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IEA Efficient Electrical End-use Equipment (4E) Standby Power Annex
Reporting Period: 2013 – 2014

A. Diaz

Berichte aus Energie- und Umweltforschung

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IEA Efficient Electrical End-use Equipment (4E) Standby Power Annex Reporting Period: 2013 – 2014

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Wien, Februar 2014

Ein Projektbericht im Rahmen der Programmlinie

IEA FORSCHUNGS KOOPERATION

Impulsprogramm Nachhaltig Wirtschaften

Im Auftrag des Bundesministeriums für Verkehr, Innovation und Technologie

Vorbemerkung

Der vorliegende Bericht dokumentiert die Ergebnisse eines Projekts aus dem Programm FORSCHUNGSKOOPERATION INTERNATIONALE ENERGIEAGENTUR. Es wurde vom Bundesministerium für Verkehr, Innovation und Technologie initiiert, um Österreichische Forschungsbeiträge zu den Projekten der Internationalen Energieagentur (IEA) zu finanzieren.

Seit dem Beitritt Österreichs zur IEA im Jahre 1975 beteiligt sich Österreich aktiv mit Forschungsbeiträgen zu verschiedenen Themen in den Bereichen erneuerbare Energieträger, Endverbrauchstechnologien und fossile Energieträger. Für die Österreichische Energieforschung ergeben sich durch die Beteiligung an den Forschungsaktivitäten der IEA viele Vorteile: Viele Entwicklungen können durch internationale Kooperationen effizienter bearbeitet werden, neue Arbeitsbereiche können mit internationaler Unterstützung aufgebaut sowie internationale Entwicklungen rascher und besser wahrgenommen werden.

Dank des überdurchschnittlichen Engagements der beteiligten Forschungseinrichtungen ist Österreich erfolgreich in der IEA verankert. Durch viele IEA Projekte entstanden bereits wertvolle Inputs für europäische und nationale Energieinnovationen und auch in der Marktumsetzung konnten bereits richtungsweisende Ergebnisse erzielt werden.

Ein wichtiges Anliegen des Programms ist es, die Projektergebnisse einer interessierten Fachöffentlichkeit zugänglich zu machen, was durch die Publikationsreiche und die entsprechende Homepage **www.nachhaltigwirtschaften.at** gewährleistet wird.

Dipl. Ing. Michael Paula
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Bundesministerium für Verkehr, Innovation und Technologie

Inhaltverzeichnis

1 Summary

The Implementing Agreement on Efficiency Electrical End Use Equipment (IEA - 4E) was formed in March 2008 to provide a forum for countries and other stakeholders to share expertise and develop their understanding of end-use equipment and policies; and to facilitate coordination of international approaches in the area of efficient end-use equipment.
Twelve countries continued participating during 2013 as members to the IEA - 4E to collect and share information on end-use equipment technologies and programs; and pool resources for agreed projects and tasks.

The Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT) is participating on behalf of Austria to the 4E Standby Power Annex. “Standby power” describes the low power mode(s) which electrical and electronic products have when not performing their main function(s) but are still connected to a power supply. The Annex work includes four major tasks: Data collection and analysis, Evaluation of policies, Development of a horizontal policy approach, and Analysis of network products.

The Annex data collection methodology provides policy makers with baseline information and a tool which can assist in the design, monitoring, and evaluation of different policy approaches. The framework developed for evaluating policies provides an instrument to design and compare different policy approaches. The Horizontal Policy Framework provides policy makers with a reference to develop a successful horizontal standby power policy, and the Network standby work brought research insights for better understanding the technical complexity of the network standby issue. The resulting Policy framework for Network Standby provides a reference and an action plan for establishing policies to achieve low energy networks.
All these tasks were followed up with workshops, collaborations and publications aimed at increasing the awareness and understanding of standby globally.

The emerging challenge of *Network standby* has been indeed the strong focal point of the work of the Standby Power Annex since two years. As the Standby Power Annex comes to an end by February 2014, a substantial amount of work has also been invested to the creation of a new 4E Annex on Electronic Devices and Networks (EDNA), which will start officially in 2014.
Austria played a key role in the development of EDNA, particularly with its leadership for the creation of a task on “Smart metering and energy monitoring systems” (SMI-EMS), which comprise so far, the first official task of this new Annex.

EDNA is part of the new work plan of the 4E implementing agreement, which has been approved for a second term of five years from 2014 to 2019. EDNA will help policy-makers in the development, implementation, and measurement of policies for network systems; enhancing the ability of countries to gather, analyze, and share market data, to improve the overall knowledge base for decision making.

Kurzfassung

Das IEA - 4E-Efficiency Electrical End-use Equipment Implementing Agreement wurde 2008 mit dem Ziel gegründet, ein internationales Kooperations-Programm für technische und strategische Aufgaben, sowie eine Plattform für Projekte für die Effizienzsteigerung von elektrischen Geräten bereitzustellen.

Das Österreichische Bundesministerium für Verkehr, Innovation und Technologie (BMVIT) war in 2013 Mitglied der Standby Power Annex. Die Arbeiten zum **4E Standby Power Annex** beschäftigen sich mit dem Leistungsbedarf in Niedrigenergie-Betriebsmodi, die bei elektrischen und elektronischen Produkte auftreten, wenn sie ohne ihre Hauptfunktion auszuführen, mit einer Energieversorgung verbunden sind.

Der Arbeitsplan enthält die vier Hauptaufgaben: Datenerhebung und –analyse, Evaluierung von Policies, Entwicklung eines *horizontal policy approach*, und Analyse von Netzwerkprodukten. Die Tätigkeitsfelder des Annex bestehen im Verständnis des Energieverbrauchs zufolge Standby Betrieb im Allgemeinen, sowie auch zu neuen Herausforderungen wie dem Standby von Netzwerkprodukten.

Politische Entscheidungsträger werden durch den Annex in Form einer methodischen Datenaufbereitung in der Gestaltung, dem Monitoring und der Evaluierung verschiedener Strategien unterstützt bzw. erlaubt das geschaffene Rahmenwerk zur Evaluierung von Strategien den Vergleich verschiedener Strategien und Implementierungen. Einerseits wurde mit dem Horizontal Policy Framework für Entscheidungsträgern ein Maßstab für die Entwicklung eigener Standby Strategien erarbeitet und andererseits wurde mit den Arbeiten zum Network standby Erkenntnisse in Bezug auf die technische Komplexität des Netzwerk-Standbys erarbeitet. Das sich daraus ergebende Policy framework for Network Standby zielt auf einen Aktionsplan ab, Netzwerke mit möglichst geringem Energieverbrauch einzurichten.

Alle diese Arbeitspakete wurden mit Workshops und Publikationen begleitet um das Bewusstsein über die Standby-Thematik weltweit auszubauen.

Die immer größer werdende Herausforderung der Netzwerk-Standby-Verbräuche ist seit zwei Jahren ein zentraler Punkt der Arbeiten im Standby Power Annex. Da der Standby Power Annex mit Februar 2014 endet wurden große Anstrengungen unternommen um einen neuen, thematisch fortführenden 4E Annex zu Electronic Devices and Networks (EDNA) einzurichten, der offiziell 2014 startet.

