Standby Power: Building a Coherent International Policy Framework

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ABSTRACT

With the advent of electronic equipment, energy consumption has become more prevalent when products are not in use. Such products are now ubiquitous in the residential and commercial sectors and collectively they consume significant electricity when not performing their main function (non-active or standby modes). Standby is a difficult policy area as the range of possible equipment types is enormous. With increasing product complexity, the number and type of standby modes is also increasing.

The IEA has coordinated action towards a 1 watt goal which has been formally adopted by Australia and Korea through mandatory requirements. Japan has included standby into some of its Top Runner levels. Europe is investigating a horizontal standby requirement under the Eco-design directive and has issued a draft implementing measure. The IEA has set up a new implementing agreement on energy efficiency and standby power is a key annex. The IEC has issued a committee draft revision of IEC62301 which includes a framework of mode definitions as well as some improvements to the overall test methodology which will be critical for accurate quantification of standby.

A horizontal approach based on a power allowance for specified functions is likely to be the key. But there are unresolved issues such as scope and ensuring that any such requirements do not create perverse changes in product design such as the removal of low power modes from the product design. Careful investigations and close consultation with industry are required to resolve these matters.

Introduction

Standby power was really only identified in the mid 1980's. With the advent of electronics and changes in the design and features of appliances and equipment, the ability of some products to reduce overall energy consumption by switching into lower power modes (referred to as standby in this paper) has become more prevalent. There are also many products which are designed to operate on a continuous basis at low power levels and which provide functions such as monitoring (e.g. smoke alarms, security systems, telecommunications and network equipment) as well as displays. End use products with some form of standby are now ubiquitous and although individually their energy consumption is usually small, collectively they consume a significant amount of electrical energy in these modes. While these devices often offer increased flexibility, versatility and in many cases improved performance, many also result in power use when they are not performing their main function. Such energy consumption is described as "standby energy".

[1] The authors would like to acknowledge the valuable feedback from Bruce Nordman of Lawrence Berkeley National Laboratories during the preparation of this paper.

The extent of the problem should not be underestimated. Studies in Australia put standby energy (including passive standby, active standby and off mode (refer EnergyConsult 2006 for modes by product)) at 12% of residential sector electricity consumption, equivalent to a continuous average load of 90 W. An average Australian home was found to have about 28 pieces of equipment connected to the mains that use some power when not performing their main function and a further 15 that are not usually connected but could use power when connected on an occasional basis (Energy Efficient Strategies, 2006). While the average energy consumption of each of these products is modest, together their energy consumption is projected to exceed all household refrigeration by 2010 in Australia (Energy Efficient Strategies, 2008). A similar study in California has found that standby power is now 13% of household electricity consumption (112W) and is likely to grow to more than 130W as a result of product trends and building code requirements (Meier et al, 2008).

Standby power is a term used widely and loosely in policy circles. In this paper it is used to mean the power drawn in one or several low power modes (including any power consumed in off mode and in networked modes), and 'standby energy' is used to mean the energy consumption during normal use over all relevant "low power modes", but not when the device is performing its main function. A range of small continuous loads (such as clocks, alarms, monitoring systems) are often considered to be "on" rather than in standby (i.e. performing their main function), however, such products can easily and appropriately be included within a broad standby policy approach as their design and main function resembles the secondary functions for many other products of concern. It is increasingly evident that there does need to be greater clarity about the terminology associated with standby in the light of recent developments in low power modes, particularly in the framing of policies which seek to address the issue.

Since the call by the IEA for countries to introduce policies limiting standby power to 1 watt for all products by 2010, the issue of standby has gained an international profile. In countries which have an energy efficiency policy, standby is now an important component. Almost all recent national energy policy statements mention standby explicitly, which was not the case 2-3 years ago.

While the amount of standby energy varies markedly among countries, in part due to the different penetration of appliances but also to some extent due to differences in their standby attributes, the global energy consumption from standby has been estimated by the International Energy Agency (IEA) at between 200 and 400 TWh per year (E3, 2006).

