NETWORK STANDBY – TOWARDS A POLICY FRAMEWORK workshop Toronto 7-8 March 2013

Workshop Summary

30 experts from around the world (primarily North America, but also Europe, Asia and Australia) attended the 2 day IEA/SEAD/4E/NRCan workshop.

An increasing number of electronic devices are connected to other electronic equipment in networks, constantly communicating with each other. This communication entails various standby states where devices consume energy even when the primary function is not being performed. IEA has together with the IEA Implementing Agreement for a Co-operating Programme on Efficient Electrical End-Use Equipment (4E) Standby Power Annex initiated a project to decrease networked standby energy consumption. The project is implemented in close cooperation with the Super-efficient Equipment and Appliance Deployment (SEAD) Initiative's working group on network standby. This second joint IEA/4E/SEAD and Natural Resources Canada technical workshop aimed to explore and discuss current and planned policies, results from ongoing projects, gain insights from industry and other key stakeholders and discuss progress needed towards a policy framework for networked standby.

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Introduction

John Cockburn of NRCan opened the proceedings and welcomed everyone to Canada. He gave an overview of IEA, IEA Implementing Agreement for Energy Efficient End-use Equipment (4E) and the Clean Ministerial Super Efficient Appliance Deployment (SEAD) Initiative collaboration in the area of network standby.

Vida Rozite of the IEA presented IEA activities in this area and highlighted workshop objectives and planned outcomes.

DAY 1

Session 1: Policy updates

Jeremy Dommu: Addressing Networked Standby through DOE Appliance Standards

Jeremy Dommu from US DOE set out US scene for standards and test procedures. DOE has the authority to start rule making activities where the aggregated energy of a product exceeds 150 kWh/year (becomes a covered product when average energy exceeds 100 kWh/year). Currently 60 product-types are covered. US regulations require that products are regulated on an annual energy consumption (it would appear to not permit power limits by mode). Any final rule establishing or revising a standard has to incorporate "on", "standby", and "off" mode energy use into a single amended standard, if feasible.

Test procedure for all covered products are to include energy consumption in "on", "standby", and "off" mode. DOE Regulatory Test Procedure is codified in the Federal Register and State Efficiency Standards and Voluntary Programs (ENERGYSTAR) also use the DOE test procedures. Manufacturers are responsible to conduct tests before they start selling products on the US market.

Set top box and television proposed test procedures were recently released for comment (Set-Top Box Proposed Test Procedure: Published 1/23/13; Television Proposed Test Procedure: Published 1/19/12; Television Supplemental Test Procedure: Pre-publication 2/28/13). For network-connected products DOE has developed a hierarchy for testing connections for products that has more than one network port. According to this hierarchy, tests are conducted on the port that consumes the most energy and it is assumed that other ports are disabled (not connected) except that one connection. Energy Star uses this hierarchy when appropriate.

DOE has authority to regulate network standby on a product by product basis as part of a single efficiency standard that incorporates energy use in "on", "standby", and "off" mode. DOE currently does not have any plans for broader requirements for networked products. No proposal for standard for networked televisions or set top boxes is planned at this stage. DOE published in March 2013 an initial analysis that estimates the potential impacts of an energy conservation standard for set-top boxes.

DOE is open to working with other standard setting bodies to incorporated harmonized terminology, definitions, and tests for networked standby, where appropriate, in current and future regulations.

Verena Radulovic: ENERGY STAR and Network Connectivity

Verena Radulovic from US EPA outlined their programs for networked products. Energy Star covers in total 65 product categories with 17,000 partners and 40,000 products. A large number of networked products are covered by Energy Star requirements. Energy Star requires 3rd party certification of product tests. Objective is to minimise overall energy budget for a product in use. Energy Star aims to incentivise energy efficient implementation and share innovations across products.

US EPA sees a clear trend of network connectivity being integrated in more and more consumer products. For example, 80% of TVs on the US market are shipped with network connectivity. Increasingly demand response-ready appliances and networked climate control is being deployed.

In dealing with networked products, it is essential to understand what is the function of the network connectivity in the product and how consumers are using it. The key objective for Energy Star in this area is to promote the delivery of network connection with the lowest power possible. Energy Star focuses on total energy consumption and network standby is viewed in this context. – consideration is paid to how standby or sleep modes can offset "on" mode and how lower power budgets for the whole product can be incentivised. In some cases additional power in low power modes can provide large overall energy savings in terms of total energy consumption. Important considerations for moving forward with network standby are an identification of similarities and differences between product categories and establishing a framework that would enable expediency in terms of dealing with new product categories.

Energy Star specifications for TVs version 6.0 (takes effect June 1, 2013) the test method establishes testing hierarchy in Standby Active Low. A new specification for displays with a network function is underway. EPA is doing more research on network use in televisions. Allowances are provided for certain functions in TVs but the limits need to be strict to ensure the most efficient implementation is delivered.

In the Energy Star Computer specification, EPA has rewarded those devices which maintain network connectivity in low power state. Including allowances for Wake-on-LAN for Ethernet connectivity and incentive for proxying (ECMA 393), which has potential for energy savings by encouraging products to enter Sleep Mode for longer periods.

Lessons learned from Energy Star that are of relevance for network standby include that there is a value to have a general framework but different classes of devices will need different treatment. It is important to design measures that promote technology transfer. A menu of allowances can be a useful approach provided that the items on the menu are limited and that the values are strict. It is important, where possible, to harmonize across specifications. There is difficulty as product categories merge, especially in the home entertainment and display area. Approaches need to consider that functionality in product categories evolves rapidly. Technology development through criteria that incentivise efficiency promoting features including Energy Efficient Ethernet, proxying, energy reporting. It is worthwhile to identify and invest in technical standard development in areas that promise big energy savings (e.g. proxying, Energy Efficient Ethernet). An important consideration is how to reward products that enable energy saving functions in default settings when shipped.

IEC62542 Environmental standardization for electrical and electronic products and systems - Standardization of environmental aspects - Glossary of terms includes definitions of modes.

Shailendra Mudgal: Relevant Policies of the European Union

Shailendra Mudgal from BIO Intelligence Service presented the current status of network standby policies for Europe. Background on the EU Lot 26 study for network standby was provided. The draft EU regulation (amendment to existing regulation) in its current form was examined. This sets power limits for January 2015, 2017 and 2019 for 3 categories of products HiNa (high-network availability), equipment with HiNa functionality, LoNa (low network availability). The amendment covers the same scope of consumer products as the Waste Electrical and Electronic Equipment (WEEE) Directive[1].

There are 2 special cases mentioned – televisions and coffee machines. There are some exemptions for specific products (large format printing equipment, printing equipment with a power supply larger than 750

[1] WEEE categories: small household appliances; IT and telecommunications equipment; consumer equipment; lighting equipment, electrical and electronic tools; toys, leisure and sports equipment; medical devices; monitoring and control instruments; automatic dispensers.

W, and tele-presence systems). Further exemptions are possible based on a "unless inappropriate for use" criteria. However, it is not yet clear how this criteria will be interpreted.

There is a review clause that the requirements will be re-examined in 2016. Time required to update regulations was discussed. In the case of TVs this was a process that took 4 years, in other cases updating has taken 5-7 years.

In terms of measurement and verification, the amendment:

- Repeals paragraph on measurement uncertainties (EN 50564)[2]
- Verification procedure indicated in Annex III but countries can supplement with methods if they become available

Currently, CEN/CENELEC has been given a mandate to develop test procedures.

Market surveillance will be a challenge – currently, methodologies for this are still lacking.

Some possible issues with the amendment include that from energy efficiency perspective, it would be better to look at the issue from a wider perspective. However, current regulation methodologies prevent an expansion of scope. There may be an opportunity to revisit this issue through the extended product approach. Another issue is that a horizontal delay time across all products does not take into account load and functionalities may bring inefficiencies. A further issue is the suitability of automated power down – for some products (e.g. coffee machines) it may be very appropriate but less so for other products (networking equipment).

Possible impacts of the forthcoming regulation were discussed. Concerns were raised that network connectivity could be added to products to entitle these to higher power limits. However, the case may instead be that network connectivity is taken out of products as it may be too difficult to adjust the power demand to the set networked standby limits.

SANGGUK JUNG: Korea's Energy Efficiency Program in terms of Networked Standby

Sangguk Jung from Telecommunications Technology Association, Korea presented information about the program in Korea that sets limits for power for products with a network connection. There are three main programme elements – energy efficiency labelling programme (encompasses minimum energy performance requirements and is mandatory, covers 35 product types), high efficiency certification programme (voluntary, 41 product types) and the e-standby programme (voluntary,22 product types).

To date, within the energy efficiency labelling programme, 7 Target Products have networked standby power limits (air conditioners, washing machines, drum washing machines, dish washers, household gas boilers, gas water heaters, TVs) an additional 28 products have efficiency level, off mode and passive standby mode power limits.

Target Product	Networked Standby Mode Power Limits	Network Function	Networked Standby Mode
Air Conditioners	≤ 1W (Passive Standby) ≤ 3W (Active Standby)	Available (some)	Available (Ethernet Communication)

[2] IEC 62301:2011 specifies methods of measurement of electrical power consumption in standby mode(s) and other low power modes (off mode and network mode), as applicable. It is applicable to electrical products with a rated input voltage or voltage range that lies wholly or partly in the range 100 V a.c. to 250 V a.c. for single phase products and 130 V a.c. to 480 V a.c. for other products. EN50564 standard provides a method of test to determine the power consumption of a range of products in relevant low power modes, generally where the product is not in active mode (i.e. not performing a primary function). It includes definitions for low power modes.

Gas Boilers	≤ 3W (Sleep Mode)	Available (majority)	Available (Serial Communication)
Gas Water Heaters	≤ 3W (Sleep Mode)	Available (majority)	Available (Serial Communication)
Washing Machines	≤ 2W (Active Standby)	Not available	-
Drum Washing Machines	≤ 2W (Active Standby)	Available (some)	Available (Ethernet Communication)
Dish Washers	≤ 3W (Active Standby)	Not available	-
TVs	≤ 0.5W (Passive Standby) ≤ 2W (Active Standby)	Available	None

Source: Sangguk Jung (2013)

Within the e-standby programme, 11 target products have networked standby power limits (computers, printers, fax machines, copiers, scanners, multi-function devices, set-top boxes, door phones, cord/cordless phones, modem, home gateways). A product by product approach has been used to set the limits. A combination of types of limits or requirements has been used including total energy consumption including “sleep mode”, “transition time” and “off mode” (computers, printers, fax machines, copiers, multi-function devices); while other products have specified transition times and power limits for modes (or for a set of modes). An additional 11 products have passive standby and idle mode power limits.

Target Product	Networked Standby Mode Power Limits	Network Function	Networked Standby Mode
Computers	TEC including Sleep Mode, Transition Time and Off Mode	Available	Available (Wake On LAN mode)
Printers, Fax Machines, Copiers, Multifuction devices	TEC including Sleep Mode, Transition Time and Off Mode	Available	Available
Scanners	≤ 15 min (Transition Time) ≤ 5~10W (Standby Mode) ≤ 0.5W (Off Mode)	Available	Available
Door Phones, Cord/Cordless Phones	≤ Various (Standby Mode)	Available	Available (Backlight off control)
Set-Top Boxes	≤ 1W (Optional, Passive Standby) ≤ 10~20W (Active Standby)	Available	None
Modem	≤ 0.75W (Off Mode) ≤ Various (Standby Mode)	Available	None
Home Gateways	≤ 10 min (Transition Time) ≤ 10~20W (Sleep Mode)	Available	None

Source: Sangguk Jung (2013)

Products are labelled according to a scale of 1-5 where 1 is the most efficient. For the labelling system – if products fail in standby performance then they cannot get more than level 2.

There are discussions ongoing in Korea on how to move towards systems rather than focusing only on individual products. However, no methodologies or demonstration cases have yet been developed.

The “reverse effect” was discussed whereby in a total energy consumption approach adding more functions leads to bigger power allowances. In other words, products need more functions to get enough power allowance giving manufacturers an incentive to add additional functionalities. In result, cases occur where products consume more power (by increasing functionalities) rather than improving energy efficiency to comply with the programme.

There is currently no specified test procedure on how to measure standby in networked products. Test procedures were discussed in this context as results will differ depending on the set up. Connection speed and cable length will influence test results. In Korea it is up to the manufacturers to chose the set up that consumes the most energy. If for a manufacturer test at a lower speed and a market audit tests at a higher network speed – the product will be found to be non-compliant. In cases of non-compliance the owners of companies are summoned to public hearings and are given two chances to change the label on their product.

Session 2: Perspectives from industry

Huw Waters: Industry perspectives on the proposed EU Ecodesign directive amendment of 1275/2008 (lot 6) with networked standby requirements (Lot 26)

Huw Waters from Sony in Europe gave a perspective on the proposed EU directive on network standby (Lot 26). It was clarified that to be in the scope of the regulation, a product has to have a network connection and has to be capable of reactivation via the network connection. Where this is not the case, the product then has to meet the requirements of the existing standby regulation as application (so called simple standby). Manufacturers will need to declare in the test report which interfaces are network ports.

