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Impacts of the EU's Ecodesign and Energy/Tyre Labelling Legislation on Third Jurisdictions

European Commission

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Glossary

ABNT	Associação Brasileira de Normas Técnicas (Brazilian Technical Standards Organisation)
ADB	Asian Development Bank
AFNOR	Association Française de Normalisation (French Association for Standardization)
AHAM	American Home Appliance Manufacturers' association (USA)
AHRI	Air-conditioning, Heating, & Refrigeration Institute (USA)
APEC	Asia Pacific Economic Cooperation
ANAB	ANSI-American Society for Quality National Accreditation Board
ANSI	American National Standards Institute
AS	Standards Australia
ASI	Austrian Standards Institute
BSI	British Standards Institute
CAB	Conformity Assessment Board (IEC)
CB	Council Board (IEC)
CD	Committee Draft (a first Committee Draft) of an International Standard (IEC or ISO)
CDV	Committee Draft for Vote of an International Standard (IEC or ISO)
CEA	Consumer Electronics Association (USA)
CECED	European Committee of Domestic Equipment Manufacturers
CEM	Clean Energy Ministerial
CEN	Comité Européen de Normalisation
CENELEC	Comité Européen de Normalisation d'Electricité
CFL	compact fluorescent lamp
CFLi	compact fluorescent lamp with integrated ballast
CLASP	Collaborative Labeling and Appliance Standards Program
CNIS	China National Institute of Standardisation
Commission	European Commission
CoP	Joint SEAD/IEA-4E/IEA Standards Coordination Community of Practice
DIN	Deutsches Institut für Normung (German Standards Organization)
DKE	Deutsche Kommission Elektrotechnik (German Electrotechnical Commission)
DOE	US Department of Energy
ECOWAS	Economic Community Of West African States
EESCC	Energy Efficiency Standardization Coordination Collaborative
EPA	US Environmental Protection Agency

EPS	External Power Supply
ETSI	European Telecommunications Standards Institute
EU	European Union
European standard	A standard adopted by a European standardization organization
FDIS	Final Draft International Standard (IEC or ISO)
FTC	US Federal Trade Commission
Harmonized standard	A European standard adopted on the basis of a request made by the European Commission for the application of Union harmonization legislation
GEF	Global Environment Fund
GMG	general management group (postulated) of the CoP
ICT	information and communication technology
IEA	International Energy Agency
IEA-4E	IEA Implementing Agreement for Efficient Electrical End-Use Equipment
IEC	International Electrotechnical Commission
IEEE-PES	Institute of Electrical and Electronics Engineers – Power and Engineering Society (USA)
IESNA	Illuminating Engineering Society of North America (USA)
International standard	A standard adopted by an international standardization body
IPR	intellectual property rights
IPEEC	International Partnership for Energy Efficiency Cooperation
ISO	International Organization for Standardization
ITU	International Telecommunications Union
JIS	Japanese Industrial Standard
MEPS	minimum energy performance standards
METI	Ministry of Economy, Trade and Industry (Japan)
MS	Member State (of the European Union)
MT	maintenance team (IEC or ISO)
National standard	A standard adopted by a national standardization body
NC	National Committee (IEC or ISO)
NDRC	National Development and Reform Commission (China)
NEMA	National Electrical Manufacturers Association (USA)
NIST	National Institute of Standards and Technology (USA)
NRDC	Natural Resources Defence Council (USA)
NSB	National Standards Body
PAS	Publicly Available Specifications (IEC or ISO)

SAC	Standardization Administration of China
SAG-E	Strategic Advisory Group on Energy of the ISO
SC	Sub-committee (IEC or ISO)
SEAD	Super-Efficient Equipment and Appliance Deployment (SEAD) initiative of the CEM
SG1	Strategic Group 1 of the IEC
SMB	Standards Management Board (IEC)
S&L	Standards and Labelling
SSL	solid state lighting
Standard	A technical specification, adopted by a recognized standardization body, for repeated or continuous application, with which compliance is not compulsory
TC	Technical committee (IEC or ISO)
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNI	Italian Organization for Standardization
US(A)	United States (of America)
WSC	World Standards Cooperation of the ISO, IEC and ITU
WTO	World Trade Organization

Executive Summary

This report presents the findings of an investigation into equipment energy efficiency policy measures, and explicitly Minimum Energy Performance Standards (MEPS) and energy labels, in countries outside the EU. The principal aim of the work is to establish the degree to which the corresponding EU policy measures (Ecodesign and energy labelling) have influenced the policies set in third countries, but also to consider the degree to which third country policies have influenced those in the EU.

The evidence presented in this report is based on a literature review and stakeholder discussions. This evidence was used to review and update the CLASP database, which is an extensive database of equipment energy efficiency standards and labelling policy measures in place around the world. The reviewed and updated data was then used for the analysis presented in this work. Through this work it has been possible to gather considerable detailed information on equipment energy efficiency standards and labelling programmes in place in forty eight countries outside the EU. Information has been gathered in less detail on a great many other economies. From this analysis it has been established that there are 45 countries, excluding the 28 EU Member States, that have adopted MEPS and 59 non-EU countries that have adopted energy labelling for energy using equipment (Figure ES-1).

The most detailed data on the specific regulations in place has been entered into a database for the following countries:

Argentina, Australia, Brazil, China, Egypt, Ghana, India, Indonesia, Japan, Jordon, Kenya, Korea, Mexico, Nigeria, Philippines, Russia, South Africa, Tunisia, Turkey, USA

The very first equipment energy efficiency regulatory requirements may have been applied in Poland in the 1960s, but the first labels were applied in Canada in 1978. Since that time there has been a proliferation of standards and labelling requirements around the world with more specifications being adopted each year. Including the EU Member States, the number of countries with comparative energy labels in place for one or more energy using product[1] reached eighty seven by 2013. This represents an increase of 1740% from 1990 (5 countries) and a 281% increase from 2000 (31 countries). The number of countries with endorsement labels in place for one or more products reached 54 (up from 1 in 1990 and 16 in 2000). Regulations setting some form of minimum energy efficiency requirement for one or more energy using, or related, products have been adopted by 73 countries as of 2013. This represents a nine-fold increase from 1990 (8 countries) and a more than two fold increase from 2000 (31 countries). Countries with MEPS in place account for 91% of global GDP and 73% of global population, while those who have implemented energy labels account for 93% of glob-

[1] The scope considered in this report is confined to energy efficiency standards and labels that apply to any tradable energy using or related products except those concerned with transportation.

al GDP and 75% of global population. This process continues and some 37 countries who have not had such policies in place previously are now known to be developing energy labelling along with 18 countries who are developing MEPS and 3 endorsement labels.

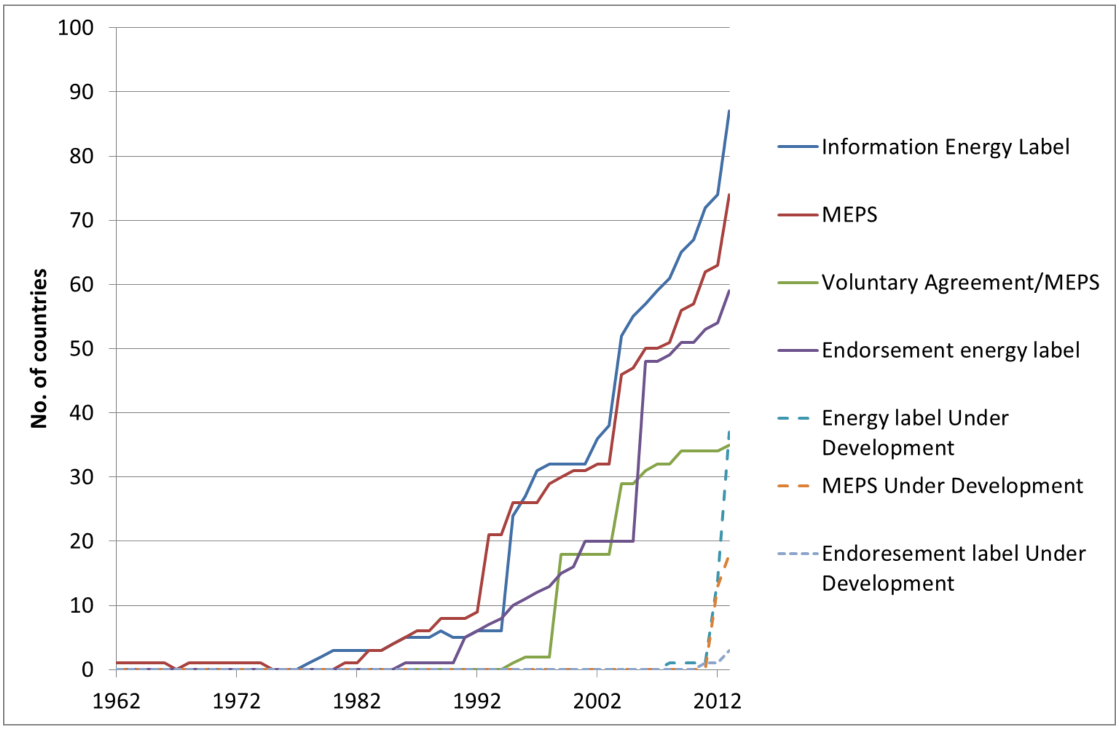

Figure ES-1: A timeline of international equipment standards and labelling policy implementation

Just as the number of countries with equipment energy efficiency standards and labelling has increased, so has the range of equipment types subject to such regulations. In 2013, there were at least 548 energy performance standards and 541 comparative energy labelling regulations in place outside of the EU, EEA and accession states covering 55 different product types. These products cover equipment destined for residential, commercial and industrial applications and are responsible for a large proportion of all energy use in these sectors.

The influence of EU policy measures

If the EU, EEA and Accession states are considered as a whole, their equipment energy efficiency regulations account for 4% of the total number of comparative energy label regulations, 7% of the endorsement labels and 6% of the minimum energy performance standards regulations implemented in the world. The EU also accounts for a greater share of all voluntary agreements. However, the influence of EU policy measures on standards and labelling extends far beyond its borders.

The evidence gathered in this project implies extensive EU policy influence in 3rd countries, in particular in the design of the energy label. Out of 59 non-EU countries that have adopted equipment energy labelling schemes, half of them (53%) have adopted designs that have fully or partially emulated the EU energy label (Figure ES-2). This includes major economies such as Brazil, China, Korea, Russia and South Africa as well as EU accession states and many others including most South American countries, many North African countries and several countries in the Middle East. The timeline for energy labelling supports the assumption of EU influence as countries that adopted the labels earlier than the EU are of a different design.

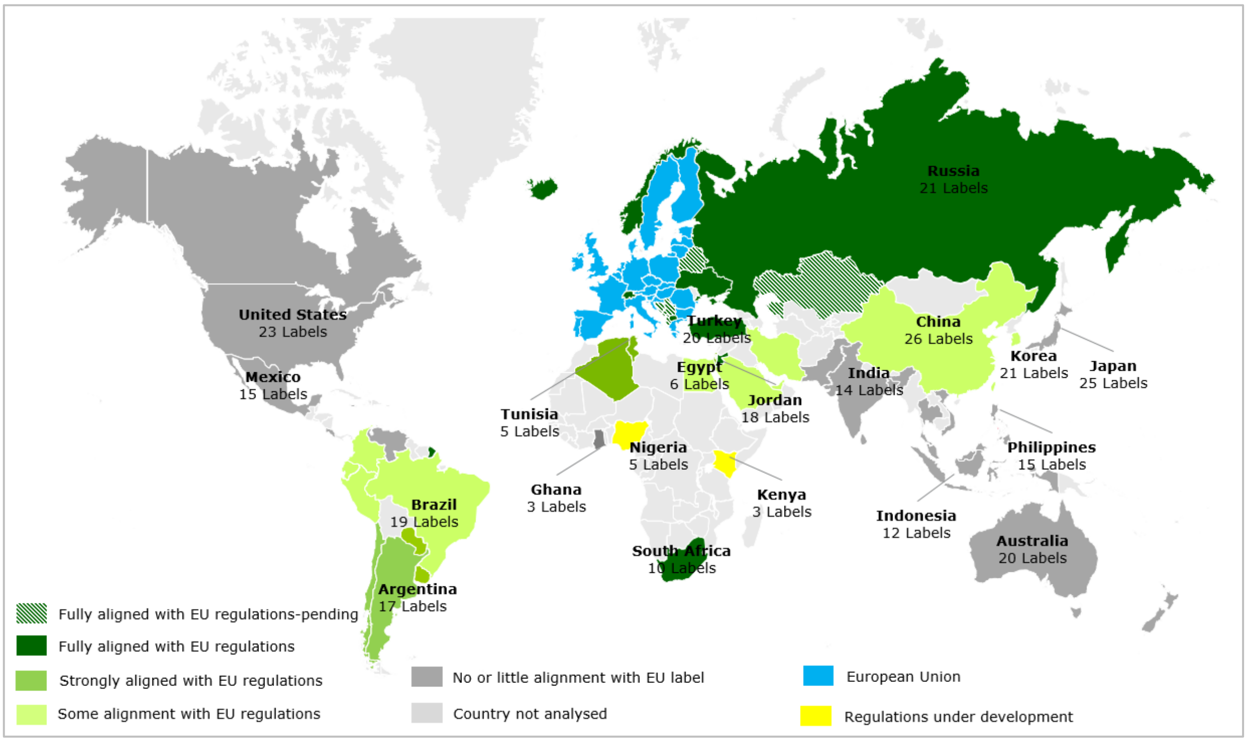

Figure ES-2: Countries with Energy Labels and degree of alignment with the EU label

The share of global GDP accounted for by countries that have implemented equipment energy labels reached 93% in 2013 and the share of global GDP taken by those who have an energy label that is in some degree aligned with the EU's was 44% (Figure ES-3).

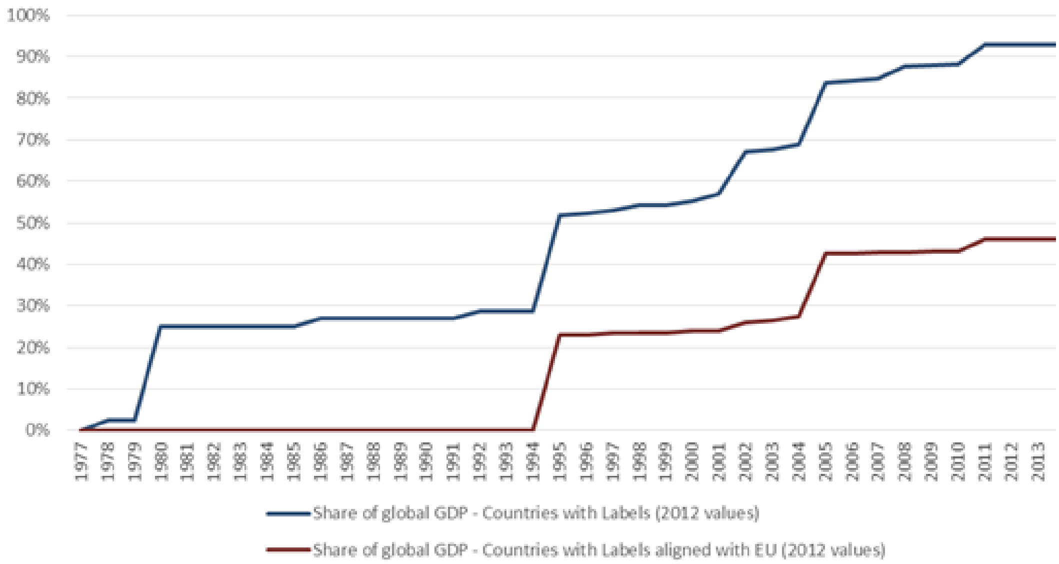

Figure ES-3: Countries with energy labels: coverage as a share of global GDP

Out of 45 non EU countries that have adopted MEPS, 23 (51%) have adopted MEPS for at least one equipment type that have fully or partially emulated the EU's Ecodesign requirements or its earlier MEPS, Figure ES-4.

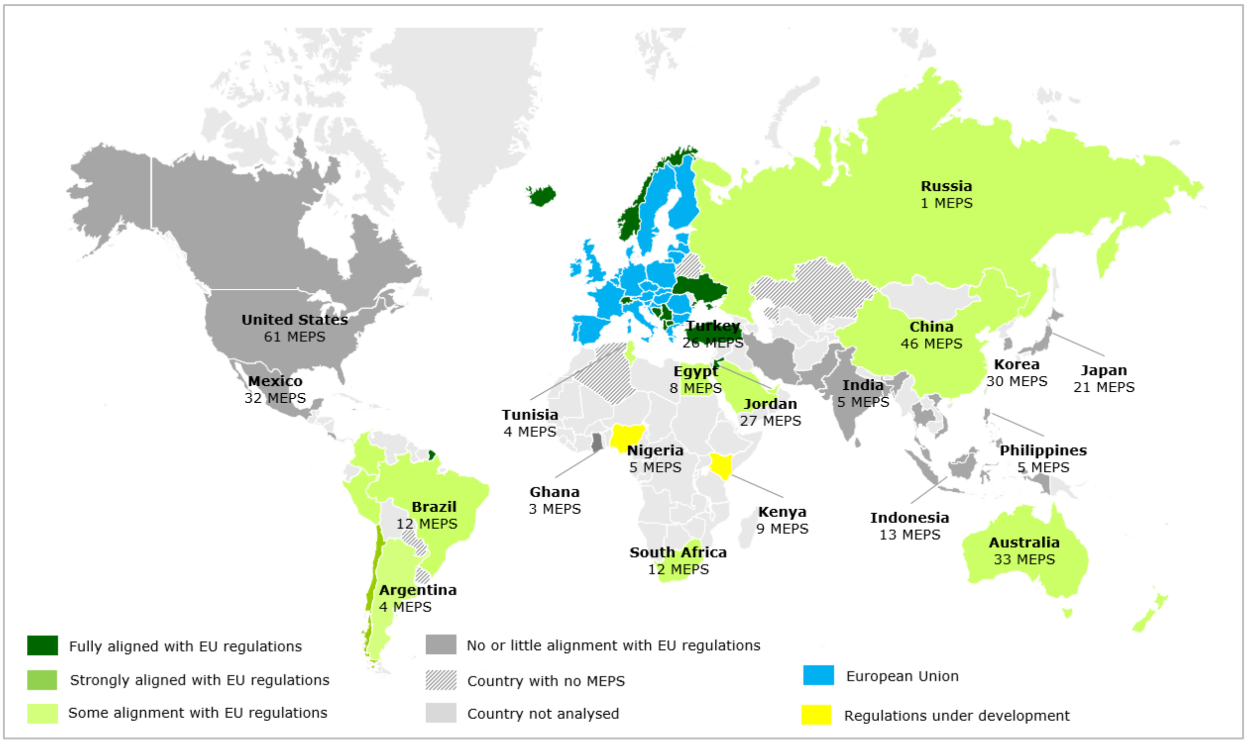

Figure ES-4: Countries with MEPS and Degree of Alignment with EU per Country

Figure ES-5 shows that the greatest alignment is in the area of test procedures. Outside of North America, the large majority of equipment energy performance test procedures in use are based on IEC/ISO/ITU test procedures. These are international test procedures but have been developed with strong input from EU national standards bodies (NSBs). The same NSBs also develop European standards through CEN/CENELEC/ETSI and these bodies have an arrangement with their international counterparts for each to adopt the other's standards through the Dresden and Vienna Agreements. As a result European energy performance test standards are usually closely aligned with international test standards.

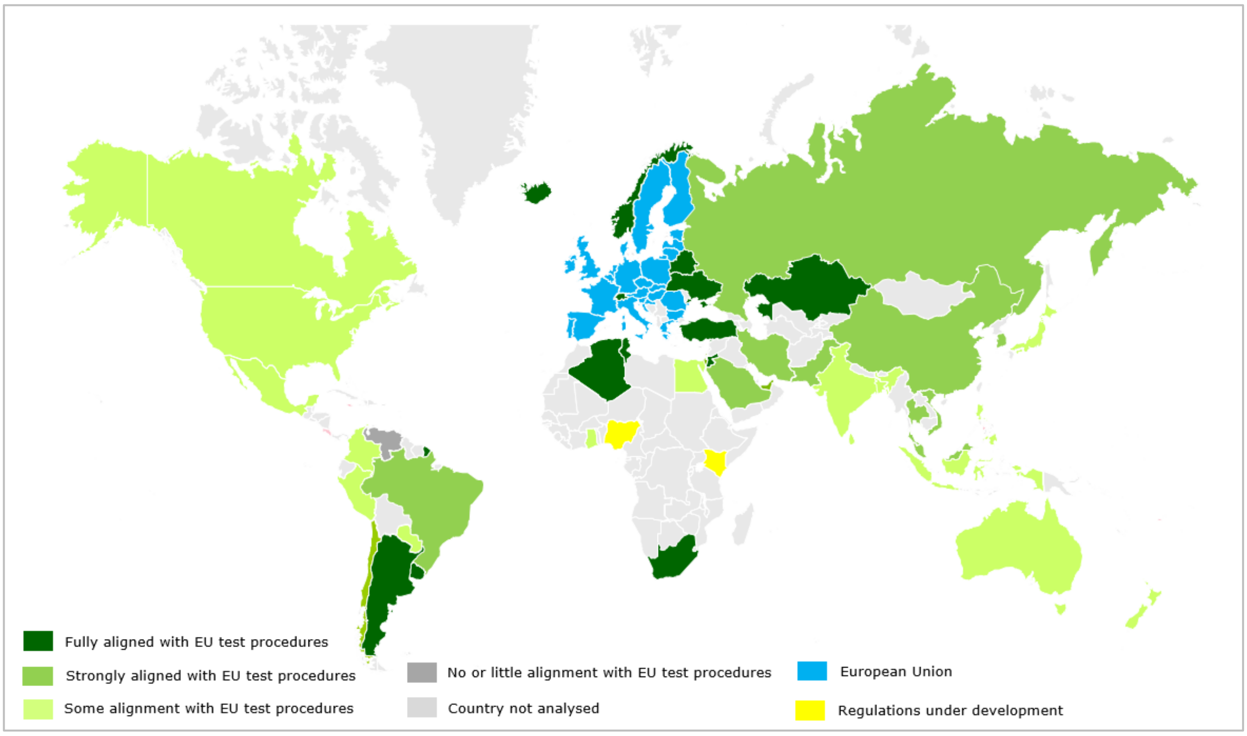

Figure ES-5: Similarities with EU test procedures

Motivation behind alignment

The motivation behind the degree of alignment seen and willingness by 3rd country regulators and standardisation agencies to consider adopting measures aligned with the EU varies. Many parties that were interviewed in relation to this work expressed a desire to avoid duplicating work and to thereby adopt measures that had been tried and tested in peer economies, such as the EU. Facilitation of trade is clearly another reason to consider alignment. Alignment of standards with other markets also avoids the situation where equipment which is below the standard in one market is dumped on the country market. As the EU is a large economy, it is an important market to consider when bench-marking standards[2]. The fact that the EU uses largely international test procedures undoubtedly facil-

[2] The IEA 4E and SEAD programmes have been mapping and benchmarking the energy performance of several products and their associated regulations.

itates this but also facilitates technology transfer. Producers in large exporter markets such as China aim to manufacturer equipment that meets EU efficiency and Ecodesign requirements to be able to export to the EU and thus the process of meeting EU specifications also facilitates the setting of domestic requirements that are potentially fully or partially aligned with the EU's. Laundry dryers provide a very clear example of where a third economy (USA) saw that the efficiency achieved by appliances on the EU market far exceeded that of the US market and is now building policies that emulate those of the EU. The use of common energy performance test standards also facilitates the adoption of common product platforms and types and hence lowers the transaction costs associated with technology and policy learning, and transfer. With globalisation of manufacturing, test standards developers tend to focus on the standards in the 'lead' economy for that product. The EU leads on home laundry equipment as discussed above, so this standard is followed by other economies, including Australia, China and US. On electric motors, the USA has been seen as the 'lead' economy and the EU has adopted IEC test methods and standards, which were strongly influenced by the USA.

An international symbol of energy efficiency

In the case of the European energy label, however, another element is in play. The EU energy label has become an international symbol of energy efficiency whose impact has extended well beyond the EU's boundaries and the appliance sector where it originated. In the EU itself the label motif of coloured stacked arrows ranging from A (green) to G (red) has been extended to buildings, tyres and cars and as to other types of consumer or commercial sector equipment (usually on a voluntary industry-association led basis). Elements of the same motif are found in energy labels adopted around the world, be it as direct or near direct copies (in South America, Africa, the Middle East, Russia and other former Soviet states), slightly amended versions (China, Hong Kong, Iran, Tunisia) or versions that copy the colour coding only (Korea, Chinese Taipei). Morocco has not yet adopted equipment energy labels yet this has not prevented it from using the EU label as a symbol for efficiency for other energy end-uses as shown in Figure ES-6. The reason for the popularity of this motif is that it has been found to successfully communicate the key concept of energy performance relative to other equivalent products or end-uses on the market around the world. This has been confirmed whenever its ability to successfully convey these factors to consumers and other stakeholders has been tested via consumer and other market research (e.g. in China, the EU and Tunisia).

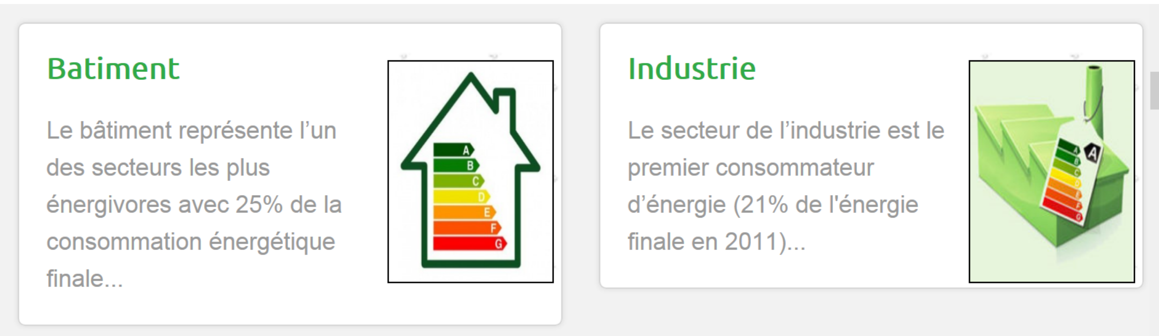

Figure ES-6. An example of how the European energy label motif is being used to promote the concept of energy efficiency in buildings and industry in Morocco. Source: http://www.aderee.ma/

The EU's label is not the only one to be emulated. The core aspects of the Australian energy label have been emulated in a number of markets and there are similarities between some aspects of the information energy labels used in Canada, Mexico, the Philippines and the USA. However, for the countries studied in this project it can be seen that the EU design is more often emulated than any other.

Influence of other programmes on the EU
The original work to develop energy labelling and MEPS in the EU was directly inspired by earlier US work and used many of the same techniques. The outcome in terms of labelling design was however quite different. Since that time, the EU has also joined forces with the US DOE and EPA to operate the international Energy Star programme (which originated as a domestic US programme in 1993). Less formal influence from 3rd county programmes has also been evident on specific EU policy measures. For example, work that had been done to benchmark the energy efficiency of room air conditioners and of their associated policy settings, was influential in encouraging a higher level of ambition in the EU energy label thresholds than had previously been envisaged. This was brought to light through the Ecodesign preparatory study process because it demonstrated that a peer economy had products of a significantly higher efficiency than the Best Available Technology on the European market at that time. A set of product case studies analysed in this report also show strong influence on EU policy measures by 3rd country activities for: electric motors, external power supplies and to a lesser extent, TVs.

Conclusions and recommendations
Evidence presented in this report, shows that international cooperation on equipment energy efficiency standards and labelling has contributed to delivering much greater energy, economic and environmental savings than would have occurred otherwise. Willingness to share programmatic experience, learn from and emulate the successes of other programmes is an essential component of the product policy achievements made so far and this has led to the rapid promulgation of equipment energy efficiency measures round the world.

When looking at how the transfer of best practice has occurred, the findings show it has often happened in an ad hoc manner. In the 1990s, there was very little international institutional support for technical and policy related support work for equipment energy efficiency best practice, yet it was in this period that the first work was done, usually by a small number of international consultants. Growing appreciation of the value of this work and the huge potential of equipment energy efficiency policy initiatives fostered the development of embryonic institutional activity in the late 1990s and early 2000s and has since led to further institutional development such that now there is:

- a dedicated NGO (CLASP) that supports international technical assistance on equipment standards and labelling
- a dedicated IEA implementing agreement (the IEA 4E) which addresses energy efficiency co-operation in electrical equipment
- a global policy support framework in the Super-Efficient Appliance Deployment initiative created through the Clean Energy Ministerial

- a dedicated UN agency supporting energy efficient lighting, in the form of UNEP's en.lighten programme
- programmatic funding sources that can assist countries to develop equipment energy efficiency standards and labelling programmes and measures via the GEF, the World Bank Group, EBRD and other regional multilateral development banks
- bilateral programmatic funding to support equipment energy efficiency policy through international technical assistance programmes operated by the EU, USAID and State Departments, METI (Japan), RET in Australia and many others, including several EU Member State agencies

All these efforts provide support that, in many cases, is the engine for the transfer of best practice, however, there are certainly potential benefits from increasing the scale of these efforts.

The EU has been, and continues to be, a beneficiary of best practice developed in other economies, for example using analytical techniques that had been pioneered in the US MEPS rulemaking processes and the sharing of product performance, technology and cost data. It has also been a major source of innovation and best practice itself. Energy labelling is a clear example of this. Some of this emulation has occurred due to support from EU financed programmes but historically such support has been limited and emulation has occurred through processes that were not directly commissioned or supported by the European Commission or Member State agencies.

Detailed recommendations are made for specific requirements agreed at the start of the project these are addressed in turn below (items 1 to 3). Following these, there are several additional recommendations for action that arose during research undertaken for the project. Sources for these included direct suggestions and requests from interviewees as well as observations drawn from the experience of the project team. These are included for consideration as they may complement or enhance the impact of recommendations under the three main requirements.

1. Methods and fora to increase international exchange about ongoing legislative processes between relevant administrations and governments with the aim to harmonise global legislation, including global standards, to establish a global, equal playing field for industry

There are many existing specialist fora through which the EU could work to increase international exchange on policies and technical issues. As resources to engage are limited, the following strategic approach is suggested for consideration:

1. Focus first on well-established international product policy fora that already attract policy-makers with whom the EU wants to engage. Priorities should certainly include **SEAD** and **IEA 4E**.
2. Develop **bi-lateral exchanges with priority economies**. Priorities can be set according to EU learning needs and also to achieve EU influence on policies in major trading blocks.

3. **Prioritise specific products** on which action is timely and necessary, working through whichever fora or activities will best achieve specific aims.
4. Consider supporting **NGO and technical Institutes** to achieve greater engagement with product policy issues within and outside of the EU. These types of organisation can achieve greater continuity than Commission officials, Member State policymakers and individual consultancies. Greater exchange between regions can also be facilitated through international NGOs and technical institutes if they can be more closely involved in the processes.

2. How to support European industry with information about planned and ongoing legislation in third jurisdictions?

Most industry associations have developed effective mechanisms to monitor regulatory developments and disseminate information to members. Improvement could be made, however, since the extent to which smaller businesses in particular exploit these mechanisms varies significantly between sectors.

The European Commission could usefully assist existing industry association communication mechanisms by providing authoritative information about third jurisdictions. This information could then be disseminated via well-established communication networks. This would ensure wider availability of well-founded information which might otherwise be derived from less well-informed and piecemeal research.

There are several ways in which the commission could add value to this information for the benefit of European industry:

- Firstly, the European Commission may have access to advanced information about policy development planning through its policy networks, and could judge on a case by case basis whether it was appropriate to make this known to the relevant industry sectors.
- Secondly, the Commission could provide expert insight into how the EU regulations differ or are similar to those from third jurisdictions in order to provide *initial indicative information* on regulations and requirements: of particular interest will be the indicative relative levels of minimum requirements, confirming which test methodologies are required to be used, specific requirements over and above any in force for the EU.
- Thirdly, labelling and minimum standard requirements exist in some other regions for products which are not yet subject to EU requirements. This presents opportunities for developing support for future development of EU regulations in those directions, as well as initiating awareness and possibly preparation for compliance with these additional regulations wherever bilateral trade is likely.

To balance resources, this activity could focus on a smaller number of sectors, prioritised by factors such as value of manufacturing in EU, potential for exports and proportion of SMEs in the sector, which could act to increase trade as well as bring environmental benefits. Such efforts should be done in manner that is complementary to existing databases, such as the CLASP database on standards and labelling programmes.

3. Methods and fora to increase the visibility of the European Union's Ecodesign and energy/tyre labelling legislation in third jurisdictions, and support third jurisdictions with the development of similar legislation

More could be done to make a one stop portal where information on all EU product policy, especially policy concerned with energy performance, is made available.

Some specific opportunities to address shortcomings and the broader dissemination of information on EU product policy are as follows:

a) While the Commission has begun to address some of these limitations by the initiation of projects to develop websites to provide data on some of these issues; these are still in their early stages and have a more limited scope than the actions described above. Thus, there is still potential to continue to improve access to and presentation of relevant information in a comprehensive format that is linked to the Commission's own site.
b) For Ecodesign studies and regulatory development processes of product groups identified as priorities for improved international harmonisation, representatives of target regions/economies could be invited to observe consultation fora, or perhaps join by webinar. Indeed a specific task to engage with such economies or bodies could be included in the task specification of contractors, and/or to brief suitable representatives via existing fora operating in those countries.
c) The Commission could present papers at a number of specific recurrent international events that are dedicated to, or have a strong focus on, equipment energy efficiency.
d) The Commission could sponsor an international journal or newsletter that carried updates on all equipment policy work carried out in the EU.

It is recommended that the Commission considers strengthening dissemination efforts via these or similar media and allocates resources that will enable a broader and more sustained communication about its programmes and their benefits.

To support third jurisdictions with the development of similar legislation the Commission could:

a) Develop regional engagement strategies and support mechanisms for the promotion of the development of product Ecodesign and labelling policies.
b) Consider supporting or working with specific Member State bilateral support initiatives addressing EU product policy topics.
c) Consider the creation of an "EU Energy Efficiency Ambassador" tasked with strengthening relations with markets outside the EU and improving communication, transfer of knowledge and knowhow regarding energy efficiency product policies between Europe and 3rd countries.

4. Emerging consensus on global 'ladders of performance standards' for various products, frameworks to enable greater harmonisation

The experience with electric motors and external power supplies has shown that where there is concerted action among governments it is possible to develop globally adopted menus of energy performance tiers for a product, which will have a common testing basis, common product categories and efficiency metrics and common energy efficiency thresholds. In general these would be developed through the international standards bodies such as ISO and IEC, although the external power supply case demonstrates that this is not always necessary if the relevant committee is not interested in working with product energy performance regulators. Ideally the standardisation process would have strong input from European standardisation experts with close ties to and knowledge of the objectives of the EU policy process. There are plenty of other product types that would benefit from the development of globally recognised energy performance tiers underpinned by common test methods and efficiency metrics. Some, such as distribution transformers, are quite advanced in developing such requirements but for most products work on performance tiers is yet to begin.

It is to address these kinds of concerns that the IEA/IEA4E/SEAD Community of Practice (section 7.1.2) was established; however, this body would be likely to make much stronger progress were the Commission to become an active partner.

Whatever form it takes it is recommended that the Commission becomes an active player in the development of international dialogues among regulators, industry and standardisation bodies to promote greater alignment in test procedures, efficiency metrics and energy performance tiers.

5. Lessons from other countries programmes – improve coverage of standards and labelling policies

While many countries have emulated the appearance and sometimes (less frequently) the efficiency thresholds used in the European energy label, the EU is far from being a leading economy in terms of the product coverage of its energy label. The EU could learn from other economies that there is value to be derived in extending labelling (or at least mandatory disclosure of energy performance) to other sectors than just residential and consumer products. Other economies (e.g. Argentina, Australia, Brazil, Canada, China, Japan, Korea, Mexico, Philippines, USA amongst others) have labelling for one or more of: commercial AC equipment, commercial refrigeration equipment, compressors, high intensity discharge lighting, imaging equipment, inverters, industrial blowers, professional lighting applications, pumps (including general pumps, agricultural pumps, circulation pumps and pool pumps), motors and transformers. Currently the only non-residential sector product-group subject to labelling requirements in the EU is some types of lamps.

The expansion of the labelling products portfolio to include new product groups is also an important issue. Technologies like solar (thermal and PV) equipment, gas appliances and vehicles other than cars are some of the groups for which the EU still has an opportunity to develop policy measures. There are good examples in 3rd jurisdictions of policy implementation for these product types and the

EU could benefit from information gathered in bilateral meetings and other forms of cooperation mentioned above, to accelerate European standards and labelling requirements for these products.

6. Cooperative work would be appropriate on energy using systems

No country has really attempted to use energy performance standards and labelling to apply to energy using systems unless they are sold as a packaged product. The EU is just now attempting to explore the boundaries of the extent to which systems level energy savings can be delivered via Ecodesign and labelling but this is innovative and there are likely to be significant limits to the ability of the policy instrument to access these savings. It is therefore recommended that the EU explores options for joint development work with 3rd country agencies on how best to establish effective policy instruments to promote energy efficient product systems.

1. Context – international alignment in equipment energy efficiency standards and labelling

1.1 Equipment energy efficiency policy – vast savings and a vast untapped savings potential

Mass produced energy using equipment accounts for the majority of energy use around the world and indirectly the majority of anthropogenic carbon dioxide emissions. While extension of energy supply has been a focus of energy policy and energy sector investment since the 1950s and earlier, the development of policy measures to improve the efficiency of energy use really trace their origins to the 1970s and the first energy crisis, although very modest actions were taken prior to that time in some economies. The development of policies targeting the energy efficiency of equipment mostly have a more recent history, with some very early efforts in the 1960s and 1970s but the vast majority of initiatives not getting under way until the 1990s or later in many economies. Over the course of this time a broad consensus has emerged that actions are needed to render energy performance more visible into the market (typically energy efficiency measurement metrics and disclosure measures, through the use of energy labels or ratings) and via minimum efficiency requirements, usually expressed through mandatory minimum energy performance standards (MEPS) or sometimes voluntary industrial agreements or mandatory fleet average performance requirements. The degree of alignment between these various international 'standards and labelling' programmes and particularly with the equivalent policy measures in the EU is the focus of this report.

While the profile of these policy measures has never been higher, there is still significant potential to induce further cost effective energy savings. Various studies have attempted to estimate energy savings potential from these policies. In the EU alone it is estimated that full implementation of the EU Ecodesign Directive would yield yearly savings of up to 600 TWh of electricity and 600 TWh of heat[3] in 2020, equivalent to 17% and 10% of the EU total electricity and heat consumption, respectively. This would translate into 400 Mtonnes of CO_2 emissions annually in year 2020, comparable to the impact on greenhouse gas (GHG) emissions expected of the EU Emissions Trading System (ETS) (Molenbroek, 2012). These savings equate to €90 billion in avoided energy costs per annum.

In the USA an analysis by the Appliance Standards Awareness Project and ACEEE (ASAP 2012) reports that existing appliance efficiency standards reduced US electricity consumption by about 280 terawatt-hours (TWh) in 2010, that is a 7% reduction. The electricity savings are projected to grow to about 680 TWh in 2025 and 720 TWh in 2035, reducing U.S. electricity consumption by about 14% in each of those years. It goes on to estimate that in 2035 the

[3] Measured as final energy.

existing standards will further produce:

- Annual natural gas savings of about 950 trillion British thermal units (TBtu), or enough to heat 32% of all natural-gas-heated US homes
- Peak demand savings of about 240 GW, saving about 18% of what the total generating capacity projected for 2035 would have been without standards
- Annual emissions reductions of around 470 Mt CO_2, an amount equal to the emissions of 118 coal-fired power plants

The cumulative net economic benefit of these standards to consumers and businesses is estimated to be worth more than US$1.1 trillion. By 2035, the cumulative energy savings are projected to reach more than 200 quads, an amount equal to about two years of total US energy consumption.

In Japan, METI reported that the energy efficiency of equipment regulated through the Top Runner programme had improved by from between 26% (for TVs over a 6 year period) to 99% (for PCS and magnetic disc drives over an 8 year period) (ANRE 2010).

Nor are the savings potentials confined to the major economies. An initial analysis for the Super-Efficient Equipment and Appliance Deployment (SEAD) initiative suggests that the West African ECOWAS region could save more than 60 terawatt hours (TWh) of electricity per year by 2030 by adopting best practice efficiency standards for primary appliances such as refrigerators, air conditioners, lighting, and other equipment. To put this figure into perspective, 60 TWh is nearly as much electricity as was consumed by the entire ECOWAS region in 2011. Similar, savings potentials are likely to exist in all global regions.