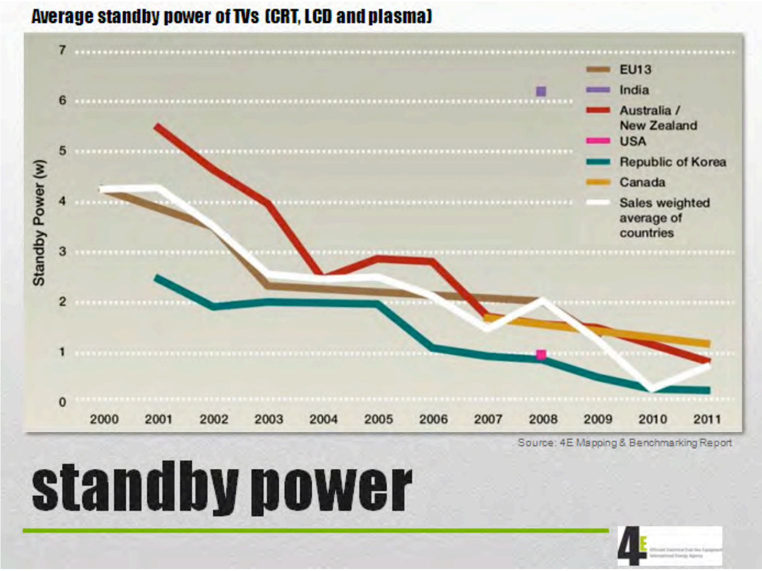
EDNA ist Teil des neuen Arbeitsplans des 4E Implementing Agreement, welches für eine zweiter Periode für 2014-2019 verabschiedet wurde. EDNA soll darin Regierungen und deren Entscheidungsträger bei der Entwicklung und Umsetzung von Regulierungsmaßnahmen für Netzwerkprodukte unterstützen. Im Speziellen sollen die Länder in die Lage versetzt werden Marktdaten zu sammeln, zu analysieren und so aufzubereiten, dass eine verbesserte Basis für Entscheidungen vorliegt.

2 Introduction (Einleitung)

Twenty years ago, concerns were raised about the energy implications of standby modes. Researchers discovered that a staggering 10 percent of residential electricity demand was due to standby. Global standby power consumption reached 400 TWh per year in just a few decades – equivalent to 2% of global electricity consumption[1].

From the latest data from Austrian households in 2012, the standby power consumption is about 3,2% of the total household electricity consumption; with 2.2% corresponding to standby power of electronic (Entertainment) products, or 93 kWh of standby power. This represents 52% of the total active power consumption of such devices (178 kWh). For specific entertainment products, the yearly energy consumption due to standby is higher than for its real active use (e.g., DVD-Recorders)[2].

Standby power policies have been implemented in an increasing number of economies, and the impact of these measures on a product level is visible, bringing down standby from 20 or 5 W to less than 1 W. For example, average passive standby power of televisions (*See box right*) was reduced from over 4 W in 2000 to well under 1W by 2011.



In 2013, the European Union became the first region to move beyond 1 Watt, introducing regulation for off and passive standby power mode at 0.5 Watts or below.

Policy makers are now facing a new challenge, Network standby power consumption. Networked products, that is, the appliances that have the capacity to communicate with other appliances via the internet or other networks, are not currently covered in most standby measures for the networked function. The number of products with network connectivity is rapidly increasing, a pattern which will continue as "smart metering" and "smart houses" become the norm and consumer expectation and desire to be "connected" grows[3].

Since the technology that drives the network and most network products belong to the global market place, international cooperation amongst governments is likely to be the most effective approach. The IEA - 4E Standby Power Annex is such a concrete form of cooperation. The 4E member countries are already collecting data and developing methodologies, and policy guidance to cut standby power consumption of network connected end-use appliances.

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[1] Gadgets and Gigawatts: Policies for Energy Efficient Electronics. IEA/OECD, Paris, 2009.

[2] Strom- und Gastagebuch 2012. Strom- und Gaseinsatz sowie Energieeffizienz österreichischer Haushalte. Auswertung Gerätebestand und –einsatz.
Mag. (FH) DI Manuela Strasser
Statistik Austria, Direktion Raumwirtschaft, Energie. Wien 2013.

[3] Staying connected: Unravelling energy waste issues in network standby. Maia consulting, 2012: http://standby.iea-4e.org/files/otherfiles/0000/0090/Network-Standby-Policy-Report-Final-2013-2-2.pdf.

3 Background (Hintergrundinformation zum Projektinhalt)

Twelve countries participate in 2013 as members to the IEA - 4E "Energy Efficient End-use Equipment" Implementing Agreement. On its second period, 4E is an international program to cooperate on technical and policy issues for increasing the efficiency of end-use equipment, and to undertake projects to meet the participants´ needs.

The 4E Standby Power Annex is particularly addressing the issues of energy consumption due to low power mode(s) of electrical and electronic products. The overall goal of the **Standby Power Annex** is:

> "*To monitor and report the extent of, and changes in, energy consumption by electrical appliances in low-power modes (standby power); and support the development of policies which seek to minimize excessive energy consumption by products in standby power modes*".

This Annex is covering the development of methodologies for the collection and analysis of standby power data from existing and new products, the compilation of measured data on standby power consumption for products across participating economies and selected benchmarking countries, and the development of policy approaches that may enable effective management of standby power globally and locally.

The Standby Power Annex was originally created in 2009 for a three year period (Phase 1). As 2011 drew to a close, delegates reflected on the achievements of the Annex and considered areas of standby power that still needed to be addressed. The result was agreement that the Annex should continue until 2014 with a new and invigorated work plan (Phase 2). The work was then organized around four major tasks: Horizontal policy approach, Network standby, Data collection and dissemination, and Communication.

This report is focusing on the activities of the *Standby Power Annex* for the period from January 2013 to end of February 2014. The emerging challenges associated with Network standby were in the scope of the Annex work in this reporting period.

> *Austria actively participated in the Standby Power Annexes during the reporting period 01.01.2013 to 28.02.2014.*

- The Federal Ministry for Transport, Innovation and Technology (BMVIT) ratified the participation on behalf of Austria to the Mapping and Benchmarking Annex for the period from 01.01.2013 to 28.02.2014.

- The BMVIT designated the ECODESIGN company GmbH to continue representing Austria as a "Member" to the Standby Power Annex for the period mentioned above.

The results are discussed following the structure of the four tasks listed before.
The outlook for future work is also discussed in light of the new Annex on Electronic Network and Devices –EDNA, replacing the SP Annex.

4 Results of the work (Ergebnisse des Projektes)

The Annex work during phase 2 was scheduled for the period 2012 to 2014. The overarching aims of the work plan for this period were:

- To support the development, alignment and implementation of **policies** that address the issues of energy wasted in low power modes for both, stand-alone and networked products, and

- To ensure **effective communication of the work** undertaken by the SP Annex, promoting the key outcomes and recommendations to policy makers and stakeholders, thereby optimizing the likelihood of their harmonization and implementation.

The work plan (and budget) of the Standby Power Annex is included in **Appendix 1**.

The work plan of the ECODESIGN company GmbH for the SP Annex is included in **Appendix 2**.

The main achievements of the SP Annex up to February 2014 are summarized in Table 1.
In **Appendix 3**, the overall achievements of the SP Annex since its creation are included.

Task	Major Deliverables
Horizontal Policy Approach	• Develop definitions of functions • Create a list of power required for functions, functions present in modes and energy management specifications
Network Standby	• Policy framework for low energy networks • A research report updating current knowledge and status of policy developments including policy options for networked products
Data Collection & Dissemination	• Provide web based access to data • Data collection methodology for field measurement of networked products
Communications	• Communication Strategy • Standalone standby power policy report • Policy briefing documents • Website enhancements • Newsletters

Table 1: Deliverables of the SP Annex for the second period 2012 to 2014 [Maia Consulting - Operating Agent SP Annex, February 2014].

In 2013 the SP Annex commissioned and finished selected of projects to assist in meeting its key objectives.

The projects were coordinated by the OA "Maia Consulting" from the leading country Australia. The technical studies were carried out by external contractors, and financially supported by the SP Annex funds, which originate from yearly contributions from the member countries.

Detailed results during the reporting period are included according to the tasks, as follows:

4.1 Horizontal policy approach

The Annex report "Provision of a horizontal policy approach to standby power" presented a recommended horizontal policy approach. In order for this approach to "move" from the recommendation made in this report to a workable, internationally-harmonised policy framework for standby power, several intermediary steps need to first be accomplished.

These steps developed several tiers (levels) of hard limits and values, allowing countries referencing it to choose a level which is appropriate for their situation. The key outcome of this task is providing both, the information and an implementation procedure to allow a central repository that specifies several tiers of hard limits and values to be established.