Definitions used in the amendment

- “Network port” means a wired or wireless interface of the network connection at the equipment through which the equipment can be remotely activated.
- “Networked Equipment” means equipment that has the ability to be connected to a network and has one or more network ports.
- “Networked standby” means a condition from which the equipment is able to resume a function via a remotely initiated trigger via a network connection.

The use of different definitions in different jurisdictions is problematic. Lot 26 introduces new definitions.

- “*Availability*” is used instead of “*place in the network*”
- “*HiNA* “is used instead of “*networking equipment”*
- “*LoNA* “ is used instead of “*edge device*”
- “*networked equipment*” is used for all products (HiNA, LoNA) with network ports
- for HiNA equipment: “*Network Standby*” is used instead of Efficient Idle

The proposed regulation sets out a longer term goal (2019). While long term goals are generally seen as a good thing, the 2019 targets appear difficult or impossible to achieve at this stage for many product types (especially home audio equipment, home theatres with multiple ports).

The proposed regulation defines 3 classes of products:

- “HiNA equipment”: equipment with the functionality of router, NW switch, hub, modem, wireless NW access point, VoIP phone, Video phone
- “Equipment with HiNA functionality”: equipment with the functionality of a router, switch, WAP as side function
- “LoNA equipment” : all the rest of networked equipment

Within 20 minutes*	Tier 1 (1st Jan 2015)	Tier 2 (1st Jan 2017)	Tier 3 (1st Jan 2019)**
HiNA	12 W	8 W	8 W
Eq. with HiNA	12 W	8 W	8 W
LoNA	6 W	3 W	2 W

Tier 1 January 1st 2015	**HiNA**	**Must be able to deactivate wireless network port**	**When all network ports are deactivated then standby (if it exists) needs to be <0.5W**	
	Eq. with HiNA			**When all network ports are deactivated then APD into <0.5W, unless inappropriate**
	LoNA			
Tier 2 January 1st 2017	**HiNA**	**Must be able to deactivate wireless network port**	**When all network ports are disconnected then standby (if it exists) needs to be <0.5W**	
	Eq. with HiNA			**When all network ports are disconnected then APD into <0.5W, unless inappropriate**
	LoNA			

*Default time when placed on the market
** Subject to detailed review in 2016

Source: Huw Waters (2013)

The proposed regulation pushes for powering down of ports that are not used thereby introducing the idea of having dynamic products, where interfaces/network ports are switched on/off when needed/not needed customer might never use a port this includes: permanently deactivated ports; night mode/ periods of inactivity; when cables are disconnected.

It also gives manufacturers different possibilities/options to comply with targets

- Choose between complying with lot 6 or lot 26
- ports can be deactivated when equipment is placed on the market
- auto deactivate ports when disconnected

Specific product types covered by vertical regulations (e.g. televisions and computers) are excluded.

As it is linked to CE mark, everyone has to comply (no free-riders), but by linking to the CE mark this regulation focuses only on the product energy consumption, not on what happens on the network.

Industry have concerns that the scope is too broad and includes some equipment types where it will not be possible to achieve the requirements. Some savings may be degraded by network operation and the behaviour of other devices on the network, which it is not possible to control. Industry believe that the definitions and terms need adjustment (e.g. for network equipment this should be “efficient idle” and not “networked standby”).

Concerns were also raised on some vagueness on its application which may lead to verification issues. Lot 26 verification procedure motivates manufacturers to optimize the device power consumption when only 1 network port of the device is connected and not when several WAN and/or LAN ports are connected which is a more realistic use case e.g. for a home gateways.

Guidance on test procedure

(1) The unit is put in the On mode, default as shipped.
(2) For each type of network port:

- Step 1:connect 1 randomly chosen network port to the appropriate network,
- Step 2: deactivate/disconnect all network ports,

- Step 3: let the unit to go into the NW standby mode and check that the power is below NW standby target after 20 minutes
- Step 4: using a NW trigger, check that the equipment has woken up from NW standby to On mode

(3) Repeat steps 1- 4 for all other types of network interfaces

Equipment compliancy:

- For each NW port type, the measured power in NW standby must be below the target defined by the relevant tier and NW availability type of equipment

It is not clear if data links are covered or if there is a sufficient differentiation between different types of links.

Peter Gibson and Nathan Moin: Industry perspectives on global policy framework

Peter Gibson of Intel and Nathan Moin of HP presented ITI and Digital Europe perspectives. It was emphasised that there is already significant alignment between industry priorities and the objectives set forth by the IEA in the draft policy framework document. However, there from an industry perspective – further issues should be considered. There particularly needs to be alignment of approaches and transparency of approach without impeding innovation. Industry support the wide use of voluntary programs. Voluntary approaches can be ambitious though more regular updating in line with technology developments. For instance, there is already an Energy Star version 6 for PCs.

IEA draft policy framework/industry alignment	Additional industry principles
• Industry perspectives on global policy framework • Ensure energy efficiency programmes for ICT products to help promote and not impede energy efficient economic growth and innovation. • Ensure that energy efficiency programmes for ICT products are based of accurate data and sound analysis. • Adopt international technical standards and metrics in energy efficiency programmes for ICT products • Ensure transparency and stakeholder. participation in the regulatory process for energy efficient ICT products.	• Use proven successful voluntary and mandatory energy efficiency programs for ICT products as a basis for regulatory convergence and product energy efficiency gains • Avoid using voluntary energy efficiency program metrics as minimum energy performance standards (MEPS) for market access of ICT products • Adopt minimally trade-restrictive conformity assessment requirements in energy efficiency programs for ICT products • Align to ENERGY STAR® framework (voluntary) supported by international technical standards

Different equipment types in a network have very different roles and functions and these need to be considered. The behaviour of the whole network during operation also needs to be considered. Standard definitions are important. A key distinction that needs to be considered in the development of programmes is the appropriateness having different types of devices entering a “sleep” state. While edge-devices can power down to “sleep” modes without necessarily having a negative impact on the rest of the network – forcing networking devices such as routers into “sleep” will disrupt the network and may induce higher energy consumption in other parts of the network. However, provisions could be made for networking devices and network infrastructure devices to scale energy consumption to traffic.

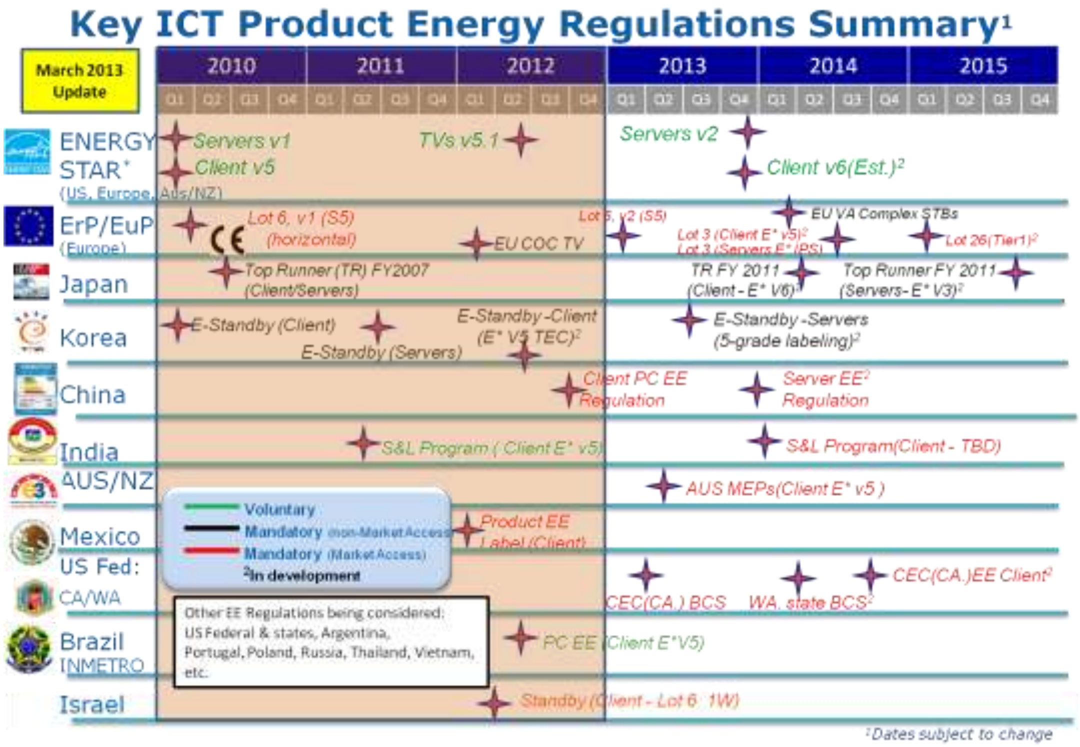
Network standby is all about the network and the components in a network. Rigid policy methodologies such as linking to CE marking may force a product-based approach. When developing policies it is important to keep in mind what the end-game is – working to increasingly lower power limits may stifle innovation.

The following guidelines for network standby policy development were proposed:

- Consider the network elements (networking devices, networked infrastructure devices, edge devices) in their entirety before considering efficiency requirements for each device class separately
- Horizontal approach is not optimal; the power and energy profiles and energy efficiency opportunities vary considerably between device classes- Horizontal approach leads to significant inefficiencies
- Vertical approach preferred and should identify product scope ensuring comprehensive studies (including effect on network) are concluded:
  - Identify product category specific requirements that may include separate limits, adjustments (adders) etc.
  - Minimises need for exemptions and avoids limits that are set too high and maximises efficiency savings.

Optimally, policies should be data driven, prioritized vertical segment approach with focus on greatest energy savings gains taking into consideration, dependencies, costs, and potential "unintended consequences".

Greater international coordination of policy efforts is warranted – already today there are large variations in approaches, scope, limits, and test procedures for ICT-based products.



Source: Peter Gibson and Nathan Moin (2013)

It was emphasised that measurement and data collection is the key to making good decisions. Standardised definitions and terminology are essential. Clear and unambiguous terminology that is based on an understanding network technology trends is needed. Definitions need to reflect the technologies in scope. Currently, the use of diverse terminology and the creation of new definitions is causing confusion and difficulties. When developing a harmonized set of definitions and key terminology it is important to bear in mind that generic terminology can cause difficulties (as shown by recent development of IEC 62542 where generic terminology creates difficulties due to differing technologies). In cases where generic terminology is used, providing examples can assist in the description of a definition (and limit the risk for variations in interpretation). Regular and comprehensive government/industry collaboration is needed to ensure suitable and viable terminologies and definitions.

Standardised testing is important (e.g. as provided in IEC 62623[3]). Need to have global approaches to minimise re-testing in different countries. Demands for in-country testing entail additional costs for industry. The objective should be to reach a level of harmonisation and transportability of data that would enable global acceptance i.e. that companies can test once and ship globally. Interoperability standards (e.g. 802.3az[4]) can facilitate energy efficiency. Technical standards can also play a role in advancing technology. Technical standards are not just developed within technical standardisation bodies. Industry can play an instrumental role in driving the development of technical standards thereby speeding up the process. The ECMA process led to a faster track where first industry developed a proposal which was then taken up by the International Electrotechnical Commission (IEC). This cut the process time by 18 months or even 2 years.

In terms of data collection and measurement, there is a clear need for comprehensive studies to consider network interactions and effects on energy consumption. Market studies for policy development need to have a clear identification of the scope (including product(s) and what is covered) and with clear identification of what the targets are (what changes on the market are aimed for). In this context it is important to note that ICT-based technologies and markets are changing at a rapid pace – reliance on previous study data may not be optimal. There are country and regional differences – local infra-structure and specific drivers (energy mix, cost, grid capacity) should be considered. However, where similarities exist – regional device-level data could be shared.

When it comes to studies of energy implications and savings potentials it is crucial to take into considerations what the ultimate objectives are – to reduce power limits or to save energy. In some cases, higher modal power could still result in low energy, and vice versa. Well designed studies could serve to identify opportunities for ensuring the implementation of largest energy cuts. It is essential to realise that the network(s) introduce an added complexity and over-simplification where upstream and downstream effects are not considered may be counterproductive.

Network standby – Robert Turner

Robert Turner of PACE showed how technology has changed dramatically even over the past 10 years. He showed the range of network connected products that are becoming prevalent in the home. Already today many homes have multiple wired and wireless network types that allow end-users to move content around. Increasingly it is becoming possible for end-users to remotely manage the devices in their homes.

He outlined some of the challenges of power management in various states of sleep for home entertainment equipment. Once user expectations for functionalities are established – they cannot be taken away. It is easy to turn off networked devices – the difficult part is waking them up quickly enough so as not to impact on delivery of services. There are some services that need to be always on such as voice-over-IP. It was noted that some entertainment networks are moving high bandwidth data flows.

