Energy efficiency options for external power supplies in Australia

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Abstract
This paper provides an overview of the analysis and results of options for improving the energy performance of external power supplies (EPS) in Australia. The energy performance levels and test methods are documented in Australian/New Zealand Standard AS/NZS4665 which is based upon the US Energy Star test method and performance marking methods.

The Government process for analysing the options is a detailed report known as Regulatory Impact Statement (RIS) which addresses methods and key requirements for analysis of proposed regulation and alternatives. The RIS process places significant demands on the level of data required, transparency of the assessment methodology, costs, benefits and other impacts on the community at large plus impacts on small business, industry and distributional issues. Whilst this may not be a challenge for single application products, such as a white good, the analysis for EPS identified methodological and data collection challenges peculiar to them and their end use. EPS are used in hundreds of applications and, as such, the cost benefit analysis of each type of EPS matched with each type of appliance highlighted the difficulty to obtain data for a comprehensive analysis across the major application types. In spite of the challenges, the conservative scenario analysis indicates greenhouse gas savings of 8.3 MT CO_2-e to 2025 and a cost benefit ratio of 2.35 for Australia. The RIS also analysed the New Zealand case, which is not included in this paper, but indicated savings of 975 kT CO_2-e to 2025 and a cost benefit ratio of 2.1 .

Introduction
Prior to introducing energy efficiency legislation in Australia (and New Zealand), a thorough analysis and public domain report, known as a Draft Consultation Regulatory Impact Statement(RIS), is published for comment, to allow for amendments, if required, for the final RIS. A RIS addresses the subjects in Table 1, and these are discussed in the following sections.

Summary
Table 2 summarises the analysis for mandatory MEPS from 2008 in Australia for the period 2008 to 2025.

At a discount rate of 10 %, for the 5 % and high sales growth rates, benefit cost ratios are 2.14 and 2.25 respectively.

At the individual application level, the mix of benefits and costs depends on current EPS technology in use and usage patterns. The analysis indicates that, in most cases, consumers will benefit from the proposed regulation.

Scope
The Draft RIS was prepared within the scope of the Equipment Energy Efficiency Program (EEEP). EEEP was formerly known as the National Appliance and Energy Efficiency Program (NAEEEP). The implementation of EEEP is overseen by the Equipment Energy Efficiency Committee (E3), which comprises officials from Commonwealth, State and Territory Government agencies as well as representatives New Zealand Government. E3 is ultimately responsible to the Ministerial Council on Energy (MCE) comprising ministers responsible for energy from all jurisdictions. [NAEEEP 2004]

Table 1 Summary of RIS contents

Subject	Brief summary for the EPS RIS
Scope	EPS up to 250W or 250 VA output and market analysis
The problem	Higher energy consumption that is economical due to market failures.
Objectives of the regulation	Reduced greenhouse gas emissions from the projected business as usual (BAU) case, with positive benefits to the community at large.
Proposed regulation and alternatives	Analysis of the projected BAU case, mandatory and voluntary minuimum energy performance standards (MEPS), levies and labelling options.
Costs, benefits and other impacts	Review of consumers, business, Government, compliance, trade, competition, electricity retailers, greenhouse gas emissions and Net Present Value (NPV) analysis.
Consultations and comments	Summary of stakeholder issues and comments on the proposal.
Evaluation and recommendations	Rationale for the recommended mandatory MEPS proposal.
Implementation and review	Method and timing of the proposed MEPS legislaion and a future date to review options of maintaing the status quo, more stringent MEPS or removal of the legislation.

Table 2 Australia – summary data 2008 to 2025 7.5 % Discount Rate

	5 % sales growth	High sales growth
Energy saved	9,044 GWh	12,048 GWh
CO2 – e saved	8.3 MT	11.0 MT
Total Benefit	A$ 462 Million	A$ 601 Million
Investment	A$ 197 Million	A$ 243 Million
Benefit cost ratio	2.35	2.47

In 2004 the Australian Greenhouse Office entered into a Memorandum of Understanding with the US EPA Energy Star Program, California Electricity Commission and China Certification Center for Energy Conservation Products (CECP) to agree upon harmonized test methods and energy performance marking of EPS. This draft document is based upon the harmonized test methods and energy performance marking.

The RIS studied the impact of proposed mandatory MEPS for EPS units, with mains supply input (nominally 115 V a.c. or 230 V a.c.) and a single output at extra low voltage (ELV), either a.c. or d.c., and a maximum output of 250 W or 250 VA.

The Problem

In Australia, EPS' standby energy and conversion losses wasted an estimated 845 GWh of direct and indirect electricity in 2004 and consequently were responsible for an estimated 885 housand tonnes CO_2-e greenhouse gases that year, representing 0.45 % of Australia's total greenhouse gas emissions attributed to electricity generation. Due to market failures within the Australian and New Zealand EPS economy, the level of energy efficiency is lower and standby energy consumption of these products is higher than the economically optimal level.

For the majority of appliances, with the exception of porTable appliances such as laptops and mobile phones, consumers are generally not aware that the appliance utilises an EPS. The EPS is "bundled" with the end use appliance and consumers have no choice but to purchase the "bundle". EPS selection is made by the appliance supplier, where cost, rather than energy performance and weight, is the driving factor. There is no incentive for manufacturers to consider energy efficiency or life cycle costs after the appliance is sold. Consumers select appliances for their own specifications, rather than the performance of its power supply, with the exception that it will function with the supply voltage and frequency in the country or countries where it will be used. Given that capital costs and energy efficiencies for EPS are not available to consumers, it is not possible for them to evaluate life cycle costs as part of the selection process. Whilst consumers continue to purchase appliances as they are, there is no need for manufacturers, importers and suppliers to change the offer.

In the case of appliances powered by EPS, there are a myriad of applications and within each application an extensive range of manufacturers and models to choose from. In many cases, it is unlikely that the appliance itself will be considered in its own right for energy efficiency programmes. Addressing the performance of EPS will assist the reduction the greenhouse gas emissions associated with these appliances.

