E3 Prioritisation Plan
Stage 2 Report

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1. Introduction

The Equipment Energy Efficiency (E3) Program is a cross jurisdictional initiative for delivering a single, integrated approach to energy efficiency standards and energy labelling for household and business equipment and appliances in Australia and New Zealand. For Australia, the E3 Program operationalises the Inter-Governmental Agreement (IGA) for the Greenhouse and Energy Minimum Standards (GEMS) legislative scheme and the Greenhouse and Energy Minimum Standards Act 2012 (the GEMS Act). In New Zealand, the Energy Efficiency (Energy Using Products) Regulations 2002 perform a similar role and these are administered by the Energy Efficiency and Conservation Authority (EECA).

As noted in the '*Independent Review of the Greenhouse and Energy Minimum Standards (GEMS) Act*' published in 2019, GEMS regulations save the average Australian household between A$140 and A$220 on their electricity bill each year (about 10-15% of the average annual bill).

From 2015 to 2020, current GEMS regulations are estimated to deliver a net benefit of between $5.1 and $11 billion. In this same period, the program is projected to deliver between 27 and 44 million tonnes of greenhouse gas emissions savings.

Setting priorities for the E3 Program is critical in ensuring that opportunities to save energy, avoid greenhouse gas (GHG) emissions and lower energy costs for households and business are realised as soon as possible. Evidence-based prioritisation of opportunities provides a basis for planning for future regulatory work and allocation of resources.

In 2016, the E3 Prioritisation Plan identified six priority areas, with a further three added in 2017. As noted in Table 1, the majority of these projects have either been completed or are very close to being finalised, which makes the development of a new set of priorities both appropriate and timely.

Table 1: 2017-18 E3 Prioritisation Plan high priority products

High priority product category	Proposed actions	Status at October 2021
Air conditioners	New climate zoned labelling and enhanced MEPS	Included in GEMS determination published in 2019 (in force from April 2020).
Domestic refrigerators and freezers	Enhanced MEPS	Included in GEMS determination published in 2019 (in force from August 2021).
Hot water systems	Under investigation for future opportunities	In 2019, COAG agreed to the introduction of demand response capability requirements for a number of products1 including electric storage water heaters. NZ and NSW progressing work on a water heating strategy.
Industrial products	Under investigation for future opportunities	Technical Discussion Papers on pumps, boilers and compressors released for consultation in Nov 2020. Consultation RIS scheduled to be released in 2021-22. Electric motors issues paper released in Jan 2020, but further work halted in 2021, as not possible to implement via GEMS Act. NZ will go out for consultation. See Section 6 below.
Lighting	Phasing out mains voltage halogen lamps in AUS and introducing MEPS for LED lamps in line with European Union regulations	Ministerial approval achieved (expected in force by 2023).
Non-domestic fans	New regulations	Consultation RIS released May 2017. Work halted during development of Decision RIS, as not possible to implement via GEMS Act. See Section 6 below.
Refrigerated display and storage cabinets	Enhanced MEPS and new regulations	Included in GEMS determination published in 2020 (in force from May 2021)
Swimming pool pumps	New regulations in AUS	Regulations expected to be in force in late 2022.
Televisions	Under investigation for future opportunities including more stringent MEPS	Investigation and consultation underway. Consultation RIS scheduled to be released in 2021-22.

[1] This included residential air conditioners, electric storage water heaters, pool pump controllers, and electric vehicle chargers. DISER now advise that it is not possible to implement these requirements under the GEMS Act.

This Prioritisation Plan has been developed to identify how the E3 work program can accelerate policy development and focus on products that will deliver the most benefits including improved energy productivity, lowering greenhouse gas emissions, and reducing energy costs.

One key way to achieve these objectives is through a closer alignment with energy efficiency regulations amongst our major trading partners, in particular with the United States, Europe and South-East Asia. The E3 Program has been pursuing closer alignment for several years as a means to reduce the costs of doing business for product suppliers and to enhance compliance. Now that several major economies regulate a wider selection of products than Australia and New Zealand, in many cases it is possible to increase energy savings by aligning product scopes with these economies. Product suppliers have indicated a clear preference for aligning with standards published by international standards organisations and international regulatory levels, especially those operation in the European Union (EU). Not only does this reduce the time and cost of developing new policies, but it substantially reduces the risk that poorer performing products will be 'dumped' into the Australian and New Zealand markets.

The Prioritisation Plan will be regularly updated to reflect new and emerging products, changes in technologies, international regulatory developments and available resourcing levels. The Energy Efficiency Advisory Team (EEAT) Committee will review the prioritisation annually, in order to ensure the E3 Program continues to deliver the greatest potential benefits.

This report is structured to provide E3 with the information necessary to determine priority areas from 2022 to 2024.

Section 2 describes the methodology and outcomes of the preliminary assessment undertaken for stage 1 of this study that determined the shortlist of products carried forward into this stage of the work.

Section 3 explains assumptions regarding the development process for regulations and the treatment of projects carried forward from previous E3 priorities.

Section 4 describes the current status of the eight regulations that are due to 'sunset' over the period of this Prioritisation Plan.

Section 5 discusses the potential for new regulations for products in the commercial and industrial sectors.

Section 6 discusses the potential for new regulations for products in the residential sector.

Section 7 identifies the potential for new regulations for building products.

Section 8 and Attachment 3 discusses the potential for new regulations to promote fuel efficient tyres.

Section 9 describes two non-regulatory projects to facilitate further savings by requiring the use of the energy rating label in advertisements and online, and by a voluntary certifications scheme for electric fan units.

Section 10 presents the estimated impacts of all the potential new regulations in terms of the energy and greenhouse gas savings, impact on electricity demand and energy cost savings.

Section 11 describes the assumptions used to determine the resource requirements to develop these regulations and shows the results of these estimates.

Section 12 explains draft recommendations for consideration as future priorities for E3.

2. Preliminary Assessment

2.1 Methodology

In Stage 1 of this project an initial assessment was undertaken on the basis of product energy savings potential (annual savings achieved after a period of implementation e.g. by 2030). In general, products that demonstrated the highest energy savings potential were shortlisted for further assessment.

The shortlist was drawn from:

- a list of around 170 individual products that could be suitable for energy efficiency regulation
- products currently regulated in the United States (US) and Europe, and those under consideration (see Attachment 1)
- information on work previously undertaken and currently underway on individual products, to assess the potential for new regulations in Australia and New Zealand
- information on previous assessments and their progress.

Also considered are criteria that critically effect the speed and the resources required to deliver new policy measures, and the degree of certainty about savings forecasts. These are listed in Table 2 below.

Table 2: Key Implementation Criteria

Additional criteria	Relevance
Is the product currently regulated in Australia and New Zealand?	Not only will this mean that data on the performance of current models is available through registrations, but also that the industry is familiar with the regulatory processes.
Is the product currently regulated in another economy?	This may provide information on product performance where there are common products, and requirements in other jurisdictions will help set local thresholds.
Is a test method available to measure energy performance? If yes, is it local or international?	The existence of a robust test method for reference by E3 will save considerable time and resources, particularly when it is internationally recognised.
Are the majority of products imported?	The supply chain of products in our markets is a factor in knowing who the key stakeholders are likely to be and potential economic impacts.
Is there a significant local manufacturing/assembling base?	As above.
Is there an active industry association/body for most of the relevant industry?	The presence of one or more active associations will help in stakeholder consultation processes, particularly where it represents a substantial portion of the industry.
Is the market or product likely to change in a way that will alter the impact of policy measures?	Recent (or imminent) changes in product characteristics or the market may mean that regulations will be more or less effective.
What level of uncertainty is associated with the analysis conducted for each product?	Data availability and quality are key factors that determine confidence in projections.
How will prospective products work within the current regulatory frameworks, including registration requirements, for both Australia and New Zealand?	It is important to understand whether each potential product category pose any particular issues in terms of the registration of models.
Will the existing approach to market surveillance and check testing work effectively for the prospective products?	How easy or difficult will it be for compliance authorities to verify compliance for each potential product category.
Are there any other significant issues?	Any other factors that may influence implementation.

2.2 Shortlisted Products

The initial review revealed that the majority of the most significant opportunities have been identified previously, and many of these have already been subject to detailed investigation by E3 members. This provides significant confidence in the estimated savings potentials and issues relating to implementation.

Of the total 170 products considered, 23 are currently regulated in Australia and New Zealand. These include 10 products determinations that will sunset from 1 April 2023 to 1 April 2025. It is standard process for determinations to automatically repeal (sunset) after 10 years unless a review finds sufficient reason for the determination to continue. Steps then need to be taken to renew or upgrade determinations to prevent automatic sunsetting. Nine of these 10 'sunsetting' products are under review by E3 through a separate process, and the early findings of those reviews are reported in this Prioritisation Plan.

A total of 38 products have been shortlisted (see Table 3) as they were assessed to have good alignment with the E3 Program criteria: reduction of energy bills, improvement in energy efficiency and reduction of greenhouse gas emissions. Regulations for these products would also improve consumer confidence when making a product choice and encourage transitions towards better technologies.

With respect to the 'key implementation issues' outlined above, these 38 products also share a number of similar attributes, including:

- 26 are not currently regulated in Australia or New Zealand[2], but all are regulated elsewhere or have been included in major endorsement programs such as Energy Star for a period of time. As a result, existing test methods have been developed and used extensively
- significant quantities of products (likely all products in many cases) are imported. The primary exception is building products, a significant proportion of which are still manufactured in Australia and New Zealand
- products are currently available that meet and exceed the energy efficiency performance thresholds in jurisdictions that export products to Australia and New Zealand
- in almost all cases, there is one or more active organisation representing the local industry
- all product groups are relatively mature, with the possible exception of connected products (products with network standby), LED lights and battery chargers, which are all evolving rapidly.

[2] There are 10 products that are currently regulated, which are subject to 'sunsetting' review.

Table 3: Summary of products shortlisted in Stage 1

Category	Product
Sunsetting Products	Ballasts for fluorescent lamps
	Transformers and converters for ELV lamps
	Close control air conditioners
	Distribution transformers
	Set-top boxes
	Computers
	Computer monitors
	External power supplies
	Electric water heaters
	Commercial chillers
Commercial/Industrial	Pumps
	Air compressors
	Industrial boilers
	Fan units
	Electric motors (NZ)
	Cool rooms
	Commercial ice makers
	Commercial dishwashers
	Commercial deep fryers
	Commercial ovens
	Commercial hot food holding cabinets
	Office equipment: printers and MFDs
	Lighting equipment (products not yet regulated, including some residential products)
Residential	Residential ovens
	Residential cooktops
	Residential rangehoods
	Battery chargers
	Ceiling fans
	Water dispensers
	Vacuum cleaners
	Network standby
	Small network equipment
	Residential space heating
	Residential water heating (assessment tool)
Building Products	Bulk insulation
	Ductwork
	Glazing
Other	Motor vehicle tyres

In addition, two projects have been considered that will facilitate energy and greenhouse savings. These are:

- Display of energy rating information online and in print advertising
- Voluntary certification of electric fans

These are discussed in Section 11 of this document.

3. Context for the Prioritisation Plan

This Prioritisation Plan commences in 2022 and inherits a range of regulatory projects that are already underway and reflect previous E3 priorities.

Some of these projects have therefore already advanced and will require less resources to finalise, compared to new projects that are initiated in the period of this Prioritisation Plan. Importantly, those that have advanced will also tend to yield energy savings more quickly than those yet to begin.

The following section explains how the different stages of development have been treated in this report.

3.1 Regulatory development processes

The full regulatory development process comprises a number of steps, however for the purpose of this report these have been summarised as:

1. a preliminary investigation
2. publication of a discussion document (sometimes called a 'product profile')
3. publication of a consultation Regulatory Impact Statement (RIS): including preparation, publication and consultation
4. preparation of a decision RIS for consideration by Ministers
5. ministerial approval.

Experience suggests that the length of time it takes to complete these processes varies for each product, depending on the complexity of the product category, the scope of products, the complexity of regulating the product and the reaction from industry. For this exercise, we have used an average duration (from the time work commences to reaching Ministerial approval) of 30 months.

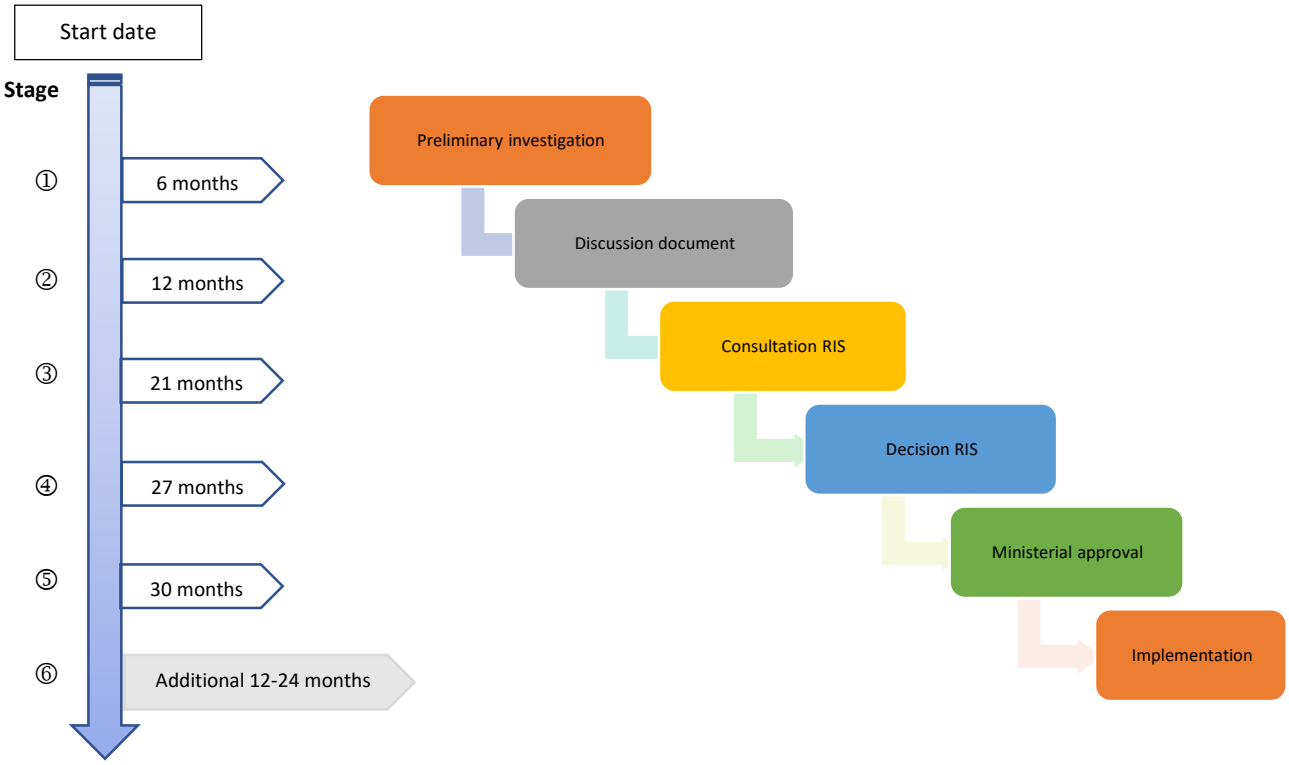
As the majority of products considered a priority by E3 are already regulated in other economies, we are generally seeking to leverage from existing internationally-accepted test methods and performance requirements. Therefore, many of our industry partners have the ability to supply products that meet these standards and see the benefits of closer alignment. This helps to speed up the policy development process.

For comparison, the development processes in the EU and United States of America (USA) are both approximately 36 months on average from initiation to publication. However, it should be noted that in both these cases, the products are often unregulated elsewhere and require a thorough examination of the technology and the development of a robust test procedure. For example, a detailed engineering analysis is often included in the US to identify all the component parts of a piece of equipment and their costs.

Since the task in Australia and New Zealand is to examine whether regulations used elsewhere can be adopted locally, the process is necessarily less onerous. For example, we are not attempting to prove that products are able to meet a specified performance level, since they are already available in other economies. Where E3 deems that an existing regulation should be upgraded (including regulations that would otherwise sunset), the availability of market intelligence from existing registrations and prior engagement with the industry may reduce the length of the preliminary stages and the length of time before a revised regulation can be implemented.

The following figure shows a simplified schematic of the major stages in the development of a new regulation by E3 and the estimated time taken for each stage. Once a new GEMS determination has been finalised, a period is allowed before the date of implementation to allow for industry to adjust, including the testing and registration of products. This final period is not included in the figure.

Figure 1: Regulatory development stages and timing



Based on these assumptions, Figure 2 shows the approximate development stage that each project has reached by late 2021.

Note that several of these projects are in the process of development, representing previous priorities by E3 jurisdictions. 5 ongoing projects are carried forward represent previous commitments made by E3; 2 projects are being taken forward by New Zealand; and 11 projects are being developed under the management of NSW. These are colour coded in Figure 2.

Figure 2: Regulatory projects development

Category	Product	Product Development Stage					
		1. Preliminary investigation	2. Discussion document	3. Consultation RIS	4. Decision RIS	5. Ministerial approval	6. Implementation
Sunsetting Products	Ballasts for fluorescent lamps						
	Transformers and converters for ELV lamps						
	Close control air conditioners						
	Distribution transformers						
	Set-top boxes						
	Computers						
	Computer monitors						
	External power supplies						
	Electric Water Heaters						
	Commercial chillers						
Commercial/Industrial	Pumps						
	Air compressors						
	Industrial boilers						
	Fan units						
	Electric motors (NZ)						
	Cool rooms						
	Commercial ice makers						
	Commercial dishwashers						
	Commercial deep fryers						
	Commercial ovens						
	Commercial hot food holding cabinets						
	Office equipment: printers and MFDs						
	Lighting equipment (products not yet regulated, including some residential products)						
Residential	Residential ovens						
	Residential cooktops						
	Residential rangehoods						
	Battery chargers						
	Ceiling fans						
	Water dispensers						
	Vacuum cleaners						
	Network standby						
	Small network equipment						
	Residential space heating						
	Residential water heating (assessment tool)						
Building Products	Bulk insulation						
	Ductwork						
	Glazing						
Other	Motor vehicle tyres						

Key:

Ongoing – previous E3 priority	Ongoing – under New Zealand management	Ongoing – under NSW management

4. Existing Regulations Due to Sunset

GEMS determinations are covered by the government's default sunsetting provisions which apply to Commonwealth legislative instruments. As such, GEMS determinations will sunset or cease to have effect after a 10 year period unless action is taken to update and renew the determinations.

The 10 existing determinations that will sunset within the next 3 years are shown in Table 4. This table also includes the current assessment provided by Department of Industry, Science, Energy and Resources (DISER) staff regarding future actions on these determinations, although it is noted that these are not considered final.

For those determinations found to still be effective and efficient, the options are that they may be remade in their current form or undergo a revision process, which could include changes to the scope, test method, metric and/or performance requirements. Determinations with significant revisions will need to undertake a RIS and consultation process.

It should be noted that in general the revision process for existing regulation will tend to be less onerous compared to initiating regulations for new products. This is due to the knowledge of the technology, market and performance of current products within E3 from years of regulation and interactions with the industry. The performance of all models on the market made available through the registration database provides an invaluable tool for assessing the impact of potential future thresholds – and this intelligence is rarely if ever available for unregulated products.

Where the revision process involves a substantial change in scope to include new technologies, or the merger of several categories, for example within a broad category of 'display devices', previous experience may not lead to a reduction in the development period or resources required.

Where products are considered suitable for revision, it is important for industry that there should be a well understood transition to the new requirements, and sufficient lead-time for industry to adjust and register products.

Given that there are several determinations due to sunset shortly, those identified for revision should be considered a priority and E3 will need to allocate resources to ensure that these can be finalised in time to ensure a smooth transition.

Table 4: Existing determinations due to sunset

Product	Due date for sunsetting	Early findings from the sunsetting review processes
Ballasts for fluorescent lamps	1 April 2023	Sunsetting assessment is still underway.
Transformers and converters for ELV lamps	1 April 2023	Sunsetting assessment is still underway.
Close control air conditioners	1 April 2023	Technology is being replaced by Chillers (which are currently regulated) in larger data centres and small data centres are being replaced by cloud computing and regular air conditioners. Further investigations are underway and no final decision has yet been made.
Distribution transformers	1 April 2023	An upgrade to be considered. Propose to remake unchanged until a comprehensive review can be undertaken.
Set-top boxes	1 April 2023	Set-top boxes are becoming obsolete. Propose to allow to sunset.
Computers	1 October 2023	Current regulations not effective in driving improvements. Propose to allow to sunset.
Computer monitors	1 October 2024	Propose to remake unchanged however there appears potential for integration within a broader category of display devices, including televisions.
External power supplies	1 April 2025	Potential for upgrading and considering a broader scope.
Electric water heaters	1 April 2023	Sunsetting assessment is still underway.
Commercial chillers	1 April 2023	The scope and MEPS will be revised and replaced through a different E3 process.

At this stage the following determinations are still being assessed or under consideration for revision and are therefore taken forward into the Prioritisation Plan. This list may be revised, depending on the decisions by E3.

- ballasts for fluorescent lamps
- transformers and converters for ELV lamps
- close control air conditioners
- distribution transformers
- computer monitors
- external power supplies
- electric water heaters
- commercial chillers

No information has currently been provided on the details of potential revisions to these determinations to date, and therefore no estimates for the potential impacts from regulating these products have been included in the following sections.

5. Commercial/Industrial Sector Products

The products considered in this section are typically used in industrial or commercial applications, are subject to energy efficiency measures in other countries and consume substantial amounts of energy in Australia and New Zealand.

The regulatory development status and energy savings potential of these products varies, as shown in Table 5. Initial investigations have been conducted for the majority of products, and these investigations provide sufficiently accurate indications of their energy savings potential in Australia and New Zealand to enable prioritisation. For products where the regulatory development process has advanced, these estimates are considerably more accurate.

Table 5 summarises some of the key relevant data for each product, including whether they are covered by energy efficiency programs in the major economies, the estimated energy savings potential and their current status in Australia and New Zealand.

Table 5: Summary of information on Commercial & Industrial products

Products	Regulated Elsewhere	Approximate Annual Energy Savings (GWh p.a.)*	Development Status in Australia & New Zealand
Pumps	M: EU, US, China	1600	Technical Discussion Paper released November 2020. RIS in preparation.
Air compressors	M: US, China UC: EU	500	
Industrial Boilers	M: EU, US, China	2200	
Fan Units	M: EU, US, China	2300	Consultation RIS released April 2017.
Electric Motors (NZ)	M: EU, US, China	520 **	Consultation RIS for NZ only due for release towards end of 2021.
Cool Rooms	M: US	800	Initial investigation by Victorian Govt in 2019 (for VEU program).
Commercial Ice Makers	M: US Energy Star: US	80	Initial investigation by NSW 2020.
Commercial Dishwashers	M: US States UC: EU Energy Star: US, Canada	500	
Commercial Deep Fryers	Energy Star: US, Canada	500	
Commercial Ovens	Energy Star: US, Canada	200	
Commercial Hot Food Holding Cabinets	Energy Star: US, Canada	20	
Office Equipment: printers and MFDs	Energy Star: US, Canada	See below	Not commenced
Lighting Equipment: phasing out of fluorescent & HID lamps; MEPS for LED fixtures and LED drivers (CFL, LED drivers and LED luminaires are all in place in the EU)	UC: EU	750	Not commenced

M = MEPS Energy Star=Voluntary labelling UC= under consideration

** Estimated energy saved in each year in Australia and New Zealand, after the entire stock has turned over following the introduction of regulations*

*** This is a preliminary estimate of the impact for implementing only the first upgrade to IE3, which has a smaller impact than the second upgrade in 2026 to IE4*

Each of these products are discussed in further detail below. With the exception of office equipment

(printers and MFDs), all products are considered worthy of further consideration and are therefore taken forward into later sections of this report.