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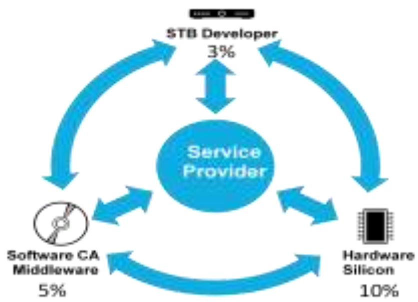
[3] IEC 62623:2012 covers personal computing products. It applies to desktop and notebook computers as defined in 4.1 that are marketed as final products and that are hereafter referred to as the equipment under test (EUT) or product. This standard specifies:
- a test procedure to enable the measurement of the power and/or energy consumption in each of the EUT's power modes;
- formulas for calculating the typical energy consumption (TEC) for a given period (normally annual);
- a majority profile that should be used with this standard which enables conversion of average power into energy within the TEC formulas;
- a system of categorisation enabling like for like comparisons of energy consumption between EUTs and a pre-defined format for the presentation of results.

[4] Institute of Electrical and Electronics Engineers (IEEE) 802.3az is the specification for Energy Efficient Ethernet

Source: Robert Turner (2013)

Energy efficiency requires the involvement of multiple stakeholders. Measures aimed only at end-use product manufacturers can deliver savings in the range of 2-3%, software and middle ware can deliver 5%, silicon hardware 10%. However, for instance, in the case of set-top boxes, if these groups and the service providers work together savings of more than 50% are possible.



Source: Robert Turner (2013)

The challenge is to get these groups to work together. There are special opportunities and challenges related to improving the energy efficiency of products such as set top boxes that are purchased and delivered by service providers. Service providers have a strong influence on the energy consumption of set top boxes. But there is currently little incentive for service providers to optimise energy consumption in the end-user premises. This is yet another example of split incentives. Some form of measure is needed that would redistribute the costs and benefits.

The topic of split incentive was discussed. One option could be to make the service provider responsible for the cost of electricity. However, with large differences in electricity prices within regions and within countries, this would be complicated. Also in many jurisdictions, households can change energy suppliers, which has an impact on electricity costs. Part of the solution could be to get the set-top box to record usage so that hours watched could be excluded from the cost covered by the service provider.

Doug Johnson: Industry Initiatives and Recommendations for Public Policy

Doug Johnson of CEA noted that the market is moving rapidly and regulating is difficult without impeding innovation. It was acknowledged that Energy Star is successful in improving efficiency. An important distinction between Energy Star and Codes of Conduct is that the former faces consumers while Codes of Conduct do not.

The consumer electronics market is characterised by:

- Rapid innovation
- Dynamic marketplace
- Highly competitive industry
- Significant time-to-market pressures
- Significant cost pressures
- Rapid rates of market penetration
- Rapid transition from one technology to another

Specific challenges with regulatory approaches were discussed:

- Product definitions change
- Products converge, new product categories emerge
- Technical complexities with consumer electronics
- Operating modes and functions change

The importance of good data for decision making was emphasised. A recent CEA study (2011) includes figures on networked consumer electronics including residential networking devices in U.S. (broadband modems with/without integrated routers, routers, etc.):

- Unit energy consumption (U.S.): **47 kWh/yr**
- Installed base (U.S.): **137 million**
- Annual electricity consumption (U.S.): **6.4 TWh**

There could be an opportunity to discuss what should be included in the next survey.

CEA has recently published guiding principles for Networked Consumer Electronics based to a large extent on the IEA guiding principles on the topic. The World Electronics Forum could provide a venue to raise awareness on the importance of energy efficiency and the issue of network standby. Moving forward with network standby it is crucial to figure out the larger ecosystem and highlight energy efficiency opportunities. An important topic warranting further attention is how to link demand response to energy efficiency.

Tony Brunello: What next?

Tony Brunello of the Green Technology Leadership Group (Smart Electronics Initiative) introduced the Smart Electronics Initiative. The initiative aims promote the expanded production & use of energy efficient electronics through the development and implementation of good public policies. The initiative links up industry leaders with state and federal policy makers, develops new solutions around voluntary and mandatory efficiency standards, procurement, and incentives. The initiative also seeks to reach and engage a wider group of stakeholders through targeted campaigns.

The need for strategic and forward thinking and more collaboration between government and industry was emphasised. New opportunities could include a code of conduct for network standby, procurement. There is increasing interest in demand response; exploration of this topic from a network standby and energy efficiency perspective is warranted.

Discussion

The limitations of voluntary agreements were discussed. Voluntary agreements may create a pull towards more efficient products but do little to push the bottom of the market. It was noted that a combination of policy approaches and tools is needed – or a hybrid approach. There also need to be mechanisms to involve regulators and non-governmental organisations (NGOs) in the development of voluntary agreements. For credibility – an independent inspector or entity to verify claims is needed. In some cases voluntary agreements are not appropriate as they would fail to bring all relevant industry together (due to e.g. competition issues).

There was discussion on the issue of vertical versus horizontal approaches. It was noted that only 20% of all standby is likely to be covered by vertical approaches (even in an aggressive regulatory environment), so standby is ubiquitous and needs to be addressed in a broader manner. It was noted that consumer electronics might be developing too fast for conventional policy approaches to tackle on a product – by product basis. The possibility of dealing with products types that consume a lot of energy in a vertical way and having a horizontal approach for the large number of small energy consuming products (described as "too small to regulate – to ubiquitous to ignore") was raised. There may be value in looking at product groupings that have similar network functionality (e.g. appliances, lighting, video etc.) as their functionality tends to be similar and this allows a more tailored sector requirement to be developed.

An important issue in this context is the need for having better data and transparency. An option could be to introduce continuous automated energy monitoring.

Session 3: Standardisation

Lloyd Harrington: Overview of the Standardisation Landscape

Lloyd Harrington of Energy Efficient Strategies, Australia gave an overview of standards related issues. He distinguished between different types of standards:

- Energy standards or specifications that set performance requirements
- Measurement methods (test standards)
- Technology standards

Energy standards are specific energy requirements set by regulation, endorsement or other programme. These are typically in form of power limits while meeting certain product design or performance criteria. Test standards are the methods that define how we measure the energy and performance of a product Sometimes test standards are combined with (to varying extents) energy efficiency requirements (energy standards). All energy standards need test standards (i.e. protocols laying out the procedure for what should be measured and under what circumstances and how measurements should be made) to determine eligibility of products.

It was noted that while some technology standards facilitate energy efficiency, many communication protocols have no facility for reduced energy modes. Some work is required to identify and address problem areas. An example of a technical standard that promotes energy efficiency in network-connected devices is the IEEE 802.3az Energy Efficient Ethernet which allows the network link to be asleep with almost zero power consumption where there are no data packets. Links can be established in less than one millisecond. This technology standard is a subset of of IEEE 802.3 that deals with energy issues. However, in order to enable energy savings, the standard has to be implemented at both ends of the link.

There are further technology standards that can promote energy efficiency in network-connected devices. These include IEEE 802.11 (Wi-Fi) which has features that allow energy saving in the edge device (the standard needs to be present and activated at both ends of the link). Features include: Power Save (PS-Poll); Automatic Power Save delivery (APSD); Fast BSS Transition – IEEE 802.11r/mb; IBSS Mode Power Save.

Developments in the area of technical standards for improved energy efficiency are ongoing:

- There are currently developments for standards for access points, including: Proxy ARP – IEEE 802.11v; TIM Broadcast – IEEE 802.11v; WNM Sleep Mode.

- DOCSIS (Data Over Cable Service Interface Specification) has not allowed any energy management - the only way to reduce energy was to manually disconnect (no function). However, a new version of the standard enabling enhanced energy efficiency has been developed (see summary of Debbie Fitzgerald's presentation).

- HDMI Version 1.4 (High-Definition Multimedia Interface) "Consumer Electronics Control" (CEC) allows coordinated power management across connected devices (via a master-slave arrangement), but is not standardised for all brands/models and is not open source. This means that savings may not be possible if devices from different manufacturers are connected.

A benefit of minimum energy performance requirements is that it does focus everyone's attention on energy issues. However, networks are a collection of equipment (called edge devices) that are connected together by network links. It is important, in a conceptual and policy sense, to separate edge devices (things that provide us services) from network equipment (things that provide the network links). The right policy questions in the context of networks is:

- How much extra energy in all modes does the presence of a network function induce?
- What can we do to minimise that additional energy while maintaining usability and quality of service?

Just focusing on low power-modes is not sufficient – instead it is important to look at elements together and make sure that everything in networks uses as little power as possible. This includes making sure that link power is as low as possible, energy management is mainstreamed in edge-devices (power down to the lowest power mode whenever possible), and power-scaling (power down of internal services that are not being used) is used (while only edge devices can do energy management, all devices can do power-scaling). Power scaling can provide large energy savings in all equipment where information and data is the main function. Product designers need to configure energy management and power scaling in a way that is appropriate for the product. Power management and power scaling cannot be defined by technology standards – technology standards can however facilitate coordinated power management across products. Energy management and power scaling can be encouraged through energy standard requirements.

Important considerations are:

- User experience has to be good (energy management that is annoying will be disabled)
- Some products may need to be able to wake up in response to network demands (link should remain available for reactivation)

Useless network chatter can keep everything awake all the time. A big challenge is how to get rid of unnecessary chatter on the network – this is largely connected to legacy products and can undermine energy savings efforts. It is important to assess what services are needed as a first step towards getting rid of unnecessary services that generate unneeded chatter.

Another challenge is the numerous different test procedures that are being developed for the same products but in different regions. Currently a full and comprehensive test procedure for network-connected products does not exist. Many network elements are covered by test procedures linked to energy standards – e.g. Energy Star, EU Code of Conduct (many bits are different). Providing a functional network for test is often necessary. There is a clear need and benefit in facilitating the development of test procedures through a repository of network test elements. This would enable developers of test procedures to select already developed test elements in accordance to what is needed for specific products or groups of products.

Test procedures need:

- Definitions and Network Categories - definition of terms integral to testing of network functions
- Product Configuration and Setup Requirements
- Network Connectivity - defined relevant network connection modes for testing
- Network States and Modes and Network Traffic

- Energy Reporting Requirements - energy by mode and network connection

Issues that still need to be resolved include:
- How are we going to make progress on technology standards where there are gaps in energy saving features?
- How can we track progress in the diffusion energy saving technology standards?
- How do we track their effectiveness in the real world?
- How will the testing elements for networks be developed?

Discussion:
It was recommended that policy making needs to take into consideration also the maturity of products. In a first generation product – the primary focus is to get the product on the market (first movers have competitive advantage), in the 2nd generation focus is placed on improving the product in terms of service and functionality and in the 3rd generation it is realistic to start taking into consideration energy efficiency.

Jon Fairhurst: IEC TC100 TA12: AV energy efficiency and smart grid applications

Jon Fairhurst of Sharp Labs gave an overview of international standards processes in the International Electrotechical Commission (IEC), with a focus on TC100 activities. He is the area manager for TA12 Energy Efficiency and Smart Grid Applications. There was a general policy decision at the Strategic Management Board (SMB) level in IEC for Technical Committees to be aware of energy and resource issues when developing performance standards. SMB do not vet standards.

The TC project process follows these general steps:
- Stage 0: New topic or area is proposed and a technical report or study is developed
- NP (New project): A national committee submits a new project (3 month vote)
- CD (Committee draft): The committee develops a draft (2-4 month review/comment and vote)
- CDV (Committee draft for vote): Draft is updated on basis of comments (3-5 month vote)
- FDIS (Final draft international standard): FDIS phase is conducted only if there are any negative or normative comments during the CDV phase.
- IS (International standard): Standard is published.

Current and planned developments include:
- A new TA is proposed for wireless power transmission.
- IEC62654 *Network-based energy consumption measurement - Energy saving system - Conceptual model*.
- IEC 62087 is being revised into a multipart standard to facilitate reviews and updates. IEC62087 has been successful because there have been adequate resources and good regulator and government input at the working group level.
- Activities within "Environmental aspects in the field of audio, video and ICT equipment" **IEC 62018 Ed1:** Power consumption of information technology equipment - Measurement methods (Published by TC108 & transferred to TA13); **IEC 62075 Ed1:** Audio/video, information and communication technology equipment - Environmentally conscious design (Published by TC108 & transferred to TA13)**; PT 100-8:** Stage 0 project on "Quantification methodology for greenhouse gas emissions for computers and monitors".
- Activities within "Interfaces and methods of measurement for personal computing equipment": **PT 62680 Ed1:** Universal Serial Bus interfaces for data and power (Parts 1-4); **PT TS 62700 Ed1:** DC Power Supply for Portable Personal Computer.

Discussion:
There is openness within TC100 for input on policy-making needs. Participation in TC100 is possible via designated national contact points. TC100 has broad international memberships, further members are welcomed.

An important distinction is that while IEC plays a crucial role in standardising terminology, the development of test procedures and even in developing efficiency tiers for some product classes (e.g. motors), most technology standards relevant to the topic area of network standby are not IEC standards, so separate efforts (outside of IEC and ISO) need to be made to address the inadequacies.

It was noted that Europe is concerned about energy efficiency of power supplies at low power levels and is adding an additional test point at 10% (or 5%) of rated power. Ideally, the test method should deliver a curve rather than an average number for efficiency across the range. The IEC has published a test method for determining efficiency as does AS/NZS 4665 Part 1 and Part 2[5]. The approach taken to establish efficiency level is to measure the input and output power at four defined points: 25%, 50%, 75%, and 100% of rated power output. Data for all four points are separately reported as well as an arithmetic average active efficiency across all four points.

