Harmonisation Potential for Computer Test Methodologies, Product Definitions and Specifications

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SEAD Computers Working Group

Jonathan Wood
Tenvic Ltd.

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Abstract

The level of harmonisation found amongst global environmental initiatives tackling the energy efficiency of computers has been investigated as part of the SEAD Computer Working Group series of activities. We investigated the main initiatives focussing on energy efficiency of the main types of domestic and office computers and recorded details about product definitions, test methodologies and energy efficiency specifications. This information was then compared to identify the level of harmonisation currently taking place within the initiatives. It became clear that many initiatives have either fully or partly harmonised with the ENERGY STAR programme for computers but that further harmonisation in the area would be possible. It was also recognised that mandatory measures are unlikely to be able to fully harmonise with ENERGY STAR due to differences in the levels of ambition. Based on these findings, the group provided suggested recommendations to facilitate further harmonisation amongst voluntary and mandatory initiatives. In essence, the group decided that wherever possible voluntary measures should harmonise with ENERGY STAR and mandatory measures should harmonise with other already existing mandatory measures. To support further harmonisation amongst initiatives the group also developed a database containing the product definitions, test methodologies and specifications found in the main initiatives. The group believe that dissemination of this database via a webpage could provide initiative developers with the data that they need to harmonise.

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Executive Summary

Introduction

This report discusses the findings of the SEAD Computer Working Group's investigations into harmonisation potentials for computer test methodologies, product definitions and specifications. The SEAD investigations were commenced due to the fact that non-harmonisation on these three key components in environmental initiatives around the world causes a number of disadvantages. The group sought to undertake work that would provide guidance and tools to help reduce the disadvantages associated with the non-harmonisation of these key components amongst initiatives.

The first stage of the project was to identify the level of harmonisation currently found within major initiatives around the world. The group collated information on product definitions, test methodologies and specifications from a large number of initiatives tackling the energy efficiency of computers.

Harmonised Product Definitions

The group identified the product definitions used for different types of computers within each major initiative. These product definitions were compared to those used within the ENERGY STAR v5.0/5.2 programme requirements for computers (ENERGY STAR v5.0/5.2 was used as the benchmark as it enjoys the largest uptake by manufacturers and therefore listed products). It was found that whilst many initiatives used the same product definitions as those found within ENERGY STAR, there were often differences. It was noted that differences occurred in mandatory measures and in refreshes to the ENERGY STAR computer specification (v6.0/6.1). The group concluded that these differences were probably necessary due to specific legal or programme specific requirements, in the case of the European legislation, or necessary refreshes to reflect changes in the market in the case of ENERGY STAR. Reflecting on these findings, the group recognised that product definitions need to vary across different types of initiatives. In particular, it was noted that there are clear differences in requirements for product definitions between mandatory and voluntary programs. It was concluded that there is still a need to support increased harmonisation of product definitions but that mandatory and voluntary programs may have different requirements.

Harmonised Test Methodologies

In assessing the test methodologies used within each initiative it became clear that the ENERGY STAR programme test methodologies are the most widely adopted methodologies. However, it also became obvious that test methodologies used within mandatory measures were often different (although often largely based on ENERGY STAR). The group agreed that there are a number of factors resulting in divergences on test methodologies. Some of these factors relate to legal issues (i.e. there is already a test procedure in a piece of legislation) whilst other factors relate to opinion or differing technical insights into the most appropriate

methodology to use in each initiative. It was further recognised that due to the resource intensive nature of test procedure development there is already a significant financial driver to harmonise with existing test methodologies whenever possible. Despite this, there was a general agreement within the group that a harmonised test procedure for all product types could not be agreed upon in the short term. However, all working group members stated that further harmonisation would be possible with further co-operation, and that SEAD could facilitate this co-operation.

Harmonised Performance Specifications

The group also reviewed the product performance specifications that are included under each of the main initiatives. Again it was clear that the ENERGY STAR v5.0/5.2 programme was the main source of specifications for computers amongst the various environmental initiatives. Once again, it was clear that mandatory measures had used different specifications (although often based on the ENERGY STAR v5.0/5.2 specifications).

Advantages and Disadvantages of Harmonisation

The relative advantages and disadvantages of further harmonisation in each of the three key components of environmental initiatives were also explored in more detail. It was recognised that one of the main advantages of harmonising across initiatives was the reduction in costs for manufacturers, initiative developers and enforcement bodies. The ability to decrease potential barriers to trade for companies selling in multiple regions was also flagged as an important advantage of harmonisation. However, perhaps the most important advantage of harmonisation is the ability to increase the influence of specifications across multiple regions (although it was also recognised that this advantage could become a disadvantage if harmonised specifications are too lenient). Some other major potential disadvantages from increased harmonisation were noted including the fact that if key impacts are missed the associated reduction in energy savings could be magnified. The loss of usable historical data was also cited as a potential disadvantage of harmonising to a different test procedure which could result making it more difficult to track the progress on energy efficiency in covered products overtime.

Harmonisation Hurdles

The group reflected on the findings of the above reviews and moved to identify the major hurdles facing further harmonisation of each of the three key components of initiatives. It was noted that many of the hurdles in the way of harmonisation can be split into “technical” and “institutional” barriers. It was noted that one of the largest potential barriers to further harmonisation are legal requirements to use certain test procedures in mandatory measures. An example was given of the EU Ecodesign Regulation (617/2013) on computers which uses different test procedures for some components due to the fact that these test procedures were already laid down in other Ecodesign Regulations. Other technical barriers noted included

the fact that there may be unique requirements in some geographical regions such as different electricity supply voltages. However, it was noted that most major multi-region test methodologies currently take account of these differences but there is a danger that a region-specific test methodology used to enforce a mandatory measure may not take account of these regional differences in electricity supply. Differences in the average efficiency of products within different markets were also noted as a potential barrier to the further harmonisation of energy efficiency specifications for computers. Further work could be conducted in this area to identify any differences in average efficiencies between regions. Some of the institutional barriers to further harmonisation were also explored in more detail. For example, it was suggested that some initiatives may simply wish to develop their own requirements, test procedures and product definitions rather than harmonise. However, it was decided that the biggest potential institutional barrier to further harmonisation of specifications is the fact that different initiatives reflect different levels of ambition. This is particularly clear when assessing the differences in ambition laid down in mandatory and voluntary initiatives with the mandatory initiatives often needing to be more lenient as they cover a whole market rather than just the most energy efficient products as is often the case within voluntary initiatives.

Harmonisation Recommendations

The group recognised that the potential advantages from further harmonisation outweighed the potential disadvantages and that some of the barriers to harmonisation could be overcome through the development of guidance and tools. As part of this work stream, the group investigated the potential of each of the main initiatives as a source of potential harmonised product definitions, test methodologies and specifications. After conducting this review the group developed recommendations for harmonised product definitions, test methodologies and specifications for both mandatory and voluntary environmental initiatives. It was suggested that voluntary programs use the product definitions, test procedures and specifications found in the forthcoming ENERGY STAR v6.1 programme for computers (and then ENERGY STAR v7.0 once developed). This finding was based on the fact that ENERGY STAR enjoys the largest participation rates and its components are already used in a number of other initiatives. However, it was also recognised that not all of the ENERGY STAR components would be suitable for harmonisation into mandatory measures due to both ENERGY STAR not necessarily covering all types of computer on the market and the fact that newly developed ENERGY STAR specifications are likely too stringent to be included in mandatory measures. Given the shortcoming of ENERGY STAR to be able to act as a source of harmonised key components for mandatory measures, the group made a further set of recommendations to cover harmonisation potentials in future mandatory measures. The group recommended that the test procedures behind the ENERGY STAR v5.0/5.2 specification or the Ecodesign ErP Computer Regulation (617/2013) be adopted into other mandatory measures until the finalisation of the ENERGY STAR v6.1 test procedures, which should then be adopted. For product definitions and specifications, the SEAD working group recommended that the definitions behind the Ecodesign ErP Computer Regulation (617/2013) should be used until either the Californian or US Department of Energy (DoE) rule making process on computers is completed. The move away from the EU mandatory measure was suggested due to the fact that the computer industry changes quickly, and so the US based mandatory measures are more likely to reflect current market conditions.