The energy consumption of EPS can be broadly categorised into two modes:

- Active mode – energy used by the appliance and energy lost as heat in the conversion process.
- No load mode, where the appliance is plugged in to mains electricity supply but switched off or unattached from the appliance being powered.

Across the entire product sector, it is estimated that no load mode accounts for some 11 % of total energy consumption and conversion efficiency losses some 24 % of total energy consumption.

Approximately 41 % of wasted energy due to EPS arises from low wattage (up to 10 Watts) applications. These applications comprise approximately 64 % of all EPS manufactured and are typified by low efficiency, low cost EPS. Higher efficiency power supplies are available, however low uptake inhibits economies of scale.

There are also indirect energy losses and gains associated with the heat from EPS. During periods of cooling, waste energy adds to the energy required by air conditioning systems and during periods of heating, waste energy is beneficial and reduces the heating energy load. Indirect energy accounts for approximately 3 % of total energy consumption. Total waste energy due to EPS represents 0.45 % of total Australian electricity generation. Within the non-residential sector waste energy of 350.4 GWh, indirect energy is estimated to be 57 GWh.

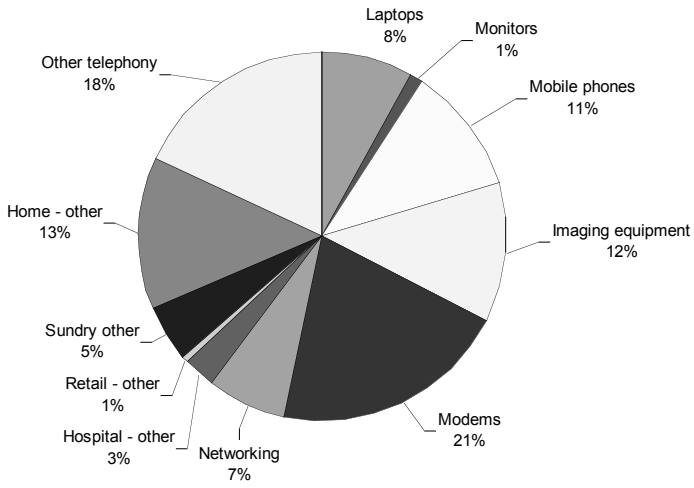

Figure 1 Standby and Conversion Loss Energy Consumption by End-Use Appliance

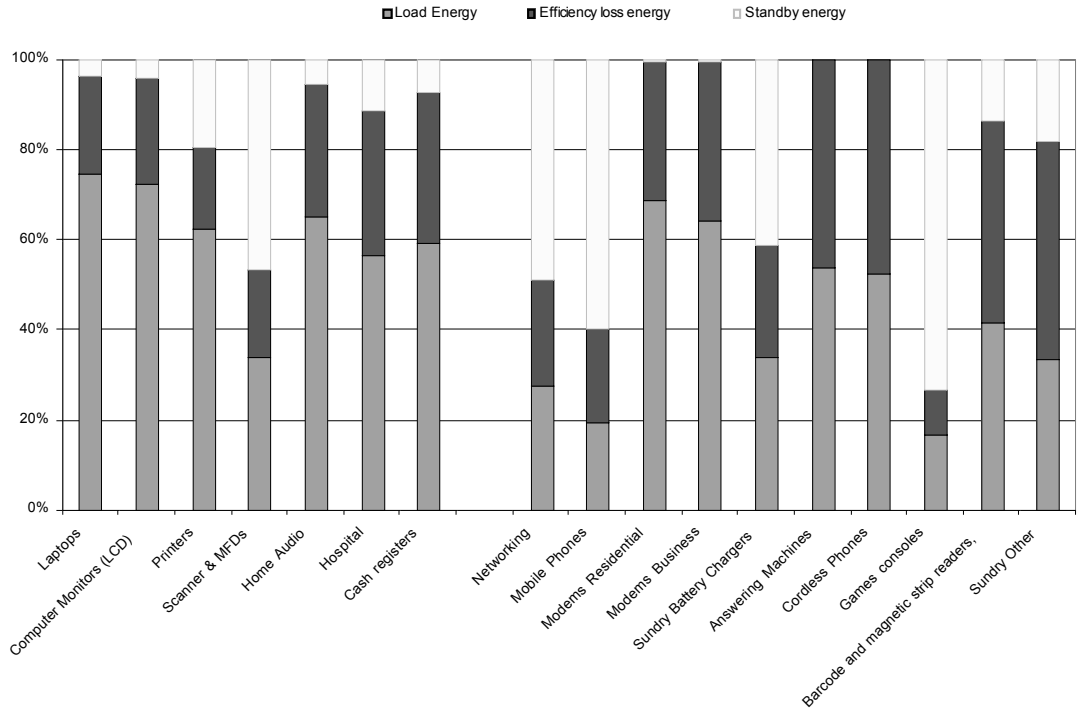

Figure 2 Energy Cost as a Percentage of 5 Year NPV – 2004 data

Figure 1 shows the estimated breakdown of wasted energy by EPS applications, in Australia for 2004.

In the portable appliance sector of the market, such as laptop computers and mobile phones, the drivers are quite different. Consumer needs for low weight, compact size and the ability to use it in a wide range of supply voltages and frequencies around the world, forces the use of lighter switch mode power supplies. Typically these are higher cost appliances, where the cost of the power supply is a lower percentage of total cost, however in the case of mobile phones, consumer demands and initiatives by some phone suppliers have produced the required economies of scale for the introduction of more efficient switch mode power supplies.