IEC 62075 "Audio/video & ICT equipment – environmentally conscious design" has a section (section 5.3) on energy efficiency)[6].

Franz Zichy: Standardization: Plans and Progress

Franz Zichy of the US State Department gave an overview of the work in the International Telecommunications Union (ITU) on standardisation in ICT networks. Study group (SG) 5 is concentrating on network equipment. SG5 has built successful collaborations with stakeholders including national administrations,regulators, international organizations,standards development organizations,companies and academia. SG5 works closely with ITU-R, ITU-D, UNFCCC, UNEP, WHO, CIGRÉ, EC, CENELEC, ETSI, ISO, IEC, GeSI, GHG Protocol Initiative and ICT4EE Forum. ITU is also actively working on ICT and smart cities.

ITU documents of relevance for the topic of network standby include:

- Recommandation ITU-T L.1310: Energy efficiency metrics and measurement for telecommunication equipment
- Recommendation ITU-T L.1400 : Overview and general principles of methodologies for assessing the environmental impact of information and communication technologies
- Recommendation ITU-T L.1410 : Methodology for environmental impacts of Information and Communication Technologies (ICT) goods, networks and services

Recommendation ITU-T L.1310 contains the definition of energy efficiency metrics, the related test procedures, methodologies and measurement profiles required to assess the energy efficiency of telecommunication equipment (Phase 1).This includes: wired as well as wireless broadband access; optical

[5] AS/NZS 4665.1: Test Method and Energy Performance Mark specifies the method of test to assess the energy performance of external power supplies, and the international system for marking the efficiency on the power supply. This test method is technically identical to the test method used by the US EPA in the Energy Star program. It describes the general test conditions, and the measurement approach for determination of efficiency at 25%, 50%, 75% and 100% of rated power output, and under no load conditions. This Standard also describes the system for marking a power supply with a Roman Numeral to indicate its overall energy performance. The requirements in AS/NZS 4665.2 are equivalent to numeral III.

[6] IEC 62075 which identifies design practices for the following product attributes throughout a product life cycle: energy efficiency, material efficiency, consumables and batteries, chemical and noise emissions, extension of product lifetime, end of life considerations, substances and preparations needing special attention, product packaging, and documentation. IEC 62075 is equivalent to the 3rd edition of ECMA-341, "Environmental design considerations for ICT & CE products".

transport technologies; routers; switches; mobile core network equipment; and small networking equipment used in homes and small enterprises. These metrics evaluate ICT equipment's energy efficiency through a comparison between its technical performance (useful work) and its energy consumption. There could be opportunities to contribute to develop the network level metrics (Phase 2).

ISO IEC JTC 1/SC 39 Sustainability for and by Information Technology is also looking at energy efficiency metrics for ICT equipment.

Recommendation ITU-T L.1200 covers direct current power feeding interface up to 400V at the input to telecommunications and ICT equipment. Benefits include power scaleability and high energy efficiency (gain of 5 to 20% energy consumption compared to different existing best in class powering solutions).

Discussion:
It was noted that there are synergies between the ITU work and IEC work on edge devices but that there could be opportunities for further liaison to ensure that there is no overlap.

Wrap up from day 1 and discussion

During the course of day 1 a range of topics was covered. Participants discussed options on how to deliver network-connectivity with lowest power possible.

- It was emphasised that network standby is all about the network and the different components in the network and that a holistic view is required to get a sensible outcome. There is a need to figure out the larger ICT-eco system, interdependencies and the variety of factors that influence energy consumption. Possible approaches could include exploring extended product approaches, dealing with product packages or clusters or groups of products. Addressing energy efficiency through network communication protocols i.e. finding ways of decreasing useless network chatter was seen as crucial to facilitate better power management. Users themselves also need to be considered as part of networks.
- The IEA Guiding Principles for Good Network Design – need to be embedded into the design philosophy of networked products.
- It was noted that the context for smart product deployment is also an important factor to consider e.g. the role of smart products in wider approaches such as demand response.
- It was stressed that networked products are a fast moving diverse category which is difficult to regulate. The dilemma of a large part of these products being small to regulate (individually), too big (collective energy consumption) to ignore was discussed. The need for programmes that pull at the high end and stimulate and reward efficient products while at the same time dealing with the worst products was emphasised. Approaches focusing on performance-based procurement were suggested. For several product categories there is a need to find approaches that deal with split incentives. An integrated package of policies could have many or at least several elements.
- The need for good data was highlighted – essential to create baselines and evaluate impacts of policies, measures and initiatives. Further efforts are needed on ensuring that definitions are harmonised and that progress is made in terms of harmonising and aligning test procedures.

The importance of harmonisation and the use of international standards was emphasised. Presentations and discussions showed that there are ongoing efforts across national, regional and international standardisation bodies. While some coordination mechanisms are in place for instance joint technical committees, further coordination may be warranted in some cases. Another aspect that was raised was how policy makers can get a sufficient understanding of the standardisation landscape to understand what is in place and where are possible gaps without expending a lot of resources and needing to follow the work of a large number of technical committees. The need for and value of communication channels from policy makers to standardisation organisations on current and future standardisation needs was also mentioned.

Ensuring that communication protocols enable or facilitate energy efficiency is a crucial step towards improved energy efficiency of edge-devices as well as systems-wide efficiency. Relevant organisations in this context include ISO IEC JTC 1/SC 6 - Telecommunications and information exchange between systems. However, it should also be noted that much of the work in developing standards in this area is done in other fora such as the Internet Engineering Task Force. In terms of communication protocols it may not be realistic to think that energy saving considerations would be a sufficient driver to change protocols. There could be scope to identify the co-benefits.

The amount of data packets that are being sent around is huge – could be in the order of 2 million packets between networking equipment and one edge-device during one night. Networks vary a lot in terms of the amount of data flowing around. Some of this is due to the legacy design of the network devices. Just measuring amount of traffic is not sufficient – there is a need to look at why the packets are being sent. Measuring power in existing systems is of moderate value as most equipment cannot power scale and much of the current data flows are of little or no value. End use measurements in the field are needed – there is a need to understand energy consumption, need to understand data packet flow and eventually how much of that data flow is necessary (how much current data is of low or no value) i.e. understanding what purpose data flows have. Topics of interest include understanding why packets are being transmitted at such a high rate and during times of inactivity. It would be valuable to identify trends and set benchmarks.

The importance of good data was emphasised, as was the need for improved methodologies and mechanisms to collect data and mechanisms to share data. There could be opportunities to establish ways for networked products to detect their own modes and report on energy consumption. There are already seeds for this in terms of some product groups such as set top boxes and games consoles. Intel has conducted studies on personal computers. Automated measurements could feed into a model that could be scaled up to create a baseline. There are technologies available to support this. It could also be possible to extract relevant information via power lines. There is also some information collected via smart meters however intervals may not be appropriate (e.g. 15 min measurements).

Also further exploration of “immediate” reaction is warranted in terms of understanding what the tolerances are. It was noted that one of the most important network component is the human interface. There could be scope to explore the role and impact of human beings as nodes on the network. Important issues to consider is that most users stick with the out-of-the box settings and if energy efficiency options are provided these should be automated and in the default settings when products are shipped. When it comes to networks – users themselves typically do not set these up or if they do they use simple default configurations. Users only change things that are annoying. There could also be a role in tasking the service providers that set up home networks to ensure energy efficiency. Energy Star is for example looking at possibilities to cover installers. In the UK some service providers are already tasked with providing some form of energy efficiency promoting activities.

Other aspects to consider include understanding drivers for making products more energy efficiency. Many manufacturers design efficient products to keep heat levels down and thereby avoiding warranty costs.

Typical user patterns that are used for comparative purposes were discussed. The reality is that real usage patterns are a distribution and this needs to be considered to get a more realistic impression of the range of product performance during normal use. The usage patterns used in Total Energy Consumption (TEC) calculations are not always a good match to how products are actually used.

Day 2

Session 4 – Towards standardised approaches

Bruce Nordman - Terminology and Definitions Needs for Low Power Mode Energy Use with Network Connectivity

Bruce Nordman of LBNL gave an overview of issues in the area of terms and definitions. Inconsistent definitions impedes communication and development of policies to deal with complex technical issues. Can be solved but will be a medium-term project.

Types of terms to be defined are topics, named modes, mode categories, mode characteristics, power levels and test procedure results. Context is also important – energy policy, test procedures, technology standards, user interfaces.

Types of terms:

- Topic areas (collections of ideas)
- Named modes (with specific meanings)
- Mode categories (with only general meaning)
- Mode characteristics (i.e. functions)
- Power levels
- Test procedure results

The context for the use of terms differs:

- Energy Policy (mandatory standards, voluntary programs, and analyses of energy consumption patterns)
- Test Procedures (instructions for manufacturers or test laboratories on how to measure energy use of products)
- Technology Standards (technical documents that specify how devices, components, or communication protocols operate)
- User Interfaces (terms printed on product hardware, rendered on displays, or described in user documentation)

Terms can be used in a range of contexts, which can lead to confusion. Terminology is not something static - terms move among contexts. There are currently relatively large variations in terminology used with terms describing the same phenomena varying among product types, manufacturers, countries.

There are some fundamentally different definitions for the same or similar phenomena that are currently used in different contexts. The term “standby” is problematic since it is used both to define one or more specific modes, as well as being used as a generic term to describe a topic area. The IEC 62301/Ed.1 (2005) defines “Minimum Power Mode” where “Standby” is: “*lowest power consumption mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when an appliance is connected to the main electricity supply and used in accordance with the manufacturer’s instructions*” according to this definition “standby” can occur in any mode. However, in some cases “standby” is considered to be a distinct mode and is defined by the functions present. In the EU Lot 26 “standby” is defined as a condition, while other approaches use a “sleep paradigm” with three basic modes “on”, “sleep” and “off”.

The second edition of IEC 62301 (2010) deals with “standby” as a collection of modes. In the standard, “standby mode(s)” are defined as: “*any product modes where the energy using product is connected to a mains power source and offers one or more of the following user oriented or protective functions which usually persist: to facilitate the activation of other modes (including activation or deactivation of active* *mode) by remote switch (including remote control), internal sensor, timer; continuous function: information or status displays including clocks; continuous function: sensor-based functions*". The standard defines "function", "mode", "product mode", "low power mode", "off mode(s)", "network mode(s)", "active mode(s)", and "disconnected mode". Modes are defined by the functions that are present and modes are placed along a linear scale. The standard distinguishes "standby" from "off" and according to this definition "standby" does not include network connectivity.

The EU regulatory framework, proposed amendment to the standby regulation (EC 1275/2008) defines "network**ed** standby" as: "a condition in which the equipment is able to resume a function by way of a remotely initiated trigger from a network connection".

Within the "sleep paradigm", "sleep" is a basic state between "on" and "off". Devices may have multiple sleep states and most (not all) products (can) retain network connectivity in sleep.

Key definitions were suggested as a first step in moving towards agreed-upon principles in terms of terminology.

- Minimum power mode
  - Concept has value and should be retained; use this term
- Network standby
  - Use for the general topic area of technologies, policies, etc., around energy use of low power modes with network connectivity; no more specific meaning
- Network**ed** standby
  - Use as defined in the EU widely-horizontal policy approach for a "condition" of a device that is in a low power mode with network connectivity
  - May at times get confused with 'network standby'
- Standby
  - Use "IEC 62301 standby" when that specific meaning is intended (v2)
  - Otherwise "Standby" to refer to the topic area of "low power modes" generally, including those with network connectivity
- Sleep
  - Use in user interfaces and product-specific test procedures and specifications
  - Refer to "network-connected sleep" when needed
  - Some devices (kitchen and laundry) could have "ready" modes and not sleep

Some sort of a framework is needed for dealing with definitions and to avoid continued confusion over terminology and definitions. As many interests and contexts are relevant – there is a need for progress that is incremental and inclusive. Terminologies are not static in time – a process for revisiting definitions may be needed in 2-3 years time.

Discussion:

Are data links included in the scope of discussions? It was noted that they probably should be, but this is slightly ambiguous.

The IEC has developed an approach towards dealing with terminology via the use of a table rather than terms. This has been done within the IEC for televisions. Such a table based approach could be a foundation on which to build on to get better clarity around network standby terminology.

It may not be possible to put definitions in a linear formal since they differ for many products and contexts. It is important to realise that terms and definitions also change with products and time and it may not be useful to spend a lot of time to develop definitions. The EU Lot 26 experience indicates that there are no perfect definitions that everyone will agree on – the ambition level should be to find a set of "best fit" definitions.

There should, however, be a limited number of key definitions where agreement can be reached. In order to avoid creating new definitions and to provide transparency the starting point should be to cite existing definitions.

It is important to distinguish between generic terms and not generic terms or rather generic use of terms and specific use of terms. Network standby is a condition and not a mode and standby is a condition and not a mode.