Worldwide the savings potential of standards and labels is very significant. A recent study analysing the impact of minimum energy performance standards (MEPS) in 13 major economies[4] concluded that the cost-effective potential for electricity savings amounts to 770 terawatt hours (TWh) in 2020 and 1,500 TWh in 2030. This is equivalent to annual CO_2 emissions reductions of 540 million tons (Mt) in 2020 and 1,000 Mt by 2030. Cumulative emissions savings amount to 11 gigatons (Gt) between 2015 and 2030. Final energy consumption can be reduced by 17% in 2030 in the residential sector and 4% in the industrial sector compared to BAU consumption (Letschert et al., 2012).

Various attempts have also been made to estimate global energy savings potentials from greater alignment in equipment energy efficiency standards and labelling programmes. For example, Waide et al (2011), who looked at a broader range of equipment types than the study by Letschert *et al* estimated global alignment to the most advanced MEPS in place in 2010 by 2030 would save annually in 2030:

[4] Australia, Brazil, Canada, EU, India, Japan, South Korea, Mexico, Russia, South Africa, US and China

- 4000 TWh of final electricity demand (12% of the total) and 45 of oil and gas demand in the residential, commercial and industrial sectors excluding energy used for transport and industrial process heat
- 2600 Mt of CO_2 emissions (11% of emissions from the sectors addressed)

While, these savings potentials are considerable and help put the topic of equipment energy efficiency standards and labelling in context, the focus of the current report is on EU influence on the global standards and labelling policy environment and on the influence that measures originating outside the EU have had on the EU's process. Before assessing the evidence base for these questions it is first appropriate to consider the different building blocks that underpin efficiency standards and labelling and how they relate to each other. It is then appropriate to consider what benefits there can be from greater international alignment in this domain. These two topics are considered in sections 1.2 and 1.3.

1.2 The building blocks of standards and labelling

Minimum energy performance standards (MEPS) and energy-labelling schemes require the specification of **energy performance thresholds**, which are determined according to agreed **energy efficiency metrics**. Metrics are a measure of efficiency expressed in terms of energy used per unit of useful service provided. The determination of useful service commonly entails dividing products into **product categories** that provide sufficient homogeneity of service. Thus, efficiency metrics are also a function of the product categorization adopted.

The manner in which energy and service levels are measured is set out in a **test procedure**[5]. Efficiency metrics and product categorizations are commonly specified in **energy efficiency regulations**, which reference a test procedure.

All product efficiency regulations therefore rest on a tri-partite hierarchy of standards needs where test procedures are at the bottom, product categorization and efficiency metrics are in the middle, and performance thresholds are the final output (Figure 1-1). Product energy efficiency regulators are always engaged in the process of setting the energy efficiency performance thresholds specified in regulations. The development and approval of energy performance test procedures is often carried out by specialist standardization bodies. The development of product categories and efficiency metrics is typically undertaken by both standardization bodies and by product energy efficiency regulators although often not within the same process.

[5] The terms test protocol and test standard are also often used interchangeably with the term test procedure

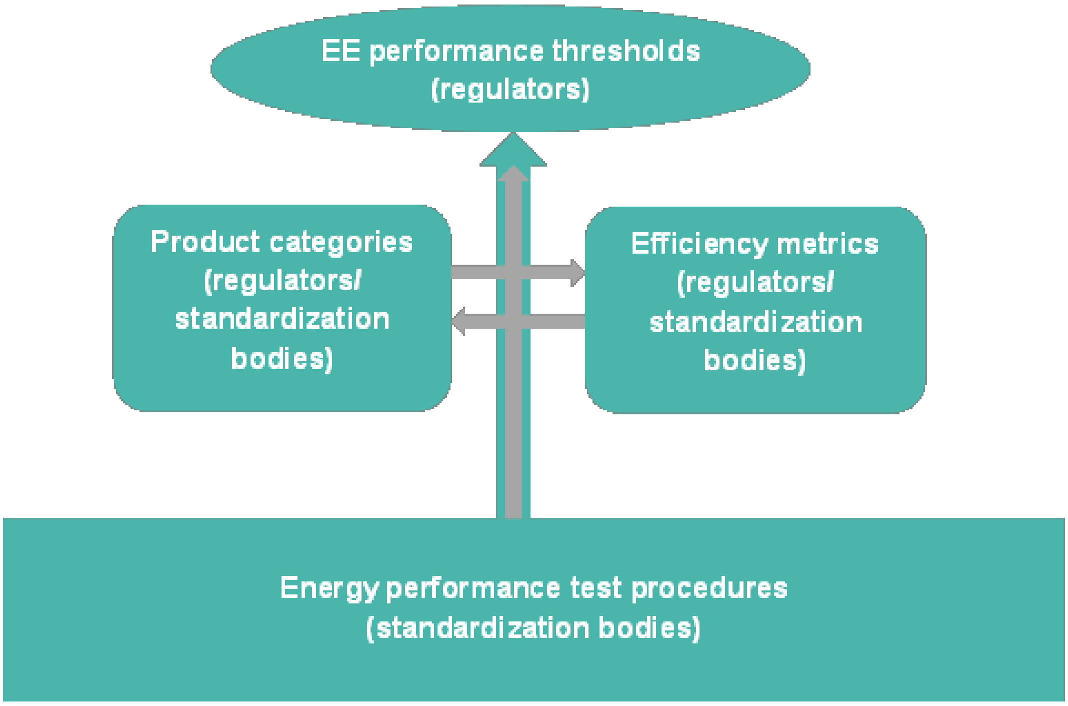

Figure 1-1 . Standardization elements needed for efficiency performance thresholds

All of the above tri-partite elements are necessary to prescribe an efficiency regulation, but the agencies involved in the development of the various elements often differ. In general, government-appointed equipment energy efficiency regulators set the performance thresholds, select the efficiency metric and specify the product categories to be used in their regulations. Test procedures referenced in the regulations are usually derived by national and international standards bodies that are not directly answerable to the equipment energy efficiency regulators. Most countries have one or more national standardization body that is charged with developing and maintaining national test and measurement standards. Almost all of these national bodies are also members of equivalent international standardization bodies of which the principal ones are: the International Electrotechnical Commission (IEC), the International Organization for Standardization (ISO) and the International Telecommunications Union (ITU). These international standardization bodies follow set procedures for developing and adopting test and measurement standards. Once an International Standard has been adopted, many economies then adopt it at the national level, in full or in part. This process shares the burden of test standards development across economies and facilitates greater international alignment. Some economies, however, are more likely than others to adopt or align with International Standards. While some countries have a policy to adopt international standards without modification, some may make local amendments and others often prefer to opt for national or regionally aligned standards in place of International Standards. Most commonly, however, nations align their test standards with some part of the international standards portfolio but not all of it.

1.3 Benefits of greater alignment

The benefits of international efficiency test standards harmonization are well characterized, as outlined below (Waide et al, 2011a).

- Enhanced transparency and clarity across economies: when test procedures, product categories and efficiency metrics are aligned, it permits direct comparison (benchmarking) of product efficiency across peer economies and can inform prioritization and efficiency standards and labelling policy decisions.
- A propensity towards lower-cost, higher-quality, more rapid and more ambitious domestic regulations: harmonized test procedures and efficiency metrics facilitate the use of analyses from other economies to determine and justify the adoption of regulations set at specific efficiency levels. They also facilitate discussion of the techno-economic potentials associated with attaining higher efficiency levels through being able to draw relevant information from other economies.
- Lower costs and higher quality of tests: the cost and expertise needed to develop and maintain test procedures is shared.
- Reduced manufacturer costs for testing and production: globally traded products that attain a sufficiently high harmonized efficiency rating will be accepted for sale in any economy that adopts the test procedure, efficiency metric or efficiency standard concerned.
- Accelerated market and manufacturer learning, lower consumer costs, and promotion of innovation: a common set of high-efficiency thresholds supports the market for high-efficiency products as manufacturers know that attainment of a given performance threshold will open up a larger market for their products. This drives up the volume of higher-efficiency products and lowers production costs through economies of scale, thereby accelerating the market-transformation effect. Furthermore, manufacturers have greater long-term incentives to pioneer even more efficient products as a result of the certainty that efficiency thresholds are globally linked, thus facilitating technology transfer.

In principle, however, whether or not they are internationally aligned, it is important to remember that energy efficiency test procedures and efficiency metrics need to satisfy as best as possible the following requirements:

- be repeatable (i.e. the same product measured repeatedly in the same test laboratory will produce the same results)
- be reproducible (i.e. the same results will be recorded if the same product is tested in different laboratories, assuming the laboratories have been accredited to do the test)
- be representative (i.e. the results measured under the test are representative of the average of what would be expected when the product is used in situ)
- be affordable (i.e. the cost of doing the test is not prohibitive)
- be viable (i.e. practicable and not unduly burdensome but also being enforceable in such a way that their intent and prescriptions cannot be readily circumvented).

2. Project description

2.1 Project scope and purpose

In this report, we provide information and analysis on the impact of the EU's Ecodesign, energy and tyre labelling regulations and processes on other economies around the world. It is the final report from the project entitled *Study on the Impact of the European Union's Ecodesign and energy/tyre labelling legislation on product policy developments in third jurisdictions/economies*. The project uses information collected on standards and labelling policies and on the policy making process in different countries. The methodology is described in more detail in the following subsections. The product and geographical scope are also detailed in this section. In addition to country specific information, several product case studies have been provided for different products and are presented in section 5.

2.2 General methodology

The information presented in this report has been obtained through a mixture of desk-research, compilation of the team member's extensive existing knowledge regarding third country equipment energy efficiency and Ecodesign related programmes and interviews/questionnaires applied to informed parties. The information gathered in this way covers at least the following:

- the energy efficiency regulations and standards in place in the economies of interest
- the processes used to develop those regulations and standards
- the motivation and inspiration behind the development of such regulations and standards
- the sources of data used to inform the regulatory/standards development process

In principal this information can cover a very wide range of product types within any given economy and regulatory framework e.g. energy labelling, minimum energy performance standards etc. and so a variety of ways of presenting the data have been used.

2.3 Geographical focus

The 20 economies studied in depth are:

Argentina, Australia, Brazil, China, Egypt, Ghana, India, Indonesia, Japan, Jordon, Kenya, Korea, Mexico, Nigeria, Philippines, Russia, South Africa, Tunisia, Turkey, USA

The analysis in the report has also been informed by less extensive information gathered on the following 54 economies:

Albania, Algeria, Bahrain, Bangladesh, Belarus, Belize, Bolivia, Brunei Darussalam, Canada, Chile, Chinese Taipei, Columbia, Cook Islands, Costa Rica, Croatia, Ecuador, Fiji, Guyana, Hong Kong-China, Iceland, Iran, Israel, Jamaica, Kazakhstan, Kiribati, Kosovo, Lebanon, Macedonia, Malaysia, Morocco, Myanmar, Moldova, Montenegro, Namibia, New Zealand, Norway, New Caledonia, Pakistan, Paraguay, Peru, Saudi Arabia, Serbia, Singapore, Sri Lanka, Switzerland, Thailand, Tonga, Tuvalu, UAE, Ukraine, Uruguay, Venezuela, Viet Nam, Western Samoa.

For these countries the project team made use of their extensive personal professional experience in product policy which covered 24 of these economies. Details on the programmes in place in the other economies came in part from the draft study *Energy Labelling Standards and Labelling Programs Throughout the World in 2013* (Energy Efficiency Strategies and Maia Consulting, 2013), which was a parallel study to the current one financed by the Australian government.

2.4 Product focus

The products considered in the review include all the products that have been subject to analysis in the EU Ecodesign, energy- and tyre-Labelling regulations. It comprises the products listed under the 9 principal product groupings shown in Table 2-1.

Table 2-1 Products to be covered in assessment

Product groupings	Lot No. and description of scope
1. Lighting	8-9 Tertiary lighting
	19 Domestic lighting
	19 Directional lighting
2. Electronics	3 PCs and servers
	4 Imaging equipment
	5 Televisions
	6 Standby and off-mode losses
	18a Simple set-top boxes
	18 Complex set-top boxes
	26 Networked standby losses
3. White Goods /Domestic appliances	13 Domestic refrigerators and freezers
	14 Domestic washing machines
	14 Domestic dishwashers
	16 Laundry dryers
	17 Vacuum cleaners
	23 Domestic and commercial hobs and grills
	25 Non-tertiary coffee machines
	22 Domestic and commercial ovens

Product groupings	Lot No. and description of scope
4. Commercial sector equipment	ENTR 1 Refrigerating and freezing equipment
	12 Commercial refrigerators and freezers
	24 Professional wet appliances and dryers
	22 Domestic and commercial ovens
5. Motors/pumps	11 Electric motors
	11 Circulators in buildings
	11 Electric pumps
	28 Pumps for waste waters
	29 Large pumps and pumps for pools, fountains and aquariums
6. AC/Ventilation	11 Ventilation fans
	6 Tertiary air conditioning
	10 Room and air conditioning appliances
	10 Residential ventilation and kitchen hoods
7. Heating supply	1 Boilers and combi-boilers
	2 Water heaters
	4 Industrial ovens
	15 Solid fuel small combustion installations
	20 Local room heating products
	21 Central heating products (other than CHP)
8. Others	X Medical imaging equipment
	2 Distribution and power transformers
	5 Machine tools
	7 Battery chargers and external power supplies
9. Tyres	Tyre labelling

All of the products listed are energy using products – with the exception of tyres which are 'energy related'. Tyres are not covered by the Ecodesign Directive as they relate to transport.

Appendices B & C give details of which of these product groupings within the 20 selected 3rd countries have standards and labelling requirements and also gives the project team's provisional assessment of the degree of alignment which exists between these measures and the equivalent EU measures.

Please note the CLASP Standards & Labelling database used for the analysis of the coverage and nature of standards and labels (Appendices B & C) summarised in section 4 only includes energy using non-transport products and does not include tyres. Information on tyre labelling has been taken from the literature.

2.5 Determination of product measure alignment

Section 4 presents results of an analysis of the degree of alignment that exists between EU product measures and those applied in 3rd countries for the same product types. Alignment is assessed separately for energy performance test procedures, energy efficiency metrics, energy efficiency thresholds (specified in MEPS, labels or voluntary agreements), and the degree to which the label appearance is aligned with the EU's.

The database of MEPS and labels used to analyse this alignment is established to include the scope and implementation date for MEPS and labels per country per product group. Those policies are compared with their equivalents in the EU according to the following four categories:

- Category A: The degree to which the test procedure is aligned with the IEC and ISO etc.
- Category B: The degree to which the energy efficiency metric is aligned to the EUs (done separately for MEPS and labels).
- Category C: The degree to which efficiency thresholds are aligned to the EUs (done separately for MEPS and labels).
- Category D: The degree to which the label appearance is aligned with the EU energy label's appearance

Based on the assessment of the project partners, the result of this detailed comparison for each product grouped is classified as fully aligned/partially aligned or as no alignment to produce graphs presented in section 4. Category D is not included in this part as it only indicates visual similarity.

Final country alignment classifications are derived using the following rationale:

- **Fully aligned:** if the policy area in question (test procedures, MEPS or Labels) is classified as fully aligned for the majority of product groups that are listed for that country. If a country has an isolated example or two of a product group with "partial alignment" or "no similarity" then 'fully aligned' grading can still be granted if in the judgement of the expert the exception(s) is/are a small minority (i.e. around 1 in 20 or less) and not for major appliances/equipment. For MEPS and labels this follows for both category B and Category C.

- **Strongly aligned:** if a combination of "fully aligned" and "partially aligned" products are observed in the country set, where fully aligned product groups are in the majority.

- **Some alignment:** a combination of "fully aligned", "partially aligned" and "no similarity", where fully aligned accounts for a minority of products. For MEPs and labels it is possible to observe a more or less equal distribution of those three classifications for one of the categories (e.g. Category B) whereas the other category (e.g. Category C) is dominated by "no similarity".

- **No or little alignment:** A combination of "partially aligned" and "no similarity" or only "no similarity".

2.6 Survey of country experts

The assessments presented in this study did not just rely on desk research but also entailed interviews with policymakers, industry representatives and experts from countries inside and outside the EU. Two tools were used to do this: a questionnaire and telephone surveys. The purpose of these surveys was to gain insights into the following:

- complete information on third country programmes that was missing from the desk research,
- identify all relevant sources of information, to verify the accuracy of the information obtained
- determine the degree to which policy and test procedure development processes in specific 3rd countries were informed (if at all) by EU developments
- establish the level of interest in cooperation with the EU
- receive feedback from outside the EU on EU product policy processes and international engagement examine the potential for harmonisation.

In total 28 policymakers and/or experts were interviewed or completed questionnaires in the following economies:

- Argentina
- Australia
- Brazil
- China
- Egypt
- India
- Indonesia
- Japan
- Korea
- Mexico
- Philippines
- Russia
- South Africa
- Tunisia
- Turkey
- USA

The largest type of interviewees (10) were programme managers often directly responsible for the design and implementation of their economy's standards and labelling programme; however, some interviewees were from standardisation bodies (3), industry associations (3), multilateral agencies (2), environmental NGOs (2), academia (4), or consultancies (4). The survey questionnaire used is shown in Appendix A.

3. EU policy background

Some individual EU Member States have very long histories of regulating the efficiency of end-use equipment dating back to the early 1960's; however, the advent of the European Community and later the European Union led to the repeal of most national regulations that could be considered as a barrier to trade within the European Economic Area. To respond to the resulting policy vacuum the European Commission passed a framework Directive on the mandatory energy labelling of household appliances in 1992. This was followed by the issue of implementing regulations for: household refrigerators and freezers, clothes washers, washer-dryers, clothes-dryers, dishwashers and household lamps. Labels for TVs, room air conditioners and ovens followed prior to eventual recast of the labelling Directive in 2010.

3.1 The background to the EU appliance energy labelling scheme

Energy labelling has a long and erratic history in the EU. The timeline to develop a common EU-wide label is shown in Figure 3-1.

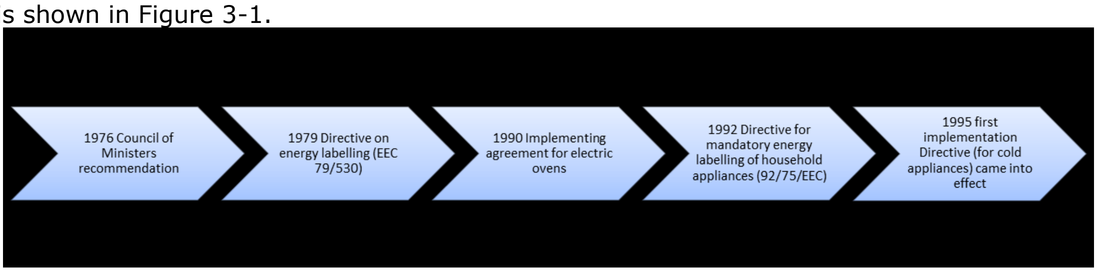

Figure 3-1 Timeline of the introduction of energy labelling in the EU

It therefore took twenty one years from the date the Council first agreed the need for a European cold appliance energy performance label for it to be introduced across the EU (Figure 3-2).

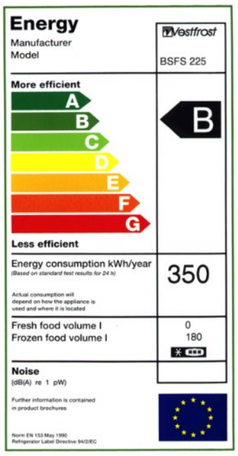

Figure 3-2 The original EU cold appliance energy label, issued in 1995

3.2 Early MEPS and voluntary agreements

In addition to issuing energy labels the EU also implemented mandatory minimum energy performance standards (MEPS) for cold appliances (Council and Parliament Directive 96/57/EC, in force from 3.9.99), liquid or gas-fired hot water boilers (Council Directive 92/42/EEC, in force from 31.12.97) and fluorescent lamp ballasts (Council and Parliament Directive 2000/55/EC, in force from 21.11.2000). All of these MEPS required the same amount of administrative and legal effort to develop as primary legislation and this constituted a major source of inertia in the rate at which the Commission developed such requirements. As a result the Commission adopted a pragmatic approach where they were willing to consider industry association proposals for voluntary agreements as a preferential alternative to new or revised MEPS requirements. These agreements set efficiency targets that the industry pledged to meet within a given time frame. Such agreements were negotiated with the industry associations CECED (European Committee of Domestic Equipment manufacturers) for major household appliances and the predecessor of Digital Europe (EICTA) for consumer electronics.

3.3 Testing and certification agencies

The establishment of the test standards agencies CEN and CENELEC was an important component of the market harmonisation process embodied in the original Treaty establishing the European Economic Community and later in the Single European Act of 1986. These bodies now issue European test and safety standards which apply in all the nations comprising the European Economic Area (EEA) (i.e. the EFTA and EU states) and that address equipment energy performance factors. Eastern European countries also made use of the CEN and CENELEC test standards even prior to their membership of the EU. Neither CEN nor CENELEC standards are mandatory within any European state unless they are incorporated in separate government legislation; however, in practice CEN and CENELEC standards were almost always adopted by the standards bodies within all these states. There was an opt-out clause within the European Treaty which stipulated that local trade protocols within EU Member States can take precedence over the European protocols in some circumstances although the legal precedents for doing so were complex.

To ensure the uniform implementation of standards within Europe, the European Organisation of Testing and Certification (EOTC) was established in 1993. The EOTC formed a group to cover electrical products and to ensure that European testing laboratories and certification bodies recognise each other’s work. In general, however, all the European energy labelling and MEPS Directives relied (and still do) on self-declaration by manufacturers.

3.4 Policy motivation and programmatic support

The importance of energy efficiency within EU energy policy increased over the 1990s to 2010 and began to become recognised as a central plank of Community policy. In general, energy efficiency policy within the EU was largely a matter for Member States to determine within their national boundaries; however, as a consequence of the Treaty of Rome and the Single European Market energy efficiency policies which have implications for tradable goods necessarily required coordination and harmonisation from the centre. This need created a role for the European Commission to propose and administer a number of actions dealing with tradable goods –and most commonly electrical or gas appliances. None of these measures prevented Member States from implementing their own energy efficiency policies for tradable goods within their boundaries provided that these national policies would not erect barriers to the free-trade of goods.

To support this effort, the European Union, or its predecessor, initiated a number of different programmes in the 1980s or 90s which were directly or indirectly concerned with the promotion of energy efficiency. The most important of these were the SAVE and PACE programmes.

Under the PACE programme a number of different actions were pursued in the domestic, commercial and industrial sectors based on the common principle that the energy savings they produce must pay for themselves within a reasonable period. The SAVE (Specific Actions for Vigorous Energy Efficiency) and SAVE-II programmes ran from 1991-2002 and aimed to promote, and remove barriers to, energy efficiency. Mandatory minimum energy efficiency standards were normally proposed as a last resort by the Commission, whose preference was to negotiate voluntary agreements with industry to raise product energy efficiency.

In general the legislative measures were found to be much more successful in achieving tangible and quantifiable energy savings than the pilot actions and dissemination activities although these are naturally useful supportive measures.

A typical PACE work sequence for household appliances was as follows:

1) mandate CEN/CENELEC to produce a measurement standard for the appliance energy consumption and performance
2) study – the range of appliances on the market, technical/economic potential for their efficiency to be improved, the impact of any efficiency improvement on manufacturers, consumers and the environment
3) build consensus on the analysis of possibilities
4) introduce labelling and market support for labelling
5) other information supporting labelling – e.g. customised information
6) explore/establish voluntary agreements with manufacturers
7) and/or mandatory minimum energy efficiency standards
8) monitor the actual use of the appliances and evaluate impact of efficiency policies
9) carry out marketing to promote the more efficient use of appliances (e.g. a reduction in wash temperatures)

The legislative measures produced in this manner were:

- mandatory minimum efficiency standards for domestic gas boilers, Directive (92/42/EEC, of 21.5.92)

- framework Directive (92/75/EEC of 22.9.92) for labelling of major domestic appliances followed by implementation directives for: cold-appliances (92/2/EC, date 21.1.94), clothes-washers (95/12/EC, date 23.5.95), clothes-dryers (95/13/EC, date 23.5.95), washer-dryers (96/60/EC, date 18.10.96) and dishwashers (97/17/EC, date 16.4.97). An energy labelling directive for household lamps was approved on 27.1.98.
- Directive (93/76/EEC of 13.9.93) for the energy certification of buildings, the billing of heating on the basis of actual consumption, thermal insulation of new buildings, third party financing, regular inspection of boilers, energy audits and industry.
- mandatory minimum energy efficiency standards for domestic refrigerators and freezers (96/57/EC of 3.9.96)

3.5 Design of the common EU energy label

Given the high impact that the EU energy label has had around the world through emulation in other economies and given the current discussion taking place about label design issues associated with the EU's review of the energy labelling Directive it is appropriate to revisit how the design used until the revision of the Directive in 2010 came into being. The design of the EU energy label evolved from work done by the University of Leiden for the Dutch government and the European Commission. Details of that design process are given in Appendix D.

Programme evaluations have illustrated the considerable impact of the EU labelling programme in influencing the efficiency of the European equipment market and have confirmed the success of this policy instrument. The efficiency of refrigerators and freezers improved by 27% in the four years following the introduction of labelling and MEPS and much of this gain has been shown to be clearly attributable to the former policy instrument, see Figure 3-3 (Waide 2001b). The high impact of the labelling programme was found to be the result of the following factors:

- the label design is effective in communicating the relative efficiency performance of different appliances to consumers, retailers and manufacturers – in particular the use of a categorical efficiency scale sets clear efficiency targets for manufacturers and facilitates the comparison of efficiency between many products by consumers.
- the means of defining efficiency used in the label rewards efficient appliances and yet respects the provision of the appliance's primary service – the inclusion of information on the non-energy performance of the appliance means that any reduction in energy consumption that is attained through a poorer provision of the primary service is clearly visible, which increases manufacturer engagement with the scheme.
- the label has been supported by a variety of related additional measures at the local level, such as advertising and information campaigns, retailer training, rebates, etc.

The original label design was produced following the conduct of consumer research into what type of label design would be most effective at communicating energy performance and efficiency concepts to consumers. This concluded that comparative categorical labelling was more likely to achieve this than other designs and outlined some basic tenants of the current design. Furthermore, each new energy label, MEPS regulation and/or voluntary agreement was determined after conducting a thorough study to investigate the energy savings potentials for a particular end-use and the policy measures best able to bring this about. These studies were financed by the European Commission and were usually conducted by a working group typically comprised of independent experts, national energy agencies, academic institutions and industry representatives.

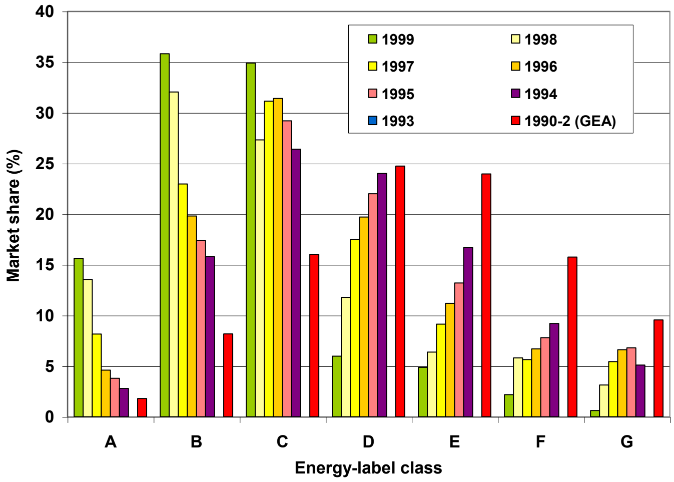

Figure 3-3 EU cold appliance market shares by labelling class from 1990–92 to 1999. [Neither data for 1999 and 1998 taken from the CECED databases nor the 1990–92 GEA data are sales-weighted; data for 1994–97 are sales-weighted and are taken from the monitoring evaluation studies for the European Commission (PW Consulting & ADEME 1998, 2000a)]

The first task of these studies was to determine product sub-categories and to identify an energy efficiency measure, which naturally varied for each primary equipment type. The market and stock characteristics were then analysed including the efficiency distribution of all products on the market. This information was then supplemented by a techno-economic energy engineering analysis whose purpose was to determine the technical potentials available to improve the efficiency of existing equipment and the costs of doing so. This type of analysis is not constrained by the technical characteristics of equipment currently on the market and may consider technical options which have not yet been commercially applied providing they are readily available and understood. A number of policy measure scenarios were then considered and projections made regarding the energy and CO_2 savings and costs of each scenario compared with a business as usual scenario. The impact of these policies on the equipment market and on manufacturers was further considered in order to gather all the information needed to make an informed policy decision. The study group then made a set of policy recommendations which often involved a mixture of energy labelling and MEPS.

3.6 Limitations of the early EU policy framework

Despite the analytical strength of the European standards and labelling setting process there were a number of weaknesses within the programme as a whole. These are summarised as follows:

- until the adoption of the Ecodesign Directive in 2005 there was no framework legislation enabling MEPS to be set, which meant that each new MEPS regulation had to be negotiated and passed at a primary Directive level. This was time consuming and the results were ad hoc which made it difficult to know what the outcome was likely to be with each new regulation at the time it was proposed
- As a result the Commission tended to prefer to negotiate voluntary agreements with industry; however, these were often set at significantly weaker efficiency levels than is recommended in the independent studies due to the difficulty of negotiating a challenging efficiency requirement. Furthermore voluntary agreements often took a long time to negotiate and were liable to weaker compliance than MEPS due to the lack of formal penalties for non-compliance. A further weakness was that the agreements would usually only involve the members of the primary industry association and hence seldom covered the entire market
- The regulatory structure for establishing labels lacked a clear time frame, which meant that negotiations and discussion often required an excessively long period (this is still a concern)
- Industry is fully represented in the regulatory process to set MEPS, voluntary agreements and labels but advocates for more stringent efficiency requirements such as energy efficiency and environmental advocacy organisations were not. This imbalance resulted in the independent study recommendations being taken as the most ambitious potential policy outcomes from which the final outcome was invariably negotiated downwards rather than the well-balanced outcome their authors intended.

The net result of these limitations was that new regulations during this period took too long to develop and their ambition was often significantly lower than that coincident with the best interests of consumers, the environment and society as a whole.

The situation was significantly improved with the adoption of the Ecodesign framework directive in 2005 and the development of standardised analytical tools such as the MEErP methodology. It is no coincidence that the pace of EU product policy development and implementation has risen dramatically since the adoption of the Ecodesign directive.

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4. Evidence of EU influence on international product policy

In this section, we summarise the evidence of EU influence on international product policy drawing on the detailed information in Section 5 and 6 and Appendices B and C. This is based on details on equipment energy efficiency standards and labelling programmes in place in 74 countries outside the EU. Detailed data on the specific regulations in place has been included in a database for the following countries:

Argentina, Australia, Brazil, China, Egypt, Ghana, India, Indonesia, Japan, Jordon, Kenya, Korea, Mexico, Nigeria, Philippines, Russia, South Africa, Tunisia, Turkey, USA

Analysis of the database[6] assembled for these 20 economies leads to the summary information presented in Table 4-1 and Table 4-2. From Table 4-1 it can be seen that these 20 economies have a total of 367 MEPS in place of which 307 (84%) apply to product types subject to Ecodesign requirements and 60 (16%) apply to product types which are not yet regulated under Ecodesign. There are some 303 energy labelling regulations of which 209 (69%) apply to product types subject to EU labelling requirements and 94 (31%) apply to product types which are not yet subject to energy labelling in the EU. For tyres, several economies are working on labelling in this area, but there is no evidence that there is direct EU influence for this product. Only three economies, Japan, South Korea and EU have labels in place (see Section 6).

Table 4-1 Summary of Product Policies Analysed

	Product Regulated in EU	Product Not regulated in EU	Total
MEPS	307	60	**367**
Labels	209	94	**303**

Table 4-2 summarises the number of regulations by economy and indicates the degree of alignment with equivalent EU regulations and energy performance test procedures. The information in Appendix C, gives details of the alignment for each product in each countries. In the table below, 'strong alignment' implies that for the separate categories the majority of products are aligned; 'some alignment' implies that some of the products are aligned and 'no or little alignment' implies that none of them are or only one or two examples of (some) alignment can be found while the overwhelming majority are not aligned. From this it is clear that six of these countries had labels that are strongly or fully aligned with the EU label and another three had some alignment with the EU label. There was less alignment of MEPS, where three countries had requirements that are strongly or fully aligned

[6] The database used is based on the CLASP database, reviewed and updated as part of this project.

with the EUs' and another five had some alignment with the EUs'. In the case of test procedures nine countries had requirements that are strongly or fully aligned with the EUs' and another eight had some alignment with the EUs', thus of 18 non-EU countries where the test procedure details were known 17 had some degree of alignment with EU test procedures.

Table 4-2 Summary of Regulated Products per Country and Alignment with EU

Country	Nr. Regulated Products		Similarities with the EU		
	Labels	MEPS	Labels	MEPS	Test procedures
Argentina	17	4	strongly aligned	some alignment	fully aligned
Australia	20	33	no or little alignment	some alignment	some alignment
Brazil	19	12	some alignment	some alignment	strongly aligned
China	26	46	some alignment	some alignment	strongly aligned
Egypt	6	8	some alignment	some alignment	some alignment
Ghana	3	3	no or little alignment	no or little alignment	some alignment
India	14	5	no or little alignment	no or little alignment	some alignment
Indonesia	12	13	no or little alignment	no or little alignment	some alignment
Japan	25	21	no or little alignment	no or little alignment	some alignment
Jordan	18	27	fully aligned	fully aligned	fully aligned
Kenya	3	9	alignment unknown	alignment unknown	alignment unknown
Korea (ROK)	21	30	no or little alignment	no or little alignment	strongly aligned
Mexico	15	32	no or little alignment	no or little alignment	some alignment
Nigeria	5	5	alignment unknown	alignment unknown	alignment unknown
Philippines	15	5	no or little alignment	no or little alignment	some alignment
Russia	21	15	fully aligned	no or little alignment	strongly aligned
South Africa	10	12	strongly aligned	fully aligned	fully aligned
Tunisia	5	4	strongly aligned	some alignment	fully aligned
Turkey	20	26	fully aligned	fully aligned	fully aligned
United States	23	61	no or little alignment	no or little alignment	some alignment

4.1 Comparison of EU energy standards and labels with those of other jurisdictions

Energy efficiency standards and labelling programmes are designed to accelerate the rate at which energy-using or energy-related product markets move into higher energy efficiency levels. The measure of their effectiveness is the degree of market transformation, energy savings and GHG emissions abatement that they produce. Many factors of programme design and implementation have a decisive impact on its overall effectiveness.

A recent report (Waide, 2013) compared EU energy standards and label policies with those of China, US, Japan and Australia. The analysis included the main elements of product policy design and implementation, namely: policy coverage; administrative processes, capacity and throughput; stringency; compliance and rigour and monitoring and evaluation of impacts. Some conclusions that can be drawn from this analysis are:

- In terms of **policy coverage** the EU has the lowest proportion of its total electricity consumption[7] covered by MEPS in the domestic and tertiary sector (although this is likely to be changing as more Ecodesign measures are adopted).
- The **administrative resources and technical support** dedicated to product policy in the EU are comparatively lower than in other peer jurisdictions. Estimates for the US show that the person-hours spent are roughly 10 times those of the EU, despite similar market size. The estimated person-hours per year for development of the Chinese programme are over twice those of the EUs. The Japanese and Australian programmes have fewer resources committed for administration but have smaller economies.
- In terms of **regulatory throughput**, the EU's average rate of adoption of standards and labels after the passage of the Ecodesign Directive has been 2.8 regulations per year, although the speed is increasing and in 2013 there was more than this. This rate is lower than that achieved in other jurisdictions. For instance China has been adopting an average of 3.8 regulations per year since 2000 but increasing to 6 per year for the last few years. The rate of adoption in the USA has been five regulations per year over the last six years and is expected to remain fairly constant in the near future.
- Comparing the **stringency** of the regulations in place in different economies is often complicated by differences in the definition and measurement of energy efficiency. Nonetheless in many cases it is possible to either compare directly policy settings or make adjustments for the differences to allow comparison. To date efforts to make such comparisons have tended to show that the regulatory measures in place in one of the EU, Japan or the USA are likely to be the most stringent for any given product type.
- **Enforcement of compliance** is weaker in the EU than in some peer economies. Proactive enforcement of the energy labelling and Ecodesign Directives is still rare among the EU Member States. Australia has probably the most proactive approach to compliance and enforcement among the economies analysed. The Australian authorities and more recently their US counterparts have been willing to prosecute non-compliance and publicise the findings to maximise the deterrent effect. Legal action against non-compliant suppliers is still very rare in the EU.
- In terms of **monitoring, evaluation and impact projection** the efforts in Australia appear to be the most consistent and systematic. Australia tracks sales of regulated products and has regularly conducted detailed end-use metering studies to confirm that theoretical savings are being realised in practice. Similar studies have also been conducted within the EU but there is no consistent and systematic effort to gather such primary data for use in evaluation processes. Australia and the USA have also developed the more comprehensive regulatory impact forecasting tools. Some EU countries have elaborated similar tools, e.g. within the UK's Market Transformation Programme, but not at the EU scale.

[7] Using 2010 as reference year

4.1.1 Summary of Regulations Analysed per Product Group

The number of MEPS analysed by product group type is shown in Figure 4-1, while Figure 4-2 shows the equivalent information for energy labels:

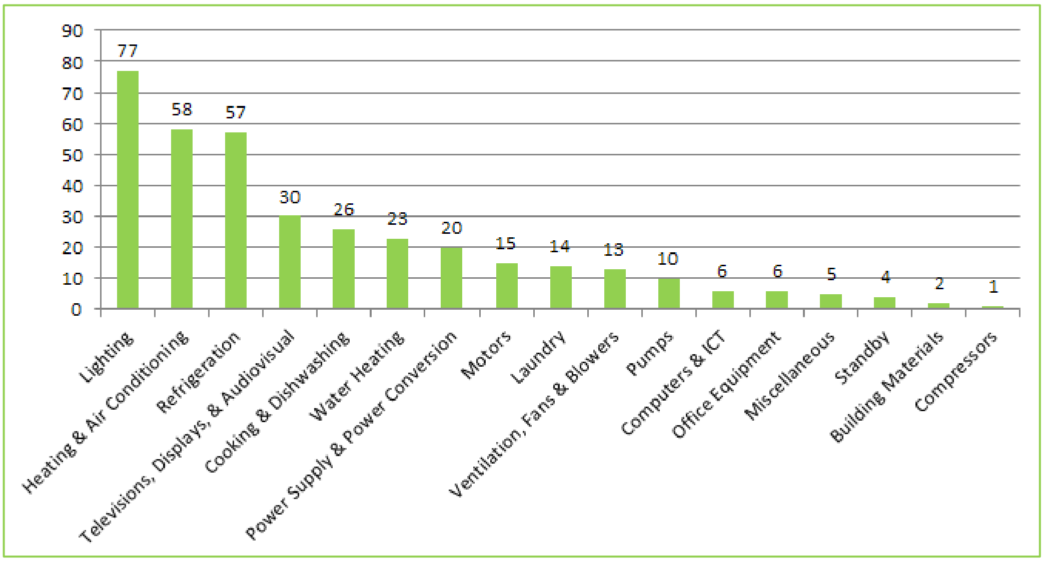

Figure 4-1: Number of MEPS per Product Group in the Countries Analysed

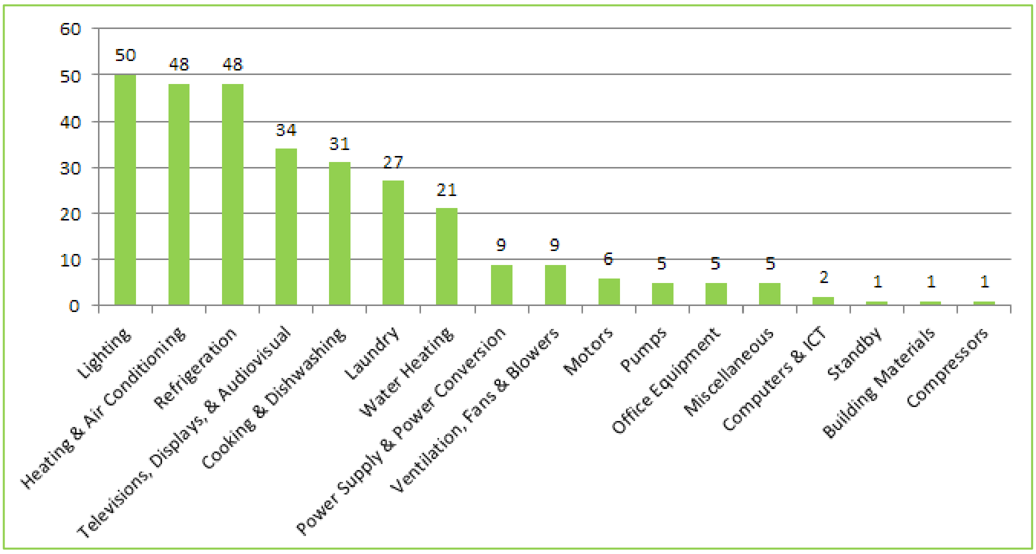

Figure 4-2: Number of Labels per Product Group in the Countries Analysed

4.1.2 Analysis of Alignment with EU per Country

At least 45 countries, excluding the 28 EU Member States, have adopted MEPS and 59 non-EU countries have adopted energy labelling for energy using equipment. If the 28 countries in the EU are added to these there are at least 73 countries with equipment MEPS in place and 87 countries with energy labels in place around the world.