Harmonisation Support Tools

Having noted the barriers to further harmonisation, the group also set about developing two tools that could help overcome these barriers. The first tool was an Excel based database which included all the findings from the research into the main initiatives (included listing out all product definitions, test procedures and specifications in each initiative). It is suggested that the database will help to overcome some of the barriers to harmonising the three main components of environmental initiatives through clearly identifying the similarities and differences between each of the main initiatives focusing on computers. The group envisaged that the database will be developed into a web solution that is regularly updated by a management organisation such as SEAD. The second project to help overcome barriers to harmonisation was the development of a Standards and Labelling Toolkit for Computers (under development by Australia, in support of the SEAD initiative). The toolkit will be described in detail in a separate report.

Conclusion

In summary, the SEAD Computer Working Group has assessed the current level of harmonisation of product definitions, test methodologies and specifications across many of the main initiatives that address energy efficiency of computers. The work showed that there is some harmonisation in the area but further harmonisation would be possible with additional support to help overcome barriers. Whilst it is recognised that not all barriers can be overcome, the group has developed a series of recommendations for further harmonisation and is in the process of developing two tools to further support harmonisation into the future.

1. Introduction

There are a large number of environmental initiatives around the world which seek to address energy efficiency of computers. Whilst these initiatives share a focus of increasing energy efficiency, the degree of harmonisation on key programme parameters, such as product definitions, test methodologies and specifications, does vary.

A number of disadvantages are brought about due to this disparity in product definitions, test methodologies and specifications. Manufacturers and suppliers of computers frequently conduct business in multiple regions around the world. The lack of harmonisation can result in increased costs for these companies due to increased testing demands and compliance assurance procedures. Organisations wishing to procure energy efficient products also often face having to decide between overlapping initiatives which address the energy efficiency of computers. Disparity amongst energy efficiency initiatives also causes further problems for policy makers when attempting to use standard nomenclatures and test methodologies in policy initiatives. That is, policy makers often look to established energy efficiency initiatives to "borrow" product definitions and test procedures, recognising that harmonisation is beneficial for many stakeholder groups.

The path towards complete harmonisation of product definitions and test procedures is not a straightforward endeavour due to a number of complexities such as different types of policy drivers having different requirements on definitions and test procedures. Furthermore, whilst there are formal links between many of the initiatives addressing energy efficiency in computers these links are not always present meaning that product definitions and test procedures can be developed in isolation.

Recognising the need for increased harmonisation on product definitions and test methodologies, a group of international government representatives was brought together under the SEAD initiative. The international SEAD working group on computers commenced in September 2011 and comprised of government representatives from Australia, Canada, India, Japan, South Korea, USA and the UK (also updating the EU on progress). The international group convened to investigate the opportunities to improve international co-operation on energy efficiency standards and labelling opportunities for computers.

Given the complex nature of the "computer" area and the number of harmonisation programs that could have been run under the SEAD Computer Working Group it was necessary to conduct a prioritisation survey amongst the members. The SEAD group participants decided that efforts should be focussed on the following work areas:

- Standardisation of Product Definitions
- Test Methodology Standardisation
- Standardisation of Specifications/Allowances
- Database of product definitions, test methodologies and specifications/allowances
- International Test Standard toolkit

Furthermore, it was decided that the above work stream should be investigated for the following types of computer and associated component:

- Desktop PCs
- Integrated Desktop PCs
- Notebook PCs
- Workstation PCs
- Thin Client PCs
- Small Scale Servers
- Tablet PCs
- Mobile Workstations
- Power Supply Units (PSUs)

This document builds on the work undertaken within the SEAD Computer workgroup by discussing the main issues surrounding the harmonisation of product definitions, test methodologies and specifications. In addition, the document includes some suggested harmonised test methodologies, product definitions and specifications for use in different types of environmental initiatives.

2. Environmental Programme Components

The SEAD working group decided to focus attention on three key components of energy efficiency programs namely: test methodologies, product definitions and specifications/allowances (herein referred to as "specifications". Each of these main components is discussed below.

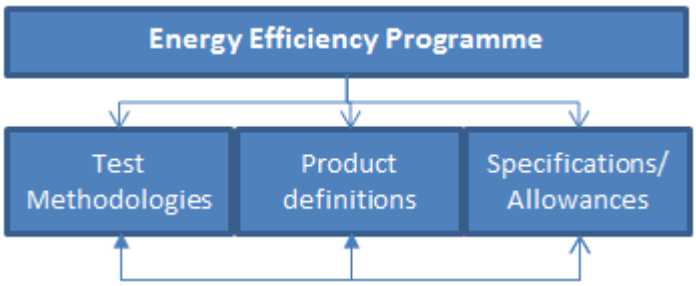

Figure 1 – Main components of an environmental programme dealing with the energy efficiency of computers

Product definitions

Product definitions are used by environmental initiatives to clearly define types of products (e.g. desktop or notebook computer). Energy efficiency specifications are then developed for each product type. Given the complex nature of computers it is unsurprising that definitions for these products can vary across the different initiatives. Some of these differences stem from the authors of each initiative developing product definitions independently. Other differences stem from initiatives having bespoke requirements that result in product definitions needing to be developed or adapted to fit the needs of the initiative.

Product test methodologies

Product test methodologies are used by environmental initiatives to guide the measurement of energy or power demands in selected product types. Test methodologies ensure that energy or power is always measured in the same way providing confidence in any energy or power values communicated by initiatives. There is less variability in the test methodologies used for each product type in the computer industry, but there is at least some duplication of efforts. The reduced variability in the numbers of test procedures most likely stems from the fact that developing the methodologies can be resource intensive.

Product Specifications

Product specifications are used by environmental initiatives to dictate a level of environmental performance, often in terms of energy efficiency, that must be met by a product. Energy efficiency product specifications for computers are most often based on energy or power demand limits. Each programme may contain a number of specifications tailored to different types of computer and to the level of functionality provided by each type of computer (e.g. type of central processing unit (CPU), presence of a discrete graphics card etc). Product specifications for computers can vary widely across different initiatives due to a variety of reasons such as levels of ambition, type of initiative or the age of the specifications.

3. SEAD Working Group Findings

In an attempt to understand the area in more detail the group investigated the current harmonisation status of the three main programme components across some of the major global environmental initiatives (i.e. those that focussed on the energy efficiency of computers). The results of this initial research are discussed in the following sections.

Product definition findings

The first major piece of work conducted under the group was to identify the product definitions used for the above product types within each major initiative.

Key				
Type of Initiative				
1 = Voluntary	2 = Voluntary (Mandatory for Government Procurement)	3 = Mandatory for Government Procurement	4 = Mandatory	5 = Mandatory (sales weighted)
Comparison to ENERGY STAR v5.0/5.2				
Same	Similar but alterations	Different	Not Included	Unsure

Figure 2 provides an overview of how each of the product definitions, within each initiative, relate to the product definitions used within ENERGY STAR v5.0/5.2 (ENERGY STAR v5.0/5.2 was used as the benchmark as it enjoys the largest uptake by manufacturers). Figure 3 provides further details about the types of environmental initiatives that were investigated.