5.1 Pumps

DISER have published discussion papers[3] for pumps, industrial boilers and air compressors, and the bulk of the information in the relevant sections of this report is derived from these discussion papers. DISER have also engaged a consultant to undertake a cost-benefit analysis for a consultation RIS for these 3 products, which are scheduled to be released in 2021-22.

The pump market annual sales revenue is estimated at around $1 billion in Australian and $540 million in New Zealand. The import and assembly of pumps supplies 66% of the market in both countries, with the remainder of pumps locally manufactured. The majority of imports are from the EU, the US and China. In both Australia and New Zealand, industrial pumps are significant consumers of electricity, accounting for approximately 12% of total industrial electricity use. Aside from requirements for pumps and circulators in HVAC systems under the Australian National Construction Code (NCC), there are no energy efficiency requirements for pumps in Australia or New Zealand.

Energy efficiency regulations for pumps are in place in the EU, USA and China. A review of the EU regulation highlights a number of improvements that could be made to pump regulations, including a recommendation for an extended product approach (EPA) for pumps, where the efficiency of a pump unit as a whole (pump, motor and variable speed drive) is considered. The Australian pumps technical working group concluded that this approach is supported by stakeholders and could be considered for pump units in Australia and New Zealand.

5.2 Air Compressors

The bulk of the information in this section is derived from the DISER discussion paper for air compressors[4]. The air compressor market annual sales revenue is estimated at $190 million in Australia and $60-100 million in New Zealand. The air compressor market in both countries is import/assembly based and anecdotally there is no manufacturing remaining. The majority of imports are from the EU, US and China. In both Australia and New Zealand, air compressors are significant consumers of electricity, accounting for approximately 10% of total industrial electricity use. There are currently no energy efficiency requirements for air compressors in Australia or New Zealand.

The US Department of Energy (DOE) has published a final rule to establish an energy efficiency standard for displacement-type, rotary, lubricated air compressors. The rule was published in January 2020 and is due to come into enforcement in March 2025. It is estimated the rule will cover over 95% of air compressors in the US. The EU is considering the introduction of Minimum Energy Performance Standards (MEPS) for a range of air compressor products. It initially identified a full range of positive displacement and dynamic compressors in 2012. The first study reported on standard air compressor packages. A second study in 2016 focused on low pressure and oil free compressor packages. Currently the EU regulations for air compressors are at draft regulation stage[5]. The Chinese regulation for compressors includes MEPS for displacement air compressors and was revised in November 2019, commencing in July 2020. The revised standard appears more stringent than the US standards.

5.3 Industrial Boilers

The bulk of the information in this section is derived from the DISER discussion paper for industrial boilers[6], which were identified as a high priority in the previous E3 Prioritisation Plan. Boilers are used in a wide variety of commercial and industrial applications, typically using a combustion source or electricity to provide hot water for heating or sanitation, and/or steam for industrial processes. They are also used in domestic and small-scale commercial applications for providing potable and sanitary hot water, and heating.

Boilers use a substantial amount of energy in both Australia and New Zealand. The energy demand for

[3] https://www.energyrating.gov.au/news/industrial-products-technical-discussion-papers-released
[4] https://www.energyrating.gov.au/news/industrial-products-technical-discussion-papers-released
[5] https://www.eceee.org/ecodesign/products/compressors/
[6] https://www.energyrating.gov.au/document/technical-discussion-paper-boilers

boilers in Australian industry is estimated to be 200 petajoules, around 3% of Australia's total energy use. In New Zealand, the energy demand for boilers is estimated to be 135 petajoules, around 24% of total energy demand. The total boiler manufacturing market in Australia had an estimated annual revenue of $426 million in 2019-20. There is insufficient information on the boiler market in New Zealand to include in this paper.

In Australia, energy efficiency standards are currently limited to new boiler installations under the NCC 2019 update, which only covers boilers installed for heating in new buildings. There are currently no energy efficiency requirements for boilers in New Zealand. The E3 discussion paper explores key regulatory approaches in the US and EU, which are the two largest import markets for boilers in Australia and New Zealand.

The discussion paper sought stakeholder input, with responses sought by early December 2020. The key issues identified in the discussion paper were as follows:

- boilers are either packaged (manufactured offsite to a specification) or field-constructed
- packaged boilers have specifications that are easily tested and verifiable at the point of manufacture. These are predominantly installed in commercial, retail and medical premises. Packaged boilers only account for around 35% of the boiler industry
- boilers used in industrial settings for process heat are usually field constructed. This makes it difficult to test and verify performance. Boilers used for process heating account for 46% of the market
- the EU, US and China have efficiency regulations in place for industrial boilers, and the majority of boilers imported into Australia come from these 3 economies. The EU and US regulations effectively mandate 'condensing' boilers, which have a significant efficiency advantage, however they are more complex.

Submissions received on the discussion paper were somewhat critical of the paper, suggesting that at least one Australian manufacturer would not be able to manufacture products that would meet the proposed MEPS. An E3 report examines technical questions about introducing condensing boilers into an existing bank of non-condensing boilers, which may present a barrier to MEPS.

5.4 Fan Units

A consultation RIS for fan units (motor-fan combinations) was issued in 2017. The RIS recommended MEPS for fan-units driven by electric motors in the range of 125 Watts to 500 kW[7]. It was proposed that the regulations would be based on the European Commission Regulation 327/2011, with product testing based on ISO5801: 2007 and regulatory levels based on fan-motor efficiency grades (FMEG) set out in ISO12759: 2010. However, despite industry support, this proposal has stalled while the following issues identified in the consultation RIS are resolved:

- double-regulation: EEAT agreed out of session in early 2018 that regulation for fan-units should not apply to equipment that is already subjected to MEPS requirements, in this case for air conditioners and gas-fired ducted heaters. The GEMS Act currently does not allow for the exclusion of registration or compliance for categories of products based on their end-use
- registration quantities: Fan suppliers will often combine a fan and motor unit to meet the requirements of particular end-use equipment for an original equipment (OEM) customer. This means there are multiple combinations of motor, fan-type, and fan characteristics (e.g. diameter, number of blades, angle of blades, etc.)
- spare parts: Currently the only way to deliver this would be a detailed and pre-emptive approach to exemptions: listing specific models that would be exempt. This would make compliance difficult and is administratively burdensome when the large number of models that would need to be listed is considered.

E3 has determined that changes to the GEMS Act would be required in order to address some of these

[7] The upper limit is subject to decisions regarding the implementation options.

issues. It is also possible that similar issues might apply to other industrial products.

The range of potential solutions to the issues raised in the Consultation RIS, including potential amendments to the GEMS Act required in order to regulate fan units, were considered in a report to DISER (summarised in Attachment 2) and are still being debated within E3.

Given the significant energy savings opportunities available in Australia and New Zealand from the regulation of fan units, and other yet unregulated products that may face similar or related barriers, the lengthy process of making changes to the GEMS Act is considered justified.

However, while these amendments are being enacted, there is considerable value in launching a voluntary scheme to publicly identify the performance of electric fans. This will enable the industry to adjust to testing and registration processes in Australia and New Zealand, in preparation for regulations. This scheme is discussed in Section 9.2.

5.5 Electric Motors

New Zealand is currently assessing the potential for increasing MEPS for electric motors in New Zealand only. A consultation RIS is scheduled for release before the end of 2021, including (at the time of writing) the proposals to adopt IE3 levels in 2023 and IE4 in 2026.

Given that most developed countries have now adopted IE3 levels for a broader range of motors than are currently regulated in Australia, and the EU will adopt IE4 levels in 2023, the potential exists for Australia to investigate following a similar pathway. Preliminary data from New Zealand suggests that an upgrade would deliver substantial energy and greenhouse gas savings.

5.6 Cool Rooms

The Victorian Energy Upgrades Program (VEUP) recently added an energy-saving measure for upgrading cool rooms (a refrigerated storage room where food and beverages are kept cool or frozen)[8]. An issues paper was also published by the Victorian Department of Environment, Land, Water and Planning (DELWP) in 2017[9] and information from that paper has been used in this section.

Cool rooms can be found in almost all food and beverage retailers (e.g. supermarkets, bottle shops, butchers and grocers), cafes and restaurants, food and beverage manufacturers, and retailers selling perishable goods (e.g. florists). There are approximately 65,000 cool rooms in Victoria and an average cool room uses approximately 19 MWh per annum in energy and costs a business around $4,000 per annum in energy bills. The energy costs of larger systems can be as much as $20,000 per annum. New technologies have also made it possible to cost-effectively upgrade the refrigeration equipment used in cool rooms, producing energy savings of 10-30% with associated cost savings of $400-$1200 per annum.

Walk-in cool rooms have been regulated in the US since 2009 and include MEPS and labelling requirements covering the entire walk-in units and the individual component parts: doors (display & non-display), panels and refrigeration systems. These requirements apply to cool rooms with a chilled storage area of less than 3,000 square feet (280 m^2). The labelling requirements are aimed at facilitating the correct matching of components by installers. The EU has also commenced investigating cool rooms for potential regulations.

A key component of a cool room is the outdoor refrigerative compressor / condenser unit, and these are also used for large retail refrigeration systems - i.e. the unit is located outdoors to service indoor refrigeration cabinets (noting that these are currently subject to MEPS). Refrigerative compressor / condenser units can also be used for HVAC, and thus this product is considered worthy of further investigation for regulation. Aside from the work undertaken for the VEUP, investigation of regulations for cool rooms or refrigerative compressor / condenser units have not commenced in Australia or New Zealand.

[8] https://www.esc.vic.gov.au/victorian-energy-upgrades/activities-offered-under-veu-program/cold-room-activity
[9] https://www.energy.vic.gov.au/__data/assets/pdf_file/0025/426616/Cold-Rooms-Issues-Paper.pdf

5.7 Commercial Ice Makers

The NSW Government have commissioned an analysis of the following commercial catering equipment: ice makers, dishwashers, fryers, ovens and hot food holding cabinets. The results of those analyses are presented in this section and subsequent sections below. Commercial ice makers are subject to mandatory MEPS in the US (as well as Energy Star) and it is estimated that the total Australian stock of commercial ice makers is between 40,000 and 50,000 units, with around 9,000 imported per annum (there is also one known local manufacturer). Energy savings of implementing the US MEPS levels are estimated at around 80 GWh p.a. for Australia and New Zealand combined (in 2030).

5.8 Commercial Dishwashers

Commercial dishwashers are subject to mandatory MEPS in the US (as well as Energy Star) and are under consideration for MEPS in the EU. They are being investigated by NSW, and these investigations reveal that the energy consumption of commercial dishwashers can be significantly improved through a variety of engineering measures including improved controls, optimised rinse arms and improved heat exchanger designs. These factors combined result in Energy Star certified commercial dishwashers of various configurations on average consuming 40% less energy than their competition. Applying 50% of the Energy Star claimed efficiency gains to the Australian and New Zealand stock, energy savings are estimated at around 500 GWh p.a. for Australia and New Zealand combined (in 2030).

5.9 Commercial Deep Fryers

Commercial deep fryers are part of Energy Star in the US and are being investigated by NSW. These investigations reveal that deep fryer efficiency can be improved through a combination of factors such as insulation, increased heat transfer efficiency from the element/burner to fry pot, and improved thermostatic controls. Energy Star certified standard size fryers achieve savings of 14-35%. Typical annual energy consumption for an electric fryer is 1,270 kWh with gas variants consuming an average 176,000 MJ annually. Applying 50% of the Energy Star claimed efficiency gains to Australia and New Zealand, savings for both countries would be in the order of 500 GWh p.a. in 2030.

5.10 Commercial Ovens

Commercial ovens are part of Energy Star in the US and are being investigated by NSW. These investigations reveal that the energy efficiency of commercial ovens can be significantly improved by increasing the effectiveness of the insulation. This is typically achieved through the installation of improved door seals, double or triple glazed oven doors, and using bulk insulation with higher R-value (higher thermal resistance rating). Energy Star claim savings of up to 15% for gas and electric convection ovens and as much as 30% for gas and electric combination ovens. If half of this were to be realised for Australian and New Zealand, savings for both countries would be in the order of 300 GWh p.a. in 2030.

5.11 Commercial Hot Food Holding Cabinets

Commercial hot food holding cabinets are part of Energy Star in the US and are being investigated by NSW. These investigations reveal that the efficiency of commercial hot food holding cabinets can be improved by increasing the effectiveness of the insulating properties, i.e. improved door seals, double and triple glazed oven doors, and thicker insulation or insulation with improved thermal properties to gain a greater R-value. Energy Star certified hot food holding cabinets are up to 70% more efficient than their non-certified alternatives. With the typical annual energy consumption for an electric hot food holding cabinet being around 4000 kWh, savings are significant. However due to relatively small sales volumes for these products, applying 50% of the Energy Star claimed efficiency gains for Australia and New Zealand, combined savings for both countries would be in the order of 60 GWh p.a. (in 2030).

5.12 Office Equipment

Recent research undertaken by the Energy Efficiency Council[10] suggests that office equipment such as servers, displays and imaging equipment represent an increasing energy load that is worthy of further examination. Hence these devices have been included as a potential new product category. The EEC research found:

- Laptop computers account for 6% of total energy consumption in office tenancies, while desktop computers account for 4% (noting that there are significantly lower number of desktop computers than laptop computers).
- The energy consumption of server equipment in offices accounts for approximately 11% of office general lighting and equipment consumption.
- Computer monitor energy usage is approximately 25% of total energy consumption in office tenancies (not including base building consumption).
- Printers and multifunctional devices account for only 2% of energy consumption in office tenancies, noting that the number of equipment found in the surveyed offices was considered low, hence this proportion could be higher.
- The remaining energy consumption for office tenancies comprises lighting (44%) and miscellaneous equipment (8%).

Computers (including small-scale servers) and computer monitors are undergoing sunset assessment (refer Section 4 of this plan) so are not dealt with here. This only leaves printers and MFDs.

No other jurisdictions are known to regulate printers and MFDs, and Energy Star is the dominant policy globally (a voluntary endorsement label). Discussions with equipment manufacturers and Energy Star program staff reveal that Energy Star has a very high penetration of devices in North America (most devices sold are Energy Star certified) and although Energy Star is no longer used in Australia, New Zealand or Europe, it has a significant trickle-down effect from North America to all regions of the globe. In other words, the products sold are essentially global also and US products are considered to be identical to Australian and New Zealand products.

A brand analysis conducted for this Prioritisation Plan revealed that of the 15 brands currently sold in Australia and New Zealand, all except one are significantly represented on the list of US Energy Star certified products. Note that due to the lack of a licensing arrangement, products in Australia are not permitted to carry the Energy Star label, thus even if the model is Energy Star certified (in the US) it cannot carry the Energy Star label in the Australian market. The other aspect worth mentioning is that the (Energy Star) performance criteria are very complex.

For these reasons, policies for printers and MFDs are not expected to deliver significant energy savings in the Australia and New Zealand market.

5.13 Lighting Equipment

In Australia, several types of lighting products are subject to regulations, with incandescent lamps, and magnetic lighting transformers effectively being phased out. Performance MEPS are in place in Australia and New Zealand for CFLs, linear fluorescent lamps and fluorescent ballasts. MEPS are also planned for LED lamps in both countries and for phase out of mains voltage halogen lamps in Australia. Thus the primary gaps in regulation that remain are:

- phasing out of CFL, fluorescent and HID lamps
- performance MEPS for integrated LED luminaires
- performance MEPS for LED drivers (the electronic circuit required to drive an LED light source).

In Europe, integrated CFLs were phased out Sept 2021, with T8 linear fluorescent lamps planned to be phased out in 2023. Investigations in Europe are also underway into phasing out the remaining

[10] https://www.energybriefing.org.au/research

fluorescent (e.g. T5) and HID lamps. These activities are worthy of investigation in Australia and New Zealand.

Australia is a signatory to the Minamata Convention on Mercury under which members have recently agreed to phase out integrated compact fluorescence lamps (CFLi) by December 2025. Linear fluorescent lamps are also to be phased out under the Minamata Convention, with a date to be agreed at the next Conference of parties in October 2023.

Performance MEPS for integrated LED luminaires was not pursued as part of the current LED MEPS following negotiations with the Australian lighting industry (due to incompatibility with product registration under the current GEMS Act), however these products are regulated in Europe. This warrants revisiting following amendments to the GEMS Act. If the registration issue cannot be resolved, voluntary MEPS and registration could be an alternative.

MEPS for LED drivers is considered worthy of further investigation. Since these products share some characteristics with external power supplies, these could be considered as part of the investigations into future regulations for external power supplies or as part of future lighting regulations. In the EU, regulations for these commenced in September 2021.

High Intensity Discharge Lamps (HID) are often used for outdoor and industrial lighting. More efficient LED replacement lamps and luminaires are now available. A regulated phase-out of these products would accelerate and complete the transition.

The EU also has energy labelling in place for lamps, and this is worthy of consideration for Australia, including possibly for luminaires.

6. Residential Sector Products

The products considered in this section are typically used in residential applications, are subject to energy efficiency measures in other countries and consume substantial amounts of energy in Australia and New Zealand.

The regulatory development status and energy savings potential of these products varies, as shown in Table 6. Initial investigations have been conducted for the majority and these provide sufficiently accurate indications of their energy savings potential in Australia and New Zealand to enable prioritisation.

Table 6 summarises some of the key relevant data for each product, including whether they are covered by energy efficiency programs in the major economies, the estimated energy savings potential and their current status in Australia and New Zealand.

Table 6: Summary of information on residential sector products

Products	Regulated Elsewhere	Approximate Annual Energy Savings (GWh p.a.)*	Development Status in Australia & New Zealand
Residential Ovens, Cooktops and Rangehoods	M: EU UC: US	700	Initial investigation by NSW 2020.
Battery Chargers	M: US	1200	Product profile released by E3 in 2013.
Ceiling Fans	M: US, EU	500	Initial investigation by NSW 2020.
Water Dispensers	M: Korea Energy Star: US & Canada	300	
Vacuum Cleaners	M: EU, Korea L: EU, Korea	250	
Network standby	M: EU L: Korea Energy Star: US, Canada	600	Not commenced. Consultation RIS for Standby Power published in 2012. Decision RIS prepared in 2014 but not presented to the Ministerial Council.
Small network equipment	M: EU Energy Star: US, Canada	600	Not commenced
Residential space heating	M: US, EU	1100	Product profile released by E3 in May 2021.
Residential water heating (assessment tool)		Not yet calculated	

M = MEPS L= Mandatory Labelling Energy Star=Voluntary labelling UC= under consideration

** Estimated energy saved in each year in Australia and New Zealand, after the entire stock has turned over following the introduction of regulations*

6.1 Residential Ovens, Cooktops and Rangehoods

Europe has regulated domestic electric/gas ovens, electric/gas cooktops and rangehoods since 2015. The stringency of these regulations increased in 2017 for cooktops and in 2019 for ovens. These standards have significantly increased the efficiency of these products, and many of the brands selling in Europe are also sold in Australia and New Zealand (the manufacturing of ovens is part global and part domestic).

The NSW Government has undertaken an analysis of these products (not published) which concluded that Australia and New Zealand do benefit somewhat from international standards, without actually adopting those standards. Taking this into account, the NSW analysis concluded that savings for Australian and New Zealand ovens combined would be in the order of 380 GWh p.a. in 2030. For residential cooktops the Australian and New Zealand savings would be around 320 GWh p.a. in 2030, and for residential rangehoods around 80 GWh p.a.

6.2 Battery Chargers

In 2013, E3 published a product profile[11] focusing on battery chargers including products incorporating a battery charger (note these are distinct from external power supplies). This product profile found that:

- An estimated 3,370 GWh in Australia and 640 GWh for New Zealand is being used on battery charging systems annually.
- There is considerable technical potential for energy savings from battery charging products - a typical battery charger is only around 13% efficient when charging over a 24 hour period and there is wide variation in the efficiency of existing chargers.
- Annual energy savings of around 700 GWh p.a. are possible for Australia and New Zealand combined.
- The majority of small battery chargers have short product lives, so efficiency improvements would quickly affect many of the products.

The above estimates of energy used and savings potentials for battery chargers is considered to underestimate the current impacts due to the very substantial increase in mobile devices since the public profile was released. The migration away from corded to cordless power tools in recent years is also a good example of the exponential increase in battery charging devices used by householders and trades.

Looking forward, we are also seeing the emergence of new technologies, such as wireless "non-contact" battery chargers. A recent global study of small wireless battery chargers[12] concluded that the increasing popularity of these products, combined with their efficiency disadvantage compared to traditional chargers, could lead to a significant increase in energy consumption.

Electric vehicles charging will further increase the energy consumed by battery chargers. A scoping study on electric vehicle charging equipment[13] concluded that there is a wide variation in the charging efficiency of technologies being used and that regulatory authorities are paying insufficient attention to the need to encourage high efficiency technologies before these are rolled-out more widely. Energy Star currently includes electric vehicle chargers in its program. The US are also revising standards for battery chargers[14] and will include uninterruptible power supplies (UPS) and wireless chargers.

Battery chargers are therefore considered to be worthy of further analysis. In considering the scope, it may be worth considering a single regulation to incorporate battery chargers, external power supplies and uninterruptible power supplies, as this could help to overcome some of the boundary issues that distinguish these products. As noted in Section 5.12, there is also the potential to consider LED drivers within this grouping.

[11] https://www.energyrating.gov.au/sites/default/files/2020-06/e3-product-profile-battery-chargers-revised.pdf
[12] https://www.iea-4e.org/edna/tasks/task-13-energy-use-for-wireless-charging/
[13] https://www.iea-4e.org/edna/tasks/project-electric-vehicle-supply-equipment/
[14] https://www.energy.gov/sites/prod/files/2020/08/f77/bc-std-rfi.pdf

6.3 Ceiling Fans

Ceiling fans are being investigated by the NSW Government, as part of their investigation into products which are regulated overseas. Ceiling fans are currently regulated in the US and China, and were proposed for the EU until issues emerged with the chosen test method.

There are considerable energy savings available from transitioning to DC motor driven ceiling fans rather than an AC induction motor fans, and advancements in aerodynamic blade design also yield considerable savings.

6.4 Water Dispensers

NSW are investigating hot/cold water dispensers, used to supply potable hot and/or cold water in homes and commercial premises. Water dispensers are a significant energy consuming product in the Australian and New Zealand market, although there is considerable potential for improving their energy efficiency. Several overseas countries, including several that are major trading partners with Australia and New Zealand, have successfully implemented energy efficiency programs with the result that their consumers can access a wide range of products with lower running and lifecycle costs.

In late 2004, all Australian and New Zealand Governments announced a commitment to introduce energy efficiency regulations for water dispenser products commencing in October 2007. However, due to changes in priorities, the Australian Greenhouse Office withdrew the intention to regulate water dispensers (amongst other products) and therefore these products are currently not subject to any energy efficiency policies in Australia or New Zealand.

6.5 Vacuum Cleaners

Vacuum cleaners are also being investigated by the NSW Government. Currently vacuum cleaners are not subject to any energy efficiency policies in Australia or New Zealand, however they are subject to MEPS in the EU and Korea as well as labelling in several economies.

