The EU Codes of Conduct: What Have They Achieved and What Are the Challenges?

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ABSTRACT

There is no doubt that developments in digital TV and broadband communication will have a large impact on residential energy consumption if no adequate policy actions are implemented. The European Union has established a successful stakeholder forum through its Codes of Conduct for Energy Efficiency. This forum agrees on power levels for defined operating modes, and provides further guidelines, e.g. on power management, to achieve desirable efficiency levels.

Two Codes of Conduct are in operation: the Code of Conduct for Digital TV Service Systems (since 2001) and the Code of Conduct for External Power Supplies (since 2003). In 2005, the first draft of a Code of Conduct for Broadband Equipment was presented at the stakeholder forum. Together, it is projected that these Codes of Conduct will save 20 TWh per year from 2010.

This paper reports on the first results for the Codes of Conduct for Digital TV Service Systems and Power Supplies, based on data from participating manufacturers. Analysis of the data shows a considerable overall improvement in power consumption, not only in the standby modes but also in the on-mode. Furthermore, the paper shows how discussion with stakeholders based on a common road map provides guidelines for the continuous development of this innovative policy tool and leads to the efficient adoption of the new criteria required to mitigate the energy impact of the new features and functions in the product that are prompted by rapid technological development and market forces.

The Need for the Code of Conduct (CoC) Policy Tool

The market penetration and energy impact of domestic electronic products and appliances is often subject to step changes driven by new technology. Commercial secrecy about product development and marketing often makes the accurate prediction of these changes complicated, if not impossible without the direct engagement and support of the key stakeholders involved in production and marketing. This engagement is often resisted, or is subject to protracted negotiation, where mandatory policy tools such as energy labeling and minimum energy performance standards (MEPS) are introduced because perceived by manufacturers as imposed on them (Bertoldi 2005). In addition, at least in the European context, the legislative process for MEPS and mandatory labels is rather slow, and once legislation is finally adopted it will take a while for changing it. This is why for fast changing technologies such as computers and digital set top boxes (STBs), there is a preference in Europe for voluntary approaches (Energy Star labeling for office equipment, and CoC for STB). As discussed later in the STB CoC the power

level, definitions and allowances needs to be reviewed almost every year, and these specs can never be set established more than two years in advance (we do not know how technology, demand and services will evolve), and as well the specs can not last more than 2 years. This rules out the use of MEPS in the European context.

In 1997, a European Commission working group identified the digital service system STB as the domestic electronic device with the largest potential to increase the energy requirement of European households. To challenge and resolve this problem, the European Commission set up a working group of the key stakeholders in digital service system development – STB designers, STB manufacturers, component providers (e.g. Silicon[1], LNB, Tuners), service providers – and energy agency specialists. The continuous threat of introducing MEPS was a strong driver to bring key manufacturers to participate in the CoC development and in the end of sign it.

Research into proposed development showed that by 2010, the STB could push domestic electronic energy consumption in the Europe Union (EU) above that of refrigerators and freezers (Harrison). With 150 million of these boxes across the EU - equivalent to one per household – the annual electricity requirement for digital service systems with full functionality and poor power management could be around 60 TWh (close to the total electricity consumption of Denmark for all sectors). The fast penetration will be driven by the announced phased put of the analogue signal in 2009. Generation of this electricity would also release 24 $MtCO_2$, which would have a significant impact on the EU's ability to meet its overall Kyoto CO_2 reduction target. This increased electricity consumption could be cost effectively be halved if polices and measures will be in place.

At the same time, in 1997, work also began on external power supplies, which at the time had high no load losses and very low on mode efficiency. External power supplies were predicted to penetrate the market due to many new uses (mobile computing, mobile telephones, consumer electronics, etc.). For this product, the fast technology change was not the main driver to introduce a Code of Conduct as for STBs. As with many other products in Europe there is a strong preference for voluntary and negotiated approaches to improve efficiency of end-use equipment (Bertoldi 2005). For external power supplies the voluntary agreement approach was investigated; however, because too many different stakeholders were involved, included OEMs, it was decided to establish a Code of Conduct[2]. The savings potential for external power supplies was evaluated to be in the order of 10 TWh for the EU, to be achieved by 2010 if all external power supplies would meet the CoC.