This paper provides an assessment of all the major policy tools currently in use around the world and provides guidance for a coherent international framework for redressing excessive standby power. In the next section, the proliferation of modes and products regarding standby is discussed. Then current policy tools are described and assessed and finally the concept of a horizontal functionality approach is developed. The results of the assessment and the discussion provide guidance for a coherent international framework for redressing excessive standby power.

Standby: The Proliferation of Modes and Products

Standby: The Proliferation of Modes

In the early days of standby, where the main product of interest was televisions, the situation was simple: standby was the mode where the on-mode could be activated using a remote control. Characteristics were easy to define; without user intervention it would persist indefinitely and (therefore) it was simple to measure. Nowadays devices have become much more complex. In principle the proliferation of standby modes can be seen as a good thing. After all, the main idea of standby is to put the product into a lower power state when (full) active mode or (one of) the main function(s) is not needed; the product can be placed into a standby mode waiting to be called into action.

Why has standby become more complex? There are three (main) reasons:

- the evolution of consumer expectations with respect to standby;
- more complex functionality of products; and
- increased network capabilities of products.

Standby is in essence a lower power mode when a main function is not needed and is therefore normally a lower power level in comparison to active mode(s). However, users are usually reluctant to wait too long for the product to become active when the product is switched from standby. When for technical reasons, the time to bring the product from a standby mode (with low power consumption) to the on-mode was too long, intermediate modes were introduced. These modes, (e.g. sleep mode or a PC and energy saving mode for copiers), tend to have a higher power than the lowest power mode (eg off) but the reactivation time is (much) shorter. Furthermore, the power management settings of the product may also determine the time that the product is in an intermediate mode. So, as the number of (standby) modes increases, it becomes more difficult to determine which (intermediate) mode the product is in and its duration during normal use.

The second reason is the increased and complex functionality of products. This has two main aspects: more functionality in active mode and more functionality in standby modes. Many products, especially in the consumer electronics area, have multiple functions. A DVD-player/ hard disk recorder not only plays DVDs but can record programs on hard disk or DVD; it has a tuner and it can be programmed to record in advance using EPG (electronic program guide) information. So, there is not only the standby mode when the product is waiting for a signal from the remote control, but also the mode(s) when the product is programmed to record a television program or the mode where EPG data are being received. Such products can also receive software updates through broadcast signals.

Furthermore, in many standby modes functions like status displays, clocks and even safety functions are more common. Examples of safety functions are a child lock on washing machines and tumble driers and water leakage monitoring/alarms on washing machines. In some cases status displays and clocks can be switched off or dimmed through user settings, resulting in several variants of the mode. So, in this case the number of relevant standby modes as the user may elect to set the product up in different ways.

Network capabilities are the ability to communicate with other products through a network (e.g. home network, internet). The consequence is that, in addition to the product itself or the user determining the mode of the product, other products can affect the mode and energy consumption. A minimal requirement is that the product should be able to activate communication when another product requires it. An example is a media PC that receives a request through the home network from another audio product to stream music to that audio product. Another example is a PC that receives a wake-up call via WLAN to perform a certain task. It is expected that in the future many more products, including lighting, security and HVAC applications will have these networking capabilities. Furthermore for networked products the software can be upgraded through the network, meaning that the functionality – including standby power levels – could change over the lifetime of the product. While networks offer a much higher level of functionality, there is also potential for greatly increased standby energy consumption if great care is not taken to mitigate this in the future.

What are the consequences of the proliferation of standby modes? One is that it becomes almost impossible to define for all products a limited number of standby modes that can be used for measuring "standby power". As a solution, a functional approach has been suggested (Nissen 2007, Harrington et al. 2007) where functional categories for standby modes are defined, e.g. information and status display, reactivation by remote control or internal timer, networking capabilities. A related aspect is that power management is critical to optimize total energy consumption of (networked) products (Siderius et al. 2006). Power management can be defined as a function of a product that ensures – without user interference – that the product is always in the state with the lowest power consumption related to the required level of functionality (by the user or the network). Technically speaking, this means that if the product is not or only partly used, unused parts should be automatically powered down as far as possible, and only those parts that are needed to detect the need for an increased level of functionality for the product are powered. Power management must be a function of the product itself because the user is not aware of all functions that may be running. Power management can also mean that products where user interaction is normal (e.g. television) could power down to a lower power state where there is no user activity (e.g. change in volume or channel) for a specified time (say 1 or 2 hours). Another example is a CD player going into a low power state if no disk is present or after the disk has finished playing.