Lloyd Harrington: Energy requirements for functions

Lloyd Harrington of Energy Efficient Strategies, Australia gave a presentation of power required for functions. Just measuring power does not provide information on what the product is actually doing. It is important to understand terms such as functions and modes. There is a need to better understand the primary power requirements for various functions. This will enable the development of better policies that more closely match the real variations in energy needs for real products. Power allowances are already used in policies, for example, Energy Star (e.g. small network equipment specification) and EU Code of Conducts (Set Top Boxes and Broadband). Also Korea also uses adders (indirectly) by permitting different power levels for different products and modes.

According to IEC 62301 Edition 2, a "function" is: "*a predetermined operation undertaken by the energy using product. Functions may be controlled by an interaction of the user, of other technical systems, of the system itself, from measurable inputs from the environment and/or time".*

- Primary function: intended purpose – the main energy service of the product
- Secondary function: other functions which can enhance the primary function or can assist with the use and operation

There may be several primary functions in a product (although often there is only one), may be none or more secondary functions.

There is an important distinction in regard to network functions:

- In most products, network functions are a secondary function
- For network equipment (eg switches, routers, and modems), network related functions are the primary function

There are 3 main types of modes:

- Active modes – where the main function is being provided and it is connected to mains power
- Low power modes (no main function is active and connected to mains power)
- Disconnected from mains power (the product may still in any mode and may be connected to a network via use of battery power).

IEC62301 Edition 2 splits low power modes into 3 categories:

- Off mode – no user oriented function present
- Standby mode – one or more user oriented functions present
- Network mode – at least one network function present such as network presence or reactivation

To understand how much power is required for functions is complicated because:

- There may be many functions present in a low power mode
- It can be difficult to tell what functions are present and what state they are in
- There are other confounding factors like power supply configuration that are important

IEA Implementing Agreement 4E is working on this topic and is in the process of commissioning further studies. While informative, it should be noted that the outcomes of these projects will not be fixed in time. It is expected that revealing power requirements of functions and by focusing attention on this aspect will contribute to better policy design, while at the same time drive innovation for low power solutions.

Discussion:
US DoE cannot use functional adders. However, it would be of interest to explore how outcomes of these studies could inform policy design.

There is a need distinguish on the basis of product performance and find ways of recognising the highest performing product in terms of functionality.

Robert Turner: Moderated discussion on test procedures

Robert Turner of Pace set out the basic requirements for test procedures: robust, repeatable, reproducible, realistic (representative), really simple. Some of these may be mutually exclusive.

Test procedures should be national or international not manufacturer specific. May be better if test procedures are codified by an international standardisation organisation like the IEC. However, sometimes there are different regional needs in terms of prevalence of technologies. Even when there are regional differences it is preferable to have an internationally standardised set-up – e.g. everything stays the same but a different cable is used. In some cases it is possible to within international standards provide options for which there can then be national specification. Options can be problematic though if no hierarchy is defined. Regionalisation is also relevant in terms of power – how many volts. IEC, for instance, does not specify power requirements.

It was emphasised that there needs to be a clear distinction between test procedure and the activities that need to be done in order to comply with regulations on a certain market. Test procedures focus on a certain product and explain what features need to be tested and how. The regulatory process in turn specifies what needs to be done to comply i.e. how many products need to be tested. These should be kept separate. Building in usage patterns (for example) into a test procedure stops it being global in application. There are considerable differences. For instance, in terms of automatic brightness control in the US 12 Lux are used while in Korea over 200 Lux are used.

Test procedures need to be sufficiently transparent. Aggregate numbers (as part of the test procedure) are not helpful.

There needs to be strong liaison between government and IEC about their regulatory needs to ensure that there is a close match between requirements and published standards. This will allow governments to use established international test methods with little or no deviation. Standardisation bodies need to anticipate policy-making needs. There may be ways of improving dialogue on this to facilitate the planning process and align timing. In some cases government agencies (e.g. US DoE) may not be able to freely communicate needs to standardisation bodies.

In terms of using international test protocols, there is sometimes and issue of timing. For instance if US DoE or Energy Star need a procedure at a given point in time in process, then if an IEC standard is not available, they have to create their own standard. Leading to a situation where there is a US standard and an IEC standard for the same product group.

Software adds a layer of complexity to test procedures since differences affect reproducibility.
Currently, while there is no comprehensive test protocol for testing power consumption in standby when products are connected to networks, there are protocols that are relevant. There could be a value in creating a repository of test elements that regulators can select relevant elements from. However, further discussion

is needed on where to house such a repository and who would be a global librarian of test procedure elements.

Nicole Kearney: SEAD network standby projects

Nicole Kearney of CLASP gave an outline of the SEAD initiative on network standby. The network standby product collaboration within SEAD has participation from Australia, Canada, Korea, Japan, UK, and US. The SEAD product collaboration is undertaking a number of projects.

The project “Real World Usage of Networked Products” includes research in the UK with tracking of data traffic for a large number of households. The project will investigate how and when the average (UK) household uses network-connected products in the ‘real world’ environment with emphasis on “always on” devices. This involves a large market survey to select participating households and 100 volunteer households and collection via Internet service providers. Information collected will include: volume and type of data packet transmitted (what they are doing from what applications – peer-to-peer, chatting, streaming) between product and modem and product to product. Report due mid 2013. The objective is to monitor usage patterns and type of data traffic to understand if there are common, regular periods of negligible traffic and to assess potential for energy savings and provide policy recommendations. The project will ensure that the methodology used is transferable and reproducible in other countries. Preliminary data shows that routers have 30% to 60% idle time.

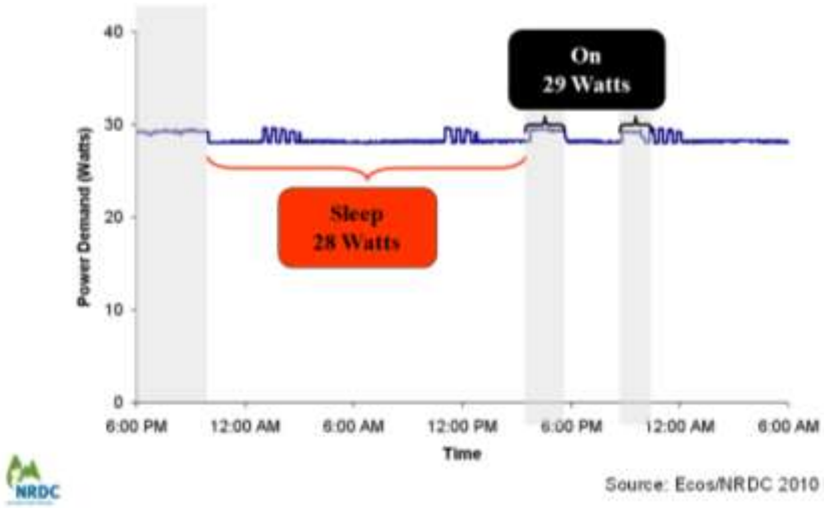
The “Standardised Definitions for Network Standby and Application to Televisions” aims to assess relevant existing definitions for “Network Standby” and related terms to recommend set of standardized terminology suited to policy development. The project will explore how this work can contribute to the improvement of TV test procedures to get better coverage of the implications of network connectivity. There are currently intense discussions on an early draft document.

Discussion:
Concerns were raised regarding accuracy of results of the real world usage project since households will know that they are monitored and may adjust behaviour. However, currently, this is one of the most feasible approaches. While the project initially experienced challenges with involving Internet service providers, 3 providers are now on board. In terms of the definitions project concerns were raised on possible overlap with e.g. IEA activities.

Pierre Delforge: “Lack of Sleep Costs Americans $2 Billion/yr”

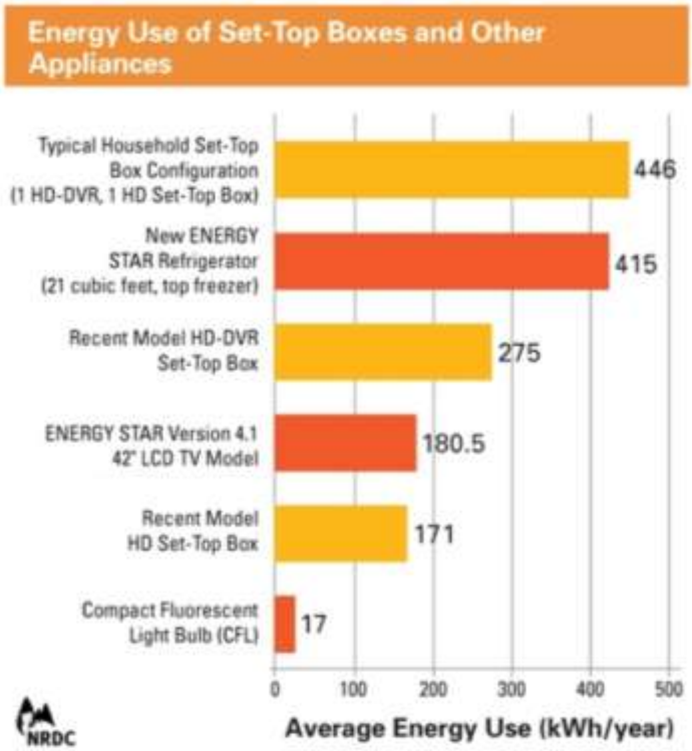
Pierre Delforge from NRDC illustrated the importance of sleep in saving energy in electronic products and set top boxes (STBs in particular).

The results of the NRDC/Ecova study on STB in 2011 were reviewed as well as recent trends and improvements in new products. The electricity consumption of 50 models of STB in various modes was measured in 2010. 80% of US households subscribe to pay-TV, installed base - 160 million STBs, many homes have 2 or more STBs. The study found that little to no difference in power use when “turned off”, hitting the “power button” merely dims the clock and the box continues to use near full power 24/7.



Source: NRDC study (2011)

There is currently little incentive for STB suppliers to reduce energy as consumers, not manufacturers nor service providers pay the electricity bill. It was noted that most service providers keep cable boxes on all the time.



Source: NRDC study (2011)

Current Energy Star 3.0-qualified boxes use 9-12W in Sleep, average new box in US may be 12-20W (2-3x EU Lot 26 Tier 1). This is a whole different magnitude of issue than discussions around 1W and 0.5W of stand-alone appliances as 15W 24/7 = 130 kWh just for "sleep".

Recent developments:

- US Environmental Protection Agency issued two new versions of ENERGY STAR (V3 and V4) which cut annual energy use by approx. 25% (V3) and an additional 30% (V4) from 2010 levels. V3 in effect now, updated V4 due out in late Q2 2013.

- Industry moving away from installing one DVR per TV. Whole home solutions growing in popularity (whole home DVR on main TV, thin client on 2nd and 3rd TV).
- Cable DVRs now have “light sleep” feature that sheds 5 to 7 W when box is turned off (spins down hard drive and turns off tuners). Also software update pushed to newer boxes in the field.
- Many new cable and satellite boxes use around 30% less energy than prior models.
- Thin clients are around 7W on, 6W standby today.

Trends and issues for further consideration:

- **Convergence** – new “gateway” boxes due to come to market that may include hi-speed internet service, IP telephony, and router, along with whole home DVR. Will this save energy overall/prevent innovative low power sleep?
- **Testing** - Power use of box is a function of BOTH the box itself, how its deployed and the head end its connected to. Testing must be done with live signals on service provider’s network.
- **Deep Sleep** - Some scheduled “deep sleep” initiatives whereby box uses very little power between 1 and 5 am.

Discussion:

There was some discussion about data since technology has progressed and the market has changed since the study was conducted. It was noted that there are only partial data sets that are publicly available and that there is a lack of transparency around energy consumption of STBs. Challenges related to sharing/publishing commercially sensitive information were explained.

A challenge is the base of STB that are already on the market. Replacement towards more efficient models may not be the best solution from a life-cycle perspective. There are software solutions that can be used to make existing set-top boxes more efficient. In some cases service providers provide consumers with used (often inefficient) set top boxes.

The need for all stakeholders to work together to solve this challenge and capture energy savings was emphasised. It is essential to involve service providers and carriers in energy efficiency efforts since they can override any energy management settings that the manufacturer includes. The need for a better understanding of how set-top boxes interact with networks and the type of information that is transmitted was stressed.

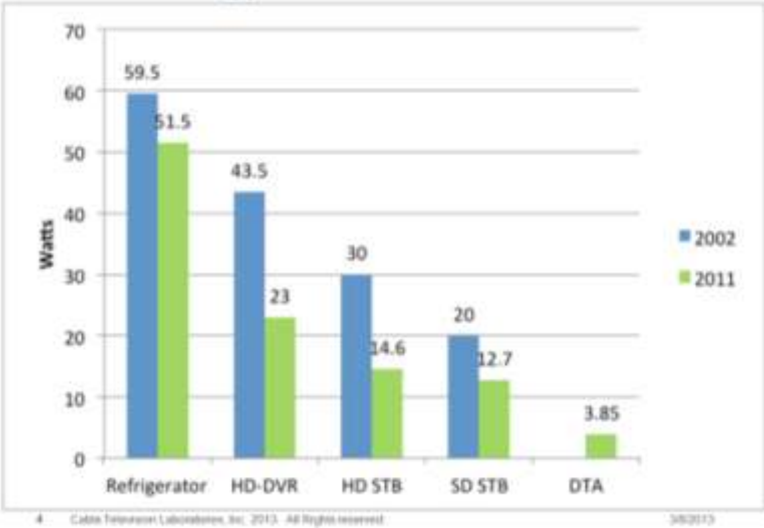
Debbie Fitzgerald: U.S. Set-Top Box Energy Conservation Initiatives

Debbie Fitzgerald from Cablelabs gave a presentation on new innovations and industry led initiatives to reduce power for cable devices. Power of various types of devices has been declining over time. Currently 90% of new STBs will meet Energy Star V3 requirements.