There is strong evidence of extensive EU policy influence in third countries, in particular in the domain of energy labelling. Some 31 non-EU countries have adopted energy labelling schemes whose designs have fully or partially emulated the EU energy label (Figure 4-3).

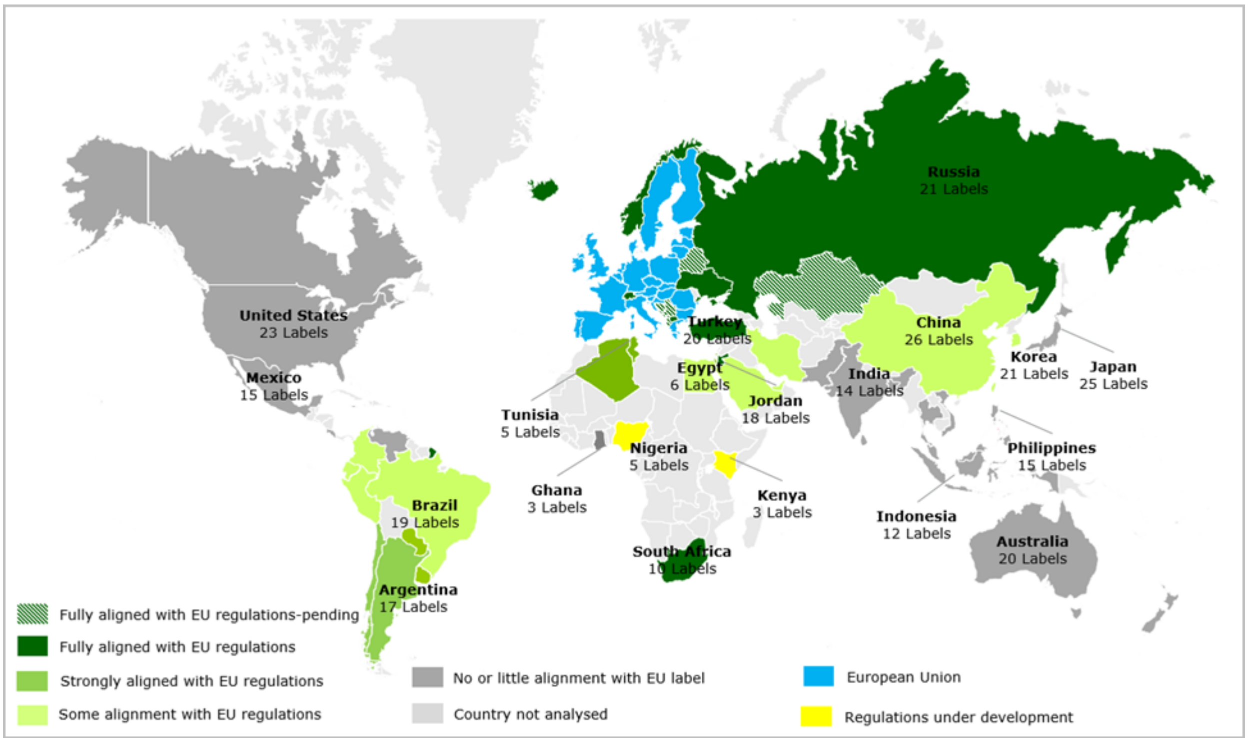

Figure 4-3: Countries with Energy Labels and Degree of Alignment with EU per Country

A smaller but still significant number of non EU countries (23) have adopted MEPS for at least one equipment type that have fully or partially emulated the EU's Ecodesign requirements or its earlier MEPS, Figure 4-4.

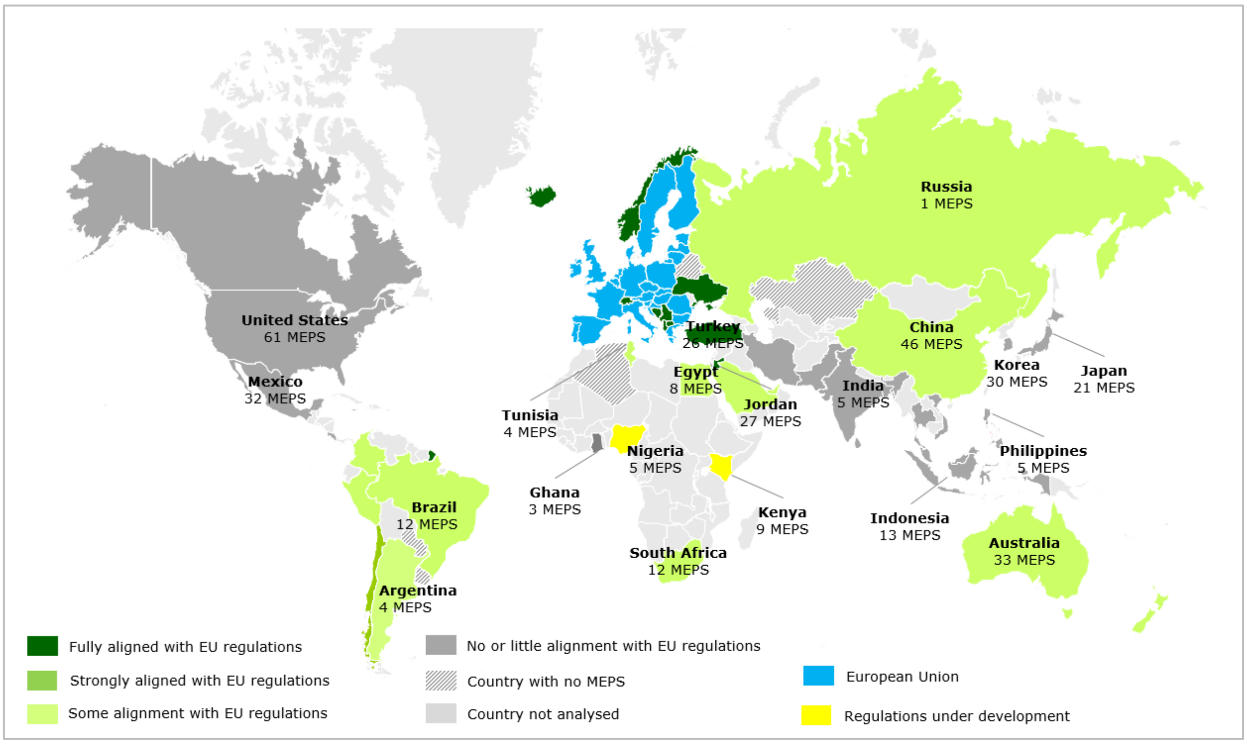

Figure 4-4: Countries with MEPS and Degree of Alignment with EU per Country

Figure 4-5 shows that the greatest alignment is in the area of test procedures. Outside of North America the large majority of equipment energy performance test procedures in use are based on IEC/ISO/ITU test procedures. These are international test procedures but have been developed with strong input from EU national standards bodies (NSBs).

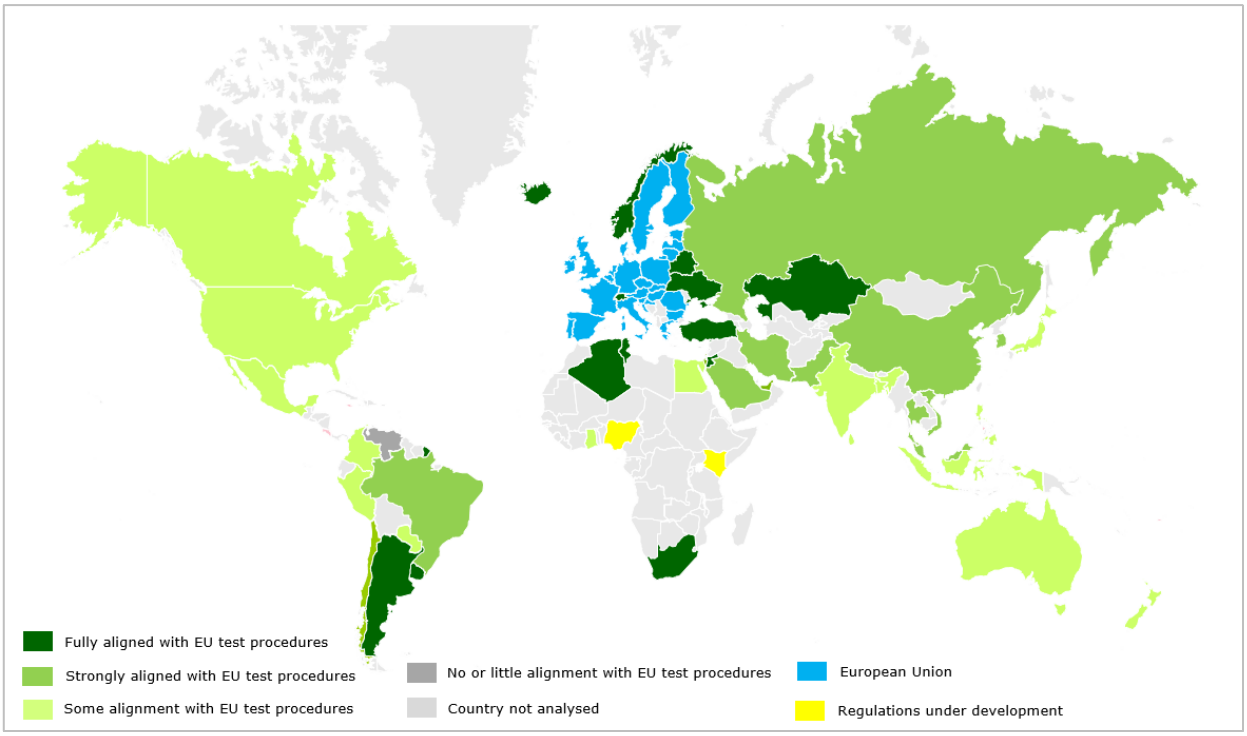

Figure 4-5: Similarities with EU in the Test Procedures

4.1.3 Analysis of Alignment with EU per Product Group

Figures 4.6 to 4.8 show the analysis of the degree of 3rd country alignment with EU test procedures, energy efficiency metrics and energy label designs by product group (derived from an analysis of the database of 20 non-EU countries equipment standards and labelling measures). Again, this shows the high degree of alignment of test procedures, but slightly less alignment in the choice of energy efficiency metrics used. The alignment in label design only shows modest variation by product type, which reflects that economies tend to apply consistent label designs across all product types.

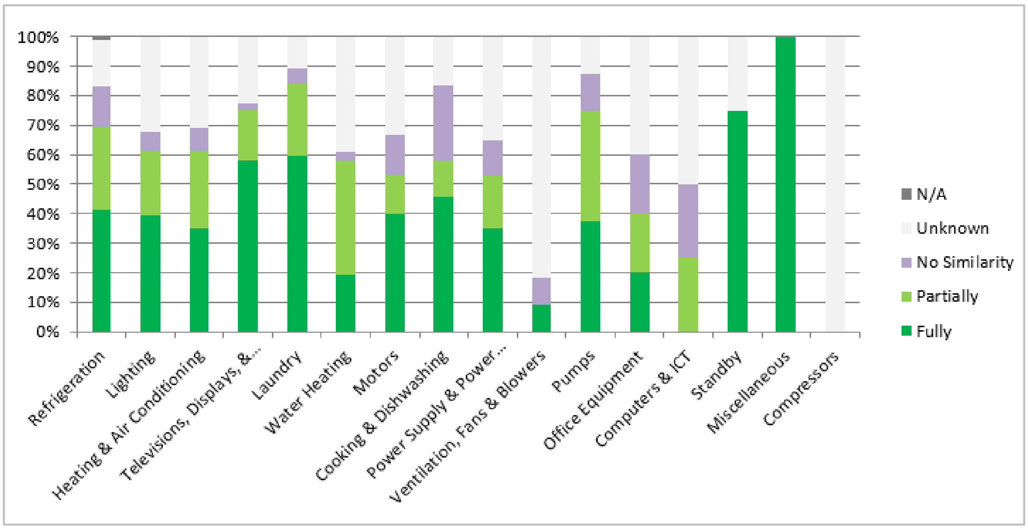

Figure 4-6: Alignment with EU Test Procedures per Product Group

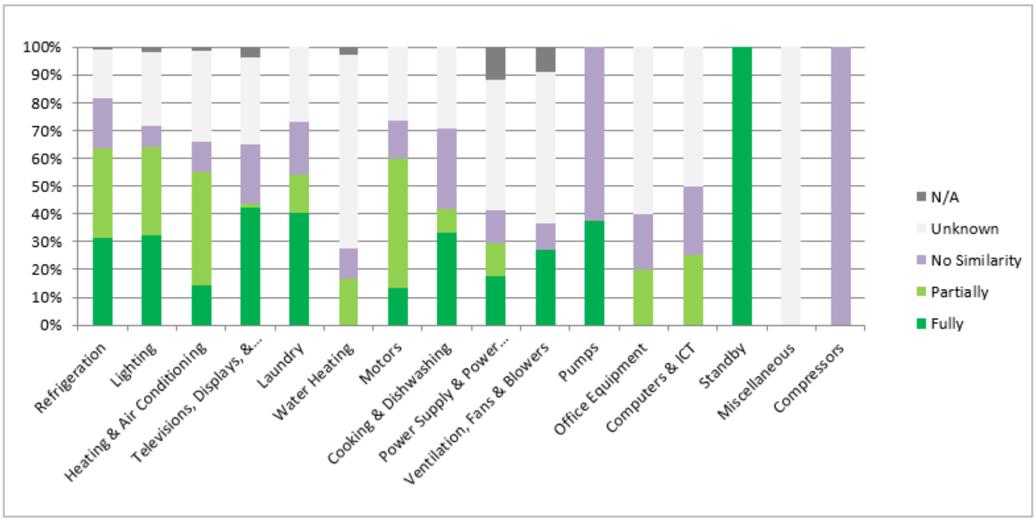

Figure 4-7: Alignment with EU Energy Efficiency Metrics per Product Group

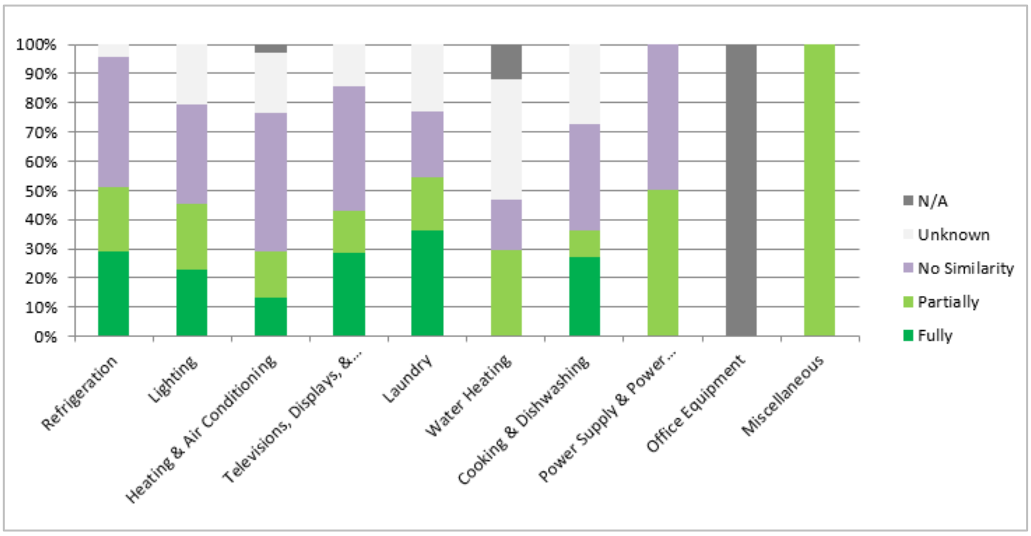

Figure 4-8: Alignment with EU Label Design per Product Group

Further analysis of the product groups and subtypes was undertaken focusing on those for which full and partial alignment was apparent because these present the areas for which further progress is likely to be easiest. There are 970 combinations of country and product subtype in the dataset derived from the CLASP standards and labels database. For example Australia/pumps/pool-pumps, Brazil/pumps/pool-pumps represent two country/product subtype entries. When that list of 970 is filtered to leave only those for which the test methodology is fully or partially aligned with that of the EU, some 379 combinations remain – see Figure 4.9.

The spread of these 379 across the different countries is shown in Figure 4.10. Brazil, China and Turkey each have around 50 product subtypes with test methods fully or partially aligned with those of the EU, followed by the Republic of Korea, Australia and Mexico with at least 30; and Japan and India with over 20. However, in terms of compatibility and comparability of policies it is important that metrics are also aligned. When that group of 379 is further filtered to retain only those for which metrics are fully or partially aligned, 192 product groups remain which are distributed by country according to Figure 4.11. Some of the countries shown in this pie chart have their test methods, metrics and policies already aligned by design and are closely following the EU (as is the case for Turkey and Jordan, for example). Others have a latent potential for closer policy alignment since the foundation of performance measurement appears to already be fully or closely aligned - this could be the case for some products in China, Brazil, Republic of Korea, Japan, South Africa etc. It is interesting to note that the range of products for which this alignment occurs is extremely broad with product subtypes in 15 of the total 17 categories of products, as listed in Table 4.3.

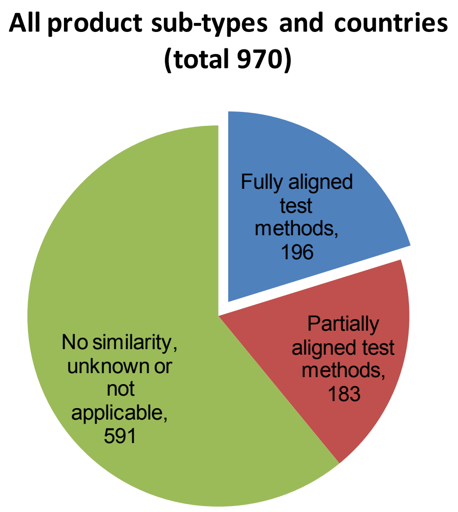

Figure 4-9: The number of product subtypes for which test methodology is fully aligned, partially aligned or has no alignment with that of the EU

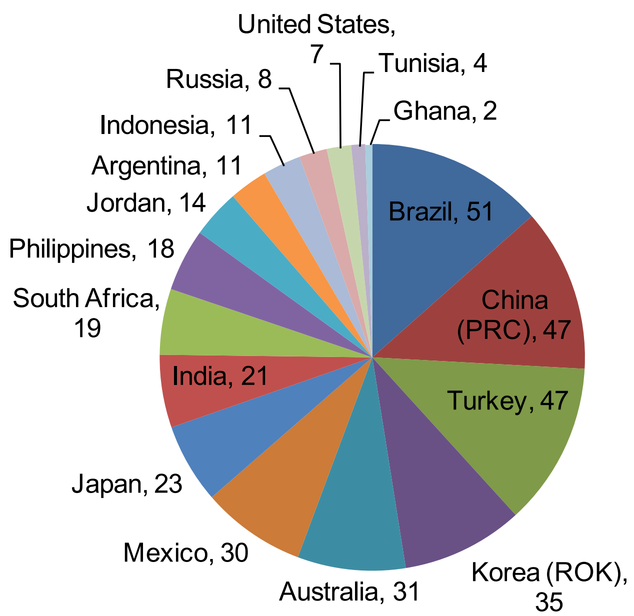

Figure 4-10: The number of product subtypes for which test methodology is fully aligned or partially aligned with that of the EU across the various countries (total 379)

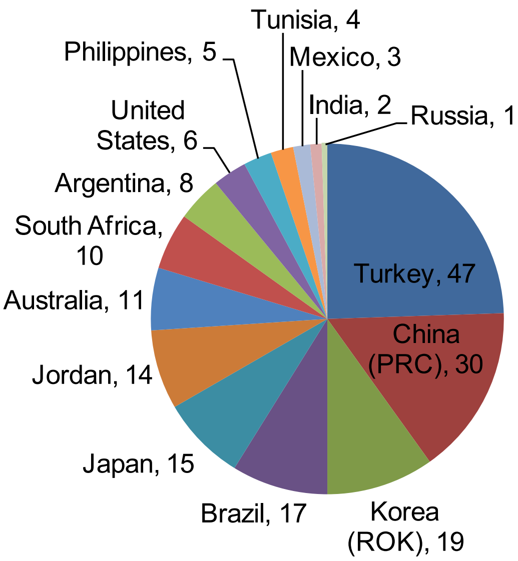

Figure 4-11: The number of product subtypes for which both test methodology and metrics are fully or partially aligned with those of the EU across the various countries (total 192)

Table 4-3 List of product categories that include product subtypes for which both test methodology and metric are fully or partially aligned with those of the EU

Product type
Building Materials
Computers & ICT
Cooking & Dishwashing
Heating & Air Conditioning
Laundry
Lighting
Motors
Office Equipment
Power Supply & Power Conversion
Pumps
Refrigeration
Standby
Televisions, Displays, & Audiovisual
Ventilation, Fans & Blowers
Water Heating

The evidence in this chapter showing areas of full or strong alignment with the EU for different aspects of various products and the timelines presented in Section 5, demonstrate that EU equipment energy efficiency policy measures have a substantial impact far beyond EU borders. In the area of energy label design this influence is certainly greater than any other single economy's and in other areas such as test procedures arguably so.

4.2 Looking Ahead: What is the outlook for further International Harmonization of Standards?

Policymakers from many countries are increasingly interested in developments in the area of energy standards and labels in other jurisdictions.

The potential impact of increased international harmonisation of standards and labels both in terms of energy savings and GHG emission reduction is large. A study (Waide et al. 2011a) found that, if adopted world-wide, the current most broadly based and stringent equipment energy efficiency regulations could save 4000 TWh of final electricity demand by 2030 (12% of the total) and 4% of oil and gas demand in the residential, commercial and industrial sectors (transportation equipment was not considered).

The alignment of test procedures and energy performance metrics would facilitate trade, conformity assessment and comparison of policy settings and results across the major economies. Standards and labels require replicable ways to measure and classify products to deliver the expected results and to ensure that performance data are reliable. The International Energy Agency (IEA, 2010) defines the following critical elements for robust, defensible standards and/or labelling schemes:

1. Testing protocols: reliable and repeatable test methods for measuring product energy performance
2. Benchmarking requirements for comparative purposes: ranking methodology of product energy performance
3. Performance requirements: classification of products into energy performance classes
4. Conformity claims: a means of the supplier communicating to the marketplace that the product's energy performance complies with market rules.

There are already examples of international harmonization in external power supplies (EPS) and industrial motors (discussed in detail in section 5). Both cases resulted in global market transformations that achieved important benefits.

In the case of external power supplies the United States, China and Australia began in 2003 to develop a harmonised test protocol, marking protocol and ranking system, which was subsequently adopted in many countries. In Europe, the EU Code of Conduct based on this system is expected to slow the growth of EPS energy consumption by about 30% (IEA, 2010).

In the case of electric motors, minimum efficiency performance standards were adopted by Canada and the United States in 1995 and 1997 respectively. Since then several major countries followed the example adopting national standards. In 2008, the International Electrotechnical Commission (IEC) adopted an efficiency specification for electric motors that unifies the many national standard schemes in place. This decision provides a common foundation for future international and national efforts. The harmonised specification includes several performance tiers, so individual nations can choose the level that best meets their needs and capabilities while remaining within the global scheme (IEA, 2010).

One key element that helped in harmonization in these examples is the availability of information at the pertinent decision making forum at the right time.

While examples of successful international product energy efficiency policy harmonisation and cooperative actions can be found the degree of engagement in such efforts is still rather piecemeal and opportunity driven. Efforts to give more structure to such efforts have been attempted through SEAD and the IEA 4E (discussed in section 5.2) but both these and other efforts would benefit from a more systematic approach and stronger engagement. There is an opportunity for the EU to take a more direct leadership role in such activities and this is explored further in section 7.

5. Detailed evidence

5.1 Timeline for international programmes

Although equipment standards and labelling programmes have been implemented in many countries around the world the longest standing and/or most influential programmes have been those in the NAFTA economies, the EU, Australia/New Zealand, China and Japan. To some extent this is due to five of these groupings being global economic powerhouses but it is also related to questions of programme design and implementation. Among these programme's the EU's has been the most widely emulated but the Australian programme has also had considerable influence and the US programme within North America and more broadly through its Energy Star labelling scheme in the domain of ICT. The methodology to develop MEPS pioneered in the US programme has also had considerable influence on the EU and Chinese methodological approaches.

Figure 5-1 and Figure 5-2 provide a timeline of the development of energy labels (EL) and minimum energy performance standards (MEPS) around the world.

The Soviet Union introduced regulations that set minimum energy performance requirements for a range of household appliances in 1976; however, it is reported these where not enforced and were often ignored in practice. These requirements seem to have fallen into disuse with the collapse of the Soviet Union.

The USA adopted legislation empowering the development of mandatory energy labels for energy using equipment and the potential to develop MEPS in the mid-1970s; however, the first energy label was not adopted until 1980 and the first MEPS in 1987. Canada implemented mandatory energy labels in some provinces as early as 1978 and this evolved into a national labelling scheme with a similar label format to the US energy label. The US/Canadian labels of this era appear to have been the first to have adopted a comparative efficiency scale i.e. one where the efficiency of the product in question can be compared to those of peer products on the market. The visual technique used in both labels is a horizontal continuous sliding scale with a pointer to indicate where the specific product in question is rated.

The first comparative energy label that used a mnemonic scale to split efficiency into categories or classes (a so-called "categorical" energy label) was developed in the Australian states of New South Wales and Victoria in the second half of the 1980s. This label design, which was subsequently adopted across Australia and then New Zealand, uses a set of stars to indicate the efficiency such that the more stars a product has the more efficient it is. The advantage of categorical designs is that they aid memory when shopping for a product (it is much easier to remember what efficiency class or category a product was in than to remember a simple energy consumption number or a point on a continuous scale). They also create specific product performance targets that product manufacturers can aspire to attain.

The EU energy label was not implemented until 1995; however, it was the first label design to be informed by consumer research and this seems to have led to the adoption of a particularly attractive and intuitive design which was subsequently strongly imitated in many parts of the world. The basic element of the EU design is a scale comprised of stacked horizontal arrows, which are shorter at the top to indicate higher efficiency and longer at the bottom to indicate lower efficiency. These arrows are colour coded from green (higher efficiency) to red (lower efficiency) and a counter-pointed arrow is used to indicate the specific efficiency level of the product being labelled. This has been emulated fully or in part in many other economies including the 22 countries indicated in Figure 5-3. The economies with earlier energy labels than the EU all have different designs as discussed above and as presented in the detailed evidence provided in Section 6 and Appendix B.

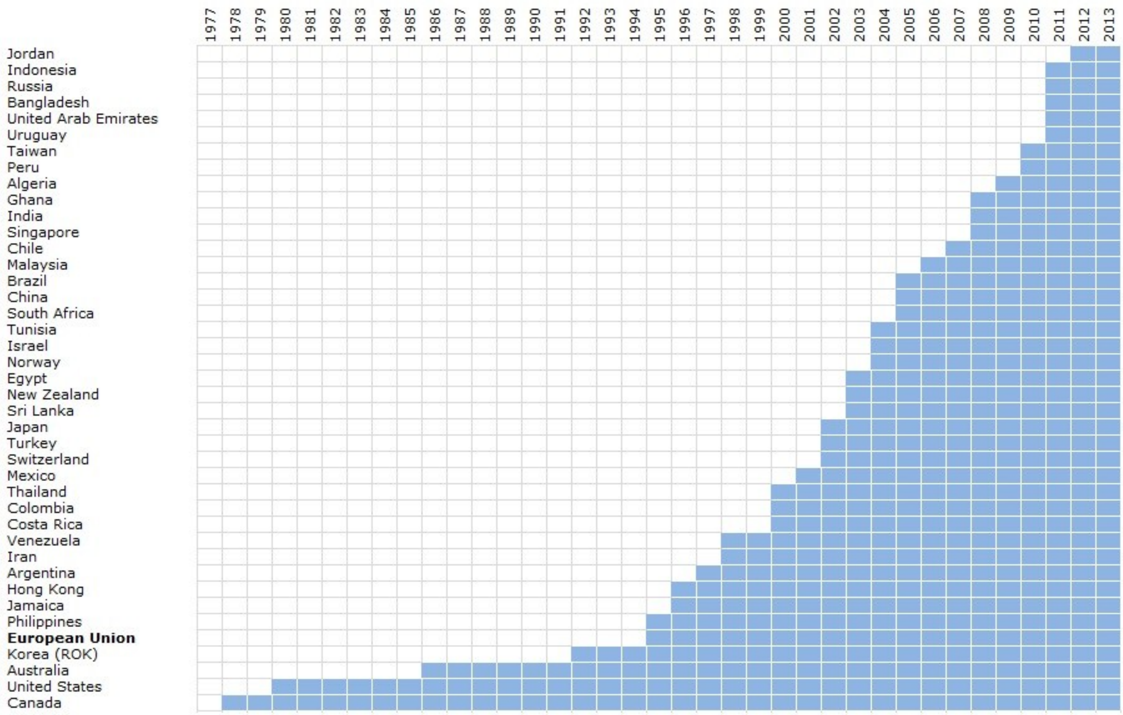

Figure 5-1 Timeline of equipment energy labels (EL)

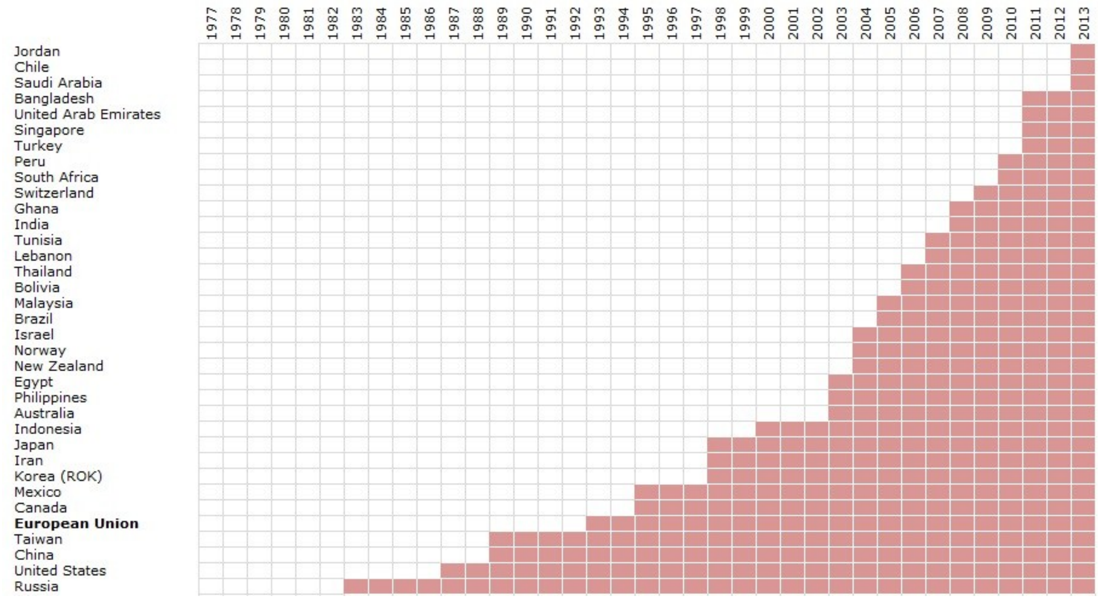

Figure 5-2 Timeline of equipment energy efficiency standards (MEPS)

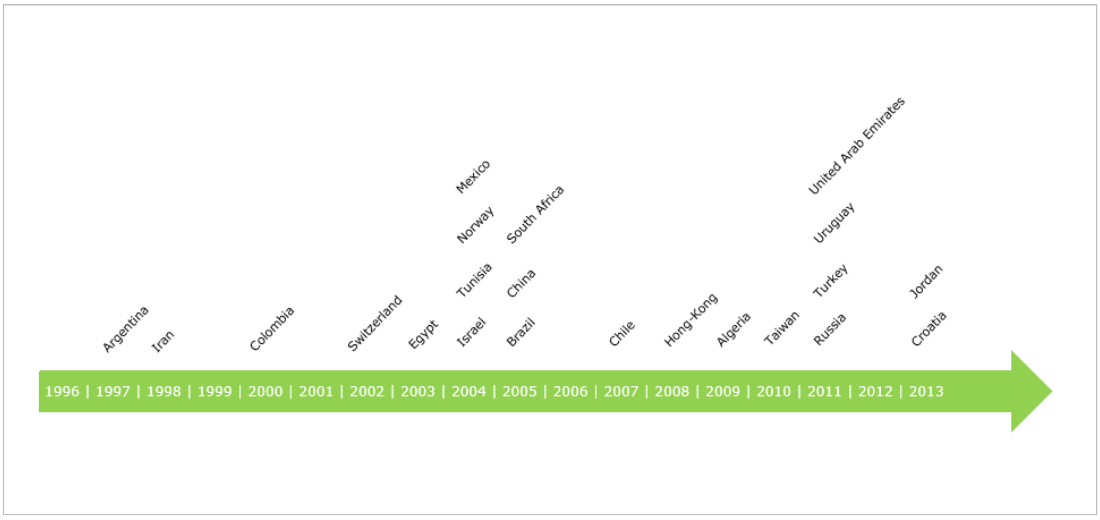

Figure 5-3 Countries that have adopted energy labels that emulate the EU label

5.2 Multi-lateral initiatives on Energy Efficiency Standards and Labels

Cooperation between countries and trade blocks improves the cost-effectiveness of product policies. Global co-operation has resourcing advantages compared with time-intensive national approaches, in which each individual government develops its own unique scheme without leveraging other governments' analyses and experiences (IEA, 2010). Energy-using products are increasingly being traded globally, and a tendency to harmonise elements of product policy between countries and major trade blocks can be observed. Countries can benefit from this situation by harmonising their policies with those of their trade partners (Energy Charter Secretariat, 2009).

Most existing programmes have benefitted to some degree from international cooperation in their development. In the case of the EU the very first product study (the 1993 Group for Efficient Appliances study on refrigerators) borrowed much of its methodology from earlier work done in the USA. This included the use of a design tool to simulate the effect of design changes on refrigerator energy efficiency and similar impacts on product life cycle costs as a function of energy efficiency. The EU labelling programme has had a great influence on the types of labelling efforts adopted in other economies (from China, to South Africa and Latin America amongst others) and much more knowledge has been transferred between programmes; however, this has usually happened in an ad hoc manner when individual experts have been encouraged to work together and has rarely occurred through concerted actions. In recent years there have been greater efforts to promote international cooperation on product policy and diffusion of best practice. Current government led initiatives include:

- The IEA 4E implementing agreement on Efficient Electrical End-Use Equipment
- The G8 and G20 initiatives
- The Clean Energy Ministerial and associated Super-Efficient Appliance Deployment (SEAD) initiative
- The International Partnership on Energy Efficiency Cooperation (IPEEC)
- APEC Energy Working Group - Expert Group On Energy Efficiency & Conservation

Programmatic support for equipment energy efficiency programmes including standards and labelling and market transformation efforts have been sponsored or supported by multi-lateral development banks, multi-lateral organisations, development and energy/environment agencies including:

- The GEF (Global Environmental facility)
- UNDP (United Nations Development Programme)
- UNEP (United Nations Environment Programme
- World Bank/IFC
- ADB (Asian Development Bank)
- EBRD (European Bank for Reconstruction and Development)
- US DOE (Department of Energy)
- The European Union
- USAID (US Agency for International Development)

- LBNL (Lawrence Berkley National Lab)
- OLADE (Latin American Energy Organisation)
- RET (Department of Resources, Energy and Tourism, Australia)
- GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit)
- METI (Japanese Ministry of Economy and Trade)
- DFID (UK Department for International Development)
- AFD (Agence Francaise de Developpement)
- Ademe (French Agence de l'Environnement et de la Maîtrise de l'Energie)
- Defra (UK Department for Food and Rural Affairs)

Technical work on standardisation has been promoted and carried out by international standardisation bodies:

- ISO
- IEC
- ITU

Specialised philanthropic NGOs have also sponsored or supported substantial work in the field including:

- CLASP
- Climate Works
- The Energy Foundation
- Natural Resources Defence Council
- ACEEE (mostly US, China)
- ASE
- WWF
- Greenpeace
- Appliance Standards Awareness Program (in USA only)

Of these, the most proactive entities in international product policy collaborative efforts are:

- SEAD
- CLASP/Climate Works
- IEA 4E

In the past there was only limited cooperation between programmes in different countries, but in the last years there are signs of more international engagement.

In recent years' major economies including Brazil, China, the EU, India, Japan, Russia and the USA have established the **International Partnership for Energy Efficiency Cooperation (IPEEC[8])**, a high level forum to facilitate the exchange of information and cooperation on energy efficiency policy (Waide et al., 2011). IPEEC members represent developed and emerging economies, which collectively account for over 75% of global GDP and energy-use. Members include OECD and non-OECD nations.

[8] http://www.ipeec.org/

The **Super-efficient Equipment and Appliance Deployment (SEAD) Initiative** is a task within the International Partnership for Energy Efficiency Cooperation (IPEEC) and was launched as an initiative within the Clean Energy Ministerial's[9] Global Energy Efficiency Challenge in July 2010. SEAD is a voluntary multinational collaboration whose primary objective is to advance global market transformation for energy efficient products. The initiative facilitates access to the resources and technical expertise needed to build and implement cost-effective product efficiency standards and labels and market transformation programmes for the participating governments[10]. SEAD economies are responsible for about half of global energy demand.

One of the Multilateral Technology Initiatives[11] of the International Energy Agency is dedicated to product policy. The **IEA's 4E Implementing Agreement[12]** brings together some of the major economies in a common cooperative framework addressing energy efficiency in electric equipment. Twelve countries[13] from the Asia-Pacific, Europe and North America are under the forum of 4E and share information and transfer experience to support good policy development in the field of energy efficient appliances and equipment. 4E focuses on electrical equipment since this is one of the largest and most rapidly expanding areas of energy consumption (IEA-4E, 2013).

The **Energy Charter Treaty** is a unique legally-binding multilateral instrument covering investment protection, liberalisation of trade, freedom of transit, dispute settlement and environmental aspects in the energy sector. It is designed to promote energy security through the operation of more open and competitive energy markets, while respecting the principles of sustainable development and sovereignty over energy resources. The Treaty is the only agreement of its kind dealing with intergovernmental cooperation in the energy sector, covering the whole energy value chain (from exploration to end use) and all energy products and energy-related equipment. Based on the Energy Charter of 1991, which was a political declaration signalling the intent to strengthen international energy ties, the Energy Charter Treaty was signed in December 1994 and entered into force in April 1998. To date, the Treaty's membership covers fifty-one states plus the European Community, which together represent nearly 40% of global GDP. There are also twenty- three observers, as well as ten international organisations with observer status. Discussions managed through the Energy Charter process have been one of the means by which awareness of EU policy settings on equipment standards and labelling has disseminated among a broader set of countries, especially those in Eastern Europe and the former Soviet Union.

There are also initiatives and co-operation projects at the regional level. In Asia, for instance, the **Barrier Removal to the Cost-Effective Development and Implementation of Energy Efficien-**

[9] http://www.cleanenergyministerial.org/
[10] SEAD's member governments are: Australia, Brazil, Canada, the European Commission, France, Germany, India, Japan, Korea, Mexico, Russia, South Africa, Sweden, the United Arab Emirates, the United Kingdom, and the United States.
[11] http://www.iea.org/techno/index.asp
[12] http://www.iea-4e.org/
[13] A full list of member countries can be found at: http://www.iea-4e.org/files/otherfiles/0000/0258/4E_Annual_Report_2012-4.pdf

cy Standards and Labelling (BRESL[14]) project is sponsored by the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF). Participating countries are Bangladesh, China, Indonesia, Pakistan, Thailand and Vietnam.

CLASP/Climate Works

With funding from the Climate Works NGO and through the SEAD programme, CLASP is helping to support standards and labelling programmes in China, the EU, India, and the USA. This work has been on-going for a few years now and is starting to have a greater impact in all these economies. CLASP provides technical input to support the calibre of the evidence base in regulatory product studies and in some cases supports technical capacity and analysis on various programme design and implementation issues, including: MV&E; labelling design and evaluation; determining the greatest opportunities for energy savings; international harmonisation; benchmarking; testing and certification etc.

G20

The G20 includes 19 countries and The European Union: Argentina, France, Japan, South Africa, Australia, Germany, Mexico, Turkey, Brazil, India, Republic of Korea, United Kingdom, Canada, Indonesia, Russia, United States, China, Italy, Saudi Arabia, and the European Union. Some G20 summits have discussed equipment energy efficiency policy.

Rio + 20

The 2012 United Nations Conference on Sustainable Development (Rio+20) contained the following article in the summit declaration:

128. We recognize that improving energy efficiency, increasing the share of renewable energy and cleaner and energy-efficient technologies are important for sustainable development, including in addressing climate change. We also recognize the need for energy efficiency measures in urban planning, buildings and transportation, and in the production of goods and services and the design of products. We also recognize the importance of promoting incentives in favour of, and removing disincentives to, energy efficiency and the diversification of the energy mix, including promoting research and development in all countries, including developing countries."