Standby: The Proliferation of Products

There is a large and ongoing change in the mix and types of products on the market. Increasingly the boundaries between certain products types are starting blur as well. This is especially true in the home entertainment area where products can now perform a wide range of functions: some products can record and edit video, burn discs in a large variety of formats, act as music players, have USB, firewire and LAN connections, can stream music and video over a wired or wireless network. We have PCs that are media centers to replace a television, set top boxes, DVD players and hard disc recorders. Many PCs now are sold with a television tuner as standard. We now have refrigerators with LCD screens and internet connections, appliances with home network connections, and air conditioners with remote communications capability. All of these variations make defining products and their relevant standby modes, as well as tracking trends in standby power, very difficult.

Product definitions are a key issue, in particular the way we treat each variation in functionality. Given that some product types may only remain on the market for as little as 5 years before becoming obsolete, it is critical to develop product definitions in the broadest and most generic manner possible so that definitions do not require regular revision. But then care is required to make sure that comparisons of power levels are actually performed on equivalent products.

Measurement of Standby

The accurate measurement of a key parameter such as standby power is essential before it can be regulated. Given that low power levels and distorted current wave forms are often associated with electronic equipment and standby modes, a special test method was required. Interest in the technical aspects of the measurement of standby power grew quickly in the late 1990's once the extent of the issue became obvious. Technical Committee TC59 within the International Electrotechnical Commission (IEC), formally commenced the development of test method for standby power in 2001. The first edition of IEC62301 was published in June 2005. Since its publication the test method has been widely used in support of national policies to monitor and reduce standby power. In 2006, a report to TC59 recommended that a number of improvements to the overall test methodology including:

- Use of data logging (sampling) as the primary test method;
- Longer stability period and tighter stability requirements; and
- Restrictions on methods permitted for some modes (short duration, cyclic).

Work on some broader definitions of modes and functions is also being included although this is necessarily fairly general. It is hoped that the technical work on the revised test method will be largely concluded in 2008 with publication of a new edition in late 2009.

Current Policy Tools

Introduction

Since the launch of the IEA's aspirational 1 watt target in 1999, the number of countries that have policies addressing standby power has been growing steadily. Almost all recent national policy statements mention standby power explicitly and standby power is addressed by various policy tools. Later in this section we assess the main approaches to standby currently in use. Criteria for the assessment are how well the tool can address the following issues: a) increasing number of products with standby, b) increasing number of relevant modes, c) their ability to cope with increased blurring of product definitions and types and the creation of new product types.

The main focus of this paper is on voluntary or mandatory policies that set maximum levels for standby power. Although in the past years various stakeholders have argued for (consumer) awareness programs for the provision of information on standby power, it is the authors' opinion that these policies will not work. The main arguments are that standby energy consumption is relatively low per product and that a large number of products are involved (Harrington et al. 2007). This means that the savings – in energy and money terms – for the individual consumer in the case of an individual product purchase is very small, whereas the transactions costs – e.g. taking information into account when buying a product. Consequently these policies are unlikely to have a long-term impact, or may even have a detrimental effect if consumers believe that by purchasing a product with low standby power they do not need to pay attention to energy efficiency in active mode, which in fact may be more important. The critical issue is to keep standby power in perspective: poor standby power with good operational efficiency is undesirable but so is good standby power with poor operational efficiency. The primary assessment should always be on the total energy consumption of the product. In some cases standby will play a large role, in other cases it will be largely irrelevant. In a similar way, campaigns to encourage behavioral responses to reduce standby energy in existing equipment are unlikely to persist – the disconnection of products from the mains when not in use to avoid standby energy can be inconvenient and often results in loss of key functionality (loss of clocks and settings). Many products are hard wired and cannot be disconnected. And the energy savings per product are often extremely small.

