# Regulating Standby

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## ABSTRACT

Countries and states are shifting from voluntary to regulatory approaches to reducing standby power use in electrical equipment. There are at least six possible approaches to regulating standby power, ranging from treating each product individually to a "horizontal" approach in which all products are covered by a single regulation. The best approach depends on the type of product being regulated, the number of products, and the structure of existing efficiency regulations. The International Energy Agency recently proposed a horizontal 1-Watt regulation which illustrates how a horizontal approach could be broadly applied while flexible enough to accommodate certain exceptions. A horizontal standby regulation gives designers a clear signal and will be easier to enforce. The European Union recently approved framework legislation for appliance efficiency standards and limiting standby power is an explicit goal. The nature of standby – a characteristic rather than a product – make a horizontal regulation difficult, but not impossible, to write. Other countries are likely to experience similar problems in regulating standby.

## Introduction

Reducing standby power use[1] in appliances and equipment continues to be the focus of a large number of government policies. In 2005-2006, at least six governments enacted or announced plans to regulate some aspect of standby power use (see Table 1). Other countries—notably China and Brazil—are seriously considering regulatory legislation. These actions are in addition to a wide range of existing voluntary programs, such as the European Code of Conduct, Energy Star, and the US Executive Order on standby power devices.

[1] Standby power use is generally considered to be the energy consumed by electrical appliances while switched off or not performing their primary function. Other modes of operation that draw more power include "sleep", "active", and "on". Definitions for these modes often depend on the device.

**Table 1. Governments Regulating Standby**

| | Year Enacted/In Force | Products Covered |
|---|---|---|
| Japan | 1998/1998 | TVs and other consumer electronics |
| Korea | 2005/2010 | 18+ products including consumer electronics, office equipment |
| California (and other states) | 2004/2007 | External power supplies, digital television adapters, compact audio products, DVD players, TVs |
| United States | 2005/2008 | Battery chargers, external power supplies |
| Europe | 2005/2008 | Many products though scope is not yet final |
| Australia/New Zealand | 2002/2012 | Various consumer electronics |

Governments appear to be shifting from voluntary to regulatory programs in response to a rapidly rising number of electrical devices that consume standby and an increasing amount (and fraction) of energy consumed by these products while in the standby mode. For example, a recent Australian study suggests that residential standby power consumption is growing at 2 – 5% per year (Energy Efficient Strategies 2006). Other recent studies in Florida, New Zealand and Europe appear to confirm this trend. Standby power use is also a politically popular target (Kirkup 2006) presumably because the sense of waste is easy for the public (and politicians) to grasp.

Regulating a product's standby power use is in principle relatively easy compared to developing an efficiency standard for a product's active or sleep modes. The voluntary programs provide useful experience that can be applied to regulations. However, regulating standby power is more difficult in other ways. This paper outlines some of the possible strategies for regulating standby power use in electrical products. Two recent initiatives, the International Energy Agency's proposal for a horizontal 1-Watt standard and the European Ecodesign Directive are discussed in detail to illustrate some of the special requirements of regulations dealing with standby power use.

## Approaches to Regulating Standby

Most energy efficiency standards for products begin with a definition of the product to which the standard applies. Next, a test procedure must be described (or referenced) to measure energy use in a consistent manner that reflects the services provided by the product.

Any regulation of standby power must begin with a definition and a test procedure. An internationally recognized definition and test procedure, IEC 62301 was adopted by the International Electrotechnical Commission in 2005 (IEC 2005). The definition is sufficiently broad that it can be applied to all commonly-used products in homes and offices. However, the definition captures one standby mode only which is in many cases the off mode.

There are many approaches to regulating standby power. Six approaches are listed in Table 2 and described below.

### Regulating Total Annual Energy Use

This approach limits the total electricity consumption, in all operating modes, rather than just standby power use. The annual energy use is based on a duty cycle that includes operation in all operating modes (off, standby, sleep, active). The duty cycle assumes a certain number of operating hours in each mode. The manufacturer must ensure that the sum of the energy consumption during all modes is less than the maximum allowable amount. This is an implicit approach to regulating standby power use but does not assure low standby. One manufacturer may achieve compliance by designing the product to have very low standby and relatively high active power consumption while another manufacturer may take the opposite approach.