The Basic Mechanism of the Code of Conduct Policy Tool

The new rationale of the CoC policy tool is to proactively engage stakeholders, at the earliest possible stage of a product's commercial roadmap, in a voluntary scheme, to mitigate the energy impact of the product, without stifling product development and commercial objectives. This activity has become an excellent example of a product policy initiative that has united stakeholders early enough to impact the design process *before* the product became ubiquitous.

[1] Throughout the text the authors use the term "Silicon" to describe the electronic components within the set-top box – components, since the principal functional blocks are embedded in LSI silicon chips.

[2] The difference between voluntary agreements, negotiated agreement and Code of Conducts in described in Bertoldi 2005, and in a forth coming publication by the same author.

The following stages can be identified, and they will be discussed in the next sections:

- Stage 1: Identify priority products and set up working groups
- Stage 2: Improved energy efficiency criteria and CoC roadmap
- Stage 3: Achieved outcome, agreed with stakeholders
- Stage 4: Continuous review to identify best practices

Stage 1: Identify Priority Products and Set Up Working Groups

In Stage 1 of the Code of Conduct mechanism, products with a potentially large market and high energy impact are identified by the European Commission through reports and papers prepared by expert consultants (Molinder, Bertoldi et al 2002) Products with the highest potential to impact on energy are prioritized, and approaches are made to key stakeholders to contribute, on a voluntary basis, in working group discussions on practicable options to mitigate predicted energy impacts. The membership of these working groups requires adroit planning and negotiation:

- The working group must involve the main manufacturers of a product genre. Manufacturers' representatives should be in a position to act as a conduit to senior levels of, product design and marketing.
- The interest and participation of major procurers, such as Service Providers, is essential, since their endorsement of CoC objectives has a significant influence on product manufacturers. For example, the early involvement of major procurers of external power supplies in the Power Supply and Charger CoC Working Group (mobile phone manufacturers) resulted in the fast uptake of relatively stringent criteria through the use of efficient switching power supplies.
- A balance of independent experts and industry experts (e.g. from the Silicon [3]Industry) is required to evaluate the factors qualifying product energy efficiency performance, identify best practice and define practicable criteria objectives to mitigate the energy impact of the product in the marketing roadmap. Ideally some of these experts should have involvement in related technical working groups of standards bodies and industry association, in order to ensure a common approach to product testing that supports the discussions in the CoC working group.
- Political representation is important, to ensure that both national and EU-wide energy-efficiency objectives are fully considered; to provide practical support with CoC working group research and testing commitments through national agencies; and to catalyze endorsement, procurement and fiscal support schemes for products that meet the CoC criteria.

[3] Throughout the text the authors use the term "silicon" to describe the semiconductor industry components in the product – since the principal functional blocks are embedded in LSI silicon chips.

Stage 2: Improved Energy -Efficiency Criteria and CoC Roadmap

The principal aim of a working group is to reduce the energy consumption of a product through the setting of agreed, practicable power requirement targets in a defined development timescale. To that end, a voluntary Code of Conduct is devised, and Europe's principal stakeholders in the product genre are encouraged to support the agreement.

The Signatories of the Code of Conduct[4] will make all reasonable efforts to:

- achieve the power consumption targets set for new products placed on the market after an agreed date, based on an agreed test method;
- support and contribute to the development and acceptance of new criteria based on the commercially practicable application of "best practice" technology;
- co-operate with the European Commission and Member State authorities in an annual review of the scope of the Code of Conduct and the power consumption targets for two years ahead;
- facilitate and encourage consumers to adopt energy-efficient practices in connection with the use of services involving the product;
- co-operate with the European Commission and Member States in monitoring the effectiveness of the Code of Conduct; and
- ensure that procurement specifications for related services, systems, equipment and components are compliant with the Code of Conduct.

Stage 3: Achieved Outcome, Agreed with Stakeholders

The achieved and committed objectives of the CoC in a product area are disseminated to a global audience to promote common international energy efficiency criteria for the product genre. It is important to notice that for the products covered by the two CoCs, there is a large degree of imports into the EU (almost 90% fro external power supplies), and also a large similarity with products commercialized in other economic regions. Therefore there is a strong interest to have similar energy efficiency polices and programmes in other region of the world, to assumer more compliance to the CoC levels. To this end Europe has been among the leaders in promoting STB and external power supplies polices since 1997, and to harmonization of test methods and specifications.

