How US Design Engineers Can Meet Global Legislation Challenges (Part 2)

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Designers of electronic and electrical equipment are increasingly challenged to design new products that comply with legislation which applies in the markets where their products will be sold. Previously, we took a look at all the different flavors of RoHS. If you missed this, you can read about it at our Legislation Center on www.newark.com/edworld [1]

As previously stated, it is always preferable to preempt legislation by utilizing good eco-design rather than to be forced to change a product's design later, so I have included some suggestions from ERA Technology, a UK engineering consultancy we have worked with extensively to facilitate compliance for our customers and ourselves.

Waste Electrical and Electronic Equipment (WEEE) Directive
This directive was adopted by the EU in early 2003, and it came into force in August 2005, although several EU States were late introducing national legislation. WEEE requires producers to finance the cost of collection and recycling of their products when they reach end-of-life. Although the directive requires good design for recycling, this is not enforced in any member state. Currently, there are few incentives to design for easy recycling, but this will probably change because the directive is currently under review. Ultimately, it will be beneficial to consider design for recycling as this should reduce costs if a producer recycles its own equipment and in the future, if compliance schemes are able to take eco-design into account.

Eco-Design of Energy Using Products (EuP) Directive
The EuP Directive takes a different approach to the older "WEEE" and "RoHS" legislations. WEEE considers end-of-life only, and RoHS just considers materials that are present in products. EuP is different as it considers the entire life cycle of equipment from mining and extraction of raw materials to recycling at end-of-life. EuP will initially target energy consumption, particularly in the use stage of product life cycles, but all aspects of a product may be considered for implementing legislation. EuP is a "framework" directive, and it does not directly affect manufacturers. However, the European Commission is carrying out many studies, and the results of these will be used to introduce new legislation called

"implementing measures."

Most of the studies carried out so far have targeted specific types of equipment such as televisions, computers and lighting. However, more general studies into external power supplies, battery chargers and off-mode and standby power losses have been carried out, and resultant legislation could affect any product that uses these. Good eco-design can take many aspects into account. For example, it can make recycling easier, avoid hazardous chemicals irrespective of any current restrictions (there will be more in the future) and adopt measures to lower power consumption.

Examples of ways to lower power consumption include the following: &#149 Design equipment with good ventilation and use low power dissipation components to avoid the need for fans because they consume significant amounts of power.
&#149 The power consumptions of ICs and other components (motors, motor controllers, transformers, etc.) vary considerably, although this data is often hidden in lengthy data sheets. Choose low power consumption components.
&#149 Use lower voltages. Power consumption is directly proportional to voltage, so halving voltage halves power consumption.
&#149 Use active power management to switch off systems and functions that are not in use. Battery life of mobile phones and laptop computers has been greatly increased by this approach.
&#149 Minimize the number of supply rails in a product as well as using low voltages.
&#149 Use LCD instead of CRT displays. LCDs also use less power than LED indicators or filament lamps.
&#149 Use switch-mode power supplies instead of linear power supplies. Low power designs can have other benefits; reliability tends to be better and the life of components, including electrolytic capacitors, will be longer if the operating temperature is lower.

REACH

The EU REACH regulations were adopted in 2006. REACH stands for "Registration, Evaluation, Authorization (and Restriction) of Chemicals." This is a complex piece of legislation that will affect manufacturers and importers of chemicals, preparations (such as adhesives, paints, etc.) and "articles" which include all types of electrical components, sub-assemblies and equipment. There are no exemptions for transport, aerospace, etc. These regulations have been adopted because of the many thousands of high volume, inadequately tested chemicals used in the EU. There is no risk data on 21%, inadequate data on 65% and only 3% are fully tested. This means that it is almost impossible to choose a "safe" substance due to a lack of test data. REACH aims to ensure that all substances are fully tested. The main emphasis is on the most dangerous substances and on those used in the largest quantities. The lower limit is one ton (of the chemical) per year, per producer.