The advantage of this approach is that it gives manufacturers greater flexibility in finding the cheapest way to reduce total energy use rather than requiring manufacturers to make uneconomic improvements in standby or active power. Limiting total annual energy use is therefore an attractive option for both regulators and manufacturers. On the other hand, developing a test procedure and operating assumptions is a difficult process and probably can be applied to only major energy-consuming products. This approach has been adopted for a few Japanese Top-Runner specifications (notably TVs), labeling US dishwashers (but not the standard), and several Energy Star specifications. A common problem is collecting reliable data on the number of hours a product operates in each mode. A future problem will be deciding how narrowly to define the product to which the standard and test applies. Consumers will operate a basic product like a TV very differently when it is equipped with new functionality or services, such as a built-in hard disk, internet access, DVD player, etc. Presence of these features translates into more hours in some modes and fewer hours in other modes.

**Table 2. Approaches to Regulating Standby Power Use in Electrical Products**

| Approach | Description | Programs (and Applicable Products) Using This Approach |
|---|---|---|
| Annual Energy Use | Establishes a typical duty cycle including specified times in standby, active, and intermediate modes | Japan Top-Runner (TVs, VCRs) Energy Star (some of the new specifications for imaging equipment; proposed for certain products in consumer electronics) US FTC label (dishwashers) |
| Individual Specification | Establishes unique standby specification for each product independently of other specifications | Korea, Federal Energy Management Program, California Energy Commission |
| Family specification | Establishes standby limits for groups of similar products (e.g., office equipment, telephony, etc.) | Not yet applied to any regulations or voluntary programs |
| Dual specification | Establishes separate limits for each product on active energy use and standby power | California, European Code of Conduct, Australia, China for external power supplies |
| Functional specification | Establishes a standby level based on functionality or services available in the product | European Code of Conduct uses similar approach for *active* power consumption in set-top boxes and EPA uses similar approach for imaging equipment |
| Horizontal specification | Establishes a single limit on standby for all products, but with a list of exceptions | Proposed by International Energy Agency |

### Individual Specification

This approach establishes a unique standby limit for each product. Thus, some products have standby limits at, say, 0.5 watt while other products will be limited to 2.0 watts. The regulation would consist of a list of products, a definition of each product, and a limit for each product. Korea and California have adopted this approach. In the case of Korea, 18 products are already listed (and more will be added). This approach is attractive because products can be easily added (or removed) and each product can have a limit on standby that reflects the specific circumstances. The drawback of this approach is the management of the list of products as manufacturers add or remove features. Sometimes two products merge (TV-VCR, Refrigerator-display, set-top box-hard disk) so the relevant standard becomes unclear. To date, the individual specification is the most common approach to regulating standby.

### Family Specification

This approach establishes a maximum allowable level of standby power use for a broader group of similar products. For example, one standby level might be established for audio products, another for video products, and another for re-chargeable products. This approach is attractive because it avoids the need to specifically list each product covered by a specification;

instead, it allows a specification to be set for all products with the same primary function. The drawback of the family specification is that many products will (and have already) features that span several families. In these situations, which specification prevails? Or, put it another way, it is difficult to define mutually exclusive families of products.

**Dual Specification**

This approach applies to products whose active power consumption is already limited by an existing regulation. For example, room air conditioners in many countries already have a standard regulating their Energy Efficiency Ratio (EER). When these standards are updated, it is possible to add a requirement limiting standby power use. The new requirement for standby would reference IEC 62301, include any appliance-specific testing conditions and establish the maximum level of standby. Australia plans to use this approach as it updates its Minimum Energy Efficiency Performance Standards (MEPS) for washing machines, dishwashers, air conditioners, and other major appliances. The dual specification is basically limited to appliances whose energy use is already regulated and cannot be applied to the larger number of unregulated products that draw standby power.

**Functional Specification**

A functional specification sets maximum standby levels based on the product's features. For example, allowances might be established for network connectivity, illumination of a status light, battery charging, or presence of a display. A microwave oven with an internet connection—they exist!—would be allowed higher standby power use than a similar model without an internet connection. The allowances could be additive so that products with many functions would be permitted to have even higher levels of standby. The European Code of Conduct for set-top boxes created functional allowances for the products while in their operating (active) mode as did Energy Star for some new imaging equipment specifications.