6.6 Network Standby

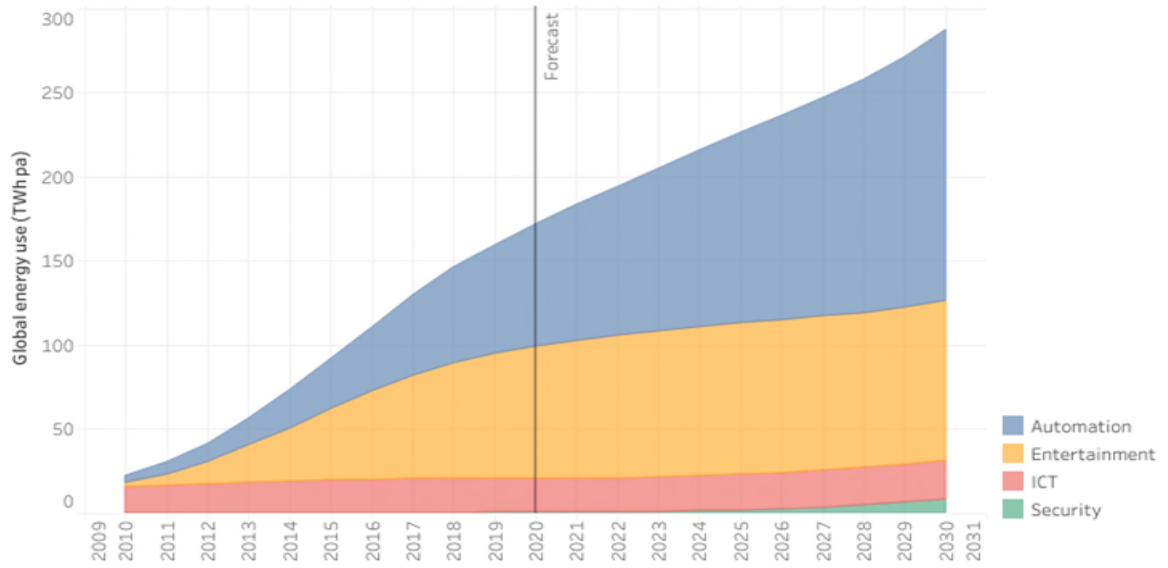
Network-connected devices are becoming increasingly popular, with global stocks expected to exceed 40 billion by 2030[15]. Network standby energy is the energy used by an internet-connected device when not performing its primary function, but maintaining network communications. For example, a regular light bulb uses no energy when switched off, but a network-connected bulb can use up to 3 watts, 24 hours a day, to maintain its network connection (so that it is able to receive a turn-on command).

By 2030 it is estimated that 300 TWh per annum could be wasted by network standby energy globally (refer Figure 3) which is the same as the current electricity consumption of the United Kingdom (UK)[16]. The network standby power of many devices can be reduced by improved product design and selection of appropriate communications protocols.

[15] IEA-4E EDNA total energy model, https://www.iea-4e.org/edna/tem/

[16] IEA-4E EDNA policy brief, https://www.iea-4e.org/wp-content/uploads/publications/2020/04/4E_Policy_Brief_EDNA_8_FINAL.pdf

Figure 3: Forecast of global network standby energy (source: IEA-4E EDNA total energy model)



Examples of mandatory and voluntary policies used to address the issue of network standby include the EU Ecodesign regulation for networked standby, Korea's E-standby label and the US ENERGY STAR® program.

The EU has implemented regulations for both standby and network standby on a horizontal basis. However US law does not permit a horizontal approach to regulation and, like other countries, the US tends to include equivalent requirements within each of its 'vertical' product regulations.

However, a vertical approach will not be as effective as a horizontal MEPS, due to the rate at which products are evolving. This tends to allow products to escape a vertical scope as their functionality changes and new product categories are formed. In addition, there are many connected products for which no regular MEPS exists or is planned, and these devices are only likely to be captured by a horizontal MEPS. Note that in Australia and New Zealand the planned LED MEPS includes maximum standby and network standby requirements (0.5W) in line with EU requirements.

In Australia and New Zealand, a consultation RIS for a horizontal Standby Power regulation that applied to most residential electrical equipment was published in August 2013, proposing MEPS harmonised with the EU requirements (no longer published on the energy rating website). However, while a Decision RIS was drafted in 2014, the Commonwealth dropped this project in late 2014 shortly before it was due to progress to the Ministerial Council for a decision. It was claimed at the time that standby power regulations were no longer warranted as standby power levels of new equipment were trending down and Australia would benefit from spill-over from the EU regulations. It was also claimed that network standby was of greater significance, and that the Commonwealth preferred to put resources into this issue.

For network standby in particular, the key issue is that very small savings are achievable on a very large, and increasing, number of products. As a result, the cost-benefit for individual products is not significant, but becomes very positive when all relevant product categories are captured, which is again why a horizontal policy approach is favoured.

Horizontal MEPS appears feasible under Australian regulatory frameworks and may also be possible in New Zealand[17], noting that the very large number of products that would fall under a horizontal regulation may pose registration issues under the existing GEMS registration framework. For this reason, the 2013 RIS proposed not requiring products to be officially registered. Section 30 of the GEMS Act states that "a GEMS determination may specify, for a product class covered by the determination, that models of products in that product class are exempt from registration under Part 5 in relation to that product class". This is one means of avoiding the registration of large numbers of

[17] Subject to clarification

products, however there may be other options to be explored.

The IEA-4E EDNA Total Energy Model[18] (TEM) is a quantitative global model of the 'total energy use' of connected devices. It covers the energy used by connected devices in these 3 conditions:

- Media streaming: a condition in which audio-visual content data is being transmitted over a network to a Smart TV, Casting Stick or similar entertainment device and includes the energy that the devices uses to fulfil its primary function.
- Network active: a condition in which a device is communicating actively with another device on a network.
- Network standby: a condition which allows a device to resume its main function upon a receiving a remotely initiated trigger via a network connection.

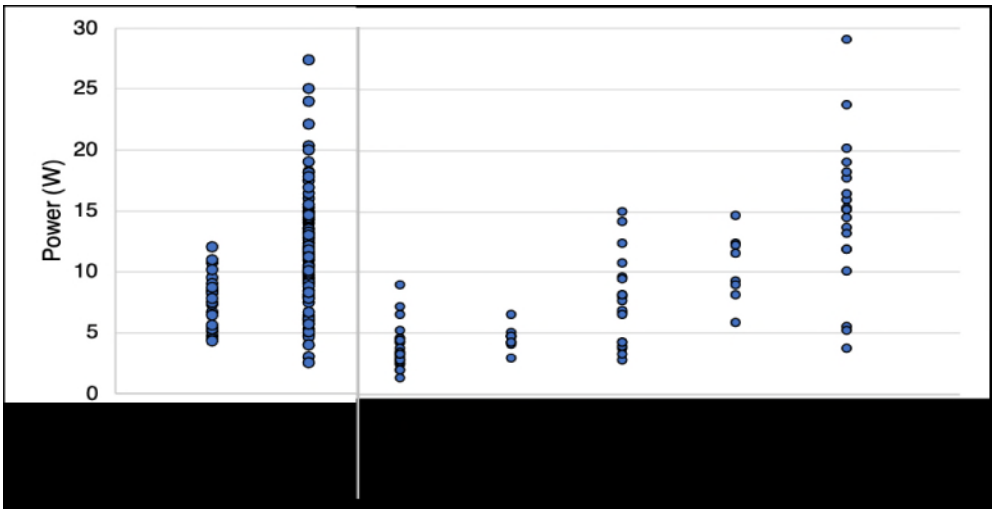
The TEM also covers the energy use of devices deployed in local area networks (LANs) such as modems and routers, as well as the 'upstream' energy that connected devices stimulate in wide area networks (WANs) and data centres. Results from the TEM are available publicly, and users can manipulate policy scenarios in order to estimate energy consumption and energy savings.

For this Prioritisation Plan, the TEM was used and suggested that, if network standby energy were to be reduced by 25%, then energy savings for Australia and New Zealand would be in the order of 600 GWh p.a. within 10 years.

6.7 Small Network Equipment

Small network equipment (SNE) has not previously been considered by E3, but primarily includes modems, routers, network extenders, ethernet switches, etc. Small network equipment is covered by Energy Star in the US, as well as by MEPS in Europe and a voluntary industry agreement in the US and Canada. There is growing global interest to increase policy coverage for these kinds of devices, which exist in very large numbers and tend to consume significant power 24 hours per day, even when not required by users (see Figure 4).

Figure 4: SNE idle power for function-based product categories (source: IEA-4E EDNA report on SNE)



A recent report for IEA-4E EDNA[19] found that power savings of 20 to 50% appear achievable. Based on EDNA's Total Energy Model, energy savings for Australia and New Zealand would be in the order of 600 GWh p.a. within 10 years.

In Europe, SNE equipment and network standby are regulated horizontally in Commission Regulation 801/2013 amending Regulation (EC) No 1275/2008 with regard to ecodesign requirements for standby, off mode electric power consumption of electrical and electronic household and office equipment. In this regulation, small network equipment is specified as 'high network availability' and

[18] IEA-4E EDNA total energy model, https://www.iea-4e.org/edna/tem
[19] https://www.iea-4e.org/edna/tasks/task-20-small-network-equipment/

therefore allowed higher power consumption than other network connected 'edge' devices. This approach may also suit Australia and New Zealand.

6.8 Residential Space Heating

In May 2021, E3 published a product profile on space heating[20]. This covered the following product types:

- electric resistance (portable and fixed)
- reverse cycle air conditioners (heat pumps) – room, multi-split, ducted
- gas space and decorative appliances
- solid fuel combustion heaters
- gas ducted
- hydronic and boiler central systems
- in-slab central heating.

In Australia the main heater uses electricity in 40% of households, gas in 30% and wood in 7%. These figures vary significantly between states, with gas the main source in Victoria and ACT. In New Zealand the proportions of households using the three main fuels for heating are electricity (75%), wood (34%) and gas (18%). Most homes use more than one heating fuel, as this data shows.

The EU and US have mandatory MEPS and labelling for space heaters, and the US Energy Star program also covers space heaters.

The E3 product profile concludes that energy labelling would enable consumers to compare models and technologies, and make a more informed decision which best meets their heating needs. DISER and NSW Department of Planning, Industry and Environment have stated that they will further consult with stakeholders and technical organisations on the development of an energy rating labelling scheme for space heaters, then potentially proceed to a consultation RIS space heater energy labelling.

For the purpose of calculating energy savings from a space heating label in Australia and New Zealand, a 2% savings fraction was applied.

6.9 Residential Water Heating (Assessment Tool)

New Zealand are working on an assessment tool for water heating, which would cover all residential water heater technologies currently in use in Australia and New Zealand. EECA has developed a methodology to assess greenhouse gas emissions based on the fuel used. This tool is intended to be one of the outputs of a package that installers and consumers can use to assess their options based on household size, make up, building typology, local climate, energy tariff, greenhouse gas emissions, etc. The potential energy / emissions savings has not yet been calculated, however the focus is currently on a voluntary measure to help inform decision making, rather than a MEPS.

[20] https://www.energyrating.gov.au/consultation/product-profile-residential-space-heaters-australia-and-new-zealand

7. Building Products

Building products have not been regulated under the GEMS Act to date, however there have been a number of investigations by E3 in 2013-15 into the potential to regulate bulk insulation, flexible ducting and glazing products.

Several economies, such as the US and the EU, currently regulate or have voluntary labelling programs for building products which have an impact on energy use. While building products are currently within the scope of the GEMS Act, New Zealand has indicated that it cannot regulate in this area.

Table 7: Summary of information on Building products

Products	Regulated Elsewhere	Approximate Annual Energy Savings (GWh p.a.)*	Development Status in Australia & New Zealand
Bulk Insulation	Energy Star: US, Canada	1000	Initial investigation 2013
Ductwork	-	400	Initial investigation 2013
Glazing	UC: EU Energy Star: US, Canada	See below	Initial investigation 2013

Energy Star=Voluntary labelling UC= under consideration

** Estimated energy saved in each year in Australia and New Zealand, after the entire stock has turned over following the introduction of regulations*

Previous E3 investigative work has included testing programs on bulk insulation and flexible ducting which demonstrated a high incidence of underperformance, with many products failing to meet the R-values claimed by suppliers. A number of market failures, including those associated with principal-agent issues ('split incentives') in the commercial field, were also found.

In 2015 the E3 Committee determined not to proceed with regulations on any of these 3 building products[21].

It should be noted that there are 3 distinct issues that affect the efficacy of bulk insulation, ductwork and glazing:

- the quality of workmanship during installation
- substitution of products during installation (e.g. lower R-value being installed than was required)
- the actual performance of the product installed, compared to its rated value.

New Zealand cannot regulate to address any of these 3 issues. In Australia, GEMS is not able to regulate the first 2 issues, as these are local compliance issues, rather than product performance issues. However, GEMS is able to address the third bullet point - the performance of products. However, in the absence of consistent trans-Tasman regulations there is a question about whether products entering the Australian market through New Zealand could negate the benefits of any Australian regulations.

Issues relating to the regulation of the 3 building products in Australia are discussed further below.

7.1 Bulk Insulation

The NCC in Australia and the New Zealand Building Code (NZBC) regulate certain aspects of building performance with respect to insulation, such as setting minimum R-values for different parts of buildings, within various climatic zones. The Australian states may also have different requirements, for example in NSW the thermal performance of new residential buildings and renovations is regulated

[21] E3 Committee Meeting #44, 25 – 26 November 2015, Building Products, Paper 3.18

using either the Basix or Nationwide House Energy Rating Scheme (NatHERS) software tools. For each building design, these tools will require the building to meet a certain level of wall, floor, ceiling and roof insulation (a minimum R-value). However, with all of these types of regulation, there does not appear to be a stringent compliance mechanism for ensuring that the bulk insulation materials actually perform as claimed, i.e. that their claimed R-value is realised.

A bulk insulation testing program was undertaken by E3 in 2013 in order to determine whether products performed according to their claimed R-values. This revealed that 9 out of 23 products (39%) tested failed, with failure rates ranging from -0.3% to -31.7% (an average of -10.7%). Given the age of the results, some further product testing is warranted together with an investigation of industry tolerance levels.

For this report, simple calculations were performed to assess the energy losses from insulation underperforming by an average of 10%. These calculations reveal that, for the buildings constructed and renovated over a 20 year period in Australia and New Zealand, energy losses from 10% underperforming insulation would be around 1000 GWh p.a.

Note that, in New Zealand, a significant Government insulation installation scheme operates. As part of this scheme, all insulation products must carry a valid AS/NZS 4859 certificate of compliance (or a BRANZ appraisal) which may require retesting and/or random check testing of thermal performance. Program installations are also required to be audited against an installation standard (NZS 4246). These requirements might be useful for Australia and this is currently part of an ongoing EEAT discussion.

7.2 Flexible Ductwork

An industry rule of thumb is that around 10% of the energy used to heat/cool a building is lost in the ductwork. When ductwork was tested by E3 in 2014, significant underperformance was found, with products exhibiting tested R values of 30% to 50% lower than claimed.

For this report simple calculations were performed to assess the energy losses from ductwork underperforming by an average of 20%. These calculations reveal that, for the buildings constructed and renovated over a 20 year period in Australia and New Zealand, energy losses from underperforming ductwork would be around 400 GWh p.a. A ductwork product profile prepared by E3 in 2014 estimated residential ductwork energy wastage at 340 GWh p.a. by 2030 (16 years accumulated savings) which is of the same order the estimate above.

7.3 Glazing

In Australia, window energy ratings are not mandatory, however for new buildings and renovations, the NCC and/or state regulations will often require certain U-values (conduction heat loss values) and SHGC values (solar heat ingress heat gain values) for windows. These values take into account the heat loss and gain for both the glass and the window frame.

The New Zealand Building Code sets minimum R-values (essentially U-values) for glazing in new construction, but not SHGC values.

In Australia, the Australian Glass and Window Association administers the voluntary window energy rating scheme[22] (WERS), which provides an independent verification of window ratings. It also allows a star-rating to be applied to windows, which makes it significantly easier for consumers to understand the energy efficiency of their windows. WERS is accredited by the Australian Fenestration Rating Council (AFRC) and adheres to AFRC protocols and procedures for the rating of windows and glazed doors. To participate in WERS, window manufacturers must obtain window energy ratings from a rating organisation that is accredited by the AFRC.

WERS employs a combination of physical testing and computer simulation to generate energy ratings, underpinned by a suite of interlinked procedures including those used by the US National Fenestration Rating Council (NFRC). WERS ratings are designed to 'plug in' to NatHERS software and similar

[22] https://awa.associationonline.com.au/wers-home

modelling tools. In New Zealand a similar scheme exists, the Window Efficiency Rating Scheme.

Physical testing of entire windows is difficult in Australia and New Zealand, requiring expensive equipment. It is understood that there is only one lab in Australia capable of undertaking testing of entire windows. For this reason, window ratings are based on computer simulation of the glass and window frame. The required values for the glass come from a global database of glass products, and the combined glass and frame performance is calculated using software. This WERS system seems robust, although it is currently voluntary and not all window manufacturers participate. Additionally, it is still possible for unscrupulous window manufacturers to substitute poor performing products, and there is no check testing undertaken, so actual window performance vs claimed performance is unknown.

The energy losses from underperforming windows (and glass doors) is difficult to estimate for 2 reasons. Firstly the level of substitution is unknown and secondly the impact of window underperformance is difficult to quantify without NatHERS modelling of a range of building types in a range of climate zones.

8. Motor Vehicle Tyres

Motor vehicle tyres have not been regulated under the GEMS Act to date. New Zealand introduced a voluntary fuel efficient tyre program (based on rolling resistance) in 2014. A 2016 evaluation of the program indicated that, although it had been supported by tyre distributors, sales of more efficient tyres had not increased due to poor retailer buy-in and the inability of motor dealers to pass on additional costs to consumers[23]. A New Zealand report noted that other approaches may be more successful, but these were not identified.

Table 8: Summary of information on Tyres

Products	Regulated Elsewhere	Approximate Annual Energy Savings (GWh p.a.)*	Development Status in Australia & New Zealand
Passenger vehicles	M: EU, Korea L: EU, Korea, China UC: US & Canada	2600	Not commenced
Light trucks	M: EU, Korea L: EU, Korea, China UC: US & Canada	1000	Not commenced
Heavy trucks and buses	M: EU L: EU UC: US & Canada	3200	Not commenced

M = MEPS L= Mandatory Labelling Energy Star=Voluntary labelling UC= under consideration
** Estimated energy saved in each year in Australia and New Zealand, after the entire stock has turned over following the introduction of regulations*

Tyres have been subject to MEPS[24] and/or mandatory energy labelling in the EU[25], South Korea, Brazil and Japan for several years, and are under development in Canada (see Table 9 for a summary).

Although many tyre companies in Australia and New Zealand make claims about the energy efficiency of their products and their performance, consumers do not currently have access to unbiased information about the rolling resistance, wet grip performance or rolling noise of tyres. (See Figure 5 for an example of the information currently provided to consumers in Europe).

Overseas energy efficiency tyre programs typically cover rolling resistance, wet grip and external rolling noise, which consumers appear to find more valuable than fuel efficiency only[26]. Using these three parameters encourages manufacturers to optimise energy efficiency without sacrificing safety.

It is likely that a regulatory approach covering these three parameters would overcome several of the challenges that hindered the New Zealand scheme, deliver energy savings and improve road safety.

E3 have recent experience with including additional attributes on the energy rating label (ERL), most notably with the new air conditioner label that includes noise levels.

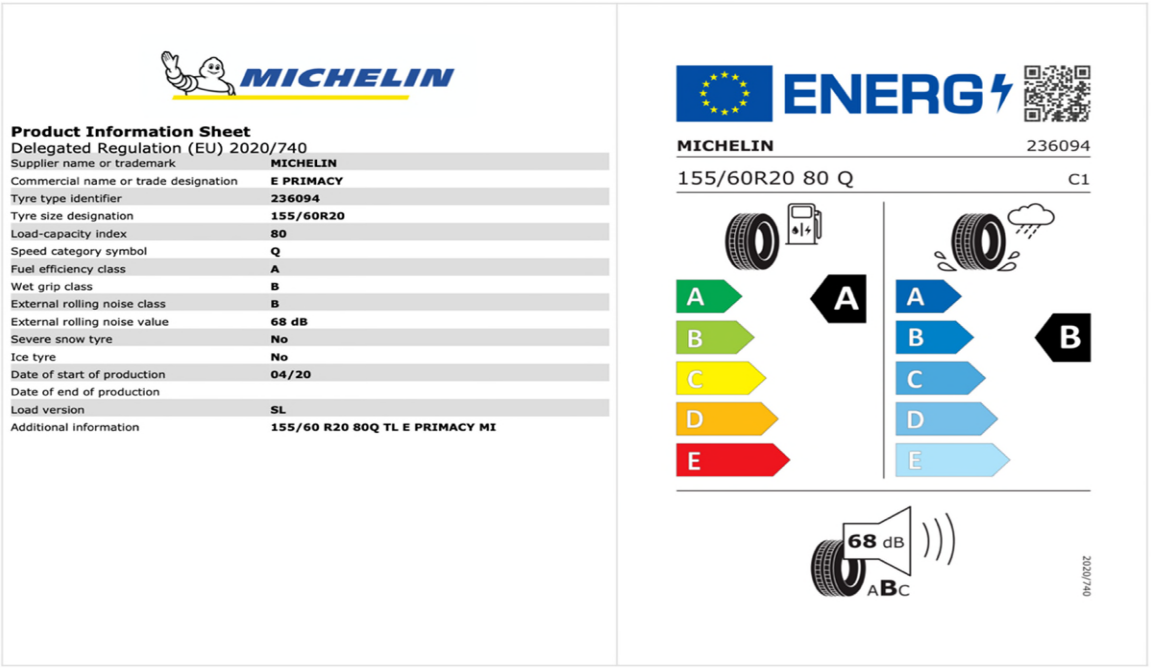
Table 9: Overseas fuel efficient tyre regulatory programs

Region/country	MEPS	Mandatory Labelling
Europe	2012 Updated in 2021	2012 Updated in 2021

[23] EECA (2016), Programme Review: Fuel Efficient Tyres, 2016.
[24] EU Regulation No 661/2009, 13 July 2009
[25] EU Regulation 1222/2009 was implemented in 2009 and updated in 2020 (2020/740).
[26] Final Report, Review study on the Regulation (EC) No 1222/2009 on the labelling of tyres, Prepared by Viegand Maagøe A/S, March 2016

South Korea	2013 passenger vehicles) 2014 (small trucks)	2012 (passenger vehicles) 2013 (small trucks)
Brazil	2015	2015
Japan		2010
China		2017
Canada	In development	In development
USA		Under consideration

Figure 5: Example of tyre product sheet and European tyre label



Although a detailed study has not been undertaken, a preliminary assessment indicates that the potential scale of savings is significant, as shown in Table 10 (see Attachment 3).