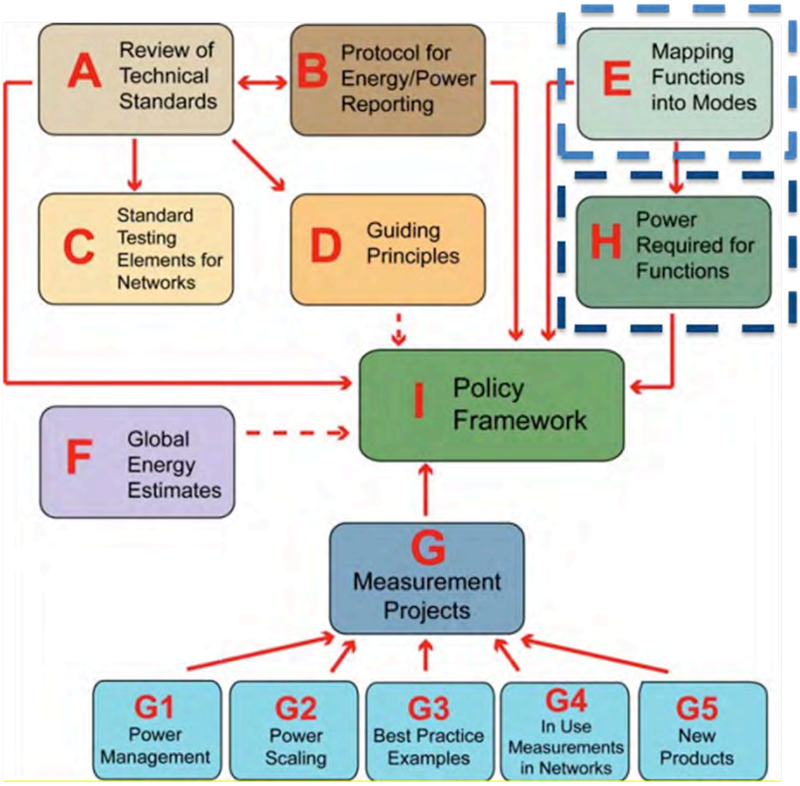

Figure 1: Scheme of all the tasks that help build up the Policy Framework of the Standby Power Annex.

Figure 1 shows all the projects and work that build the policy framework. The projects marked in blue boxes correspond to the latest work of the Annex, for which specific reports were issued in 2013. These two reports are described in the next sections.

Report on "Power requirements for functions". *See Appendix 4, and also*: http://standby.iea-4e.org/files/otherfiles/0000/0103/PFF_Final_Report_FINAL_v2_Xergy_17Sep2013.pdf

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, particularly 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.

This report builds on the previous work of ECOVA's Mapping Secondary Product Functions report, examining in greater detail several high-priority secondary functions to further quantify their power requirements and provide the technical background that might be required to advance horizontal policy action. Power allowances are already used in policies, e.g., Energy Star (For small network equipment specification), and EU Code of Conducts (for Set-Top Boxes and Broadband). Also Korea uses adders (indirectly) by permitting different power levels for different products and modes.

According to IEC 62301 Edition 2[4], 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), and maybe one 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 (e.g., switches, routers, and modems), network related functions are the primary function.

And there are three 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 be 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.

Knowing what functions are present and what state they are in is difficult. There are other factors (e.g., power supply configuration) which are also important when assessing power to functions. It should be noted that the outcomes of studies like this are not 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, and at the same time drive innovation for low power solutions.

[4] IEC 62301 ed2.0 - Household electrical appliances - Measurement of standby power (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.

Report on "Mapping secondary product functions to products and operational modes", *see Appendix 5 and also:* *http://standby.iea-4e.org/files/otherfiles/0000/0085/Ecova_Mapping_Functions_to_Modes_FINAL_29Jan2013_R.pdf*)

This project comprehensively examined secondary functions for the first time by identifying, defining, and classifying the relevant functions across three broad categories of consumer products: major appliances, home entertainment and office products, as shown below.

Major Appliances	Home Entertainment	Office Equipment
Clothes washers, clothes dryers, and dishwashers	Televisions	Printers and multi-function devices
Refrigerators and freezers	Home audio (e.g. stereos, amplifiers)	Desktop and mobile computers
Water heaters	Home video (e.g. DVD players, streaming video devices; excluding set-top boxes)	Small network equipment

The authors conducted market research to identify the prevalence of each secondary function across products and to determine how frequently those functions are used in various modes of device operation. We then generated tables or "maps" of each function to identify clusters of functions with the greatest horizontal applicability across different products and modes of operation.

In addition to assessing the overall horizontal applicability of certain secondary functions, expert judgment was included to determine which functions may be rapidly growing or that are otherwise expected to have the greatest energy impact on products. Several key opportunities for continued technical research and **potential policy action** were identified as follows (see also **Table 2** below):

- ➔ **Displays and user interfaces:** information displays continue to proliferate as secondary functions in a wide variety of products, often as a means to enhancing user interfaces. We see this across all three major product categories in devices that traditionally had no display technology, such as printers and laundry equipment. Luminous efficacy may not be as much of a concern in these applications, but appropriate power management strategies may play a more central role.

- ➔ **High-speed networking:** both wired and wireless network functionality (e.g. Ethernet and Wi-Fi, respectively) have made their way into a broad array of consumer products beyond traditional information technology equipment. Many new home audio and video products include networking functions to facilitate digital media streaming from Internet sources.

- ➔ **Low-speed wireless networking for smart appliances:** although still in their infancy, a growing number of "smart" appliances are currently entering the market that have the capability to interpret and act upon signals from smart grids (i.e. utility networks with Advanced Metering Infrastructure or AMI). Those appliances typically incorporate some form of wireless networking to communicate with the broader system.

  Devices that once had absolutely no standby power due to the use of hard mechanical disconnects now possess "soft" power controls and LCD display interfaces and will eventually incorporate some form of wireless networking for smart grid functionality. These trends all suggest that further investigation of low-power modes in the latest generation of major home appliances is merited.

- **Power management:** is central to the energy efficiency of many other secondary functions and should be a cornerstone of any further secondary function technical research. Power management can be uniquely implemented in every appliance, but certain best practice, universal principles could be developed to ensure that power management achieves maximum possible energy savings. This would require investigation of power management implementations across a wide cross-section of consumer products.

- **Power sources and power factor correction:** in electronic products, power electronics are a key bottleneck in power delivery, and have proven to be an ideal place to address efficiency horizontally across a large number of products. Despite recent policy successes in addressing external power supply and battery charger efficiency, very little research has been done to date to document the typical efficiency of internal power supplies integrated into many other consumer products like home entertainment equipment.

  Furthermore, opportunities exist to improve the efficiency of advanced secondary or standby power supplies used to deliver electricity in low power modes. Secondary power supplies now represent an opportunity for major appliances as well, since many white goods now incorporate soft switches and electronic power controls that require some amount of power at all times.

  Finally, power factor correction technology can provide benefits on both, the grid and customer side of the electric meter, so requiring higher power factor in electronic products could present another important horizontal policy opportunity.

