers (registrants) of 1356 air conditioner models that directly incur administrative costs in complying with the regulations⁷³. This includes the compliance costs for the 530 models for which the label is mandatory (incurred by 38 of the 45 suppliers).

There were estimated to be another group of 350 downstream suppliers/retailers that incur compliance costs in the supply of air conditioners. This estimate includes retail groups/chains, online suppliers and other specialist stores/store chains that have a showroom (and hence have obligations to display the label). Installers and many other specialist stores that supply products downstream (that are advertised through brochures and online) are not included in this count, as it is assumed they source products from upstream suppliers that ensure products comply with the regulations.

The compliance costs for these businesses (both registrants and downstream suppliers) were estimated by multiplying labour costs (wage costs plus on costs) by the time spent performing a particular task. For example, for one administrative officer to complete an online registration form that takes two hours to complete, the cost is estimated as $1 \times \$69 \times 2 = \138 . The assumed labour costs (including on costs) is \$68.79.

Administrative compliance costs (per year) associated with the regulations include:

- reviewing/understanding legislative requirements
- time spent registering a product (not including the registration fee)
- internal compliance assurance

⁷³ Energy Rating database at 1 June 2015.

- data collection for reporting
- record keeping
- testing
- labelling.

Table 51 shows the additional regulatory costs for Option A, compared with BAU.

Table 51 Option A regulatory costs

Change in costs	Business	Community organisations	Individuals	Total change in costs
Total, by sector	\$2.0m	\$0	\$6.9m	\$8.9m
Cost offset	Business	Community organisations	Individuals	Total, by source
Total, by sector	\$0	\$0	\$0	To be confirmed
Are all new costs offset? A regulatory offset has not been identified. However, the Department of the Environment and Energy is seeking to pursue net reductions in compliance costs and will work with stakeholders and across Government to identify regulatory burden reductions where appropriate.				
Total (Change in costs – Cost offset) (\$million) = To be confirmed				

The average annual regulatory costs were calculated by estimating the total undiscounted (nominal) cost for each policy option over the ten year period from 2019 to 2028, and dividing this by ten. The costs shown are based on the Commonwealth's portion of the E3 program funding agreement, which is 43 per cent.

The additional regulatory costs for Option A are estimated at around \$8.9 million per year. Under this option, an additional 23 registered suppliers and 103 models of portable air conditioners are assumed to be in scope and therefore incur compliance costs. An additional 50 downstream suppliers (i.e. retailers that sell portable air conditioners only) are assumed to be in scope under this option.

The factors that account for the increased regulatory costs under Option A include:

- costs associated with moving from the current label to the SEER rating/Zoned Label, such as costs to test products and purchase new standards (the cost increase has been limited by allowing less expensive test methods for some product types) and the associated increase in the price of products
- expanding the scope of energy labelling requirements to cover single duct portable air conditioners
- expanding the scope of the requirements by including MEPS requirements for air conditioners greater than 65 kW.

Other factors that are assumed to offset these increased regulatory costs include removing:

- the need to purchase standards that contain the MEPS and energy labelling requirements
- the need to register VRF multi-split systems that are comprised of multiple outdoor units
- the maximum cooling test.

Option B

Table 52 shows the additional regulatory costs for Option B, compared with BAU.

Table 52 Option B regulatory costs

Change in costs	Business	Community organisations	Individuals	Total change in costs
Total, by sector	\$2.0m	\$0	\$7.5m	\$9.6m
Cost offset	Business	Community organisations	Individuals	Total, by source
Total, by sector	\$0	\$0	\$0	To be confirmed
Are all new costs offset? A regulatory offset has not been identified. However, the Department of the Environment and Energy is seeking to pursue net reductions in compliance costs and will work with stakeholders and across Government to identify regulatory burden reductions where appropriate.				
Total (Change in costs – Cost offset) (\$million) = To be confirmed				

The additional regulatory costs for Option B are estimated at around \$9.6 million per year. Compared with Option A, Option B has higher regulatory costs, largely as a result of the additional purchase costs (i.e. the higher upfront cost) for consumers arising from the new MEPS level for portable air conditioners. The increased purchase costs for portable air conditioners have been listed against individuals, as they will mainly be borne by households (an additional \$0.7 million per year compared with Option A).

Option C

Table 53 shows the additional regulatory costs for Option C, compared with BAU.

Table 53 Option C regulatory costs

Change in costs	Business	Community organisations	Individuals	Total change in costs
Total, by sector	\$2.4m	\$0	\$7.5m	\$9.9m
Cost offset	Business	Community organisations	Individuals	Total, by source
Total, by sector	\$0	\$0	\$0	To be confirmed
Are all new costs offset? A regulatory offset has not been identified. However, the Department of the Environment and Energy is seeking to pursue net reductions in compliance costs and will work with stakeholders and across Government to identify regulatory burden reductions where appropriate.				
Total (Change in costs – Cost offset) (\$million) = To be confirmed				

The additional regulatory costs for Option C are estimated at around \$9.9 million per year. Compared with Options A and B, Option C has higher regulatory costs, largely as a result of the additional purchase costs (i.e. the higher upfront cost) arising from the increased MEPS level for air conditioners greater than 65 kW capacity. The increased purchase costs for these large capacity air conditioners have been listed against businesses (an additional \$0.4 million per year compared with Option B).

Table 54 shows the additional regulatory costs for the policy options by year.

Table 54 Regulatory costs by year (A\$m)

Year	Option A	Option B	Option C
2019	\$28.0	\$30.4	\$30.4
2020	\$19.3	\$20.9	\$20.9
2021	\$13.7	\$14.7	\$15.4
2022	\$9.4	\$10.1	\$10.6
2023	\$6.4	\$6.7	\$7.2
2024	\$4.4	\$4.6	\$5.1
2025	\$3.0	\$3.2	\$3.6
2026	\$2.1	\$2.2	\$2.6
2027	\$1.5	\$1.5	\$1.9
2028	\$1.0	\$1.1	\$1.4
Total	\$88.9	\$95.5	\$99.1

Testing costs

The testing costs assumptions for the policy changes were:

- all products already undertake standard rating condition tests for cooling and heating (i.e. T1 and H1) for marketing products in brochures/online, not because of the energy efficiency regulations
- the additional tests required would be done immediately after standard tests, so the additional testing time does not include installation and setup time
- a 25 per cent reduction was applied to the time spent testing, to account for the time a technician spends performing other tasks while a product is in the laboratory
- for some products, part load and H2 tests are already performed for internal purposes and for SEER tests in other markets (assumptions were based on SEER testing undertaken by E3 in 2013 and estimates for some product categories). These proportions vary depending on the product—for example, window/wall models are assumed to have undertaken none of the additional SEER tests. However, for single phase non-ducted split systems, 90 per cent of products are assumed to have already undertaken the additional cooling and heating part load tests, and 88 per cent to have already undertaken the H2 test. H2 testing costs for 30 kW and above products have been removed from the costing, due to the revised proposal to only require SEER testing for the cooling cycle
- sound test costs were estimated based on the requirements of ISO standard 3741. For most products sound tests are already performed (as they already declared in brochures/online), so additional costs due to the new proposed test method are assumed to be two hours (except for portables, where sound is not usually declared and time costs were assumed to be four hours)
- removing the maximum cooling test is assumed to provide savings of four hours of testing time for products in scope.



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