Table 10: Estimated fuel, energy and cost savings potential in Australia and New Zealand

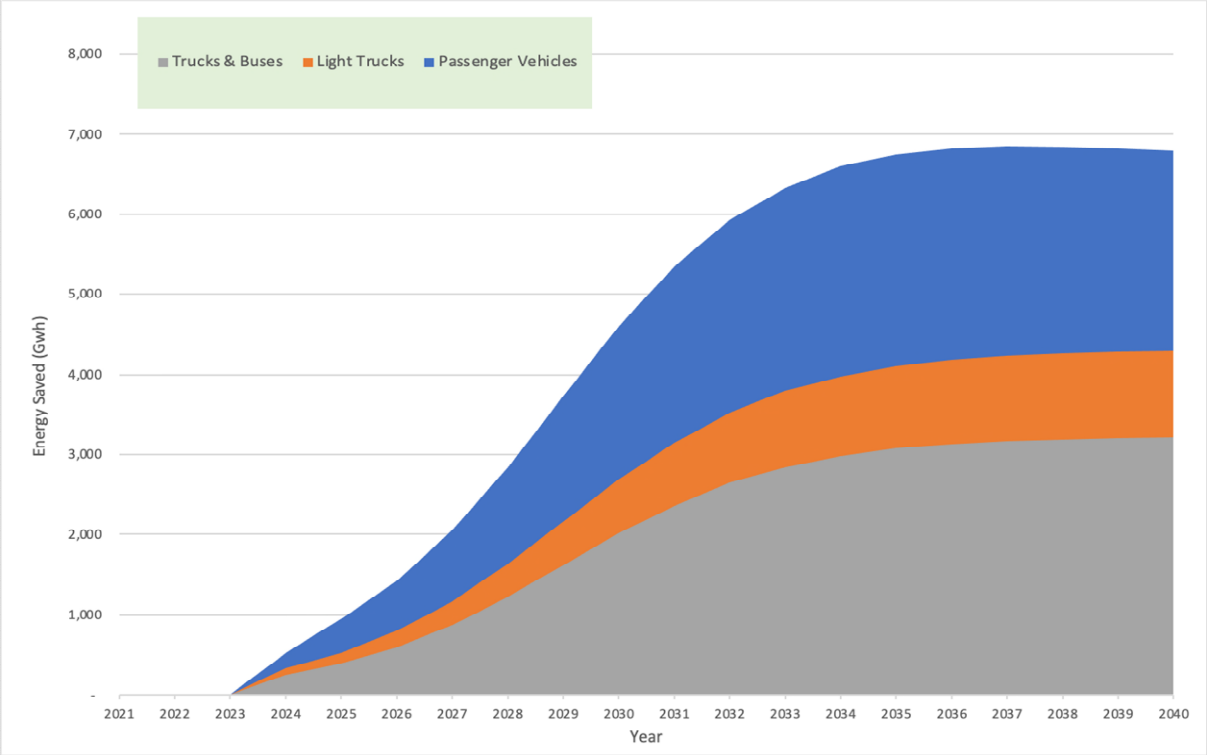
Assumption	**Fuel**	**Energy**	**Fuel Costs**
	Megalitres	*GWh*	*A$m*
Rolling Resistance reduced by 5%	360	3,700	$460
Rolling Resistance reduced by 10%	750	7,700	$960
Rolling Resistance reduced by 20%	1,600	16,300	$2,000

It should be noted that due to the high turnover rate of the tyre stock, changes in the performance of new tyres will have a more rapid impact compared to products with a longer average lifetime.

This savings potential estimate is based on the current profile of vehicles in Australia and New Zealand. If, as expected, there is a transition to electric vehicles then the savings to fuel and fuel costs would be less, since even when considering the primary energy consumption, electric vehicles consume in the region of one-third the energy of petrol/diesel vehicles per kilometre travelled. However, the use of low rolling resistance tyres in electric vehicles would still result in lower electricity consumption for charging and increase their distance travelled between charges, i.e their 'range'.

Figure 6 below shows the estimated impact of a 10% improvement in rolling resistance achieved by 2040 on vehicles in Australia and New Zealand. This estimate includes the increased sales of electric vehicles in current forecasts, which explains why annual energy savings reduce over time. It is also noticeable that the savings in heavy trucks are very significant, in part due to the lower rate of expected electrification in this sector.

Figure 6: Estimated annual energy savings from tyre MEPS & labelling, 2021-2040, Australia and New Zealand combined



The range of an electric vehicle is a key selling point and reducing road friction is one of the easiest and cheapest ways to extend the range. Therefore, considerable effort is being devoted to the development of increasingly low rolling resistance tyres.

In fact, because electric vehicles are heavier than conventional vehicles, tyre manufacturers have developed special tyres for this market. These tyres have low rolling resistance and high grip and durability properties, and because road noise is more noticeable in an electric vehicle, they also are designed to be quieter.

As a result, the labelling of tyres with key attributes is arguably going to be even more valuable to consumers as economies transition to electric vehicles.

9. Facilitating Projects

There are two projects discussed in this section comprising:

- The display of energy rating information online and in print advertising.
- Voluntary certification of electric fans.

These are considered separately to the others since they are difficult to evaluate on the same basis as the previous product regulations. However, they are considered important steps to stimulating further energy savings.

9.1 Display of Energy Rating Information Online and in Print Advertising

The ERL has been in existence in some form since 1986 and studies continue to show that it enjoys extremely high recognition rates amongst consumers, who value and are influenced by the information provided. For all relevant products, it is mandatory for the label to be displayed on products when offered for sale in a physical retail stores. The issue of whether similar information should be displayed in online environments and advertising media has been an ongoing concern for E3.

In 2010, E3 undertook a cost-benefit analysis on the mandatory use of energy label in print media and advertising, and this was followed up by a consultation RIS in 2011. The development of online retail around this time was causing many overseas energy labelling programmes to broaden the scope of their regulations and as a result, the GEMS Act was established with the intent to require mandatory labelling in online stores and in advertising media.

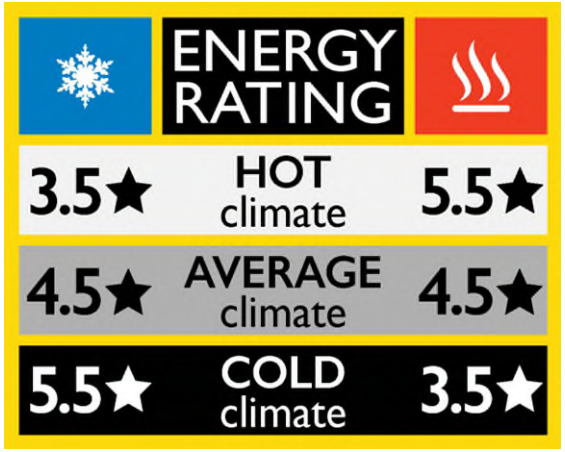
The GEMS Act does not itself identify how energy labels shall be used in relation to the 'offer to supply' but allows the GEMS determinations to specify the precise labelling requirements for a product class (see box below).

To date mandatory labelling online and in advertising has not been required, although E3 has extensively explored the promotion of voluntary labelling in these environments over recent years[27]. This has included making a smaller 'icon' version of label available and working with major retailers to encourage the use of the label or the icon in advertising and online. See for example the information available to all retailers on the energyrating website[28].

Most recently the 2019 GEMS determination for air conditioners provides an option for retailers wishing to display the ERL on advertising or online. In either case, the determination provides detailed specifications for the production and use of the icon (see Figure 7).

While there has been some voluntary use of the energy label and icon in advertising materials and online, this has been piecemeal and sporadic to date.

Figure 7: New ERL icon for air conditioners



[27] See EEAT Meeting 24 May 2017 discussion of 'Display of energy rating information online and in print advertising'
[28] https://www.energyrating.gov.au/retailers/labellingresources

The growth in the use of the internet by consumers to both search for new products and make direct purchases increases the case for requiring the energy label or its equivalent information available wherever GEMS products are offered for sale. In 2015, between 10-20% of sales of GEMS labelled products in Australia occurred online, and this has increased significantly in 2020-21 during the COVID pandemic.

Research conducted in 2018 for E3 demonstrate that consumer use of internet searches to identify models to buy is now highly significant, and show that trials of the energy label in online store environments influence purchasing decisions.

Given the potential to increase the impact of the energy label and thereby increase the uptake of high efficiency products, it is appropriate for labelling requirements to be extended to all 'offers to supply'. This would also redress the unequal burden on physical stores, making a level playing field across all retail environments.

Following a review Product Regulations in 2019 initiated by EECA[29] the Office of the Minister of Energy and Resources issued a discussion document in July 2021 proposing to '(2.3) *Include online sales in labelling requirements'*. Due to public support for this proposal, the online rating requirement is scheduled to come into effect in New Zealand in July 2022.

The decision to include labelling requirements for online sales in New Zealand, strengthens the argument to see this replicated in Australia. To proceed with mandatory labelling online and in print media in Australia, the next step is to produce a single consultation RIS (in effect updating the previous one) to examine the cost-benefit of introducing uniform requirements for the use of appropriate labelling information in advertising and online environments in all determinations covering GEMS labelled products.

If it is considered that there are insufficient resources available to proceed with mandatory labelling within the short term, then greater efforts could be made to encourage the voluntary use of the icon by retailers.

The GEMS Act requires GEMS determination to specify the labelling requirements for a product class, including:

(a) requirements relating to the information that must be communicated in connection with supplying or offering to supply products in that product class;

(b) requirements relating to the manner in which that information must be communicated (see subsection (2));

(c) requirements for conducting tests in relation to products in that product class, using the methods specified in the determination, in order to rate them against criteria specified for the product class in the determination for the purposes of complying with a requirement under paragraph (a).

Note: Requirements under paragraph (a) or (b) may relate, for example, to one or more of the following:

(a) the characteristics, contents, placement and quality of labels or marks attached or applied to products or displayed on packaging for products;

(b) documents or other material used for, or provided in connection with, the supply of products;

(c) advertising products.

9.2 Voluntary Certification of Electric Fan Units

It is proposed that E3 develop a voluntary certification program. The initial focus should be on electric fan units given the issues encountered in Section 5.4, however it would be sensible to allow for a potential broadening of scope to accommodate other industrial/commercial products if deemed to be useful at some future date.

[29] 'To ensure the Product Regulations and their legal-making power are clear, accessible, fit-for-purpose, and can continue supporting New Zealand's future energy efficiency and conservation, and emissions reduction goals'.

In order to act as a steppingstone to regulation, the suppliers of fan units should be encouraged to register through a process similar to that used for GEMS products, including the provision of evidence relating to the performance of registered models. Energy performance should be measured according to the method identified in the consultation RIS (ISO 5801: 2007). Information for other key attributes may also be required.

E3 will need to work with the industry to encourage participation. While some suppliers will no doubt see the benefit of early adoption, for most suppliers the perceived benefit of registering products will be enhanced by a public listing of registered products. There are advantages for E3 to both manage the registration process given the intention to regulate, and host the list of registered models, to add credibility as an independent authority. Publishing the list on the energyrating website would appear the best solution.

There is considerable international and local experience to draw on with respect to similar programs. Where such initiatives have been solely a listing of models that meet certain specified performance specifications, they have tended to be short-lived. However, they have proved highly effective in the following instances:

1. When used as the basis for the allocation of financial incentives, tax rebates, etc.
2. In transition to other program types such as regulation, audit, training and other support activities.

Examples of the first category include the UK Energy Technology List[30] which is a voluntary program that identifies criteria and products that are eligible for support under the UK Capital Allowance scheme[31]. Pacific Gas & Electricity (PG&E) is a major US utility that also provides rebates for certain equipment that it deems as energy efficient[32].

In Australia, the VEUP[33] identifies products that can attract Victorian energy efficiency certificates (VEECs). Installers of these identified products can then pass on some of the value of VEECs to customers as an incentive. The adoption of the proposed listing of electric fan units by the VEUP, and any similar programs, would significantly increase the attractiveness of voluntary certification.

We also have experience in Australia with the use of voluntary approaches as a transition to regulation for televisions and pool pumps. In both cases, E3 managed a registration, compliance and labelling program which have proved successful in helping industry transition to a regulatory environment.

There are numerous examples from the US of voluntary certification programs run by the Consortium for Energy Efficiency[34] amongst others that have now either been replaced by national regulations and/or been replaced by programs such as the Compressed Air Challenge[35].

In terms of priorities, this project should be considered of high priority in order to maintain the momentum and goodwill created with the industry, and to benefit the transition to regulation.

[30] https://etl.beis.gov.uk/purchasers
[31] https://www.gov.uk/capital-allowances/first-year-allowances
[32] https://www.pge.com/en_US/large-business/save-energy-and-money/business-solutions-and-rebates/product-rebates.page
[33] https://www.esc.vic.gov.au/victorian-energy-upgrades-program/participating-veu-program/veu-product-applicants
[34] https://www.cee1.org/
[35] https://www.compressedairchallenge.org/

10. Potential Impacts

This section provides the estimated impacts of the product regulations identified in previous sections, with the exception of the regulations for products that were due to sunset but which will be revised or extended, and for glazing as there is insufficient information available to date to make a reasonable estimate.

In all cases the impacts have been calculated over a 20 year time horizon[36], assuming that they all come into force in year zero. While in fact the regulation start dates would be staggered, the method used facilitates a comparison of the impacts of each regulation.

In general, the date of maximum impact will vary for each period depending upon the rate at which the stock is replaced. The savings shown here peak and remain constant once all the pre-regulation stock is replaced with regulated products. In reality, savings would then tend to fall year-on-year compared to an assumed business as usual rate of improvement until the exogenous rate of improvement matches the impact of the regulation. At this point the net savings would be reduced to zero, unless the stringency of the regulations was raised in line with technological improvement.

Figure 8 shows the estimated energy savings by product, over time (for the sake of comparison, assuming that all regulations come into force in year zero).

[36] As noted previously, the large majority of these estimates of energy savings are based on more detailed reports into specific products undertaken by E3 Members, unless specified otherwise.

Figure 8: Estimated additional energy savings in Australia and New Zealand over 20 years by product

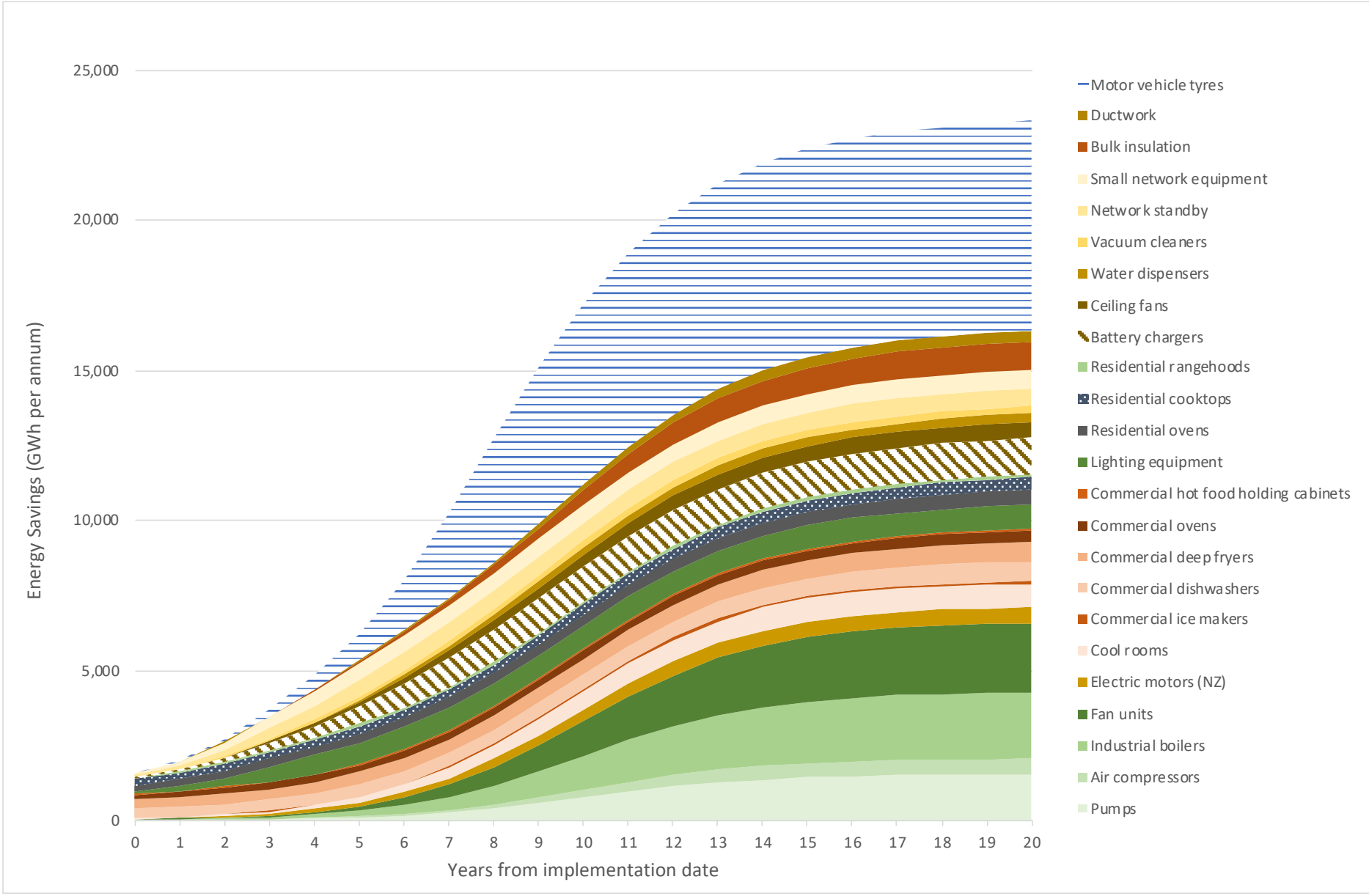


Table 11 show the estimated energy and greenhouse gas savings by product, in years 10 and 20.

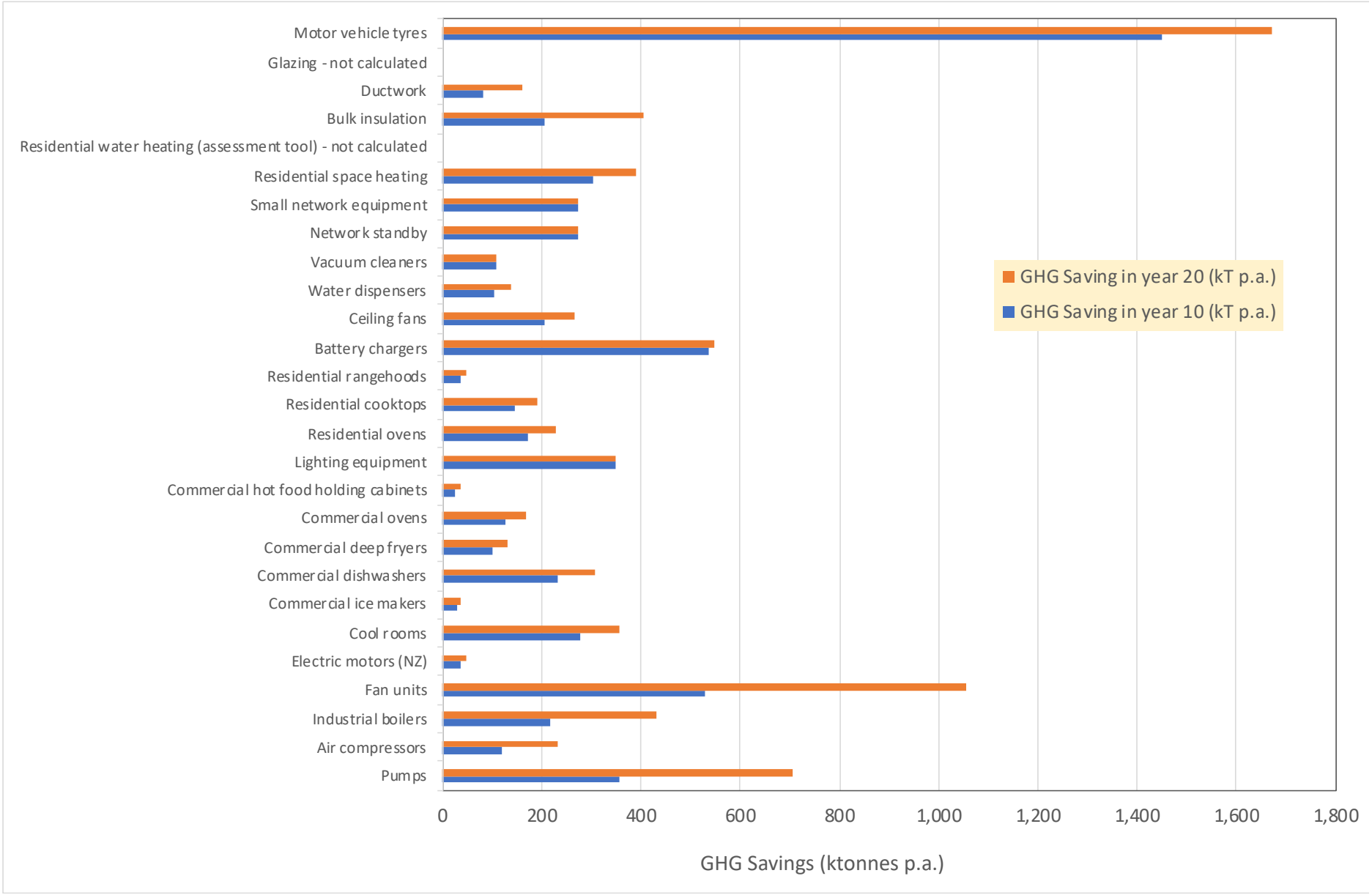
The greenhouse gas savings per product are shown graphically in Figure 9.

Table 11: Estimated additional energy savings in Australia and New Zealand in 10 and 20 years by product

Category	Product	Energy Savings (GWh p.a.)		GHG Saving (kT p.a.)	
		10 years	20 years	10 years	20 years
Industrial/Commercial	Pumps	780	1,550	356	708
Industrial/Commercial	Air compressors	258	513	118	234
Industrial/Commercial	Industrial boilers	1,117	2,218	218	433
Industrial/Commercial	Fan units	1,162	2,309	531	1,054
Industrial/Commercial	Electric motors (NZ)		520 *	36	47
Industrial/Commercial	Cool rooms	606	778	277	356
Industrial/Commercial	Commercial ice makers	62	80	28	36
Industrial/Commercial	Commercial dishwashers	510	830	223	228
Industrial/Commercial	Commercial deep fryers	510	760	95	97
Industrial/Commercial	Commercial ovens	280	420	89	91
Industrial/Commercial	Commercial hot food holding cabinets	60	90	9	9
Industrial/Commercial	Lighting equipment	767	767	350	350
Residential	Residential ovens	380	700	106	137
Residential	Residential cooktops	320	540	106	137
Residential	Residential rangehoods	82	140	35	46
Residential	Battery chargers	1,172	1,200	535	548
Residential	Ceiling fans	408	524	208	267
Residential	Water dispensers	233	299	106	137
Residential	Vacuum cleaners	234	240	107	110
Residential	Network standby	600	600	274	274
Residential	Small network equipment	600	600	274	274
Residential	Residential space heating	842	1,081	305	392
Residential	Residential water heating (assessment tool)	Not calculated			
Building Products	Bulk insulation	478	950	205	407
Building Products	Ductwork	191	380	82	163
Building Products	Glazing	Not calculated			
Other	Motor vehicle tyres	6,035	6,959	1,448	1,670

*** This is a preliminary estimate of the impact in New Zealand only for implementing only the first upgrade to IE3, which has a smaller impact than the second upgrade in 2026 to IE4*

Figure 9: Estimated additional greenhouse gas savings in Australia and New Zealand in 10 and 20 years by product



The impact on electricity demand resulting from the identified regulations has been estimated at the summer (4pm) and winter (6pm) peaks for Australia and New Zealand. Figure 10 and Figure 11 show the estimated maximum impacts (in year 20).

It should be noted that the analysis of peak demand undertaken for this Prioritisation Plan is relatively simplistic, and is included for general information only. The introduction of renewable energy sources into the grid has significantly changed the way that the peak demand of household appliances should be viewed, including the times of day and the direction of energy flow. This situation will continue to change into the future as renewable energy sources are further taken up. This kind of technical analysis would require a significant effort, involving research at a sub-national level, and EEAT may wish to address this in future.