The functional specification has both technical and administrative advantages over other approaches. First, the specification is flexible and enables manufacturers to add functionality without being constrained (as much) by a single limit on standby. Second, a functional specification avoids the administrative problems of defining each product. Finally, the functional specification treats all products consistently, that is, the internet capability in the toaster gets the same allowance as in the heat pump.

The functional specification has drawbacks, too. First, the size of the allowances will be small, probably less than 0.25 W for most functions. A 0.25 W allowance corresponds to a very small amount of annual energy use (about 2 kWh/year). Differentiation by functionality may simply not be worth the administrative effort when a single, slightly higher, specification would cover almost all cases.

**Horizontal Specification**

A horizontal specification means that a single limit on standby applies to all products. Thus, the standby limits for a computer display, table radio, and rechargeable drill would be the same. A horizontal specification is technically feasible because the causes of standby power

consumption are similar in most products. This approach is easy to understand and it is also easy to enforce. Some products—certain medical devices, perhaps—might need to be exempted from the horizontal specification; in those cases, a list of exceptions would need to be maintained. Other products covered through a specification based on annual energy use would also be exempted. The International Energy Agency (IEA) has proposed a horizontal standard for standby; this is discussed in detail below.

None of these approaches is clearly superior and there may be benefits from combining approaches. In the following sections, we describe in greater detail two proposals for regulating standby. In the first, we introduce the International Energy Agency's horizontal 1-Watt proposal. In the second, we consider how standby power could be regulated through the European Ecodesign Directive. Both proposals are being actively considered by governments and illustrate the practical difficulties in regulating standby.

## The IEA Proposal for a Horizontal Standard for Standby Power

In 1998, Meier (Meier et al. 1998) and the International Energy Agency (IEA) proposed a "Global 1-Watt Plan" to address rising standby power use in appliances and equipment. This plan consisted of three elements. First, it established a target value for standby, that is, a maximum of one watt. Second, it established a schedule for all countries to reach that goal for new products by 2010. Third, it urged coordinated international efforts to define standby power and adopt an energy test procedure to measure it. The plan did not specify the nature of polices that countries should employ to achieve low standby; it instead encouraged each country to select its own mixture of regulations, labels, voluntary programs and incentives.

Some countries, notably Korea and Australia, formally adopted the IEA 1-Watt plan. Other countries, notably Japan and the United States, developed unique policies, though drawing upon the IEA proposal for certain elements.

In July 2005, the leaders of the G8 countries met in Gleneagles, Scotland. Energy efficiency appeared prominently in the discussions and final Communiqué. In particular, it stated that the G8 countries would "promote the application of the IEA's 1-Watt initiative" (G8 Gleneagles 2005).

To this end, the IEA proposed that IEA member countries adopt a regulation to limit standby power in all products (IEA 2006). The proposal went beyond the original 1998 proposal. The new proposal recommended a regulatory approach rather than a mixture of voluntary policies. Furthermore, it proposed that the regulation apply "horizontally" across all products. Put another way, all products would be covered unless specifically excluded.

### A Horizontal Approach with Two Exclusions

The IEA advocated a horizontal approach for several reasons. As mentioned earlier, it has become increasingly difficult to define and oversee the flow of energy-consuming products with standby energy use. It is administratively simpler to apply the 1-Watt limit to all products and manage a much shorter list of exceptions. A horizontal approach is also simpler for manufacturers: the default standard is one watt. With this kind of certainty, the market for technical solutions is likely to transform faster and at lower costs.

The IEA also proposed that two groups of products be excluded from the horizontal standard:

- Products already regulated by an efficiency standard, whose test procedure captures standby power use
- Products with special features that make it "difficult" to immediately achieve a one watt level

The first exclusion—those products already covered by an efficiency standard—avoids possible conflicts with other national efficiency standards. However, it also requires that the standard be based on a test procedure that captures standby power use (the "annual energy use specification" listed in Table 2). For example, the Japanese Top-Runner standard for CRT televisions is based on a duty cycle, assuming a certain number of operating hours in the on-mode and the standby mode. Televisions sold in Japan would therefore be excluded from the horizontal 1-Watt regulation. In contrast, U.S. efficiency standards for clothes washers capture only the energy consumed during the washing cycle but ignore standby power use (which is off-cycle). Washing machines would be included in the horizontal standby standard.