Stage 4: Identified Best Practice for CoC Reviews

This aspect of the CoC mechanism is of particular importance. Expert input to the CoC working group must continuously review the potential for innovation in the technology to mitigate the energy demands resulting from increased functionality in the product. On a regular basis, relevant industry and independent experts are asked to review power requirement criteria for the basic product and for the power demands of the increased functionality dictated by product marketing.

[4] The list of the Signatories and the Codes of Conduct can be seen at the website of the EU Stand-by Initiative, the European Actions to Improve Energy Efficiency of Electrical Equipment while either Off or in Standby, at http://energyefficiency.jrc.cec.eu.int/html/standby_initiative.htm

In this context, the CoC for Digital TV identified a key tool for the achievement of significant energy efficiency targets in digital service system platforms - the development of effective power management in the silicon for the principal functional blocks.

The CoC power management task force, originally formed and supported by the UK Market Transformation Programme, has created a dynamic Silicon development "roadmap" which helps to qualify future revisions of the power requirement targets in the Code of Conduct. A range of power requirements in the standby passive, standby active and on modes are assembled for each functional block or group of blocks for which power can be managed. These values, qualified by the likely uptake time of the new Silicon or hybrid component (e.g. tuner) are used to agree on the timing and value of criteria updates. The task force relies on the cooperation of platform designers and silicon suppliers in the construction and continuous updating of this roadmap of the functional blocks.

A similar approach was also followed with manufacturers of external power supplies, where through discussions with all stakeholders the no load consumption has been dramatically reduced.

What Has Been Achieved by the Existing Codes of Conduct?

Conformance Results for the Code of Conduct for Digital TV Service Systems

The conformance of set top box products from signatories to the CoC for Digital TV service systems for the year ending December 2005 was presented to the March 2006 CoC working group. An overview of the results for 2005 shows declarations from four key signatory manufacturers. Also the data supplied by a major service provider was included. Conformance criteria for 57 products were returned. They comprised, 33 TVs with integrated receiver-decoder, 11 stand alone Satellite set top boxes, 7 stand alone Terrestrial set top boxes and 6 stand alone Cable set top boxes. 90% of these products complied with the CoC criteria. These products represent a major share of products for the vertical market (service providers specifying the box functionality to receive their services and in many cases providing the boxes to their clients), this because of the active engagement of the major service providers. In additional many other manufacturers and service providers in the EU market produce/specify products CoC compliant without having signed the CoC and/or reporting the consumption of their models.

The average power requirements for the on mode and standby active mode for Terrestrial and Satellite STBs in Figure 1 show the impact of the trend toward Personal Video Recorder (PVR) functions in these products. Although the power requirement of the added functional characteristics in general meet the CoC's 15W criterion for maximum standby active power , the power management task force has prioritized actions to examine power management options for the hard disc, DVD R/W and additional tuner/decoder functions of these products to achieve a better energy efficiency in the standby active mode.

Figure 1. 2005 Declared Conformance Results (Averages)