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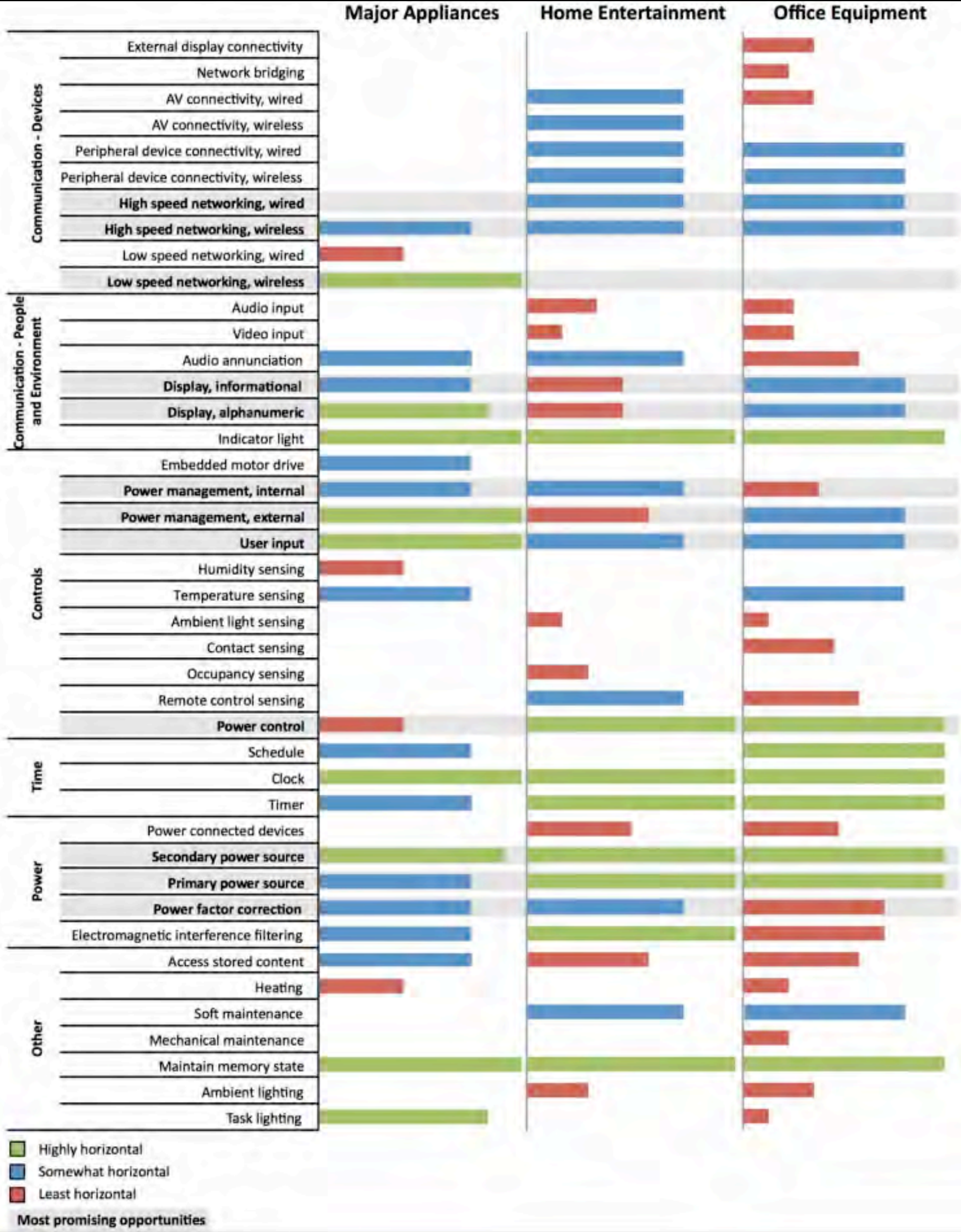


Table 2: Potential areas and types of policy action for three categories of products and technical issues [Mapping secondary product functions to products and operational modes, Ecova 2013, see Appendix 5].

4.2 Network standby

The development, promotion, and implementation of policy solutions to address the issue of networked products are of vital importance. The key outcome of the task "Network Standby" is the development of a policy framework to tackle energy wasted by networked products in low power modes. Various aspects of network standby are investigated in parallel not only by the 4E SP Annex, but also by the IEA Energy Efficiency Unit, the SEAD network standby collaboration, the European Commission and even manufacturer organizations.

For example, some of the challenges investigated for power management in various states of sleep for home entertainment equipment, are show in Figure 2.

These have to do with the user expectations and compromises in the product functionalities. 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.

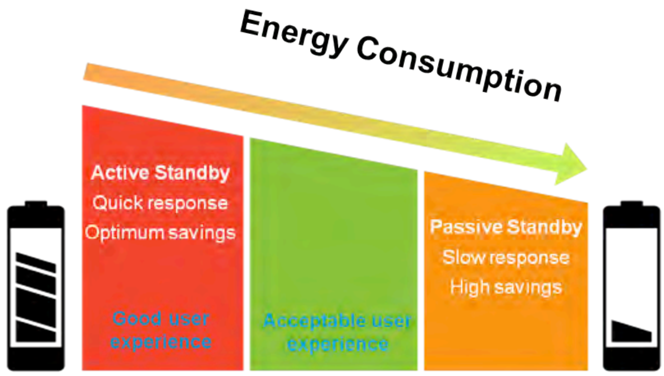
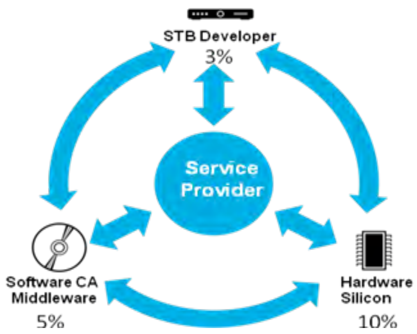


Figure 2: The challenge of power management and user acceptance [from slides Mr. Robert Turner (March 2013), courtesy V. Rozite, IEA Secretariat].

Other challenges arise from the need to involve multiple stakeholders, because the measures aimed only at end-use product manufacturers can only deliver savings in the range of 2 to 3%, software and middle ware can deliver 5%, and silicon hardware 10%, as show in Figure 3.



In the case of set-top boxes, if these groups and the service providers work together, savings of more than 50% are possible. There are special challenges and opportunities related to improving the energy efficiency of products such as set-top boxes, which are purchased and delivered by service providers. Service providers play an important role in influencing the energy consumption of set-top boxes, but there is currently little incentive to optimise energy consumption in the end-user premises.

Figure 3: Range of energy savings at various stakeholders, example from Set-Top Boxes [from slides Mr. Robert Turner (March 2013), courtesy V. Rozite, IEA Secretariat].

In addressing these challenges, the consumer electronics industry associations from around the world published in 2013 the ***Guiding principles for energy efficiency in networked consumer electronics***. These principles draw on those developed previously by the IEA and 4E, and are listed as follows:

1. Government and industry should support voluntary, market-oriented programs and initiatives, including industry-led standard test procedures. Emphasis should be on initiatives that support continued innovation, expanded consumer choice, and enhanced product functionality.

2. Government and industry should pursue harmonized policy approaches that benefit the global marketplace for consumer electronics.

3. Network technologies should actively support power management and follow generally accepted international power management principles and designs.

4. Consumers should be informed about and have reasonable control over power management, including but not limited to understanding power states and how network connected sleep modes affect the user experience.

5. To the extent possible, industry should embrace open networking standards, such as Internet Protocol, so that future audio-visual devices can interoperate with other networked devices in buildings, such as computers and lights, for functionality and energy savings.

6. New and revised standards for data and network interfaces should be efficient in active modes and when lightly or not utilized, and they should convey power states to connected devices while enabling efficient maintenance of network connectivity in sleep modes.

7. Connection to a network should not impede a device from implementing its own power management activities.

8. Networked devices should not impede power management activities in other devices connected to the network.

9. Networks should be designed such that legacy or incompatible devices do not prevent other equipment on the network from effective power management.

10. Network links should have the ability to modulate their own energy use in response to the amount of the service or level of function required.

11. Innovation should move the market to a future of automatic power control of audio and video devices in support of product utility and energy efficiency.

These guiding principles are available under: http://standby.iea-4e.org/files/otherfiles/0000/0101/CEA_-_Guiding_Principles_for_Energy_Efficiency_in_Networked_Consumer_Electronics__January_2013__-_FINAL__English___3_.pdf, see also **Appendix 6**.

4.3 Data collection and dissemination

The SP Annex has successfully collected and shared data during phase 1, which helped to assist in evaluating policy success and monitoring changes in technologies and the market.

Additionally participants benefited from the development of measurement methodology for standby. Currently there is minimal data on energy wasted by networked products, as with stand alone products. The data collection and sharing for networked products would allow a better understanding of this problem and smarter policy outcomes.