Country	Initiative	Type of Initiative	Desktop PCs	Integrated Desktop PCs	Notebook PCs	Workstation PCs	Thin Client PCs	Small Scale Servers	Tablet PCs	Mobile Workstations	Internal Power Supply Units	External Power Supply Units
US, EU, UK, Canada, Australia, Japan	ENERGY STAR V6.0	2										
EU	ErP Computer Regulation	4										
	EU Ecolabel	1										
	EU GPP	3										
UK	Government Buying Standards	3										
Australia	MEPS	4										
Canada	Federal procurement plan	3										
Japan	Top Runner	5										
Korea	e-standby program	1										
India	BEE STAR Ver 1	1										
China	MEPS	4										

Key				
Type of Initiative				
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Comparison to ENERGY STAR v5.0/5.2				
Same	Similar but alterations	Different	Not Included	Unsure

Figure 2 – Product Definition Divergence from ENERGY STAR v5.0/5.2

Type of Initiative	Examples	Details
1= Voluntary	EU Ecolabel, BEE STAR, e-standby programme	These types of initiatives seek to encourage manufacturers to meet underlying requirements on a strictly voluntary basis. Manufacturers are often allowed to display a label on qualifying products proving that they have met the underlying requirements of a voluntary programme.
2 = Voluntary (Mandatory for Government Procurement)	ENERGY STAR	These types of initiatives are generally voluntary in nature but an additional policy measure has been taken to make the underlying requirements of a scheme a mandatory consideration in public procurement contracts. For example, in both the US and EU central government bodies need to ensure that the computers they purchase meet the underlying energy efficiency criteria
3 = Mandatory for Government Procurement	EU GPP, Government Buying Standards, Federal procurement plan.	The primary purpose of this type of initiative is to provide mandatory technical specifications for use within Government procurement contracts. Underlying environmental requirements may be bespoke or borrowed from other schemes. For example the energy efficiency criteria behind ENERGY STAR are often copied into these types of initiative.
4 = Mandatory	Australian MEPS, Chinese MEPS, Ecodesign measures (ErP)	Mandatory initiatives place legally binding minimum efficiency levels on products sold within a country or region. All new products placed on the market must meet the underlying energy efficiency requirements.
5 = Mandatory (sales weighted)	Toprunner	Some mandatory initiatives place legally binding average energy efficiency targets on a range of products sold by manufacturers rather than on individual products. This allows the manufacturers to sell some inefficient products but still ensures that on average their range of products must meet the overall energy efficiency requirements.

Figure 3 – Types of Environmental Initiatives

It is clear that whilst there are a large number of similarities in the product definitions used, within the different initiatives across each region, many are based on the product definitions found in ENERGY STAR v5.0/5.2. However there are a number of key differences in some initiatives. Newer initiatives, such as ENERGY STAR v6.0, appear to build on or improve older product definitions. This "updating process" reduces harmonisation of product definitions in the short term but given the fast moving nature of the computer industry it is likely that these changes are needed to make the definitions better reflect computer products on the market.

It is also clear that the European Commission (EC) Ecodesign measure on computers includes amended ENERGY STAR v5.0/5.2 product definitions. Given that ENERGY STAR is a joint US/EU programme it is unlikely that the EC would have amended the ENERGY STAR definitions without good reason. Harmonisation of product definitions across all initiatives therefore appears to face several hurdles.

There was a general agreement within the SEAD working group that product definitions need to vary across different types of initiatives. It was noted that experience with the EU Ecodesign measures suggest that product definitions used within legislative measures need to be defined in such a way that there is no room for interpretation or misunderstanding. For example, definitions need to ensure that products that fall under the scope of the measure are irrefutably covered without unintentionally bringing more product types into scope. Conversely, it was also noted that product definitions within voluntary programs, such as ENERGY STAR, can be altered more quickly if the need arises to avoid any unintended consequences. This quick refresh of product definitions is unlikely to be suitable for mandatory measures which are typically rigid and offer little possibility to update product definitions without repealing the legislation. In addition, there is a much greater risk of unintentional consequences in mandatory programs or other initiatives that run through slower processes, whereas voluntary programs such as ENERGY STAR can make relatively rapid adaptations should the need arise and arguably cause fewer issues when their definitions don't align with products on the market.

Despite these clear differences in approaches, it is important that with globally traded products like computers, product definitions are harmonised as much as possible, especially in mandatory measures, to minimise the impact on suppliers and to avoid any negative impact on consumers. As such the definitions in standards need to be consistent and clear.

The overall findings and SEAD working group opinions suggest that there is a need to facilitate further product definition harmonisation, but that any approach needs to take account of different types of policy initiative. The next section of the report investigates some of the processes that the SEAD group investigated which may facilitate this increased harmonisation whilst taking account of the needs of different initiatives.

Product test methodology findings

The group sought to identify the test methodologies that were used for each of the product types within each of the main environmental initiatives. Data was either collected from the working group members or sourced from a previous CLASP report and supplemented by additional research. A summary of the results can be seen in Figure 4.

It is clear from the results that the ENERGY STAR programme test methodologies are the most widely adopted methodologies. However, other test methodologies are used within Australia, Europe and Japan. The Australian and EU mandatory measures include bespoke methodologies but these are heavily based on the ENERGY STAR v5.2 test procedure.

Country/ Region	Scheme	Desktop PCs	Integrated Desktop PCs	Notebook PCs	Workstation PCs	Thin Client PCs	Small Scale Servers	Tablet PCs	Mobile Workstation	Internal PSUs	External PSUs
US, EU, UK, Canada, Australia, Japan	ENERGY STAR v5.0/5.2										
	ENERGY STAR v6.0										
Australia	MEPS										
	Gov. Procurement										
	Good Environmental Choice										
Canada	Federal procurement plan										
UK	Energy Saving Recommended										
	Government Buying Standards										
EU	Ecodesign (ErP)										
	EU Ecolabel										
	EU GPP (Gov Proc)										
Germany	Blue Angel										
India	BEE STAR Ver 1										
Japan	Top Runner										
Korea	e-standby program										
New Zealand	MEPS										
	Government Procurement										
	Environmental Choice										
China	MEPS										
Russia	MEPS										

Key - Test Methodologies
ENERGY STAR v5.0/5.2
ENERGY STAR v6.0
Initiative Specific
IPS: Generalized Internal Power Supply Efficiency Test Protocol Rev. 6.4.2
Uniform Test Method for Measuring the Energy Consumption of External Power Supplies, Appendix Z to 10 CFR Part 430
ENERGY STAR: External Ac-Dc and Ac-Ac Power Supplies Eligibility Criteria (Version 2.0)
IEC 62301
COMMISSION REGULATION (EC) No 278/2009 (EN 50563:2011)
AS/NZS 5813.1:2012
EC- to be developed
Not covered
No data
Uncertain

Figure 4 – Test Methodologies and Initiatives

Most countries agreed that there are a number of factors resulting in divergences on test methodologies. Some of these factors relate to legal issues (i.e. there is already a test procedure in a piece of legislation) whilst other factors relate to opinion or differing technical insights into the most appropriate methodology to use in each initiative.

As previously mentioned the development of test procedures can be resource intensive and so there is a financial driver to harmonise with existing test methodologies whenever possible. However, test procedures for computer products (and associated components) are developed by a wide variety of organisations and that the complete harmonisation of test procedure would therefore likely reduce workload for some of these organisations. This may serve to reduce the possibility of complete harmonisation as much of this workload is paid work.

There was a general agreement within the group that a harmonised test procedure for all product types could not be agreed upon in the short term. However, all working group members stated that further harmonisation would be possible with further co-operation.

The overall findings and group opinions suggest that further harmonisation of test methodologies could be facilitated by work in this area. However, it is also necessary to consider some of the major hurdles that stand in the way of complete harmonisation of test methodologies. These hurdles or barriers are discussed in more detail later in section 4.2.

The next section of the report investigates some of the processes that the group investigated which may facilitate this increased harmonisation whilst taking into account the needs of different initiatives.

Product specifications findings

The group also reviewed the product performance specifications that are included under each of the main initiatives. Figure 5 illustrates the product energy efficiency specifications that are included in each of the regional environmental initiatives (limited to the initiatives studied as part of the group activities).