Figure 10: Maximum peak demand savings, Australia (MW)

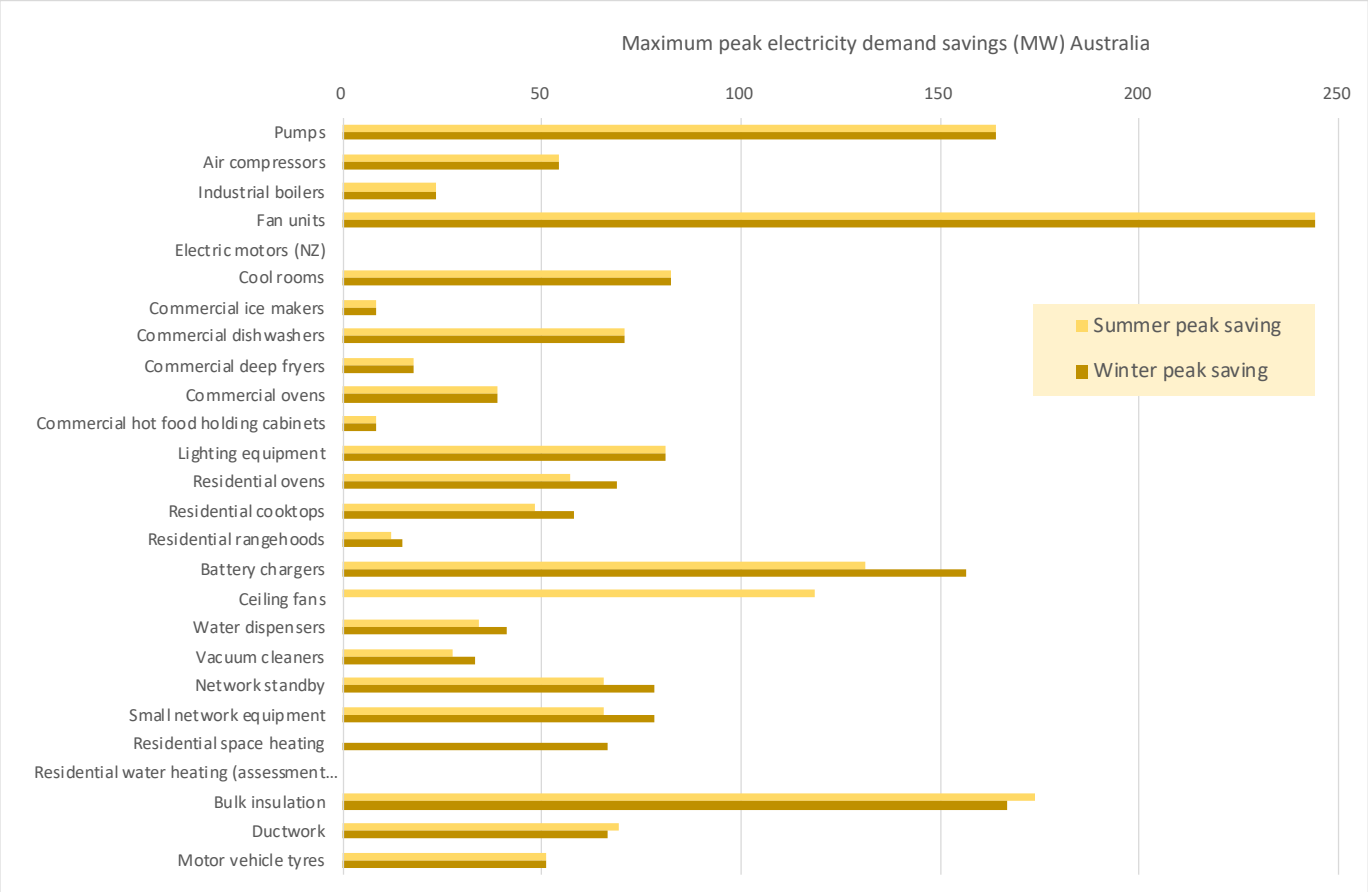
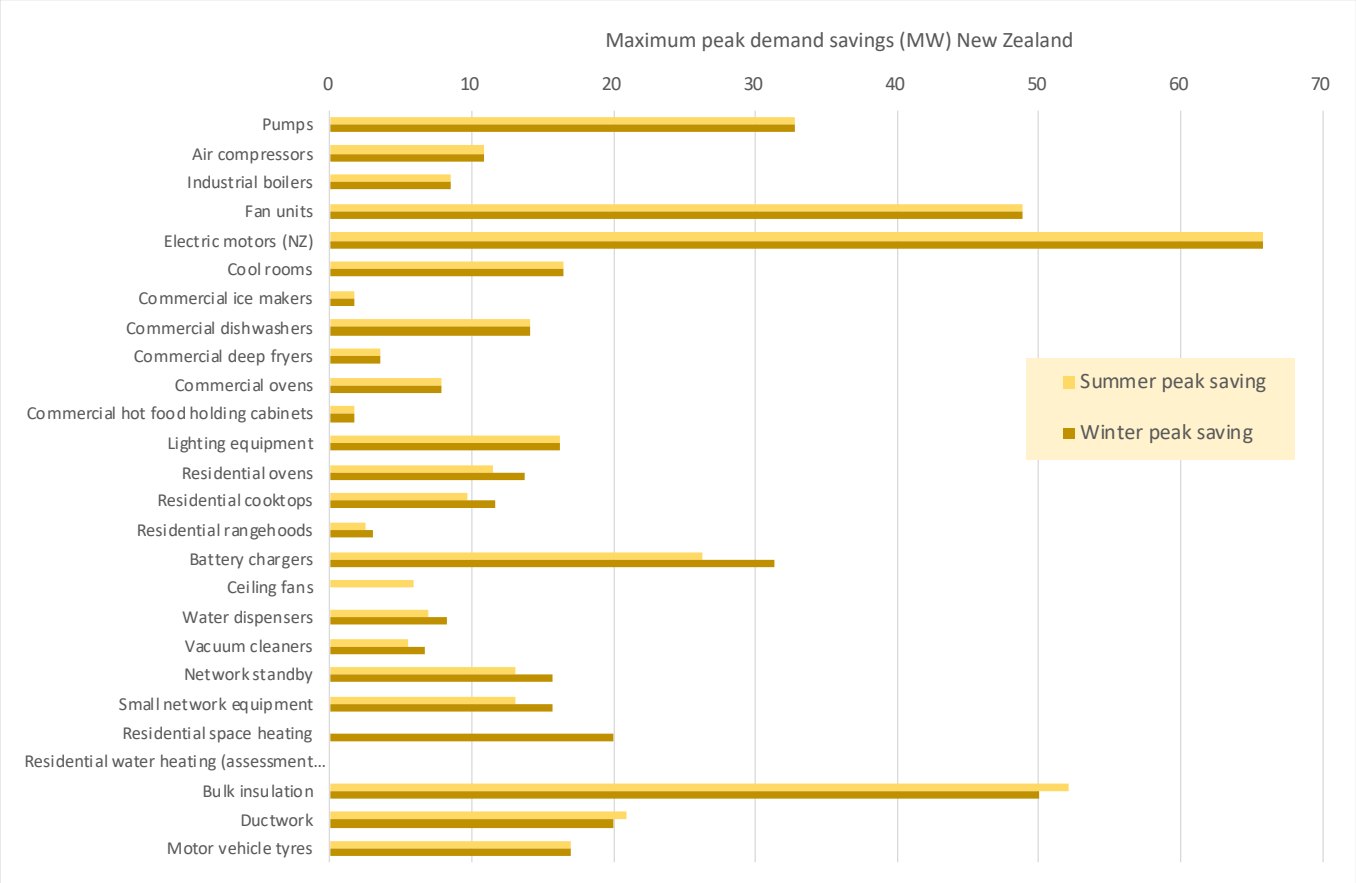
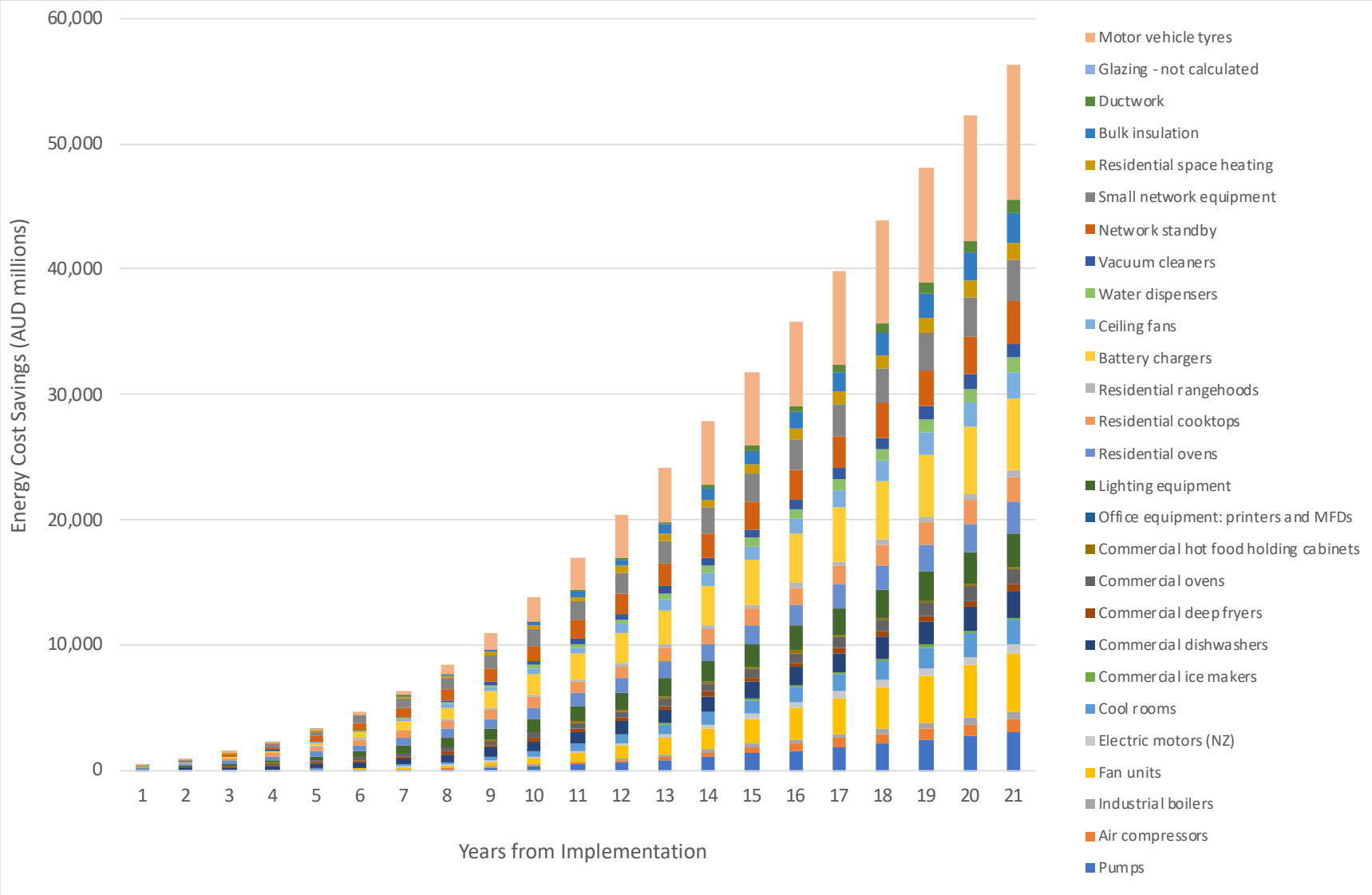


Figure 11: Maximum peak demand savings, New Zealand (MW)



It should be noted that the modelling for the impact of motor vehicle tyre regulations assumes a switch towards increased uptake of electric vehicles, which will result in an overall increase in electricity demand, however this will result with or without regulations on tyres. The impact of the regulation on tyres shown in the above figures goes a small way towards reducing this impact. The annual (cumulative) savings in energy costs per product are shown in Figure 12. The total present value of these savings is A$27 billion.

Figure 12: Cumulative total savings in energy costs over 20 years



11. Resource Implications

11.1 Resource Assumptions

This section considers the government resources required to enable each regulation to reach the implementation stage. The resources required for each product may vary depending upon the complexity, the availability of data and market information, and the degree of support from industry partners. The following therefore represents the assumed average values.

Financial resources may be needed for, amongst other items, funding expert consultants, legal advice and to purchase market research and/or data.

The resources required by government are primarily staff time and financial resources for fees. The assumed average resources required for each stage are shown in Table 12. For the purposes of this analysis, resources can be switched between each stage without significant impact, so long as the overall total resources per regulation are not affected.

It should be noted that there can be a trade-off between staff time and financial resources, for example where it is considered expedient to use external consultants as a replacement for government staff.

Table 12: Assumed resources required for development of regulation per development stage

Stage	Staff	Duration	Fees (A$)
Preliminary investigation	1 member of staff, fully occupied	6 months	20,000
Discussion document	1 member of staff, fully occupied	6 months	30,000
Consultation RIS	1 member of staff, fully occupied	9 months	50,000
Decision RIS	1 member of staff, fully occupied	6 months	10,000
Ministerial approval	1 member of staff, half time	3 months	0
Implementation	Not considered		Not considered
Total		**30 months**	***$110,000***

Key exceptions to these assumptions are for the proposed voluntary certification scheme for fan units, and for the amendments to the GEMS Act (the 'Facilitation' projects). The resource assumptions for these two projects are shown in the table below. For the GEMS Reform project, the resources indicated are for the processes involved in changing the Act and do not include subsequent work.

Table 13: Assumed resources required for development of facilitation projects

Projects	Staff	Duration	Fees (A$)
Voluntary fans certification scheme	1.5 member of staff, fully occupied	12 months	100,000
GEMS Reform	1 member of staff, half time	24 months	20,000

11.2 Overall Resource Implications

Based on the previous assumptions shown in Figure 2 regarding the stage of development of regulatory projects at the start of the period of this Prioritisation Plan, the additional stages to be completed are shown in Figure 13 below.

It should be noted that this also assumes that all projects commence at the same time, and at the start of the period being considered. This is extremely unlikely to occur in reality for a range of practical reasons and in order to spread resources more evenly over the three year period. Nevertheless is provides an estimate of the maximum resource needs if all the projects were to go ahead.

Figure 13: Development stages to be completed for regulated products

	Year 1				Year 2				Year 3			
	1st qtr	2nd qtr	3rd qtr	4th qtr	1st qtr	2nd qtr	3rd qtr	4th qtr	1st qtr	2nd qtr	3rd qtr	4th qtr
Ballasts for fluorescent lamps	stage 2		stage 3			stage 4		stage 5				
Transformers & converters ELV lamps	stage 2		stage 3			stage 4		stage 5				
Close control air conditioners	stage 2		stage 3			stage 4		stage 5				
Distribution transformers	stage 2		stage 3			stage 4		stage 5				
Computer monitors	stage 2		stage 3			stage 4		stage 5				
External power supplies	stage 2		stage 3			stage 4		stage 5				
Electric water heaters	stage 2		stage 3			stage 4		stage 5				
Commercial chillers	stage 2		stage 3			stage 4		stage 5				
Pumps	stage 3			stage 4		stage 5						
Air compressors	stage 3			stage 4		stage 5						
Industrial boilers	stage 3			stage 4		stage 5						
Fan units	stage 4		stage 5									
Electric motors (NZ)	stage 3			stage 4		stage 5						
Cool rooms	stage 1		stage 2		stage 3				stage 4		stage 5	
Commercial ice makers	stage 2		stage 3			stage 4		stage 5				
Commercial dishwashers	stage 2		stage 3			stage 4		stage 5				
Commercial deep fryers	stage 2		stage 3			stage 4		stage 5				
Commercial ovens	stage 2		stage 3			stage 4		stage 5				
Commercial hot food holding cabinets	stage 2		stage 3			stage 4		stage 5				
Lighting equipment	stage 1		stage 2		stage 3				stage 4		stage 5	
Residential ovens	stage 2		stage 3			stage 4		stage 5				
Residential cooktops	stage 2		stage 3			stage 4		stage 5				
Residential rangehoods	stage 2		stage 3			stage 4		stage 5				
Battery chargers	stage 1		stage 2		stage 3				stage 4		stage 5	
Ceiling fans	stage 2		stage 3			stage 4		stage 5				
Water dispensers	stage 2		stage 3			stage 4		stage 5				
Vacuum cleaners	stage 2		stage 3			stage 4		stage 5				
Network standby	stage 1		stage 2		stage 3				stage 4		stage 5	
Small network equipment	stage 1		stage 2		stage 3				stage 4		stage 5	
Residential space heating	stage 3			stage 4		stage 5						
Res water heating (assessment tool)												
Bulk insulation	stage 1		stage 2		stage 3				stage 4		stage 5	
Ductwork	stage 1		stage 2		stage 3				stage 4		stage 5	
Glazing	stage 1		stage 2		stage 3				stage 4		stage 5	
Motor vehicle tyres	stage 1		stage 2		stage 3				stage 4		stage 5	
ERL information online	stage 3			stage 4		stage 5						
Fans certification scheme	All stages											

Key to stages	**1**. Preliminary investigation	**2**. Discussion document	**3**. Consultation RIS	4. Decision RIS	5. Ministerial approval	6. Implementation

Based on the data in Figure 13 and the assumed staff and financial resources required for each stage, Figure 14 presents the estimated total resource requirements.

This indicates a maximum of 33 full time staff would be required if all projects were to commence simultaneously. The total financial resources required are estimated to be A$2.9 million. If optimised over the whole 3 years period, an average of 20.3 full time staff would be required and a budget of A$950,000 per annum.

These costs represent a small fraction of the total estimated reduction of A$27 billion (present value) in cumulative fuel bills up to 2040.

Figure 14: Estimated total resources required for regulatory development

Table 14 provides a summary of the resource, energy saving, greenhouse gas and peak saving estimates, by product. As discussed in section 10, peak savings estimates are simplistic only at this stage.

Note that projects that are in the process of development are colour coded as follows:

KEY	
Current regulations due to sunset	
Ongoing – previous E3 priority	
Ongoing – under NSW management	
Ongoing – under New Zealand management	

Table 14: Comparison of resource, energy savings and peak savings estimates, by product

Category	Product/Project	Staff	PV of Savings	Energy Saving	Energy Saving	GHG Saving	GHG Saving	Emissions Savings to 2030	Summer Peak Saving
		FTE	($m over 20 years)	in year 10 (GWh p.a.)	in year 20 (GWh p.a.)	in year 10 (kT p.a.)	in year 20 (kT p.a.)	(cumulative ktonnes)	in year 20 (MW)
Sunset	Ballasts for fluorescent lamps	1.88	Estimates not available						
Sunset	Transformers and converters for ELV lamps	1.88	Estimates not available						
Sunset	Close control air conditioners	1.88	Estimates not available						
Sunset	Distribution transformers	1.88	Estimates not available						
Sunset	Computer monitors	1.88	Estimates not available						
Sunset	External power supplies	1.88	Estimates not available						
Sunset	Electric water heaters	1.88	Estimates not available						
Sunset	Commercial chillers	1.88	Estimates not available						
Ind/Comml	Pumps	1.38	1,462	780	1,550	356	708	7,490	197
Ind/Comml	Air compressors	1.38	484	258	513	118	234	2,477	65
Ind/Comml	Industrial boilers	1.38	282	1,117	2,218	218	433	4,572	32
Ind/Comml	Fan units	0.63	2,179	1,162	2,309	531	1,054	11,160	293
Ind/Comml	Electric motors (NZ)	1.38	384	404	519	36	47	607	66
Ind/Comml	Cool rooms	2.38	1,004	606	778	277	356	4,634	99
Ind/Comml	Commercial ice makers	1.88	103	62	80	28	36	475	10
Ind/Comml	Commercial dishwashers	1.88	1,185	510	830	233	306	4,921	85
Ind/Comml	Commercial deep fryers	1.88	323	510	760	99	131	2,056	21
Ind/Comml	Commercial ovens	1.88	651	280	420	128	168	2,703	47
Ind/Comml	Commercial hot food holding cabinets	1.88	139	60	90	27	36	577	10
Ind/Comml	Lighting equipment	2.38	1,528	767	767	350	350	6,367	97

Category	Product/Project	Staff	PV of Savings	Energy Saving	Energy Saving	GHG Saving	GHG Saving	Emissions Savings to 2030	Summer Peak Saving
		FTE	(A$m, 20 years)	in year 10 (GWh p.a.)	in year 20 (GWh p.a.)	in year 10 (kT p.a.)	in year 20 (kT p.a.)	(cumulative ktonnes)	in year 20 (MW)
Residential	Residential ovens	1.88	1,377	380	700	174	228	3,669	69
Residential	Residential cooktops	1.88	1,159	320	540	146	192	3,088	58
Residential	Residential rangehoods	1.88	298	82	140	38	49	793	15
Residential	Battery chargers	2.38	3,020	1,172	1,200	535	548	8,525	157
Residential	Ceiling fans	1.88	1,066	408	524	208	267	3,477	125
Residential	Water dispensers	1.88	602	233	299	106	137	1,782	41
Residential	Vacuum cleaners	1.88	604	234	240	107	110	1,705	33
Residential	Network standby	2.38	1,863	600	600	274	274	4,980	79
Residential	Small network equipment	2.38	1,863	600	600	274	274	4,980	79
Residential	Residential space heating	1.38	724	842	1,081	305	392	5,105	0
Residential	Residential water heating (assessment tool)		Not calculated						
Residential	Bulk insulation	2.38	1,145	478	950	205	407	4,308	226
Residential	Ductwork	2.38	458	191	380	82	163	1,723	90
Residential	Glazing	2.38	Not calculated						
Residential	Motor vehicle tyres	2.38	5,388	6,035	6,959	1,448	1,670	21,710	68
Facilitation	ERL information online	0.50	Not calculated						
Facilitation	Fans certification scheme	1.50	Not calculated						
Total		**61**	**26,943**	**17,686**	**23,486**	**6,124**	**8,204**	**106,863**	**1,960**

12. Draft Recommendations

The 38 products originally listed in Figure 2 have been reduced to a shortlist of 36 products/projects in this Prioritisation Plan. The change in the total is due to:

- Addition of 'projects': ERL information online and fans certification scheme (+2).
- Office equipment not proceeding (-1).
- Building products (bulk insulation, flexible ductwork, glazing) reduced to bulk insulation only (-2).
- Network standby and small network equipment are combined (-1).

10 existing determinations are due to sunset and are therefore under review. At the time of writing, 8 of these are still awaiting a final agreement by E3 on how to proceed. Those identified for revision should be considered a priority and E3 will need to allocate resources to ensure that these can be finalised in time to ensure a smooth transition.

18 product assessments are currently under development. Of these 5 are carried over from the previous E3 work plan and 11 are being pursued by the NSW Government. New Zealand is developing an assessment tool for water heaters, and is also in the process of upgrading MEPS for electric motors in New Zealand and this work might usefully be extended to cover Australia.

All of these 18 assessments represent previous commitments by 4E members based on their potential to increased energy savings, and considerable work has been invested to date. **It is therefore recommended that these continue along the regulatory development pathway, accepting that some may not reach fruition.**

This prioritisation process has identified an additional 8 products/projects that are considered a future priority. For these, work has either not yet commenced or has stalled in recent years. These are as follows:

- battery chargers
- network standby and small network equipment
- ERL information online
- fans certification scheme (other products added as required)
- motor vehicle tyres
- cool rooms
- lighting equipment
- building products: bulk insulation.

These projects have been prioritised as either 'near term' or 'medium term' according to the amount of perceived effort and lead time required. Note that the designation as 'medium term' does not necessarily mean that development work should not commence right away. An example is motor vehicle tyres which is a new product for Australia and New Zealand, in an area that has not typically been subject to energy efficiency policy, thus it is likely to require a significant lead time and will benefit from preliminary development work commencing as soon as possible.

For these 'new' product regulations it would be prudent to commence development with a broad assessment of risks with particular focus on highlighting any impediments posed by the current GEMS Act. This review could also serve to identify how improvements might be made in the

future to the legislation in order to support increased energy and greenhouse gas savings.