The second exclusion—for "difficult" products—applies to products where there are technical or economic barriers to complying with the 1-Watt limit. Certain medical products, where high-voltage and low current must be delivered, might qualify for this exclusion. There may also be low-voltage, high-current applications needing exclusion. The IEA proposed that no products be permanently excluded; instead, a postponement would be granted, with an interim level set in the meantime.

**Managing the Exceptions through an IEA Implementing Agreement**

The IEA further proposed that an international committee be created to manage the list of recommended exceptions. The list could be posted on a website. Participating countries (that is, those enacting a horizontal standby standard) could then use the list in their implementation of the horizontal standby regulation. An internationally coordinated list of exceptions would further simplify the local administration of the standby standard. Manufacturers of internationally traded products would also find this arrangement more convenient because they would need to seek only one exemption (through the committee) rather than an exemption in each country. The list would also simplify compliance by manufacturers because the default level would be one watt.

How would the international coordinating committee be created and operate? The existing standards organizations (IEC, ISO, etc.) are not suitable candidates. The foremost reason is that these entities define test procedures but avoid establishing the values. Many other arrangements are possible, but the IEA suggested that a framework for such a committee already exists through the IEA "Implementing Agreements" on technology cooperation. Using this framework, the committee could be established quickly and with low administrative costs. Participating countries would control the committee by nominating members. Participating countries maintain sovereignty because each country still has the opportunity to adopt or reject the IEA recommendations.

The combination of these actions — creation of a horizontal 1-Watt standard and an international committee to manage the exceptions — results in a "lean" administrative apparatus, but one capable of making rapid decisions and establishing internationally consistent policies. Manufacturers will appreciate the clear signals and lower cost of compliance.

The IEA proposal may have appeal because of its simplicity and consistency. However, translating the proposal into domestic legislation is a challenge. The following section explores legislative obstacles in Europe based on the newly-passed Ecodesign Directive.

## Regulating Standby Power in the European Ecodesign Directive

The Ecodesign Framework Directive of 2005 (Official Journal of the European Union 2005) establishes procedures that will create minimum efficiency standards for most of the major appliances in the next five years. (See Siderius and Meier (2006) in these Proceedings for a detailed description of the Ecodesign Directive.) It is similar to the Energy Policy Act in the United States, which established the framework for federal energy efficiency standards. The Ecodesign Directive defines an "Energy-Using Product (EuP)". Each EuP fulfilling certain criteria shall be covered by either a voluntary agreement or a (mandatory) "implementing measure," which sets efficiency levels and other environmental characteristics. This section explores how standby could be addressed by the Ecodesign Directive and speculates about the feasibility of a horizontal standard.

### Does the Ecodesign Directive Apply to Standby?

Standby is a priority item in the Ecodesign Directive and is explicitly mentioned to be covered by an implementing measure (as stated in Article 16(2)). Furthermore, in the preamble (item 14) it states, "As a general principle, the energy consumption of EuPs in standby or off-mode should be reduced to their minimum necessary for proper functioning." Clearly the Directive has the authority and intent to regulate standby, so the question becomes which approaches to regulation are technically and administratively the most attractive?

### Individual and Family Approaches

At one end of the spectrum is the creation of a unique implementing measure covering standby for each product. This corresponds to the "individual specification" in Table 2. Here, every product, from rechargeable vacuum cleaners to PCs to heated toilet seats will require a unique implementing measure (based on unique analyses of life cycle costs and industrial impact). This approach is clearly permitted but would be an administrative nightmare to create and maintain. Sales and stock data may not be available for some products, too.

A middle option is to use the "family specification" approach in Table 2, where a standby measure is written for a *family* of similar products (such as audio/video, white goods, re-chargeables, etc.). Even this will be difficult to apply to cross-over products, such as a refrigerator with a built-in TV because of the criteria for definition of an EuP.

**Annual Energy Use**

A third regulatory approach is to incorporate measurement of standby power use in the energy test procedure and the minimum efficiency standard for each product. This corresponds to the "annual energy use" specification in Table 2. This strategy best applies to white goods and some office equipment where energy test procedures are already based on a duty cycle that includes a certain amount of operating time in standby mode. Manufacturers will minimize the annual energy use rather than optimizing separately the operating and standby modes. The Ecodesign Directive would need no special modifications for these products. On the other hand, this approach requires modification of energy test procedures of all major energy-using products. The Ecodesign Directive relies on international test procedures established by the European standards organizations CEN and CENELEC, so the process of revising test procedures is mostly out of its control or would take many years to implement. A second weakness of this approach is that internationally-recognized energy test procedures exist for only a small fraction of the products that draw standby power.