		Voluntary Initiatives						Mandatory Initiatives					Procurement Initiatives			International Standards
		US, EU, Australia	US, Australia	EU	EU	India	Korea	EU	Australia	China	Japan	USA	Canada	EU	UK	Global
		ENERGY STAR v6.0	ENERGY STAR v5.2	ENERGY STAR v5.0	EU Ecolabel	BEE STAR Ver 1	e-standby program	Ecodesign (ErP)	MEPS	National Standards	Top Runner	Federal Regs.	Canada - Federal Proc.	EU GPP	UK GBS	International efficiency marking protocol
Desktop PC																
Integrated Desktop																
Notebook PC	Notebook PC															
	Tablet															
	Slate device															
	Mobile Thin Client															
Thin Client PC	Thin Client PC															
	Integrated Thin Client															
	Ultra-thin Client															
Workstation PC																
Mobile Workstation																
Small-scale server																
External PSU																
Internal PSU																
Graphics	Discrete Graphics Card (dGfx):															
	Graphics Processing Unit (GPU):															
Display:	Display:															
	Enhanced-performance Integrated Display															
Power Management Requirements																

Key			
Energy Star v6.0 Specs	Energy Star v5.0/5.2 Specs	Other Colours - Initiative Specific	Not Included

Figure 5 – Product Specifications in Various Environmental Initiatives

The cells shaded in green illustrate where the ENERGY STAR v5.0/5.2 specifications are used. The blue highlighted cells identify where the ENERGY STAR v6.0 specifications have been used. Colours, other than green and blue, indicate where bespoke specifications exist in each program. Some of these bespoke specifications are also based on the ENERGY STAR v5.0/5.2 specification but with changes added. For example, the EU Ecodesign (ErP) mandatory initiative on computers only includes internal PSU requirements on desktop computers, integrated desktop computers, thin clients, workstation and small scale-server computers. Squares with dotted fill show that no specifications are in place. It should be noted that within the Australian MEPS there are no internal power supply efficiency requirements placed on all computers, however, there is a requirement for single models with less than or equal to 200 sales per annum.

It is clear from the results that the ENERGY STAR v5.0/5.2 specifications have been widely used throughout a significant number of environmental initiatives. This is especially evident within the procurement initiatives, all of which have included the ENERGY STAR v5.0/5.2 specifications. ENERGY STAR v5.0/5.2 specifications are favoured for use in EU based procurement initiatives due to the fact that there is an EU law stating that all central government bodies must purchase ICT equipment that meet levels of energy efficiency no less demanding than those laid down in the ENERGY STAR specifications[1]. It is expected that future iterations of the EU based procurement initiatives, as well as other EU initiatives such as the EU Ecolabel, will reference the ENERGY STAR v6.0 specifications once they are implemented. Procurement initiatives also benefit from the large uptake of ENERGY STAR by manufacturers as procurers are assured that a wide variety of products will be available that meet the ENERGY STAR specifications, helping to ensure that there are no excessive costs associated with meeting energy efficiency requirements.

4. The Harmonisation Issue

To understand why there are harmonisation issues surrounding environmental programs on computers it is first necessary to explain the format in which the programs are developed. Most widely adopted environmental programs on computers are developed by either government organisations or standards bodies (or a combination of the two). These organisations are charged with detailing the test procedures, product definitions and specifications used within each of the programs. There are a large number of these bodies around the world developing environmental programs focussing on computers.

Each of these different bodies may have different remits or policy ambitions when it comes to addressing the environmental impacts of computing products. For example, whilst some bodies may be focussed on developing voluntary initiatives to encourage manufacturers to build more efficient products, other bodies may be focussed on developing mandatory initiatives which force manufacturers to build products that reach a certain level of energy efficiency. Each of these types of programs are likely to have different needs meaning that encouraging full harmonisation between voluntary and mandatory programs tackling the same products may be difficult to achieve.

[1] REGULATION (EC) No 106/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 January 2008 on a Community energy-efficiency labelling programme for office equipment, available from: http://www.eu-energystar.org/downloads/legislation/20080213/l_03920080213en00010007.pdf

In addition to the different voluntary and mandatory approaches there are differences in the availability of technical knowledge to programme developers. That is, in some regions there are established policy and technical experts who are fully able to develop all aspects on an energy efficiency programme on computers. In other regions, there may not be such a high level of expertise available and so components of a programme are more likely to be borrowed from elsewhere.

As well as the above there are also issues of timing where one body may be refreshing their initiative (including a review of test methodologies, product definitions and specifications) on different time frames to other initiatives. This can result in some initiatives using older requirements which no longer fit with current best practice that may have been developed during the more recent refresh of another initiative.

The development of energy efficiency initiatives for computers is resource intensive. It can take a considerable amount of time and money to develop all aspects of an energy efficiency programme for computers. Given that resourcing of environmental initiatives is becoming more difficult in many regions, harmonisation of some of the key components of these initiatives may help cut costs considerably.

Manufacturers also face additional costs when needing to comply with a plethora of energy efficiency programs on their products. Where mandatory programs exist manufacturers have no choice but to ensure product compliance if they wish to sell their products in that area. In addition, some voluntary programs are de facto mandatory for access to large government procurement contracts. Harmonisation amongst these programs is therefore beneficial to most manufacturers.

Harmonisation Advantages and Disadvantages

It is often suggested that harmonising the three main programme components across a wide range of regional energy efficiency programs will result in benefits to multiple stakeholders and offer the potential for further energy efficiency savings. This section of the report investigates that thinking by discussing both the potential advantages and disadvantages of harmonising the three main programme requirements across different programs. Figure 6 identifies some of the advantages and disadvantages of harmonising each programme component.

	Harmonisation	
	Advantages	**Disadvantages**
Test Procedures	Reduced costs for manufacturers, as well as for market verification and enforcement bodies	All products tested the same way which may miss some key impact areas
	Decreases potential barrier to trade	May favour larger companies if test procedures are too onerous
	Reduced costs for programme developers	Reduces the ability to tackle inefficiencies not covered in main test methodology
	Greater awareness of attributes tested by test methodology	Familiarity with test procedures may result in some learned gaming of procedure
	Testing organisations more familiar with procedure	
	Any successes are multiplied when shared across programs	Any negative facets are shared across all programs

	May encourage programs to synchronise refreshes/development	Programme refreshes may be on different time scales therefore new test procedures may not be able to be adopted in a suitable time frame
	Provides comparable data on products in different regions. Allows for improved data gathering	Potential loss of usable historical data if a new test methodology is adopted making it difficult to track progress on energy efficiency
	Encourages increased manufacturer involvement during development and consequently provision of more technical expertise.	Potentially increases manufacturer influence over test procedure.
Product definitions	Clear identification of products covered	Slower to cover new products coming to market
	Issues with definitions less likely in established program	Any issues with borrowed definitions are multiplied
	May encourage programs to synchronise refreshes/development	Programme refreshes may be on different time scales therefore new product definitions may not be able to be adopted in a suitable time frame
Specifications	Increased influence of specifications across multiple regions	Potentially reduces the speed of innovation in product efficiency as pace set by changes to single specification
	Reduced costs for manufacturers as same changes needed	Manufacturers may be quicker to adopt and therefore mean that programme refreshes are needed more quickly
	Reduced costs for programme developers	Reduces the ability to set more stringent requirements or tackle other areas of product inefficiencies
	Greater awareness of specifications by purchasers/suppliers	Purchasers provided no alternatives
	May encourage programs to synchronise refreshes/development	Programme refreshes may be on different time scales therefore new specifications may not be able to be adopted in a suitable time frame
	Encourages increased manufacturer involvement during development and consequently provision of more technical expertise.	Potentially increases manufacturer influence over specifications.

Figure 6 – Advantages and Disadvantages of Harmonisation of the three key energy efficiency components

The most important of the advantages and disadvantages to the harmonisation of the three main programme components listed in Figure 6 lists are discussed in further detail below.

Reducing the costs for manufacturers, as well as for market verification and enforcement bodies, of test procedures is a major benefit of harmonisation. The development of test procedures for assessing the energy use of computers is a complex and lengthy process, resulting in significant costs for all organisations involved in their development. As such, using an established test procedure can significantly reduce costs for any organisation developing, or refreshing, environmental programs on computers. Actually testing computers against a test methodology can also be time consuming and expensive so many manufacturers favour the harmonisation of test procedures across multiple environmental programs to reduce their own costs.

One of the main downsides to harmonising test procedure is that any **key impacts missed** in the main test procedure will then not be tackled in multiple environmental programs. This downside can be somewhat

mitigated by the fact that any missed impact areas are likely to be noted and then covered in the refresh of the main test procedure.