Energy consumption is highly dependent on the appliance being powered, its usage pattern and the type and specifications of the EPS. Figure 2 shows the normalised energy cost by application. The left hand group of columns are applications typically using switch mode power supplies and the right hand group of columns are applications typically using linear power supplies, with the exception of mobile phone chargers which are increasingly utilising switch mode power supplies. Whilst relative percentages are dependent on application and usage, the chart demonstrates that switch mode power supplies, with higher efficiency and lower standby energy consumption, waste much less energy. I.e. a greater percentage of total energy is used by the product being powered. Whilst switch mode power

Table 3 High Scenario Sales Growth

Power Range (W)	0 to 5	5 to 10	11 to 20	21 to 50	51 to 100
Annual sales growth	5.20 %	6.60 %	12.50 %	8.00 %	12.00 %

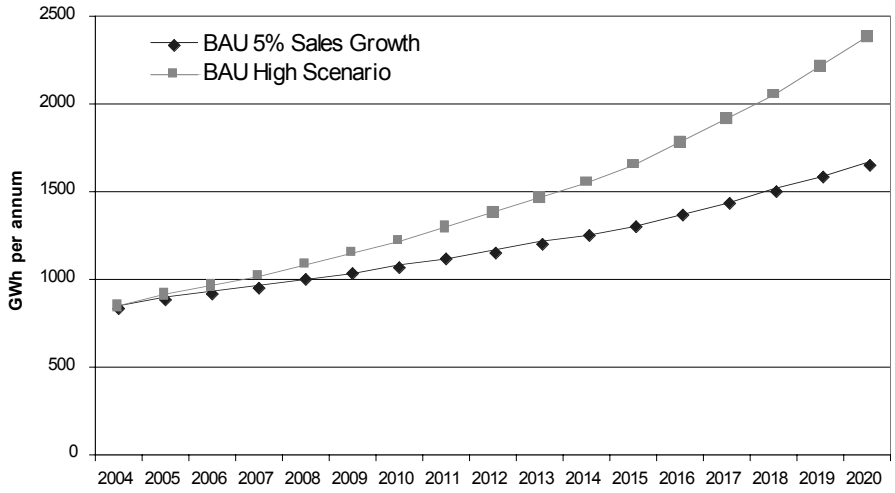

Figure 3 BAU Wasted Energy Consumption 5 % and High Growth

supplies are typically more efficient that linear power supplies, there are some linear power supplies that are more efficient than the low cost norm.

Objectives

The objective is to bring about reductions in Australia's greenhouse gas emissions below what they are otherwise projected to be (i.e. the "business as usual" case), in a manner that is in the broad community's best interests. The energy performance improvements of EPS will also provide reductions in greenhouse gas emissions for appliances that are currently not being considered, in their own right, for energy efficiency programmes. The proposed regulation must also provide a broad positive financial benefit to end consumers, without compromising appliance quality or functionality.

Proposed regulation and alternatives

The RIS process requires that alternatives are considered, including the "do nothing" BAU case. This section provides a summary of all the options considered.

STATUS QUO (BAU)

Total wasted energy consumption, direct and indirect, due to EPS for 2006 is estimated to be 923 GWh, with annual greenhouse emissions of 949 kT CO2-e.

The estimated annual energy consumption for two projected sales growth scenarios are shown in Figure 3. The BAU 5 % Sales Growth is a relatively conservative increase of 5 % in sales per annum. The BAU High Scenario is based upon sales growth forecasts shown in Table 3 from 2005 to 2010 [PMSA 2005] and extrapolated to 2020. There will be some natural improvement in efficiency, but there is little or no change expected in the low power, highly price sensitive end of the market.

As shown in Figure 3, wasted energy consumption for appliances powered by EPS are forecast to increase by 80 % to 147 % between 2006 and 2020.

VOLUNTARY MEPS

Voluntary MEPS relies on equipment suppliers being effectively encouraged to meet certain minimum energy efficiency levels voluntarily, i.e. in the absence of regulation. As there are few commercial incentives for doing so, it is unlikely that suppliers would willingly make these changes without significant Government incentives. Stakeholder feedback was that "brand name" suppliers may participate, but others would not, thus affecting their competitiveness and encouraging the use of poorer performing products. This is borne out by results from the US ENERGY STAR and the European Union Code of Conduct (EU CoC) for EPS.

The EU CoC was established in June 2000 and by 2005, 21 companies had become signatories to the CoC. Available data does not break this down to the number of EPS manufacturers this affects. Whilst the program has been successful with the signatories, there is still a plethora of companies who are not participants. The present Code of Conduct has been very successful in some end-use equipment such as notebook computers and mobile telephones, and less successful in other such as kitchen tools, consumer electronics, etc. Many inefficient power supplies are still supplied with appliances, particularly games and home telephony. [EC 2006] It is also noTable that the current CoC requires that a minimum of 90 % of a signatory's models, not sales, must comply, which therefore permits the remaining 10 % of models to be non compliant.

In its Action Plan for Energy Efficiency [EC 2006 – 1] the European Commission has included EPS as one of two highest

Table 4 Energy Labeling Potential Mis-information

Appliance	Appliance Power	EPS efficiency	Power to EPS
A	30 W	60 %	50 W
B	20 W	50 %	40 W

priority products for MEPS and labeling by the end of the first quarter of 2008.

The US ENERGY STAR voluntary program came into force on 1st January 2005 after several years of testing and development of efficiency and standby levels. Many EPS manufacturers have embraced the program and compliant EPS are available across the power range. The ENERGY STAR Partner List of Qualified Manufacturers currently lists 56 companies from around the world, with 690 qualified EPS from 0.15 to 220 Watts. Integrated circuit manufacturers have also designed and manufacture integrated circuits to enable the manufacture of compliant EPS.

Appliance suppliers have not responded in the same manner as power supply manufacturers. The ENERGY STAR Partner List for End Use Products (appliance manufacturers/suppliers) has eight companies, with 90 qualified end use products, compared to the 21 signatories to the EU CoC.

Whilst the two voluntary programs cited have merit and have achieved good results with participants, the participation to date by appliance manufacturers indicates that this option may have little effect in many product sectors and hence overall reduction of waste energy.

VOLUNTARY CERTIFICATION PROGRAM

As with other voluntary information-type programs, there is a tendency for only the better performing products to participate in an attempt to gain a marketing advantage over cheaper, and poorer performing, products. This type of program can work in a market where consumers are looking for efficient products, but given that the purchase of an EPS is "incidental" to the primary appliance being purchased, it is unlikely to drive a purchase decision.

Australian industry associations' opinion is that only the "brand name" companies may participate and others probably would not. This would then result in a commercial advantage to non-participants with cheaper products, thus increasing the probability of sales of poorer performing products.