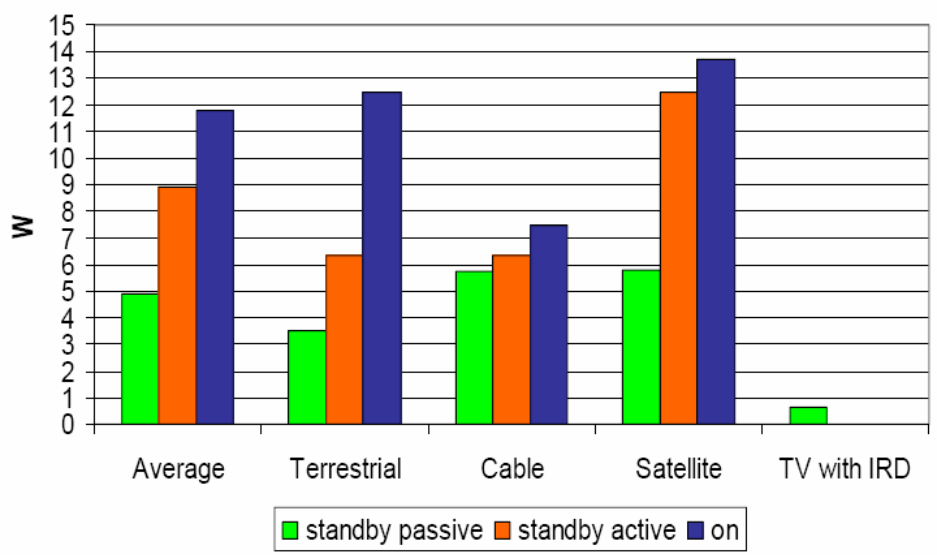
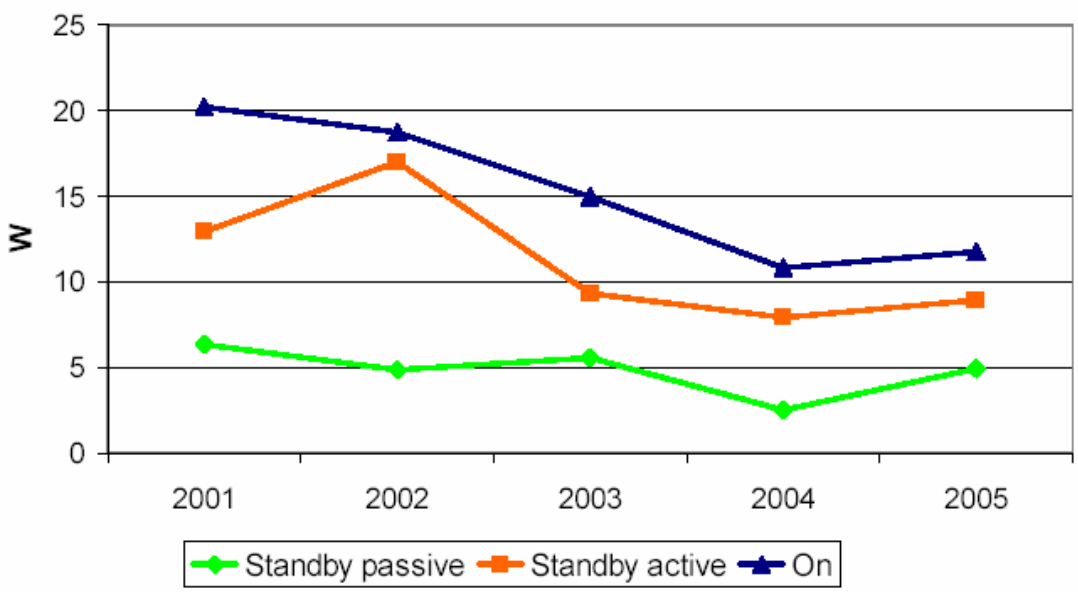


Figure 2 shows the impact of revised criteria on the energy efficiency of STBs in Europe and underlines the importance of the impact of power management in the context of a massive increase in platform functionality.

Figure 2. Influence of the CoC on Set-Top Box Power Requirement 2001-2005 (Average Power Requirement – All types STBs)



Conformance Results for the Code of Conduct for Energy Efficiency of External Power Supplies

The conformance of External Power Supplies from signatories of the CoC for the year ending December 2005 was presented to the March 2006 meeting of the working group. It should be noted that signatories to this CoC commit themselves to:

- Design power supplies or components so as to minimize energy consumption of external power supplies. Those companies who are not responsible for the production of power supplies shall include the concept of minimization of energy consumption in their purchasing procedures of power supplies.
- Achieve both the no-load power consumption and on-mode efficiency targets shown (see Tables 4 and 5) within the time schedule for at least 80% of products for Phase 1, and 90% of products for Phase 2, for the new models of external power supplies that are introduced on the market after the indicated date.

For these criteria, the on-mode efficiency is measured at 100% load (i.e. full rated output current) or declared as the simple arithmetic average of efficiency measurements made at 25%, 50%, 75% and 100% of full rated output current."