Otherwise there appears to have been little of substance discussed or agreed with any relevance to energy-using product policy.

APEC

As can be seen from elsewhere in this report, some of the 21 member states that make up the membership of the Asia-Pacific Economic Cooperation (APEC) have had Labelling and Eco-design regulations in place for longer than the EU. The APEC economies consume approximately 60% of the world's energy and have agreed a target to reduce energy intensity by at least 45% by 2035. In a

[14] http://www.bresl.com/

number of respects, there is much in common between APEC and the EU. APEC, through its Energy Working Group (EWG), deals with many of the same challenges as the EU. Of these, the work on advancing the application of energy-efficiency practices and technologies for products is undertaken by a specific working group, its Expert Group on Energy Efficiency & Conservation (EGEE&C). Examination of the outputs from EGEE&C has shown that a number of the topics they are challenged by are the same as those the EU finds challenging too. There has been a recent example of where EGEE&C have specifically sought to learn of EU experiences and this may indicate a willingness of that body to engage in the future with its equivalent in the EU. This, then, would provide an opportunity for influence to flow both ways and for each region to learn from the best practices developed by the other.

Lighting

There are number of initiatives focused on lighting including:

- SEAD solid-state lighting working group
- IEA 4E solid-state lighting annex
- Lighting Africa – now also Lighting India and the Global Lighting and Energy Access Programme (Global LEAP) launched at the London CEM. The Lighting Africa and Lighting India programmes are operated by WB/IFC
- Efficient Lighting Initiative (ELI)
- UNEP en.lighten initiative, which is focused on encouraging and supporting the phase-out of incandescent and other inefficient lighting in developing and emerging economies

While superficially there appears to be a degree of overlap between the SEAD and 4E work, in practice this has not occurred. The latter is focused on solid-state lighting (SSL) performance criteria for quality assurance, SSL test procedures and testing competence, accreditation. The former is focused on standards and labelling cooperation for solid state lighting.

The last three programmes are more focused towards the needs of emerging and developing economies, although the Global LEAP work does address SSL quality needs in off-grid applications. ELI appears to be relatively dormant now but the other programmes are all quite active.

Apart from the initiatives mentioned above there is little on going work to cooperate on equipment energy efficiency in OECD economies. Outside of the OECD there are various projects, usually supported by international donor funding, to help promote and build-capacity for product energy efficiency policy. An example is the BRESL[15] programme which is cooperation on energy efficiency standards and labelling between Bangladesh, China, Indonesia, Pakistan, Thailand and Vietnam that's supported by the GEF and UNDP. Many similar bilateral or regional initiatives have previously occurred and in some instances have led to the initiation of successful programmes.

[15] http://www.bresl.com

5.3 Product case studies

To consider the mechanisms by which international alignment in energy efficiency test standards, efficiency metrics, energy labelling and efficiency standards have come into being it is helpful to consider case studies. In this section examples of alignment processes are considered for six product types as shown in Table 5-1.

Table 5-1 Products considered in alignment case studies

Product	Interest in case study
Domestic refrigerators	EU energy labelling approach emulated in China, Latin America, Africa, Middle East, Russia but challenges remain
TVs	EU test method and policy development helps frame international developments
Non-directional households lamps	A global move towards phase out of incandescent lamps - EU and European companies some of the key players/instigators
Electric motors	EU support adoption of US originated test method through IEC and thereby helps create a globally harmonised system to define motor efficiency
Household tumble driers	EU label helps pioneer heat pump clothes dryer technology
External power supplies	Regulatory cooperation between China, EU and USA creates de facto global efficiency rating system

5.3.1 Refrigerators

Domestic refrigerators were the first EU product to be labelled and the second (after boilers) to have MEPS. The regulation developed in the EU was informed by an extensive product study published in 1993 by the Group for Efficient Appliances (a name given to the project consortium led by the French, Dutch and Danish national energy agencies). This study borrowed some of the analytical techniques that had been pioneered in the US MEPS rulemaking processes and published in the US DOE's Technical Support Documents, most critically being the approach of conducting an energy engineering techno economic analysis. An energy performance simulation tool developed in Denmark was used to analyse the impact of prospective design changes on the energy performance of refrigerators. A database containing energy consumption and volume characteristics of approximately 3000 European cold appliances sold in eight European countries was assembled. This was analysed using advanced statistical methods to determine when differences in the appliance external configuration, internal storage temperatures and other pertinent product characteristics made a statistically significant difference to its energy performance once differences in internal temperature and volume had been normalised using the adjusted volume approach that was pioneered in the previous US work. This work led to the identification of nine fundamental domestic cold appliance types and one additional catch-all category, which were then used to establish energy consumption versus adjusted volume reference lines and an associated energy efficiency index (EEI) – the first time this was developed in Europe. These EEI definitions were adopted in the subsequent EU energy efficiency regulations for energy labelling (implemented in 1995) and MEPS (implemented in 1998).

While the US method to define refrigerator energy efficiency was appropriate for the types of products found on the North American market these were much less representative of the products found in most other parts of the world. Most countries at the time had a tradition of using ISO test procedures to measure the energy performance of refrigerators and the EU EEI approach was the first system established to define product categories and energy efficiency metrics within an economy that used test standards aligned with ISO. Furthermore, the type of refrigerators and freezers sold in the EU were more representative of the most common types in use around the word than the product types sold in the USA which, which tend to be much larger and predominantly frost-free types.

The spread of the EU approach to define refrigerator energy efficiency
Given this background, including the considerable technical efforts made to define refrigerator energy efficiency in the EU it is not surprising that other markets with common product types and test procedures to those used in the EU should consider adopting the EU product categorisation and means of defining energy efficiency. However, Australia, Canada, Thailand and the USA had all established refrigerator energy labelling prior to the EU and these offered alternative systems for defining refrigerator efficiency. Nor was all this information available in easily accessible public domain locations at the time. Very little was posted on the internet and knowledge about the technical underpinnings of equipment energy efficiency regulations was only known by a small number of expert consultants who would naturally be most familiar and comfortable with the systems they used domestically. Thus when China was in the early stages of developing its future energy labelling programme in the late 1990s it learned of international approaches through select workshops and project activity that were generally financed by international NGOs, some bilateral aid agencies and UN institutions. Information about the various methods in place internationally would be disseminated via international expert input to such events and projects and this would allow Chinese regulators to assess which, if any, system in use internationally was best suited for adoption in their domestic regulations. As knowledge of the European, Thai, US, Canadian and Australian methods were assessed it became apparent that the EU method was directly applicable for use in China because:

- the EU product types and characteristics corresponded well to those in use in China,
- the test procedures were the same in both economies
- the EU system for defining efficiency had been derived from knowledge of several thousand products on the EU market which helped avoid the need for Chinese regulators to gather an equally large database to derive their own efficiency metric
- aligning the Chinese domestic metric with that in use in the EU would avoid the need for Chinese producers to develop parallel product lines if they wished to export to the EU and other similar markets,
- pooling the approach taken in both markets would also help to create an even greater critical mass of economies using the same approach

Nonetheless the key to the adoption of the EU approach in China was the presence of European consultants in the relevant regulatory discussion fora, without whom knowledge of the EU system would not have been disseminated in time to inform the decision. EU industry dissemination activity helped propagate elements of the EU approach in some economies, such as Brazil. However, there the scheme adopted was similar to but not fully aligned with the EU approach and at the time that the Brazilian regulators defined their efficiency metric there had been no European consultancy support to disseminate information about the approach used. By contrast, in Argentina an EU funded project introduced the European method for defining efficiency to regulators at the initial stages of developing their approach and led to its direct adoption, for similar reasons as occurred in China. Columbia also aligned with the EU approach and more recently so have Uruguay, Peru and Chile.

When India defined its energy efficiency metrics they were advised by Australian consultants and opted for an approach that aligned the Indian test procedure with Australia's. The subsequent efficiency metric adopted in India is not really aligned with those in use in Australia or the EU and hence an opportunity was lost to have a system that can be directly benchmarked against other economies.

Egypt initially adopted a method based on the Canadian approach because the Egyptian process was initially advised by Canadian consultants. However, following a later review where European expertise was available, a decision was made to adapt the approach to be closer to the international test procedure and hence the EU efficiency method, although a legacy of differences still exists. Other North African and Middle Eastern countries (Tunisia, Israel, Iran, Lebanon, Algeria, Jordan and Turkey) have all aligned with the EU approach as has South Africa. In most of these cases the decision was made following explanation of the EU approach via technical assistance projects but in all these cases the decision would have been with comparable knowledge of the alternative approaches used elsewhere for which a similar rationale to that adopted by the Chinese authorities applied. The only other African country to have adopted energy labelling and MEPS for refrigerators is Ghana, but technical assistance for that work was supported by US sources and the resulting regulations are not harmonised with the EU's or the rest of the continents. Programmes are currently under development in Kenya and Nigeria and also among the 15 ECOWAS member countries. It remains to be seen if these will result in approaches that align to that adopted in the EU or not.

Eastern European countries have also adopted the EU method but in many cases this was as a direct consequence of application for EU membership and following the associated EU acquis process e.g. as occurred for the 13 EU countries that have joined since the adoption of the refrigerator energy label in 1995. Russia, also decided to adopt the EU energy label in 2011 and the first label implemented was for refrigerators. More recently Ukraine and Kazakhstan are in the process of aligning with EU labelling regulations, including for refrigerators. In all these cases regulatory decisions have been informed by expert consultants knowledgeable of the EU and other regulatory frameworks.

De-harmonisation for refrigerators triggers global test procedure review

Japan's policy of harmonising national test procedures with international ones led to the abandonment of national refrigerator test procedure in favour of the international test procedure in the early years of the Top Runner programme. The national test procedure had many similar elements to the international one but also had some key differences including the choice of ambient (room) temperature when conducting energy testing and the use of door openings. Some years after adopting the international test procedure field energy measurements were conducted from which it was found that the actual *in situ* energy consumption of refrigerators was much higher than recorded under the international test procedure. Furthermore, it was found that the international test procedure did not produce a correct ranking of the actual product energy efficiency. Therefore a decision was made to adopt a test procedure closer to the original Japanese test procedure and to once again diverge from the international test procedure. As a result the test results are now more representative of actual usage conditions in Japan but it has become much more complicated to compare efficiency levels of Japanese products with those sold elsewhere. The Japanese authorities have not given up on international harmonisation, however, and now there are on-going efforts inspired by this and similar experiences in other economies to improve the general applicability of the international test procedure. Partly as a result of these efforts the IEC is well advanced in the adoption of a new draft international test procedure (IEC62552 Edition 2) which it is hoped will give more representative results in all economies. This new IEC test procedure will have implications for the EU Ecodesign and labelling requirements and work may be needed to recalibrate these if the IEC test procedure is also adopted in the EU (as is common). If it is adopted, the new IEC test procedure offers the possibility of North America, Europe, China/Asia and Japan all being able to use the same test procedure, and thereby facilitating trade, technology transfer and regulatory comparison. In pursuit of these objectives the USDOE recently revised their refrigerator test procedure to largely align it to the draft version of the IEC62552 Edition 2 standard.

Refrigerators: Key lessons

1. Being the first economy among those that use international (IEC, ISO or ITU) test procedures to initiate an energy efficiency rating system for a specific product group can help establish that efficiency metric as the one of choice internationally providing its technical merits are clearly evident
2. The size and openness of the EU's market is a key attraction to emulation by third parties, not least as exporting or importing countries will already design or receive products with specifications influenced by EU standards and labelling regulations
3. However, the EU approach to deriving refrigerator efficiency is itself essentially the adaptation of a method first pioneered in the USA – thus the major economies can and should learn from each other with respect to best practice in the design of standards and labelling
4. Funding of technical support work is essential to foster coordination and speed emulation. It produces benefits at a fraction of the cost of investment in additional energy supply
5. If this support is not provided in a timely manner there is greater likelihood of divergence and a lack of harmonisation.
6. Once achieved, harmonisation requires ongoing work to maintain

5.3.2 Televisions

The television is a product that was typically adopted in the second round of standards and labelling policy around the world, largely once awareness rose concerning the importance of standby power demand and the appreciation that TV screen technology and trends were rapidly changing. This case study provides an example of the European Commission working closely with manufacturers to facilitate development of an innovative test standard that has now become the de-facto global method. Consumer electronics in general is a challenging area for standard-setting due to the pace of technology innovation, and recent EU policies have not been immune to the problems this poses. Nevertheless, global harmonisation of test methodology and policies is within reach for this product (with one leading economy as a notable exception).

Tackling standby leads to televisions: EU take a lead in 1997

Experts began warning of standby as a major energy issue on the late 1980s but the first products to be subject to a policy measure on standby may have been computers with the ENERGY STAR criteria in 1992. Around this time the European Commission (DG TREN) began work in this area and in 1997 secured a voluntary agreement with manufacturers of televisions and video cassette recorders to limit standby to less than 10W. Furthermore, signatories were to achieve a sales weighted average of less than 6W by 2000.

It was two years later in 1999 that the IEA formalised the challenge and policy options with its 1-Watt plan that went on to stimulate global progress on this issue. G8 ministers formally committed to address this challenge at their 2005 meeting at Gleneagles and thereafter followed a series of national plans, voluntary initiatives, labelling and regulatory measures applying to a rapidly expanding range of products.

The key to this early success was how the Commission worked closely with industry experts, independent experts and EU industry associations such as EICTA (later renamed Digital Europe). Through regular meetings and productive working relationships, product performance data was made available along with insight into emerging technologies. This enabled the setting of challenging but achievable performance standards which in turn ensured the deployment of the most efficient technologies of the time. Whilst these standards were voluntary, the very high engagement rate of all the major manufacturers (importantly including manufacturers of 'own-brand' products for major retailers) ensured almost universal compliance.

Television policy rolls out internationally

The lead established by the EU was not maintained, however, and mandatory labels were established over the following decade in many countries including Brazil from 2008, Japan and Australia in 2009. The USA ENERGY STAR programme introduced criteria for television on mode in 2008.
It was not until 2009 that the EU introduced its own Eco-design and energy labelling directives for televisions. Figure 5-4 shows the countries around the world that currently have minimum energy performance standards for televisions.

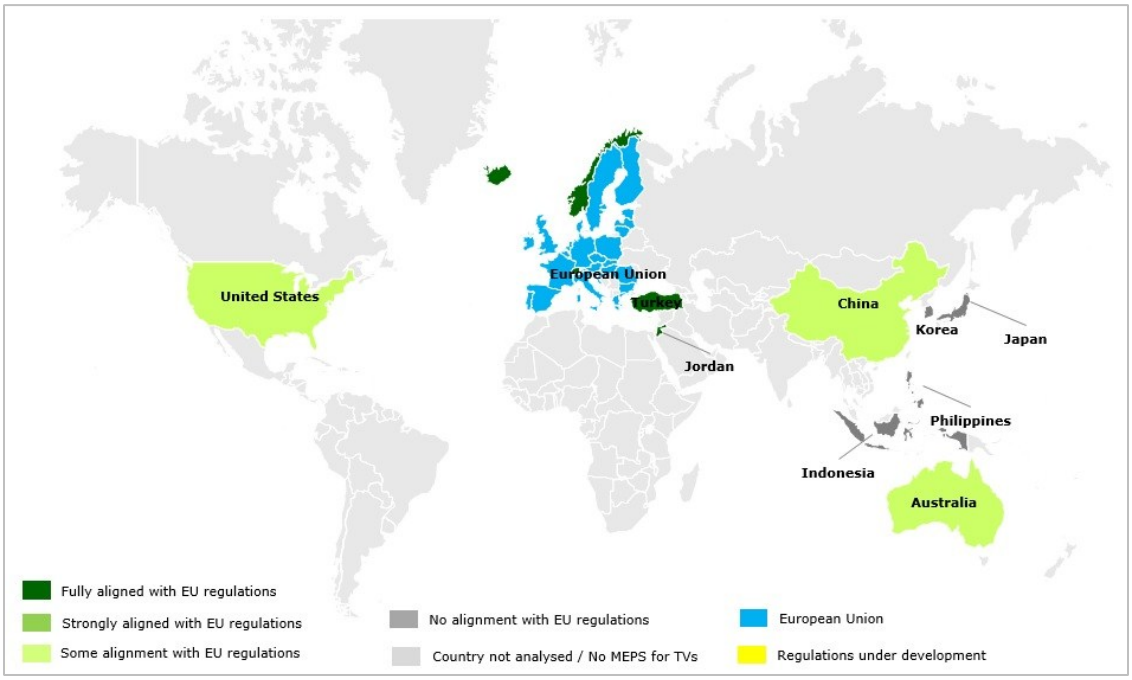

Figure 5-4 Countries with minimum energy performance standards for Televisions

EU driving test method innovation

The cooperation between the European Commission and industry on televisions remained active during the intervening years. Early on-mode test methods were based around static images that clearly did not reflect real usage and so to address this, the European Commission initiated an ad hoc standards working group. This consisted of technical representatives of manufacturers as well as experts working on behalf of governments (notably the UK). A group meeting at Helsinki saw the first proposals for moving picture test loops and the draft was later adopted into edition 2 of IEC 62087 in 2008, ready for the EU Ecodesign regulation in 2010.

Another significant innovation initiated within the EU was to establish the principle of testing products at their factory settings: operating exactly as they are unpacked from their packaging by the consumer, which is often how they remain in home use. Televisions were previously usually factory-set at very high brightness in order to look good in the retail showroom beside many other products. This demands significantly higher energy consumption, but consumers would mostly not readjust them for home use. This is another innovative feature of IEC 62087 championed by the EU.

Policy challenges from divergent test methodologies

However, as more governments acted to limit the growth in television energy consumption through standards and labelling with each region trying to keep pace with rapidly developing technologies, development of test methodologies headed in distinctly different directions. Both China and Japan developed their own national efficiency metrics and were not part of the IEC initiative. The practical consequences of the divergence were shown clearly in the 2013 EEDAL paper by the TopTen organisation: testing showed that the same televisions tested under Chinese and then under EU label schemes have different ranking of efficiency. In Europe, an efficient television is one with low power in on-mode compared to a reference model of the same screen size; whereas in China an efficient TV is one that achieves a bright image relative to its power demand.

This lack of harmonisation carries risks of underachieving efficiency progress:

- With limited comparability of efficiency, best available technologies are more difficult to determine and less likely to promulgate between regions
- When national standards cannot be compared, pressure on suppliers to improve cannot be concerted and risks emerge of product dumping into areas with less stringent requirements
- Product engineers are inevitably influenced by the test methods and the TopTen analysis showed that Chinese televisions have significantly higher on mode demand that those sold in Europe - i.e. the lack of transparency hinders identification of policy best practice.

It now appears likely that the Japanese will adopt edition 4 of IEC 62087 (due in 2014) and the associated metrics, bringing to an end test methodology divergence for that country. The Chinese difference remains, even though the Chinese use IEC 62087 for the on mode energy measurement, the television set up and metric calculation are completely different.

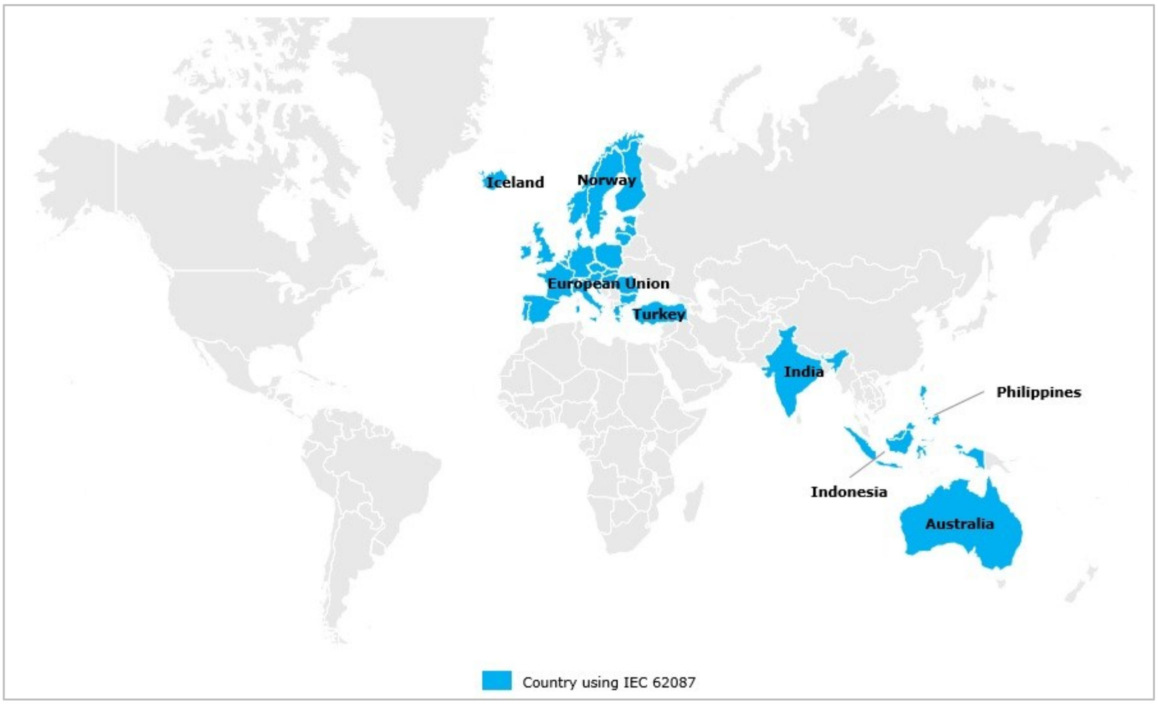

Figure 5-5 Countries using IEC 62087

EU takes criticism for television standards not being future proof

The EU energy label for televisions which came into force in 2010 set out the mandatory display of the A+ class on labels in 2014 and class A++ in 2017. Showing the existence of these classes on the label ensures consumers are aware of how good the best available technologies are. However, even by 2012 the best televisions were already at A++ performance levels, undermining this aspect of the label function. It was probably the slow pace of regulatory administrative processes that resulted in the rapidly out of date EU standards of 2010. Forecasting the future performance of products to ensure future-proof standards is challenging, especially for consumer electronic products like televisions for which technology is developing rapidly. Systematic approaches to make this forecasting more robust exist and are now under consideration in policy circles. These include moving from standards based upon 'least life cycle cost' at that moment in time during the policy research study (that often delivers a higher efficiency and reduced total cost), to an approach that favours a higher and more future-proof level of efficiency: a contemporary typical life cycle cost is calculated, and then a level of performance is determined that offers *the same* total cost but higher initial cost offset by higher savings. Other approaches involve the use of learning curves (tracking historical improvement rates and impact on costs and projecting forwards) and S-curve analysis, as developed by the Lawrence Berkeley National lab (curves modelling product diffusion into the market) and already deployed in US rulemakings.

Key lessons

- Developing long term working relationships with both manufacturers and technical experts through regular working group meetings can yield authoritative insight and data on which to base effective policy. This can be more effective than fully independent but largely isolated research and policy development.
- Test methodology and policy development that is harmonised to the maximum practical extent (recognising the need for differences in some aspects) ensures comparability of energy test results. This is important for promulgating BAT, ensuring concerted pressure on industry and to identify policy best practice.
- Internationally harmonised test standards require continuous work to keep them harmonised, otherwise there is a risk major jurisdictions will develop and adopt divergent standards
- Products with rapidly evolving technologies require more nimble regulatory processes if regulatory requirements are to have an influence on the market: factoring in learning effects may therefore be necessary.

5.3.3 Non directional household lamps

The move towards the international phase out of incandescent lamps began with the publication of *Light's Labour's Lost: Policies for Energy Efficient Lighting* by the IEA in the summer of 2006 (Waide and Tanishima, 2006). This publication, which was the fruit of two years' work, set out the full internal policy value proposition of improvement in lighting energy performance. Through the development and application of a highly detailed bottom up model it established that lighting accounted for 19% of global electricity consumption, that there was a very significant difference in the efficacy and efficiency of lighting sources and systems in use and that there was a tremendous opportunity to save energy and carbon emissions cost-effectively through the use of energy efficient lighting. The biggest and most obvious opportunity concerned the prevalent use of incandescent lamps in households. These lamps have an efficiency of about 5% which means that 95% of the energy they consume produces heat rather than light. Even in 2006 there were much more efficient technologies available in the form of compact fluorescent lamps (CFLs) that would use between a third and a quarter of the energy of incandescent lamps for the same light output and would have an extremely short payback period in most applications. In spring 2006 in the lead up to the release of *Light's Labour's Lost* the IEA, using a mandate received by the organisation in the 2005 Gleneagle's G8 summit, recommended to the G8 that they should endorse the establishment of energy efficiency policy recommendations including the objective of across the-board best practice in lighting. The 2006 G8 St Petersburg summit communiqué supported the IEA's proposal to develop concrete measures but requested that they be developed in more detail.

The initial steps

European lighting companies helped supply data to the IEA to produce *Light's Labour's Lost* and purchased large numbers of the book for circulation within their organisations. Following the extensive press and media coverage the book attained coupled with rising concerns about heightened energy prices and climate change Philips conducted an internal analysis of the viability of phasing out incandescent lamps. This analysis showed that a phase-out of incandescent lamps would meet sustainability objectives and not be damaging in terms of profitability. Accordingly, Philips held a press conference in December 2006 where they proposed a global phase-out of inefficient incandescent lamps in favour of energy-efficient alternatives over a 10 year period.

In the wake of this, the IEA organised a major workshop in February 2007 in Paris where leading international policymakers met with the principal international lighting industry players to discuss the feasibility of a move to phase out incandescent lighting. A few days ahead of this workshop the Australian government enacted a law that had the effect of disallowing most sales of incandescent light bulbs by 2010, while the state of California had previously announced a policy process to consider options. At the meeting itself Philips, Osram, GE and Sylvania (the largest lighting companies in the world) agreed with policymakers that such a phase-out would be feasible and desirable if managed within a reasonable timeframe.
This breakthrough led to the establishment of a set of dynamic policy initiatives in Europe as follows:

- On 1 March 2007, the European Lamp Companies Federation (ELC) announced a first-ever joint industry commitment to support a government shift to more efficient lighting products for the home.
- On March 9th, the EU Council of Ministers (a meeting of the heads of state) called on the European Commission to establish a regulation addressing the phase-out of incandescent lighting by 2009 under the auspices of the 2005 Eco-design Directive
- On March 12th, the UK announced a plan to complete the phase-out of inefficient GLS incandescent lamps by 2011, independently of eventual EU Directive provisions
- On March 28th, cross-party group of Members of European Parliament urged governments and the EC to quickly introduce new energy efficiency standards for lighting and to introduce market surveillance measures to prevent such standards from being flouted by importers
- On 20 April 2007 a Questions & Answer document was published by the ELC on the topic and the lamp industry commitment to support a government shift to more efficient lighting products for the home
- In April to May other EU states/regions (Ireland, Flanders and Portugal) announced that they will also introduce measures that effectively phase-out incandescent lighting via a mix of financial and fiscal incentives/disincentives and agreements with the lamp supply chain in advance of the EU Eco-design process.
- Finally in May 2007 the European Commission announced the start of their Ecodesign Preparatory study for an Implementation Measure on domestic lighting. This essentially committed the EU to a sustained process to consider all the options to phase out incandescent lighting.
- Switzerland announce their intention to phase-out incandescent lamps in June the same year

Within this timeframe the ELC committed itself to work with the EU institutions to develop ambitious minimum energy performance requirements for lighting in the home. Specifically they put forward a proposal on June 5th 2007 where they advocated:

- Staged energy performance requirements for household GLS and halogen lamp-categories over a period of up to 10 years
- A phased approach starting in mid-2009 to ensure availability of energy saving alternatives in all applications and to safeguard interests of ELC employees, the supply chain and consumers
- For each lamp category and for each phase, proposals for minimum efficiency specifications were set forward on the basis of the Energy Efficiency Classification used in the EU household lamps energy label

The ELC proposal advocated:

- That minimum efficiency specifications become more stringent over time in two stages
- Measures should first focus on lamps with Edison & Bayonet cap as defined under the labelling Directive 98/11/EC which covered approximately 85% of the total EU27 incandescent lamps market (excluding incandescent reflector lamps and other specialties)

Meanwhile on the other side of the Atlantic Ocean the State of California held a hearing on the topic of phasing out incandescent lighting in June 2007. Negotiations between industry and environmental NGOs led to a bipartisan bill at the national (Federal) level, S. 2017 " the Energy Efficient Lighting for a Brighter Tomorrow Act", being put forward in the US Senate. Hearings on this were held in the Senate on 12th September 2007[16] at which the IEA testified about developments in Europe and elsewhere. The legislation was subsequently approved and included in the US Energy Independence and Security Act, which was signed into law by President Bush in December 2007. The US legislation was adopted faster than the EU legislation, but was undoubtedly influenced by the European regulatory process which began sooner, adopted the policy in principle earlier and first tabled a staged approach to phasing out lamps by output class. The timetable adopted in the US legislation had the effect of phasing-out standard incandescent lamps from 2012 to 2016, beginning with higher wattage lamps first. The EU Ecodesign process eventually resulted in legislation being adopted in March 2009[17] that introduced a staged timetable to set minimum efficacy requirements for household non-directional lamps that distinguished between clear lamps and non-clear lamps. Each of the six stage's requirements entered into force on 1st September beginning with Stage 1 requirements in 2009. Implementation is currently up to Stage 5, which entered into effect in September 2013. Stage 6 requirements are scheduled to take effect in 2016 but are now the subject of further discussion and may be delayed.

Current Status and Discussion

Inspired by the process in these OECD economies other countries also adopted similar policy measures (Figure 5-6).

- In Canada, Ontario's Minister of Energy announced the provincial government's intention to ban the sale of incandescent light bulbs by 2012 in April 2007. Later in April, the federal government announced that it would ban the sale of inefficient incandescent light bulbs nationwide by 2012 as part of a plan to cut down on emissions of greenhouse gases. On 9 Nov 2011, the federal government approved a proposal to delay new energy efficiency standards for light bulbs until 1 January 2014.

- The sale and importation of incandescent light bulbs over 25W has been prohibited in Argentina since 31 December 2010, under Law No. 26.473.

- Brazil adopted measures in 2010 to phase out inefficient incandescent lamps from 2012 to 2016.

- Mexico adopted legislation in 2010 (NOM-028-ENER-2010) that phases-out inefficient incandescent lamps from 2011 to 2013.

[16] http://www.c-span.org/video/?200971-1/energy-efficient-lighting
[17] COMMISSION REGULATION (EC) No 244/2009

- The Japanese government encouraged major electronics retailers and home appliance makers to voluntarily halt production and sales of incandescent bulbs in June 2012. Industry indicated it will respect this request.

- China is phasing out the sale of incandescent light lamps in stages from 1st October, 2012 for higher wattage lamps to 1st October 2016 for lamps of 15W or more.

- The Russian Federation is also phasing out incandescent lamps in stages from 2011 to 2016.

- Most ASEAN and Latin American countries have similar legislation in progress or implemented and many African and Middle Eastern countries also have adopted measures, meaning that the large majority of lighting markets have now set requirements that essentially phase out standard incandescent lamps.

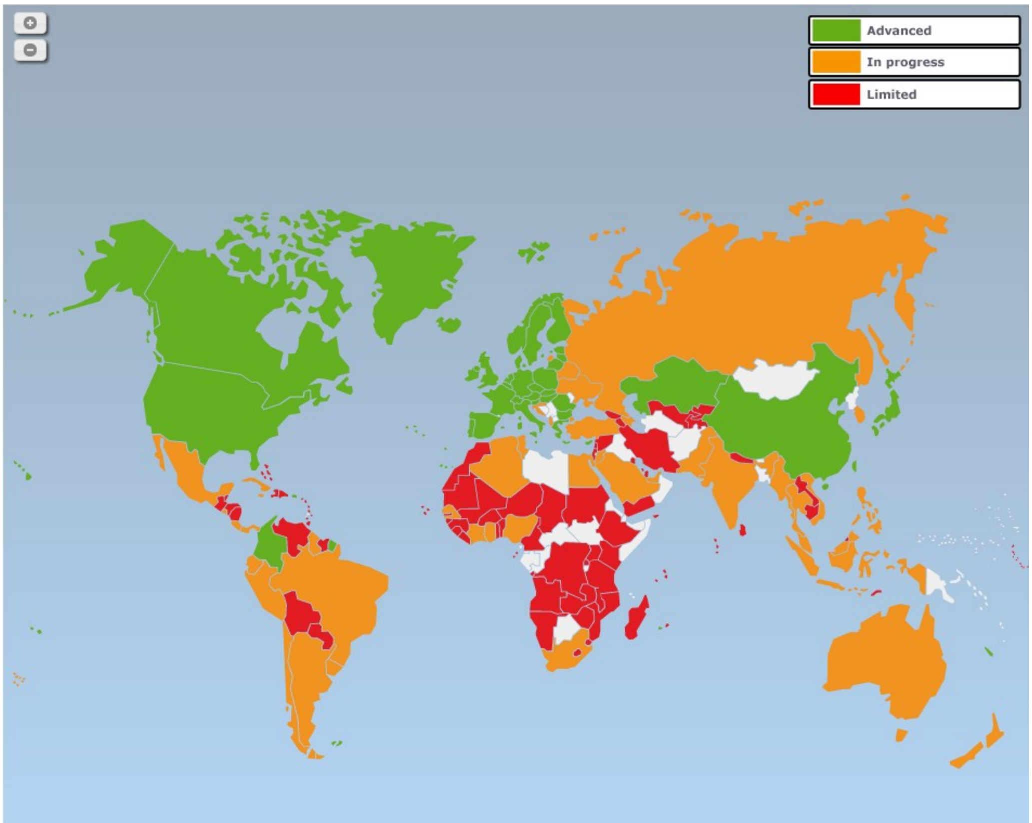

Figure 5-6 Global policy map indicating the status of energy efficient lighting policy around the world (source http://learning.enlighten-initiative.org/GlobalPolicyMap.aspx, accessed April 2014)

In recent years momentum to promote the phase-out of inefficient incandescent lighting has been picked up by the United Nations Environment Programme (UNEP)-Global Environment Facility (GEF)-funded en.lighten initiative. Development of this initiative got underway in 2007 and it was formally established in 2009 to accelerate a global market transformation to environmentally sustainable, energy efficient lighting technologies, as well as to develop strategies to phase-out inefficient incandescent lamps to reduce CO_2 emissions and the release of mercury from fossil fuel combustion.

Key considerations in the regulatory process

In opting to phase-out a technology that sold about 13 billion units around the world annually regulators needed to assure themselves that there would be an ample supply of acceptable alternative lamp technologies before setting a phase-out time table. The IEA conducted extensive analysis to investigate this issue (Waide 2010) and in particular to ensure that the phasing of the regulations was such that demand would meet supply given the radically different replacement cycles of incandescent lamps and the alternatives (principally CFLs). The analysis showed that there would be no risk of shortages of supply providing the major economies of the EU, China and the USA phased-out lamps over at least a four year period, which is exactly what they opted to do. The other principal concern was to ensure that the replacement lamps were of an adequate quality. More proactive regulators, such as the European Commission, set minimum quality criteria into their regulations, however, policing of these requirements was left to individual EU Member States.

Impacts

The phase-out of incandescent lamps has had more impact and become internationalised than any other single energy efficiency policy measure. Not only has it resulted in a global market of billions of incandescent lamps sales per year giving way to the sale of CFLs, advanced halogen lamps and LEDs but it has also resulted in colossal and highly cost-effective[18] energy savings. The *Light's Labour's Lost* analysis projected that a complete global phase-out of incandescent lamps would result in:

- ~5% of world electricity demand being avoided
- the avoidance of CO_2 emissions equivalent to ~16% of the world's cars

Such has been the pace of regulatory development that savings on this scale must be well on the way to being realised. This outcome seemed highly improbable in 2006 when the process began, yet the public-good logic of the policy argument when clearly articulated was so overwhelming that successive economies moved to adopt regulations once the process had got underway. Nonetheless, it was far from being a painless exercise. Some EU countries, such as the UK, provided subsidies to quality assured CFLs and this helped ensure that public backlash against the phase-out of a technology that had been in place for over 130 years was minimised. Nonetheless, even there some parts of the media characterised the phase-out in a negative manner although others strongly supported it. In some other EU Member States efforts were not made to ensure the quality of replacement lamps and in several there were sections of the public and media that reacted strongly against the phase-out. This created a significant public communications burden for regulators that caught many by surprise and poorly equipped to respond to it. In the USA legislation that was passed with bipartisan support in all chambers of Congress was attacked retrospectively and attempts were made, yet failed, to overturn it. In New Zealand legislation to phase out incandescent lamps was subsequently revoked

[18] The typical internal rate of return on capital invested in a CFL is well over 180%

when a different government was elected. Overall though an extraordinary and unprecedented policy-driven transformation has occurred.

Indeed it could never be expected that such a revolution in lighting technology would happen without teething issues and these were even foreseen from the very beginning of the process in the IEA policy discussions, which focused as much on how to ensure that the quality of the replacement technologies would be acceptable to the public and be communicated as such, as it did on the merits of phasing out incandescent lamp technology per se.

Key lessons

- Product policy value propositions when clearly articulated and communicated to both industry and policymakers can be highly compelling and lead to rapid legislative developments to transform energy technologies, usage and markets
- Huge savings can be achieved at a fraction of the cost of supplying energy
- Cooperation between EU industry and EU policymakers can exert a global influence if carefully targeted
- A regulatory push can also provide a strong stimulus to technology innovation (in this case first CFLs, then advanced halogens and LEDs)
- Attention to quality and communication is vital to minimise opposition to a technology phase-out and needs to be carefully planned for and adequately resourced in advance.

5.3.4 Electric Motors

Electric motors account for between 43% and 46% of all global electricity consumption and thus give rise to about 6040 Mt of CO_2 emissions (Waide et al., 2011a), making them comfortably the largest source of electricity consumption. There is also a huge volume of international trade in electric motors. The largest proportion of motor electricity consumption is attributable to mid-size motors of between 0.75 kW and 375 kW. Among the many different motor technologies the most numerous and highest energy-consuming type are asynchronous alternating current (AC) induction motors. These can be sold to original equipment manufacturers to be integrated into pre-packaged products, such as fans, pumps and compressors. Alternatively, they can be sold as standalone motors that are then integrated into a specific on site application. To service this motors are produced in large volumes according to standardised input power and size specifications.

The energy efficiency of electric motors has been regulated in North America since 1997 while Europe operated a voluntary efficiency programme from the late 1990's onwards. A number of other countries including Australia and China had a mixture of mandatory or voluntary efficiency levels. As AC three phase AC induction motors in the range 0.75 kW to 150 kW are the most important type of motor in terms of energy use these were the only types subject to any energy efficiency regulations internationally until recently; however, in more recent times efforts have been made to extend regulations to cover smaller and larger motor types.

Test Method and Background

There are a range of test method approaches that can be used for electric motors. The most commonly used for small to medium sized motors is the so called sum of losses approach, where estimates of the losses associated with each of the key components of motor operation are separately measured and added to determine overall efficiency (by deduction where efficiency = 1 minus the sum of the losses). These losses are determined from test measurements and associated calculations. They are broken-down into stator losses, rotor losses, friction and windage losses, core losses and additional load-losses (or so called "stray" losses) which are losses that cannot be attributed to any of the other elements.

Prior to 2000 there were effectively three main test methods for electric motors in use around the World. These were:

- IEC60034-2A Rotating electrical machines - Part 2: Methods for determining losses and efficiency of rotating electrical machinery from tests
- NEMA MG 1-1987, Motors and Generators, Revision No. 2
- ANSI/IEEE 112-1984, Test Procedure for Poly-phase Induction Motors and Generators (Method B)
- JIS C4210 Low voltage three phase squirrel cage motors for general purpose

The North American ANSEE/IEEE and NEMA methods are equivalent and either method was considered to be generally acceptable for use in North America. While much of the content of these three main test methods was similar, there were some key differences. The most important difference between the test methods considered the treatment of additional or "stray" losses: under IEEE and NEMA these are determined directly by measurement, under IEC they were assumed to be a constant 0.5% of input power for all motor sizes while under the Japanese JIS method these losses are ignored (i.e. assumed to be 0%). There are also some other differences such as assumed winding temperatures for the calculation of resistance based losses. Given these differences it was not possible to directly compare the efficiency of motors tested under different test methods and manufacturers selling the same product in multiple markets would be obliged to retest their products to all the different test methods.

This problem was recognised in the mid-1990s and following a concerted effort to promote the issue a number of governments teamed together to fund coordination work. Following a period of sustained international collaborative dialogue the IEC decided to revise IEC60034-2 to bring it into line with the approach being used in North America, which was generally regarded as a technically superior test method but somewhat more expensive to use because accurate torque measurements, especially for larger motors are more expensive to make. Torque measurements are required in order to directly quantify additional losses for a particular motor under test. The revised IEC 60034-2-1 test procedure was published in 2007 after about 10 years of work in the IEC arena. It describes different methods of determining additional-load losses which involve low, medium or high uncertainty. One of the methods so-described is the determination of power load losses from measurements, equivalent to IEEE112B. As this is the method with the lowest uncertainty it is therefore the preferred, test method.