Cable networks were originally designed as a one way transmission. This has now changed towards multiple channel communication. There is a continuous flow of information between the STB and the cable head-end /network related to TV programming, subscriber entitlements, system information, software updates. STBs in home must constantly monitor this information to respond to changes correctly.

Data Over Cable Service Interface Specification (DOCSIS) is an international telecommunications standard that permits the addition of high-speed data transfer to an existing cable TV infrastructure. It is used by many cable television providers to provide Internet access. DOCSIS 2.0 did not have any energy management options. DOCSIS 3.0 allows multiple channels to be turned off when data flow is low, reducing power. Much of the energy consumption in DOCSIS is also proportional to data throughput on the DOCSIS system. A DOCSIS 3.1 specification is being developed.

Historic reductions in cable STB power requirements



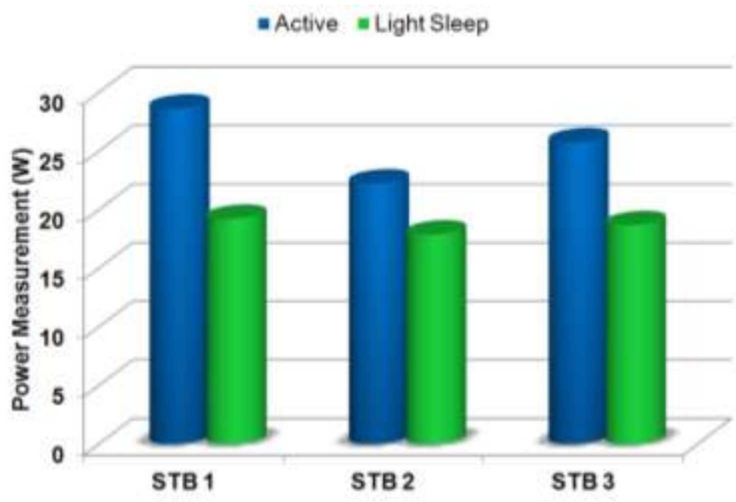
Source: Debbie Fitzgerald (2013)

Cablelabs have extensive facilities to test different cable operator systems to allow energy innovations to be assessed in real world conditions. Currently research is ongoing on ways of making "handshaking" and security functions more energy efficient. Also opportunities for more efficient digital tuners are being explored, as well as options for storing more information and even recorded programs in the cloud so that data flow to the STB can be reduced during times when there is no user requirement.

US set top box industry voluntary agreement was established in December 2012. The agreement is flexible and it is expected that new products will be considered in the future. The agreement is expected to save US$1.5 Billion Annually (4+ Power Plants). Benefits of industry-driven voluntary agreements include the ability to have an agreement come into effect sooner, the additional savings born of updating set-top boxes already in the field via software downloads, and the flexibility this industry requires given the rapid cycles of innovation and the complexity of networks. Voluntary agreements do not stifle innovation and can be deployed faster than a regulation.

"Light sleep" is being implemented in an increasing number of new set-top boxes and involves powering down hard disks, in-band tuners, video outputs and auto-power down.

Effect on "light sleep" on power requirements



Source: Debbie Fitzgerald (2013)

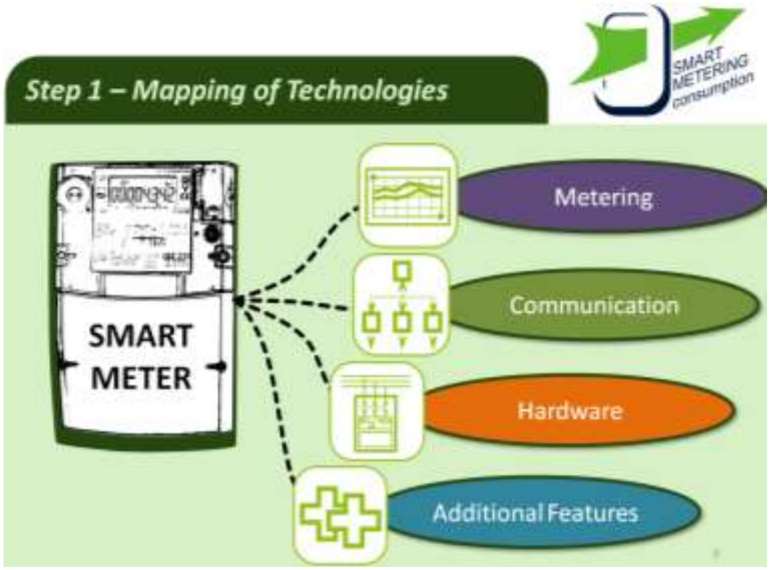
Discussion:
DoE was planning regulation on set top boxes but agreed to put this on hold and allowed advocates and industry to negotiate an agreement, but no agreement was reached. Advocates were not satisfied that there would be sufficient savings from the voluntary agreement and highlighted the need for an independent administrator. Instead a US industry voluntary agreement was established in December 2012 without the participation of non-governmental organisations. There are still some concerns are whether the industry voluntary agreement is ambitious enough to ensure STB efficiency and what energy efficiency measures should be included. DoE is still considering whether regulations are warranted. A study has been published in March 2013.

Post-workshop comments regarding systems-wide efficiency consideration and STBs
Thin clients are being credited with saving energy as they use a fraction of the main STB in on mode. However, it should be highlighted, that although there is a savings in standby or network standby energy by potentially having fewer STB's connected and in a home (currently, households with 5 STBs exist), there is a compounding energy consumption when one of the additional televisions using the thin client is being used while the primary TV with its STB may normally be turned off (since the main STB now has to be left on or in network standby mode). This is a trade off, as it is likely to be more efficient having one STB in on mode sending signal to a thin client in on mode, rather than the typical current and past configuration of one STB in on mode (for the additional television) and another in standby or network standby mode (unused on the primary television). However, in cases where some energy efficient consumers may have been using power bars or hard-off habits for STB's on their main TV's when they were not being used, there is a potential for additional energy consumption as they now have to be left "on" or in "standby mode" all the time.

It is important to consider the overall net benefit of networked systems not just the energy consumption of individual devices.

Adriana Diaz: Is smart efficient? Assessing energy consumption of network products with the example of smart meters

Adriana Diaz of Ecodesign Company (Austria) gave presented issues relating to the own energy consumption of smart meters. There is a strong move to the use of smart meters in developed countries, however, the energy efficiency of the meters themselves has not warranted much attention. There is a considerable variation between the most efficient and least efficient meters on the market today. Similarly to set top boxes, smart meters are not a consumer product but are procured and installed by government agencies or energy providers.

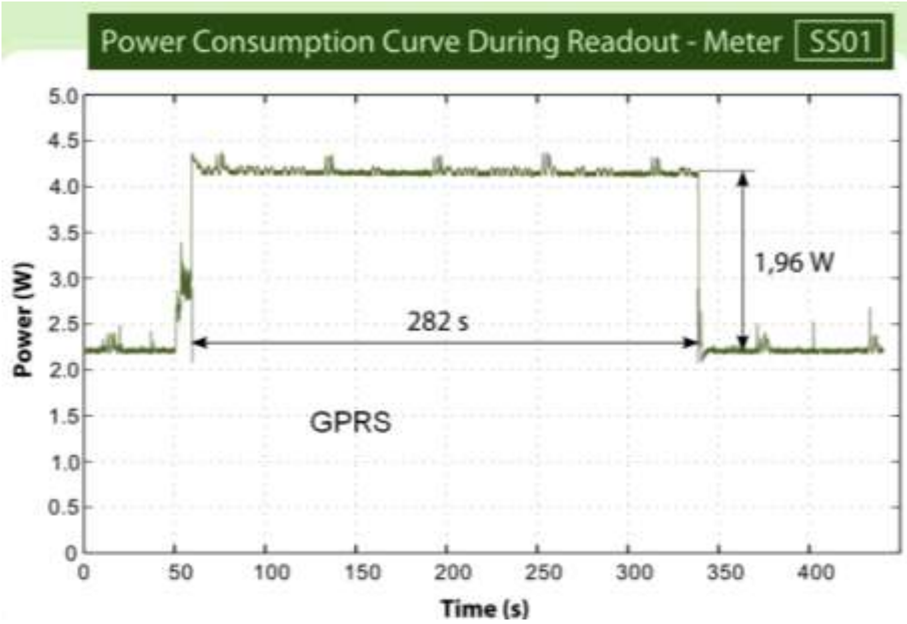


Source: Adriana Diaz (2013)

The research team looked at the components of energy consumption in smart meters and reviewed best available technology for smart meters. Base-line consumption for a meter is of the order of 2W to 4W. Communication functions are about 5W for 5 min with external communications and radio. Power Line Carrier (PLC) tends to have a similar power increase but data transmission period is as long as 5 hours. The researchers reviewed the energy impact of different installation and roll-out scenarios. The ideal approach was to get independent measurements of real meters working the in the field. Options for communication are: PLC, GPRS/UTMS (phone), proprietary radio signals, bridge to existing internet gateway.

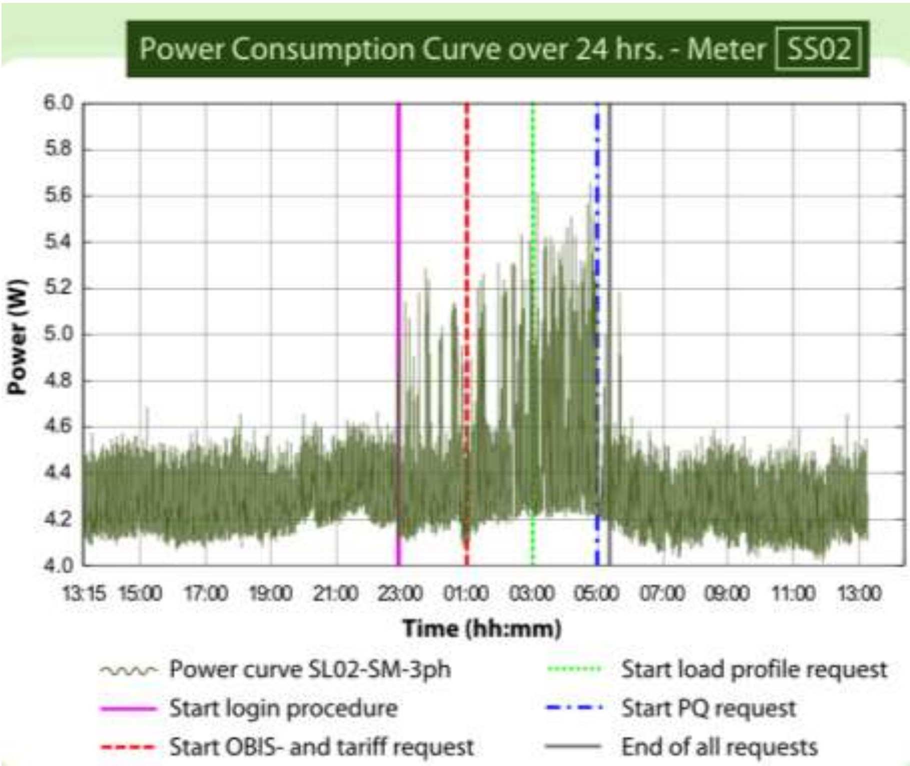
An average manual electromechanical meter is 34 kWh/year and an electronic meters are about 38kWh/year (no communication functions in either). Smart meters ranged from 12 kWh/year to 45 kWh/year. Radio had lowest power requirements. There is a considerable difference in the power consumption of different meters (factor of 3 – 1.5W to 4.5W base consumption). Most of the electricity consumption is due to communication functions not metering.

Electricity consumption of tested meter



Source: Adriana Diaz (2013)

Electricity consumption over longer time period



Source: Adriana Diaz (2013)

Discussion:

While the differences in energy consumption of different meters indicates that this is a product category that warrants further attention, the greatest impacts on energy consumption may come from the control systems that smart-metering systems can facilitate. Home gateway options in the future could increase consumption. Lessons learned from addressing products like set top boxes could be of relevance for measures aimed to improve the energy efficiency of smart meters. Engaging service providers is a challenge for this product group also. It is important to note the reasons for smart meter roll-out – the objective is not necessarily energy efficiency. For instance, in Italy the primary driver was to reduce electricity theft. It would be interesting to better understand how smart meters compare with not smart meters in terms of electricity consumption.