12.1 Near Term Projects

The near term projects are briefly discussed below, in no particular order.

Battery Chargers, External and Uninterruptible Power Supplies, and LED Drivers

The potential upgrading/expansion of external power supply MEPS could be widened to incorporate battery chargers, LED drivers and uninterruptible power supplies. These products share many similarities (including methods of test) and it is considered that their inclusion into one single determination would clarify issues about product definitions and reduce the amount of effort required. Given the proposal to review and increase the stringency of regulations for external power supplies, there is a near term opportunity to expand the external power supplies regulation to cover the other three products.

Network Standby and Small Network Equipment

Network-connected devices and small network equipment should be combined into a single regulation, as is the case in Europe. Adoption of the European horizontal regulation by Australia and New Zealand would make sense since many of the products are internationally traded. As discussed in section 6.6, in Australia at least, it should be possible to regulate these products horizontally, while exempting them from the requirement to be registered. Thus this is considered a near term opportunity.

Display of Energy Rating Information Online and in Print Advertising

Mandatory display of energy rating information online and in print advertising would require the determination for each product to be altered. A consultation RIS is required to assess the costs and benefits of changing all determinations covering GEMS labelled products. However this is a considerable task and would take some time, even though no technical work is required and there are no other regulatory impediments. Given the recent migration of significant sales to online and the recent decision by New Zealand to proceed with this for products labelled in New Zealand, this is considered a near term priority. Work should commence immediately, with preparation of icons for all labelled products and the incorporation of their mandatory use within determinations. While this is underway, communications efforts should be stepped up to encourage wider use of the icon on a voluntary basis.

Voluntary Certification Scheme

Given the challenges of regulating fan units, with respect to the GEMS Act, this product would suit a voluntary certification scheme as outlined in section 9.2. If other products, for example pumps, compressors, cool rooms, etc. should encounter similar challenges, they could be considered for inclusion in the voluntary certification scheme. As there are no regulatory impediments, this project should be commenced in the near term so as to maintain the momentum with the industry. It is important however that work on reforming the GEMS Act continues so that the affected products can ultimately be regulated.

12.2 Medium Term Projects

Motor Vehicle Tyres

Motor vehicle tyres represent a significant energy savings opportunity. There is potential for Australia and New Zealand to adopt policies for tyres, and it makes sense to leverage the European scheme as there are many products common to both markets. To minimise costs for suppliers, the European tyre labelling scheme could be adopted in Australia and New Zealand, with the label graphically translated to match the star rating scheme which is familiar to Australian and New Zealand consumers. Tyres could also be introduced on a voluntary basis to

begin with, as a precursor to a mandatory MEPS and/or labelling scheme, although this would have a limited impact unless accompanied by an education programme targeted at tyre installers. Given that tyres are a new class of product for energy efficiency regulation, there is likely to be significant effort and lead time required. It is recommended that efforts commence right away, with a preliminary risk analysis and a view to introducing regulation in the medium term.

Cool Rooms

Cool rooms (and potentially the refrigeration compressor / condenser units that supply them and other applications) are likely to require significant effort to develop, including study of the US regulations (which involve some complexity in regulating 'as built' cool rooms) and EU proposals. Hence this is viewed as a medium term opportunity.

In the meantime, the option of developing voluntary certification could examined (linked to the development of the voluntary certification of fan units) if supported by the key industry actors.

Lighting Equipment

Further regulation of lighting equipment could involve:

- phasing out of CFL, fluorescent and HID lamps (as is being undertaken / considered in Europe)
- performance MEPS for integrated LED luminaires
- performance MEPS for LED drivers (the circuit required to drive an LED light source)
- energy labelling of lamps and luminaires.

LED drivers are mentioned above as a near term project. MEPS for LED lighting fixtures was excluded from recent LED lighting regulations at the request of the industry due to incompatibility with the current GEMS registration system. This issue may be resolved through revisions to the GEMS Act, or alternatively, a voluntary registration system could be established. However, the phasing out of CFL, fluorescent and HID lamps has merit, as does energy labelling, and these initiatives could be investigated as a medium term project, following closely the developments in Europe.

Building Products

Regulation of building products has the potential to deliver significant energy savings, although it is not possible for New Zealand to regulate in this area, and these products are somewhat outside the regular scope of products considered by E3. Hence building products are not considered to be a high priority for this Prioritisation Plan, but should not be removed from the scope of the GEMS Act and if resources allow, consideration should be given to exploring regulations for bulk insulation to ensure that these products perform as claimed.

Attachment 1: Energy Efficiency Program Coverage in the US and EU

In recent years, the range of products regulated for energy efficiency in the EU and in the US/Canada has expanded, although it should be noted that the trigger for regulation, product coverage and the process for setting regulatory thresholds varies between these jurisdictions.

The presence of existing regulations in these major economies is a useful place to start examining the potential expansion of the Australia and New Zealand program, since it indicates that:

- There is a pre-existing method of testing, which is considered sufficiently accurate and robust to support the enforcement of regulation.
- Technology improvements and savings estimates are thoroughly investigated and may be transferrable on a pro-rata (or other) basis to the Australia and New Zealand market, given the considerable resources allocated by these economies in researching the products in question.
- Some performance data will be available for products in that market and, where these are internationally traded, this may assist in understanding the performance of products sold locally.
- Global suppliers will understand many of the key processes involved in regulation, albeit that they vary slightly between jurisdictions, and may be more receptive than 'new' industry players who have not yet been exposed to any regulation.
- Inefficient products, where regulated elsewhere, could be 'dumped' on our market if not regulated in Australia and New Zealand, or if the Australian and New Zealand regulatory levels are less stringent than in major economies.

There will likely be some lessons learned by other economies that we could also learn from in developing the E3 prioritisation plan.

However, some caution is needed in considering the suitability of products regulated elsewhere, since:

- The legislative framework of other jurisdictions may provide different opportunities to those available in Australia and New Zealand.
- Technologies may differ between economies, which will affect both the assessment of individual product performance and overall savings potentials.
- The technical scope of regulation may not suit our local market.
- The market size and savings opportunities may not scale pro-rata.
- There may be environmental differences which make comparison difficult, e.g. climate.

Table 15 lists products regulated in the USA, as well as those actively being developed (under consideration).

Table 15: Coverage of product regulations in US

Residential	Commercial/Industrial	Lighting
Battery Chargers	Automatic Commercial Ice Makers	Ceiling Fan Light Kits
Boilers	Boilers, Commercial	Compact Fluorescent Lamps
Ceiling Fans	Clothes Washers, Commercial	Fluorescent Lamp Ballasts
Central Air Conditioners and Heat Pumps	Commercial CAC and HP (65,000 Btu/hr to 760,000 Btu/hr)	General Service Fluorescent Lamps
Clothes Dryers	Commercial CAC and HP (<65,000 Btu/hr)	General Service Lamps
Clothes Washers	Commercial CAC and HP (Water- and Evaporatively-Cooled)	Illuminated Exit Signs
Cooking Products	Commercial Refrigeration Equipment	Incandescent Reflector Lamps
Dehumidifiers	Commercial Warm Air Furnaces	Mercury Vapor Lamp Ballasts
Direct Heating Equipment	Commercial Water Heaters	Metal Halide Lamp Fixtures
Dishwashers	Computer Room Air Conditioners	Torchiere Lighting Fixtures
External Power Supplies	Distribution Transformers: Liquid-Immersed	Traffic Signals
Faucets	Distribution Transformers: Low-Voltage Dry-Type	
Furnace Fans	Distribution Transformers: Medium-Voltage Dry-Type	**Other**
Furnaces	Electric Motors	Light vehicles (under the Department of Transport)
Microwave Ovens	Packaged Terminal AC and HP	Medium and Heavy vehicles (under the Department of Transport)
Pool Heaters	Pre-Rinse Spray Valves	Windows (ENERGY STAR)[37]
Portable Air Conditioner	Pumps, Commercial and Industrial	Insulation (ENERGY STAR)
Refrigerators and Freezers	Single Package Vertical Air Conditioners and Heat Pumps	
Room Air Conditioners	Small Electric Motors	
Showerheads	Unit Heaters	
Televisions	Urinals	
Toilets	Vending Machines	
Water Heaters	Walk-In Coolers and Freezers	
	Water-Source Heat Pumps	
Products under development		
Pool Pumps	Air Compressors	
	Uninterruptible Power Supplies	

Table 16 lists products regulated in the EU, as well as those actively being developed.

[37] ENERGY STAR is national endorsement labelling program in the US.

Table 16: Coverage product regulations in EU

Regulated products	Products under development
Space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device	Industrial ovens
Professional refrigerated and freezing storage cabinets	Steam boilers
Water heaters, hot water storage tanks and packages of water heater and solar device	Power cables
Distribution and power transformers	Lifts
Computers and computer servers	Professional wet appliances and dryers
Televisions	Uninterruptible power supplies
Welding equipment	Pumps for wastewater
Tertiary air conditioning and ventilation systems	Large pumps, and pumps for pools & fountains
Battery chargers and External power supplies	Air compressors
Linear and compact fluorescent lamps, HID lamps and ballasts	Window products (labelling)
Enterprise servers	Smart appliances
Residential ventilation units	Solar PV modules, inverters and systems
Room air conditioner appliances	Building automation and control systems
Electric motors	Refrigerated containers
Circulators in buildings	Batteries
Ventilation fans	Machine tools
Water pumps	High pressure cleaners
Refrigerating appliances with a direct sales function	Taps and showerheads
Household refrigerating appliances	
Household dishwashers	
Solid fuel boilers and packages of a solid fuel boiler, supplementary heaters, temperature controls and solar devices	
Household tumble driers	
Vacuum cleaners	
Simple set-top boxes	
Directional lighting	
Domestic lighting and light sources	
Local space heaters	
Central heating products	
Domestic ovens, hobs and range hoods	
Coffee machines	
Household washing machines	
Standby and off mode losses	
Networked standby losses	
Domestic washing machines	
Tyres	
Cars	
Vans	
Heavy-duty vehicles	

Attachment 2: Treatment of Registrations and Potential Amendment of the GEMS Act

The responses to the RIS for electric fan units has raised a number of issues that have to date impeded taking this regulation forward into a decision RIS. Although these issues have been identified in relation to electric fan units, several of these might equally apply to other product categories that are being considered for regulation.

The key issues highlighted to date that have wider implications include:

- the burden of suppliers registering a large number of models;
- the burden of registering models that are designed but may never be sold;
- the burden of registering models that are only ever sold in small numbers;
- the ability to exempt some products from compliance and/or registration based on their end-use application, in order to avoid double regulation

In these instances, the burden on suppliers includes both the effort to complete and maintain a model registration and the payment of registration fees.

A report in 2018 by George Wilkenfeld and Associates[38] for the Department of Environment and Energy examines these issues in detail (amongst others) to determine potential changes needed to the GEMS Act. In particular, the report aims to distinguish between which issues can be 'fixed' within the current Act and where solutions may require amendments to the Act.

The following attempts to summarise these findings, although it does not cover all the issues discussed in the Report, particularly those related to implications for revenue raising. It is recommended that the full report should be considered.

Products with a large number of models per supplier

There are many product categories that have large numbers of models per suppliers (e.g. lamps) and this is best dealt with by allowing related models to be registered in families. Within the technical criteria for models and family groups, there should not be a limit on the number of models in a family. Suppliers can then make their own decisions about how to group families – or maintain separate model registrations - based on their perceptions of administrative convenience and compliance risk.

Products designed but not yet built

The current definition of an offer to supply within the meaning of the Act covers the documented design of a new model creating an obligation to register the model, whether or not it is ever actually supplied.

To remove the obligation to register new designs for GEMS products (an obligation not enforced at present) it would be necessary to specify that an offer to supply arises if a product actually exists and is available for supply at the time of offer (which would cover nearly every GEMS product), or if an order is placed for its delivery (which would exclude designs that are never actually supplied).

Low volume products

One a model is registered (on its own or as part of a family) the supplier may still expect to sell it in very low numbers. Computers offer an example of how this situation has been handled previously.

[38] George Wilkenfeld and Associates, Greenhouse and Energy Minimum Standards (GEMS) Act: Product Registration Issues, Report to the Department of Environment and Energy, Draft 2, March 2018

The GEMS (Computers) Determination 2013 designates a "deemed to comply" sub-class of computers. A computer model qualifies as a members of this sub-class if:

- No more than 200 computers of the same model have been or will be supplied in any one year (from the date of the first supply)
- The model meets the energy requirements in a separate clause (4.4) of the test standard (AS/NZS 5813.2:2012), which is a more limited test than that which applies to other computers.

This approach can only be enforced if the sales numbers can be audited by the Regulator. Under New Zealand legislation, imports, exports and sales in New Zealand of every registered model must be reported annually to EECA. Section 56 of the GEMS Act empowers the GEMS regulator to seek this type of information, but the power has never been invoked[39].

Exclusions on the basis of end-use

Suppliers of air conditioners and ducted gas heaters wish to be excluded from complying with possible regulations on electric fans on the basis that these products are already required to meet product level energy efficiency regulations and should not be required to meeting requirements for component parts (E.g. electric fans).

Up to now, determinations have exempted categories of product from compliance (and registration) based on physical or functional characteristics (e.g. refrigerators intended for the storage of wine). Determinations have also set different testing/declaration requirements for groups of complying product according to the numbers sold (e.g. computers).

However, they have not so far exempted from compliance a category of products based on their intended purpose or form of supply, as envisaged by the fan-unit proposals.

Currently, the Regulator can grant compliance exemption for those fan-unit models that are supplied to (identified) OEMs of end-use products, but only on an individual model basis. Those exempted models would still need to be registered.

Changes to the GEMS Act would be required in order to provide the Regulator with the discretion to grant exemptions (either for compliance or registration or both) for groups of GEMS products based on their end-use.

Nomenclature

There is already a range of approaches used in existing determinations to delineate product sub-classes, model criteria and family criteria for each GEMS product. However, it would be helpful for similar cases to be treated in consistent ways. The concepts that need clarification are "deemed-to-comply", "custom designed", "parent model", "basic model" and "built-to-order".

[39] Since this report was published, The GEMS Regulator requested Kirby air conditioning to provide "evidence of sales volumes to demonstrate compliance with subparagraph (6)(b)(iv), under section 56 of the Greenhouse and Energy Minimum Standards Act 2012 (15 July 2021).

Attachment 3: Fuel Efficient Tyres

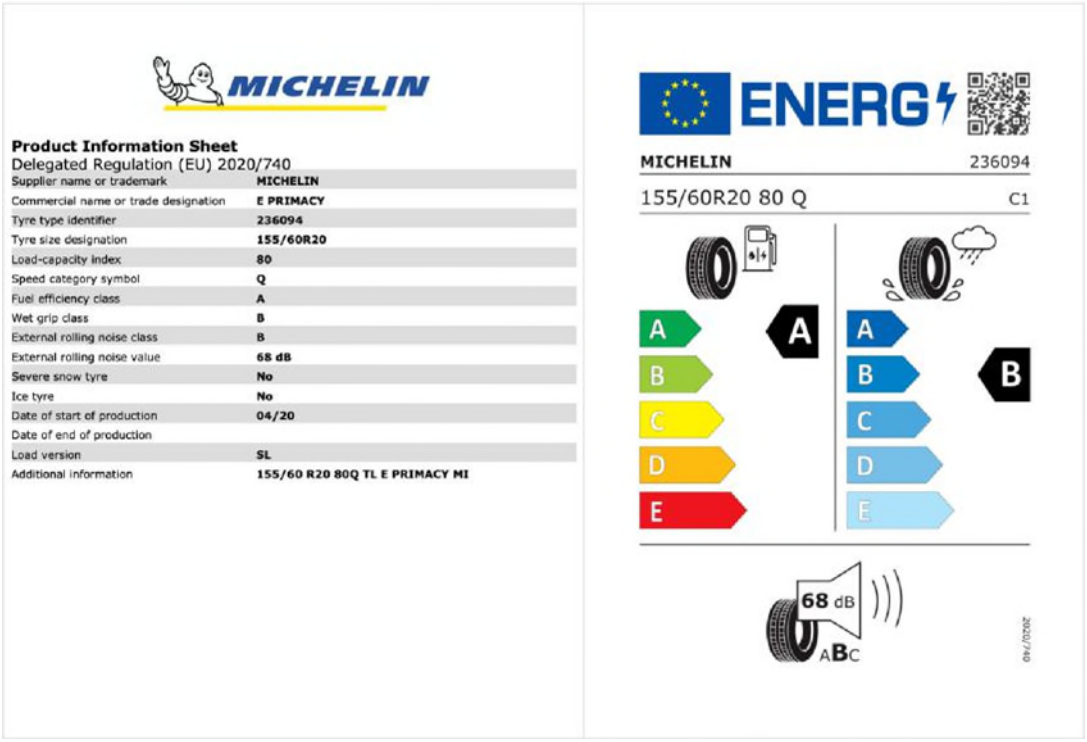
Tyres have been subject to MEPS[1] and/or mandatory energy labelling in the EU[2], South Korea, Brazil and Japan for several years, and are under development in Canada (see Table 1 for a summary).

New Zealand introduced a voluntary fuel efficient tyre program (based on rolling resistance) in 2014. A 2016 evaluation of the program indicated that, although it had been supported by tyre distributors, sales of more efficient tyres had not increased due to poor retailer buy-in and the inability of motor dealers to pass on additional costs to consumers[3]. A New Zealand report noted that other approaches may be more successful, but these were not identified.

Although many tyre companies in Australia and New Zealand make claims about the energy efficiency of their products and their performance, consumers do not currently have access to unbiased information about the rolling resistance, wet grip performance or rolling noise of tyres. (See for an example of the information currently provided to consumers in Europe).

Overseas energy efficiency tyre programs typically cover rolling resistance, wet grip and external rolling noise, which consumers appear to find more valuable than fuel efficiency only[4]. Using these three parameters encourages manufacturers to optimise energy efficiency without sacrificing safety.

Figure 1: Example of tyre product information sheet and European tyre label



MICHELIN

Product Information Sheet
Delegated Regulation (EU) 2020/740

Supplier name or trademark	MICHELIN
Commercial name or trade designation	E PRIMACY
Tyre type identifier	236094
Tyre size designation	155/60R20
Load-capacity index	80
Speed category symbol	Q
Fuel efficiency class	A
Wet grip class	B
External rolling noise class	B
External rolling noise value	68 dB
Severe snow tyre	No
Ice tyre	No
Date of start of production	04/20
Date of end of production	
Load version	SL
Additional information	155/60 R20 80Q TL E PRIMACY MI

It is likely that a regulatory approach covering these three parameters would overcome several of the challenges that hindered the New Zealand scheme, deliver energy savings and improve road safety.

[1] EU Regulation No 661/2009, 13 July 2009

[2] EU Regulation 1222/2009 was implemented in 2009 and updated in 2020 (2020/740).

[3] EECA (2016), Programme Review: Fuel Efficient Tyres, 2016.

[4] Final Report, Review study on the Regulation (EC) No 1222/2009 on the labelling of tyres, Prepared by Viegand Maagøe A/S, March 2016

Table 1: Overseas fuel efficient tyre regulatory programs

	MEPS	Mandatory Labelling
Europe	2012 Updated in 2021	2012 Updated in 2021
South Korea	2013 passenger vehicles) 2014 (small trucks)	2012 (passenger vehicles) 2013 (small trucks)
Brazil	2015	2015
Japan		2010
China		2017
Canada	In development	In development
USA		Under consideration

The following sections provide further information on the key issues relating to the consideration of the regulation of tyres for fuel efficiency in Australia and New Zealand.

1 Tyre profile in Australia

Since 2011 and the closure of Bridgestone's Adelaide plant, all tyres sold in Australia are imported.[5]

It is understood that Bridgestone, Goodyear-Dunlop and Yokohama are the top three tyre manufactures operating in Australia and New Zealand. Other companies with significant market share include:

- Michelin Australia Pty Ltd.,
- Kumho Tyre Australia Pty Ltd,
- Hankook Tyre Australia Pty. Ltd.,
- Continental Tyres of Australia Pty Ltd,
- Pirelli Tyres Australia Pty Ltd,
- Toyo Tires & Rubber Australia Limited and
- Federal Tyres Australia.

Industry sources indicate that approximately 60% of Australia's tyre market is now Chinese-made imports[6].

The industry is represented by several organisations, including:

- Australian Tyre Industry Council (https://www.atic.org.au/)
- Motor Trades Association of Australia (https://www.mtaa.com.au/)
- Australian Tyre Dealers and Retreaders Association of Australia (https://www.atdra.org.au/)

There are several trade publications, including 'Tyre Business Australia', a national trade journal for tyre retailers, targeting over 3000 retail/workshop outlets in Australia published bi-monthly (6 issues annually)[7].

[5] https://www.drive.com.au/news/how-tyre-manufacturing-changes-have-turned-an-industry-on-its-head

[6] https://www.drive.com.au/news/how-tyre-manufacturing-changes-have-turned-an-industry-on-its-head/

[7] https://www.aaen.com.au/tba/

1.1 Stock and Sales in Australia

The current stock and sales of tyres in Australia and New Zealand is shown in Table 2. Industry estimates the Australia tyre market was valued US$3.54 Billion in 2019[8].

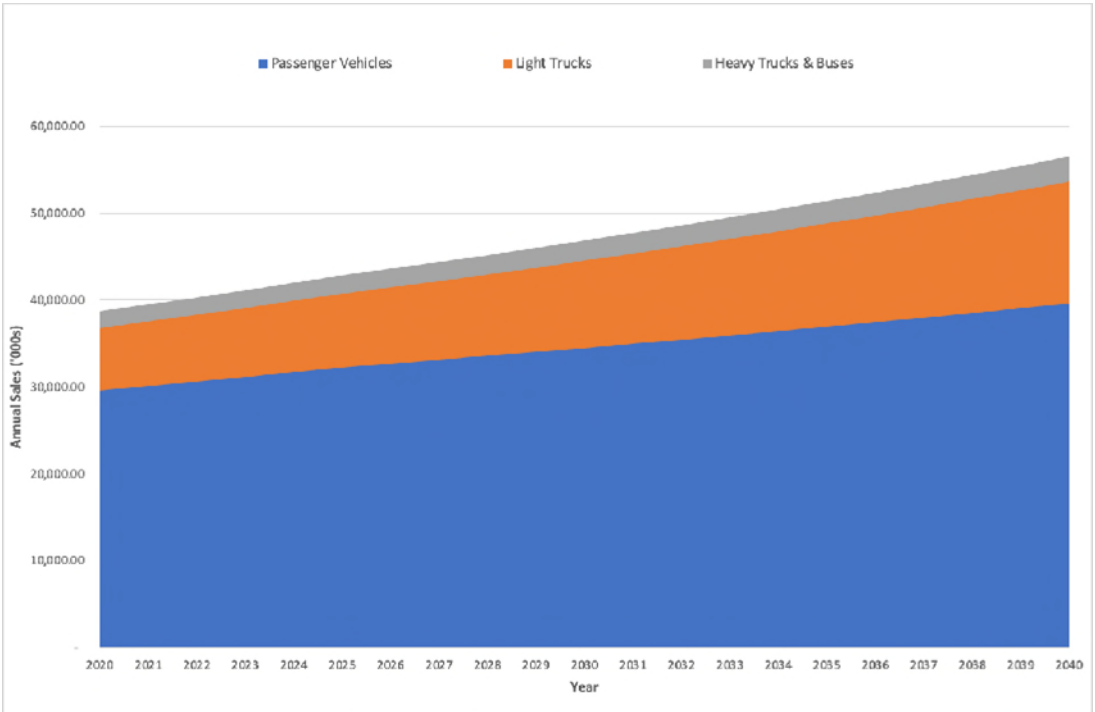
Table 2: Estimated tyre stock and sales in Australia (2021) and New Zealand (2019)

	Australia 2021		New Zealand 2019	
ABS Category	**Stock (millions)**	**Sales (million)**	**Stock (millions)**	**Sales (million)**
Passenger Vehicles	59	23.8	13.5	5.6
Campervans	0.3	0.09		
Light Commercial	14.3	5.9	2.7	1.0
Light Rigid Trucks	0.7	0.4	0.6	0.3
Heavy Rigid Trucks	2.1	1.0		
Articulated Trucks	0.6	0.2		
Non-freight Carrying Vehicles	0.1	0.04		
Buses	0.6	0.2	0.07	0.03
Total	**77.9**	**31.7**	**16.9**	**7.1**

The expanding vehicle fleet, increasing industrialisation, robust road infrastructure and growing penetration of online sales channel across the country is said to drive annual average growth of 7% to 2025 by industry analysts.[9]

Figure 2 shows our estimated sales by sector to 2040, based on a more conservative 1.7% annual average growth over the total period.