Harmonisation process and government engagement

Even though the IEC test method for electric motors had been in existence for a long time and was in fairly extensive use internationally, there was a difference in the regional test methods in use in North America and Japan. The problem of fragmentation in the use of international test methods was recognised in the mid-1990s when a number of academics and analysts started to point out the differences and illustrated the weaknesses in the IEC and JIS test methods (and the superiority of the NEMA/IEEE methods in North America). This lead to a groundswell of international opinion that the IEC test method needed to be improved and essentially aligned with the North American approach in order to be more accurate and relevant.

Concrete action towards the harmonisation of electric motor test procedures had its origins in a private initiative SEEEM (Standards for Energy Efficiency of Electric Motor Systems) instigated by a group of interested consultants that originally came together through the Energy Efficiency in Motors and Drives (EEMODs) conference organised by the European Commission and supported by certain governments (Switzerland, Australia and UK amongst others). The SEEEM initiative was initiated in the early 2000s and helped convene a process that brought together international industry, government and experts into a common platform that aimed to harmonize motor energy efficiency standardization and agree globally accepted test procedures, informative efficiency thresholds and eventually MEPS and labelling regulations set in alignment to these thresholds. It entailed extensive meetings, workshops, conferences, analysis and broad facilitation to achieve and hence was a relatively lengthy and costly process. Nonetheless these steps were necessary to bring key stakeholders into a common dialogue, where they could develop and support a common vision of what needed to be done while establishing the level of trust needed to overcome the difficulties. With the advent of the IEA 4E Implementing Agreement, the SEEEM initiative was co-opted in 2009 to form one of its' annexes (the Electric Motor Systems Annex, EMSA http://www.motorsystems.org) and thus continues to do useful work to advance motor efficiency standardisation – most recently addressing needs of small and more exotic motor types.

In the IEC committees, there was some limited direct engagement by government officials, mainly through technical consultants that participated in committee work. There is a significant input from specialised test laboratories into these committees. As with all IEC development work, the timeframe for the generation of this new test method took many years (even though the basic parameters were already in existence) and such long term resourcing can be difficult to maintain.

The successful harmonisation achieved with this product was unusual as surrounding the IEC work there was a framework of consultants and academics that were also pursuing a broader efficiency agenda, either on behalf of governments or as part of a more altruistic objective. Regular conferences such as EEMODs (Energy Efficiency in Motor Driven Systems, supported by the European Commission) and work by SEEEM and more recently the IEA 4E Implementing Agreement Annex on Electric Motor Systems Annex have provided strong impetus for this work. Support for efficiency from industry groups such as the International Copper Association[19] has also provided resources for some of the development work.

Efficiency Metric

The efficiency metric for electric motors is straightforward and is expressed as the ratio of mechanical output power over the electric input power at a defined point of operation. Typically motor efficiency is determined at a number of defined points (e.g. 25%, 50%, 75%, 100%, 125% of the rated capacity). The change of efficiency with load is an important parameter to consider for applications with variable loading requirements, so consideration of the efficiency curve as a function of load is considered to be the best overall metric and this is widely used. Even motors that have constant loading rarely work exactly at rated capacity, so having data across a range of outputs is important.

Motor manufacturers are generally required to display the measured efficiency at rated capacity (or perhaps 75% and 100%). This gives insufficient information to determine the service efficiency for many situations as variable load output during operation is common. Motors that have higher efficiency at rated capacity also tend to have much better operating efficiency at part load (due to reduced losses across the board), although this does vary for individual motors. So the new IEC 60034-30 efficiency classification standard recommends reporting efficiency at 50%, 75% and full load.

[19] More efficient motors generally use more copper in their windings, so this support has some elements of self-interest.

Efficiency Thresholds
While the precise efficiency levels set for labelling and MEPS requirements were slightly different between the major national/regional programmes, there was some broad equivalence across the different programmes (once test method differences were taken into account). As a result it was possible to develop some harmonised efficiency thresholds as an adjunct to the new IEC test method that broadly satisfied current and future programme requirements for the major regions. With the purpose of harmonising the different energy efficiency classification schemes for induction motors in use around the world, the International Electrotechnical Commission (IEC) introduced, in 2008, a new classification standard – IEC60034-30. The standard defines three levels of energy efficiency:

- IE3 – Premium efficiency (equivalent to NEMA Premium)
- IE2 – High efficiency (equivalent to EPAct/EFF1)
- IE1 – Standard efficiency (equivalent to EFF2)

A fourth level, IE4 – Super Premium efficiency, is also introduced but not defined, since there is no sufficient market and technological information available to allow standardization. The next revision of the standard will incorporate this efficiency level.

The presence of a harmonised set of efficiency thresholds in a commonly adopted international standard provides a simple and straightforward pathway to introduce or upgrade efficiency standards and high efficiency levels at an appropriate level on a timetable that suits local requirements. Given the differences in nominal supply voltage (and therefore current) and frequency in different regions, it is important to take these into account when developing global efficiency metrics and thresholds. These new thresholds were adopted in the EU's 2009 Ecodesign requirements and in the 2010 US MEPS. In 2013 Japan also adopted labelling and Top Runner specifications for electric motors and METI reports that these are directly informed by the Ecodesign specifications.

Current Status and Discussion
While this is a successful example of a product where global alignment has been achieved for test methods, efficiency metrics and efficiency thresholds, it was a very slow and resource intensive process (10 years). There was general agreement that an existing test method (US IEEE) was technically superior and it was therefore possible to move to a harmonised global approach regarding the test method within IEC without too much controversy (although there was some disagreement within Europe on some details). Fortunately the existing efficiency metric and thresholds were already similar, so it was possible to develop uniform requirements under the new test method. There are still some issues with respect to frame sizes (these are generally smaller in Europe, which can make it difficult to attain the highest efficiency levels due to the impact of size constraints on the amount of high conductivity material that can be used). Also, because motors in the US work at a higher speed (60Hz) they are able to achieve higher efficiencies. Two tables exist in the classification standard, one for 60Hz and one for 50Hz operation.

It appears that the test method and the metric for determination of efficiency is well settled and there is strong consensus on the use of the approaches internationally. The efficiency metric for motors appears to be well accepted. It remains to be seen how extensively the current and future efficiency threshold levels developed within the IEC process will be adopted by governments and other bodies as part of their programme of measures for motors. But there has already been substantial progress and the framework has been developed and available for use by all interested parties into the future.

Key lessons

- International collaborative policy development can transform markets further and faster than unilateral action.
- Robust performance data representative of products throughout the world provides a policy resource on which all countries can draw to build effective policy.
- An agreed framework of performance levels based on an internationally recognised test method, a global 'ladder of performance', ensures low barriers to trade and combines policy flexibility with transparency of harmonisation.
- Close working between governments and industry can pave the way for major policy innovation.

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5.3.5 Laundry Driers

Context

This case study shows how policy initiatives in Europe (notably Switzerland, Austria, Germany and Italy) transformed their markets for laundry dryers and then how their success has inspired a revision of policy thinking for dryers in North America. Introduction of heat pump technology in laundry dryers brings a step change in performance and saves around 50% of the energy consumption although the purchase price can be significantly higher than for a simple conventional dryer. The EU market lead on this dryer technology is perhaps surprising given that US consumers have far more to gain from better dryers than their EU counterparts, with most US wash loads being put straight into the dryer. However, its origins date back to the original 1995 study for the Commission by the Group for Efficient Appliances that identified that the use of heat pumps could reduce dryer energy consumption by at least 50%. As a result the EU labelling scheme set the class A level at an efficiency that could only be attained by heat pumps dryers as an incentive for producers to develop heat pump models. The first such model was exhibited in the 1997 Domotechnica trade fair in Germany but was produced by micro scale manufacturer who had very limited access to distribution channels and very limited options to scale-up production and drive down costs.

A neglected but high energy-consuming product

In the meantime, electric laundry dryers were rather low on product policy priority lists in Europe and the USA because conventional dryers have relatively limited options for efficiency improvement, other than good residual moisture based controls. This is probably what was behind an earlier EU stance after the introduction of the energy label for dryers in 1995 that an Ecodesign measure was not necessary for these products. In North America, dryer performance remained static for at least 16 years following the imposition of MEPS in 1994/95. Virtually all products in the US market achieve a similar efficiency level, which is a level that is arguably reasonable for a conventional electrical laundry dryer but not more demanding.

Both the ownership and usage of dryers are much higher in North America than the EU: approximately 85% of U.S. households have dryers and being used for an average of over 400 cycles per year (IEA4E, 2011) they account for 6% of residential electricity consumption (compared with an average less than 200 cycles per year in the EU and only 50 cycles in Australia). Despite this high usage, right up until 2012 dryers were the only major household appliance in the USA without an ENERGY STAR label, nor an Energy Guide label, nor subject to any financial incentive or promotion by utilities to encourage the sale of the most efficient models.

Diversity of test methods hampers comparison

Despite the very high level of technical similarity in electrical dryers around the world, there are many fundamental differences between the test methods employed to measure their energy consumption. Test methods vary in:

- The quantity and type of fabrics in the test load: North American tests use a fixed 3.17 kg load consisting of 50% cotton and 50% polyester fabric clots; EU and Australian tests load to the capacity of the dryer with 100% cotton fabrics.
- How wet they are at the start and how dry they must be at the finish point: there exists substantial variation on this, even in the metrics used to measure moisture content.
- The ambient temperature and humidity conditions in which the test is carried out: this affects vented dryers particularly since ambient air is drawn through the device.
- The algorithms used to calculate efficiency of vented dryers versus condensing dryers.
- The metrics used for capacity of drum: EU and Australian products defined capacity in terms of kilograms of dry fabric whereas North American products are defined in terms of internal volume of the drum with no consensus on any conversion factor between the two.
- The metrics used for efficiency (kWh/kg dry fabric vs. lb./kWh)

One attempt to quantify the differences in measured performance developed conversion algorithms to render laundry dryer test results comparable on a fair basis. A benchmarking study (IEA4E, 2011) concluded that comparability was achieved with an average adjustment for Australian results of a 50% cut in consumption, an average 36% cut in EU test results and average 3% cut in US/Canadian results. Adjustments for any particular product, however, vary substantially from product to product according to its capacity.

These differences in energy test results mean that it is impossible for consumers (and for policymakers) to compare the relative efficiency of products from different markets. This means that technologies and overall market efficiencies cannot be compared, and neither can policies; nor can global best performing products be identified. There is also a lack of comparability with real life consumption, such that one 2013 US report concluded that the USDOE should develop a test procedure that better reflects real-world use (Denkenberger et al. 2013).

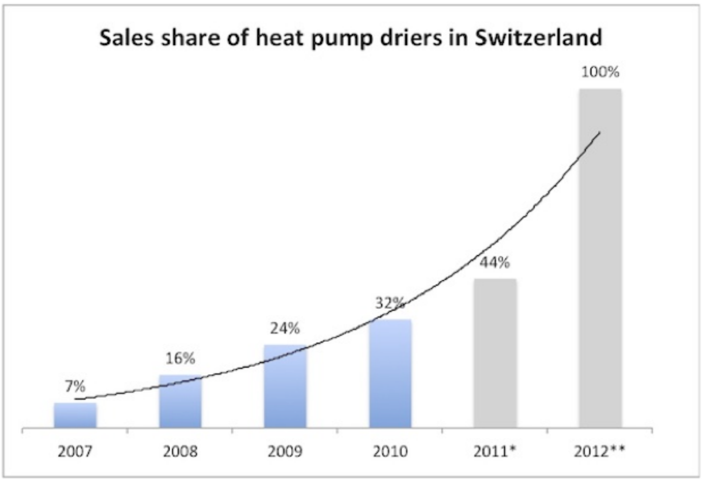
Heat pump dryers get policy support in the EU

Heat pump dryers first came onto the market in the EU in the late 1990s and even then offered substantial savings compared with conventional dryers.

But it was in Switzerland that initiatives to promote heat pump dryers beyond labelling first started due to the efforts of an energy efficiency project that specialised in promoting the 10 most energy efficient products in many appliance categories, called Topten. In 2003, the Topten project team undertook the first tests of heat pump driers available on the Swiss market (Werle et al. 2011). Later that same year, based on this testing and feedback from users, Topten convinced the city of Zurich to choose only heat pump driers for its housing projects. In 2006, the power utility of Zurich began to offer consumers a rebate of up to EUR 200 upon purchasing a heat pump dryer. Since 2007, several other Swiss utilities and communities have launched rebate programmes for heat pump dryers.

As a result of these efforts, the market share of heat pump dryers in Switzerland consistently increased, reaching 24.5% by 2009 (see Figure 5-6) and was projected at that time to top 30% in 2010. Similar improvements were achieved in the Austrian market, with German and Italian markets also having a notable proportion of heat pump dryers in their markets by 2009.

The Swiss government then stepped in to cement this technology as the de-facto choice by banning dryers with anything less than an energy efficiency label of class A from January 2012[20]. This performance level is extremely challenging to achieve with any technology other than a heat pump dryer. The impact this policy support has had on heat pump dryer market share is shown in Figure 5-6.



Data source: FEA.
** the 2011 figure has been extrapolated*
*** 2012 forecast: based on the Swiss MEPS*

Figure 5-6 Growth in market share of heat pump dryers in the Swiss market following focused policy support (source: TopTen[21])

The first EU label for dryers appeared in 1995 but under the update of September 2013 heat pump dryers generally achieve label A and above. Having energy labels does enable differentiation of better performing products and this has assisted market diversity in the EU, whereas the US market has remained largely undifferentiated on performance due to low visibility for improvement options: in 2010 the spread of performance above and below the average for the EU was +/-25% but only +/-7% in North America (IEA4E, 2011).

An EU Ecodesign regulation for tumble driers came into force in November 2013 and removed the poorest performing products from the market. By October 2011 there were 66 different domestic heat pump drier models from 17 manufacturers, 64 of which reach the new class A+ or better[22].

[20] Faktenblatt-Energieverordnung-Anpassung-English.doc, Bundesamt für Energie BFE, Juli 2009.
[21] Topten Focus, Heat pump driers: 50% energy saving potential, 30th April 2012.
[22] Laundry driers: Ecodesign requirements not ambitious enough, Topten Focus 18 October 2011.

Purchase costs for heat pump dryers remain substantially higher than simple electrical dryers, but have come down significantly in recent years to make purchase of many economically viable over the life cycle. However, conventional dryers with good humidity controls continue to be available on the EU market and so energy savings of close to 50% could be achieved for most products on the EU market.

EU influence on US policy

The USEPA became aware of the savings being achieved in Europe and decided to do something to encourage similar developments in the US market. CLASP, the technical NGO focused on standards and labelling, facilitated an evaluation programme which began with establishing evidence under which a selection of four European models and three conventional North American models were tested under the same test procedures. The study (Denkenberger et al. 2013) confirmed that heat pump dryers are a mature technology and that even heat pump dryers designed with a shorter drying time expected to be required by the North American market could offer significant energy savings.

Following this, US utilities, backed by the USEPA, took up the challenge to develop this market - much as Zurich utilities did in Switzerland. The Super-Efficient Dryer Initiative (SEDI) was launched in 2010 by the New Jersey Clean Energy Program (run by an office of the New Jersey state government) to promote the introduction of advanced clothes dryers into the North American market. SEDI draws directly on lessons learned from TopTen's success in that same task in Europe and conducts technical research, promotes policy measures, and coordinates stakeholder engagement to build the US market. Figure 5-7 shows a slide from a presentation at the 2012 ENERGY STAR partner meeting that exemplifies the US government view that heat pump dryer technology should be introduced from the EU. SEDI brings together dryer manufacturers, government agencies, utilities, and appliance retailers in the U.S. and Canada. US DOE regulations on dryers are now being prepared.

The motivation for this was the realisation that the EU was already exploiting a technology option with 50% savings and where proportionally the US total savings would be far larger in magnitude due to much higher dryer usage.

Lessons from this case study

- This is a good example of partnership between NGO, governments, utilities and manufacturers to bring about transformation of a market and transfer of a whole technology type between regions.
- It is also an excellent example of how techno-economic energy engineering analyses can be used to identify energy savings technologies that are not currently being deployed and how policy settings (through a label and incentives) can be used to stimulate a technological revolution.
- Switzerland transformed its market through focused policies building towards a 100% upgrade and saved over 50% of national consumption on dryer energy.
- Utilities in particular were able to offer financial incentives to get a technology established that was much more expensive than conventional alternatives. Then a government was able to take the bold step to cement the market shift.

- Surprisingly, the new technology was established in a region where the benefits to consumers were far lower than in the USA due to much lower dryer usage. The reverse situation could, however, be exploited by policy-makers to establish, or look for, advanced technologies where they are most economically attractive and export to other regions once more mature.
- The extreme diversity and inherent flaws[23] of the various test methods were factors in the lack of policy action on this product. It was impossible for consumers or policy-makers to compare efficiency of products and stringency of policies between markets and opportunities to improve were harder to verify.

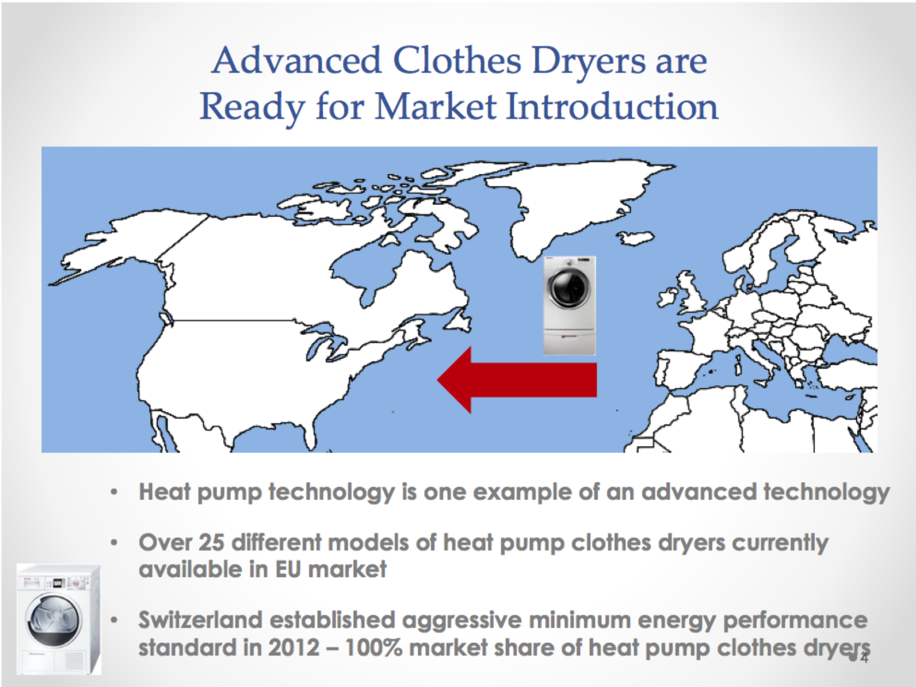


Figure 5-7. Prospect of EU best products being introduced to North America, as presented at the 2012 ENERGY STAR partners meeting as part of the Super-Efficient Dryers Initiative (SEDI)[24].

[23] Flaws were evident variously in different test methods, such as non-representative fabric types and loading patterns; starting and ending moisture levels requiring subjective judgement; earlier test methods unable to demonstrate the benefits of moisture sensors etc.

[24] *Super Efficient Dryer Initiative*, 2012 ENERGY STAR Partner Meeting, Chris Badger & Rebecca Foster (VEIC) Christopher Wold (CLASP) Chris Granda (Grasteu Associates), slide 4.

5.3.6 External Power Supplies

External Power Supplies remain a significant global product policy concern with energy losses estimated at over 50 TWh in 2010 and as high as 120 TWh by 2030 (Figure 5-8). The reasons for this are hard to miss: by 2011 there were a total of around 6 billion mobile cellular subscriptions globally (International Telecommunication Union, 2012) growing at around [10%] per year (Figure 5-9) and the vast majority of these are associated with a mobile telephone or similar smart device that gets its power via an external power supply. Even in 2008 it was estimated that each OECD household used between five and 10 different external power supplies at any given time (IEA, 2009). Sheer numbers of even the smaller EPS make them a policy concern and total numbers include EPS associated higher power products such as notebook computers, power tools, routers and broadband modems, computer displays and more (Figure 5-10). In energy terms, mobile phones account for only around 20% of EPS energy consumption since many of these other EPS users draw more current and so losses in the EPS are more significant (IEA, 2009). No-load power accounts for less than a fifth of total consumption and so power supply efficiency is the primary issue although no-load (i.e. standby) power must also be reduced.

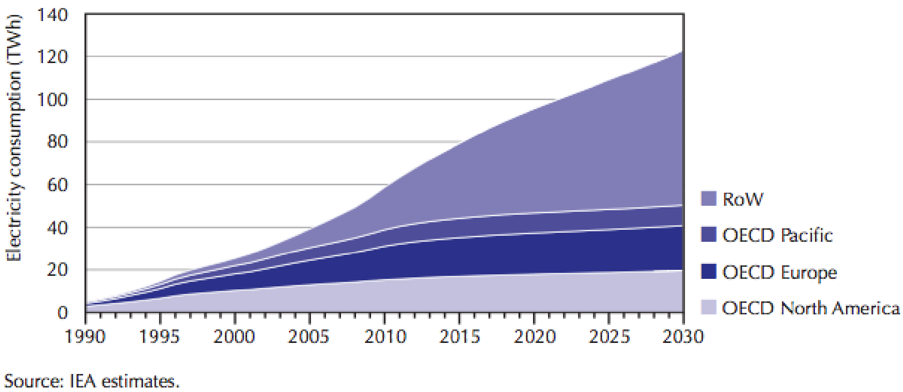


Figure 5-8. Estimated electricity consumption by external power supplies for 1990 to 2030 (source: Gadgets and Gigawatts, page 338, IEA, 2009)

Whilst efficiency of external power supplies, and the devices they power, has improved significantly in the past decade, numbers in use rise remorselessly and they remain 'hard to access' for many types of conventional policy. This is because they are generally bundled with other products, often selected for lowest possible price and there is no consumer involvement in their selection (energy labels are not so useful for EPS).

Despite these challenges, the global product policy community has tackled them and driven performance to very much improved levels in the past decade. The EU has been a major player in this from the start and continues to drive innovative policy solutions.

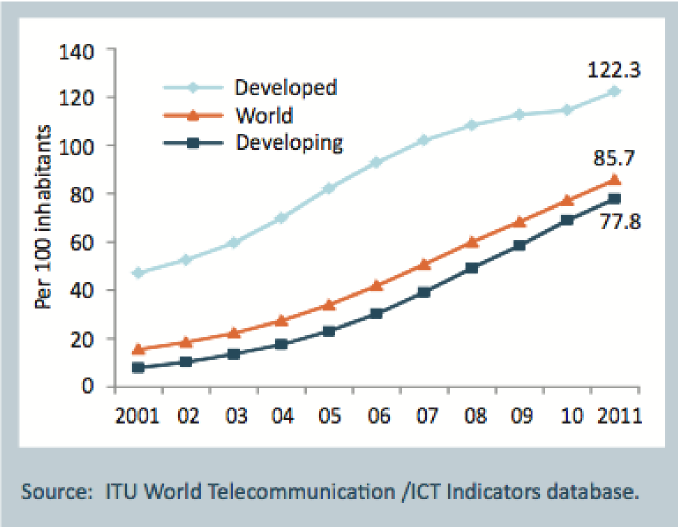


Figure 5-9 Mobile-cellular subscriptions from 2001 to 2011, world and by level of development (source: Measuring the Information Society, International Telecommunication Union, 2012).

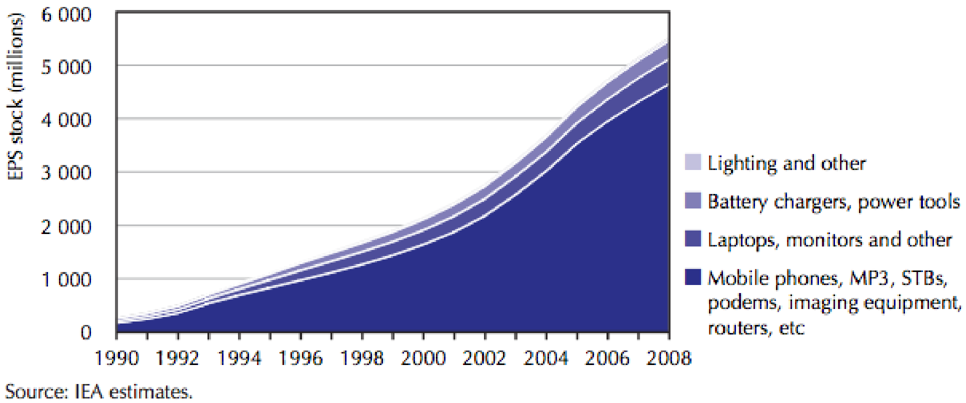


Figure 5-10 Estimated stock of external power supplies by major market sector in 2008 (source: Gadgets and Gigawatts, page 330, IEA, 2009)

Recognition of the problem spurs a global effort

The seminal IEA publication 'Things that go blip in the night' identified external power supplies (or wall packs) as significant contributors to standby consumption in 2001. This and the IEA '1 Watt' campaign of that time were significant catalysts to global action on EPS. Beginning in 2002 the ENERGY STAR programme in the USA began work on EPS[25] and soon joined with the Californian Energy Commission, CECP in China, JRC for the European Commission in Europe and the Australian Greenhouse Office to jointly support policy development and implementation on EPS. They began with the

[25] See the substantial archive of development documents and evidence of the international collaboration on EPS at http://www.energystar.gov/index.cfm?c=archives.power_supplies.

development of a robust energy performance test methodology that was finalised in February 2004 and published as "Test Method for Calculating the Energy Efficiency of Single Voltage External Ac-Dc and Ac-Ac Power Supplies (August 2004)". The IEC expressed no interest in developing this standard at the time so the respective government agencies collaborated to develop it themselves. The fact that this standard was developed entirely outside of the IEC process may have been a factor in it being possible to achieve so quickly[26].

Early policy action

As is often seen, agreement on the test method enabled policies to follow rapidly:

- An international design competition began in 2004 - the grand champion prize went to Power Integrations Inc. in March 2005. The judge's comments at the time noted that the unit's "69% efficiency is outstanding" - this was largely due to a proprietary chip design. Significantly for the future improvement of the industry, Power Integrations Inc. went on to market their EcoSmart technology globally with reasonable licensing terms.
- The European Commission's JRC launched a voluntary code of conduct for the efficiency of EPS in November 2004 based on the ENERGY STAR test method. The voluntary code required at least 80% of the manufacturer's products after January 2005 to meet a sliding scale of no load power consumption depending upon rated power output, all of which were 1 Watt or less. This was combined with an overall efficiency level requirement of between 30% to 80% efficiency depending upon the rated power. A second and more stringent phase of requirements began in January 2007.
- An ENERGY STAR product category was launched in December 2004. Importantly, several ENERGY STAR criteria for other appliances require any external power supply included to meet the ENERGY STAR EPS criteria.

A global evidence base

As part of their collaborative effort, the governments of the USA, China and Australia conducted testing of nearly 700 EPS products using the new test method and so established a robust evidence base of product performance around the world. This was crucial not only in refining the test method but also in providing the evidence on which effective standards could be based. An evidence base of such global significance was beyond the reach of any single country and provides an excellent example of the power of global coordination on product policy.

A 'global ladder' for performance combines flexibility and harmonisation

The policy co-operation also extended to co-ordination of setting of performance thresholds in national policy measures. Furthermore, participating nations encouraged other national energy efficiency agencies to adopt similar measures. This ensured maximum harmonisation and alignment of

[26] Note, the IEC technical committee concerned with EPS was approached about developing an international energy measurement and rating standard for EPS but expressed no interest in doing so. Therefore the various government agencies mentioned decided to develop their own measurement and rating system.

standards so reducing barriers to trade and creating a critical mass of demand that kept costs for the new and more efficient products to an acceptable level.

It is clear that different economies require the flexibility to set standards appropriate to their own markets: whilst all may have a common end goal, they start at different points. An important product policy tool was therefore developed for EPS: a set of distinct performance levels based on a common test methodology, like rungs on a ladder that can be applied to any market. In this way, each country can select a level of performance for minimum requirements and/or for policies encouraging best practice but the number of different specifications is agreed, recognised and limited. Countries can also easily set a time series of requirements to achieve higher rungs at future dates. This international efficiency marking protocol for EPS consists of a numerical integer scale denoted in roman numerals where a higher number represents high efficiency. For example, the EU set its first minimum requirements corresponding with level V in 2009.

Such a global ladder approach has also since been set for some other globally significant products including electric motors and, more recently, distribution transformers.

Success for governments working closely with industry
The government agencies cooperating closely on this initiative took the lead, with significant credit due to the US EPA and to the JRC in Europe. The process was primarily driven by and owned by governments but industry stakeholders were vital to its success. Requirements were developed relatively quickly and due to the close industry involvement, there was little opposition or dissent from industry. The market for EPS has been substantially transformed within a few years with a majority of EPS now highly efficient and of the 'switched mode' type with higher efficiency and much lower metals and resource use than the old-fashioned and heavy 'linear' type.

Further policy innovation from the EU: the universal charger
Energy consumption is not the only environmental concern from EPS: their sheer numbers in the billions globally results in significant resource usage and waste challenges. A major initiative to tackle this is ensuring 'interoperability', or having a universal interface such that one charger will work on any number of similar devices[27] and hence EPS does not have to be included with every product. An early initiative by the EU tackled this head-on: the memorandum of understanding in 2009 between the European Commission DG ENTR and mobile phone manufacturers[28]. This MoU set out a clear intent by manufacturers to work to develop the necessary standards to enable this as well as practical preparatory undertakings that their own product ranges are developed in this direction. The necessary CEN standard, EN 62684:2010 Interoperability specifications of common external power supply (EPS) for use with data-enabled mobile telephones was made available in December 2010. An estimated 90 % of new devices put on the market by the end of 2012 support the common charging

[27] One charger for all - The story, DG ENTR. Available from http://ec.europa.eu/enterprise/sectors/rtte/chargers/story/index_en.htm. Accessed 6 January 2014
[28] MoU regarding Harmonisation of a Charging Capability for Mobile Phones
June 5th, 2009, DG ENTR. Available from http://ec.europa.eu/enterprise/sectors/rtte/files/chargers/chargers_mou_en.pdf.

capability[29] but EPS are still supplied with most and so market transformation is far from complete. The European Commission is considering further policy action in this area.

Key lessons

1. International collaborative policy development can transform markets further and faster than unilateral action.
2. Robust performance data representative of products throughout the world provides a policy resource on which all countries can draw to build effective policy.
3. An agreed framework of performance levels based on an internationally recognised test method, a global 'ladder of performance', ensures low barriers to trade and combines policy flexibility with transparency of harmonisation.
4. Close working between governments and industry, for example through memoranda of understanding, can pave the way for major policy innovation such as that being achieved for universal phone chargers.

[29] DG ENTR, Enterprise & Industry Magazine, Tajani: Common charger for small electronic devices, 25/04/2013. Available from http://ec.europa.eu/enterprise/magazine/articles/single-market-goods/article_11065_en.htm, accessed 6 January 2014.

5.3.7 Summary of lessons from the case studies

While each case study brings specific lessons, four main lessons can be drawn from them as a whole.

1. **Close cooperation between governments, industry and NGOs brings substantial benefits, particularly if long term working relationships are built**, as demonstrated for external power supplies, laundry dryers, motors and televisions. These benefits include more robust performance data on which to base standards.

2. **Policy emulation facilitated by coordinated dialogue can greatly accelerate and multiply savings** as seen most clearly for non-directional lamps but also for the other product case studies.

3. **The case studies on televisions, motors and EPS, show that an internationally agreed framework of performance levels based on an internationally recognised test method lowers barriers to trade, facilitates technology transfer and combines policy flexibility with transparency of harmonisation**. Equally the laundry dryer example shows that differences between test procedures can be barriers to policy action and technology transfer.

4. **International collaborative policy development can transform markets further and faster than unilateral action**, for example as in the case for non-directional lamps and motors. Even major economies can and should learn from each other with respect to best practice in the design of standards and labelling.

5.4 Examples of where EU product policy has learnt from others

The EU may have led in the development of some aspects of product policy but that policy has also been informed by developments in other economies. In general it should be stressed that the EU has as much to learn from its peers as they do from it and that strengthening cooperative mechanisms will help facilitate this learning process in a manner that's beneficial to all. The remainder of this section gives some examples of where EU policy has been informed by product policy developed in other economies.

5.4.1 MEPS based on the principle of least life cycle cost

The US National Appliance Energy Conservation Act of 1993 was the first to enshrine the principle that MEPS should aim to be set at an efficiency level that corresponded to the least life cycle cost from the consumer (end-user) perspective. This principle was subsequently adopted in the EU's 2005 Ecodesign legislation.

5.4.2 Techno-economic energy engineering analysis

The US regulatory process also pioneered the application of technical and economic analyses to determine the potential to save energy through specific higher efficiency design options and the cost-benefits from doing so. US regulatory processes have pioneered the use of detailed design option analysis design tools based on physics and engineering principles to determine energy savings potentials and of related tools to determine the economic costs and benefits for the consumer, manufacturer and the economy as a whole. These type of analyses were emulated in the very first EU product policy analyses such as the study by the Group for Efficient Appliances that informed the EU's first energy label and subsequent MEPS for domestic refrigeration appliances. They have continued to be included in the Ecodesign preparatory studies although the depth and sophistication of the EU techno-economic analyses is not always as advanced as in the US analyses.

5.4.3 Energy Star

The most visible example of where the EU has learnt from others is its Energy Star Regulation, based on the EU-US Energy Star Agreement under which the EU coordinates it's energy-efficiency labelling programmes for office equipment with those developed by the US Environment Protection Agency. The increasing energy consumption of office equipment and the global nature of the ICT market provided a strong rationale for international regulatory cooperation in this domain recognised by the implementation of the Energy Star programme in several other economies, including Japan, Canada and Australia, through agreements similar to that with the EU. Although this appears to be an internationally harmonised activity, the leadership and much of the input into future developments comes from the USA.

5.4.4 Ecodesign preparatory studies

Whilst this is the most visible example, it is not the only one. It is a matter of established practice that the Preparatory Studies undertaken for each of the ErP product sectors examine, where possible, the international situation and any significant findings would have been included in the study reports that form the basis of the proposal (working document) developed by the EC. Whilst there is not necessarily any direct acknowledgement of which study conclusions were based on internationally adopted standards, it is likely that some influence was derived from such sources.

Even less tangible, but probably more significant, is the two-way influence that comes from the activities of a relatively small base of EU-based expert consultants who work closely with IEA4E, SEAD and a number of non-EU institutions, such as the IEC, and non-EU Governments that are particularly active at developing progressive labelling and eco-design policies. These experts use their expertise within the EU too and, by their nature, can be highly influential.

5.4.5 Commercial refrigeration

When product performance data is lacking within the EU, useful insight can be gained from countries that have mandatory product performance databases based on their own regulations. This type of evidence was used in the case of DG ENTR lot 1 for design of the energy labelling criteria for professional refrigerated storage cabinets. Over 80% of the available EU data was from an Italian industry association database, with 3 other small EU data sets that were partial market. It was therefore important to gain insight into the profile of a complete market data set, even if external to the EU. Datasets were obtained from Australia, Canada and the USA (both from California and from ENERGY STAR) which boosted the total count of cabinets in the data set from 1,000 up to 3,500. A good understanding of these foreign markets and the local test methods was obtained to enable careful interpretation of relative performance and spread. Performance data was normalised to enable fair comparison (building upon work carried out under the IEA 4E Mapping and Benchmarking Annex). This work has since been extended by CLASP to provide benchmarking and least life cycle cost techno-economic energy engineering analysis for a group of major economies around the world (Waide et al, 2014) and by SEAD to include a comprehensive review of test procedures (Ellis and Tait 2013). This type of procedure could be followed for many product groups, significantly enhancing the understanding of how her performance varies across a market, as long as market and test method differences are fully understood.

5.4.6 Industrial motors

The case study on industrial motors in section 5.3.4 is a good example of where the EU policy process has been influenced by standardisation and MEPS thresholds developed in the USA and subsequently worked with US and other parties to create a globally applicable rating system for motor efficiency.

5.4.7 Room air conditioners

The EU energy labelling efficiency thresholds were strongly informed by an international benchmarking analysis conducted by CLASP which showed that the Japanese Top Runner requirements were much more stringent than those previously considered in the EU, once differences in test procedures had been taken into account, and illustrated that the average efficiency of room air conditioners in Japan was substantially higher than in the EU (Econoler et al 2012).

6. Country summaries

This section presents summary information for the countries studied in depth. The country summary includes basic information about the product groups covered, the responsible implementing institutions and a summary of similarities with EU product policies. Additional information is provided in Appendix B. The information is obtained from a literature review and interviews with stakeholders.

6.1 Argentina

Argentina is the third largest energy market in Latin America and has been implementing energy efficiency programmes since 1985, although with limited scope and almost entirely decoupled from supply-side oriented energy policies.

The Energy Efficiency Standards and Labelling Programme was initiated in 1996, under the framework of the Energy Efficient Use Programme URE[30], which was launched with the cooperation of the European Union. Because of this cooperation the Argentinean label is a mandatory, comparative scheme that is to a great extent based on the European energy labelling scheme (European Directive 92/75/EEC). Regulations and standards were directly adapted from the European scheme.

Argentina has equipment energy efficiency regulations comprising:

- Mandatory minimum energy efficiency standards for 4 products;
- Mandatory energy labelling for 17 products;
- Voluntary energy labelling for 0 products.

Argentina introduced labelling to reduce energy demand, with no focus on other environmental factors.

The Argentinean Standards Institute IRAM[31], is responsible for creating and implementing standards and regulations regarding energy labelling. The Government authority in charge of mandatory labelling is the Sub-Secretary of Consumer Protection of the Secretary of Internal Commerce, at the request of the National Energy Secretariat.

Responsible implementing ministry:

- Department of Energy (Secretaria de Energia) (Spanish)
- **IRAM** - Argentinean Standards Institute, (Instituto Argentino de Normalizacion) (Spanish)
- **INTI** - National Industrial Technology Institute, (Instituto Nacional de Tecnologia industrial) (Spanish)

[30] Programa URE - Program de Uso Racional de la Energía
[31] IRAM – Instituto Argentino de Normalización y Certificación

Details/websites:

- IRAM - www.iram.com.ar
- Secretaria de Energia - http://energia.mecon.gov.ar
- INTI - http://www.inti.gov.ar/

Summary of international influences and alignment with other jurisdictions

International influences: The Argentinean Energy Labelling scheme is largely based on the European scheme, as when the programme was initiated there was a cooperation programme with the EU called Racional Use of Energy Project (Proyecto URE in Spanish). As part of this co-operation, EU-based consultants of ICAEN (Institut Català dÉnergia de Catalunya in Spanish) proposed that Argentina should adopt the EU label scheme. The earlier close co-operation with Argentina in this area now seems to have been lost.

Energy efficiency thresholds and metrics: Strong alignment with the EU first regulation.

Test procedures: Full alignment with the EU. Argentina adopts international test procedures from ISO, IEC and some modified EN standards, and basically transposes them. Existing standards are not similar to EU where the minimum efficiency level is established according to a minimum performance coefficient. In Argentina minimum efficiency levels are established in accordance with the energy label class e.g. B for cloth washers.

Energy label design - There is strong alignment with the first EU energy label. The number of energy classes is different depending on each appliance. The energy label used is a bar label design which uses a stacked bar scale with grading from best to worst. All grade bars are visible on every label with a marker next to the appropriate bar indicating the grade of the model. Energy classes range from A, the most efficient, to G the least efficient, in a coloured scale with technically similar (but not identical) calculation of EEI as used in the EU. The metric used for each appliance is very similar to the European one, with different thresholds adapted to Argentinian circumstances. In the meantime, the EU has revised its energy classes (e.g. A+++, A++ and A+ for refrigeration appliances) but Argentina has not yet followed this lead.

In Figure 6-1 it is possible to see the degree of alignment in the Argentinian and EU label appearance.