Shailendra Mugdal: CompliantTV project

Shailendra Mugdal of BIO Intelligence Service gave an outline of several Intelligent Energy Europe projects of interest for instance the project SELINA which measured standby in stores. Several projects looked at compliance issues, including ATELETE 1 for refrigerators and ATELETE 2 for televisions (2012/13). A new project ComplianTV (starting in April 2013) aims to test 50 televisions and 30 computer monitors. The project will help to assess in a general sense the level of compliance in the marketplace. Lessons will help to develop harmonised testing approaches and better guidelines. It was noted that there is no regulatory requirement for monitors at this stage (will be later in 2013). The project will help to improve testing capacity in European labs.

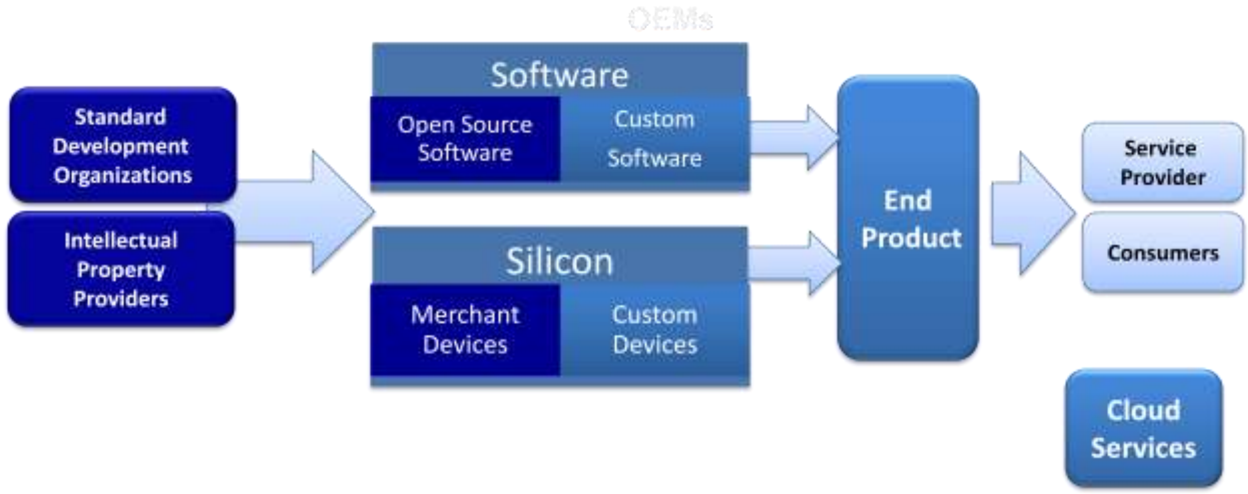
Discussion:

The project team is open to suggestions in regard to methodology. When working with products to check compliance it is important to ensure that test laboratories with experience of testing the products considered are involved. Also feed-back to manufacturers on products tested is important. Round robin testing can help identify holes in test procedures. There are ongoing initiatives that are looking at test procedures and the project will be cooperating with these.

Kumuran Siva: Technical options and drivers for implementation

Kumuran Siva from ARM gave a presentation on technical options for achieving low power in products. The development supply chain for network-connected products is complex. There is IP that goes into device designs, there is open source software (most commonly Linux and Android), silicon and customer software – all of these are combined to make products used by consumers.

Network-connected product development supply chain

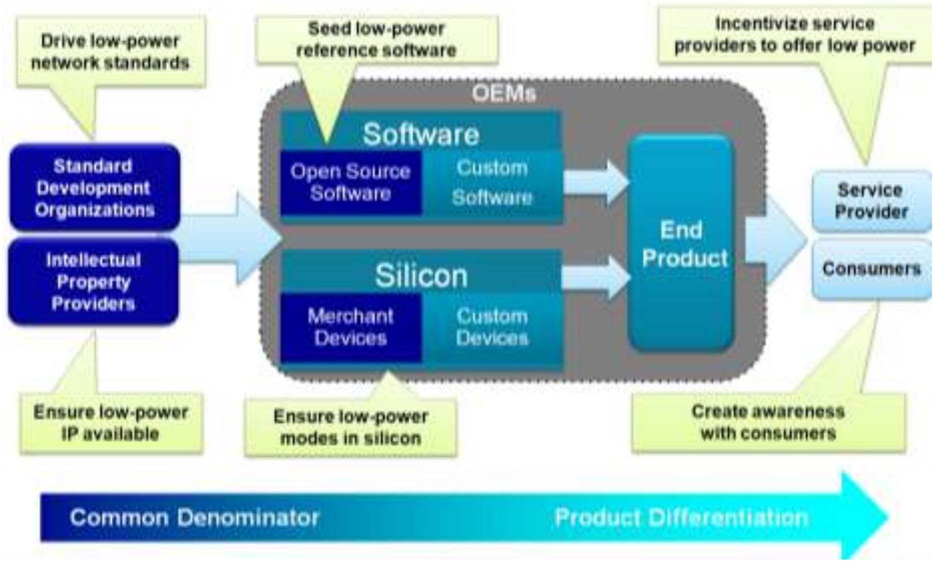


Source: Kumaran Siva (2013)

There is a need to drive low power in technology standards, ensure low power is available in IP, low power modes in silicon and options for software – all elements of the supply chain need to have an ethos of low power in their design and development. Software can be used to control cores on products.

Regulation sets goals for end-use products but many parts of the supply chain are not aware of what they will need to do to achieve these requirements. In order to achieve targets, the upstream and downstream supply chain needs to be ready at least in terms of awareness. The downstream supply chain also needs sufficient time to develop technologies and capabilities. Regulators need to think about measures that make it easy to be power efficient. Efforts are needed to seed standards with low-power modes and options. An important consideration is that open source software is prolific in CE. Open source will largely influence the direction of industry.

Making low-power networking less painful



Source: Kumaran Siva (2013)

Looking at what is the state of the art in mobile products indicates what is technically feasible. Industry has created very efficient devices in the mobile space. Example of a high-end mobile phone – multiple cores can be turned on and off in accordance with load. They can sit fully on the network at 50mW. The processor has ability to process information in different ways including through smart operation in silicon. For mobiles there is appropriate software to enable huge power scaling. Mobile devices can scale with workload at a very small granularity. There are no distinct modes instead there are different power islands in the cores. There is an opportunity to proliferate learning in other product classes.

The cost of silicon has gone up in recent years. Most devices use merchant silicon. There are limits to how much processing power you can get out of silicon – we are soon reaching those limits. This will have an impact on future technology development.

There will be an explosion of devices in the home network providing a range of services (homes, entertainment, medical, wearable).

Wi-Fi (802.11) may not be strong into the future – there will be a mix of technologies (wireline, powerline, low power wireless), depending on the application. Network characteristics include – range, availability, reliability, bandwidth, security and power. It is also likely that products will start being able to chose the network that they connect to. In such a scenario it would be crucial to get appliances to choose low power connections i.e. to get appliance to connect to a network based on the need that it has. Currently most energy is used for connectivity not for the actual need. IEEE P1905[7] allows bridging and connecting through a range of possible/ available networks.

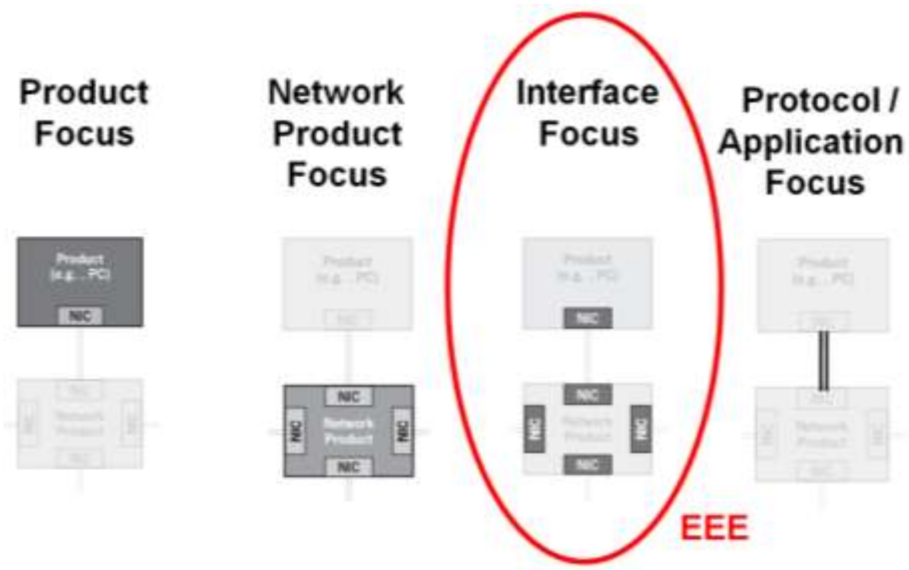
[7] 1905.1 defines an abstraction layer for multiple home networking technologies that provides a common interface to widely deployed home networking technologies: IEEE 1901 over power lines, IEEE 802.11 for wireless, Ethernet over twisted pair cable and MoCA 1.1 over coax. The 1905.1 abstraction layer supports connectivity selection for transmission of packets arriving from any interface or application. The 1905.1 layer does not require modification to the underlying home networking technologies and hence does not change the behavior or implementation of existing home networking technologies. 1905.1 specification introduces a layer between layers 2 and 3 that abstracts the individual details of each interface, aggregates available bandwidth, and facilitates seamless integration. This layer simplifies setup, for example, by eliminating the need for a user to enter different passwords to

A problem with the Lot 26 proposal is that it may not be possible to fit all the services into a single box within the power limit (will encourage boxes to be split by function in order to get under the power limit).

Bruce Nordman: Energy Efficient Ethernet (EEE)

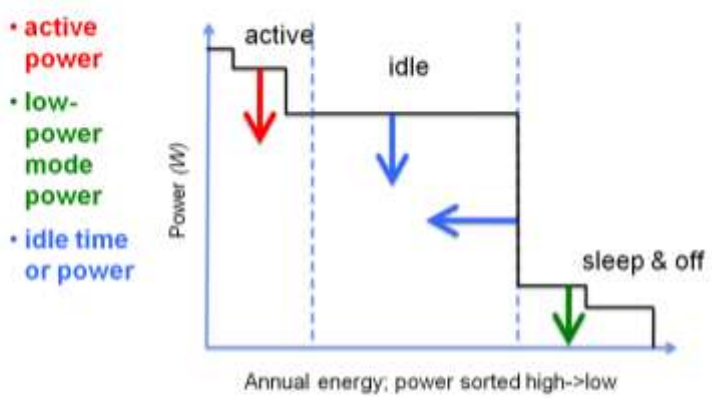
Bruce Nordman of LBNL gave an outline of Energy Efficient Ethernet and how it was developed. Energy Efficient Ethernet is a technology standard that enables network connected products to power down provided that the standard is implemented in both the edge-device that is connected and the link (network device) that it is connected to. It does not cost anything extra to include EEE in products. There is a slight delay but this is in the region of microseconds. Networked products can have an influence on other products on the network (and can be influenced). Networks drive energy use directly through network interfaces and network products and indirectly by inducing higher energy use in networked products through increased power levels and increased time in higher power modes (to maintain network presence).

Efficiency approaches in networks



Source: Bruce Nordman (2013)

Core methods to reduce energy use

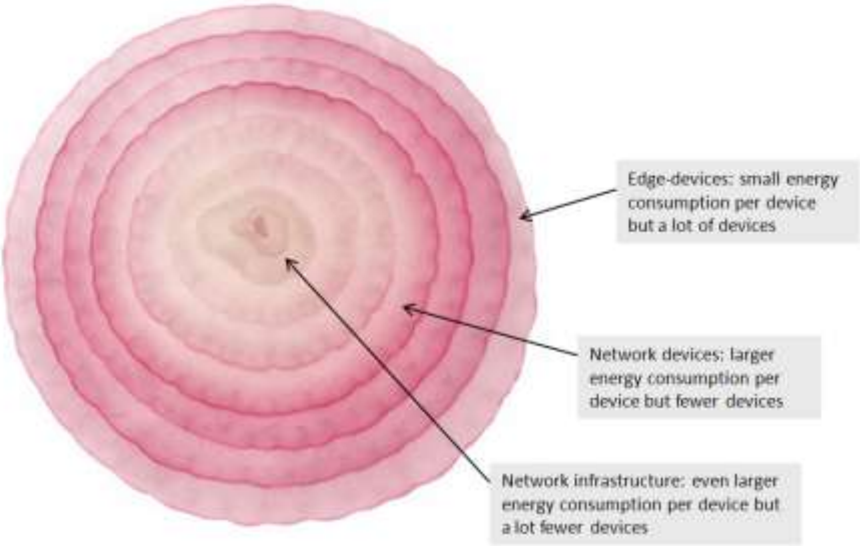


access each of the links. The 1905.1 also facilitates end-to-end quality of service (QoS) while simplifying the introduction of new devices to the network, establishing secure connections, extending network coverage, and facilitates advanced network management features including discovery, path selection, auto configuration and Quality of Service (QoS) negotiation.