IEA

The IEA 1 Watt target was endorsed by the G8 leaders in the 2005 Gleneagles Plan of Action (G8 Gleneagles, 2005). Further detail was added in the IEA recommendation to the 2006 G8 Summit which called for the adoption of a 1 watt mandatory horizontal standard for all products covered by the IEC definition (IEA 2006). Follow-up processes to the Asia Pacific Partnership, APEC and the Commission on Sustainable Development Marrakech accord have all called on Governments to make a greater commitment to the IEA 1 Watt standby target and other programs to tackle standby power.

However, these organizations are dependent on governments to implement policies to achieve these goals. Furthermore, the proliferation of national standby policies raises the issues of information exchange, co-ordination and harmonization. Recently a new IEA Implementing Agreement on Efficient Electrical End-use Equipment (4E) has been established (IEA 2008a). This Implementing Agreement and especially the Annex on standby will provide a forum for countries and program managers to discuss the potential for coordination and cooperation. The Implementing Agreement, which is open to broad participation, also could be used to conduct collaborative research and develop the scope of a horizontal standard, standby power budgets for specified functions, and other tasks in support of national policies.

Standby Policies in Various Parts of the World

Australia has announced a uniform 1 watt requirement for all electronic appliances and equipment by 2012. The requirement will cover a wide range of household and commercial equipment in relevant standby modes. The details are still being finalized, but should be announced by late 2008. The energy associated with standby modes is also being incorporated into a number of existing or new regulatory programs for energy efficiency, generally targeted at products with high overall active mode energy use. These include energy labels (for whitegoods standby is incorporated into the energy label rating system), overall efficiency standards which incorporate energy used in low power modes (e.g. air conditioners and televisions) and mandatory limits on low power modes for some product types (e.g. set-top boxes).

Canada has for many years operated an Energy Star program closely aligned to the US scheme. In addition, it currently is in the process of implementing MEPS requirements for standby power levels for a range of products, from 2008 to 2010. In 2004, Canada (with the US) also revised the test procedure for dishwashers to include standby power into the energy label (but not the MEPS requirement at this stage).

China includes standby criteria in the endorsement label (CSC) for a number of products such as TVs, DVDs, printers and copiers. The program is closely aligned with International Energy Star and many products and criteria are similar. In addition, a mandatory procurement policy for government departments and local authorities was adopted in 2007, replacing the earlier preferential policy, which stipulated that TVs, computers and printers with low standby consumption must be purchased.

The European Union passed the Ecodesign Directive in 2005 (Official Journal of the European Union, 2005) which establishes procedures to set minimum (efficiency) standards for energy using products (excluding transport). The Directive explicitly calls for an implementing measure to reduce standby "losses" for a specified group of products. On 19 October 2007 the European Commission presented a proposal for an implementing measure on standby (European Commission, 2007). This proposal covers "electrical and electronic household and office equipment dependent on energy input from the mains power source" and refers for further specification of the product scope to the Annex 1B of the WEEE Directive of 2003 (Official Journal of the European Union, 2003). On one hand this is not a fully horizontal product specification because it excludes a range of products e.g. industrial equipment, but on the other hand the list of products in Annex 1B contains an "open category" for many of the product groups, e.g. for the product group "consumer equipment" (mainly consumer electronics): "and other products or equipment for the purpose of recording or reproducing sound or images, including signals or other technologies for the distribution of sound and image than by telecommunications." Future products that are not covered by the current list but fulfill the same sort of function are therefore covered. This is a vital feature to deal with the increasing number of products that may have relevant standby modes.

The definitions of off mode and standby mode in the draft implementing measure are related, but not equal, to the definitions in the draft second edition of IEC62301. In off mode, as defined by the draft implementing measure, the equipment is connected to a mains power source and provides no user function. A mere indication of the off mode condition is also considered to be off mode. For off mode both documents are equivalent. In standby mode as defined by the draft implementing measure, the equipment is connected to a mains power source and provides a reactivation function (and a mere indication of enabled reactivation function) and/or information or status display. A reactivation function means a function intended to switch the equipment by remote switch, internal sensor, or timer to a condition providing additional functions, including the main function. Under the draft implementing measure the scope of the directive is limited by excluding products with preheating functions, sensor-based safety functions and network reactivation and network integrity functions (European Commission 2007).