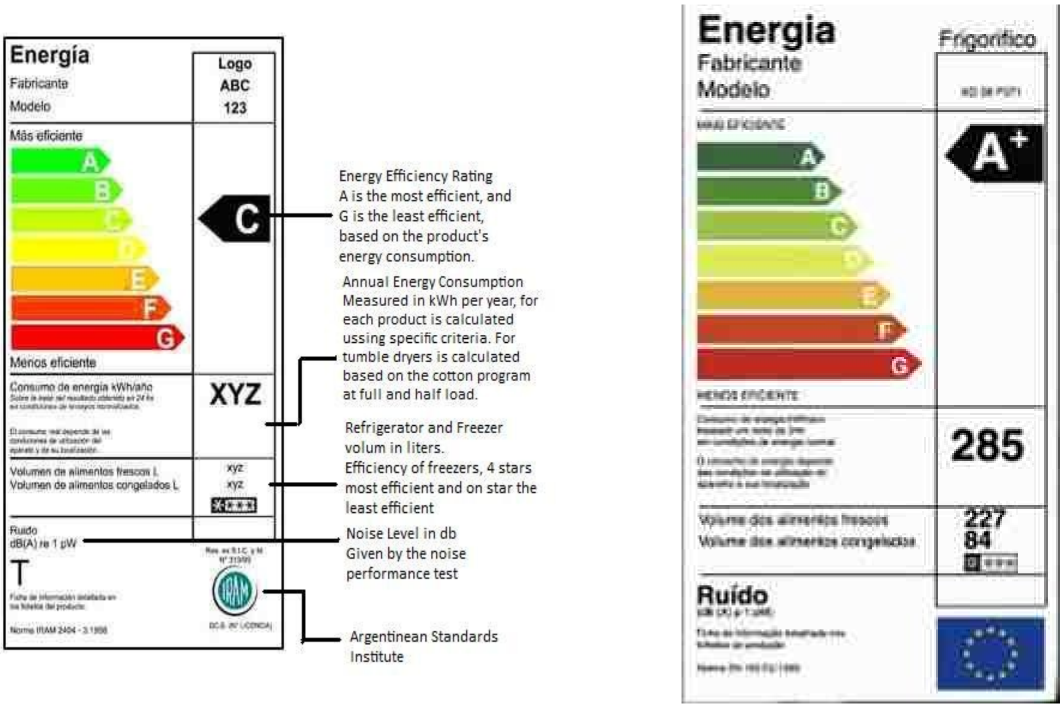


Figure 6-1 Generic energy label in Argentina (in the left) and generic European energy label second version (in the right) – Source: Department of Energy (Argentina Department of Energy, n.d.)European Commission (European Commision, n.d.)

Other general points regarding closer potential alignment with the EU

The stakeholder consultation suggested that market surveillance could be an issue in Argentina, so there may be scope for improvement through co-operation in this area.

Regarding MEPS, there are 4 MEPS established in Argentina. Some literature refers to voluntary agreements between manufacturers with the purpose of removing the most inefficient products from the market, for instance, appliances below C class are banned from the market. According to the CLASP S&L database, Argentina has no MEPS, and some stakeholders classify Argentinean MEPS as labelling standards and mentioned they are not real MEPS as the thresholds are outdated. However, according to the survey carried out in this study, it was possible to confirm that thresholds are based on negotiated agreements with industry and other stakeholders (e.g. laboratories) and then they are legally binding. After the period of negotiations with stakeholders the Secretary of Energy launches a legal resolution establishing the minimum efficiency requirements based on label efficiency classes thresholds (e.g. Resolución SE Nº 682/2013 Fecha 07/10/2013 for clothes washers).

It is not clear that there are either penalties or surveillance of the effect of the voluntary agreement. The stakeholders we interviewed disagreed on whether this policy should be regarded as a MEP. There is scope for international co-operation to help with updating S&L programmes in Argentina.

6.2 Australia

Australia has equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standards for 32 products
- mandatory energy labelling for 11 products
- Voluntary energy labelling for 8 products

Australia has operated a successful labelling scheme since the mid-1980s and introduced MEPS for refrigerators and water heaters in 1999. As in the EU, the Australian energy label is mandatory and uses a categorical efficiency scale which makes it easier for users to remember the comparative energy performance of different appliances. Until recently Australia lacked general legislation mandating the issue of MEPS for a wide range of energy end-use equipment but in 2000 the (then) Australian Greenhouse Gas Office (AGO) adopted a new policy wherein Australia will adopt the most stringent MEPS in place internationally on an individual equipment basis. The motivation for doing this was two-fold: first, the lack of framework legislation and a clear set of guiding principles for MEPS had resulted in the MEPS setting process becoming adversarial, which resulted in just three low stringency MEPS being issued over a 9 year period; second, the small size of Australia's internal market meant that some Australian manufacturers were keen to harmonise their regulatory requirements with wider international requirements so as to avoid having multiple production requirements.

The Australian equipment energy efficiency programme is implemented by the Department of Industry under a joint initiative of Australian, State and Territory and New Zealand Governments. It began in 1986 in the State Territories of New South Wales and Victoria.

Contact details/websites:
http://www.energyrating.gov.au/

Summary of international influences and alignment with other jurisdictions

International influences: The Australian MEPS and Energy Labelling scheme predates that of the EU and was largely developed internally. Historically, the development of individual standards was much influenced by the needs of industry. Standards were developed to suit national requirements where there was a strong manufacturing base within Australia. This is now changing with less local manufacturing and with the 2012 introduction of the Greenhouse and Energy Minimum Standards (GEMs) Act which heralds a move towards adoption of international standards.

Australia is an active and influential member of IEA 4E and of SEAD. These bodies are seen by many as the best mechanism for sharing its regional experience and communicating its future priorities and whilst a number of EU Member States are members of these bodies, the EC (for EU) is not. UNDP or UNFCCC events are not seen as alternative fora since they are less likely to be attended by energy efficiency specialists.

Australia is currently the only national policymaking group actively working at international (IEC) standards to implement an improved strategic approach to the development of international standards. It appears that they, uniquely amongst policymakers, understand the influence and leverage that international standards have on regional and national standards making.

Energy efficiency thresholds and metrics There is partial alignment with the EU where both some EU Member States and Australia have jointly worked on a programme e.g. EPS, standby. Currently, alignment with the EU is an exception but this will change on a product by product basis following the adoption of GEMs. Of the first two product sectors to be reviewed since its introduction, one, domestic laundry equipment, is expected to be aligned with the EU. This is because of the strong similarities between the products sold in both markets (some are identical). The other product sector, domestic refrigeration, is expected to be aligned with the USA because that is where the product similarities are greatest.

Test procedures There are many instances of partial alignment with the EU over test procedures. This is primarily due to both economies adopting, or at least basing, their test methodology on the international standard.

Energy label design There is no alignment at this time. The Australian label design (Figure 6-2) is currently under review supported by a programme of market research. Stakeholder opinion suggests that the sunken investment in the Australian label over 25 years is unlikely to be jettisoned in favour of an EU styled label.

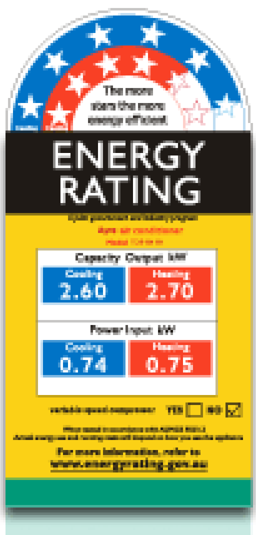


Figure 6-2 - Generic energy label in Australia

Other general points regarding closer potential alignment with the EU
Quote from one stakeholder: "A more global approach by Europe would assist. Programme measures need to satisfy local EU requirements, but building in approaches that can make these more regionally relevant would assist (both test procedures and policy requirements). Clearer vision regarding test

procedures is required, plus more active engagement in IEC/ISO. EU has the potential to be a strong global leader in energy efficiency policy, but current approaches are generally not very global."

Another stakeholder suggests that national sovereignty would continue to influence standard and labelling development and this will shape/constrain future global cooperation. Making the EC documentation much easier to access could bring standards closer.

6.3 Brazil

Brazilian product energy efficiency policy is based on voluntary and mandatory labels and standards for several domestic, industrial and commercial appliances. The Brazilian Association of Technical Standards[32] (ABNT) is responsible for test procedures management and ensuring compliance in voluntary or compulsory product certification. The National Institute of Metrology[33] (Inmetro) developed a minimum efficiency performance standards programme and every year the National Programme for Conservation of Electrical Power[34] (PROCEL) for home appliances, and the National Programme for Rational Use of Oil Products and Natural Gas[35] (CONPET) for gas appliances, award endorsement labels to the most efficient products in the market.

Brazil has implemented a rather complex network of policies and procedures, of both a voluntary and mandatory nature, to overcome existing market barriers. The energy efficiency policy is based on a combination of policies: comparative labels, endorsement labels or both, and for some products there are also MEPS.

According to the available literature and according to the stakeholders consulted during this research it is clear that the motivation behind the Brazilian system is based on two main factors: competitiveness and energy savings. The purpose of the Brazilian Energy Labelling Programme (PBE) was clearly to influence consumers into purchasing more efficient appliances to stimulate industry competitiveness. Later on, after the blackouts in 2001, the Brazilian government put a lot of efforts towards energy efficiency policies in an attempt to decrease energy demand.

Brazil has equipment energy efficiency regulations comprising:

- Mandatory minimum energy efficiency standards for 12 products;
- Mandatory energy labelling for 19 products;
- Voluntary energy labelling for 20 products.

Responsible implementing ministry:

- **MME** - Ministry of Mines and Energy –(Ministério de Minas e Energia in Portuguese)
- **INMETRO** -National Institute of Metrology
- **ANEEL** - Brazilian Energy Regulatory Agency –(Agência Nacional de Energia Elétrica in Portuguese)
- **ABNT** - Brazilian Standards Association –(Associação Brasileira de Normas Técnicas in Portuguese)
- **PROCEL** - National Energy Conservation Programme –(Programa Nacional de Conservação de Energia Elétrica in Portuguese)

[32] Associação Brasileira das Normas Técnicas
[33] Instituto Nacional de Metrologia, Qualidade e Tecnologia
[34] PROCEL - Programa nacional de Conservação da Energia Eléctrica
[35] CONPET - Programa Nacional da Racionalização do uso dos Derivados de Petróleo e do Gás Natural

Details/websites:

- www.mme.gov.br – MME - Ministry of Mines and Energy
- www.inmetro.gov.br – INMETRO -National Institute of Metrology
- www.abnt.org.br – ABNT - Brazilian Standards Association
- www.aneel.gov.br – ANEEL- Brazilian Regulatory Agency
- www.eletrobras.gov.br/procel/10.htm - PROCEL - National Energy Conservation Programme

Summary of international influences and alignment with other jurisdictions

International influences: The EU is a reference for the Brazilian standards and labelling policies although direct cooperation with EU was not significant. Officially, there was no cooperation from EU, but independent experts from Europe have been giving support to Inmetro (MB) through visits, giving talks and exchange of information.

Energy efficiency thresholds and metrics: Partial alignment with the EU.

Test procedures: Partial alignment with the EU. There was disagreement in the stakeholder responses about the degree to which standardised test procedures would bring benefits in Brazil. There were also different views as to whether the standards adopted should be of international or EU origin.

Energy label design: Partial alignment. The number of energy classes is different depending on each appliance, (e.g. TV CRT screens are graded from A to D, air conditioners and refrigerators from A to E and lamps from A to G). The number of bars depends on the highest pre-set threshold for energy performance that the model is able to achieve. For example most appliances are graded from A, the most efficient, to E, the least efficient, but there are some appliances like TV CRT screens and table fans that are graded from A to D. The metric used for each appliance has some similarity with the European one but with different thresholds, adapted to Brazilian circumstances.

In Brazil, label endorsement policy is used in a large number of products and is called the Selo PROCEL for electrical appliances and CONPET for gas appliances. Both are awarded to the most efficient products in the market being quite different from the European Ecolabel, which also deals with other life-cycle environmental impacts.

In Figure 6-3 is possible to see the degree of alignment in the labels appearance between Brazil and EU.

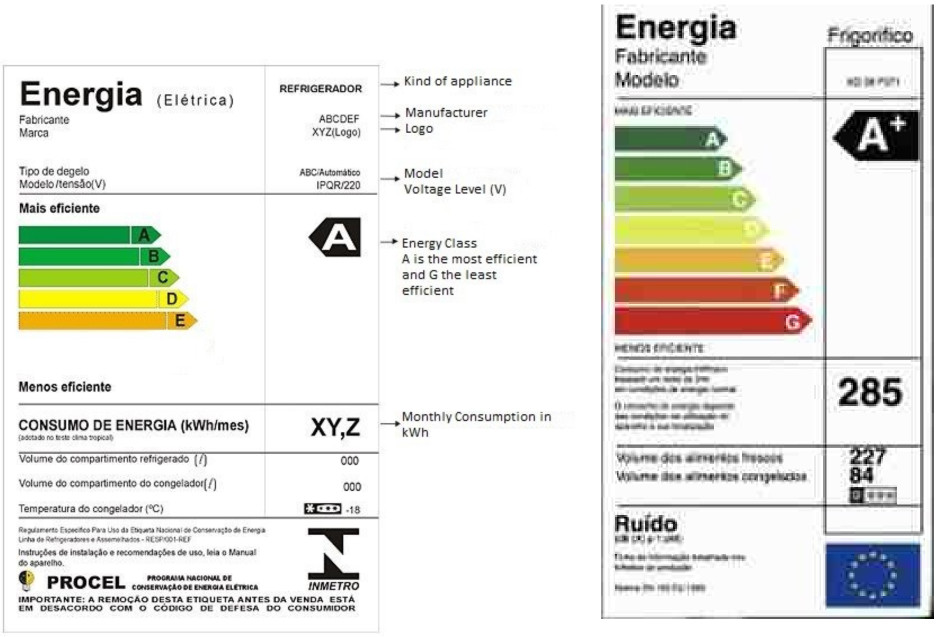


Figure 6-3 - Generic energy label in Brazil (in the left) and Generic European energy label first version (in the right) – INMETRO (INMETRO, n.d.), European Commission (European Commision, n.d.)

Other general points regarding closer potential alignment with the EU
Brazil has carried out awareness raising campaigns through several means: TV, radio, magazines, newspapers which have promoted the success of the label.

Market surveillance is very effective in Brazil. Inmetro was able to establish a network for verification and surveillance system around the country, which is running very well, with penalties for non-compliance manufacturers and or retailers.

6.4 China

China has equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standards for 46 products
- mandatory energy labelling for 27 products
- voluntary energy labelling for 66 products

The Chinese equipment energy efficiency programme is implemented by the National Development and Reform Commission and began in 1989.

Contact details/websites:

http://www.ndrc.gov.cn/

The principal decision-making bodies involved in the process of developing and implementing China's standards and labelling programme are:

- General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ)
- National Development and Reform Commission (NDRC)
- Standardization Administration of the PRC (SAC)
- China National Institute of Standards (CNIS)
- China Quality Certification Center (CQC)
- China Association for Standardization (CAS)

The primary functions, roles and responsibilities of these organisations are shown in Figure 6-4.

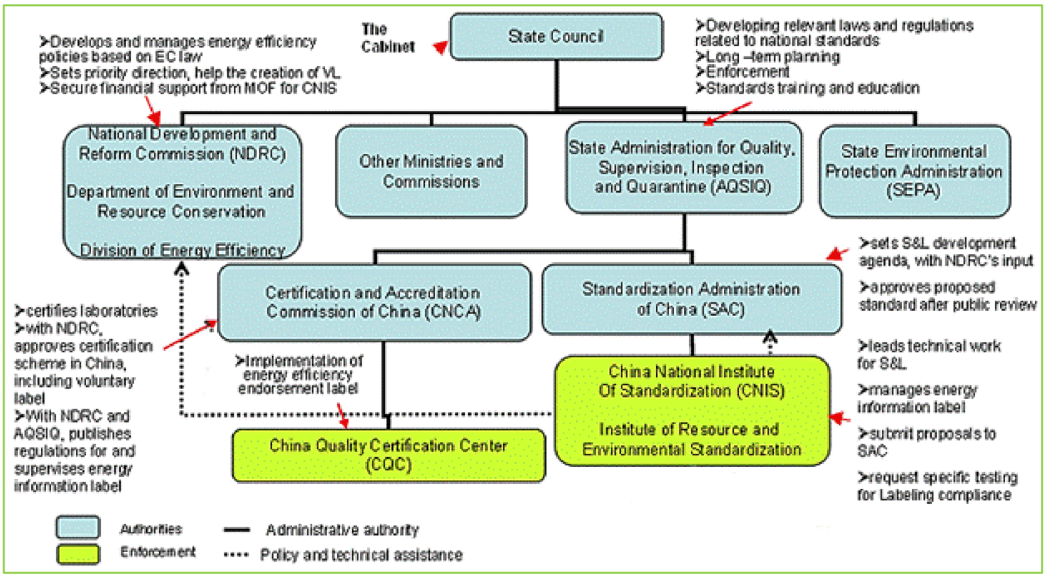


Figure 6-4 - The organisation of China's equipment standards and labelling programme

The share of product energy consumption covered by China's MEPS programme is among the highest of any economy. If MEPS coverage is considered for all residential and commercial energy using equipment and for industrial electric motor driven applications China's MEPs programme covered 64% of all potential electricity use and 10% of residential and commercial sector oil and gas use in 2010 (Waide et al. 2009).

Summary of international influences and alignment with other jurisdictions

International influences. The development of China's equipment energy efficiency programme has been strongly influenced by international experts and philanthropic organisations. This began in 1996 when WWF (the first international NGO in China) hired a European expert to work with the Chinese authorities on developing their equipment energy efficiency policy. This and related work lead to the inclusion of MEPS and labelling in the 1997 ECL, the development of MEPS for refrigerators and air conditioners and the development of a national mandatory energy labelling scheme. Since that time, international engagement with China's equipment efficiency programme has continued and been broadened to include direct support from international organisations.

Energy efficiency thresholds and metrics. There is no prescriptive set of analyses that has to be done to determine the MEPS and labelling thresholds. In practice, China invariably develops efficiency test procedures and metrics if these are not already in place (often by drawing on internationally developed metrics), conducts a statistical analysis of products on the market and does some benchmarking against international markets. Based on the findings from these analyses, a decision is then made about where the MEPS level should be set and for the efficiency thresholds used in the mandatory labelling scheme. A decision is also made regarding whether to have three or five efficiency classes in the label (where class 1 is always the highest efficiency level).

Chinese energy labelling and MEPS regulations to the extent that test procedures, product categorisation and efficiency metrics were largely harmonised with existing international regulations for:

- refrigerators and freezers
- industrial electric motors
- clothes washers
- room air conditioners
- fluorescent lamp ballasts
- electric storage water heaters
- VCRs and DVDs
- Unitary air conditioners
- Multi-connected air conditioners
- Water heaters and combi-boilers
- Metal halide lamps
- High pressure sodium lamps
- Chillers

The results of this process are that the efficiency levels (thresholds) used in Chinese MEPS and labelling regulations are very rarely aligned with those used in the EU. Equally, the efficiency metrics used are sometimes fully aligned, but more often partially aligned with those used in the EU. In some cases there is no alignment.

Test procedures. China's policy is to use international test procedures whenever they are available and deemed satisfactory for the purpose required. When international test procedures are not available or not suitable the authorities will consider using another country's national standard. If none of these are available or suitable, CNIS will develop a dedicated Chinese national standard. Figure 6-5 shows the origins of China's test procedures used for MEPS and labelling.

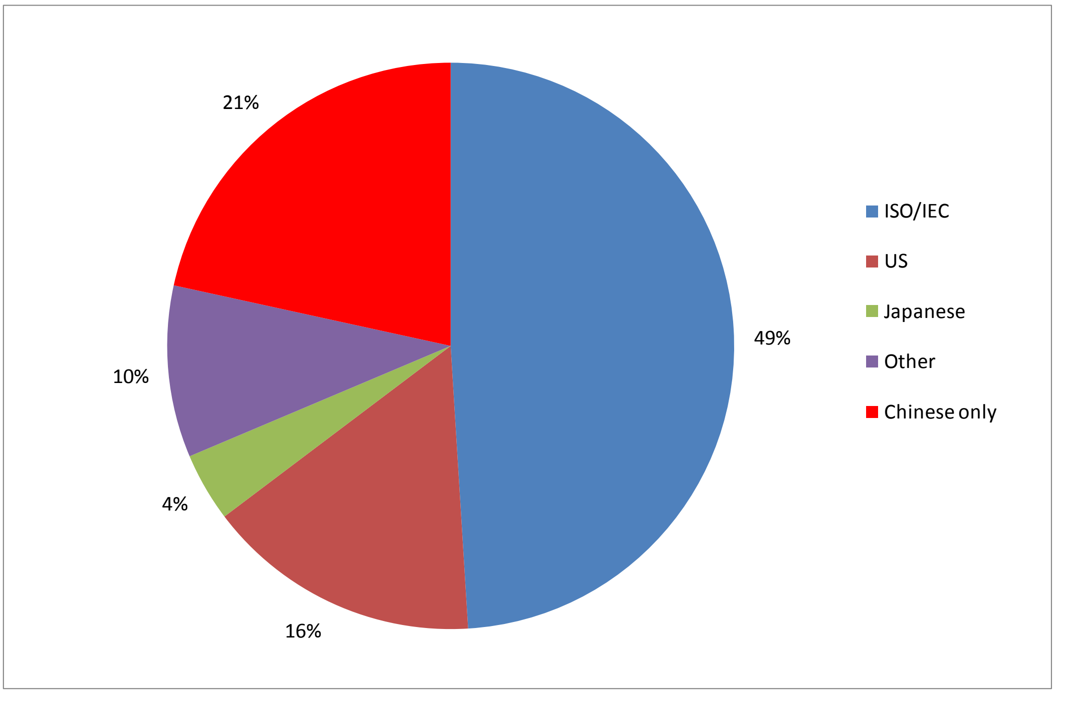


Figure 6-5 - Origins of energy test procedures used in Chinese MEPS and Mandatory Energy Labelling

A larger range of Chinese regulations have made use of international test procedures including:

- CFLs
- TVs
- Transformers
- Set to boxes
- Range hoods and extractor fans
- Printers
- Fluorescent lamps
- Fax machines
- Centrifugal pumps
- Fans

- High pressure sodium lamp ballasts
- Metal halide lamp ballasts

Label design. The Chinese mandatory energy label has similar elements to the EU label in that it has a set of stacked pointed horizontal bars which are colour coded from Green for high efficiency to Red for low efficiency and that are graded in distinct efficiency levels. The grades, however, are from 1 (more efficient) to 5 (less efficient) and there are only 5 efficiency classes on the Chinese label (or sometimes just 3 if there is little differentiation in efficiency for the product in question) (Figure 6-6).

Figure 6-6 The Chinese energy label (for Air Compressors)

Other general points regarding closer potential alignment with the EU
China is the major supplier of energy using equipment imported into the EU and is also the world's largest emitter of GHGs, thus the strength of Chinese efforts to improve energy efficiency are important for global climate change policy, global energy demand and EU equipment energy efficiency. Despite historically being an adopter of aspects of equipment energy efficiency regulatory measures taken from other economies China is becoming more assertive and has shown that it is not averse to leading the development and adoption of equipment energy efficiency measures in some instances. There are potentially many areas of China's programme that would be of interest to the EU policy process, including:

- The measures being taken to improve the quality of compliance with Chinese regulations and those required in export markets (noting that China recently joined a project within the SEAD initiative, to which it has observer status, to conduct international round robin energy efficiency testing for flat panel televisions)

- The technical details of the measures adopted for products which are regulated in China but not yet in the EU (e.g. air compressors, chillers, commercial packaged air conditioners, pumps, heat pump water heaters, range hoods, induction cook tops, PCs, servers)
- The relative ambition of Chinese policy settings compared with those in place in Europe and perhaps equally important, information on the cost-efficiency relationships which Chinese equipment is able to attain compared to those reported in Europe (this is potentially important to help verify the cost-efficiency relationships reported in the Ecodesign Lot studies)
- The details of the current work plan and whether there might be opportunities for collaboration on the design of policy measures
- Cooperation on the development of improved international product energy efficiency test procedures
- Cooperation on new product groups under regulatory consideration

6.5 Egypt

Egypt has equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standards for 8 products
- mandatory energy labelling for 6 products

The Egyptian equipment energy efficiency programme is implemented by the Egyptian Organization for Standardisation and Quality Control (EOS) and began in 2003 coming into force in 2006. According to the EOS regulations will be upgraded every 3 years.

In order to enforce the Ministerial Decrees concerning standards and labelling programmes a new Ministerial Decree has been issued defining the roles of each organisation and establishing the penalties to be applied in case of non-compliance. Accordingly a specific Energy Efficiency Unit (EEU) has been established at the Egyptian Organisation of Standardisation and Quality Control (EOS) to monitor the situation of MEPS and labels in the market. The Energy Efficiency Unit (EEU) is in charge – amongst other responsibilities - of the following activities: issuing the energy efficiency labels; verifying the level of consumption of appliances; authorising companies to place the label in the product; and maintaining a database with information about labelled products and authorised companies.

Contact details/websites:

http://www.eos.org.eg/Public/ar-eg/

Summary of international influences and alignment with other jurisdictions

International influences[36]: In designing its standards and labelling policies, Egypt has considered the previous work done in the EU. The label design was inspired by the European label and there is a strong degree of harmonisation with EU specifications. Egypt has been collaborating with the EU in efficient lighting and S&L of home appliances under the framework of the MED-ENEC[37] project.

Test procedures: The energy performance test procedures used under in the Egyptian programme are fully aligned with international test procedures issued through the IEC or ISO.

Energy efficiency thresholds and metrics: The energy efficiency measures (indices) used to define efficiency in the MEPS and labelling regulations are partially in line with those of the EU. The energy efficiency thresholds applied in the Egyptian MEPS and labelling schemes do not generally match those used in the EU.

Energy label design: The Egyptian mandatory energy label has similar elements to the EU label in that it has a set of stacked pointed horizontal bars which are colour coded from Green for high effi-

[36] Personal communication from Ibrahim Yassin Mahmoud, Managing Director of UNDP Lighting and Appliances Project for Egypt. November 28th, 2013.
[37] http://www.med-enec.com/

ciency to Red for low efficiency and that are graded from A to E (not G, as there are only 5 efficiency classes on the Egyptian label). In other regards the label is dissimilar (Figure 6-7).

Figure 6-7 The Egyptian energy label (for room air conditioners)

6.6 Ghana

Ghana has equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standards for 3 products
- mandatory energy labelling for 3 products

The Ghanaian equipment energy efficiency programme is implemented by the Ghana Energy Foundation and began in 2005.

Contact details/websites:

http://www.ghanaef.org/

Summary of international influences and alignment with other jurisdictions

Test procedures: Some of the energy performance test procedures used under this programme are fully aligned with international test procedures issued through the IEC or ISO.

Energy efficiency thresholds and metrics: The energy efficiency thresholds applied in the Ghanaian MEPS and labelling schemes are not thought to be internationally aligned.

Energy labels and design: The Ghanaian mandatory energy label uses a star rating scale ranked from 1 star (low efficiency) to 5 stars (high efficiency), it is thus dissimilar to the EU label (Figure 6-8).

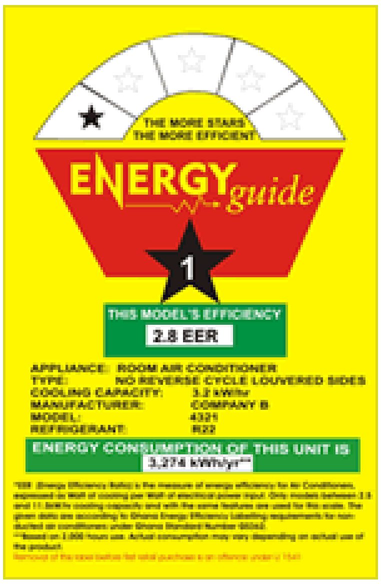


Figure 6-8 The Ghanaian energy label (for room air conditioners)

6.7 India

The government set up the Bureau of Energy Efficiency (BEE) on March 1, 2002 under the provision of the Energy Conservation Act, 2001 to coordinate and implement the energy efficiency policy actions.

The standards and labelling scheme targets display of energy performance labels on high energy end use equipment and appliances. The scheme establishes also minimum energy performance standards. The S&L scheme has been launched on a mandatory basis for air conditioners, refrigerators, fluorescent tube lights and distribution transformers. A voluntary scheme is applied for direct cool refrigerator, general purpose industrial motors, mono-set pumps, open-well pumps, ceiling fans, domestic gas stoves, stationary storage type water heaters, colour televisions and washing machines.

Various organizations play different roles. The Bureau of Indian Standards (BIS) is the national standard body framing standards for safety and performance. The Bureau of Energy Efficiency (BEE) is the regulatory body mandating the energy performance.

Contact details/websites:

http://www.bee-india.nic.in

Summary of international influences and alignment with other jurisdictions

International influences: In designing its S&L policies India has looked at policy work in other jurisdictions and tried to follow the best available practice, however there is no mandate to follow the EU policies in particular. For instance the regulations for IT products follow similar guidelines as those of the US DOE and the refrigerator labelling requirements were influenced by those in Australia.

In terms of EU regulations, the EU policy on automobiles had the maximum impact in India's policies. The washing machine programme was also designed based on the learnings from the EU. India is directly engaged with EU countries through bi-lateral dialogue e.g. Sweden, Austrian, German, UK, etc.

Test procedures: The energy performance test procedures used under this programme in India are generally not fully aligned with international test procedures issued through the IEC or ISO and hence are not fully aligned with those used in the EU; however, some test procedures are aligned and others are inspired by the international equivalents.

Energy label design: The Indian energy label differs significantly from the EU label. The EU label has a set of stacked pointed horizontal bars which are colour coded from Green for high efficiency to Red for low efficiency and that are graded from A to G . Whereas the Bureau of Energy Efficiency uses a star rating system for indicating the energy efficiency of labelled products with 5 stars being the most efficient and one star the least efficient (Figure 6-9).

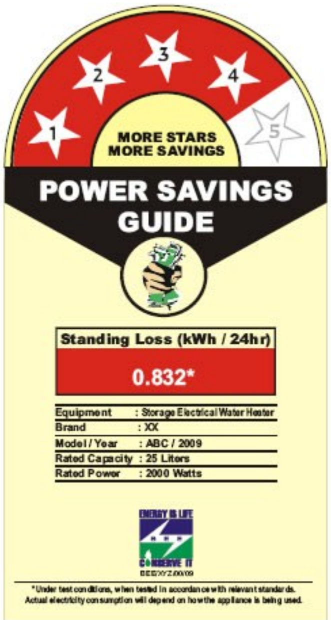


Figure 6-9 The Indian energy label (Water Heaters - Storage)

6.8 Indonesia

Indonesia has equipment energy efficiency regulations comprising:

- Mandatory minimum energy efficiency standards for refrigerators, chillers, lighting systems, and air conditioning packaged terminals.
- Mandatory energy labelling for CFL lamps and voluntary energy labels for refrigerators and room A.C. units.

Additional energy efficiency standards on electrical appliances are currently under development.

The programme is coordinated by the Directorate General of Electricity and Energy Utilisation, Ministry of Energy and Mineral Resources and by the Energy Technology Center, Agency for Assessment and Application of Technology.

Energy efficiency standards and labelling are currently focused exclusively on household appliances, however there are plans to expand the programme to the commercial, industrial and transport sectors.

Contact details/websites:

http://www.esdm.go.id/index-en.html (Ministry of Energy and Mineral Resources)

Summary of international influences and alignment with other jurisdictions

International influences[38]*:* There is ongoing cooperation between the Indonesian Ministry of Energy and Mineral Resources and the EU or entities within the EU, among others with Denmark through DANIDA programme for energy efficiency projects, and the UK with a focus on Energy Management (ISO 50001).

Indonesia has not adopted directly EU standards or labels, however the work done in the EU has served as inspiration and reference. Indonesia would consider alignment of standards and labelling policies with the EU in the future as far as that would comply with national circumstances or regional circumstances such as the development of ASEAN[39] energy efficiency harmonization programmes.

Test procedures: The energy performance test procedures used in the Indonesian programme are generally aligned with international test procedures issued in European Norms.

Energy efficiency thresholds and metrics: The energy efficiency metrics are only partially aligned with those of the EU. Metrics are defined in imperial units.

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[38] Source: Personal communication from Maritje Hutapea, Director of Energy Conservation at the Indonesian Ministry of Energy and Mineral Resources. December 30th, 2013.

[39] http://aseanenergy.org/

Energy label design: The design and appearance of the Indonesian comparative energy label (defined in the Standard SNI 04-6958-2003) is completely different to the EU label (Figure 6-10).

Figure 6-10 The Indonesian energy label

The efficiency rating is defined by means of stars in a 1-4 level scale. In this sense the label has some similarities with the Australian design (defined in standard AS 2575 1989), which was used as a reference for the definition of the Indonesian standard[40].

[40] SNI 04-6958-2003: Standard for Energy Saving Level Label for electrical household appliances.

6.9 Japan

Japan has equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standards for 21 products
- mandatory energy labelling for 7 products
- voluntary energy labelling for 19 products, including tyres

The Ministry of Economy, Trade and Industry (METI) is the key entity responsible for the development and administration of equipment energy efficiency policy in Japan. Specifically it is the Energy Efficiency and Conservation Division within the Agency of Natural Resources and Energy (ANRE), within the Ministry of Economy, Trade and Industry (METI) who manages the Top Runner and energy labelling programmes. The only exception is the case of vehicle efficiency requirements, including those specified under the Top Runner programme, where responsibility lies with the Ministry of Land, Infrastructure and Transports (MLIT).

METI (http://www.meti.go.jp/english/index.html)
ANRE (http://www.enecho.meti.go.jp/english/index.htm)

METI's work is supported by a number of government funded agencies including: the Japanese Institute for Energy Economics (IEEJ) and the Energy Conservation Centre of Japan (ECCJ). It also subcontracts some equipment energy efficiency work to an energy-efficiency NGO, the Jyukanko Research Institute.

ECCJ (www.eccj.or.jp)
IEEJ (http://eneken.ieej.or.jp/en/)

The function of these agencies in helping to support institutional memory and provide technical expertise is considerable, as civil servants within METI will typically only spend three years administering a programme like Top Runner before changing functions.

R&D is supported by the New Energy Development Organisation (NEDO)
http://www.nedo.go.jp/english/index.html

The test procedures used in Japanese regulations are developed under the auspices of the Japanese Industrial Standards Committee (JISC, http://www.jisc.go.jp/eng/index.html) whose members include all the most important testing centres in Japan and is also supported by the Japanese Standards Association (JSA). Accreditation of test labs is carried out by the Japan Accreditation Board for Conformity Assessment (JAB).

Strictly speaking Japan does not operate MEPS in the way China, the EU or the USA does but rather has the Top Runner programme which imposes mandatory minimum fleet-average efficiency requirements that producers or importers have to satisfy for regulated products. What this means is, that instead of each product having to meet a minimum energy-efficiency threshold, that the sales-weighted sum of all products that a producer sells have to meet the specified Top Runner minimum energy efficiency threshold. Including transportation some 23 energy-using product categories are subject to Top Runner requirements (see Appendix B).

Japan operates a rather novel form of mandatory energy label known as the Energy Saving Label, Figure 6-11. Under this labelling scheme products which have met the Top Runner efficiency threshold have a green E logo while those that are below the efficiency threshold have a red logo. The label also indicates the energy efficiency threshold such that 100% is the Top Runner threshold, above 100% is more efficient and below 100% is less efficient than the Top Runner threshold. Typical annual energy consumption is also indicated.

The label requirements state that the labels may be displayed on the packaging, the product itself, the price tags as well as the catalogues.

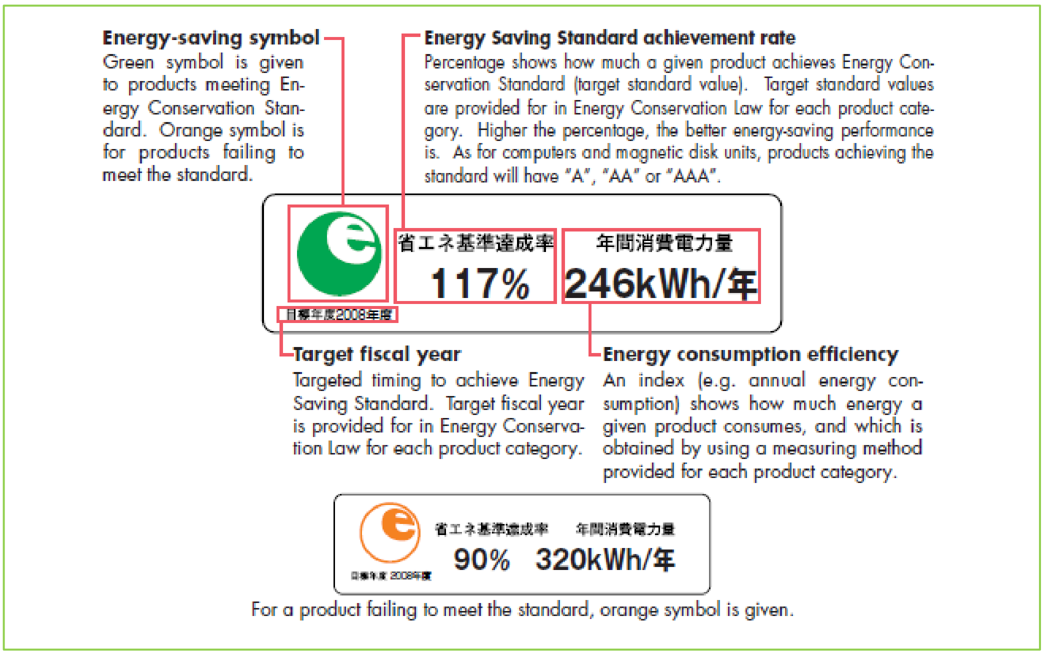

Figure 6-11 Japan's "Energy Saving Label"

In 2006 the Energy Savings labelling programme was complemented by a new mandatory categorical information label for selected product types, known as the "Uniform Energy-Saving Label". This ranks efficiency from 1 to 5 stars (where 1 star is the lowest, given to products that don't meet the Top Runner fleet average efficiency threshold and 5 stars is the highest). It also indicates the average expected electricity bill amongst other information, Figure 6-12.

Figure 6-12 Japan's "Uniform Energy-Saving Label"

METI and IEEJ estimate that about 55% of residential electricity use and about 70% of household energy use is currently covered by Top Runner standards, Figure 6-13 and Figure 6-14.

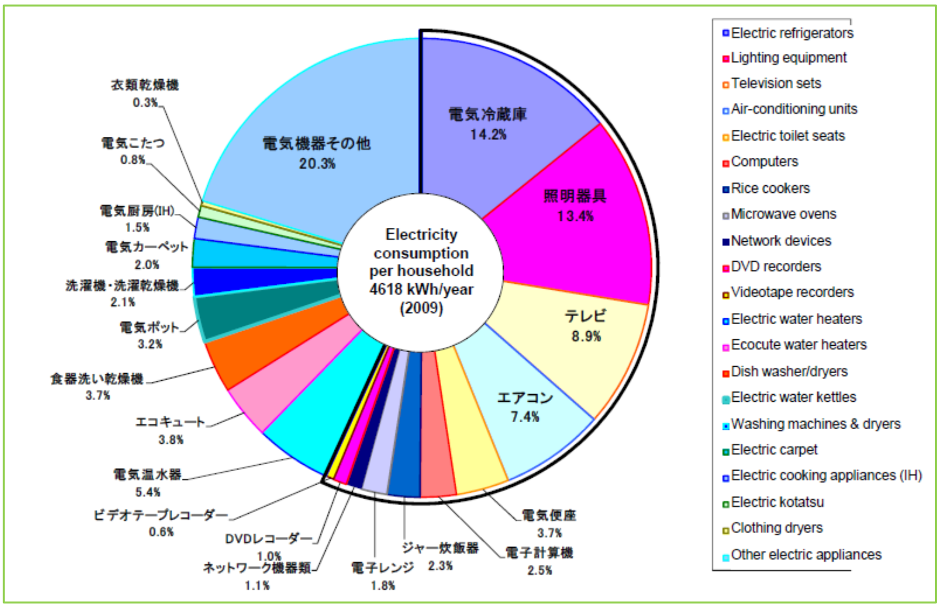

Figure 6-13 Average electricity consumption by end-use in Japanese households in 2009 and the proportion of electricity use covered by Top Runner requirements

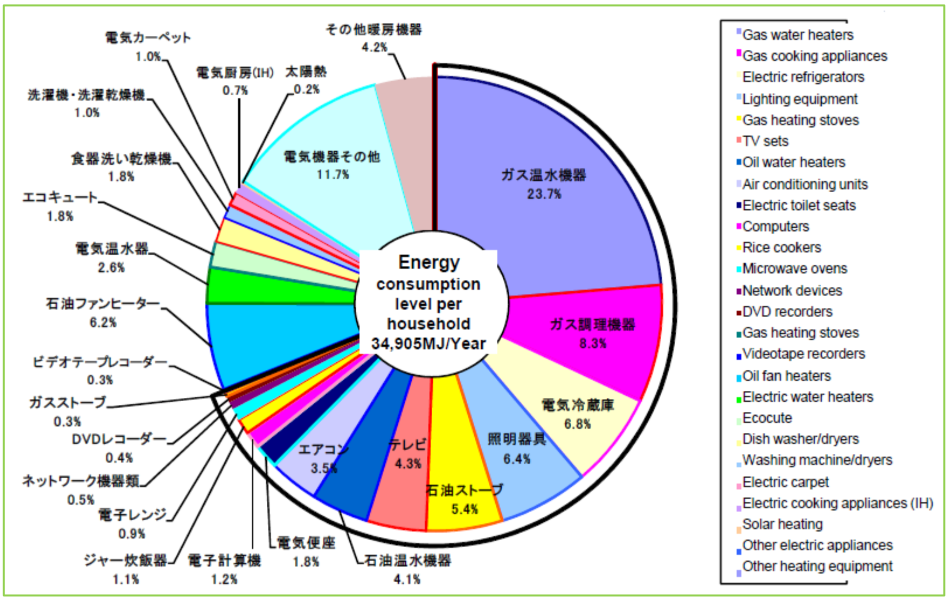

Figure 6-14 Average energy consumption by end-use in Japanese households in 2009 and the proportion of energy use covered by Top Runner requirements

Summary of international influences and alignment with other jurisdictions

International influences: The Top Runner programme sets fleet-average minimum energy efficiency requirements and hence is quite different to Ecodesign. The form of the Japanese label is also different to the EU label. The efficiency thresholds used in both policy instruments are completely independent of those used in Europe. Japan has shown itself to be quite eager to engage in international dialogues on equipment energy efficiency and in particular has reached out to China to encourage it to strengthen its product efficiency programme and even consider adopting a Top Runner approach. Japan is also active in many international fora addressing product efficiency including: IEA 4E (although not the benchmarking annex), SEAD, APEC, IEA, IPEEC (where it has played a key role), etc. Japan's product efficiency administrative capacity is relatively lean and so there is unlikely to be much scope for those most closely engaged in the Top Runner programme to commit a significant amount of time to internationally orientated activities; however, METI does have supporting capacity from experts, NGOs, satellite agencies etc. and staff from these bodies may be able to commit more time to support international engagement.