Source: Bruce Nordman (2013)

The behavior on the network of one device can change the energy use of devices it is connected to. In networks, technology standards have a strong influence on what is achievable in terms of energy savings (technology standards play the same role as the law of physics plays for other end-uses).

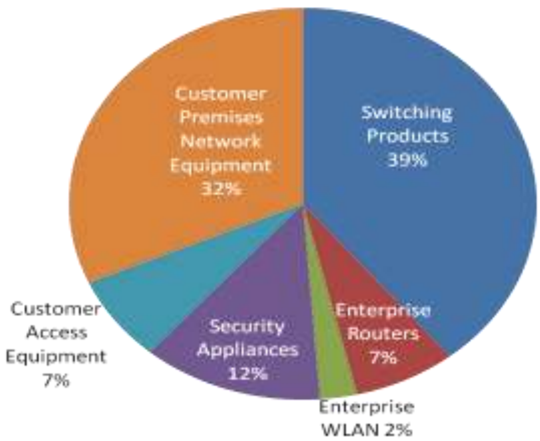
Network energy use is like an onion



Source: Bruce Nordman (2013

Most energy savings potential is in the smaller pieces of network equipment that are in large numbers in the stock. EEE technology took about 6 years from concept to implementation and availability.

US energy consumption of network devices (2008)



Source: Lanzisera et al, 2010 in Nordman (2013)

In the US in 2008 network devices 18 TWh. This segment is experiencing rapid growth – 10% between 2007 and 2008 and the forecasted annual growth rate (in 2008) was at around 6%. Customer Premises Equipment (Small Equipment) used 5.8 TWh in 2008.

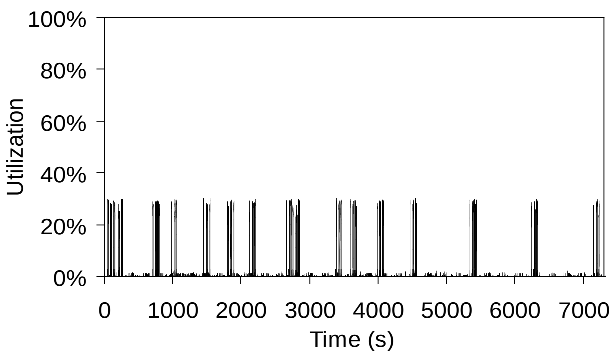
Network links can be explained with a pipe analogy where capacity is the pipe size and the amount of data is the water flow. Currently, we often have very little water flowing through very big pipes. Utilisation of capacity is low and energy is not scaled to the amount of data transmitted. Traffic often comes in bursts followed by periods of even lower traffic flow.

Ethernet technologies have evolved at a rapid rate. What was just a few years ago called "fast Ethernet" is now considered slow.

Speed	Comments
10 Mb/s	Original speed; originally shared medium
100 Mb/s	"Fast Ethernet"; still commonly used in homes and commercial buildings
1 Gb/s	Standard for PCs, etc.
10 Gb/s	Servers, network links
40/100 Gb/s	Servers, network links
Other	> 100 Gb/s, optical, backplane, automotive, ...

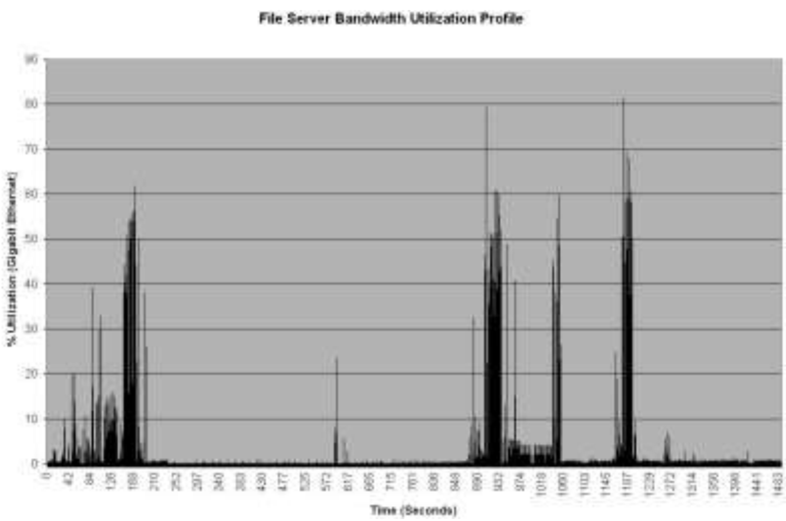
Source: Nordman (2013)

Snapshot of an Ethernet link



Source: Singh in Nordman (2013)

File server link utilisation (daytime)



Source: Bennett (2006) in Nordman *2013)
There is no data on how large the market is for EEE. Some reports indicate that 290 million products with EEE were shipped last year.

For EEE to work it has to be enabled with shipped. It is important to reward energy saving technologies in test procedures. Eventually this can be a required technology. There are many things that could be done in the technology standards space and policy can help drive these issues. Having EEE in the test equipment has been included in the IEC and other test procedures for televisions.

Alan Meier: After We Have Conquered Network Standby, Then What?

Alan Meier of LBNL moderated a discussion on what are further issues to focus on beyond network standby. Topics discussed included:

- Power-scaling electronic equipment
- Use of networks to power-scale other building services. How ICT can be used to leverage energy efficiency in other sectors.
- New networks
- New logic
- New concepts of “sleep”?
- Use of big data to prioritise energy efficiency actions
- Interfaces between humans and buildings, standardising interfaces, interoperable buildings
- Voluntary agreements to improve the efficiency of smart meters
- Low cost of energy is still constraining progress towards increased eenrgy efficiency

Wrap up

Energy reporting is needed understand the energy consumption of a large number of devices and help identify where there are energy saving potential. Pervasive monitoring and reporting of energy would give good data on how to make better decisions on priority areas. But waiting for perfect data is not the solution. Processes for data sharing should be established.

Definitions can change over time – need to be relevant to the application – draw on existing work where possible. Need a better understanding of the functions present and the power that they need. Need better alignment of test procedures and approaches. Standards need to anticipate regulator needs and there needs to be stronger engagement in that process by government. There seems to be a lot of energy saving opportunity for STB (especially in North America). Service providers have been a significant issue in their influence over end use operating state for STB. There is a need to evaluate policies, establish baseline before implementation. Test procedures need to be complete in the coverage and approach and global in design. Still some development required with respect to network connected products. The development process for new products has many actors and each of those need to have an energy efficient ethos built into their design philosophy.

What policies and supporting measures are needed? Need to identify gaps in energy efficiency in current technical standards. More work on definitions and functions is needed. How can industry drive efficiency?

Discussion:

As the base power for networked devices is reduced over time, attention to the power supply configuration and its efficiency in low power states is important. We have developed a clearer sense of what is needed and have built on our understanding through better dialogue.

Energy efficiency paradigm in all product design is critical – how do we ensure that this is top of mind in all players involved product design. There is a need to work on test procedure elements to get better alignment in testing approaches. To ensure that there are good outcomes, there needs to be a much greater dialogue between governments, industry and test procedure developers. Energy standards are a critical area to force change in the market where this is necessary. It was recognised that this is not always done in the most elegant way, but governments tend only to act where the problem appears to be critical and require redressing. Rapid advances in energy efficiency lead by industry can lead to lower government intervention. It was noted that horizontal requirements for highly diverse products can lead to perverse effects if different levels of functionality are not considered.

Follow up:

Policy framework document draft new version is out for comment – comments and inputs are still welcome. In regard to the IEA publication, drafting planned until June 2013 where after a review process will be organised. Contact vida.rozite@iea.org if you are interested in participating in the review process or would like to discuss the content of the forthcoming publication. A third workshop is planned Paris on 16-17 September 2013 focusing on next steps and concrete actions.

Annex 1: Agenda

Agenda: NETWORKED STANDBY POLICY FRAMEWORK WORKSHOP 7-8 MARCH, TORONTO CANADA

	7 March	
Time	**Topic**	**Speaker -**
9.00	**Welcome**	**John Cockburn**, NRCAN
	Introduction and overview	**Vida Rozite, IEA**
9.45	**Session 1: Policy updates**	**Moderator: Vida Rozite, IEA**
	US standards and policies	**Jeremy Dommu,** US DoE
	US Energy Star	**Verena Radulovic,** US EPA
	Questions and discussion	
10.30-11.00	*Coffee break (AB Toronto)*	
	EU	**Shailendra Mudgal**, BIO Intelligence Service
	Korea	**Sangguk Jung**, Telecommunications Technology Association, Korea
	Questions and discussion	
12.00 – 13.00	*Lunch (AB Toronto)*	
13.00	**Session 2: Perspectives from industry**	**Moderator: Elizabeth Westbrooke, NR CAN**
	Perspectives from processor industry	**Peter Gibson**, Intel
	Industry perspectives on the proposed EU Ecodesign directive amendment on networked standby	**Huw Waters**, Sony
	Perspectives from set-top box, software, gateway industry	**Robert Turner**, Pace plc
	Industry initiatives and recommendations for public policy	**Doug Johnson**, US Consumer Electronics Association
	Role of industry in promoting energy efficiency/Smart Electronics Initiative	**Tony Brunello**, Green Tech Leadership
	Questions and discussion	
15.00 – 15.30	*Coffee Break (AB Toronto)*	
15.30	**Session 3: Standardisation**	**Moderator: Elizabeth Westbrooke, NR CAN**
	Overview of the standardisation landscape	**Lloyd Harrington**, Energy Efficient
	Overview of TC100 and the energy efficiency work done within Technical Area 12	**Jon Fairhurst**, IEC TC100 TA12, Sharp Labs of America
	Standardization: Plans and Progress – update on the work of the International Telecommunication Union.	**Franz J.G. Zichy,** U.S. Department of State, ITU study group 5
	Questions and discussion	
17.10 – 18.00	**Moderated discussion**	**Moderator: Vida Rozite**, IEA

	8 March	
Time	**Topic**	**Speaker**
9.00	**Welcome and summing up from day 1**	**Vida Rozite**, International Energy Agency
9.30	**Session 4: Towards standardised approaches**	**Moderator: Elizabeth Westbrooke, NR CAN**
	Definitions	**Bruce Nordman**, LBNL
	Energy requirements for functions	**Lloyd Harrington**, Energy Efficient
10.30 – 11.00	*Coffee Break*	
	Moderated discussion on test methodology	**Robert Turner**, Pace plc
	SEAD Network Standby Projects: (a) Real World Usage of Network-Connected Products, (b) Standardised Definitions for Network Standby and application to televisions	**Nicole Kearney,** SEAD Initiative
12.00 – 13.00	*Lunch*	
	Session 5: Experiences with set-top boxes	**Moderator: Vida Rozite, IEA**
	Set top boxes – what happens when no one is watching	**Pierre Delforge**, Natural Resource Defence Council
	U.S. Set-Top Box Energy Conservation Initiatives	**Debbie Fitzgerald**, Video Services & Technology CableLabs
14.00	**Session 6: Lessons learned and looking forward**	**Moderator: Nicole Kearney, SEAD Initiative**
	Is smart efficient? Assessing energy consumption of network products with the example of smart meters	**Adriana Diaz,** ECODESIGN company
	Lessons from Lot26 and planned compliance projects	**Shailendra Mudgal**, BIO Intelligence Service
15.10 – 15.30	*Coffee Break*	
	Technical options and drivers for implementation	**Kumaran Siva, ARM**
	Energy Efficient Ethernet	**Bruce Nordman**, LBNL
	Discussion: After we have conquered network standby, then what?	**Alan Meier**, LBNL
17.00 – 18.00	**Moderated discussion: Towards a policy framework - next steps & international cooperation and alignment**	**Moderated discussion: Vida Rozite**, IEA

Annex 2: Participants

First name	Surname	Affiliation
Tony	BRUNELLO	Greentech Leadership
John	COCKBURN	NRCAN
Pierre	DELFORGE	Natural Resources Defense Council
Adriana	DIAZ	Ecodesign company engineering & management consultancy
Jeremy	DOMMU	US DoE
Richard	FASSLER	Power Integrations
Debbie	FIZGERALD	Video Services & Technology CableLabs
Peter	GIBSON	INTEL
Lloyd	HARRINGTON	Energy Efficient
Doug	JOHNSON	US Consumer Electronics Association (CEA)
Sangguk	JUNG	TTA
Nicole	KEARNEY	SEAD/CLASP
Kumaran	SIVA	ARM
Richard	MARTEL	Electro-Federation Canada
Alan	MEIER	LBNL
Nathan	MOIN	HP
Shailendra	MUDGAL	BIO Intelligence Service
Bruce	NORDMAN	LBNL
Mark	Ostrowski	NRCAN
Daisy	POON	Cisco
Verena	RADULOVIC	US EPA
Vida	ROZITE	IEA
Chris	SAUNDERS	Lexmark International
Robert	TURNER	PACE
Huw	WATERS	SONY
Elizabeth	WESTBROOK	NRCAN
Susan	WINTER	Canada Consumer Electronics Council
Jon	FAIRHURST	IEC TC 100/Sharp Labs of America
Franz	ZICHY	US Department of State