Table 1 below shows the proposed criteria of the implementing measure. These values are well in line with the IEA 1 Watt plan. The power consumption is to be measured according to IEC62301: 2005 (clauses 4 and 5).

Table 1. Proposed EU Ecodesign Requirements for Standby and Off Mode

Mode	Maximum Power Watts
Tier 1 (1 year after implementing measure has come into force)	
Off (no function)	1.0 W
Standby (only reactivation function)	1.0 W
Standby (information or status display plus reactivation function)	2.0 W
Tier 2 (3 years after implementing measure has come into force)	
Off (no function)	0.5 W
Standby (all variants)	1.0 W

Source: European Commission 2007.

In addition to the requirements for standby and off mode, the draft implementing measure includes a (qualitative) requirement with respect to power management. Although this is certainly a very important attribute, the general nature of the requirement as set out in the draft implementing measure makes it difficult to enforce in practice.

International Energy Star, a voluntary endorsement labeling program operated by the US Environmental Protection Agency, was the first major program that addressed standby power, setting requirements for a range of products (mostly office equipment) as early as 1992. Due to the nature of the Energy Star program, specifications continue to be set on a product by product basis and the levels are reviewed on a regular basis. The permitted levels for Energy Star appear to be converging on 1 watt for many products, although the limits are necessarily adjusted at a product level to take account of the level of functionality. For most products, limits on standby power has traditionally been the main specification, but Energy Star is now moving towards a vertical approach for some products (for example monitors, computers, some imaging equipment) where standby energy consumption is included as part of an overage usage pattern and duty cycle which includes on mode(s).

Japan effectively regulates standby power through the Top Runner program. This is a product by product approach where for relevant products standby is included in vertical measures (ECCJ 2006). For example, the Top Runner limits for televisions specify a maximum energy consumption per year (kWh/year) that includes power in all modes (on and remote control active and off) over an assumed usage pattern. There are currently 7 product categories which include standby requirements in the overall energy performance targets. In addition, there are a range of voluntary agreements in place with industry to minimize standby power consumption to 1 watt or less. Products covered by this approach are typically those which have no other policy measures applied.

Korea also will implement regulations for standby power consumption for many products in the next few years. In 2005 Korea adopted a strategy to limit standby power to below 1 watt by 2010. The first phase of this strategy (2005-2007) has been a voluntary labeling of products which meet 1 watt in standby mode ('Energy Boy'). During the second phase (2008-9), standby power requirements of less than 1 watt will be will be included in the most stringent level of the comparison label (1st grade), and two products (external power supplies and battery chargers) will be subject to minimum energy performance (MEPS) requirements. In addition, a mandatory warning label which advises consumers if a product fails to meet the 1 watt target, will be progressively introduced. Following 2010, further MEPS may be introduced for products which fail to meet the 1 watt standby target. From 2007, public institutions are required to purchase only office equipment with the 'Energy Boy' label, giving priority to appliance with standby power usage at or below 1 watt (KEMCO, 2007).

Taiwan is currently implementing the first phase of its standby strategy, involving voluntary agreements with industry to reduce standby power to 2 watts for DVD players, desktop PCs, integrated stereos, microwave ovens, set-top boxes, ADSL modems and digital TVs. The second phase aims to introduce regulations that require electronic devices to meet 1 watt in standby mode by 2012.

The US Federal Energy Management Program has implemented Executive Order 13221 made by President Bush (Bush 2001), which can be seen as a aspirational 1 watt target that is specified for many products. The program is mandatory for Federal Government procurement. The levels are set out in FEMP (2008) and while 1 watt is specified for many product types, some specified products are permitted to have higher limits. US government agencies are also required to purchase Energy Star products where available (Executive Order 12845, 1993).