Chemicals and preparations used in the construction of equipment designed by U.S. engineers and assembled outside of the EU are outside the scope of this legislation. However, REACH will have implications on U.S. design engineers because the regulation also affects substances that are within products which are either

intentionally released or their release is foreseeable. "Release" is a term that has not been fully defined but a few examples of how this could be interpreted are as follows: &#149 Ink from printer cartridges &#151 the ink is considered to be a preparation and the cartridge a receptacle. Therefore, very hazardous substances in the ink should be avoided as these are likely to be restricted in the future by REACH.
&#149 Alkali batteries can leak when old. Although this is not intended to occur, it is foreseeable and so the released substances are in the scope of REACH.
&#149 Lead is used in many forms in electrical equipment. Some equipment is outside the scope of RoHS and it may contain lead solders and other products that are within the scope that will contain lead in exempt forms such as in optical glass or in ceramics. When these products reach end-of-life, the WEEE directive requires these to be recycled and this process will recover this as lead metal. Therefore, the authorities may decide that lead "release" is foreseeable and so should be within scope of REACH.

If any chemicals are in the scope of REACH, usually the importer of the equipment or the U.S. manufacturer’s appointed representative in the EU will need to ensure that these chemicals are registered. Registration costs can be considerable, although they are usually born by chemical manufacturers. Costs will be especially high for the most hazardous substances, so it will be advisable for designers to avoid chemicals that are in the scope of REACH and which are toxic or carcinogenic. It is likely that manufacturers will collaborate to produce health and safety data and to share costs of registration of most chemicals, but where a chemical is very unusual and used by only one manufacturer, the costs could be considerable.

It is becoming clear that chemical producers are planning to phase out some chemicals rather than pay the considerable registration cost. This would initially affect EU sales of these chemicals only, but as the EU is such a large market and there are signs that other countries may adopt similar legislation, worldwide phase-outs are likely. REACH would therefore affect design engineers since they will need to redesign products using materials that are not likely to be phased out.

The intensive scrutiny of all chemicals by REACH over the next decade will almost certainly result in further substance restrictions. Design engineers are advised to avoid the inclusion of any hazardous materials in new products now to prevent having to redesign in the future.

Batteries
The EU has adopted a new batteries directive that comes into force in 2008. The most significant new restriction that is different to the U.S. batteries act is a ban on nickel cadmium batteries. Although there are exemptions for limited applications, it will be advisable in all new designs to avoid this type of battery. Nickel/metal hydride is similar and it can be used as a drop-in replacement in most applications, but it does have disadvantages such as a faster self-discharge rate (they lose ~4% of their charge per day when not being used). Lithium-ion batteries are superior in many ways, but their characteristics are quite different and they need special charging circuits to avoid over-charging and under-discharging, both of which can cause over-heating or even fires.

European National Restrictions
EU states are obliged to transpose EU directives and they have limited scope for varying these measures. However, for products that are outside the scope of these directives, individual states are permitted to introduce their own legislation. For example, Denmark introduced limited lead restrictions before RoHS was adopted, and this still applies to products that are outside the scope of RoHS. This legislation has had only a minor impact on electrical equipment design, but there are proposals to amend it to introduce further restrictions.

These restrictions would ban the use of lead as a stabilizer in PVC insulation, but lead in solders and lead in electronic components would continue to be exempted from this legislation. Recent Norwegian proposals for new restrictions on 18 substances would have a more serious impact on electrical equipment design. This legislation would impose restrictions (with exemptions) on the use, in consumer products only, of lead, cadmium, tetrabromobishenol A (TBBPA which is added to epoxy laminates), bisphenol A (a constituent of epoxy resins) and Diethylhexyl phthalate (DEHP, a common PVC plasticizer). All of these substances are fairly common in electrical equipment.

Other Legislation
China WEEE is being discussed although no drafts are available yet. It is possible that measures based on Japanese recycling legislation or EU WEEE legislation will be adopted. China has safety and quality legislation that requires certain products to be tested and approved for CCC (China Compulsory Certification) marking, and so products must be designed to meet these legal requirements. This has parallels with EU CE marking and will be extended in the future when China RoHS Stage 2 comes into force as this approach will be used to show that products comply.

Rest of the World
"RoHS-based" legislation exists or is being discussed in many countries worldwide. South Korea has adopted substance restrictions that come into force in 2008. This legislation also has labeling and recycling requirements. Japan has had labeling legislation for many years (J-MOSS) and China RoHS labeling is based on this. Australia, Thailand, Taiwan and several other countries are discussing the adoption of "RoHS" legislation. Many more countries have or are planning "WEEE based" legislation including Mexico, Taiwan, Australia (mobile phones) and several South American countries.

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Links:

[1] http://www.newark.com/edworld