An overview of the declared results for the period ending December 31st 2005 showed that eight key signatory manufacturers reported on 130 power supply models. Of these models 92% conformed with the CoC criteria. Figures 3 and 4 below summarize the conformance details and show the number of products already meeting the next criteria phase. The coverage is very high in external power supplies for mobile telephones (the major mobile telephone manufacturers have signed the Code of Conduct and reported), and notebook computers (again major manufacturers have signed, together with major power supplies manufacturers). There are also other OEMs (mainly ITC equipment), and power supply manufacturers that participate in the stakeholder meeting, but have not signed the CoC. These manufacturers claim that they are meeting the CoC levels.

As indicated, the External Power Supplies CoC is rather successful in reducing energy consumption in mobile telephones (almost 90% of the market) and office equipment (more difficult to evaluate, estimated by the authors to be around 50%), however the CoC of conduct has been rather unsuccessful in other products categories, such as simple STB (DTAs), DECT telephones, small appliances and kitchen tools, consumer electronics.

Figure 3. No Load Power Conformance

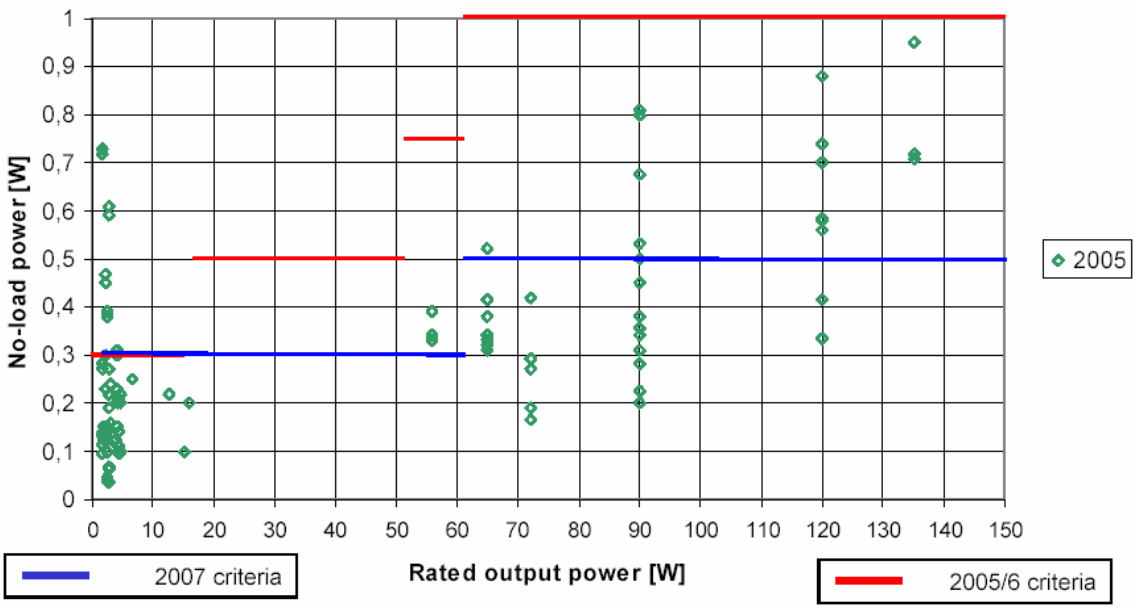
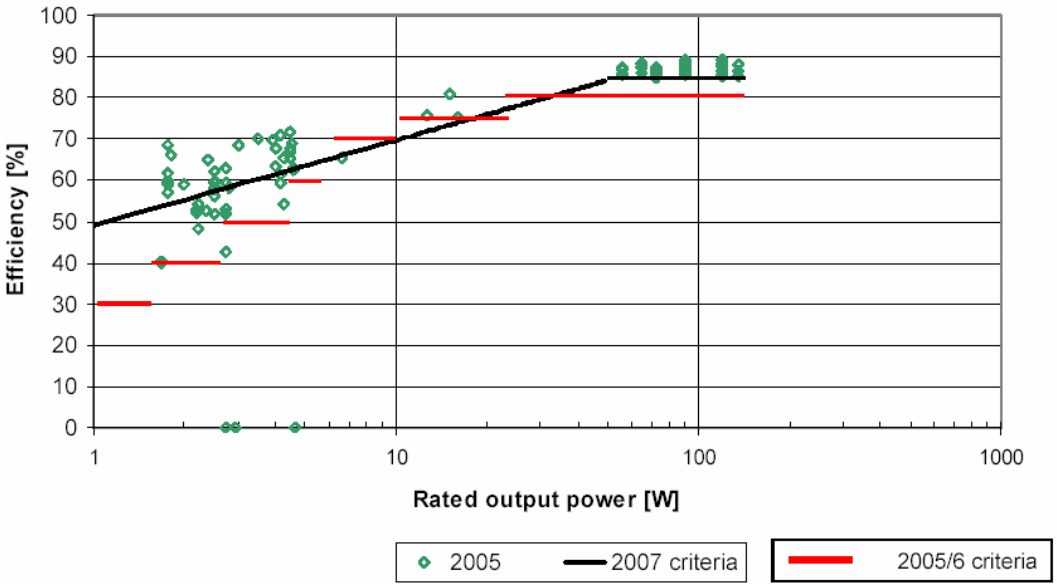