The costs associated with this option, for participants and government, would be the same as the MEPS option. In addition it would also require a significant complementary consumer and salesperson education programme, of quite a technical nature, in stores and in the media to convey the message. There is also the question of where to effectively place the information – for example, on the external power supply or on the overall product packaging. In summary the costs would be higher and the benefits lower than the MEPS option and is not considered to be the best option to meet the objectives.

DIS-ENDORSEMENT LABEL

The principle of a dis-endorsement label is to highlight that a product is an energy waster. This type of labeling is most suited to a complete product in one package, for example an instantaneous water heater, refrigerator etc. In the case of appliances powered by EPS, the dis-endorsement label would only apply to the power supply, rather than the appliance being powered. The appliance itself may be energy efficient, however a dis-endorsement label has the potential to incorrectly infer that the appliance being powered is an energy waster. I.e. the wrong message could be sent to the consumer and potentially increase waste energy.

For example, if there are two appliances A and B that perform the same function, but have different appliance power consumption and different EPS efficiencies. Comparing them in Table 4, appliance A has a more efficient power supply, but because its own power rating is higher than appliance B, it consumes more energy than appliance B with the less efficient power supply. However, labeling appliance B as having a less efficient power supply, may influence the consumer to purchase appliance A, rather than the lower overall energy consuming appliance B.

Dis-endorsement labeling would require a significant, complementary education program of quite a technical nature, that would be beyond the comprehension of many consumers. Costs to manufacturers, importers, suppliers and government would be the same as the MEPS option, with additional education programme costs. Therefore the costs would be higher and the benefits lower, due to poor performing products still remaining in the market place.

LEVIES AND FINANCIAL ASSISTANCE

Levy options are not currently government policy and would require extensive consultation at the highest levels of government. Hence these options are not worthy of consideration until such time as government policy changes to favour levy schemes.

MANDATORY ENERGY LABELING

Mandatory energy labeling requires the application and display of a comparative energy performance label on products and packaging. It is important to recognise that the majority of these devices are sold bundled with their end-use equipment, e.g. mobile phone, laptop computer, wired telephony, games machines etc.. The number of products that are sold as a stand-alone EPS are estimated to be less than 5 %. This has ramifications for any labeling program, since it is not obvious where a label would be fixed in order to be visible to the customer at the point of purchase, i.e. on the power supply or the end-use equipment. Furthermore, even if the label is visible, to what extent is the consumer able to change their purchasing decision if they want to buy a more efficient power supply? It seems unlikely at this stage that manufacturers will offer the same end-use equipment with a range of power supply options from which to choose. In some instances, such as games machines, consumers do not have a choice of products due to proprietary nature of these machines and therefore must purchase the appliance as supplied.

As with dis-endorsement labeling, labeling alone creates the potential for a consumer to select an appliance with higher

Table 5 Proposed No-Load MEPS Requirements, Australia 2008

Nameplate Output Power (Pno)	MEPS Proposal Phase (1)
0 to < 10 watts	≤ 0.5 watts
≥ 10 to ≤ 250 watts	≤ 0.75 watts

Table 6 Proposed MEPS Requirements for Average Efficiency. Australia 2008

Nameplate Output Power (Pno)	Australian MEPS Proposal Phase (1)
0 to ≤ 1 watt	≥ 0.49 * Pno
> 1 to ≤ 49 watts	≥ [0.09 * Ln (Pno)] + 0.49
> 49 watts	≥ 0.84

overall energy consumption. The comparative energy label which has been used in Australia on many whitegoods has been highly effective. It provides an easily understood and credible means for consumers to compare the performance of competing appliances. Even though the display of the label is mandatory in many cases, any benefit in terms of reduced energy consumption relies upon the selection of the appliance by the consumer.

In the case of EPS, the consumer/purchaser is unlikely to see the EPS at the time of appliance selection or purchase. However, if, like ENERGY STAR, the label is on the appliance packaging, the consumer may see it; but the question is whether it would influence their purchasing decision. Therefore mandatory labeling, as the sole means of encouraging purchases of more efficient EPS, is unlikely to succeed. As with the previous options, costs would be the same as MEPS, but would require a complementary education programme, thus increasing programme costs.

PROPOSED MEPS

MEPS aims to remove the worst performing products from the marketplace, rather than promoting the best. In Australia this is achieved by including the energy performance criteria within an Australian Standard which is mandated through State and Territory legislation. These requirements apply to products covered by the standard which are sold in Australia (and usually New Zealand as well).

Mandatory MEPS would apply to all EPS within the scope of Australian New Zealand Standard AS/NZS 4665 whether sold separately or with an end use appliance, and therefore would overcome the issues relevant to labeling. A further advantage of MEPS is that it protects the investment of those wishing to sell more efficient devices, since they know they will not be undercut by products which may be cheaper, but less efficient.

Australia has introduced MEPS for a range of products and has a very successful track record in this area. Further information is available from: http://www.energyrating.gov.au/meps1.html.

Table 5 contains phase 1 proposed no-load MEPS requirements and Table 6 the proposed phase 1 efficiency levels from April 2008.

Phase 2 levels are the same as proposed by the Californian Energy Commission (CEC) for later implementation. Should the future levels proposed by the CEC change from those shown here, the phase 2 MEPS levels would also change so that they harmonise with those adopted in California. Although there is currently no fixed date for the implementation of phase 2 MEPS, for the purpose of this report, it is assumed to be during 2011.

COSTS, BENEFITS AND OTHER IMPACTS

COST TO THE TAXPAYER

The proposed mandatory MEPS program will impose costs on governments and these are included in the cost benefit analysis at A$ 150,000 per annum.

BUSINESS COMPLIANCE COSTS

The RIS assumed that any increases in EPS design, construction, testing and registration costs will be passed on to customers and are included in incremental costs to consumers in the cost benefit analysis. The initial cost of testing is assumed to be borne by the manufacturers, either locally or overseas. Cost of compliance with the standard is incremental to testing and registration costs already borne by the manufacturer in compliance with other standards. These compliance costs will ultimately be amortised over the sales of the product, thus making the unit cost of compliance dependent upon the volume of sales expected.