The US Department of Energy is working on national regulations for a range of appliances and home electronics equipment that will include standby power. The approach is a vertical one: test procedures are developed that include standby power and subsequent standards will set criteria for total energy consumption (U.S. DOE, 2008).

Assessment of current standby policies

Policy instruments that have been developed around the world vary, but the approaches to establishing standby criteria fall into several main categories:

- set maximum permitted targets product by product (voluntary or mandatory);
- integration of standby energy into the total energy consumption for the product (usage pattern/duty cycle) – this is the so called vertical approach (voluntary or mandatory);
- set a uniform maximum level for all products across the board (such as the IEA 1 Watt target) – so called horizontal approach.

While each of these approaches has merit, they also have problems and limitations, which are discussed below. It should be noted that a major issue of concern is the need for policies to address standby modes with active network connectivity and power management, however these are considered as discrete policy objectives which can be added to whatever general policy approach is taken. They are therefore not discussed in the following assessment.

Product by product targets. The advantage of this approach is that clear requirements can be defined for each product. The requirements can take into account typical product designs and variations (functionality) and provide a basis for putting pressure on manufacturers to improve their products to meet the specified targets. Different targets can be set for different modes. However, the main problem is the sheer number of products which have to be considered (possibly hundreds), classified, analyzed, documented and targets set and maintained. A related problem is the continual introduction of new products onto the market (which require further analysis and new targets) and the morphing of existing product types, making historical targets irrelevant. Setting and maintaining targets at a product level is administratively burdensome and difficult to justify when the contribution of each product is relatively small.

Vertical approach. In the vertical approach the standby energy is considered in conjunction with on mode energy consumption, typically for a defined or typical usage profile (or duty cycle) that is representative of normal use across all relevant modes for the product. This allows standby energy to be considered as part of the total energy consumption of the product. This approach keeps standby in perspective with total energy consumption for the product (standby may be a large or small share of total energy). However, the main problem is that there are a limited number of cases where a vertical approach will be feasible and workable – typically only for those products which warrant specific policy measures in some shape or form on the basis of total energy consumption (generally where active mode energy is significant in its own right). So this approach is excellent but is only applicable to perhaps 10 or 20 product types (maximum) and even in an aggressive policy context is only likely to cover 25% of household standby energy (author estimates based on Energy Efficient Strategies 2008).

Uniform targets for all products. Under this approach a flat target is set for all products irrespective of type or the functions that may be present. An example includes programs based on the IEA 1 Watt target for standby. Under these programs the maximum permitted power in a single standby mode is generally one watt, although there are sometimes exceptions. This approach has transparency and simplicity as its key benefits. However, such an approach does not take into account how easy or how difficult it may be to achieve the target for particular product types. So, in general terms, it is a fairly blunt instrument. For products with low functionality, a 1 watt target is very easy to meet. More complex products (with displays, remote controls and communication or network functions) may really struggle to meet both consumer performance requirements and a 1 watt power target. Uniform targets tend to only apply to lower power modes and they tend not to deal with higher, intermediate or secondary modes, nor the requirement for power management into the lowest possible power state.

So each of the main policy approaches used to date have advantages but they also have some serious limitations. To cope with standby in the future we need a new approach. The main issues that need to be addressed within a new approach are a result of the proliferation of standby modes and products. These issues seem to be:

- continual changes in product **definitions**, splitting and merging of traditional product types, new products types appearing;
- changes in product **features and functionality**;
- a range of relevant **modes of interest** (rarely a single mode, or the lowest mode only, is of interest), encouraging or mandating energy management within the product;
- setting technically advanced but achievable **low power mode targets** at a product level.

In developing policies for standby power, there are several issues that policy makers need to take into account:

Gaming. It is important to avoid providing an incentive for manufacturers to circumvent the requirements through gaming or adjustment of modes. For example, a manufacturer may provide a product mode that has very low standby power attributes which meets a specified target but in reality this mode is difficult or inconvenient for the consumer to activate (or there are negative consequences such as loss of presets or clock settings etc.). Another option is to remove standby modes entirely from the product design so that the product remains in "active mode" or in some higher standby mode which is not covered by a target. This of course results in a highly negative outcome and policy makers need to remain vigilant to ensure that such perverse outcomes are not occurring as a result of new policy measures. Another possible example is a product that has a low power when first tested as shipped but which reverts to a higher power mode in normal use.