Figure 4. Efficiency Conformance



What Are the Challenges for the Existing Codes of Conduct?

The New Generation of Digital TV Reception Platforms

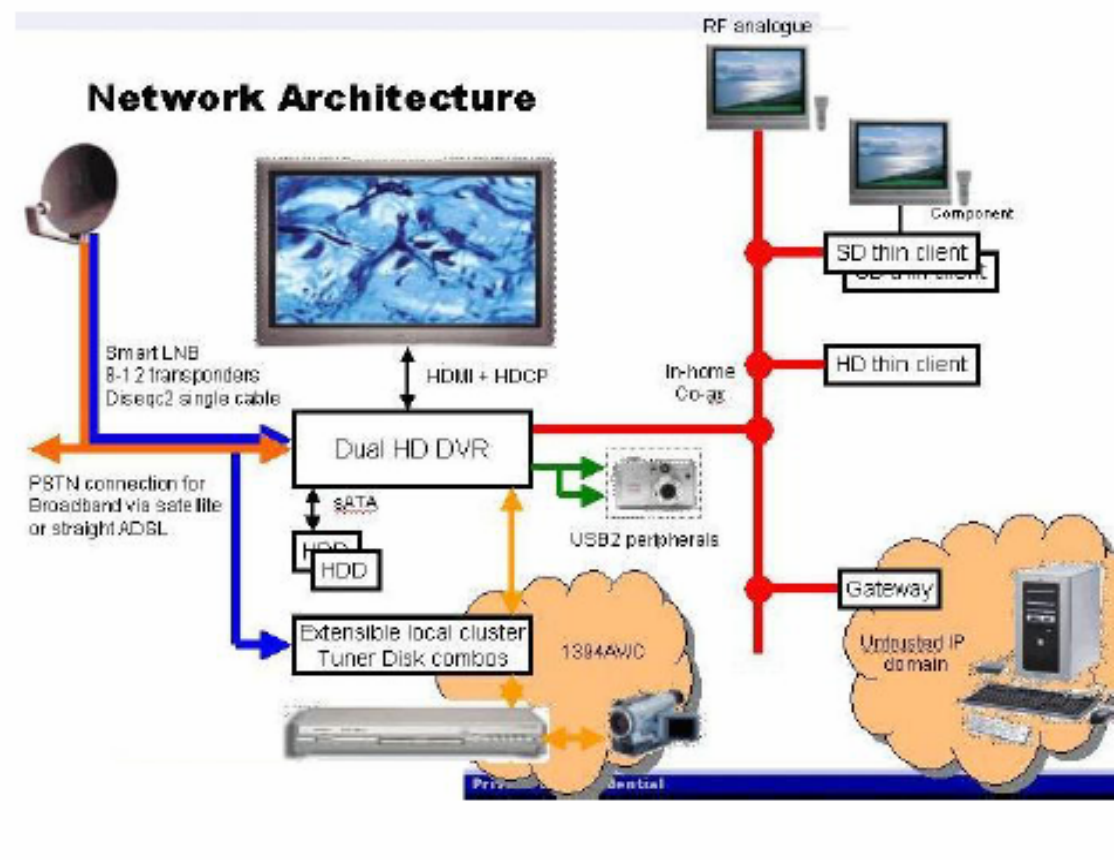
New technologies are emerging for digital television in Europe particularly to service the fast developing market for high definition television (HDTV). This is likely to grow significantly in Europe from 2006 with a predicted five million homes using advanced (mainly Satellite) platforms for HDTV by 2008.