INDUSTRY, COMPETITION AND TRADE ISSUES

Industry issues

In many industries manufacturers, importers, distributors and retailers vary greatly in size, from trans-national corporations to small family businesses. Clearly these groups have different capacities to respond to the costs that the proposed regulations will place on them. Product energy testing costs are more or less fixed for each model, so suppliers with many models will have higher costs, and will be at a further disadvantage if average sales per model are low.

Via international collaboration, the US EPA (ENERGY STAR), the European Union, China and Australia have agreed that the US Energy Star test methods be used in each country/region. In addition a performance marking system for EPS has been developed. Australian/New Zealand Standard AS/NZS 4665.1 documents the test methods and performance mark. Testing, irrespective of the energy performance and mark achieved, will be uniform for all products destined for these markets. Therefore the cost of performance testing and marking will be spread across all EPS, irrespective of ultimate sale

destination and/or application. With the international acceptance of the performance mark, end use appliance suppliers and manufacturers will only need to specify which performance mark is required. As most EPS are currently imported, either from a standard range or custom designed, MEPS will not affect material and sub-component suppliers within Australia.

Trade

Mandatory energy efficiency regulations apply to all products sold, whether locally manufactured and imported, and irrespective of country of origin. Nevertheless it is useful for decision-makers to know whether the proposals are likely to impact on the balance between local manufacture and imports, e.g. by affecting one group of suppliers more than another.

Published information by manufacturers and designers of power supplies from China, the USA and Europe state that there are a wide range of power supplies currently available which meet these proposed requirements. If new products need to be developed, integrated circuit manufacturers have control electronics ready for shipment and some EPS manufacturers and designers have design guides available for the manufacture of compliant EPS. [PET 2005] [EDN 2005] [PI 2003] [PI 2006]

The lead time from specification to availability in the marketplace ranges from 5 to a worst case scenario of 17 months depending upon the specification and component availability. By allowing 23 months between the publication of the new Australian Standard and implementation of MEPS in April 2008, there should be adequate time for the Australian industry to make any necessary adjustments to purchasing policies.

GATT issues

The proposed regulations are fully consistent with the GATT Technical Barriers to Trade Agreement, and follow international standards where possible.

TTMRA

The Trans-Tasman Mutual Recognition Agreement (TTMRA) states that any product that can be lawfully manufactured in or imported into either Australia or New Zealand may be lawfully sold in the other jurisdiction. If the two countries have different regulatory requirement for a given product, the less stringent requirement becomes the de facto level for both countries unless the one with the more stringent requirement obtains an exemption under TTMRA.

As the ANZ appliance and equipment markets are closely integrated, TTMRA issues arise if one country proposes to implement a mandatory energy efficiency measure but the other does not, if the planned implementation dates are different, or even if the administrative approaches are different (for example, Australian governments may require products sold locally to be registered with regulators, whereas New Zealand may not, so changing administrative and compliance verification costs).

Currently there are no known manufacturers of EPS in New Zealand and therefore it is deemed that the TTMRA is not contravened. An issue that may arise is in the instance where a New Zealand manufacturer of appliances imports an EPS, however if New Zealand implements MEPS legislation, in accordance with the Standard, at the same time as Australian States, then this will not be an issue.

Competition

The proposed regulation will prevent manufacturers from making and selling EPS that do not meet the proposed MEPS, and constitutes a prima facie technical barrier to entry and a potential restriction on competition. The MEPS will result in many current models of linear and some switch-mode EPS being removed from the market. It is difficult to quantify the exact number of EPS models that manufacturers will remove from the market.

Manufacturers of inefficient linear EPS will be affected the most by the proposed regulation. However, the phased introduction of the proposed regulation will enable these manufacturers to firstly run down existing stock, and secondly, to have a reasonable amount of time to re-design and tool- up to make EPS that are compliant.

Compliant technology is readily accessible and not costly and would appear not to greatly affect the current level of competition in the EPS manufacturing sector. The market is typified by original equipment manufacturers of EPS, supplying to appliance suppliers and manufacturers. The market is highly fragmented with the top ten companies accounting for some 41 % of the 898 million worldwide sales in 2004. Eight of the top ten competitors, by annual turnover, are headquartered in Asia, with seven of the eight in Taiwan and mainland China. The remaining 59 % of the market is supplied by literally hundreds of other companies, mostly manufacturing in Asia (Darnell Group 2005). During the preparation of the technical report and this draft RIS, no manufacturers of AC-DC EPS were identified in New Zealand and Australia.

In view of the low technical barriers and associated cost for the technological adoption required by current and potential EPS manufacturers, the proposed standard is unlikely to affect the ultra competitive EPS and consumer appliance markets . In fact, best available market research suggests the price of high efficient switch-mode EPS are likely to continue to decline. This should ensure appliance manufacturers of low-end products who currently rely on cheap inefficient linear EPS remain competitive. Accordingly, current levels of competition in the EPS and appliance markets are likely to remain the same without any material impact on consumers.

Consumer costs and benefits

There are literally thousands of appliances in the marketplace powered by EPS and the number is increasing as appliance manufacturers use EPS to make the appliance itself independent of worldwide voltage and frequency differences. Given the myriad of EPS in the market, it is difficult to predict the percentage that will be regulated out of the market. The MEPS report on EPS [MEA 2004] provided data on tests carried out in the US, China and Australia on 605 samples in 2003/4. This identified that 38 % met the proposed no load limits, 32.7 % met the efficiency requirements and 22 % met both no load and efficiency criteria. The report also noted that the sample included older models that may not be representative of new models in the market. Therefore the worst case scenario is that 78 % of external supplies will need to be improved or substituted with existing compliant EPS.