Data is the baseline and trend data to monitor the success of any policy developments. The SP Annex has made proposals for possible data collection activities to be undertaken after the Annex is finished, under the new Electronic Devices and Network Annex – EDNA, established in 2013. See more information under Section 4.5.

4.4 Communication

The main goal of the communication task has been to assist policy makers and stakeholders to make optimum decisions, by keeping them up to date with the latest facts and research into standby power.

The work conducted by the Annex has been documented in technical reports, as described under Section 4.2, and presented in a series of *technical workshops*. The Annex is also presenting its results through its own website (http://standby.iea-4e.org), by means of *policy briefs* and *newsletters*. The idea is to make information available in simple, easy to understand language and formats. These instruments are described in the following sections.

4.4.1 Network standby technical workshops

The SP Annex actively collaborated with the IEA Energy Efficiency Unit and SEAD[5] to showcase the results of the SP Annex work to different audiences. In this context the following two technical workshops took place in 2013:

- IEA / 4E / SEAD and Natural Resources Canada (NRCAN) Workshop: "**Networked Standby Policy Framework**". Toronto, Canada. March 2013. http://www.iea.org/workshop/networkedstandbypolicyframeworkworkshop.html

- IEA / 4E / SEAD Network Standby Workshop: "**Beyond 1-Watt -Towards energy efficiency in the digital age**". Paris, France. September 2013. http://www.iea.org/workshop/iea4eseadnetworkstandbyworkshop.html

The aims of these technical workshops were:

- To track emerging issues and monitoring trends and providing recommendations on how to develop and implement effective energy efficiency policies.
- To create opportunities for sharing policy experiences, and
- To provide a forum for discussion.

Key messages of these two events were:

- Network connectivity is a good thing, providing opportunities for new functions and services including energy saving, but if network connectivity is left unmanaged, energy efficiency opportunities will be missed.
- Network standby is a topic of growing importance, where there is an urgent need for a policy response.
- There are a number of technical and policy solutions, and no need to start from scratch but instead there are opportunities to build on existing initiatives such as 4E.
- Network standby is only one issue; in general more work is needed on promoting energy efficiency in networked systems and environments.
- Energy saving opportunities that networks can unlock should be identified and pursued.

[5] SEAD: Super Efficient Appliance Deployment Initiative, working group on network standby.

Key issues from the workshop "Networked standby policy framework"- March 2013

IEA together the Standby Power Annex and Natural Resources Canada organized this technical workshop 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.

30 experts from around the world, primarily North America, but also Europe, Asia and Australia, attended this 2 day workshop in Canada. The workshop included substantial discussions under the various *policy approaches and updates* in various regions, as follows:

Network standby policy of the European Union

The background on the EU Lot 26 study for network standby sets the framework for the EU regulation in its current form (at time of workshop in March 2013). This sets power limits for January 2015, 2017 and 2019, for 3 categories of products:

- ➔ HiNA - High-Network Availability: equipment with the functionality of router, NW switch, hub, modem, wireless NW access point, VoIP phone, Video phone
- ➔ Other networked Equipment with HiNa functionality: equipment with the functionality of a router, switch, WAP as side function
- ➔ LoNA - Low Network Availability: 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 funct.	12 W	8 W	8 W
LoNA	6 W	3 W	2 W

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

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			

[Slides of H. Waters (2013), courtesy V. Rozite, IEA secretariat].

The amendment covers the same scope of consumer products as the Waste Electrical and Electronic Equipment (WEEE) Directive[6]. There are two special cases mentioned, for televisions and coffee machines.
There are exemptions for specific products such as large format printing equipment, printing equipment with a power supply larger than 750 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 criterion will be interpreted. There is a review clause that the requirements will be re-

[6] 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.

examined in 2016. The process required to update regulations, in the case of TVs, took 4 years, in other cases updating has taken 5 to 7 years. Currently, CEN/CENELEC has been given a mandate to develop test procedures.

Market surveillance will be a challenge because currently methodologies for this task are still lacking. Some possible issues with the amendment include that, from the 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.
Also concerns are 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.

US Department of Energy (DOE) - Network standby and appliance standards

The US Department of Energy - DOE has the authority to start rule making activities where the aggregated energy of a product exceeds 150 kWh/year (A product becomes a covered product when average energy exceeds 100 kWh/year).

Currently 60 product-types are covered, and the US regulations require that products are regulated on *annual energy consumption*. Any final rule establishing or revising a standard has to incorporate "on", "standby", and "off" mode energy use into a single amended standard, when feasible.

Test procedures for all covered products are to include energy consumption in "on", "standby", and "off" mode. The DOE Regulatory Test Procedure is codified in the Federal Register and State Efficiency Standards, but also voluntary programs (e.g., ENERGY STAR) use the DOE test procedures. Manufacturers are responsible to conduct tests before they start selling products on the US market.

For network connected products DOE has developed a hierarchy for testing connections for products with 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 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.

US ENERGY STAR and network connectivity

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. The objective is to minimize overall energy budget for a product in use.

The US Environmental protection Agency - 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 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. 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 dealing with new product categories. Lessons learned from ENERGY STAR, of relevance for network standby are:

- ✓ There is a value to have a general framework. Nevertheless, 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, wherever possible, to harmonize across specifications. This is difficult 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 support 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 large energy savings, e.g., proxying, Energy Efficient Ethernet, IEC62542 Environmental standardization for electrical and electronic products and systems - Standardization of environmental aspects - Glossary of terms includes definitions of modes.
- ✓ An important consideration is how to reward products that enable energy saving functions in default settings when shipped.

Korea's energy efficiency program and network standby

In the strategy of Korea setting limits for power of products with a network connection there are three main program elements:

- ➔ Energy efficiency labeling, with mandatory minimum energy performance requirements covering 35 product types,
- ➔ Voluntary high efficiency certification program, covering 41 product types, and
- ➔ Voluntary e-standby program, covering 22 product types.

To date the energy efficiency labeling program has 7 target products, with networked standby power limits as shown below in Table 3: Air conditioners, washing machines, drum washing machines, dish washers, household gas boilers, gas water heaters, TVs. Additionally, 28 products have efficiency, 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)
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

Table 3: Target Products for network standby regulation in Korea [from slides of Mr. S. Jung (2013), courtesy of V. Rozite, IEA secretariat].

Within the e-standby program, the target products with networked standby power limits are shown below in Table 4: computers, printers, fax machines, copiers, scanners, multi-function devices, set-top boxes, door phones, cord/cordless phones, modem, and 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 with "sleep mode", "transition time", and "off mode" (For 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).

Additional 11 products have passive standby and idle mode power limits. Products are labeled according to a scale of 1 to 5, where 1 is the most efficient. For the labeling system, if a product fails in standby performance, it 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.

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

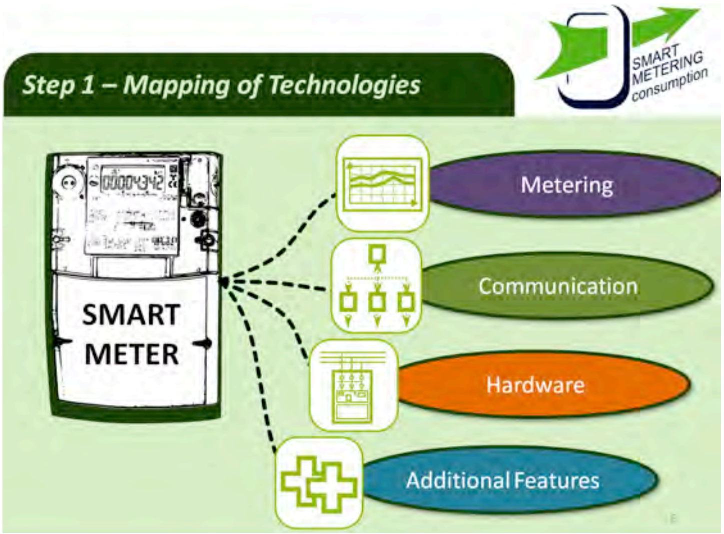
Table 4: e-standby targeted products in Korea [From slides Mr. S Jung (2013), courtesy V. Rozite, IEA Secretariat].