Smart controls. The inclusion of "smart" controls in many new product designs provides great opportunities for energy saving and power management and these need to be encouraged. But they can create difficulty in testing and verification where controls are designed to change their operational modes when they sense that they are "under test" (so called circumvention). Fuzzy logic controls (where the product learns to adjust its operation in response to ongoing use), also pose some possible problems for verification.

Mode definitions. Care is required to avoid narrow mode definitions where specific functions have to be present (or absent). If the conditions specified for a mode are not fulfilled, then the product may not have to comply with the regulatory requirements; clearly this is a large potential loophole. It is a general problem when a policy provides a definition of very specific modes but does not require the product to have these modes and/or it does not cover modes that are similar. Restrictive mode definitions also provides an opportunity for manufacturers to design products in a manner which deliberately circumvents the requirements of the policy by adding or removing functions that make the product fall outside the scope. For example the definition of off mode in the EU draft implementing measure is defined as having "no function". This can easily lead to the interpretation that most products have no off mode, since data which is stored when the product is effectively off (e.g. in program channels, user settings, any sort of memory) could be considered a "function" and therefore it may be excluded from the requirements under this definition.

Network issues. Standby modes with network connections active are likely to become more prevalent and therefore some contingency should be made to cover these in policy measures. In particular, a requirement to ensure that network "chatter" does not lead to high levels of power consumption on a network is critical (Harrington et al. 2007). There is a need for urgent new work to ensure that the emerging standard network protocols incorporate aggressive energy management requirements in their core operations (IEA 2007 and LBNL 2008).

A Horizontal Functionality Approach to Standby

An alternative approach to overcome these problems is what we have termed the 'horizontal functionality' approach. This is where a maximum power level is based on the level of functionality offered by each individual product, potentially across the full range of different standby modes that may be present. Conceptually, it is a system of providing a power budget or allowance for the provision of a specified level or type of function (or combination of functions) which are actively being provided by the product in the particular mode. This is a 'horizontal' requirement as it applies to potentially all products and the budget is allocated to functions rather than product types[2].

The advantage of this approach is that it can capture any new product or variations on existing products and, in a fair and technically consistent manner, develop an acceptable (maximum) power level based on the present and/or activated functions. The total power level could theoretically be unique for an individual product (if the combination of functions was unique), although in reality a single level would apply to broad groups of products with the same combinations of functions. Ultimately, this policy could effectively keep up with changes in the technical design of products over time and with new products as they appear on the market in a way that is more comprehensive and coherent than any other policy platform developed to date.

The way it would work would be to define an acceptable power budget or level for each type of function in any mode where the function is activated. For example, a product with a remote control would be given a certain allowance, a product with a remote control and a clock display would get a higher allowance. The allowance for individual products would be the sum of the relevant allowances for functions present for that product and mode.

[2] This approach is similar to the approach taken by the European Code of Conduct on Broadband and the Energy Star specification for Imaging Technology.

The horizontal functionality approach can co-exist with current policy measures such as vertical measures or it could initially for the basis of an exemption from a flat 1 watt target. It is envisaged that (in most cases) vertical measures should take precedence and that the horizontal functionality approach would be used for all products currently not covered by other requirements.

It is critical that the power allowances are developed on the basis of well proven available technologies that can provide the level of functionality required in real products. Two notional levels could be developed over time – one which is based on "acceptable" practice (the basis of a maximum permitted power level) and a more stringent level that represents "current best practice" – this level would be suited to endorsement type programs which identify and reward exceptional performers in the market place.

The horizontal functionality approach deals with most of the problems arising in the current policy approaches. However, to date we have not seen any country develop a fully horizontal approach of this type to address standby across all product types and all sectors.