Table 7 Five Year NPV for BAU and MEPS at 7.5 % Discount rate

Application	BAU Annual kWh	NPV BAU	NPV MEPS	5 Year Saving	Annual Energy Saving kWh	MEPS % saving
Laptops	158.9	$138.57	$133.24	$5.33	10.3	4 %
Mobile Phones	9.0	$9.74	$9.20	$0.55	2.3	6 %
Computer Monitors (LCD)	167.3	$139.48	$133.26	$6.22	11.7	4 %
Modems Residential	80.6	$70.00	$71.51	$(1.51)	4.7	- 2 %
Modems Business	86.5	$73.53	$74.38	$(0.85)	5.8	- 1 %
Printers	59.6	$74.85	$69.56	$5.29	10.1	7 %
Scanner & MFDs	48.7	$57.75	$45.42	$12.33	21.5	21 %
Sundry Battery Chargers	8.7	$9.57	$8.88	$0.68	2.6	7 %
Home Audio	46.9	$43.87	$41.98	$1.88	3.7	4 %
Answering Machines	50.2	$36.83	$34.65	$2.18	5.9	6 %
Cordless Phones	46.6	$32.29	$29.79	$2.50	5.6	8 %
Games consoles	20.7	$28.16	$24.34	$3.82	11.6	14 %
Hospital	73.2	$62.50	$55.81	$6.69	11.8	11 %
Cash registers	78.7	$65.78	$60.06	$5.72	10.2	9 %
Barcode and magnetic strip readers,	22.5	$20.70	$19.96	$0.74	3.6	4 %
Networking	63.2	$53.67	$34.14	$19.52	33.0	36 %
Sundry Other	10.1	$11.89	$11.49	$0.39	2.6	3 %

Table 8 Impact of Price Increases on 5 Year NPV by EPS Type

SMPS Price Increase	**2 %**	**4 %**	**6 %**	**8 %**	**10 %**
5 year NPV saving	$M 136.8	$M 85.37	$M 53.22	$M 21.08	$M (11.07)

Linear Price Increase	10 %	15 %	20 %	25 %	30 %
5 year NPV saving	$M 58.52	$M 42.89	$M 27.26	$M 11.63	$M (4)

Data for the impact of MEPS on EPS prices is somewhat limited, however confidential data provided by three international appliance (not EPS) companies, indicates that their cost of compliance will be greater, as a percentage increase, for linear power supplies, due to their typically current low, ultra competitive price and poor performance.

Based upon the confidential data provided on incremental costs and published pricing data it is estimated that the average consumer price will increase as follows;

EPS for appliances using linear EPS will increase by 20 %, even though 2006 data for low power EPS indicates equivalent pricing and switch mode power supplies will increase by 2 %.

Table 7 summarises the NPV, by application, for current and MEPS compliant EPS. The energy calculations are based upon the usage patterns and energy consumption estimated in the Analysis of Minimum Energy Performance Standards [MEA 2004] and more recent data from an Australian standby energy consumption survey [E3 2006]

Within Table 7, the majority of appliances show cost savings over the 5 year service life. The "MEPS % saving" shows the percentage savings due to MEPS. Only modems show a slight average increase in cost.

Combining the NPV data by EPS type and current stock, Table 8 shows that SMPS provide positive benefits for a range of price increases and that linear power supplies may or may not provide a net benefit depending upon percentage price increase. The NPV neutral price rise for linear power supplies is approximately 29 % and the NPV neutral price rise for SMPS is approximately 23 %.

Cost of Forgoing Product Features

The design and some aspects of performance of EPS is governed by standards and specifications covering electrical safety, interference, power factor correction and total harmonic distortion.

Current EPS may exceed the minimum requirements of these standards and there is potential for manufacturers/importers to use alternative components to just meet, rather than exceed them. However, these are not "features" that are driven by consumer choice and, irrespective of MEPS, the consumer will still have an EPS that as a minimum will meet these standards. To the consumer the EPS is a "black box" that may have an LED to indicate that it is connected to the mains supply. If a non compliant linear EPS is replaced by a compliant linear model, there may will be some increase in weight, due to increased material content, such as copper and iron. However, if a SMPS is used, weight and hence shipping cost attributed to the EPS will decrease.

Distributional Impact

This section provides an analysis of impacts on consumers with respect to patterns of usage different to the base model used for the analysis. Table 9 shows the impact for active usage time 20 % greater and 20 % less than the base case. Data for the base case is as per Table 7, which is the NPV analysis over 5 years

Table 9 Impact of usage time 20 % greater and 20 % less than the base case

Application	Base case BAU	Base case MEPS	Base +20 % BAU	Base +20 % MEPS	Base - 20 % BAU	Base - 20 % MEPS
Laptops	$138.57	$133.24	$155.57	$150.34	$121.60	$116.16
Mobile Phones	$9.74	$9.20	$10.00	$9.46	$9.48	$8.94
Computer Monitors (LCD)	$139.48	$133.26	$156.69	$151.19	$122.30	$115.35
Printers	$74.85	$69.56	$79.95	$74.70	$69.74	$64.42
Scanner & MFDs	$57.75	$45.42	$59.50	$47.86	$56.00	$42.97
Home Audio	$43.87	$41.98	$48.05	$46.39	$39.68	$37.58
Games consoles	$28.16	$24.34	$28.65	$24.91	$27.67	$23.77

Table 10 Examples of impacts in other community sectors

Sector	Impacts
Electricity retailers	Reduced sales of electricity and reduced profit. Lower operating costs. E.g. hedging contracts and exposure to high pool prices in periods of peak demand. Contribution to electricity reliability and security. Reduced need for greenhouse gas certificates.
Electricity transmission entities	Contribution to potential for deferral of transmission line upgrades.
Electricity generators	Reduced revenue and contribution to deferred capital expenditure.
Federal Government	Lower energy sales results in lower GST collected. Reduced Government energy consumption provides reduced operating costs. Contribution to meeting the Kyoto target.
Waste	Smaller EPS means less packaging and hence less waste.
Freight	Lower weight means reduced revenue for shipping companies. Lower weight means reduced fuel consumption and greenhouse gas emissions.
Business	Lower operating costs (for EPS) provide increased competitiveness and profits. Marginally increased sales (from consumers spending the money saved on their electricity bills on other goods and services). Higher profits increase Federal Government tax revenue.
Transport/travel	Lower weight means reduced fuel consumption resulting in reduced greenhouse gas emissions and lower operating costs.

at 7.5 % discount rate. Some appliances are not included, such as answering machines, cordless phones and hospital applications, as change in usage pattern is unlikely. Table 9 shows that there is a benefit from MEPS over the five year service life for higher and lower active energy usage time.