Figure 2: Estimated annual sales, 2020-2040, Australia and New Zealand



[8] https://www.techsciresearch.com/report/australia-tire-market/2830.html

[9] https://www.techsciresearch.com/report/australia-tire-market/2830.html

1.2 Energy Consumption by motor vehicles

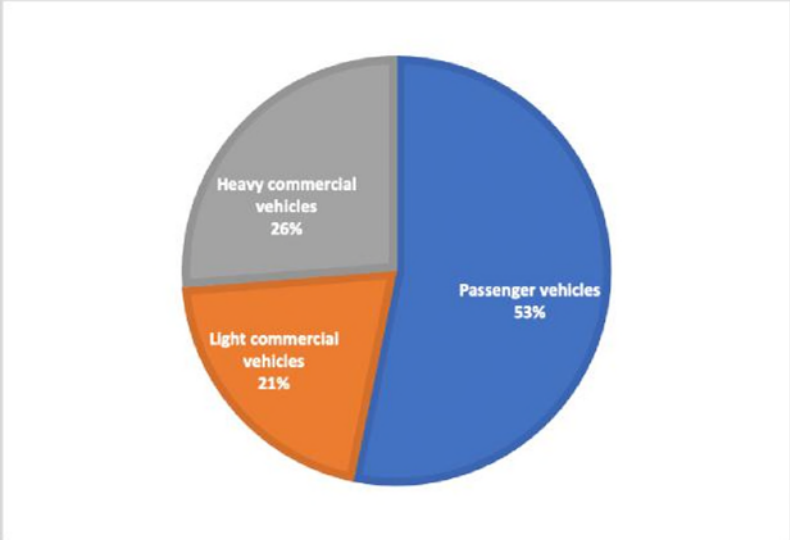
The total fuel consumption by Australian and New Zealand motor vehicles in 2019-2020, and the resultant fuel costs, are shown in Table 3. As indicated in the figure below, although there are far fewer commercial vehicles, these consume nearly half the total energy consumed by motor vehicles each year.

Table 3: Fuel/Energy consumption and expenditure by motor vehicles, New Zealand 2019, Australia 2020

Vehicle Type	Australia			New Zealand			Australia & New Zealand		
	Energy		Cost	Energy		Cost	Energy		Cost
	PJ	GWh	(A$ m)	PJ	GWh	(A$ m)	PJ	GWh	(A$ m)
Passenger vehicles	632	175,479	22,345	118	32,813	5,893	750	208,292	28,239
Light commercial vehicles	250	69,373	8,380	39	10,933	1,340	289	80,306	9,720
Heavy commercial vehicles	314	87,152	10,317	56	15,523	1,701	370	102,675	12,018
Totals	**1,195**	**332,004**	**41,042**	**213**	**59,269**	**8,934**	**1,409**	**391,274**	**49,976**

Source: ABS 2020, Te Manatū Waka Ministry of Transport

Figure 3: Motor vehicle energy consumption distribution in Australia & New Zealand, 2019-2020



2 Savings potential

Based on the modelling of EU regulations, the assumed relationship being the rolling resistance coefficient (RRC) of tyres and fuel consumption is as follows:

- C1 & C2: 1.5% reduction in fuel consumption for a 10% reduction of RRC
- Trucks and buses: 3.3% reduction in fuel consumption for a 10% reduction of RRC.

A 5%, 10% and 20% reduction in the rolling resistance of the stock of tyres in Australia and New Zealand in 2021 is estimated to have the annual savings potential shown in Table 4.

Table 4: Estimated fuel, energy and cost savings potential in Australia and New Zealand

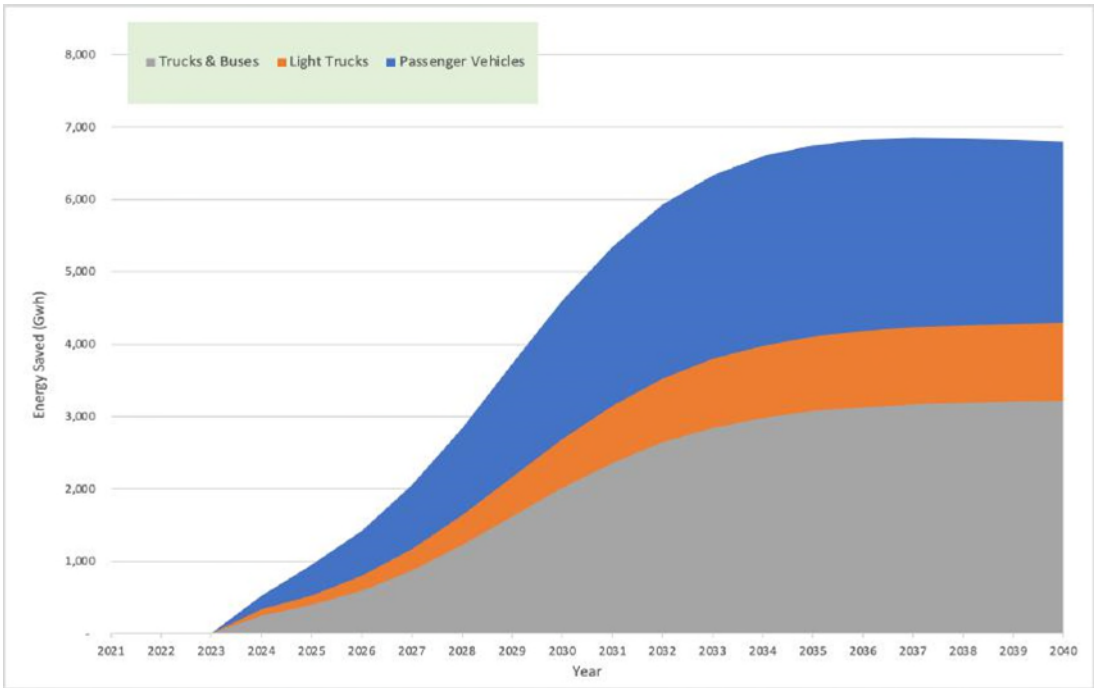
Assumption	Saving per annum		
	Fuel	Energy	Fuel Costs
	Megalitres	*GWh*	*A$m*
Rolling Resistance reduced by 5%	360	3,700	$460
Rolling Resistance reduced by 10%	750	7,700	$960
Rolling Resistance reduced by 20%	1,600	16,300	$2,000

It should be noted that due to the high turnover rate of the tyre stock, changes in the performance of new tyres will have a more rapid impact compared to products with a longer average lifetime.

This savings potential estimate is based on the current profile of vehicles in Australia. If, as expected, there is a transition to electric vehicles then the savings to fuel and fuel costs would be less, since even when considering the primary energy consumption, electric vehicles consume in the region of one-third the energy of petrol/diesel vehicles per kilometre travelled. However, the use of low rolling resistance tyres in electric vehicles would still result in lower electricity consumption for charging and increase their distance travelled between charges, i.e their 'range'.

Figure 4 below shows the estimated impact of a 10% improvement in rolling resistance achieved by 2040 on vehicles in Australia and New Zealand. This estimate includes the increased sales of electric vehicles in current forecasts, which explains why annual energy savings reduce over time. It is also noticeable that the savings in heavy trucks are very significant, in part due to the lower rate of expected electrification.

Figure 4: Estimated annual energy savings from tyre MEPS & labelling, 2021-2040, Australia and New Zealand combined



The range of an electric vehicle is a key selling point and reducing road friction is one of the easiest and cheapest ways to extend the range. Therefore, considerable effort is being devoted to the development of increasingly low rolling resistance tyres.

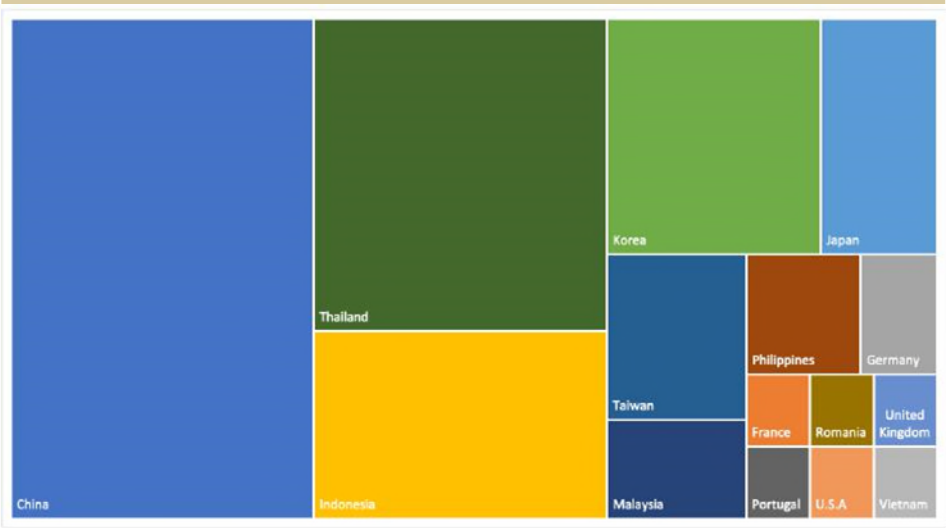
In fact, because electric vehicles are heavier than conventional vehicles, tyre manufacturers have developed special tyres for this market. These tyres have low rolling resistance and high grip and durability properties, and because road noise is more noticeable in an electric vehicle, they also are designed to be quieter.

As a result, the labelling of tyres with key attributes is arguably going to be even more valuable to consumers as economies transition to electric vehicles.

3 Tyre performance and costs

Choice Australia published the results of tests conducted on 102 tyres in April 2018, ranging in price from A$54 to A$360. The majority of these tyres are manufactured in China and SE Asia, as shown in Figure 5.

Figure 5: Car tyre country of origin: Choice test



3.1 Correlation between rolling resistance, grip and price

Choice tested for wet and dry cornering, topping distances in wet and dry conditions and rolling resistance, and collected information on the current retail price.

The tests were not conducted according to international methods (see[10] for further information). Figure 6 shows the results for the performance of each tyre with respect to stopping distance in the wet, rolling resistance and price. Note that price is expressed as a percentage relative to the most expensive, so that a higher value indicates a higher purchase price. For rolling resistance and stopping distance in the wet, a higher % value indicates the better performance.

It should be noted that the results confirm findings from the EU and Canada that suggest very little correlation between rolling resistance and price. Furthermore, there does not appear to be a correlation between rolling resistance and performance in the wet (wet grip).

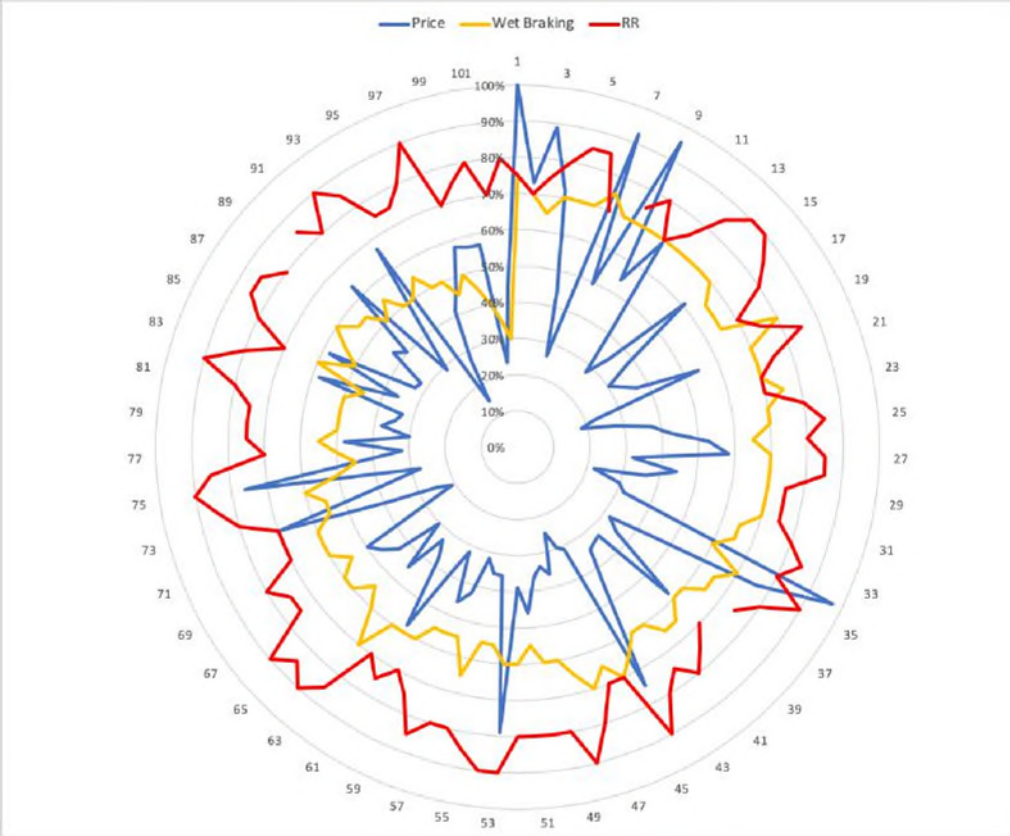
[10] The Choice tests were conducted as follows:

Dry and wet braking: Using a GPS system, the distance it takes to come to a complete standstill in emergency braking tests from driving speeds of 50km/h and 80km/h in both dry and wet conditions.

Rolling Resistance: The distance it takes to roll to a stop from a starting speed of 25km/h. This is completed five times and the shortest and longest measured distance discarded. The three remaining measured distances are then averaged.

Price: The retail prices at the time of publication.

Figure 6: Results of Choice test, 2018

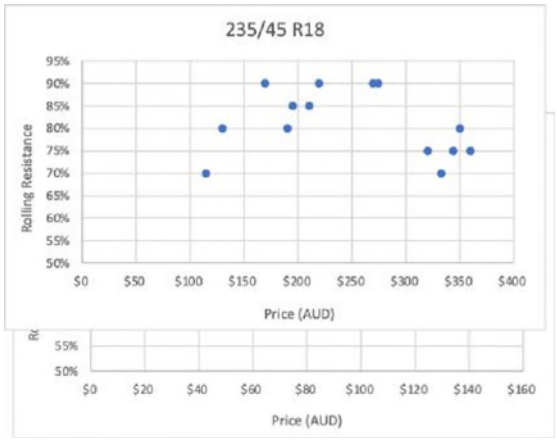


A study in 2018 in Canada of 108 tyre models summarised its findings as follows[11]:

"New technology is enabling tire manufacturers to reduce tire rolling resistance, leading to reduced fuel consumption and greenhouse gas emissions in the transportation sector. This project analyzed current relationships between the environmental and safety performance of commercially-available light-duty tire models in North America. Performance data was rated using the EC No. 1222/2009, and compared against tire price, uniform tire quality grading standards (UTQG), and other attributes. A random selection of tire models was tested, consisting of: 108 all-season, 23 studless winter, and 5 all-weather tire models. All test results were blinded for the purpose of confidentiality. Tire rolling resistance coefficients were measured using the single point ISO 28580 standard, and wet grip index values were measured according to UN-ECE Reg.117. Rolling resistance and wet grip indicators were measured using dynamic mechanical analysis (DMA). Snow and ice traction ratings were calculated according to the ASTM F1805 procedure.

For the sample of all-season tires, no correlation was observed between rolling resistance and wet grip ($0.004 < =R^2 <= 0.065$). For the sample of winter tires, a weak positive correlation was observed between rolling resistance and wet grip ($R^2 = 0.189$), indicating that lower rolling resistance values weakly predict lower wet grip values. A weak negative correlation between rolling resistance and snow traction ($0.156 <= R^2 < 0.177$) was observed, indicating that lower rolling resistance values weakly predict higher snow traction. For the sample of all-weather tires, there was a strong negative correlation between rolling resistance and wet grip ($R^2=0.708$), indicating that lower rolling resistance coefficients strongly

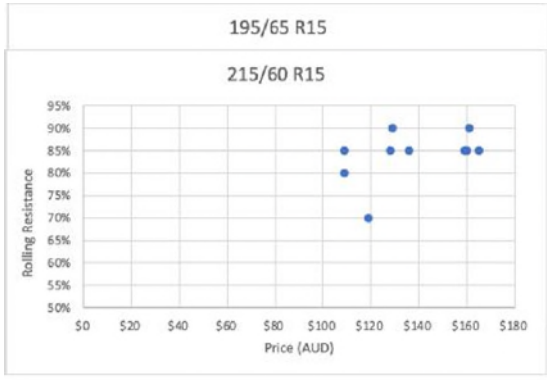
[11] Shafique, H., Richard, B., Christenson, M., and Bayne, S., "Environmental and Safety Performance of Commercially-available Light-duty Vehicle Tires in North America," SAE Technical Paper 2018-01-1336, 2018

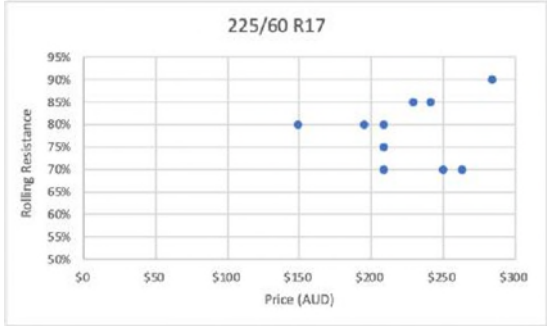


resistance and price by tyre size are shown in the following figures.

predict higher wet grip indices. There was also a strong positive correlation between rolling resistance and snow traction (0.769<=R^2<0.779), indicating that lower rolling resistance coefficients strongly predict lower values of snow traction. When categorized according to the tire labeling standards from EC 1222/2009, sample populations trended towards the lower ends of the performance bins for both rolling resistance and wet grip."

The results of the Choice tests in Australia, showing the relationship between rolling

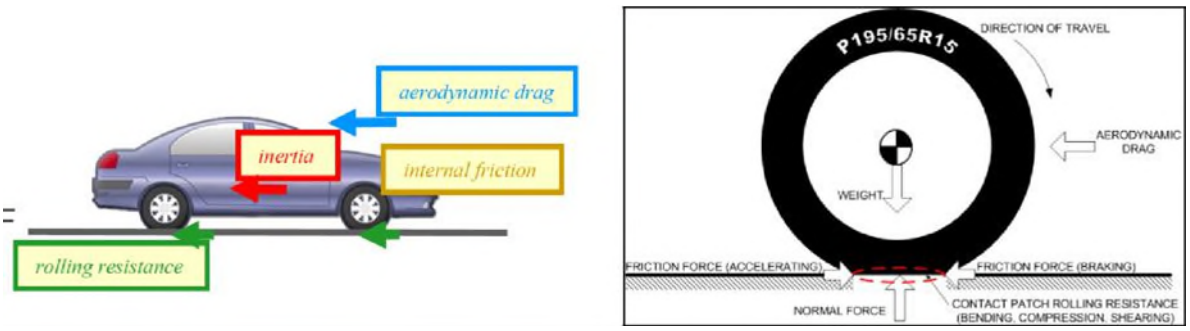




3.2 Rolling resistance of tyres

Rolling resistance is one of several forces that must be overcome for a vehicle to move forward (see Figure 7).

Figure 7: Rolling resistance



Apart from the tests conducted by Choice, no reliable data on the rolling resistance of tyres in Australia has been found. It is noteworthy that while major tyre manufacturer websites include claims of 'fuel efficiency' attributes for some tyres, this is typically not supported by test results – even if the same tyres are sold in Europe and carry the label when marketed there.

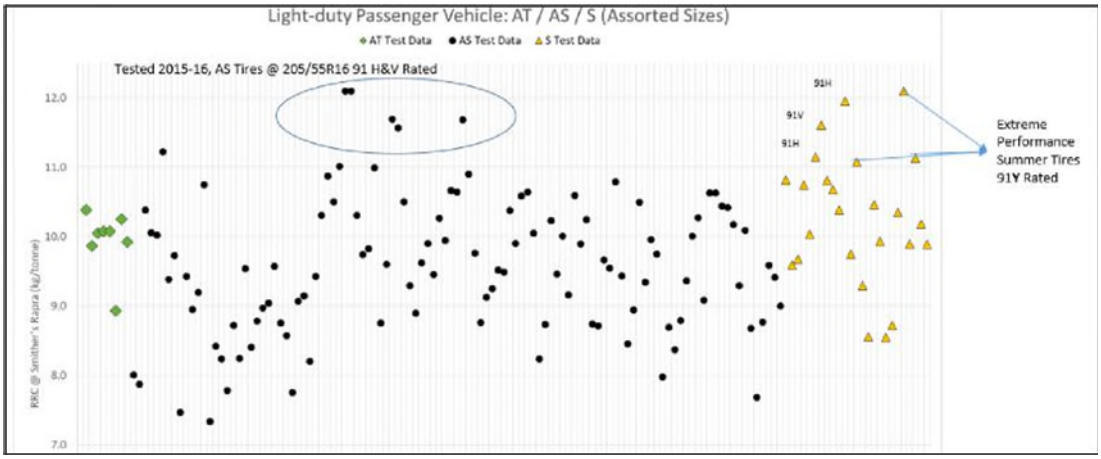
Studies in Europe prior to the introduction of tyre regulations found the performance profile indicated in Table 5.

Table 5: Summary of Rolling Resistance (RRC, kg/t) by Vehicle Types, Europe 2004

Vehicle Type	Av	Min	Max
Passenger Car – summer	11.8	7.9	15.7
Passenger Car – winter	12.8	9.1	16.5
All Passenger Cars (C1)	12.1	8.2	15.9
Light Truck – summer	10.4	7.3	13.8
Light Truck – winter	11.4	8.3	14.8
Al Light Trucks (C2)	10.7	7.6	14.1
Truck/Bus – summer (steer/trailer)	6.4	3.5	10
Truck/Bus – winter (Drive)	7.4	4.6	10.8
All Trucks & Buses (C3)	6.6	3.8	10.2

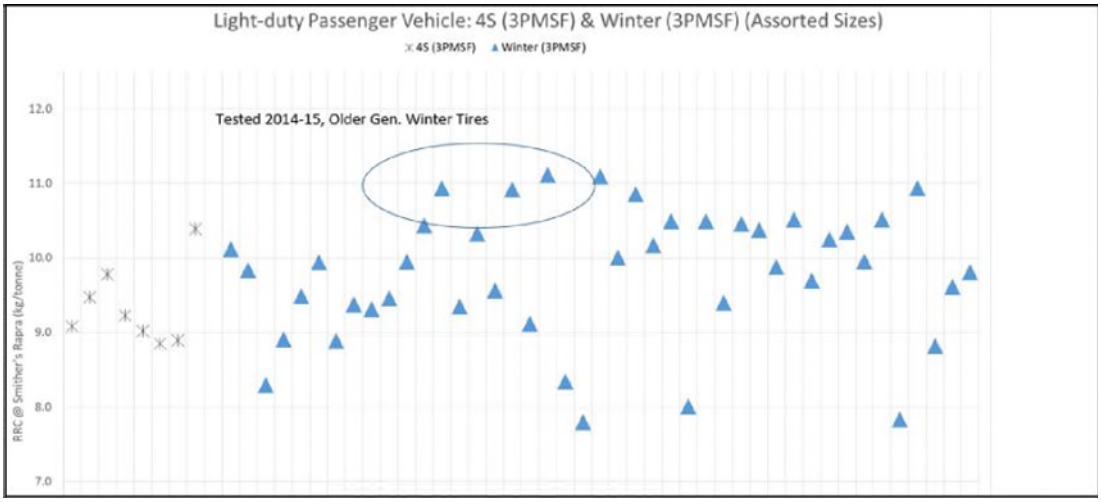
A more recent study in Canada (2018) (see above), also found that the rolling resistance of tyres varied considerably, as indicated in Figure 8.