Irrespective of the form of the final policy, it is likely that some exemptions for some specified equipment types will be necessary. Such exemptions may be very few in the short term, but if allowed to grow, it could create a complex layer of requirements and levels that lie outside the original uniform requirements. If exemptions are seen as a possible route to avoid regulation by industry, the exemption process can become political rather than technical – large well funded organizations could pressure government to provide exemptions for specific products types or classes. A requirement with a large number of exceptions and variations is no better than trying to deal with targets at a product by product level. In the first instance it would appear that hospital medical equipment, security and military equipment should be subject to some sort of exemption from such a policy. But these categories need to be very tightly defined and exemptions only given under exceptional circumstances and perhaps for a limited period of time.

Towards a Coherent International Framework on Standby

Given that standby power is a universal issue and that most major economies are committed to policies which effectively reduce standby power, this approach could form the basis of a global strategy. While participation would remain the decision of national authorities, the concept of pooling resources behind the development of one strategy will minimize the effort required by individual countries and reduce the potential for duplication. Clearly there are also benefits for industry from having a clearly identified road-map and potentially uniform international requirements (or at least uniform approaches) which cover their products.

A coherent strategy would need to have several streams, some of which would be developed in parallel. We can envisage the following streams which are short term (to 2012) and the implementation which would be medium term (2012+):

- A commitment to a standby limit of 1 watt for most electronic products not covered by vertical policy measures. Some limited exclusions could be allowed for a limited period.
- Preparations for horizontal functional approach (technical): identify common functions and power budgets for each function ('acceptable' and 'best' practice), document common modes (function combinations). Define any exclusions. Expand international data collection activities to improve knowledge and understanding of available products (averages and distribution), establish trends in standby power.

- Preparation for horizontal functional approach (policy): draft policy templates for the horizontal functionality approach, develop guidance on terminology, coverage, exclusions and how to include power management requirements.
- Revise IEC62301 to ensure it continues to provide a robust test method and is consistent with the horizontal functionality approach.
- Implementation of a horizontal functionality approach.

The potential timeline for these activities is illustrated in Table 2.

Table 2. Short and Medium Term Stages – Horizontal Functionality

Timeline	Policy	Support Activities
Now until 2010/2012	1 watt passive standby	Technical and policy development for horizontal functionality approach, Improve IEC62301
2012 onwards	Adopt horizontal functionality approach	Review function and allowances

Until now, regional groups, such as the European Commission, AP6, APEC and the North American Energy Working Group have provided a means of enabling countries to co-operate on energy policies, however there has been no international forum to date. The establishment of the new IEA Implementing Agreement on Efficient Electrical End-use Equipment (4E) under the standby annex potentially provides a mechanism for gaining support for a global strategy on standby power as well as coordinating the research required.

Conclusions

The issue of standby energy is growing and the number of products in the home and office that use some power when not performing their main function is expanding. There is limited concrete information on what is actually happening in the market place in terms of standby attributes – the trends for existing products are often unclear and there are many complex and rapid changes in the market (in terms of available products and their relevant modes) that are likely to impact on future standby energy consumption, even where there is active data collection.

Given the urgent nature of our efforts to try to redress ongoing climate change impacts, it is critical that governments act in a decisive and responsible manner, even in the face of the limited information currently available. We cannot wait for good data to develop perfect policies. Pragmatic action is critical but we need to be mindful of possible consequences and ensure that favorable outcomes arise under a range of possible scenarios. It is important to remember that nearly 90% of the equipment that will use standby power in 2020 is yet to be designed and built, so we have a great opportunity to make a difference over the coming years if we act now.

Many countries have started to address the standby energy question through a number of considered and carefully constructed policy approaches. However, while all of the approaches that have been adopted to date have merit, they also have problems in terms of implementation and longevity.

The policy of setting a uniform 1 watt target appears to have the most appeal in the short term and could build on the significant efforts already implemented in many parts of the world. The IEA initiative provides a strong focal point for policy actions to address growing standby energy consumption and allows concrete policies to be implemented quickly. This could be complimented with an approach to develop horizontal functionality requirements that could initially be applied to more complex products but in the medium term provides the basis for an integrated scheme to deal with all product types and designs in a coherent fashion.

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