Other impacts

Outside the costs and benefits to consumers, there are many other costs, benefits and impacts in other sectors of the community. Table 10 provides examples of impacts that result from reduced energy consumption.

IMPACT ON ENERGY USE AND GREENHOUSE GAS EMISSIONS

Since the MEPS criteria apply only to new products entering the market, it will be a number of years before these measures impact on the stock and hence reductions in waste energy. In both scenarios, stock is retired after 5 years service. Within the analysis, BAU waste in 2008 is estimated to be 3 % less than 2004 with this trend changing by 1 % per annum and peaking at 10 % in 2015.

For the 5 % annual growth in EPS sales, by 2015 the proposed MEPS criteria (phase (1) and (2)) are estimated to reduce annual energy consumption by 512 GWh, and by 2020 the savings will total approximately 687 GWh. (see Figure 4. This is equivalent to reducing annual greenhouse emissions by 483 kt CO_2-e and 606 kt CO_2-e respectively. The estimated total cumulative savings in emissions by these dates are 2.41 Mt CO_2-e and 5.24 Mt CO_2-e. Emission savings are based upon projected state household numbers and marginal emissions-intensity of electricity supply by State 2003-2020.

Under the high growth scenario by 2015, the proposed MEPS criteria (phase (1) and (2)) are estimated to reduce annual energy consumption by 645 GWh, and in 2020 the annual saving will be approximately 972 GWh. (see Figure 5. This is equivalent to reducing annual greenhouse emissions by 609 kt CO_2-e and 856 kt CO_2-e respectively.. The estimated total cumulative savings in emissions by these dates are 2.88 Mt CO_2-e and 6.69 Mt CO_2-e. Note: emission savings are based upon projected state household numbers and marginal emissions-intensity of electricity supply by State 2003-2020.

NATIONAL AND STATE COSTS AND BENEFITS

Community at large analysis, excluding loss of profit to electricity retailers

Table 11 shows the Net Present Value and Benefit Cost Ratios for Australia for a range of discount rates. All data tables are based on EPS prices increasing by 20 % for linear power supplies and 2 % for SMPS. All State and Federal program costs are included.

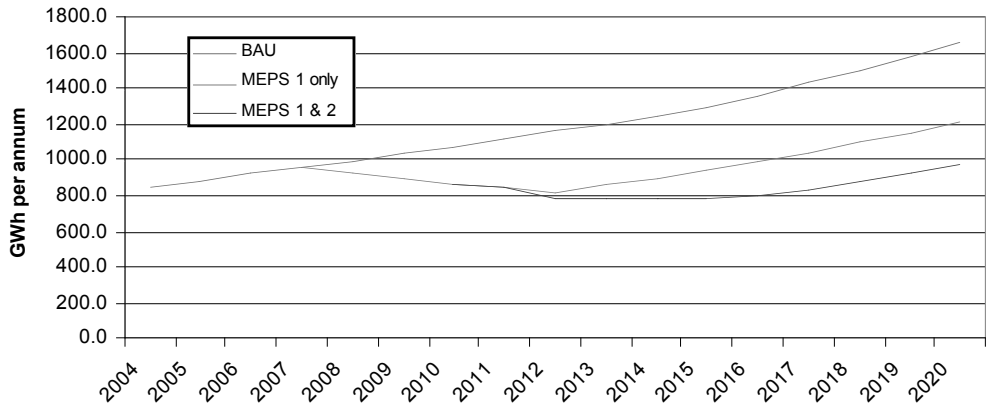

Figure 4 Waste Energy Consumption – BAU and MEPS Scenarios 5 % Annual Sales Growth

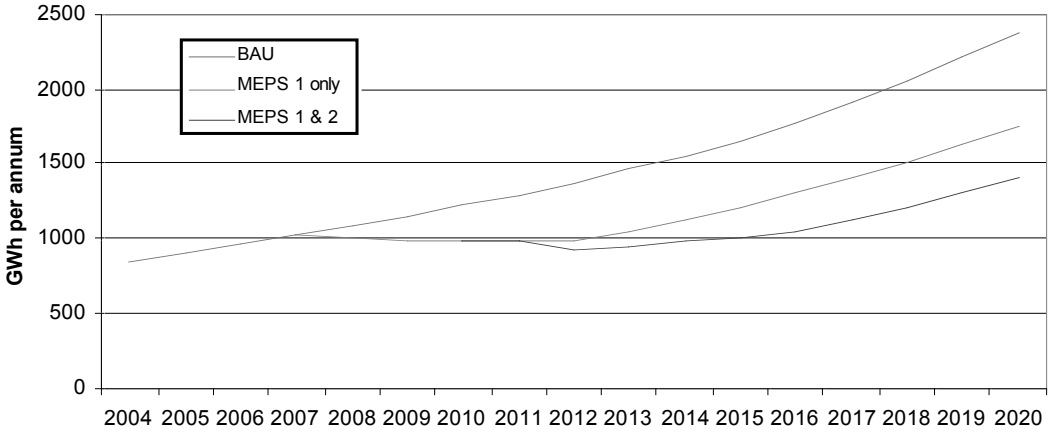

Figure 5 Forecast Energy Consumption – High Sales Growth Scenario

Table 11 Financial Analysis – Australia 5 % Sales Growth

Discount Rate	NPV Benefits $M	NPV Costs $M	Net Benefit $M	Benefit Cost Ratio
0 %	$1,246.9	$386.2	$860.7	3.23
5 %	$631.0	$243.9	$387.7	2.59
7.5 %	$462.4	$197	$265.4	2.35
10 %	$345.0	$161.4	$183.6	2.14

Table 12 Financial Analysis – Australia High Sales Growth

Discount Rate	NPV Benefits $M	NPV Costs $M	Net Benefit $M	Benefit Cost Ratio
0 %	$1,661.1	$487.4	$1,173.5	3.41
5 %	$827.2	$302.5	$524.7	2.73
7.5 %	$601.1	$243.1	$358.0	2.47
10 %	$444.9	$197.8	$247.1	2.25

Note – net benefits are evaluated to 2025 based upon an average 5 year service life for EPS including those purchased in 2020.