**Horizontal Implementing Measure**

Does the Ecodesign Directive permit the same implementing measure to apply to a wide range of energy-using products? (This corresponds to the "horizontal specification" in Table 2.) There is no clear answer.

According to Annex VII, Article 1, the implementing measure can specify more than one type of EuP. This would appear to allow the creation of a horizontal measure for standby. Unfortunately, all the procedures and criteria for establishing an implementing measure require a separate analysis for each product. A solution to this predicament is to define the EuP as the universe of devices drawing standby power. In other words, the EuP would consist of all electrical products in homes and offices that have standby consumption. Then one generic analysis restricted to standby could be conducted.

A raft of further analyses must still be undertaken to ensure that the implementing measure meets various technical, environmental, and economic criteria. The implementing measure must <u>not</u>:

a) diminish functionality of the product;
b) adversely affect health, safety and the environment;
c) negatively impact the affordability and the life cycle cost of the product;
d) negatively impact industry's competitiveness;
e) impose a proprietary technology on manufacturers; and
f) place an excessive administrative burden on manufacturers.

Again, each of these criteria was created with a *product* in mind rather than a *characteristic* such as standby power use. A generic analysis of standby should nevertheless be able to satisfy these criteria.

**So… Can the Ecodesign Directive Handle Standby?**

Yes, the Ecodesign Directive can easily regulate standby in energy-using products on a case-by-case basis. But this approach is unwieldy for a large number of products and Article 16(2) suggests that standby power should be dealt with through a horizontal implementing measure. However, there are aspects where untested approaches may be needed. The first aspect is that the Directive allows an implementing measure on standby for a group of products. The horizontal approach can apply if a *characteristic* is used to define this group of products, namely, the products that have an off mode and/or a standby mode. The second aspect is the nature of the environmental and savings analyses. A traditional life-cycle analysis is impossible to perform on a characteristic. However, it is still possible to perform a legitimate generic analysis that covers all of the major conditions.

Could the implementing measure reference a list of exceptions described in the IEA proposal? The Ecodesign Directive already relies on international organizations for definitions and test procedures, so drawing on an international list of exceptions would create no precedent. On the other hand, this list would likely be updated frequently to reflect the addition of new products and removal of products now obliged to meet the 1-Watt requirement. Revisions to the list of exceptions need to be published in the Official Journal (the European Union's counterpart to the Federal Register). The legal aspects of this approach still need to be further explored.

## Conclusions

Governments are gradually shifting from voluntary programs to regulations to limit standby power use in energy-using products. The trend is likely to continue given the attention by the G8 and other high-level international coordinating groups. Regulations are easier to write now that an internationally recognized definition and test procedure are available.

Many different approaches to regulating standby are possible. The best approach depends on the type of product being regulated, the number of products, and the presence of existing efficiency regulations. If the goal is to regulate only a few devices, then the levels can be set on a case-by-case basis. For complex devices with significant energy use and several operating modes, an implicit standby regulation is superior. Standby energy use can be captured in a duty cycle, whose total use is then regulated. Manufacturers have the greatest flexibility in minimizing production costs. Keeping the definition of the product up-to-date will be difficult in both of these approaches, especially for the case of consumer electronics.

A horizontal approach to regulating standby, that is, requiring all products to meet the same limit, is superior for tackling the universe of products drawing standby. The horizontal approach gives a clear signal to designers and is easy to administer and enforce. The IEA horizontal proposal offers additional flexibility with exceptions for certain "difficult" products and those products already regulated through duty cycles. International coordination of exceptions will benefit international trade because it simplifies compliance for exporting manufacturers.

Translating a horizontal approach into regulations is possible but may be difficult. Limiting standby power use is an explicit goal of the Ecodesign Directive, but there are still some problems to be tackled related to the product oriented character of the Ecodesign Directive. Thus, it remains awkward to regulate a characteristic (or mode) rather than a product. Legislation

in other countries and states pose similar obstacles. Writing entirely new legislation to address standby will, in some cases, be easier than trying to bend existing regulations into a shape compatible with the technical characteristics of standby.

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