Test procedures: Some of the energy performance test procedures used in the Japanese programme are aligned with international test procedures issued through the IEC or ISO; others are quite different. Japan's stated policy is to use international test procedures whenever they are available and deemed satisfactory for the purpose required. When international test procedures are not available or not suitable the authorities will either develop a national test procedure, or they may consider using another country's national standard. In practice energy test procedures used in Japan are a mix of national and international test procedures, although even when there are material differences between them, many aspects of the national test procedures are likely to correspond to elements found in international test procedures, unless there were no relevant international test procedures at the time the national test procedure was adopted.

The summary document describing the Top Runner Programme issued by METI states:

"Principle10. Measurement methods should bear domestic and international harmonisation in mind. If a standard has been already established, the measurement method should harmonise with the standard to the extent possible. Where no measurement method standard exists, it is appropriate to adopt specific, objective, and quantitative measurement methods based on actual equipment usage."

And goes on to assert:

"Measurement methods should be based on specific equipment's actual usage. If a measurement method has been established through voluntary or compulsory standards, including International Standards and Japanese Industrial Standards (JIS), it is appropriate to adopt relevant measurement methods that ensure domestic and international harmonisation. When no measurement method exists as described above, the measurement method should be objective and quantitative."

Thus, harmonisation with international test procedures is asserted as a specific objective albeit a non-binding one. Currently it is thought that Japan's test procedures are equivalent or reasonably equivalent with international test procedures for: lighting equipment, motors, some ICT equipment and transformers. For refrigerators and air conditioners there are some important differences. For other appliances the degree of similarity remains to be assessed.

While pointing out the benefits of harmonisation it is also important to be clear that the opposite can also occur. Japan's policy of harmonising national test procedures with international ones led to the abandonment of national refrigerator test procedure in favour of the international test procedure in the early years of the Top Runner programme. The national test procedure had many similar elements to the international one but also had some key differences including the choice of ambient (room) temperature when testing and the use of door openings. Some years after adopting the international test procedure field energy measurements were conducted from which it was found that the actual *in situ* energy consumption of refrigerators was much higher than recorded under the international test procedure. Furthermore, and worse, it was found that the international test procedure did not produce a correct ranking of the actual product energy efficiency. Therefore a decision was made to adopt a test procedure closer to the original Japanese test procedure and to once again diverge from the international test procedure. As a result the test results are now more representative of actual usage conditions in Japan but it is much more complicated to compare efficiency levels of Japanese products with those sold elsewhere. The Japanese authorities have not given up on international harmonisation, however, and now there are on-going efforts inspired by this and similar experiences in other economies to improve the general applicability of the international test procedure (which already works quite well for many usage conditions and refrigerator types). Partly as a result of these efforts the IEC has now prepared a new draft international test procedure which it is hoped will give more representative results in all economies. Final voting on this test procedure is expected this year but if it is adopted it will likely have implications for the EU Ecodesign and labelling requirements and work may be needed to recalibrate these if the IEC test procedure is also adopted in the EU (as is common). If adopted the new IEC test procedure does hold out the possibility of North America, Europe, China/Asia and Japan all being able to use the same test procedure, however, and thus ultimately facilitate trade, technology transfer and regulatory comparison.

Energy efficiency thresholds and metrics: Historically the energy efficiency levels of Japanese equipment and regulations have not been directly benchmarked against those in other economies and because of differences in test procedures it is not a simple matter to make these comparisons. In recent times there have been some efforts to bridge this gap although much still remains to be done.

Benchmarking of regulatory stringency carried showed that the Japanese Top Runner requirements for the most common categories of room air conditioner were substantially more demanding than those in place in the EU, the USA, Korea or China and it is clear that the average efficiency of air conditioners sold in Japan are much higher than for other leading markets.

Energy labelling: The Japanese energy labels differ quite significantly from those used in the EU.

6.10 Jordan

Jordan has equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standards for 10 products
- mandatory energy labelling for 7 products.

The activities to oblige importers and manufacturers of energy consuming appliances to fix "energy efficiency label " indicating the annual consumption of the equipment" on their product is implemented by National Energy Research Centre (NERC), Institution of Standards and Metrology (JISM) and Ministry of Energy & Mineral Resources (MEMR).

Contact details/websites:

http://www.nerc.gov.jo
http://www.jism.gov.jo/
http://www.memr.gov.jo

Summary of international influences and alignment with other jurisdictions

International influences: The Government of Jordan started the process to establish an energy labelling system and energy standards programme for household appliances in 2010 in cooperation with the United Nations Development Programme (UNDP)[41]. The EU Ecodesign and Energy Labelling Directives constitute the basis for the design of the programme in Jordan.

Test procedures: The energy performance test procedures used under the Jordan programme are aligned with international test procedures issued in European Norms.

Energy efficiency thresholds and metrics: The energy efficiency measures (indices) used to define efficiency in the MEPS and labelling regulations and therefore the energy efficiency thresholds applied in the Jordanian MEPS and labelling schemes match with those used in the EU.

Energy label design: The Jordan mandatory energy label is completely aligned to the EU label in that it has a set of stacked pointed horizontal bars which are colour coded from Green for high efficiency to Red for low efficiency and that are graded from A to G.

[41] http://www.undp.org/content/jordan/en/home/operations/projects/environment_and_energy/EE.html

6.11 Kenya

Kenya is in the process of developing equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standards for 6 products
- mandatory energy labelling for 2 products
- voluntary efficiency requirements for 1 product

The Kenyan equipment energy efficiency programme is implemented by the Kenya Bureau of Standards (KBS).

Contact details/websites:

http://www.kebs.org/

Summary of international influences and alignment with other jurisdictions

As the requirements are under development, extent of international influences and alignment are not yet known.

6.12 Korea

Korea has equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standards for 30 products
- mandatory energy labelling for 22 products, including tyres
- voluntary energy labelling for 46 products

The Korean equipment energy efficiency programme is implemented by the Ministry of Knowledge Economy (MKE) and Korea Energy Management Corporation (KEMCO). The Korean Agency for Technology and Standards is responsible for industrial standards and technical evaluation. The equipment standards and labelling programme began in 1992.

The 26 products subject to MEPS and labelling are: refrigerators, freezers, kimchi refrigerators, air conditioners, washing machines, horizontal drum washing machines, dish washers, dish driers, water coolers, rice cookers, vacuum cleaners, electric fans, air cleaners, incandescent lamps, fluorescent lamps, CFLs and CFL ballasts, 3-phase electric motors, household gas boilers, adapter-chargers, electric driven heat pumps, commercial refrigerators, gas water heaters, distribution transformers, windows and TVs. Labelling for tyres was introduced as voluntary label in 2011 but became mandatory in November 2012

To stimulate demand for the highest efficiency appliances Korea also operates a voluntary endorsement labelling scheme known as the Energy Boy (Figure 6-15). Products which are eligible for the Energy Boy scheme can apply to receive an energy efficiency certificate with the Energy Boy logo included providing their product's energy performance is verified in an approved third party test lab. Purchasers of these products are eligible to receive rebates. Furthermore public sector agencies are also required to preferentially procure products with the Energy Boy certificate, which creates additional market pull.

Voluntary "Energy Boy" endorsement label for highest efficiency products	Voluntary Energy efficiency certificates and rebates for high efficiency products, from 20XX
	

Figure 6-15 Korea's endorsement energy label and energy certificate scheme

There's been no thorough publicly available assessment of what proportion of Korea's product energy consumption is covered by the efficiency standards and labelling programme. An estimate of the national average breakdown of household electricity consumption is shown in Figure 6-16 and matching this against the MEPS in existence suggests that at least 62% of residential electricity consumption is covered by MEPS and mandatory labelling and probably closer to 80%. The coverage of equipment energy use in the commercial and industrial sectors will be much lower.

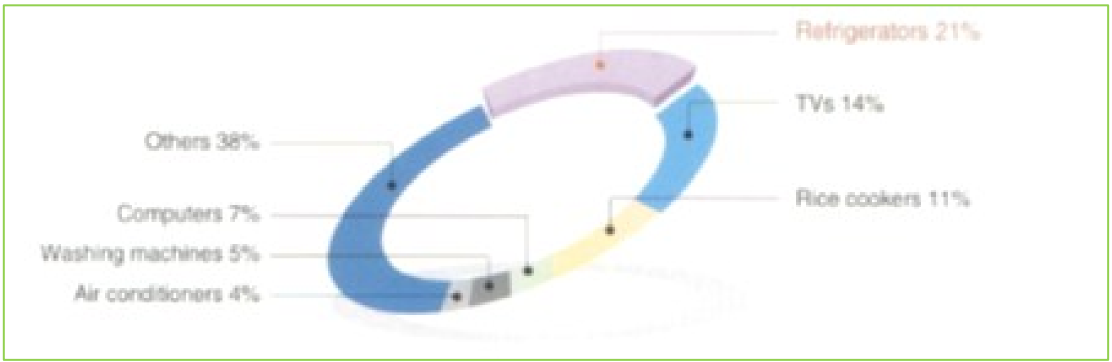

Figure 6-16 Korean household electricity consumption by major end-use

Contact details/websites:

www.kemco.or.kr
www.mke.go.kr

Summary of international influences and alignment with other jurisdictions

International influences Korea does not yet publish details of the process it follows to develop its MEPs and labelling requirements and there appear to be no associated technical documents in the public domain. Unlike China, Korea has followed an entirely self-contained process to develop its requirements and while there are some Korean subject experts with outside links to the international equipment energy efficiency community they tend to have been mostly focused on test procedure development and internationally orientated collaborative projects rather than in sharing experience useful for the development of Korea's domestic regulations. Korea is engaging in a number of international initiatives addressing equipment energy efficiency including: IPEEC, G8 Summits and G20 meetings; SEAD; IEA-4E Annexes on: Benchmarking, Standby, Motors, Lighting and Set-top boxes; the APEC EGEE&C for energy related projects; and previously some 55 projects on Buildings and Appliances within the APP initiative.

Test procedures: The energy performance test procedures used under the Korean programme are mostly, but not always, aligned with international test procedures issued through the IEC or ISO. Hence they are often fully aligned with those used in the EU.

Energy efficiency thresholds and metrics: The efficiency metrics used are sometimes fully aligned, but more often partially aligned with those used in the EU. In some cases there is no alignment.

The Efficiency levels (thresholds) used in Korean MEPS and labelling regulations are not thought to be aligned with those used in the EU although EU regulations are assessed when Korean regulations are being prepared and help inform them.

Energy labelling: The Korean mandatory energy label is a categorical design (i.e. it denotes efficiency through a set of efficiency classes as does the EU's), and it was revised from its earlier form to imitate the colour coding used in the EU label (Green for high efficiency to Red for low efficiency). The grades, however, are from 1 (more efficient) to 5 (less efficient) and there are only 5 efficiency classes on the Korean label (Figure 6-17).

Figure 6-17 The Korean energy label (for Dishwashers)

Other general points regarding closer potential alignment with the EU
The National Energy Resources Technology Development Basic Plan emphasises strengthening international cooperation and information sharing and Korea has recently stepped up its international engagement with energy efficiency policy development and product policy in particular. Given this the timing may be good to propose stronger cooperative engagement between EU and Korean regulatory processes. Some of the areas which are likely to be of interest are:

- Threshold ambition analysis i.e. improved benchmarking of product efficiency requirements to properly reflect differences in test procedures and efficiency metrics
- The sharing of technical analyses so results can be input into Ecodesign product studies in order to improve the quality of their technical assumptions (e.g. for commercial refrigerators, distribution transformers, windows and TVs)
- Greater engagement with Korea in test procedure development and alignment within IEC/ISO
- Cooperative efforts on regulatory efforts for specific products in the regulatory pipeline.

6.13 Mexico

Mexico first adopted energy efficiency standards in 1992 (CLASP Mexico, 2006) under the supervision of the National Commission for Energy Saving - CONAE[42]. Mexican policy is strongly influenced by the United States. This country's programme has a primary focus on MEPS while labelling is considered a complementary instrument. In 1995 the Sello FIDE[43], a voluntary energy efficiency endorsement label awarded by the FIDE Commission, was introduced with the purpose of promoting the efficient use of energy in industry, small and medium companies, residential and agricultural sectors. The initiative also provides technical and financial support for consumers or projects that improve productivity, contributes to the economic and social development and the preservation of the environment. This label is awarded to products that achieve higher levels of energy savings. In 2008, the Sustainable Use of Energy Law transferred the authority for energy efficiency standards from CONAE to the just-created CONUEE[44] which established energy efficiency standards for a total of 15 product categories and seven system categories (CLASP Mexico, 2006). CONUEE also issued mandatory comparative label standards for home appliances and was in charge of the development of standards including MEPS. Test procedures for determining the equipment performance and their compliance is also a responsibility of this institution.

Mexican energy efficiency policy is based on MEPS for a large number of appliances and is complemented with a mix of labelling policies, but especially with label endorsement. CONUEE developed a minimum efficiency performance standards programme and other incentives for efficient use of energy.

Mexico has equipment energy efficiency regulations comprising:

- Mandatory minimum energy efficiency standards for 32 products;
- Mandatory energy labelling for 15 products;
- Voluntary energy labelling for 46 products.

Responsible implementing ministry:

- **SENER** - Energy Department -Secretaría de Energía (in Spanish)
- **CONUEE** - National Commission for Energy Efficiency - Comisión Nacional para el Uso Eficiente de la Energía (in Spanish)
- **IIE** - Electrical Research Institute - Instituto de Investigaciones Eléctricas (in Spanish)
- **FIDE** - Federal Electricity Commission - Comisión Federal de Electricidad (CFE) y FIDE
- **ANCE -** National Standardization and Certification Association for the Electrical Sector (in Spanish Asociación Nacional de Normalización y Certificación del Sector Eléctrico)

Details/websites:

http://www.sener.gob.mx – SENER -Energy Department

http://www.conuee.gob.mx – CONUEE - National Commission for Energy Efficiency

www.iie.org.mx – *IIE* - Electrical Research Institute

www.fide.org.mx – *FIDE* - Federal Electricity Commission

[42] CONAE – Comisión Nacional para el Ahorro de Energía
[43] Sello FIDE Fideicomiso para el Ahorro de Energía Eléctrica
[44] CONUEE – Comisión Nacional para el Uso Eficiente de la Energía

www.semarnat.gob.mx – *Department of the Secretariat of Environment*
www.ance.org.mx - *National Standardization and Certification Association for the Electrical Sector*

Summary of international influences and alignment with other jurisdictions

International influences: According to the available literature and to the responses given through stakeholder consultation it is clear that the motivation behind the Mexican system is based on four main factors: reducing energy consumption (energy savings), minimizing environmental impacts, ensuring energy supply for all Mexican population. In addition to these, external pressure from the US market is important. The US market is very important for Mexican trade balance in terms of exports, all manufacturers in Mexico (native or not) look at the US as the main destination for their products. So compliance with US requirements is extremely important. The Mexican scheme is therefore heavily influenced by the US and not by the EU. CONUEE has bilateral meetings with its counterparts in the USA for the development of Energy Efficiency Standards. CONUEE evaluates the issues and considers specific agreements for the development of standards. Although, the main influence is from US, the stakeholder consultation process brought out that there is a great need of improving buildings construction quality, and the EU building code is seen as a good example to copy.

Energy efficiency thresholds and metrics: MEPS, which are the focus of the energy efficiency policies in Mexico, are very similar to the American standards. MEPS in Mexico are very effective, and together with the EE programmes implemented, have brought about a real market transformation, which is shown by an ex-post evaluation carried out by LBL (Letschert, V. et al. 2013). There is no alignment between Mexican and EU MEPS.

Test procedures: In terms of adoption of international test standards (ISO and IEC), Mexico establishes their own standards based on domestic industry requirements[45]. In practice, these requirements are established by the US market as mentioned before. Some interviewees expressed a view that international test standards are not helpful for domestic use due to specific demands from the social and economic point of view. Mexican test procedures have no alignment with those in the EU.

Energy label design: The evidence of US influence can also be seen in the Mexican labels which are similar to the US labels. However, a recently adopted label for cook tops/ovens shows some similarities with the European label with respect to the efficiency levels, and uses an efficiency rating ranging from A to E. Since this is the only appliance in Mexico with this metric, the motivation to have this new appearance would need to be determined before any alignment with the EU label can be confirmed. The figure below shows the difference between the label used in Mexico for most appliances and the EU label design.

[45] Information from the stakeholder interview

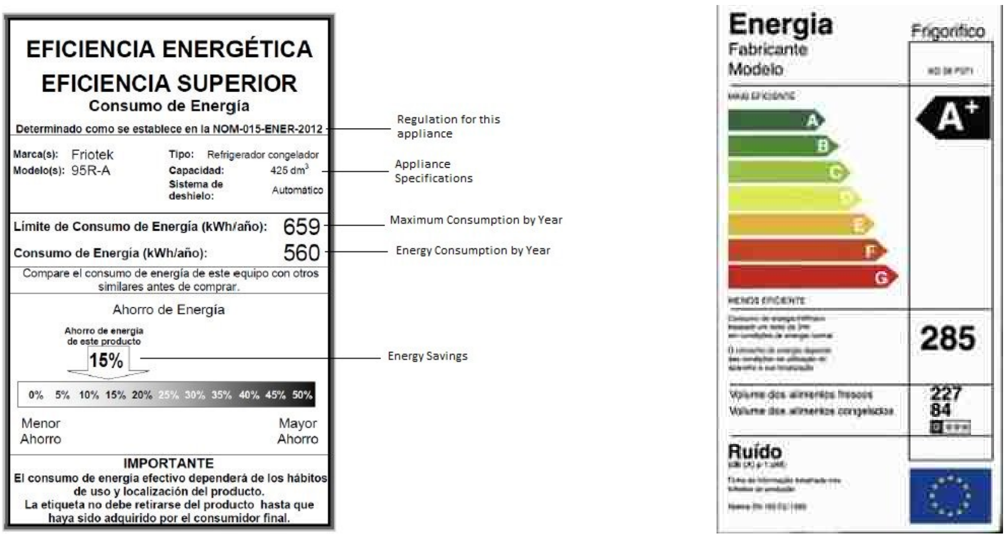

Figure 6-18 Mexican energy labels vs. EU

6.14 Nigeria

Nigeria is in the process of developing equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standards for 5 products
- mandatory energy labelling for 5 products
- voluntary requirements for 2 products

The Nigeria equipment energy efficiency programme is implemented by the Energy Commission of Nigeria.

Contact details/websites:

http://www.energy.gov.ng/

Summary of international influences and alignment with other jurisdictions

As the requirements are under development the similarities with EU policy measures are not yet known. The energy performance test procedures to be used under this programme are not yet known.

6.15 The Philippines

The first development in energy efficiency in the Philippines was a MEPS programme that begun in the early 1990's. This programme was jointly run by the Department of Energy[46] (DOE) and the Bureau of Product Standards (BPS).

The National Appliance and Equipment Energy Efficiency Programme (NAEEEP) is part of the National Greenhouse Strategy that targets energy efficiency of home appliances, industrial and commercial equipment. This programme includes mandatory policies regarding labelling and MEPS, voluntary measures including endorsement labelling and training support to promote the best available products.

The legislative development process is carried out through a technical committee approach. This committee is composed of members from the BPS, the DOE, representatives from industry (manufacturers, importers and suppliers), consumer and professional groups, research institutions and testing laboratories. The technical committee approach follows a formal procedure which includes research and testing, consultation, approval stages and promulgation.

The energy efficiency policy programme is driven by the need to reduce the dependence on imported fossil fuel, increase industrial competitiveness and reduce environmental impacts. The primary goal

[46] DOE – Kagawaran ng Enerhiva

that programme is to increase awareness among users of energy in the commercial, industrial, transport and household sectors, on how to use energy efficiently. DOE has recognized the important role of energy efficiency and energy conservation in achieving the goal of cutting down on energy consumption with the benefit of reducing environmental emissions. DOE has been implementing and coordinating energy conservation programmes to promote the efficient use of energy, and establishing energy standards and labelling programmes for several appliances.

In the Philippines the following equipment energy efficiency regulations are in place:

- Mandatory minimum energy efficiency standards for 4 products;
- Mandatory energy labelling for 21 products;
- Voluntary energy labelling for 1 product.

Responsible implementing ministry:

- **DOE** - Department Of Energy – Kagawaran ng Enerhiya (in Malayo-Polynesian);
- **BPS** - Bureau of Product Standards – is part of the Department of Trade and Industry;
- Energy Research and Testing Laboratory Services (part of Department of Energy);
- Technical committee comprising representatives of academics trade/industry associations, consumer/users associations, professional associations, research and testing institutions, government agencies;
- **FATL** - Fuels and Appliance Testing Laboratory - Part of the DOE, FATL conducts product energy efficiency testing.
- **AHAM** - Association of Home Appliance Manufacturers - Part of Technical Committee which defines standards.

Details/websites:
http://www.doe.gov.ph – DOE -Department Of Energy
www.bps.dti.gov.ph – BPS - Bureau of Product Standards
www.doe.gov.ph/ertls/LATL.htm - Energy Research and Testing Laboratory Services
http://www.aham.org/ - AHAM - Association of Home Appliance Manufactures

Summary of links and similarities with equivalent EU policy measures

International influences: The main international influences are from the USA and Canada and there is less influence from the European Union. With assistance of the UNDP, the government has set up the first Fuel and Appliance Testing Laboratory (FATL), a neutral entity that can verify the degree of compliance that manufactures claim for their appliances. The Philippine Energy Efficiency Project (PEEP 2009-2013) is being developed with the support and funding of the Asian Development Bank (ADB) and it aims to demonstrate the societal benefits of implementing energy efficiency and conservation. ASEAN is a very strong drive for the S&L programmes in is this region. It works towards regional harmonization and aims to accelerate the economic growth, promotes active collaboration and mutual assistance on matters of common interest in the economic, social, cultural, technical, scientific and administrative fields. It also provides assistance to each associate in the form of training and research facilities in the educational, professional, technical and administrative spheres. An important EU effort to incorporate energy efficiency training in the engineering syllabi of leading universities in

ASEAN was done with the establishment of exchange programmes with universities in Germany. Another EU cooperation programme, SWITCH-Asia, aims to promote the adoption of Sustainable Consumption and Production (SCP) among small and medium sized enterprises and consumer groups in Asia. SCP is an attempt to reconcile the increased demand for goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, in order not to jeopardize the needs of future generations.

Energy efficiency thresholds and metrics: For most appliances the thresholds are unknown, because policies that cover them are under development. According to stakeholder consultation the labelling efforts are slowly gravitating towards the simplicity of the EU standards and EU published documents are often used to provide regional benchmarks for EE standards and policies.

*Test procedures***:** ISO and IEC norms are followed for test procedures so there is partial alignment with the EU. It is recognised that following international procedures can be useful to minimise costs.

Energy label design: There is no alignment with EU. There is a very high degree of alignment with US policy and label appearance, more specifically with the Canadian ENERGUIDE. This programme uses a comparison type of label which allows consumers to compare the energy cost of competing brands and models of similar size, capacity or rating. It aims at reducing monthly electricity bills for end users, eliminating the least efficient products from the market and it encourages manufacturers to improve appliances efficiency to make their product more competitive in the world market.

Figure 6-19 illustrates the differences between the label appearance between the Philippines and EU.

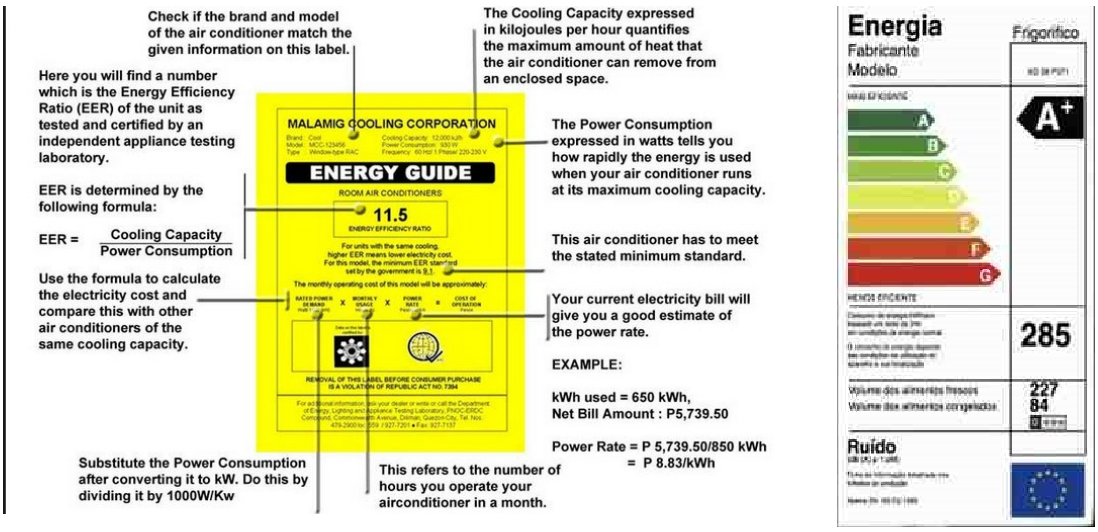

Figure 6-19 Comparison between Philippines Energy label (left side) and EU label (right side) Source: DOE (Huliganga, 2012) and European Commission (European Commision, n.d.)

6.16 Russia

Russia has equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standards for lamps, banning 100W incandescent bulbs since 2011 and 75W from 2013.
- mandatory energy labelling for 7 products was due to take effect in late 2013 but at October 2013 had not yet passed WTO approval.

There is no single Russian government body with clear responsibility to lead on energy efficiency product policy, but in the medium term this is likely to fall to the Eurasian Economic Commission, Department for Technical Regulation and Accreditation. This body will oversee technical product standards for the 'Customs Union' of Russia, Belarus and Kazakhstan, though interviewees were not yet clear how proactive on eco-design standards the Eurasian Commission will be. One interviewee asserted that the majority of Customs Union standards are those of the Russian Federation. See http://www.eurasiancommission.org/ru/act/texnreg/deptexreg/Pages/default.aspx.

Voluntary labelling schemes are under-developed in Russia, with mandatory schemes also proving challenging to enforce.

Contact web sites:

- Russian standards and technical regulations
  http://runorm.com/gost-gost-r-standards
- Technical standards of the Customs Union (of Russia, Kazakhstan and Belarus)
  http://www.eurasiancommission.org/ru/act/texnreg/deptexreg/tr/Pages/default.aspx
- Russian Energy Agency
  http://rosenergo.gov.ru/info/
- Federal Agency on Technical Regulation and Metrology
  http://www.standard.gost.ru/wps/portal/

Any energy efficiency standards (including labelling standards) currently appear only voluntary due to an overarching 2002 law (№184-FZ) that decrees all products standards are voluntary except those involving hazards to life and health etc. Political and legal initiatives are underway to work around or repeal this. A rather comprehensive system of rules and procedures is in place to develop product standards, including certification systems and direct transposition of many EU test standards for appliances, but they do not yet include any mandatory requirements regarding energy efficiency other than for lamps. However, a number of voluntary schemes have been started in various regions.

There is a framework law with the intent of mandatory standards and declarations (№261-FZ). The first Federal technical regulation detailing efficiency indices and thresholds for labels was due to take effect in September 2013 covering seven product types.

Interviewees confirmed that Russia follows the EU approach in everything related to technical regulations and standards. Progress towards harmonisation is underway.

The drive for harmonisation is strongly and openly motivated by a desire to reduce paperwork, reduce necessity for multiple product ranges (for different regulations) and increase trade between Russia and the EU. These are from Government and industry points of view. Russia now follows the EU approach in technical regulations and standards and the new Federal energy label follows closely the EU A to G coloured scale with technically similar (but not identical) EEI calculations (Figure 6-20). The national standards body Rosstandart is working on transposing EU MEPS into Russian standards to facilitate bilateral trade as part of a working agreement with CEN CENELEC. There are a number of working groups, task forces, etc. that work on developing Russian standards that approximate those of the EU. However, an interview with an influential representative of a multi-national appliance manufacturer showed that there is strong resistance to making the same 'mistakes' made by the EU on energy labels - i.e. having a closed A to G scheme that poses major challenges when re-scaling is required. He also indicated that there would be strong resistance from influential Belarussian manufacturers to mandatory eco-design requirements, though labelling would be largely welcomed.

There are several specific initiatives in hand to assist progress on product standards:

- A framework programme called "*Standards and Labels for Promoting Energy Efficiency in Russia*" with $7.8M GEF funding for 2010-2014 is piloting in the Moscow area and sponsoring development of EU style test methods, voluntary labelling, institutional capacity building and awareness raising activities. Focus is on washing machines, fridges, water pumps, industrial air conditioners, fans and chillers. Transposed IEC standards, most including energy labelling requirements (that remain voluntary until a supporting regulation comes into force), have been published or drafts submitted to GOST covering most of these products at October 2013. (www.label-ee.ru). An interview with the project manager indicated that this project does not yet have any good operational links with EU institutions, organisations or NGOs and is very much aiming to develop these. Also to become better acquainted with the EU regulatory process.
- An EBRD project helping a Russian arm of the Association of European Businesses to set up a voluntary endorsement labelling scheme for best performing motors, windows and refrigerators: *Energy Efficiency Labelling: Stimulating investment in energy efficient equipment in Russia.* Deployment is incentivised as the labels will facilitate loan disbursements to certified products from the Russia Sustainable Energy Finance Facility (RuSEFF). The scheme was formally launched on 18 September 2013[47].
- The EuropAid project "Approximation of EU and RF technical regulation and standardisation systems" is designed to provide tailored support in overall national efforts towards closer alignment and the key reference frame for operations is the EU regulatory framework. Areas of action include market surveillance, conformity of voluntary standards, technical regulations and standards and market education. This lead to the formal agreement between CEN,

[47] http://aebrus.ru/en/news/index.php?ELEMENT_ID=714552

CENELEC and Rosstandart mentioned above, for closer collaboration on standardization to facilitate trade in goods between Europe and Russia. (http://eu-rf.org)

It would appear that focused EU support at high level and on technical issues could lead to significant progress on harmonisation across the whole Customs Union (Russia, Belarus and Kazakhstan) which has a combined population of over 170 million people (one third that of the EU).

Summary of international influences and alignment with other jurisdictions

International influences: Russian test methodologies fully harmonised with their EU equivalents are already in existence for at least 8 product groups: refrigerators, washing machines, dishwashers, washer-dryers, clothes dryers, ovens & grills, air conditioners & chillers, induction motors, plus for standby power. A further set of test methodologies covering a further 4 product groups have been identified with an unknown level of harmonisation with those of the EU relating to energy efficiency: circulator pumps, TVs, lamps and water heaters. Details are given at the end of this section.

*Energy efficiency thresholds and metrics***:** The only mandatory MEPS identified are those for incandescent lamps which align closely with EU equivalents: these have banned 100W lamps from 2011 and 75W lamps from January 2013; all incandescent lighting above 25W is prohibited from January 2014. No other specific mandatory or voluntary MEPS have been identified to enable comparison with EU equivalents.

*Test procedures***:** Fully harmonised IEC test methodologies have been identified for ten product groups: Washing machines, dishwashers, clothes washer-dryers, refrigeration appliances, standby power, Tumble dryers, Electric cooking ranges, hobs, ovens and grills; Air conditioners; single-speed, three-phase, cage-induction motors.

Energy labelling: The first detailed technical regulation for energy labelling of seven products was due for adoption in 2013 using an A to G label very clearly following the EU format (Figure 6-20), albeit simpler than the more recent EU labels that are packed with additional detail. The thresholds appear in most of these seven cases to be similar or identical to the EU ones. No mandatory energy labels actually in force have been identified (despite existence of regulations stating they should be, but lacking any implementing details).

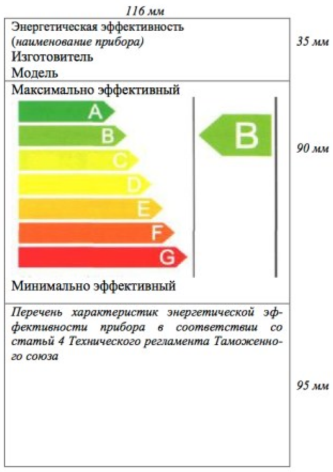

Figure 6-20 Image of the proposed single energy label[48] for Russia as applicable to seven product groups under the draft of Technical Regulation of the Customs Union on informing of consumers on energy efficiency of electrical energy-consuming devices[49].

[48] Text on the label translates as: *Energy Efficiency; (name of the device) ; Manufacturer ; Model ; The most effective ; The minimum effective; The list of characteristics of the energy efficiency apparatus in accordance with Article 4 of the Technical Regulations Customs Union.*

[49] Draft regulation, in Russian, available from http://www.tsouz.ru/db/techreglam/Documents/TR%20Energoeffect.pdf.

6.17 South Africa

South Africa has equipment energy efficiency regulations comprising:

- Mandatory minimum energy efficiency standards for residential lighting systems (fluorescent lamps)
- Mandatory energy labelling for refrigerators and freezers and voluntary energy labels for clothes washers, dryers, combinations of clothes washers and dryers, room air conditioning equipment, dishwashers, ovens and televisions

The South African (SA) National Energy Efficiency Strategy (NEES) outlines a number of energy demand reduction targets for different economic sectors amounting to a total 12% reduction in energy demand by 2015.

For the residential sector, the National Regulator for Compulsory Specifications (NRCS) sets compulsory specifications for priority products used in households. The compulsory specifications make reference to product minimum energy performance standard set out by the South African Bureau of Standards (SABS).

The SA mandatory standards and Labelling (S&L) programme, coordinated by the Department of Energy will be introducing 12 energy efficient household appliances in the period 2013 to 2017.

Contact details/websites:

http://www.energy.gov.za (Department of Energy)
http://home.sanas.co.za/
https://www.sabs.co.za/

Summary of international influences and alignment with other jurisdictions

International influences: South Africa generally follows the European system for energy performance standards and energy labelling in designing its own regulations. This strategy enables the imports of products – a substantial part of them from Europe - to flow freely without having to be re-tested and relabelled[50].

Test procedures: The energy performance test procedures used under the South African programme are aligned with international test procedures issued in European Norms.

Energy efficiency thresholds and metrics: The energy efficiency measures (indices) used to define efficiency in the MEPS and labelling regulations match with those used in the EU. The thresholds to define MEPS may differ from those established in the EU (National Regulator for Compulsory Specifications, 2013).

[50] Source: http://www.energy.gov.za/files/faqs/faqs_energyefficiencystandards.html

Energy label design: The design and appearance of the South African comparative energy label is fundamentally the same as that used in European Union (Figure 6-21). The main difference being that the EU flag is replaced by the energy star, the Department of Energy symbol for the Energy Efficiency Initiative[51]. The minimum standards for many appliances have also been adopted from the European market.

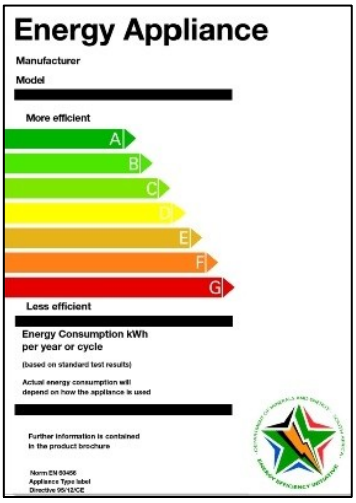

Figure 6-21 South African comparative energy label for refrigerators

[51] DoE website. Available from: http://www.energy.gov.za/files/faqs/faqs_energyefficiencystandards.html Last accessed November 2013.

6.18 Tunisia

Tunisia has equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standard and energy labelling schemes for refrigerators, freezers and air conditioners.

The Tunisian standards and labelling programme for household appliances and other energy using equipment began in 2004. The programme is implemented by l'Agence Nationale pour la Maitrise de l'Energie (ANME). ANME was established in 1985. It is a non-administrative public entity belonging under the authority of the Ministry of Industry, Energy and Small and Medium Enterprises. The mission of ANME consists in implementing the State policy in the field of energy conservation, and this based on rational energy use, the promotion of renewable energies, as well as energy substitution.

Summary of international influences and alignment with other jurisdictions

International influences: The Tunisian S&L project has made an extensive analysis of the Tunisian appliance market, after which it was decided that Tunisia would benefit most from adopting the European appliance policy for refrigerators, with minor adaptations.

Test procedures: The method used to calculate the efficiency index for refrigerators is mostly harmonised with that applied in the EU. The work was based on ISO and European EN 153 norms: a specific norm 'NT 81.70' was issued by the Tunisian Institute for Standardization in 2001.

Energy efficiency thresholds and metrics: The thresholds used for labelling purposes have some differences. The Tunisian class 1 corresponds to an energy efficiency index (EEI) of 42% or less. Although this threshold is nominally the same as the EU A+ threshold it is calculated with the same formulae used to calculate the EU G to A classes and hence is slightly more stringent than the EU A+ requirement. By contrast there is no higher threshold corresponding to the EU A++ class. The other Tunisian label classes 2 down to 8 correspond one to one with the EU label classes of B to G.

Energy label design: Since September 2004, Tunisian law requires the display of an EU-style energy label (Figure 6-22). The label also has eight classes, in the form of stacked bars and colour progression from red to green. The top class represents the recently added EU A+ and A++ classes. However as Tunisia is mostly a bilingual country, a bilingual label design (both Arabic and French) was adopted and the numbers 1-8 indicating classes instead of letters).

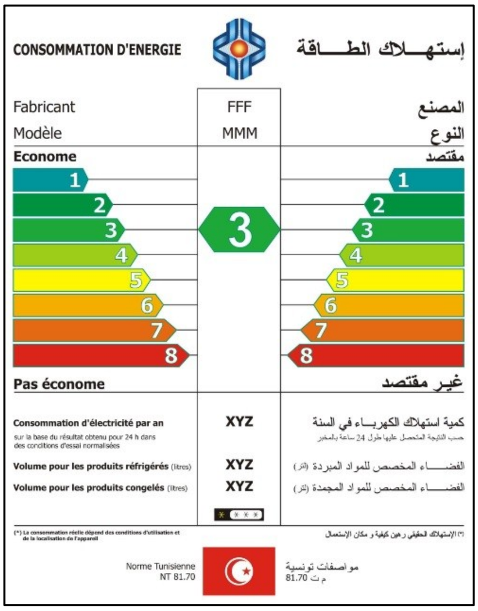

Figure 6-22 Tunisian comparative energy label for refrigerators

6.19 Turkey

Turkey has equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standards for 26 products
- mandatory energy labelling for 20 products
- voluntary energy labelling for 31 products

The Turkish equipment energy efficiency programme is implemented by the Ministry of Energy and Natural Resources (MoENR/DG) and the Ministry of Science, Industry, and Technology (MOSIT) and began in 2011.

Contact details/websites:

http://www.enerji.gov.tr/index.php

Summary of international influences and alignment with other jurisdictions

International influences: The energy performance test procedures are fully aligned with the EU test procedures and hence are mostly fully aligned with international test procedures issued through the IEC or ISO. As the programme is fully aligned with the EU's the efficiency metrics and thresholds used in the regulations are exactly the same as those used in the equivalent EU regulations.

Energy labels and design: The Turkish mandatory energy label is the EU label and the mandatory standards are the EU's Ecodesign requirements (Figure 6-23).