Another significant disadvantage of harmonising test procedures is that any change to a test procedure can result in the **loss of usable historical data**. This makes it more difficult to track the progress on energy efficiency in covered products overtime. This disadvantage can be offset by conducting analysis to try and compare the results from a past test procedure to the results from a new procedure. However, it should be noted that direct comparisons will not always be possible and so this disadvantage is likely to remain. Despite the potential loss of historic data from changes to test procedures, increased harmonisation on test procedures and product definitions can also provide comparable data on products in different regions, which in turn facilitates improved data gathering. This increased data gathering can subsequently provide improved data and help to support the development of more ambitious future specifications, potentially offering increased savings.

Harmonising test procedure also **decreases potential barriers** to trade for companies wishing to sell their products in different regions. For example, a mandatory measure supported by a bespoke test procedure would likely add costs to manufacturers and could therefore act as a barrier to a market (this is especially true for smaller organisations).

Harmonising the three main components of environmental programs is also likely to **increase their influence across multiple regions**. This increased influence may encourage manufacturers to adapt their products more quickly in order to meet any harmonised specifications meaning that new more ambitious specifications can be developed more quickly. However, refreshes in product specifications could also slow if specifications are developed by a single programme or body as the refresh rate could be dictated by this single entity. This concentration of development into a single programme could also increase manufacturer engagement resulting in improved test procedures, definitions and specification. Conversely, this concentrating of "development power" may increase manufacturers' influence and result in less ambitious test procedures and specifications.

Barriers to Harmonisation

It is clear that there are disadvantages inherent in harmonising the three main aspects of energy efficiency programs but despite this there are some very clear advantages to increasing harmonisation. However, it is also clear that it is likely that a number of potential barriers would need to be overcome in order to realise these advantages.

Figure 7 illustrates some of the main barriers limiting harmonisation of each of the three main programme components. The barriers have been subdivided into institutional and technical barriers. This further separation was conducted as the SEAD working group had previously raised concerns about the ability to influence barriers at the institutional level.

	Barriers	
	Institutional	**Technical**
Test Procedures	There may be legal requirements for using test procedures that may not be product specific (e.g. in EU External PSU measures)	Regions may have unique requirements for testing. For example, countries with average temperatures above that normally found in test procedures may want to test at higher temperatures.
	Regions may not have test houses with enough expertise or technical equipment to follow complicated test procedures	
	Developers of each programme may see fit to develop programme specific test procedures	
	Funds may not be available to transfer new test procedures into existing programs	
	Potential resistance to change existing test methodologies which are well understood	
Product definitions	Developers of each programme may see fit to develop programme specific product definitions	There may be examples of differences in products within specific regions
	Product definitions may not translate accurately from one language to another	
Specifications	Developers of each programme may see fit to develop programme specific product definitions	Differences in products on the market may mean that specifications in one region are more stringent than in another
	Potential legal requirements in place to develop specifications that reflect a certain level of environmental performance.	
	Programme refresh rates may be slower than needed to constantly harmonise with other initiatives' specifications	

Figure 7 – Barriers towards harmonisation

Perhaps the biggest barrier to harmonisation of test procedures is the fact that there may be legal requirements for using certain test procedures within an environmental initiative meaning that a more commonly used test procedure cannot be adopted. For example, the EU Ecodesign measure on computers references the EC Regulation 278/2009 on external power supplies which in turn references the test procedure detailed in EN 50563:2011. This is despite the fact that ENERGY STAR v5.0/5.2 (the most widely adopted environmental programme for computers) references a different test procedure (i.e. EPRI Generalized Internal Power Supply Efficiency Test Protocol, Rev. 6.4.2) on these components for computers. In this case, the Ecodesign measures on computers needed to reference an existing legal statue which addressed external power supplies. Since external power supplies are used in many other products as well as computers, and therefore covered by the same EU law, any moves towards harmonisation would likely need to be taken at the standards level (i.e. between EPRI Generalized Internal Power Supply Efficiency Test Protocol, Rev. 6.4.2 and in EN 50563:2011) rather than at the environmental programme level. This issue appears to have been recognised in the standards area as EN 50563:2011 was largely based on the EPRI test procedure. However, EN 50563:2011 is more detailed and references the up-to-date EN 50564:2011 for low power measurements (EN 50564 is the European version of IEC 62301 Ed2.0 which clearly defines stability and more clearly defines allowable uncertainties of measurement). EN50563 and the test procedure references in ENERGY STAR

produce similar results but EN50563 has been said to instil more confidence in the results which is essential for mandatory compliance testing.

As well as barriers connected to legislation, there may also be further barriers to harmonisation stemming from unique requirements in some geographical regions. For example, testing products at relatively low ambient temperatures (as dictated in many test methodologies) may result in unrealistic energy use values when products are used in warmer regions (i.e. warmer ambient temperatures often result in products using more energy). However, these regional differences in temperatures are unlikely to be considered in any multi-region test methodologies due to the diverse range of ambient temperatures. More pressing regional differences include differences in the voltage of local electricity supplies. That is, different regions around the world have electricity supplies that run at different voltages (e.g. USA has a 110V supply whilst the EU has a 230V supply). Most major multi-region test methodologies currently take account of these differences but there is a danger that a region specific test methodology used to enforce a mandatory measure may not take account of these regional differences in electricity supply.

There are additional technical based barriers to harmonisation of the three main components of environmental programs. Differences in the average efficiency of products in each region may limit the ability to harmonise specifications since this would impact the levels of ambition.

Arguably the biggest hurdles to increase harmonisation of test procedures, specifications and to a lesser extent product definitions, are institutional barriers. Some environmental programme owners may simply wish to develop their own programme specific test methodologies, test procedures and product definitions. If the advantages of saved time and resources are not important to these programme owners then increased manufacturer engagement may be a useful incentive for increasing harmonisation efforts.

It is likely that the most significant potential institutional barrier for harmonisation of specifications lies in the fact that different environmental programs reflect different levels of ambition in their specifications. For example, when ENERGY STAR develops, or refreshes a specification, it normally attempts to ensure that only around 25% of the most efficient products on the market at the time of development can meet the specification. Given its success in the marketplace it is likely that many environmental programs would like to harmonise with ENERGY STAR, however, this 25% level would be too ambitious to include in a mandatory measure. However, ENERGY STAR has been extremely effective in encouraging manufacturers to alter their products in order to meet their specifications. This means that overtime significantly more than 25% of products on the market are able to meet the ENERGY STAR specifications. Harmonisation of specifications is therefore possible as long as the specifications are adopted at a time when a suitable percentage of products on the market are able to meet them. Delaying the timing of harmonising with ENERGY STAR specifications could solve many issues of market availability but not all. For example, ENERGY STAR does not necessarily cover all types of computer on the market, such as high specification gaming desktop computers, due to its focus on energy efficiency and so its specifications may be unsuitable for certain product sub-types. Mandatory programs however may be required to cover all types of a product on the market meaning that the ENERGY STAR specifications may not be suitable for all covered products. In cases where sub-types of products are not covered under ENERGY STAR then there will be a need to develop suitable separate specifications. Other barriers to harmonisation of specifications may arise where other voluntary programs wish to set specifications that are more stringent than those found under the main environmental programme

(e.g. ENERGY STAR). This situation is more likely to occur when the ENERGY STAR specifications are older. A solution to this situation could be to either refresh the main programme (e.g. ENERGY STAR) more frequently or to harmonise the refresh timings of the other environmental programs with the main environmental program.

5. Initiative's Harmonisation Potential

The SEAD investigatory work clearly showed that many environmental initiatives already borrow heavily form the ENERGY STAR program. However, it has also been shown that ENERGY STAR may not be the ideal source of all material for use in mandatory programs.

This section of the report investigates each of the main programs in more detail and assesses their suitability for providing harmonised test procedures, product definitions and specifications.

ENERGY STAR

ENERGY STAR is a joint US and EU voluntary programme which focusses on the energy efficiency of a variety of products including many types of computers. The programme is also adopted in several other countries around the world including Australia, Canada and Japan.