High definition requires higher data rates and new signal processing techniques. Advanced video Codecs (e.g. MPEG4) for this purpose require more power as do the tuner/demodulators for the DVB – S2 standard for satellite HDTV signal delivery. This standard delivers a 30% increase in bit rate and has powerful error correction, but there is a power requirement penalty. This is compounded by the functional requirement of several tuner/ demodulators to allow local hard disc recording of multiple signals within the STB platform and decoding of multiple signals for distribution around the home.

The implications for power management are severe. There will be a higher overall power requirement generated by a large number of circuit blocks. The power management system will need to know the status of circuit blocks simultaneously supporting internal platform requirements and external network requirements. The management of network data streams will be complex, and remote command instructions from home network clients may mean that the box never has a standby active mode as the current CoC defines it. Intelligent "Auto-Standby functions may be needed. In satellite systems we will see multiple LNB combining units for single cable routing. These may well be separately powered and incorporate their own power management.

For the CoC, a task force has been mandated to address the issues raised by the new generation of platforms. This will not only have to address the implications on power requirement criteria limits of new functions and circuit blocks but will also have to review the relevance of the existing definitions of standby, standby active and on modes. Test set up and test methodology for these new platforms will require a radical review especially in the context of networked signals and single cable multiple LNB routing. This work will have to be completed in a relatively short time frame since one of Europe's leading Service providers, B-Sky-B has stated that 3 million UK subscribers will be using multi-room networking by 2010.

Figure5. Network Architecture for the Next Generation of STBs



(Courtesy Pace Micro technology)

The Challenge of Simple Digital TV Converter Boxes

It is likely that more than 200 million simple converters will be in operation in Europe, beyond 2015, to keep legacy analogue TVs and video recorders in operation in the transition to Digital TV broadcasting.

These converters will be, in the main, horizontal market products. The impact of cost competition on these products has already driven energy efficient design to an all-time low. Standby passive power requirement has moved from less than 1W in 2003 from two major manufacturers to a point where no manufacturer is currently meeting the CoC criterion of 2W. Conformance testing shows that there is a step increase in the average standby power of these products to an average level of over 6W. [5]

Activity from CoC working group members to remedy this situation is concentrated on establishing a set of international criteria for simple converters, with the object of influencing OEM sources of the product to endorse good energy efficiency criteria. The large majority of simple converters are imported into the EU, and are manufactures by relatively known manufactures. There is in place a major efforts to try to make this manufacturers aware of the

[5] Briefing note UK Market Tansformation Programme www.mtprog.com

CoC specifications. Cooperation with China, the USA and Australia in this area, , a very important initiative to further promote the CoC, is starting to influence production standards. But every effort must still be made by political representatives in the CoC working group to ensure that national product procurement schemes and product subsidy mechanisms endorse only the best energy efficiency standards.

Even if good standby passive performance is achieved for the majority of simple converter products in the market, the problem of mitigating their potentially massive energy impact is still not resolved. Unrelated surveys of user habits [6] show that around 60% of STBs are left on when the TV is put into standby, if another remote control or a secondary remote control operation is required. The CoC working group has discussed this problem over several meetings and has recently endorsed an elegant Auto-Standby solution proposed from the Pace Micro Technology[7]. Again every opportunity is being taken by working group members to drive this solution into an internationally accepted set of criteria for simple converters.

External Power Supplies - What are the Challenges?

Conformance testing for the CoC working group[8] has shown that the most popular external power supplies, those supplied for mobile phones, all comfortably meet CoC criteria. There are still major product groups where

Inefficient linear supplies are the norm such as DECT wireless PSTN phones, DAB Radios and of growing concern because of the spiraling volume of sales, Broadband, Modems, Switchers and Wireless routers. A priority for the political members of the working group is to convince major procurers of these products, such as supermarket chains, of the fact that CoC working group discussions show that the delivered cost at point of sale of a more efficient supply, meeting the CoC criteria, can be the same as or less than the inefficient linear alternative.[9]

A major step forward in further reducing external power supplies consumption will be the introduction of the Phase 2 levels on1.1.2007, when no lad consumption will be further reduced, and the load operation efficiency will be harmonized with the Energy Star current specifications. In addition, both the Digital TV Service CoC and the Broadband CoC requires that products supplied with external power supplies, have models that are CoC compliant, this should further promote efficient power supplies. In additional the revised Energy Star specifications for office equipment will also require compliant external power supplies for the Energy Star labeled products.