Figure 8: Results of rolling resistant tests on assorted size tyres, Canada 2018



Since Canada has a high percentage of winter tyres (denoted by the 3-Peak Mountain Snowflake 3PMSF), tests were also conducted to determine the performance of these tyres. These do not appear to indicate that 3PMSF tyres necessarily have worse rolling resistance than conventional tyres, as shown in Figure 9.

Figure 9: Results of rolling resistant tests on 3PMSF tyres, Canada 2018



4 Overseas policies

4.1 European regulations

4.1.1 Phase 1: 2012

In 2009, the European Parliament and the Council adapted the Tyre Labelling Regulation (Regulation (EC) No 1222/2009) which entered into force on 1 November 2012.

The tyre labelling provides harmonised information about fuel-efficiency, wet grip and external rolling noise, in order to encourage the manufacturers to optimise relevant parameters beyond the standards already achieved and to influence end-users' purchasing decisions in favour of safer, quieter and more fuel-efficient tyres.

The Tyre Labelling Regulation covers tyres for:

- passenger cars (C1 tyres).
- tyres for light commercial vehicles (C2 tyres).
- tyres for heavy-duty vehicles (C3 tyres).

Retreaded tyres, studded tyres and tyres for a number of specific applications, such as racing and spare tyres, are exempted.

C1 & C2 tyres must be labelled with their fuel efficiency, wet grip and external noise classes. All C1, C2 & C3 classed must provide information of their performance on technical information sheets, promotional materials including websites.

The Tyre Labelling Regulation is closely related to the Tyre Type Approval Regulation which sets out minimum requirements for rolling resistance, wet grip (for C1 tyres only) and external rolling noise.

The MEPS and labelling values for the Rolling Resistance Coefficient (RRC), when measured in accordance with Annex 6 of UNECE Regulation No 117, as shown in Table 6.

Table 6: Rolling resistance coefficient values for MEPS and labelling, Europe 2012

Fuel efficiency class	C1 tyres *RRC* in kg/t	C2 tyres *RRC* in kg/t	C3 tyres *RRC* in kg/t
A	*RRC ≤ 6,5*	*RRC ≤ 5,5*	*RRC ≤ 4,0*
B	*6,6 ≤ RRC ≤ 7,7*	*5,6 ≤ RRC ≤ 6,7*	*4,1 ≤ RRC ≤ 5,0*
C	*7,8 ≤ RRC ≤ 9,0*	*6,8 ≤ RRC ≤ 8,0*	*5,1 ≤ RRC ≤ 6,0*
D	Empty	*Empty*	*6,1 ≤ RRC ≤ 7,0*
E	*9,1 ≤ RRC ≤ 10,5*	*8,1 ≤ RRC ≤ 9,2*	*7,1 ≤ RRC ≤ 8,0*
F	*10,6 ≤RRC ≤ 12,0*	*9,3 ≤ RRC ≤ 10,5*	*RRC ≥ 8,1*
G	*RRC ≥ 12,1*	*RRC ≥ 10,6*	*Empty*
Max Value (MEPS)	12.0	10.5	8.0

4.1.2 Evaluation of Phase 1

An evaluation of the EU mandatory tyre labelling program in 2018 indicated that it has been effective, although would benefit from a broadening of scope, increased market surveillance and awareness raising[12].

The evaluation report noted that:

"For all the performance parameters included in the scheme (fuel efficiency, wet grip and external rolling noise), it has been able to transform the market in a positive direction from 2013 to 2015, although the positive tendency is less obvious for external rolling noise than for fuel efficiency and wet grip. Analysis of the market data shows that the Tyre Labelling Regulation has driven an increased R&D and technology innovation effort, resulting in increased wet grip performance of tyres, as well as optimisation of fuel efficiency leading to decreased fuel consumption.

"The C1 end-user survey showed that around half of the private car owners in the surveyed countries are aware of the tyre label, and that most (64%) have medium confidence in the labelling scheme. The survey showed that when purchasing tyres, C1 end-users find wet grip the most important of the labelling parameters (62% rated it "very important") followed by fuel efficiency (34% rated it "very important") and lastly external rolling noise (21% rated it "very important")."

[12] Final Report Review study on the Regulation (EC) No 1222/2009 on the labelling of tyres Prepared by Viegand Maagøe A/S, March 2016

4.1.3 Phase 2: 2021

The Tyre Labelling Regulation was updated by (EU) 2020/740 in May 2020, coming into effect from May 2021.

The revised regulation applies to C1 tyres, C2 tyres and C3 tyres that are placed on the market. The Regulation does not apply to:

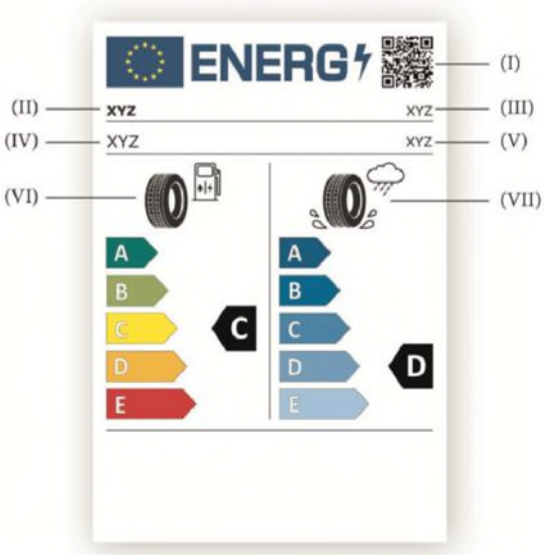
- off-road professional tyres
- tyres designed to be fitted only on vehicles registered for the first time before 1 October 1990
- T-type temporary-use spare tyres
- tyres whose speed rating is less than 80km/h
- tyres whose nominal rim diameter does not exceed 254 mm or is 635 mm or more
- tyres fitted with additional devices to improve traction properties, such as studded tyres
- tyres designed only to be fitted on vehicles intended exclusively for racing
- second-hand tyres, unless such tyres are imported from a third country.

The new rules increase the stringency of the MEPS and labelling thresholds and require that tyres for buses and trucks (C3) must be labelled.

In addition, the label allows for information to highlight tyres suitable for use in snow or in extreme, icy conditions. The label also now carries a QR code.

The regulation foreshadows the possible inclusion of mileage and abrasion as parameters for the label, as soon as suitable testing methods become available. Similarly it suggests the inclusion of re-treaded tyres, once suitable testing method to measure the performance of such tyres has been developed.

Figure 10: EU Tyre label, 2021



I QR code

II Trade name or trademark of the supplier

III Tyre type identifier

IV Tyre size designation, load-capacity index and speed category symbol

V. Tyre class: i.e. C1, C2 or C3

VI. Fuel efficiency pictogram, scale and performance class

VII. Wet grip pictogram , scale and performance class

Information to be included in the bottom part of the tyre label for all tyres:

- external rolling noise pictogram, value (expressed in dB(A) and rounded to the nearest integer) and performance class.

Where applicable:

- tyres which satisfy the minimum snow grip index values set out in UNECE Regulation No 117, or the relevant minimum ice grip index values, or both.

Further information is provided below:

Obligations of tyre suppliers, vehicle suppliers and vehicle distributors

Suppliers shall ensure that C1 tyres, C2 tyres and C3 tyres that are placed on the market are accompanied by a tyre label, in the form of a sticker indicating the information and class for each of the parameters and a product information sheet.

Suppliers shall ensure that any visual advertisement for a specific tyre type shows the tyre label. If the visual advertisement indicates the price of that tyre type, the tyre label shall be displayed close to the price indication.

For visual advertisements on the internet, suppliers may make the tyre label available in a nested display.

Where end-users intend to acquire a new vehicle, vehicle suppliers and vehicle distributors shall provide, before the sale, those end-users with the tyre label for the tyres offered with or fitted on the vehicle and any relevant technical promotional material, and shall ensure that the product information sheet is available.

Fuel efficiency classes and rolling resistance coefficient

The fuel efficiency class shall be determined and illustrated on the tyre label on the basis of the rolling resistance coefficient (*RRC* in N/kN) according to the 'A' to 'E' scale specified in the table below and measured in accordance with Annex 6 to UNECE Regulation No 117.

If a tyre type belongs to more than one tyre class (e.g. C1 and C2), the grading scale used to determine the fuel efficiency class of that tyre type shall be that which is applicable to the highest tyre class (e.g. C2, not C1).

Table 7: Fuel efficient tyre label classes

Fuel efficiency class	C1 tyres *RRC* in N/kN	C2 tyres *RRC* in N/kN	C3 tyres *RRC* in N/kN
A	*RRC ≤ 6,5*	*RRC ≤ 5,5*	*RRC ≤ 4,0*
B	*6,6 ≤ RRC ≤ 7,7*	*5,6 ≤ RRC ≤ 6,7*	*4,1 ≤ RRC ≤ 5,0*
C	*7,8 ≤ RRC ≤ 9,0*	*6,8 ≤ RRC ≤ 8,0*	*5,1 ≤ RRC ≤ 6,0*
D	*9,1≤RRC≤10,5*	*8,1 ≤ RRC ≤ 9,0*	*6,1 ≤ RRC ≤ 7,0*
E	*RRC ≥ 10,6*	*RRC ≥ 9,1*	*RRC ≥ 7,1*
Max Value (MEPS)	*10.5*	*9.0*	*6.5*

Wet grip classes

The wet grip class shall be determined and illustrated on the tyre label on the basis of the wet grip index (*G*) according to the 'A' to 'E' scale specified in the table below, calculated in accordance with point 2 and measured in accordance with Annex 5 to UNECE Regulation No 117.

Calculation of wet grip index(*G*):

G = G(T) –0,03

where:

G(T) = wet grip index of the candidate tyre as measured in one test cycle.

Table 8: Wet grip tyre classes

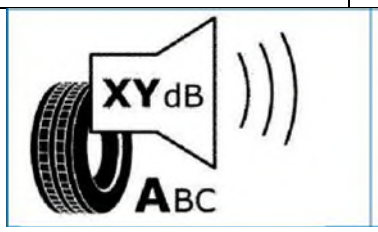
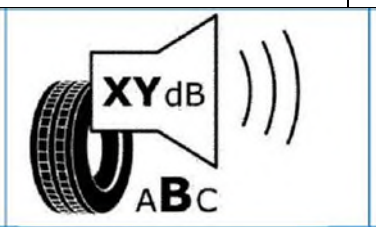
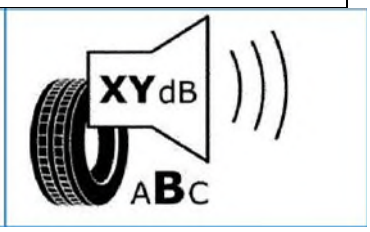
Wet grip class	C1 tyres	C2	C3
A	*1,55≤G*	*1,40≤G*	*1,25≤G*
B	*1,40≤G ≤ 1,54*	*1,25≤G ≤ 1,39*	*1,10≤G ≤ 1,24*
C	*1,25≤G ≤ 1,39*	*1,10≤G ≤ 1,24*	*0,95≤G ≤ 1,09*
D	*1,10≤G ≤ 1,24*	*0,95≤G ≤ 1,09*	*0,80≤G ≤ 0,94*
E	*G≤1,09*	*G≤0,94*	*G≤0,79*

External rolling noise classes and measured value

The external rolling noise measured value (*N*, in dB(A)) shall be declared in decibels and calculated in accordance with Annex 3 to UNECE Regulation No 117.

The external rolling noise class shall be determined and illustrated on the tyre label on the basis of the limit values (LV) set out in Part C of Annex II to Regulation (EC) No 661/2009 as follows:

Table 9: External rolling noise classification

N ≤ LV -3	LV -3 < N ≤ LV	N > LV
		

Snow grip

The snow grip performance shall be tested in accordance with Annex 7 to UNECE Regulation No 117.

A tyre which satisfies the minimum snow grip index values set out in UNECE Regulation No 117 shall be classified as a tyre for use in severe snow conditions and the following pictogram shall be included on the tyre label.

Ice grip

The ice grip performance shall be tested in accordance with reliable, accurate and reproducible methods, including, where appropriate, international standards, which take into account the generally recognised state of the art.

The tyre label of a tyre which satisfies the relevant minimum ice grip index values shall include the following pictogram.

4.2 Korea

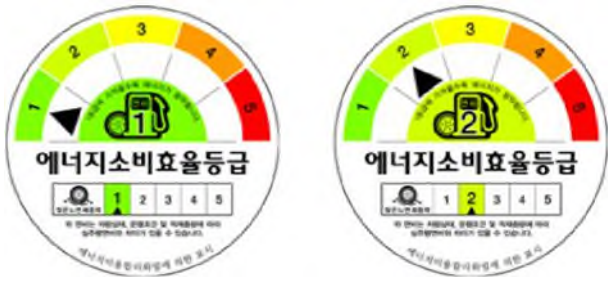
Korea has introduced tyre labelling and MEPS progressively since 2012.

- November 2012: compulsory labelling for Passenger Car (PC) tyres
- November 2013: compulsory reporting for small trucks ("ST") tyres

- November 2013: MEPS for PC tyres
- November 2014: MEPS for small truck (ST) tyres.

The label, which covers rolling resistance and wet grip, is shown in the following figure. The relevant thresholds are shown in Table 10.

Figure 11: Korean tyre label



The test method for RRC is JIS D4234: 2009 (ISO28580): *Passenger car, truck and bus tyres - Methods of measuring rolling resistanc*e. The Single point test and correlation of measurement results is applied.

For Wet Grip performance, Annex 1 of EU regulation Wet Grip grading test method (draft): "*Test method for tyre Wet Grip grading (C1 tyres*)" is applied[13].

Table 10: Korean fuel efficiency classes for tyre label

Fuel efficiency class	Passenger Car tyres ***RRC*** in N/kN	Small Truck tyres ***RRC*** in N/kN
1	*RRC ≤ 6,5*	*RRC ≤ 5,5*
2	*6,6 ≤ RRC ≤ 7,7*	*5,6 ≤ RRC ≤ 6,7*
3	*7,8 ≤ RRC ≤ 9,0*	*6,8 ≤ RRC ≤ 8,0*
4	*9,1≤RRC≤10,5*	*8,1 ≤ RRC ≤ 9,2*
5	*RRC ≥ 10,6*	*RRC ≥ 9,3*
Max Value (MEPS)	*12.0*	*10.5*

Table 11: Korean wet grip classes for tyre label

Wet grip class	C1 tyres	C2
1	*1,55≤G*	*1,40≤G*
2	*1,40≤G ≤ 1,54*	*1,25≤G ≤ 1,39*
3	*1,25≤G ≤ 1,39*	*1,10≤G ≤ 1,24*
4	*1,10≤G ≤ 1,24*	*0,95≤G ≤ 1,09*
5	*G≤1,09*	*G≤0,95*
MEPS value	*1.10 or higher*	*0.95 or higher*

4.3 Japan

Japan has a mandatory tyre labelling system implemented in January 2010. This applies to summer-use tyres for passenger vehicles that are purchased as replacement tyres by consumers at tyre dealers, etc.

[13] Japan Automobile Tyre Manufacturers Association, Inc. 'Guideline for tyre labelling to promote the use of fuel efficient tyres (labelling system)', 04 December 2009

The scheme covers only rolling resistance and wet grip, with the requirements shown in the tables below.

Table 12: Rolling resistance labelling requirements, Japan

Class	Rolling resistance: RRC (N/kN)
AAA	RRC ≤ 6.5
AA	6.6 ≤ RRC ≤ 7.7
A	7.8 ≤ RRC ≤ 9.0
B	9.1 ≤ RRC ≤ 10.5
C	10.6 ≤ RRC ≤ 12.0

Table 13: Wet grip labelling requirements, Japan

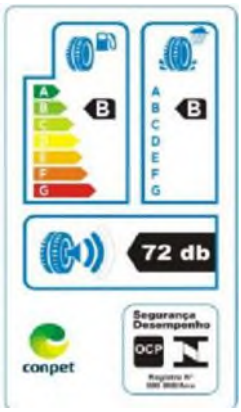
Class	Wet Grip: G (%)
A	155 ≤ G
B	140 ≤ G ≤ 154
C	125 ≤ G ≤ 139
D	110 ≤ G ≤ 124

4.4 Brazil

Only tyres with a grading of A and above for rolling resistance performance are defined as "Fuel Efficient Tyres" and can use the uniform mark (right) on the label, as shown below.

Brazil implemented MEPS and mandatory labelling in 2012. The scheme is harmonised with phase 1 of the EU requirements. The label is shown below.

Figure 12: Tyre label, Brazil



4.5 China

The China tyre label is based on the EU label, and is shown in Figure 13.

Figure 13: China tyre label

4.6 Canada

The Canadian government has made a regulatory commitment to develop MEPS for light-duty tyres and began work in 2013, led by Natural Resources Canada (NRCAN). This work is now advanced, with the Canadian Standard Association completed its technical specification in early 2021. NRCAN is now in the process of considering labelling options and it likely that the regulation will be passed within the next 2-3 years.

4.7 USA

In 2010 the National Highway Traffic Safety Administration (NHTSA) drafted a proposal for the introduction of tyre labels covering three factors; fuel efficiency, wet grip and durability. To date, the US government has not formally adopted the proposals however they continue to be debated and remain under consideration.

5 Classification of vehicles and tyres

Table 14: International classification of vehicles

	Definition	European Tyre Classification
M_1	Vehicles designed and constructed for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat, and having a maximum mass ("technically permissible maximum laden mass") not exceeding 3.5 tons	C1
N_1	Vehicles for the carriage of goods and having a maximum mass not exceeding 3.5 tonnes	C1
O_1	Trailers with a maximum mass not exceeding 0.75 tonnes	C1
O_2	Trailers with a maximum mass exceeding 0.75 tonnes, but not exceeding 3.5 tonnes	C1
M_2	Vehicles designed and constructed for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass ("technically permissible maximum laden mass") not exceeding 5 tons	C2 or C3
M_3	Vehicles designed and constructed for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass exceeding 5 tons	C2 or C3
N	Power-driven vehicles having at least four wheels and for the carriage of goods	C2 or C3
O_3	Trailers with a maximum mass exceeding 3.5 tonnes, but not exceeding 10 tonnes	C2 or C3
O_4	Trailers with a maximum mass exceeding 10 tonnes	C2 or C3

Note C2 = tyres with a load capacity index ≤ 121 and the speed category symbol ≥'N' (130km)

Note C3 = tyres with a load capacity index ≤ 121 and the speed category symbol ≤'M' (120km)

5.1 Classification of Tyres in EU Regulation

The following table is included in regulation (EC) No 661/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009.

Table 15: EU classification of tyres for regulation

Class	Explanation	Vehicle type	
C1 tyres	tyres designed primarily for vehicles of categories M_1, N_1, $O_1$and O_2	M_1	Vehicles designed and constructed for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat, and having a maximum mass ("technically permissible maximum laden mass") not exceeding 3.5 tons
		N_1	Vehicles for the carriage of goods and having a maximum mass not exceeding 3.5 tonnes
		O_1	Trailers with a maximum mass not exceeding 0.75 tonnes
		O_2	Trailers with a maximum mass exceeding 0.75 tonnes, but not exceeding 3.5 tonnes
C2 tyres	tyres designed primarily for vehicles of categories M_2, M_3, N, O_3 and O_4 with a load capacity index in single formation < 121 and the speed category symbol ≥'N'	M_2	Vehicles designed and constructed for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass ("technically permissible maximum laden mass") not exceeding 5 tons
C3 tyres	tyres designed primarily for vehicles of categories M_2, M_3, N, O_3 and O_4 with one of the following load capacity indices:(i) a load capacity index in single formation < 121 and the speed category symbol < 'M'	M_3	Vehicles designed and constructed for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass exceeding 5 tons
		N	Power-driven vehicles having at least four wheels and for the carriage of goods
		O_3	Trailers with a maximum mass exceeding 3.5 tonnes, but not exceeding 10 tonnes
			Trailers with a maximum mass exceeding 10 tonnes

5.2 Tyre markings

Tyres are designed to carry a maximum specifed load when operating at a maximum given speed. On the tyre's sidewall there are various markings, which indicate the tyre's dimensions and how it may be operated. Tyre markings are illustrated in Figure 14, and explained in the test below.

Figure 14: Tyre markings

Section Width: The tyre's section width is measured on an ideal width of wheel, for which it has been designed to operate. The measurement distance in millimeters is from the maximum width of the tyre's mid point of its sidewall to the same point on the opposite sidewall.

Aspect Ratio: This is the height of the tyre's sidewall expressed as a percentage of the tyre's section width. In the example, the height of the tyre's sidewall is 40% of the tyre's section width or 245 x 40% = 98mm.

Construction Code: R indicates the tyre is manufactured with a radial ply construction.

Rim Diameter: The tyre's rim diameter is measured in inches taken from the wheel flange where the tyre is seated (bead seat area) to the same point on the opposite side.

Load Index: The load rating, load index or load carrying capacity is represented by a numerical code and is associated with the maximum load that the tyre can carry when operating at its maximum speed rating up to but not exceeding 210kph (see table below).

Speed Index: The speed rating or speed index is represented by a letter and associated with the tyre's maximum speed capability when operating at its maximum load carrying capacity (see table below).

Table 16: Load index

Load Index	Kilograms per Tyre	Load Index	Kilograms per Tyre	Load Index	Kilograms per Tyre
69	325	98	750	127	1750
70	335	99	775	128	1800
71	345	100	800	129	1850
72	355	101	825	130	1900
73	365	102	850	131	1950
74	375	103	875	132	2000
75	387	104	900	133	2060
76	400	105	925	134	2120
77	412	106	950	135	2180
78	425	107	975	136	2240
79	437	108	1000	137	2300
80	450	109	1030	138	2360
81	462	110	1060	139	2430
82	475	111	1090	140	2500
83	487	112	1120	141	2575
84	500	113	1150	142	2650
85	515	114	1180	143	2725
86	530	115	1215	144	2800
87	545	116	1250	145	2900
88	560	117	1285	146	3000
89	580	118	1320	147	3075
90	600	119	1360	148	3150
91	615	120	1400	149	3250
92	630	121	1450	150	3350
93	650	122	1500	151	3450
94	670	123	1550	152	3550
95	690	124	1600	153	3650
96	710	125	1650	154	3750
97	730	126	1700	155	3875

Table 17: Speed Index

Speed Category Symbol	Speed (km/h)
A1	5
A2	10
A3	15
A4	20
A5	25
A6	30
A7	35
A8	40
B	50
C	60
D	65
E	70
F	80
G	90
J	100
K	110
L	120
M	130
N	140
P	150
Q	160
R	170
S	180
T	190
U	200
H	210
V	240
W	270
Y	300
Z	*Over 240