Issues surrounding the use of ENERGY STAR as a resource for harmonised test procedures, product definitions and specifications.

a) ENERGY STAR test procedure

The ENERGY STAR test procedure for many computer products addresses regional differences in electricity supply by allowing for testing at either 115v (North America and Taiwan), 230v (Europe, Australia and New Zealand) and 100v (Japan).

b) ENERGY STAR Product Definitions

The ENERGY STAR product definitions are developed to ensure that specifications can be developed which cover products providing the same or very similar functionalities. As such the definitions provide for a fairer way in which to compare between products. The definitions are often very detailed, ensuring that there is little likelihood of confusion about which product definition matches any particular products. However, the definitions are not always sufficiently exclusionary to ensure that only very select products may meet the definition. For example, the ENERGY STAR v5.2 definition for notebook computers can be seen below:

> "***Notebook Computer:*** *A computer designed specifically for portability and to be operated for extended periods of time either with or without a direct connection to an ac power source. Notebooks must utilize an integrated*

computer display and be capable of operation off of an integrated battery or other portable power source. In addition, most notebooks use an external power supply and have an integrated keyboard and pointing device. Notebook computers are typically designed to provide similar functionality to desktops, including operation of software similar in functionality as that used in desktops. For the purposes of this specification, docking stations are considered accessories and therefore, the performance levels associated with notebooks presented in Section 3, below, do not include them. Tablet PCs, which may use touch-sensitive screens along with or instead of other input devices, are considered Notebook Computers in this specification".

Many types of portable computing products (e.g. e-readers etc) could meet the above computing definition. Whilst this is not an issue in a voluntary program, where participation is voluntary, any potential unintended product inclusion within a mandatory programme could have significant impacts on manufacturers.

c) ENERGY STAR specifications

The ENERGY STAR specification process initiates when it is clear that a significant number of products on the market already meet existing specifications or where it is deemed suitable to develop a new specification for products not already covered under the program. Traditionally ENERGY STAR has included specifications that can only be met by the 25% most efficient products on the market at the time of specification development. In reality, the ENERGY STAR specifications, at development, can be met by a wide range of products on the market from 10% to near 100% depending on individual products. Despite these variances, the guiding principle is that ENERGY STAR specifications should be met by around 25% of the most efficient products on the market at the time of development.

After finalisation of the ENERGY STAR specification there is normally a delay of between 9 months to a year before they are implemented (i.e. become specifications that must be met for a product to meet ENERGY STAR)[2]. This delay gives manufacturers the opportunity to make changes to their products so that they may meet the new ENERGY STAR specifications. This results in a rapid increase in the number of products on the market that are able to meet the ENERGY STAR specifications. However, there are currently further delays in adopting new ENERGY STAR specification in the EU. The EC is currently investigating how these delays can be reduced so that the uptake of new or revised ENERGY STAR specifications happens along similar timelines to uptake in the US.

The ENERGY STAR specifications are likely to be suitable for direct transfer to most voluntary initiatives given that they are the most widely used voluntary energy efficiency specifications. However, their level of suitability will depend on which point in the ENERGY STAR specification cycle they are adopted. They are, however, unlikely to be fully suitable for direct adoption into mandatory measures due to the fact that the specifications are likely too stringent (i.e. when the specifications have been recently developed) to be applied to a whole market.

[2] There may be no delay between specification finalisation and implementation for completely new ENERGY STAR specifications covering new product groups.

d) ENERGY STAR product coverage

The ENERGY STAR specifications are designed to be met by efficient products on the market which sometimes means that very high specification products, that typically use more energy, may not be able to meet the requirements. This is a suitable situation for a largely voluntary (N.B. ENERGY STAR specifications are mandatory requirements in both US and EU central Government procurement contracts) programme but is less suitable in mandatory measures which could limit the availability if high specification products required for mission critical processes (e.g. high powered workstation PCs used in financial institutions or flood monitoring operations).

e) Use of external test procedures

ENERGY STAR often references test procedures that have been developed by international standards bodies. This allows the ENERGY STAR development team to concentrate on developing the requirements rather than the test procedures.

Ecodesign on Computers

The Framework Directive 2009/125/EC ('Ecodesign Directive') lists products which have been identified by the Council and the European Parliament as priorities for Commission implementing measures which lay down legally binding energy efficiency requirements on products in scope. This list included consumer office equipment such as computers. On 26th June 2013 the European Commission adopted Regulation (EU) n° 617/2013 implementing Directive 2009/125/EC with regard to ecodesign requirements for computers and computer servers. This Regulation sets out ecodesign requirements and product information requirements for a range of computer types including:

- Desktop Computers
- Notebook Computers (including tablet computers, slate computers and mobile thin clients)
- Integrated Desktop Computers
- Computer servers
- Workstation computers
- Desktop Thin Clients
- Mobile workstations (information requirements only)
- Small-scale servers (internal PSU requirements only)

The implementing measures also explicitly exclude a number of computer, or related, products from the scope of the measures. These include:

- Blade systems and components
- Server appliances
- Multi-node servers
- Computer servers with more than four processor sockets
- Game consoles
- Docking stations

The Ecodesign measure on computers entered into force on 17th July 2013 with some requirements applying from that date. Other requirements are phased in over an 18 month timeframe.

The Ecodesign measures for desktop, integrated desktop and notebook computers are largely based on the ENERGY STAR v5.2 specifications but with important amendments to make them more suitable for use in a mandatory measure. That is, as previously mentioned the ENERGY STAR v5.2 specifications were not designed to cover all sub-types of computers on the market, especially high specification gaming computers. In addition, some types of computers, including workstation computers, very high specification desktop and notebook PCs and thin clients were exempted from most energy efficiency measures apart from requirements placed on the efficiency of the power supply units. These exemptions were included due to the nature of the Ecodesign measures being mandatory market access requirements which could have limited the availability of high specification computers on the EU market. As previously mentioned, some very high specification computers are required for mission critical operations and so removal of these products from the market could have caused considerable issues. The ENERGY STAR v5.0/v5.2 programme requirements were used as the basis for the EU Ecodesign measure due to the fact that most stakeholders involved in the development process requested as much harmonisation between the initiatives as possible.

Californian Rule Making Process

In 2012 the California Energy Commission (CEC) instigated a rulemaking proceeding to consider amendments to the Commission's Appliance Efficiency Regulations (Title 20, Cal. Code Regs., §§ 1601 - 1608). The Commission is currently considering establishing efficiency standards, test procedures, marking and labelling requirements, and other regulations for a number of appliances that consume a significant amount of energy or water, amongst which they have included computers. The CEC state that the ultimate goal of the rulemaking is the reduction of excessive energy and water consumption by regulated appliances in the state.

The CEC has invited interested stakeholders to submit proposals for standards, test procedures, labelling requirements, and/or other measures that will improve the efficiency and reduce the energy consumption of computers. At the time of writing the CEC is considering the responses from their call for proposals and will draft recommendations for further consideration as part of the formal rulemaking on computers.

Due to the early stage in the CEC rulemaking process it is not possible to identify whether this process will go ahead or what, if any, requirements will be placed on computers in California.

US Department of Energy (DoE) Rule Making

The U.S. Department of Energy (DOE) has issued a proposed determination that, if finalised, would give DOE authority to issue standards on computers. This decision has been taken as the DOE identified that computers may qualify as a covered product under Part A of Title III of the Energy Policy and Conservation Act (EPCA) because the average U.S. household energy use for computers is likely to exceed the 100 kilowatt-hours (kWh) per year limit laid out in the EPCA.

Again, due to the early stage of the potential US DOE rulemaking on computers it is not possible to provide further information at the time of writing.

Australian MEPS

The Greenhouse and Energy Minimum Standards Act 2012 (Act) establishes a national framework for regulating the energy efficiency of products supplied or used within Australia. The legislation allows the Australian Government to set mandatory minimum energy efficiency requirements for products including computers.

From 1 October 2013, all computers manufactured in or imported into Australia (and New Zealand) are subject to Minimum Energy Performance Standards (MEPS). These MEPS cover a wide range of computing products with the specifications largely based on the ENERGY STAR v5.2 requirements (minus any PSU efficiency requirements) although, similarly to the EU Ecodesign measure, with additional allowances to account for higher specification products. The Australian MEPS includes a "Deemed-to-Comply" option for single models where the manufacturing quantity does not exceed 200 units in a year. In this case TEC requirements do not apply and external power supplies must be performance mark V and internal power supplies 80Plus silver when tested using AS/NZS 5814.1, which is technically equivalent to the Generalised Internal Power Supply Efficiency Test Protocol Version 6.5.