The "rebound effect" is also under consideration when having a total energy consumption approach, as 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. As result, there are cases where products consume more power (by increasing functionalities rather than improving energy efficiency) to comply with the program.
There is currently no specified test procedure on how to measure standby in networked products. In Korea it is up to the manufacturers to choose the set-up that consumes the most energy for performing the testing. 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.

4.4.2 Austrian participation in SP Annex workshop - March 2013

The ECODESIGN company GmbH delivered a full presentation on the topic "**Smart metering consumption**" during this workshop. The presentation is available at: http://www.iea.org/media/workshops/2013/networkedstandby/20AdrianaDiazIEAWS_Smart_Metering_Consumption_A_Diaz_05_03_2013.pdf.

Dr. Adriana Díaz of the ECODESIGN company GmbH (And alternate 4E delegate for Austria) 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.



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 communication 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 electromechanical meter is 34 kWh/year and an electronic meters are about 38 kWh/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.

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.

Key issues from the workshop "Beyond 1-Watt, towards energy efficiency in the digital age"- September 2013

The objective of this second workshop was to help future-proof energy efficiency policy-making by providing insights into trends and energy implications of increasing network connectivity. Focus will be placed on how to limit standby power consumption of network connected appliances, as well as policies and supporting measures needed to improve energy efficiency.

The workshop also provided an opportunity to discuss wider energy implications of "smart products and systems" and identify new areas where international collaboration could be instrumental in accelerating progress towards energy efficiency.

The workshop culminated in a high – level session in the afternoon of the 17 September which provided an overview of key issues and approaches and offered a platform of strategic discussions on how to move forward with tackling ICT related energy consumption. This particular issue has been addressed as it is a sector of growing consumption not only at a country level, but also globally, as shown in Figure 4 and
Figure **5**.

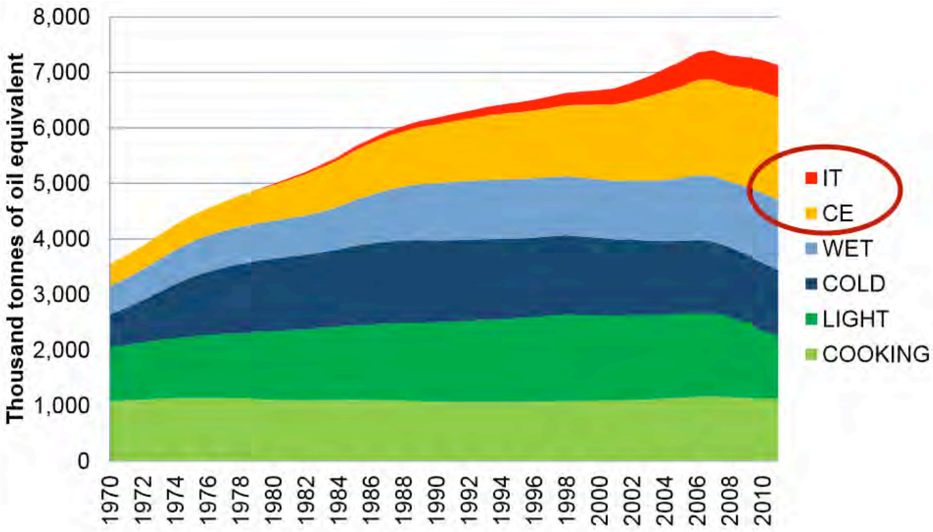


Figure 4: UK electricity consumption by household domestic appliances including ICT equipment, from 1979 to 2011 [Slides V. Rozite, IEA Energy Efficiency Unit, 2013].

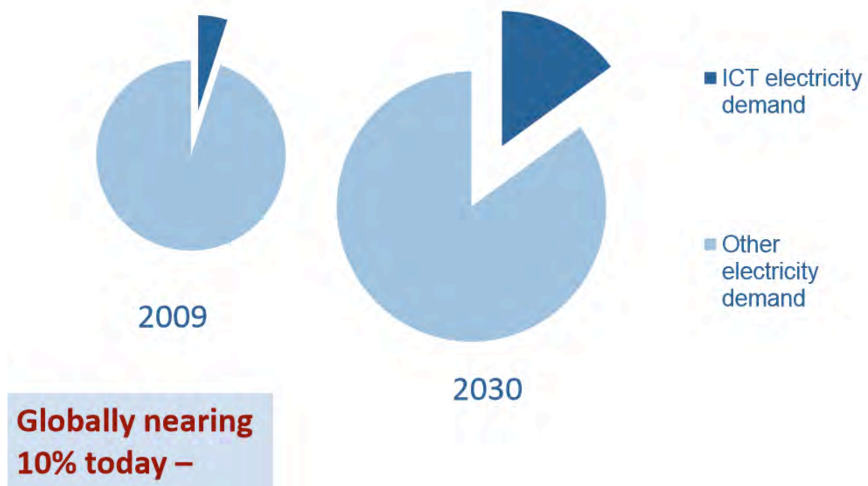


Figure 5: Growing global ICT energy demand [Slides V. Rozite, IEA Energy Efficiency Unit, 2013].

Greater international coordination of policy efforts is needed as today there are large variations in approaches, scope, limits, and test procedures for ICT based products, as shown in Figure 6.

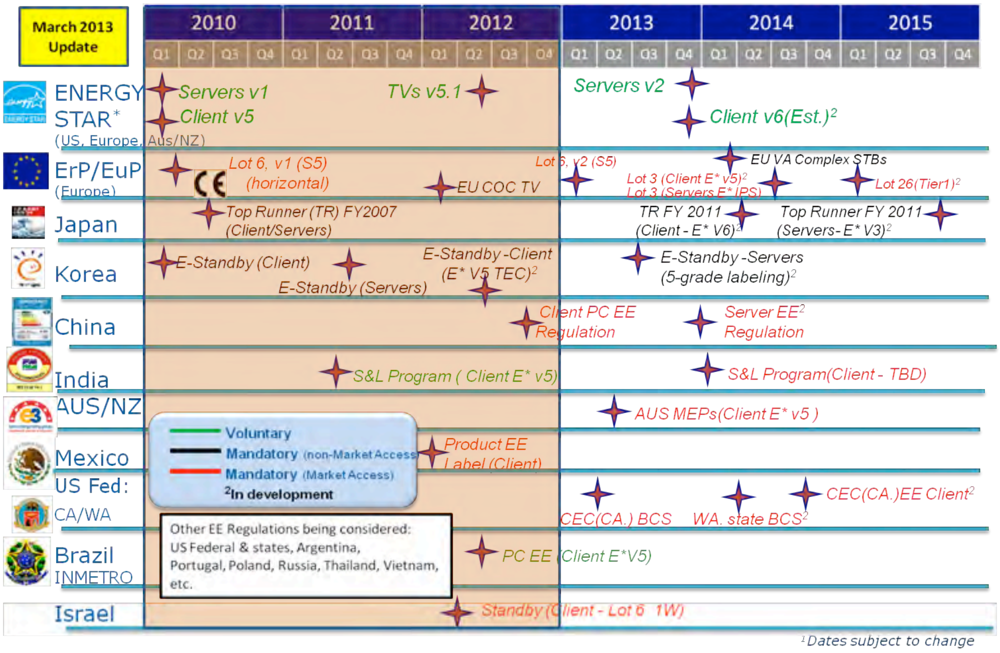
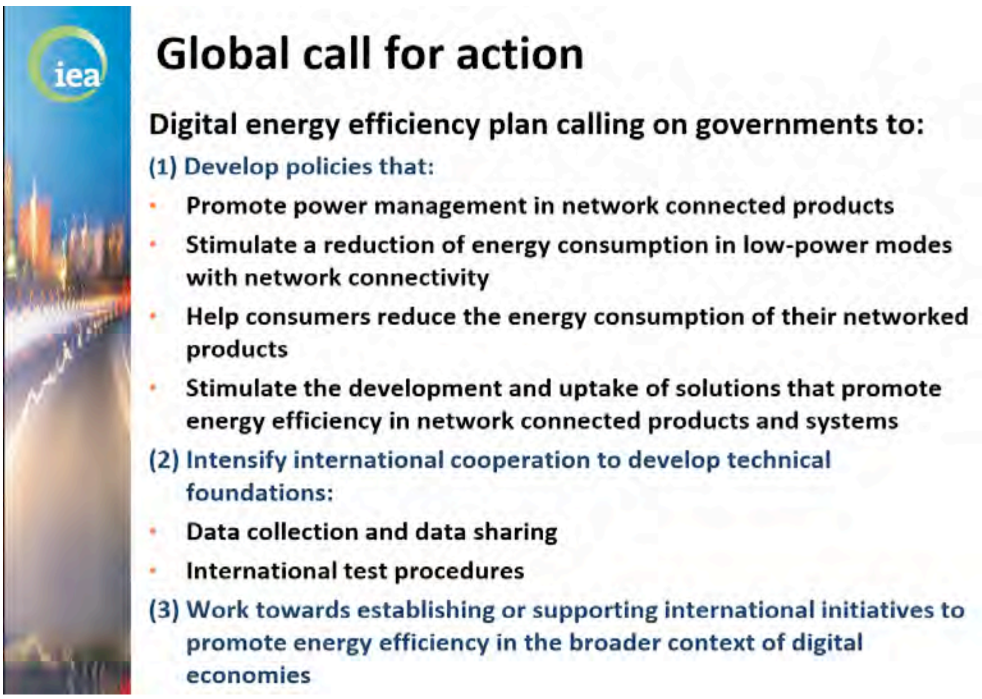