Table 13 Summary data for other reduction rates in BAU waste – 5 % scenario

7.5 % discount rate	Base case 1 % pa, peak 10 %	2 % pa, peak 20 %	Equals MEPS in 2015
Energy saved	9,043 GWh	6,705 GWh	3,430 GWh
CO2 – e saved	8.3 Mt	6.1 Mt	3.1 Mt
Total Benefit	A$ 462 Million	$ 346 Million	$ 180 Million
Investment	A$ 197 Million	$ 168 Million	$ 157 Million
Benefit cost ratio	2.35	1.92	1.17

Table 14 Summary data for other reduction rates in BAU waste – High scenario

7.5 % discount rate	Base case 1 % pa, peak 10 %	2 % pa, peak 20 %	Equals MEPS in 2015
Energy saved	12,048 GWh	8,880 GWh	4,444 GWh
CO2 – e saved	11.0 Mt	8.1 Mt	4.1 Mt
Total Benefit	A$ 601 Million	$ 447 Million	$ 232 Million
Investment	A$ 243 Million	$ 207 Million	$ 193 Million
Benefit cost ratio	2.47	2.01	1.20

Table 15 Benefit cost ratio for Australia including loss of electricity retail profit

	5 % Growth		High Growth	
Discount rate	No loss	With loss	No loss	With loss
0 %	3.23	3.13	3.41	3.31
5 %	2.72	2.61	2.87	2.76
7.5 %	2.52	2.41	2.66	2.54
10 %	2.35	2.23	2.47	2.35

Summary data for alternative BAU waste energy reductions

5 % growth scenario

The impact of greater reduction in BAU waste energy compared to the base case is shown Table 13 for the 5 % growth scenario. It provides data for a 2 % reduction per annum, peaking at 20 % in 2015 and the third case where BAU waste reduces to the equivalent of MEPS in 2015. Note, for the calculation of MEPS investment in these two cases, any natural "free of cost" improvement to the BAU case would also apply to the MEPS option.

High growth scenario

The impact of greater reduction in BAU waste energy compared to the base case is shown Table 13 for the high growth scenario. It provides data for a 2 % reduction per annum, peaking at 20 % in 2015 and the third case where BAU waste reduces to the equivalent of MEPS in 2015. Note, for the calculation of MEPS investment in these two cases, any natural "free of cost" improvement to the BAU case would also apply to the MEPS option.

Community at large analysis, including loss of profit to electricity retailers

Table 15 compares the benefit cost ratios for the two cases of loss of profit included and not included. This demonstrates a small impact on the benefit cost ratios to the community at large.

Consultations and comments

Since the launch of MEA Technical Report: October 2004, a number of consultation meetings have been held, including the opportunity to comment on standards in the normal standards development process. In summary, there are no major objections to MEPS for AC-DC EPS, however Australian and international parties state that the no load requirement cannot be achieved economically for AC-AC EPS above 40 VA. This does not affect the RIS analysis as the bulk of AC-AC EPS applications do not operate in no load mode.

Evaluation and recommendations

REDUCE GREENHOUSE GAS EMISSIONS BELOW BUSINESS AS USUAL

Based on a service life of 5 years, the majority of low efficiency EPS will be removed from Australia within 5 years of 2008. Due to their voluntary nature, the other options will not reduce low efficiency EPS stock in the foreseeable future. Due to its non-voluntary nature, mandatory MEPS option has the highest probability of reducing greenhouse gas emissions below business as usual, whilst providing economic benefit to the community at large.

ADDRESSING MARKET FAILURES

By requiring the removal of low efficiency EPS from the market, mandatory MEPS will most cost effectively address market failures. All other options rely on voluntary mechanisms or non-harmonised approaches and therefore cannot as effec-

tively reduce average lifetime costs. (i.e. by mandating EPS with lower lifetime costs).

Mandatory MEPS will not provide buyers with improved access to product performance information, nor will any of the other options, with the exception of labeling, which would be limited to the small replacement market.

The mandatory MEPS option would clearly require importers of EPS and appliances powered by EPS to remove non-complying products or utilise compliant EPS. This is not thought to involve negative impacts on suppliers as the volume of sales would not be affected.

CONCLUSIONS

After consideration of the options it is concluded that:

- The mandatory MEPS option is the only option likely to be effective in meeting all the objectives.
- The non-MEPS alternatives examined do not appear as effective in meeting all the objectives. Some would be completely ineffective with regard to the objectives and some would be considerably more difficult or costly to implement and possibly increase energy consumption.
- Given that the proposal for MEPS has been in the public domain since October 2004, and the Australian Standard was published in November 2005, the program could be implemented as early as April 2008.

RECOMMENDATIONS (DRAFT)

It is recommended that:

- States, Territories and New Zealand implement mandatory MEPS for EPS.
- The mode of implementation be through amendment of the existing regulations governing appliance energy labeling and MEPS in each State and Territory, to add EPS to the schedule of products for which MEPS are required.
- The regulations refer to Australian and New Zealand Standard AS/NZS 4665.1 - Performance of External Power Supplies.
- The amendments take effect on 1st April 2008.
- State and Territory governments should require registration of EPS, so invoking Part 2 of the Standard.
- Governments re-examine, no later than 2011, the costs and benefits of MEPS.

Implementation and review

EPS MEPS would be implemented under the same State and Territory regulations as household appliance labeling and MEPS, and so subject to the same sunset provisions, if any. Australian Standards called up in State and Territory labeling MEPS regulations are also subject to regular review. The arrangements between the Commonwealth, State and Territory Governments and Standards Australia provide that the revision of any Standards called up in energy labeling and MEPS regulations are subject to the approval of the governments.

E3 has adopted the principles that there should be a MEPS 'stability period', and that a cost-benefit analysis would be undertaken before any revisions are proposed. If they are implemented in April 2008, the earliest possible revision would be October 2011. However, it would be necessary to carry out a study well in advance of that time, so that adequate notice could be given to industry in the event that a change was justified.

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