The Australian MEPS and test procedures are detailed in the following Australian standards:

- AS/NZS 5813.2– Information technology equipment –Energy performance of computers Part 2: Minimum energy performance standards (MEPS) for computers.
- AS/NZS 5813.1 - Information technology equipment –Energy performance of computers Part 1: Methods of measurement of energy performance.
- AS/NZS 5814.1 - Information technology equipment –Energy performance of internal power supplies Part 1: Methods of measurement of energy performance.

China Mandatory Measures

On the 14th November, 2012, in accordance with the regulations of the Management of Energy Efficiency Label, the National Development and Reform Commission (NDRC) and General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) of the Peoples' Republic of China (PRC) jointly released the "Implementation Rules of Energy Efficiency Label of Microcomputers".

These Implementation Rules of Energy Efficiency Label of Microcomputers require that desktop, integrated desktop and notebook computers placed on the Chinese market meet mandatory energy efficiency limits and are labelled according to three energy classes by the 1st February 2013. Products placed on the market, or imported, into China before the 1st February 2013 can postpone adding energy efficiency labels until the 1st February 2014.

The mandatory requirements included in the Chinese initiative are significantly less stringent than the ENERGY STAR v5.2 specification limits.

International Standards

International standards are standards that are developed by international standards organisations and are most often designed to be used worldwide. International standards most often contain detailed test procedures rather than quantified efficiency requirements. As such, environmental initiatives often reference these international standards when addressing test methodologies. International standards therefore hold the potential to encourage increased harmonisation of test procedures across the major initiatives.

There are a number of international standards that address different aspects of energy use in the computer products covered under the SEAD Computer Working Group scope, including:

- **IEC 62623 ed1.0 -** The main international standard addressing the energy efficiency of computers is IEC 62623:2012. The standard was developed using the earlier ECMA 383 standard as a basis. The IEC standard applies to desktop and notebook computers. The standard includes a test procedure to enable the measurement of the power and/or energy consumption in different power modes, formulas for calculating typical energy consumptions (TEC) and a categorisation system for computers and selected components. This IEC standard has been adopted in the latest ENERGY STAR v6.0 specification for computers. As such the standard will be widely used throughout the world.

- **IEC 62301:2011 -** specifies methods of measuring power demand in standby mode(s) and other low power modes (off mode and network mode). The standard also includes definitions for low power modes. Section 4 of IEC 62301:2011, "General Conditions for Measurements", is referenced in the ENERGY STAR v5.2 and v6.0 specification for computer however the actual measurement of off and sleep modes in ENERGY STAR v6.0 is conducted in line with the test methodology laid out in IEC 62623.

International standards have the potential to offer significant levels of harmonisation in terms of power demand measurements, energy use calculations and even product nomenclature. However, they are unlikely to provide harmonised efficiency specifications (i.e. standards do not normally lay down performance

requirements). A barrier to the use of international standards in EU mandatory measures is that all referenced standards need to be available in all 14 official EU languages. This hurdle is easily overcome however through the translation of the standardised test methodology into an appropriate EU standard.

The rate at which international standards can be refreshed may hinder their ability to provide harmonised product definitions and test procedures. This slower refresh rate could cause issues where new types of computers have entered the market or where it has become clear that other power modes of existing products need to be tested.

6. Proposed Harmonised Components

Taking the earlier findings and discussion into account, this section of the report includes recommended sources for harmonised test procedures, product definitions and specifications.

Proposed Harmonised Test Methodologies

Figure 8 illustrates sources of test methodologies that could be promoted for use in multiple environmental initiatives which focus on the range of covered computer products.

		Suggested Harmonised Test Methodologies	
		Voluntary Initiative	Mandatory Initiative
Desktop PC		ENERGY STAR v6.0/6.1 and referenced test procedures (until ENERGY STAR v7.0 finalised)	ENERGY STAR v5.0/ v5.2 or Ecodesign ErP Computer Regulation (617/2013) until finalisation of the ENERGY STAR v6.1 test procedure
Integrated Desktop			
Notebook PC	Notebook PC		
	Tablet		
	Slate computing device		
	Mobile Thin Client		
Thin Client PC	Thin Client PC		
	Integrated Thin Client		
	Ultra-thin Client		
Workstation PC			
Mobile Workstation			
Small-scale server			
External PSU			
Internal PSU			
Graphics	Discrete Graphics Card (dGfx)		
	Graphics Processing Unit (GPU)		
Display:	Display		
	Enhanced-performance Integrated Display		

Figure 8 – Suggested Harmonised Test Methodologies

The ENERGY STAR v6.0 test methodologies have been suggested for use as harmonised test procedures due to the following reasons:

a) ENERGY STAR is the most widely adopted voluntary energy efficiency on computers and so the back ground test procedure and methodologies are also widely used elsewhere.

b) ENERGY STAR is a mandatory consideration in both US and EU government procurement contracts. These government contracts account for a considerable amount of ICT sales.

c) Many environmental schemes around the world already harmonise with the ENERGY STAR test procedures (e.g. Blue Angel, Nordic Swan, EU Ecolabel).

d) ENERGY STAR has significant amounts of technical expertise employed during the development process. The high level of technical awareness from multi-stakeholder groups involved in the development process helps to ensure suitable and robust test methodologies are developed or the correct test methodologies are referenced.

e) ENERGY STAR undertakes refreshes of programme requirements on a relatively regular basis. This helps to ensure that suitable test procedures are referenced and updated if necessary.

The test methodologies behind the ENERGY STAR v5.0/v5.2 specification and the EU Ecodesign regulation have been suggested as sources for harmonised test procedures in mandatory initiatives for the following reasons:

a) The ENERGY STAR v5.0/v5.2 specification affords the same advantages as those listed for ENERGY STAR v6.0 listed above.

b) The EU Ecodesign measure will include test procedures that are slightly less stringent than those found under ENERGY STAR. This is beneficial in a mandatory programme which will cover a significantly larger number of manufacturers, some of whom will not be familiar with testing products for energy efficiency.

c) It is suggested that after the 15th January 2014 the test procedures behind the ENERGY STAR v6.1 specification are proposed as candidate sources for harmonised test procedures. This date has been chosen as the US EPA will no longer accept new registrations to the ENERGY STAR v5.2 specification after this date. Despite this recommendation it is also suggested that some aspects of the EU Ecodesign test procedures, where they are less stringent (e.g. the Ecodesign Regulation contains greater allowed variance in testing results), continue to be proposed for use in other mandatory measures for the reasons identified above.

Proposed Harmonised Product Definitions

Figure 9 illustrates sources of product definitions that could be promoted for use in multiple environmental initiatives which focus on the range of covered computer products.

		Suggested Harmonised Product Definitions	
		Voluntary Initiative	Mandatory Initiative
Desktop PC		ENERGY STAR v6.0/6.1 until ENERGY STAR v7.0 finalised	Ecodesign ErP Computer Regulation (617/2013) until either the Californian or US DOE Rule Making process is complete
Integrated Desktop			
Notebook PC	Notebook PC		
	Tablet		
	Slate computing device		
	Mobile Thin Client		
Thin Client PC	Thin Client PC		
	Integrated Thin Client		
	Ultra-thin Client		
Workstation PC			
Mobile Workstation			
Small-scale server			
External PSU			
Internal PSU			
Graphics	Discrete Graphics Card (dGfx)		
	Graphics Processing Unit (GPU)		
Display:	Display		
	Enhanced-performance Integrated Display		

Figure 9 – Suggested Harmonised Product Definitions

The ENERGY STAR v6.0 specification has been suggested as a source of product definitions for voluntary programs mainly due to the programme advantages described above. In addition, ENERGY STAR v6.0 introduces only relatively minor changes to the long established product definitions that were included within the ENERGY STAR v5.2 specification. However, these product definitions may not be detailed enough to ensure that there are no unintentional product inclusions within mandatory measures. For this reason it is suggested that the product definitions found in the EU Ecodesign measure are used in other mandatory programs until either the Californian or US DOE rulemaking on computers is complete, at which point a re-assessment would need to be made. This recommendation does not suggest that any product definitions included in the Californian or US DOE rulemaking processes will be superior to the definitions included in the Ecodesign measure, merely that the definitions in the US based initiatives will be more in line with the fast moving nature of the IT industry. That is, new product types (e.g. mobile all-in-one desktop PCs) come onto the market on a regular basis and so it is essential that these new product types can be suitably addressed within any mandatory measure.