Figure 6: ICT product energy regulations approaches for ICT [Slides of P. Gibson and N. Moin (March 2013, courtesy of V. Rozite, IEA secretariat].

It was emphasised that measurement and data collection is the key to making good decisions, and that 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.

Policy makers shall consider developing and implementing policies which build on existing initiatives/approaches or aligning where possible. Finally, the IEA called for global action:

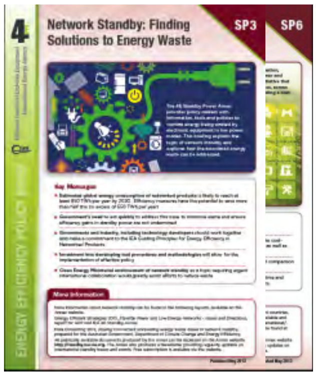


A summary presentation on "**Smart metering and energy monitoring systems**" was provided by the ECODESIGN company GmbH (on behalf of Austria) as reference document for this workshop in Paris.
The workshop was well attended by industry representatives, standards committee representatives, technical experts, and policy makers, where there was broad agreement on the need to form a new high level collaboration on technical standards and other measures to support the improved efficiency of networked and other electronic products.

4.4.3 Policy briefs

The SP Annex website provides a section where all the reports from all tasks and projects can be downloaded, including the summaries of two pages explaining the key features of each project, under: http://standby.iea-4e.org/reports.

Over the last 12 months the SP Annex has released **seven policy brief** summarizing the research and analysis undertaken.
These summary documents provide an overview of major findings and recommendations for policy makers in a simple two page format.
The central policy messages are highlighted with references to more detailed information.



All seven policy briefs are freely available *in English* at: http://standby.iea-4e.org/standby-policy-briefs. These policy briefs have been translated to various languages to facilitate the sharing of results at the national level. Austria conducted the review of the *German translations* of these policy briefs, in coordination with the Swiss delegates.

These German policy briefs are available under: http://www.iea-4e.org/publications, also included in **Appendices 7 to 13,** and are listed as follows:

Standby Power Annex Overview (SP0): providing a summary of the Annex, including goal, aims, achievements to date and future areas of work.

Standby Power Global Cooperation in Action (SP1): highlighting the positive effect that visible concerted action by governments can have on reducing global energy waste.

Standby Power in Televisions (SP2): this briefing tracks the successful of 4E Annex member governments and others in reducing the standby power consumed by televisions.

Network Standby: Finding Solutions to Energy Waste (SP3): explains the topic of Network Standby and exploring how the associated energy waste can be addressed.

Measuring Success: Evaluation Methodology for Standby Power Policies (SP4): this briefing highlights the ten step approach to evaluating standby power policies. Developed to encourage a better understanding of the elements for successful standby policies.

Tackling Standby Power Wastage with a Horizontal Policy Approach (SP5) : explaining the benefits and features of an internationally aligned horizontal policy approach to address energy wasted in standby and other low power modes.

"Basket of Products" - A global approach to measuring standby power (SP6): this briefing explains the "Basket of Products" initiative that has resulted in the measurement of standby power in over 13,000 appliances, across 21 countries, demonstrating successful international cooperation and providing a cost effective methodology for collecting and sharing large amounts of data.

4.4.4 Newsletter

The newsletter "Load Down" of the SP Annex from September 2013 is available under: http://standby.iea-4e.org/load-down-newsletter. See also **Appendix 14**.
This issue covered:

- The Industry Associations' Guiding principles for networked products
- Outcomes from Network Standby Workshop in Toronto
- EU Network Standby Amendment
- Standby Power Policy Briefs
- Latest Research from the 4E Standby Annex
- International update
- Standby Power Webinar
- 4E Standby Annex Website Upgrade

4.4.5 Upcoming Annex results and publications

At the time of writing this final report, the work underway is the summarizing of the policy framework for Network Standby in the form of a "**Policy Framework Toolkit**". An outline for this report was presented at the Paris Workshop (September 2013) for input and feedback from participants. Public release of the final document will occur at same time as the **IEA Network standby publication "More data, less Energy"**, to ensure recognition that they are companion reports and not competing reports.

- ➔ The SP Annex will release the document "Beyond Network Standby: A policy framework and action plan for low energy networks" next April 2014.
- ➔ The Energy Efficiency Unit of the IEA will release in July 2014 the *IEA Network Standby Publication "More data, less energy"* (as mentioned above).
- ➔ April 2014 will see the release of the Edition 14 of the SP Annex Newsletter *Load Down*.
- ➔ Policy Briefs on *Network Standby* will be released as well in March 2014.

In May 2014, during the 13th ExCo meeting in Utrecht, The Netherlands, the final Standby Annex Meeting will take place. Documentation from this meeting will be available after the ExCo in the second quarter of 2014.

Under the SEAD initiative, and in collaboration with the 4E SP Annex, a study has been commissioned to provide information on actual network traffic on networked equipment from a representative sample of UK households. This is developed under the "**Real usage project**".

There is an additional requirement to delve deeper and try to understand and define the actual network traffic throughout the day and over long periods of time. A further objective of the project was to provide transferrable and reproducible methodologies that could be applied by other countries. Data has been collected during the last quarter of 2013. A draft report has been circulated to selected 4E delegates, and final results are likely to be ready in quarter 3 of 2014.

As the Standby Power Annex officially finishes end of February 2014, the member country delegates recognized the importance of *network systems* and their energy consumption, and took the opportunity to proposed work to create the new "Electronic Devices and Networks" Annex (EDNA) in 2013. This new Annex goes beyond the topic of network standby to include, in general, aspects of consumption and energy efficiency of different network systems.

EDNA has been officially approved during the 4E ExCo in Washington, USA (November 2013), and is to start its activities in 2014. The result of this work until February 2014 is therefore securing a smooth transition from the SP Annex to the new EDNA.

4.5 The new Electronic Devices and Networks Annex - EDNA

In 2013 4E Executive members and SP Annex members agreed that their future focus will concentrate on non-transport energy-using equipment and systems in the residential, industrial and commercial sectors. Moreover the conclusion of the Standby Power Annex did open the way for an extended scope in looking at electronic products by means of EDNA.