Conclusions

The EU Codes of Conduct have served as an important platform for promoting energy efficiency in Europe. The Code of Conduct for Digital TV Service Systems has already reduced

[6] BSkyB 2003, UK Consumers' Association 2000

[7] Presentation Ken Dale 30th Nov 2005 STB CoC meeting Draft Proposal for an Auto Standby Standard for STB http://energyefficiency.jrc.cec.eu.int/html/standby_initiative.htm

[8] Presentation Bob Harrison 25th May 2005 Power Supply CoC meeting UK MTP Conformance testing overview. http://energyefficiency.jrc.cec.eu.int/html/standby_initiative.htm

[9] Presentation Ben Sutherland Power Integrations at the CoC Power supply meeting: http://energyefficiency.jrc.cec.eu.int/html/standby_initiative.htm

the energy consumption of STBs, even if these offer many more features and services. Now energy efficiency is among the design priorities of next-generation STBs and in the procurement specification of service providers. The full transition to digital TV and enhanced services such as HDTV and home networking will add further challenges for energy savings and climate change mitigation in the EU.

The revised Code of Conduct for Digital TV Service Systems also covers the 'simple' STBs used to convert free digital TV signals. It is hoped that the Code of Conduct will make an impact on the power demand of these devices before hundreds of millions of them are sold. Simple' STBs are now the principle target for the CoC, however if it proves too difficult to have them adequately covered by the CoC, MEPs should be introduced as soon as possible. The new European Directive on Eco Design (also known as EuP) offers an excellent platform for adopting effective MEPS. The only concerns is the time requested to arrive to have MEPS in force, and the ambitiousness of the MEPS levels. For more traditional and technological stable products, imported in large quantities such as external power supplies and simple STBs, in the authors' view MEPS will be a more appropriate policy tool for achieving savings. In any case, the experience made so far with the external power supplies CoC has been useful to show that efficient power supplies could be used also with mass market end-use products (e.g. mobile telephone), and that cost-effective technologies exist to meet challenging efficiency requirements (even with linear technologies).

Last but not least, given the success of the Codes of Conduct in creating a useful stakeholder forum and in achieving concrete results in a very dynamic technological sector, the European Commission and national experts have prepared a new Code of Conduct to reduce energy demand in broadband equipment for the residential sector. This activity has raised an interesting expansion of the CoC to influence energy-efficiency standards in the Broadband Service Provider network exchanges and road boxes, where savings in power at the subscriber interface will drive large savings in cooling power.

References

Bertoldi, Paolo et al.. 2002. "Standby Power Use: How Big is the Problem? What Policies and Technical Solutions Can Address It?". In Proceedings of the ACEEE 2002 Summer Study on Energy Efficiency in Industry. Washington, D.C.: American Council for an Energy-Efficient Economy

Rezessy, Silvia, Paolo Bertoldi and Agneta Persson. 2005. "Are voluntary agreements an effective energy policy instrument? Insights and experiences from Europe" In: *Proceedings of the ACEEE 2005 Summer Study on Energy Efficiency in Industry.* Washington: American Council for Energy Efficient Economy

Harrison, Robert et al. 2004. "Digital TV and Broadband Communication: Containing the Energy "Black Hole" With the Innovative Policy Tool of a Code of Conduct" In Proceedings of the ACEEE 2004 Summer Study on Energy Efficiency in Industry. Washington, D.C.: American Council for an Energy-Efficient Economy

Molinder, Olof 1997. "Study on Miscellaneous Standby Power Consumption of House Equipment (light-audio-white goods)." In *Proceedings of First International Conference on Energy Efficiency in Household Appliances*, Florence, 1997 Italy (Editor P. Bertoldi, Publisher Springer Verlag).