Proposed Harmonised Specifications

Figure 10 illustrates sources of product specifications that could be promoted for use in multiple environmental initiatives which focus on the range of covered computer products.

		Suggested Harmonised Specifications	
		Voluntary Initiative	Mandatory Initiative
Desktop PC		ENERGY STAR v6.0/6.1 until ENERGY STAR v7.0 finalised	ErP Computer Measure until either the Californian or US DOE Rule Making process is complete
Integrated Desktop			
Notebook PC	Notebook PC		
	Tablet		
	Slate computing device		
	Mobile Thin Client		
Thin Client PC	Thin Client PC		
	Integrated Thin Client		
	Ultra-thin Client		
Workstation PC			
Mobile Workstation			
Small-scale server			
External PSU			
Internal PSU			
Graphics	Discrete Graphics Card (dGfx)		
	Graphics Processing Unit (GPU)		
Display:	Display		
	Enhanced-performance Integrated Display		

Figure 10 – Suggested Harmonised Product Specifications

The energy efficiency specifications behind the ENERGY STAR v6.0 specification will be suitable for adoption in most voluntary initiatives as long as those initiatives are developed within suitable time frames. If specifications which reflect current best practice in market performance are needed it is suggested that bespoke specifications should be developed once the ENERGY STAR v6.0 specifications have been implemented for over two years.

It is further suggested that the specifications behind the EU Ecodesign regulation on computers are used on other mandatory initiatives until such time as the newer Californian or US DOE rulemakings are complete. Once these US based initiatives are completed a re-assessment would need to be made on their suitability for use in other mandatory measures. However, in the interim the switch to the Californian or US DOE rulemaking requirements is suggested due to the fact that the specifications will have been developed using updated background data.

7. Harmonisation Tools

It is clear that there are many advantages associated with harmonising the three main components of a typical environmental initiative. However, it is also clear that there are some barriers in place. Many of these barriers are found at the institutional level and so breaking down these barriers cannot be achieved through a simple technical fix. The technical barriers, such as access to information and regional test requirements, are more likely to be easier to fix through the provision of information. However, solutions to aid the breakdown of institutional barriers can be developed to further increase harmonisation across environmental initiatives.

The group highlighted two main tools that could be developed to help overcome barriers to harmonisation. These two solutions are discussed below.

Database

As part of this project a draft Excel based database has been built which includes all findings from the SEAD working group. The database is designed to act as an easy to search repository of information for the test procedures, product definitions and specifications used in each of the main environmental initiatives investigated during the SEAD project.

The database contains the following worksheets:

- **Introduction**
- Provides a full list of worksheets included in the database.
- **Selection-Page**
- Provides an example of how users could select different metrics to support their decision making process when developing or refreshing an environmental initiative. The functionality has not been programmed into the initial Excel version of the database as it has been assumed that the Excel version will not be published for use.
- **Example-Outputs-Prod-Defs**
- Provides an example of the outcomes that users could expect when selecting options on the “Selection-Page” worksheet.
- **Program-Summary**
- Provides a basic summary of each environmental initiative including initiative name and regional scope, a brief description of each initiative, contact details of appropriate individuals, and website links to the appropriate program, test procedures and any associated product data.
- **Test Methodologies-Summary**
- Provides a list of all test procedures used for each product covered under each of the initiatives. The worksheet does not include the text of each test methodology due to the length of many of the test procedures and the fact that some of the test procedures are contained in standards that are not reproducible due to copyright.

- **All-Product-Definitions**
- Includes the product definitions used for each product covered under each of the initiatives.
- **All-Product-Specifications**
- Includes the product definitions used for each product covered under each of the initiatives.
- **Worksheet for each test procedure**
- A worksheet is included for each test procedure which either contains the actual test procedure (where reproduction is allowed) or a link to the test procedure documents (where reproduction is not allowed).
- **Worksheet for each environmental initiative**
- A worksheet is included for each initiative. Wherever possible the main document from each initiative is included.

It is suggested that the database will help to overcome some of the barriers to harmonising the three main components of environmental initiatives through clearly identifying the similarities and differences between each of the main initiatives focussing on computers. In addition to the provision of technical information and references to applicable test standards, the database lists key contacts for each initiative. It is hoped that by supplying key contact information it will encourage increased dialogue between the various initiatives and foster increased levels of harmonisation.

It is envisaged that the database will be developed into a web solution that is regularly updated by a management organisation. Regular updates will be essential to ensure that the database can continue to support the decision making process of policy makers and technical experts when developing or refreshing initiatives focussing on the energy efficiency of computers. It is suggested that an organisation such as SEAD would be well placed to manage and continually update the database.

Toolkit

The aim of the toolkit is to simplify and greatly reduce the effort required in the preparation, justification and rationale for implementing an IEC test standard proposal (e.g. “cut and paste” from the toolkit to individual country proposals). The potential benefits of such an approach are as follows:

- Countries can adopt the test procedures that are already recognised and preferred by major governments and jurisdictions, at relatively low cost.
- Suppliers and manufacturers can use the same test methodology for all countries that adopt a specific methodology, thus reducing their testing expenses and time to market.
- Subject to local requirements, international test reports may be acceptable for use in multiple countries, which would help to overcome one barrier to the introduction of standards: a lack of qualified local test laboratories.

An additional report detailing the toolkit will be produced as part of the group tasks.

8. Conclusion

This report has discussed the results of the SEAD Computer Working Group investigations into the main environmental initiatives focussing on the energy use of computers. It has been shown that there are a large number of similarities between many of the initiatives in terms of the product definitions, test methodologies and specifications behind each scheme.

Despite these similarities there are a number of differences between different initiatives. The ENERGY STAR v5.0/5.2 test procedures, product definitions and specifications have been either fully or partially adopted by a large percentage of the initiatives investigated. The reasons for the initiatives opting not to use all of the attributes behind the ENERGY STAR v5.0/v5.2 programme are not always clear. Nevertheless, it is evident that some differences have occurred due to issues such as legal precedents dictating the use of different test procedures. Other differences have likely arisen due to different levels of stringency required by the different initiatives. The fact that the ENERGY STAR v5.0/v5.2 specifications were implemented in 2008 gave industry sufficient time to greatly increase the efficiency of products. This increase in product energy efficiency since 2008 has likely encouraged the development of more stringent energy efficiency specifications as it was likely evident that there were sufficient numbers of products on the market that would be able to comply. In addition to the timing issue, some initiatives have different levels of ambition, so even when ENERGY STAR has been recently refreshed the levels of ambition may not be suitable for every initiative. For example, it is unlikely that a mandatory programme would include ENERGY STAR specifications verbatim as this could restrict sales of specialist computing equipment in a market.

The report investigated some of the future harmonisation potentials possible for each of the three main environmental initiative components (i.e. product definitions, test methodologies and specification) along with potential barrier to harmonisation. Recommendations were made for voluntary programs to further harmonisation with the ENERGY STAR programme but for mandatory programs to look towards existing, or forthcoming, mandatory programs for harmonisation potentials. The report made clear that the specifications behind ENERGY STAR are unlikely to be suitable for use within mandatory measures without first making adjustments to the stringency of the requirements for some types of computers.

The Excel based database on environmental initiatives was also introduced along with a discussion about how it could support further harmonisation across different initiatives. The report included the recommendation that the Excel database should be converted to an online tool which should then be managed and updated by an organisation such as SEAD.

In summary, much harmonisation between the initiatives has already been undertaken but further harmonisation is possible. It is more likely that further harmonisation on test procedures and product nomenclature could be achieved allowing more freedom for initiatives to set different levels of stringency suitable for their individual programs.