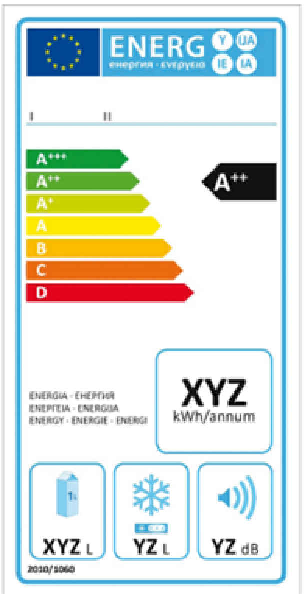

Figure 6-23 Turkish energy label (shown for Refrigerators) is the EU energy label

6.20 United States

The US has equipment energy efficiency regulations comprising:

- mandatory minimum energy efficiency standards for around 61 products
- mandatory energy labelling (EnergyGuide) for around 22 products
- voluntary energy labelling (ENERGY STAR) for around 63 products

The responsibility for standards and labelling in the United States is split among three agencies – DOE, EPA, and FTC. The breakdown of responsibilities is pictured in the diagram below[52].

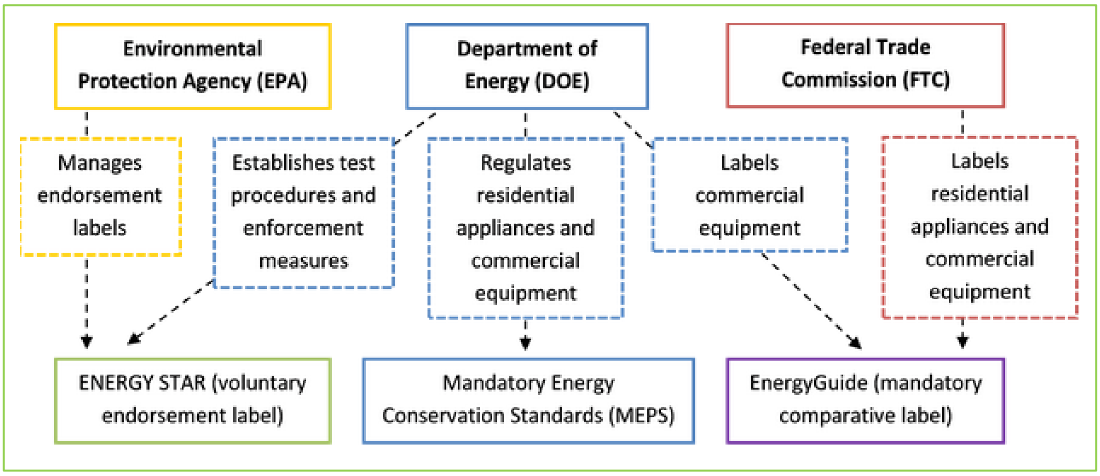

Figure 6-24 Responsibilities in the US programme

Energy efficiency standards are set either directly by legislation or by actions of the executive branch (Department of Energy) to set new or updated standards for covered products. The guiding principle behind the US MEPS is that the threshold for a minimum energy performance standard should be set to achieve maximum efficiency that is technologically feasible and economically justified; however, a number of other factors also influence their design.

The US's MEPs programme covered 52% of all product electricity use and 95% of residential and commercial sector oil and gas use in 2010 (Waide et al., 2011a). A tyre label is under development and a rule on this was promulgated in March 2010 but this left some aspects (labelling formats and consumer education programmes) undecided and these have yet to be settled.[53]

Contact details/websites:

MEPS: (termed Energy Conservation Standards in the US):
http://www1.eere.energy.gov/buildings/appliance_standards/EnergyGuide label (FTC):

[52] Courtesy of CLASP
[53] http://www.tirebusiness.com/article/20130814/NEWS/130819956/nhtsa-still-working-on-tire-labeling

For consumers http://www.consumer.ftc.gov/articles/0072-shopping-home-appliances-use-energyguide-label
For business http://www.business.ftc.gov/selected-industries/appliances
ENERGY STAR (EPA): http://www.energystar.gov/

Summary of international influences and alignment with other jurisdictions

International influences: The US MEPS and energy labelling scheme predates that of the EU and was developed internally. There is a strong manufacturing base within the US and the US is a large market – sufficient to have products which are specific to the US. This has meant that there is little interest in collaboration for most product groups.

The US has become much more strongly involved with international collaboration in recent years and is currently a member of IEA 4E and SEAD, taking a strong role in the latter.

Where the EU is in advance of the US in regulating or sets levels more ambitious than the current US standards the preparatory study reports have been used by advocates to demonstrate that higher efficiency and performance are possible and can be cost effective.

Energy efficiency thresholds and metrics There is partial alignment with the EU where the EU have regulated first (e.g. network standby, STBs), where the EU have directly followed from pioneering work in the US e.g. the California regulations on EPS and battery chargers, or in the case of office equipment – where the joint recognition of ENERGY STAR as carried over to some extent to the mandatory requirements. However, alignment with the EU is an exception.

Test procedures Manufacturers have been strongly involved in the development of test procedures in the US and in many cases via trade associations, have led their development. As a result few test standards are aligned with those in the EU. The exceptions are in globally traded goods with the recent US involvement in the development of new TV standards as an example. LEDs are also considered to present an opportunity for international collaboration.

Energy label design There is no alignment at this time with the exception of ENERGY STAR for office equipment. US advocates would prefer a categorical mandatory label, as evidence from the EU and elsewhere has shown these to be more effective, and have campaigned for this for many years.

The compulsory energy label is very different to that used in the EU, as shown in Figure 6-25.

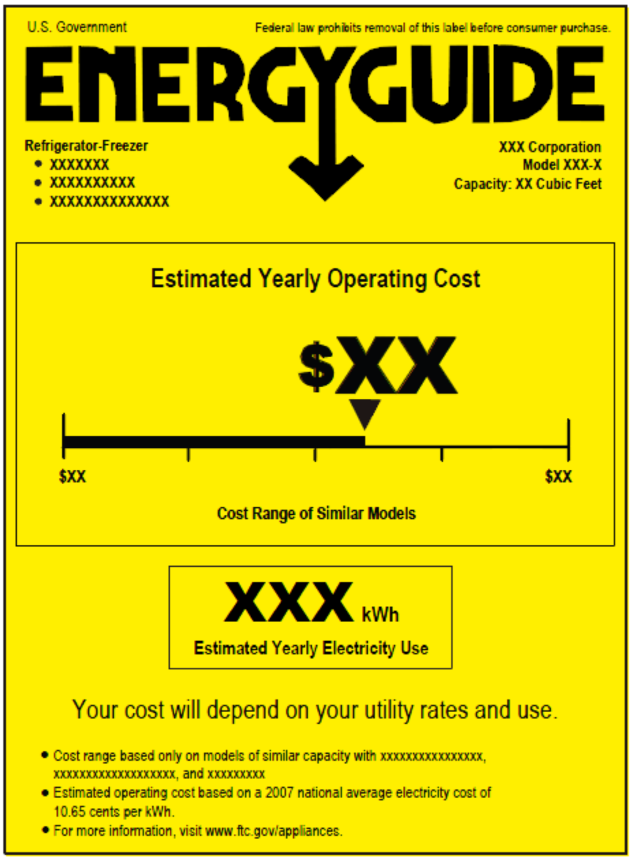

Figure 6-25 The US mandatory energy label administered by the Federal Trade Commission

While both economies use comparative labels the US label is a sliding scale, not categorical. The main display is the range of energy costs per year, (using standard assumptions), with the cost of particular product marked with arrow. With this design there is no scope for influence from other jurisdictions.

Other general points regarding closer potential alignment with the EU

The US mandatory requirements focus strongly on energy and cost savings. ENERGY STAR, as a voluntary programme that includes broader criteria of interest to the consumer beyond just energy such as colour temperature for lighting and noise levels for washing machines. ENERGY STAR has also started to include other environmental impacts into its criteria, such as the use of F gases in manufacturing flat panel TVs and displays. In this inclusion of other impacts ENERGY STAR is closer to EU regulations than the US regulations.

It is recognised at all levels in the US that there are advantages in harmonisations of metrics and standards, although these are only felt to be significant for globally traded goods: consumer electronics, office equipment and possibly LEDs. Other product areas suggested by one US stakeholder as possible areas for collaboration are motors, pumps and street lights.

One of the barriers to greater collaboration is timing – there is concern that the effort to harmonise should not delay the introduction of US standards or weaken their stringency. Also the fact that international test procedures take a long time to develop and then be revised is a concern as this could cause indirect delays.

6.21 Summary of experience and messages from 3rd countries

When considering the influence that EU product policy has on 3rd countries or vice versa it is instructive to summarise the messages heard from the 3rd country stakeholders themselves.

6.21.1 Africa and the Middle East

North African and Middle Eastern S&L programmes have been strongly influenced by EU product policy. Egypt has coordination with the EU backed MED-ENEC project in the field of efficient lighting and S&L for home appliances, and is likely to consider alignment or closer alignment with EU product policy in the future. Test procedures are mainly aligned with IEC/ISO. The preferred means of exchange is through exchange of experience and know how through workshops and seminars. Programmes in Egypt, Tunisia, Turkey and Algeria have been supported by the GEF while that in Bahrain has been supported by the World Bank. Some countries, such as Saudi Arabia, Israel and Iran have funded their own programmes but have made their own enquiries about product policy in other countries and have let this inform their own programmes. The Iranian and Israeli programmes have been strongly influenced by the EU's. Others, such as Jordan and Turkey, have moved to align their product policy with the EU's because of trade agreements and/or the Aquis process (Turkey). EU programmatic support has been a contributory factor in these cases. In South Africa there is a general willingness to use international test procedures and to consider adopting aspects of peer economy product policy (such as the design and thresholds of the EU energy label) when it suits national needs. Engagement through dialogue is welcome. Other African regions have not always received EU input when framing their S&L programmes and some, such as Ghana, have taken options that were not directly informed by EU policy settings and processes. When this has occurred it is mostly because the EU did not offer to engage with the economy in question on the topic, but this can then have impacts beyond the national boundaries as regional programmes, such as ECOWAS, are often influenced by existent national programmes.

Reduction of energy demand has been the principal motivation in all these programmes, but many are also concerned with trade and industrial policy and to a lesser extent with other environmental objectives. It is clear that EU engagement on product policy is generally welcome, well received and influential in this region but that it does require sustained efforts to bring about real impacts.

6.21.2 Australia

The evidence from Australia is that there has been very little, if any, direct influence to date from the EU on Australian policy development. This is not likely to change until the EC/EU join the international fora such as IEA4E and SEAD, where Australia is an active member or where, under its new GEMS policy which requires Australia to seek more adoption of international standards, it chooses to align the standards in a particular product sector with those in the EU. This will happen where the products are very similar in both markets e.g. home laundry appliances and not where they are different e.g. domestic refrigeration (where Australia is looking into alignment with the USA).

6.21.3 China

China's product policy has been partly influenced by international policy settings and processes such as the EU label, the US MEPs methodology and IEC/ISO test standards. China will usually engage with entities that are willing to engage with it and it has a history of bilateral engagement with the EU, EU Member States and European NGOS and consultants as well as those from other leading economies. The Ministry of Industry and Information Technology have expressed interest in greater cooperation on dissemination regarding Ecodesign measures in both economies and on standardisation. The China National Institute of Standardisation has traditionally been interested in cooperation on test procedure development and other technical matter related to product policy development. Although energy savings have been the main motivation behind Chinese product policy developments they are not the exclusive concern. Water saving, resource uses and broader environmental factors are also of relevance.

6.21.4 India

Of all EU product policies that on passenger vehicles has had the maximum impact on Indian policy as India follows a similar framework. The Indian washing machine programme was designed based on EU experience. India aims to follow the example of the best policies and adopted standards in place and hence is open to learning more about EU experiences. India has considered alignment to US and EU requirements for IT products. India has cooperation efforts with EU partners through bilateral dialogue with EU Member States. Examples are with: Sweden, Austria, Germany, the UK, etc. Energy saving is the principle motivation for Indian product policy. India also engages with SEAD, IPEEC and other international fora addressing product policy.

6.21.5 Indonesia

There has already been some cooperation between the Ministry of Energy and Mineral Resources and the EU or entities within the EU, among others with Denmark through its DANIDA program, for energy efficiency projects, and the UK with a focus on Energy Management (ISO 50001). Indonesia appears open to collaboration with the EU to help develop energy efficiency standards and labelling, including for capacity building and preparing test laboratories. It is reported to be open to considering stronger alignment but under the proviso any measure takes proper account of national or regional circumstances such as the development of ASEAN energy efficiency harmonization programs. In particular support would be welcome on market surveys, assessing impacts, and providing testing laboratory equipment and capacity building. Indonesia does not currently directly consider EU product policy requirements but sometimes use them as a reference.

6.21.6 Japan

Japan has traditionally had a domestically focused product policy development process but have periodically looked at peer economies policy settings and there is some evidence this has influenced their own (e.g. MEPS for motors from the EU, incandescent GLS phase-out). Japanese policy is to aim to harmonise with IEC/ISO test procedures; however, when these have not been found to be appropriate for domestic needs they have made major modifications or developed wholly new test procedures. These have often been at the expense of having comparable test procedures to peer economies but in recent times Japan is showing more interest in fixing failures in international test procedures, as evidenced by their active engagement in the IEC refrigerator test procedure revision process. Japan exchange product policy information in the EU-Japan Environment Working Group, the IEA4E, SEAD and other initiatives. Product policy motivation is primarily for energy savings and the lead agency (METI) is less interested in other product policy impacts.

6.21.7 Korea

Korea's product policy is to use international (IEC/ISO) test procedures, although other aspects of policy development have tended to be domestically focused. Just like their EU counterparts, Korean agencies are showing more signs of looking outwards and peer economy policies are now reviewed when Korea sets their own. Most focus was traditionally given to Japanese policy settings but now investigations are looking further afield. EU regulations on standby power and boilers are reported to have influenced Korean national requirements, albeit they are not aligned with these. There is some interest in Korean product policy circles in exploring options to align requirements for the following equipment: air conditioners, heat pumps, refrigerators, washing machines and TVs. The preference is for this to be done through formal or informal engagement through UN agencies, SEAD or other international partnerships. Energy savings are the principal motivation for product policy development but there is some interest in other environmental impacts.

6.21.8 Latin America

South American product policy has been strongly influenced by developments in the EU and there continues to be interest in dialogue with the EU on this domain. Technical cooperation efforts, when initiated, have generally been well received and have had a domestic impact. Much of the current level of alignment with EU product policy (most visibly through the appearance of Latin American energy labels) has occurred through a mixture of some direct project work and regional diffusion of ideas. MEPS and even labelling thresholds are much less likely to be aligned with EU specifications and test procedures can often have significant divergence from the IEC/ISO test procedures they are mostly based upon.

6.21.9 Russian Federation

Russian product policy is strongly influenced by and aligned to EU policy principally in order to foster trade and reduce bureaucracy. Test procedures, EE metrics and label appearances are aligned but divergence exists for MEPS and the thresholds used in some of the energy labels. The events of February in Ukraine may impact immediate prospects of closer ties with Russia but prior to this the opportunities for collaboration were improving.

6.21.10 USA

The evidence from the USA is very much the same as for Australia except that the USA does not have legislation encouraging it to adopt international standards. There has been exchange between EU and US product policymakers and the current trade negotiations could provide renewed impetus to stronger cooperation; however, the US product policy process is strongly domestically focused and thus cooperation will usually need to occur via soft pathways. Information sharing and technical exchange via existing networks such as the US initiated SEAD program, or IEA 4E could be some such routes.

7. Recommendations

Evidence presented in this report shows that international cooperation on equipment energy efficiency standards and labelling has been a major factor in the rapidity and direction of programme developments around the world and therefore contributed to delivering greater energy, economic and environmental savings than would have occurred otherwise. Willingness to share programmatic experience, learn from and emulate the successes of other programmes is an essential component of the achievements made so far and this has led to the rapid promulgation of equipment energy efficiency measures round the world.

When looking at how the transfer of best practice has occurred, our findings show it has often happened in an ad hoc manner. In the 1990s there was very little international institutional support for technical and policy related work for equipment energy efficiency best practice, yet it was in this period that the first work was done, usually by a small number of international consultants. Growing appreciation of the value of this work and the huge potential of equipment energy efficiency policy initiatives fostered the development of embryonic institutional activity in the late 1990s and early 2000s and has since led to further institutional development (see Section 5.2)

In this section, we draw out the main lessons learned from previous co-operative attempts and also consider the objectives for international co-operation. Based on this and the opportunity that exists to greatly strengthen the benefit from international cooperation on product policy, we then make detailed recommendations for three requirements specified at the start of the project.

Specifically, the Request for Services asked the study team to propose recommendations addressing:

- *Methods and fora to increase international exchange about on-going legislative processes between relevant administrations and governments with the aim to harmonise global legislation, including global standards, to establish a global equal playing field for industry;*
- *How to support European industry with information about planned and on-going legislation in third jurisdictions;*
- *Methods and fora to increase the visibility of the European Union's Ecodesign and energy/tyre labelling legislation in third jurisdictions and support third jurisdictions with the development of similar legislation.*

These are addressed in sections below.

Following these, there are several additional recommendations for action that arose during research undertaken for the project. Sources for these included direct suggestions and requests from interviewees as well as observations drawn from the experience of the project team. These are included for consideration as they may complement or enhance the impact of recommendations under the main three requirements.

7.1 What lessons have been learnt from previous attempts at product policy cooperation?

Previous experience with product policy cooperation has shown there can be some major successes when efforts are pursued in a sustained way. The experience of phasing out conventional incandescent lamps, of developing globally harmonised efficiency metrics and performance ladders for motors and external power supplies, of developing internationally acceptable test procedures for TVs and refrigerators and of fostering technology transfer for clothes dryers, room air conditioners and refrigerators have all demonstrated the viability, desirability and high impact of international cooperation among advanced peer economies. They have also tended to come about through specific initiatives driven by a few key actors and thus have not been as numerous or sustained as they might have been were stronger institutional backing to have been provided. Some difficulties or failures have also occurred in international cooperative efforts. Attempts by some governments to foster globally common quality specifications for CFLs were unsuccessful in the late 1990s early 2000s due to a lack of industry support, despite a sustained effort to find common ground. Product policy programme managers have often found that the demands of their domestic processes have been so intense that they have made it very difficult to extract value from international cooperative dialogues that they personally engage in. By contrast, the experts that inform their domestic processes will often take inspiration and information from international developments for the local programmes and policies that they work on. Thus strong direct policymaker engagement internationally is not always necessary for international cooperative exchanges to bear fruit, as long as policy-makers are open to learning from abroad and direct interaction happens at other levels.

EU product policy engagement has also often been productive when it has been offered in the form of technical support and capacity building for developing or emerging economies that are wishing to strengthen their product policy efforts. In these circumstances it has often helped clear the way towards greater international alignment and trade.

Overall, the four main lessons drawn from the case studies remain relevant:

1. Close cooperation between governments, industry and NGOs brings substantial benefits, particularly if long term working relationships are built.
2. Policy emulation facilitated by coordinated dialogue can greatly accelerate and multiply savings.
3. An internationally agreed framework of performance levels based on an internationally recognised test method lowers barriers to trade, facilitates technology transfer and combines policy flexibility with transparency of harmonisation; conversely, differences between test procedures can be barriers to policy action and technology transfer.
4. International collaborative policy development can transform markets further and faster than unilateral action. Even major economies can and should learn from each other with respect to best practice in the design of standards and labelling.

7.2 Considerations on the objectives of international cooperation and exchange

A key objective for international exchange is to promote greater international harmonisation to:

- Facilitate free trade with minimum additional cost to manufacturers
- Identify and foster deployment of best practice policies and technologies
- Allow resource-constrained governments to gain maximum benefit from policy research and technology assessment carried out by regions that lead on such issues

Harmonisation can bring many benefits but needs to be considered at the different technical levels that underpin product energy performance regulations comprising: energy performance test procedures, product categorisation, energy efficiency metrics and the performance thresholds applied in energy efficiency standards and labelling regulations.

7.2.1 What type of harmonisation is appropriate and feasible?

1. **Harmonisation at the technical level of test methods, product categorisation and metrics** so that levels of energy performance are comparable for manufacturers and policy-makers alike. In cases where *complete* harmonisation of energy ratings is not feasible, for example when addressing appliances whose performance is sensitive to climate differences, if the underlying test methods are sufficiently harmonised, then conversion factors can be derived and comparability demonstrated by simple calculations. *This level of harmonisation is both appropriate and feasible and has been already achieved for Motors (IEC 60034-30-1 publication due this year) and is a goal for work currently under development at IEC for domestic refrigerators.* Thus while some international test procedures are unlikely to be fully harmonised due to systematic variations in average operating conditions and local patterns of use, if the test procedures are well designed then results can be applied in a way that is pertinent to each local circumstance and test results can be representative of those circumstances.

2. At the next level**, harmonisation of energy performance thresholds** is desirable to: facilitate market and technology comparisons, lower production costs (by reducing the number of product designs required) and facilitate technology transfer. However, harmonisation to a single threshold is unlikely to be appropriate due to differences in, for example, energy costs and usage profiles from one economy to another. Therefore levels of policy ambition such as MEPS will be determined for each region/country based on consideration of the specific economic and environmental circumstances such as energy prices, technology availability, market readiness, consumer attitudes, appliance usage etc. As a result it is a more realistic ambition is to aim to establish common tiers or "ladders" of energy performance as discussed previously. Internationally agreed 'ladders of performance', as used already for electric motors, external power supplies and soon for distribution transformers: allow specific levels to be chosen by each economy, but on the same reference framework so comparability and future

policy progression paths are clear. *This level of harmonisation is important as a medium term aim in order to avoid product dumping into countries with low or absent MEPS, and also to ensure fair and motivating pressure on manufacturers to improve, justifying investment in efficiency through its necessity at comparable levels across many big (and small) markets. A key driver for harmonisation of standards is to undertake benchmarking of performance of products. Policy makers are often motivated to improve regulatory requirements (and bring them up to match the best) when they have evidence that the performance of products in other market is superior to their own. This is an activity already undertaken by IEA4E and, separately, CLASP and SEAD which, as with other activities mentioned here, is constrained due to limited funding to conduct analysis and verification testing.*

Harmonisation of label appearance (layout and design) can occur with or without the aspects set out in 1) and 2) above and while it can be simpler if the performance thresholds are aligned it is not a prerequisite for comparability for the purposes of policy-makers and manufacturers. Consumers can only compare levels if label design is similar of course, but note that harmonisation of the graphics and style of a label when the underpinning test methods are fundamentally different can create a misleading impression of the true degree of harmonisation and result in flawed conclusions on relative performance.

7.3 Recommendations

7.3.1 Methods and fora to increase international exchange

There are many existing specialist fora through which the EU could work to increase international exchange on policies and technical issues. As resources to engage are limited, the following strategic approach is suggested for consideration:

1. Focus first on well-established international product policy fora that already attract policy-makers with whom the EU wants to engage. Priorities should certainly include **SEAD** and **IEA 4E**. SEAD runs working groups on many major product groups that have achieved good progress on pooling information resources and developing harmonised approaches; SEAD is also closely tied with the work of CLASP, since CLASP is the SEAD Operating Agent. EU support could mean fielding Commission staff on board or steering groups; paying membership fees in some cases; fielding EU specialists in working groups (noting that technical specialists can often provide more continuity than Commission staff or other policy-makers); feeding in EU experience, and connecting relevant people and information. To address test methodology needs SEAD, IEA 4E and the IEA itself have joined forces to form an informal Standards Coordination Community of Practice. Both the SEAD and the IEA 4E conduct benchmarking studies on equipment energy efficiency with direct tangible benefits into Ecodesign and EU energy labelling processes; by direct involvement, the EU could leverage much greater insight and benefit EU policy-making and make more systematic use of the findings.
2. Develop **bi-lateral exchanges with priority economies**. Priorities can be set according to EU learning needs and also to achieve EU influence on policies in major trading blocks. Exist-

ing bilateral exchanges include with the USA (via the former EU-US High Level Regulatory Forum dialogue), Japan (via the EU-Japan Environment Working Group) and China (via the China-EU Dialogue and Consultation Mechanism on Industrial Sectors, Industrial Energy Efficiency & Greenhouse Gases Emission Reduction Working Group). Further candidate countries include Brazil, Korea, Russia and South Africa and regional economic groupings such as ECOWAS (West African States), MENA, ASEAN, CEFTA (Macedonia, Albania, Bosnia and Herzegovina, Moldova, Montenegro, Serbia), MERCOSUR (Argentina, Brazil, Paraguay, Uruguay, and Venezuela), the Customs Union of Belarus, Kazakhstan and Russia, NAFTA and APEC. These bilateral exchanges can be developed through regional engagement strategies.

3. **Prioritise specific products** on which action is timely and necessary, working through whichever fora or activities will best achieve specific aims. For example on appliances for which new and improved international test methods are in hand or near (examples include refrigerators, distribution transformers and televisions for which the new test method needs promotion and assimilation into policy); where effort is required to address flaws in existing test methods or for which EU preparatory work is underway. Priorities could be added for appliances from which global long term carbon saving benefits are the highest, as identified in the BUENAS/CLASP harmonisation potential studies (Waide et al., 2011a) or the Global Carbon Impacts study (Defra, 2009).
4. Consider supporting **NGO and technical Institutes** to achieve greater engagement with product policy issues within and outside of the EU. These types of organisation can achieve greater continuity than Commission officials, Member State policymakers and individual consultancies. Greater exchange between regions can also be facilitated through international NGOs and technical institutes if they can be more closely involved in the processes. As an example of this, the Commission has recently enabled ECOS to play an active role in CEN CENELEC working groups, helping to ensure that civil society and environmental interests are upheld and that test methods are fit for Ecodesign and labelling purposes; JRC has also been engaged in such work in 2013 and 2014. Such organisations can of course also be engaged to help solve specific challenges that occur.
5. **Consider the creation of an "EU Energy Efficiency Ambassador"** tasked with strengthening relations with markets outside the EU and improving communication, transfer of knowledge and knowhow regarding energy efficiency product policies between Europe and 3rd countries. Such a person, or institutional arrangement, could promote regular cooperation, bilateral meetings between EU and third jurisdictions counterparts regarding energy efficiency, onsite technical assistance from European consultants for short periods..

Elaborating on the specific priorities noted above, these and other initiatives and organisations that **analyse and compare/contrast policies around the world** and **identify best practice** include:

a) IEA4E IA (LEDs, motors, standby, mapping and benchmarking various appliances);
b) SEAD product working group initiatives on room air conditioners, transformers, motors, commercial refrigeration, water heaters, lighting.
c) The TopTen initiative that started in the EU to identify and promote the best performing products in many product categories and has now expanded to China and the USA.

d) The CLASP database (which has taken over the former APEC-ESIS database and was used to inform some of the detailed policy sections in this report)
e) The UNEP/GEF en.lighten project
f) The APEC Expert Group on Energy Efficiency and Conservation (EGEE&C)
g) The APEC-ESIS initiative
h) International Copper Association
i) The Lites Asia initiative
j) BRESL (Barrier Removal to the Cost-Effective Development and Implementation of Energy Standards and Labelling Project) project under GEF in Asia
k) UNDP Market Transformation through Energy Efficiency Standards and Labelling of Appliances in South Africa
l) UNDP Development and Implementation of a Standards and Labelling Programme in Kenya with Replication in East Africa
m) UNDP SPWA-CC: Promoting of Appliance Energy Efficiency and Transformation of the Refrigerating Appliances Market in Ghana
n) The UNDP/GEF Standards and Labels in Russia project
o) The International Partnership for Energy Efficiency Cooperation (IPEEC, hosted at the IEA in Paris) is also interested in promoting equipment energy efficiency cooperative initiatives
p) Other Clean Energy Ministerial initiatives such as the Clean Energy Solutions Center
q) Multilateral agencies with interests in product policy include UNEP, UNDP, GEF, World Bank, EuropAid, UNIDO, EBRD.
r) The European Union External Action Service (EEAS) is already working to build "a coalition for a legally binding agreement on climate change"[54]; an element of such an agreement could include appliance standards or outreach via EU delegations where those exist.

7.3.2 Supporting European industry with information about planned and ongoing legislation in third jurisdictions

Most industry associations have developed effective mechanisms to monitor regulatory developments and disseminate information to members and this was confirmed through some interviews. However, improvements could be made, since the extent to which smaller businesses in particular exploit these mechanisms varies significantly between sectors.

The European Commission could usefully assist existing industry association communication mechanisms by providing authoritative information about third jurisdictions. This information could then be disseminated via well-established communication networks. This would ensure wider availability of information that might otherwise be derived from less well-informed and piecemeal research. Indeed, this kind of exercise is already being developed bilaterally through the China-EU Dialogue and Con-

[54] http://eeas.europa.eu/what_we_do/index_en.htm

sultation Mechanism on Industrial Sectors Industrial Energy Efficiency & Greenhouse Gases Emission Reduction Working Group[55].

There are several ways in which the Commission could add value to this information for the benefit of European industry:

- Firstly, the European Commission may have access to advanced information about policy development planning through its policy networks, and could judge on a case by case basis whether it was appropriate to make this known to the relevant industry sectors. This could include reporting on regions for which the EU is providing support to update obsolete regulations, such as has been requested by Argentinian and Brazilian contacts interviewed.
- Secondly, the Commission could provide expert insight into how the EU regulations differ or are similar to those from third jurisdictions to provide *initial indicative information* on regulations and requirements: of particular interest will be the indicative relative levels of minimum requirements, confirming which test methodologies are required to be used, and specific requirements over and above any in force for the EU. Information given would of course require careful caveats regarding any legal standing.
- Thirdly, labelling and minimum standard requirements exist in some other regions for products which are not yet subject to EU requirements. This presents opportunities for developing support for future development of EU regulations in those directions, as well as initiating awareness and preparation for compliance with these additional regulations wherever bilateral trade is likely. For example, cases were identified in Brazil and Mexico for solar thermal collectors, gas appliances and vehicles.

The resources needed to developed and maintain a database of such information could be quite large. However, if it were focussed on a smaller number of sectors with the aim also of increasing exports there could be a net positive economic effect in the EU. Criteria to use to prioritise the sectors include value of manufacturing in EU, potential for exports and proportion of SMEs in the sector. Typically, sectors with a larger proportion of SMEs have more difficulty disseminating information. It should be stressed that such efforts should be done in manner that is complementary to existing databases, such as the CLASP database on standards and labelling programmes, to take advantage of work already carried out.

7.3.3 Methods and fora to increase the visibility of the European Union's legislation in third jurisdictions, and to support third jurisdictions with the development of similar legislation

Much more could be done to make a one stop portal where information on all EU product policy, especially policy concerned with energy performance, is made available. The US DOE has pages where comprehensive information on all past and on-going equipment energy efficiency rulemakings and related energy performance standards can be found. The result is a fully transparent set of infor-

[55] http://www.eu-chinapdsf.org/EN/Activity.asp?ActivityId=441&ActivityStatus=1

mation available in one place and authorised by the US DOE. Much, but not all, of this type of information is also made available in the EU regulatory development process as each Ecodesign preparatory study has to create a website and place relevant materials on that; however, there is no single webpage on the Commission's site (e.g. DG Energy's or DG Enterprise's) where one get all this information. Furthermore, this information does not include the following elements:

- Information on the development of test procedures (unless they are written into the EU regulation directly)
- Access to the models and data used to drive the techno-economic energy performance analyses nor the models and data used to derive the EU impact assessments (whereas all this is available on the USDOE site)

In the longer-term, complete transparency is beneficial to programme outcomes as it highlights any data and methodological limitations and allows informed comment to focus on areas of current weakness. It is recommended that the Commission considers strengthening dissemination and allocates resources that will enable a broader and more sustained communication about its programmes and their benefits.

Some specific opportunities to address these shortcomings and the broader dissemination of information on EU product policy are as follows:

1. While the Commission has begun to address some of these limitations by the initiation of projects to develop websites which will provide data on some of these issues, these are still in their early stages and have a more limited scope than the actions described above; thus, there is still potential to continue to improve access to and presentation of relevant information in a comprehensive format that is linked to the Commission's own site.
2. For Ecodesign studies and regulatory development processes of product groups identified as priorities for improved international harmonisation, representatives of target regions/economies could be invited to observe consultation fora, or perhaps join by webinar. Indeed a specific task to engage with such economies or bodies could be included in the task specification of contractors, and/or to brief suitable representatives via existing fora operating in those countries.
3. The Commission could present papers at a number of specific recurrent international events that are dedicated to, or have a strong focus on, equipment energy efficiency. These are ideal for networking with specialists and sharing insight into policy development, evidence and standards-making between economies. Where Commission presentations are being made, the Commission could consider encouraging participation by target economies supporting a study tour that includes the conference and other bilateral briefing/exchange. Suitable conferences include:

- Energy Efficiency in Domestic Appliances and Lighting (EEDAL)
- Energy Efficiency in Motor Driven Systems Conference (EEMODS)
- International Conference on Energy Efficiency in Commercial Buildings (ICEECB)
- ECEEE Summer Study
- ECEEE industrial summer study
- EU Sustainable Energy Week

- ACEEE Summer Study
- ACEEE Market Transformation Symposium
- Cape Town University's Domestic use of Energy Conference

These recurrent events are complemented by occasional events such as the Commission's Conference on Products Policy - International Trends in Ecodesign & Energy Labelling and dedicated energy efficiency policy workshops (usually in Brussels) promoted by ECEEE, IEA, etc.

4. Via international journals: In the past there was also a well subscribed and highly informative international journal, *Appliance Efficiency*, which was funded by a consortium of EU energy agencies. This journal carried developments on policy, regulations, technology, energy consumption trends, consumer behaviour, end use metering etc. from around the world and typically included regular news items along with thematic issues exploring in depth particular topics of interest. The resurrection of such a journal, preferably in a low cost electronic format, would help to unite international practitioners and disseminate news of developments in Europe and elsewhere. Another option would be for the Commission to sponsor a periodic newsletter that carried updates on all equipment policy work carried out in the EU. In the absence of such a specialised journal there are also journals that focus on energy efficiency topics more broadly (such as Elsevier's Energy Efficiency), on policy (such as Energy Policy) and numerous industry and trade publications that tend to focus on the provision of commercially relevant information for specific product areas. Many are now in electronic format.

To support third jurisdictions with the development of similar legislation the Commission could:

- Develop regional engagement strategies and support mechanisms (see 7.3.1)
- Consider the creation of a regional Energy Ambassador (see 7.3.1)
- Consider supporting or working with specific Member State bilateral support initiatives addressing EU product policy topics. Several individual EU Member States have particular initiatives or arms of government that deliver bilateral assistance in target countries e.g. in India, Germany's GIZ is active and the German government sponsored BigEE initiative has a specific focus on spreading best practice in product policy in developing countries[56]. AFD/ADEME, DFID/DEFRA and other Member State development and energy agencies have provided such support in the past. Similarly the US and other countries also have specific outreach programmes with which EU could aim to cooperate to provide more comprehensive and coordinated technical assistance.

7.3.4 Emerging consensus on global 'ladders of performance standards' for various products, frameworks to enable greater harmonisation

The experience with motors and external power supplies discussed in section 5.3 has shown that where there is concerted action among governments it is possible to develop globally adopted menus

[56] http://www.bigee.net/en/appliances/guide/

of energy performance tiers for a product. These have a common testing basis, common product categories and efficiency metrics and common energy efficiency thresholds. In general these would be developed through the international standards bodies such as ISO and IEC or via for example SEAD, IEA4E or other industry or government coordinated expert fora. Ideally, the standardisation process would have strong input from European standardisation experts with close ties to and knowledge of the objectives of the EU policy process. There are plenty of other product types that would benefit from the development of globally recognised energy performance tiers underpinned by common test methods and efficiency metrics. Some, such as distribution transformers, are quite advanced in developing such requirements but for most products work on performance tiers is yet to begin.

Traditional standards committees are often dominated by industry sponsored participants who have limited experience in public policy related issues and may also have conflicts of interest with broader public policy goals. Thus, regulators will need to take the lead in teaming up with each other, finding common ground and engaging with the standards committees if such tiers are to be developed and adopted. Experience shows the first steps toward the development of common performance tiers are a situation analysis followed by the establishment of a sustained dialogue between regulators, industry and standards bodies. Once this happens the reasons for regional differences can be identified and addressed in the future revisions of international standards, and the foundations for international adoption of a common test method can be laid. Adoption of common test methods necessarily precedes adoption of common efficiency metrics and energy performance tiers but these can follow on quite quickly if favourable conditions have been created. Even when achievement of energy performance tiers within a global recognised standard is challenging there can still be value from the establishment of agreed algorithms to enable cross comparison of standards and products performance, achieving 'proxy ladders'.

It is to address these kinds of concerns that the IEA/IEA4E/SEAD Community of Practice was established; however, this body would be likely to make much stronger progress were the Commission to become an active partner.

Whatever form it takes it is recommended that the Commission becomes an active player in the development of international dialogues among regulators, industry and standardisation bodies to promote greater alignment in test procedures, efficiency metrics and energy performance tiers.

7.3.5 Lessons from other countries programmes – improve coverage of standards and labelling policies

While many countries have emulated the appearance and sometimes (less frequently) the efficiency thresholds used in the European energy label, the EU is far from being a leading economy in terms of the coverage of its energy label. The EU could clearly learn from other economies that there is value to be derived in extending labelling (or at least mandatory disclosure of energy performance) to other sectors than just residential and consumer products. Other economies (e.g. Argentina, Australia, Brazil, Canada, China, Japan, Korea, Mexico, Philippines, USA amongst others) have labelling for one or more of: commercial AC equipment, commercial refrigeration equipment, compressors, high intensity discharge lighting, imaging equipment, inverters, industrial blowers, professional lighting applications, pumps (including general pumps, agricultural pumps, circulation pumps and pool pumps), motors and transformers. Currently the only non-residential sector product-group subject to labelling requirements in the EU is some types of lamps (although EU labelling for professional refrigeration cabinets is imminent at time of writing).

In the case of Ecodesign, the EU is catching up rapidly but has not been one of the leading economies in terms of energy coverage. Rather, Australia, Canada, China, Japan, Korea, the USA have had broader coverage, at least until recently. Sometimes this coverage can be deceptive however, as a simple count of the number of regulations does not address the breadth of those regulations and thus what proportion of energy use is affected by them. Nor does it address the even more pertinent question of what proportion of accessible energy savings are addressed by current regulations. Most economies have more to do to properly access this and the EU is no exception.

Some countries, such as Japan, regulate vehicle fuel economy via the same policy instruments used for equipment efficiency, whereas others, such as the EU, have different ministries dealing with transport and equipment. In terms of the appropriate policy instruments this distinction can be rather artificial as the same market barriers apply and hence the same types of policy remedies apply for both transport and stationary equipment products.

The expansion of the labelling products portfolio to include new product groups is also an important issue. Technologies like solar (thermal and PV) equipment, gas appliances and vehicles other than cars are some of the groups for which the EU still has an opportunity to develop policy measures. There are good examples in 3rd jurisdictions of policy implementation for these product types and the EU could benefit from information gathered in bilateral meetings and other forms of cooperation mentioned above, to accelerate European standards and labelling requirements for these products.

7.3.6 Cooperative work would be appropriate on energy using systems

No country has really attempted to use energy performance standards and labelling to apply to energy using systems unless they are sold as a packaged product. The EU is just now attempting to explore the boundaries of the degree to which systems level energy savings can be delivered via Ecodesign and energy labelling but this is innovative and there are likely to be significant limits to the ability of the policy instrument to access these savings. It is therefore recommended that the EU explores options for joint development work with 3rd country agencies on how best to establish effective policy instruments to promote energy efficient product systems.

7.4 Prioritising who to work with

Resources are finite and so it is appropriate to have a framework to assess with which actors it is most beneficial for the EU to engage. An initial attempt to outline these is set out below.

QUESTION: When would it make sense for the EU to work with 3rd countries by providing targeted technical assistance or cooperation?

ANSWER 1): When there is a strong commercial interest in cooperation because:

a) it is a major economy and trading partner
b) there is potential to be a stronger trading partner due to a free-trade agreement or one that is under development

ANSWER 2): There is strong development, sustainability or strategic interest in cooperation because:

a) there is a "green-field site" e.g. S&L have not yet been developed in that economy
b) the economy is a target partner for a broader EU assistance effort in the energy and environment field
c) development of stronger S&L in the economy would have a major overall environmental benefit due to the scale of product energy saving potential
d) there is some existing alignment that needs support to be maintained

ANSWER 3): There is strong reciprocal EU product-policy or -technology development benefit because:

a) technical development costs can be shared for issues like standardisation, benchmarking, techno-economic energy engineering analysis, product and policy databases and international communication
b) costs can be shared for technology innovation and R&D

...and there are good prospects of a successful working engagement because:

a) a credible partner within the economy expresses strong willingness to work with the EU on the topic (note credibility implies that: i) the partner has a clear mandate to develop policy or assist policy/technology development in this field, and ii) the partner has the requisite technical capacity or the ability to acquire it)
b) there is already a successful history of EU support and cooperation to the economy in the broad topic area
c) there is a viable programmatic aggregator such as a functional regional cooperation

In general it is recommended that the

- EU should consider identifying or establishing an expert group on Energy Efficiency which can act as a pool of expertise to work with 3rd countries
- EU and expert group should aim to work with clusters of countries
- EU should focus most efforts on the harmonisation of standards

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