The Electronic Devices and Networks Annex - **EDNA** is proposing to develop policies for any electrical or electronic appliance or equipment type operating alone or within a network.
The Annex goals are:

- *To monitor, measure, report and compare the extent of, and changes in, energy consumed by connected devices within Annex participant countries and other select locations; and*
- *To support the alignment of government policies (including voluntary or mandatory approaches) which permit participating members to minimize excessive energy consumption by connected devices.*

This Annex will concentrate on internationally-traded equipment identified by Annex participants, to deliver outcomes beyond what may be achieved by any country acting alone. The scope of this Annex is broad, including end-use electrical and electronic equipment sold for any consumer, business/industrial, utility customer purpose, as well as any other mass-produced devices connecting to any type of network.

The traditional appliances and consumer electronic devices (e.g., computers and games consoles) are considered in the scope but also the commercial sector devices used to storage or send information (e.g., data centers), equipment used to connect and monitor networks (e.g., utility smart meters with network connections), and even equipment used in industrial factory situations. The Annex seeks to assist policy makers in the development, implementation and measurement of policy action of connected devices through:

1) **Identifying and prioritizing devices**: the participants will identify particular categories of network connected devices where coordinated international cooperation will enhance efficiency outcomes. The Annex may develop key criteria for selecting these types (Such as the degree of energy efficiency opportunities, internationally homogenous products/markets, and national priorities) in their efforts to coordinate and prioritize policy actions.

2) **Enhancing market knowledge**: the Annex will enhance the ability of individual countries to gather, analyze, and share market data beyond their own borders. This information sharing will improve the overall knowledge base for decision-making and will generate valid international comparisons. The rate of improvement or deterioration in connected device energy use can be quantified within and between countries, against the backdrop of the particular policies being deployed.

3) **Coordinating policy integration:** building and developing on the work undertaken by countries and groups previously, the Annex will report on the policy approaches in progress within particular regions. For example, it may examine programs, policies and projects undertaken in Europe (European Ecodesign Directive, individual country MEPS), North America (Energy Star and the Californian Energy Commission), and Australia (MEPS and Voluntary Action) and elsewhere. It looks to streamline and internationalize that work to become the basis for a global approach by governments to efficiency improvements.

4) **Making recommendations on opportunities for international alignment of policy approaches:** the Annex will investigate and recommend actions that support the alignment of policy approaches, such as the development of test methodologies, energy performance levels and related technical work that can be used in voluntary or mandatory actions at a regional and international level.

5) **Integrating of network standby in international standards:** A key aspect of the goal for the Annex is to minimize excessive energy consumption by network connected devices. Therefore, the Annex will work to ensure that Network Standby continues to be addressed when developing and modifying international standards. This effort will be primarily directed at connected devices, but also ensure network protocols and systems enable devices to minimize excessive energy consumption when connected to networks.

5 Knowledge transfer (Vernetzung und Ergebnistransfer)

The SP Annex has unique access to data, methodologies, and latest information on policy development through its participating member governments. This exchange is crucial to getting insights into the **emerging issues** and the possible policy approaches which might work in the design and implementation of better energy efficiency policies.

The growing numbers of "smart" devices in homes and businesses demand further attention, as network connectivity is being added to products which would not previously have had such functionality (televisions, white goods, power meters within smart grids, etc). Also the demand for the availability of traditionally network-connected equipment is increasing (e.g., home and office computers). Greater quantities of new network-connected products are entering the market (e.g., home media servers, digital picture frames, tablets). In the US in 2008 network devices accounted for 18 TWh, as shown in Figure 7.

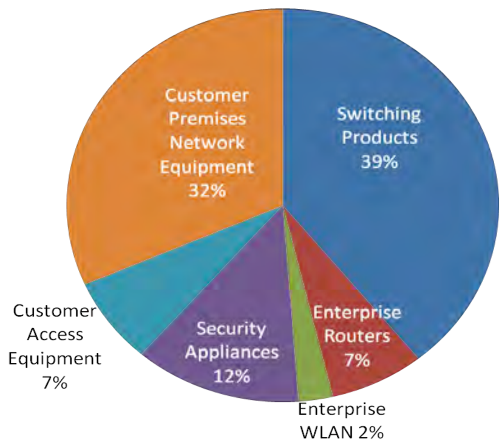


Figure 7: US energy consumption of network devices (2008) [Slides B. Nordman (March 2013), courtesy of V. Rozite, IEA secretariat].

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.

Products are also spending more time in higher power modes (e.g., active instead of standby) because of network-related requirements and due to a lack of effective power management strategies. Power consumption in lower power modes is increasing (e.g., network interfaces require more power in standby modes in order to maintain a network link). Networks are tending towards faster speeds and higher bandwidth, which increases power in the absence of effective power management.

The work and outreach of the SP Annex so far has demonstrated that this is one of the few established platforms effectively addressing the issue of Network standby at the international level. This has also been the case of previous SP Annex workshops as explained in Section 4.3.1.

The high level IEA support to 4E and the interested industry engagement demonstrates that the participation of countries like Austria shall continue, to bring for example bring the attention to the new topics in EDNA, e.g., the Austrian task on SMI-EM.

The ECODESIGN company GmbH has been working for the last three years on the issue of the own energy consumption of smart metering infrastructure and energy monitoring systems, focusing on the energy consumption which is demanded for the operation of the specific devices and processes involved. The publications and results related to this topic are available under: https://ecodesign-company.com/smi.

As a result of this work, Austria proposed to the 4E a specific task for EDNA, for Smart Metering and Energy Monitoring Systems (SMI-EMS), led by Austria.

5.1 Austrian leadership on smart metering and energy monitoring systems

More and more countries worldwide are on their way to implement smart grids. Connecting a household, factory, production plant or other end-user to a smart grid requires suitable hardware - a smart meter and possibly additional devices which have to be supplied with power. No comprehensive technical comparison has been undertaken regarding the energy consumption of smart metering infrastructure. The energy consumption impact of the metering infrastructure might range from low to high depending on the technologies of smart meters and their additional necessary components of the energy network. The energy consumption of the smart meeting and energy monitoring systems themselves will need to be considered against the benefits of this new technology of greater demand control, energy information provision, time of use tariffs and user behavior generated energy savings.

Studies show that the immediate and detailed visualization of energy consumption figures offers an average potential of 5 to15% energy savings in today's homes and offices. Nevertheless, a comprehensive estimate of efficiency has to include the power use of the infrastructure. There are trade-offs between the energy consumption resulting from the deployment of new smart metering infrastructure and the potential gains at the consumer side, by enabling monitoring and feedback on their energy consumption.

This project will explore these issues and consider the magnitude of the impact of smart metering/energy monitoring systems. Key Issues to be explored are:

- Energy consumption of the smart metering infrastructure (SMI) and energy monitoring (EM); both the components and the systems as a whole.
- Categorization and classification of the functionality of the SMI-EM systems to ensure that comparisons can be made on a like for like basis.
- Measurements and data gathering of components of the SMI-EM systems to determine the ranges of energy use and the scope of potential improvements.

The goals for this task are to categorize the smart metering infrastructure and energy monitoring technologies and systems and measure and assess the impacts of the various technology solutions and compare their efficiency. The potential of policy interventions by governments within the SMI-EM market to encourage efficient technologies and solutions should be explored.

The activities are designed to initially scope the technologies and there impacts over the next 12 months. After this period, the Annex will review the goals and establish the medium to long term activities of the project within 3 to 4 years. The key actions will be to:

- Research SMI-EM technologies and systems at present in the market place and future directions. This information will classify the systems and their functionality to enable the comparisons of their power use (such as provision of two-way communications, control, flexible tariffs, power quality monitoring and the end user functionality for home monitoring devices such as handhelds, in-home displays or LAN web portals).
- Measure and report the energy use of different SMI-EM systems and technologies so that comparisons can be made of the different implementations of these systems.
- Engage with Stakeholders, including manufacturers, standardization organizations, energy agencies, energy utilities, and communities or networks dealing with smart metering and energy monitoring systems

- Identifying market trends on future energy monitoring technologies and their functionalities at an early stage so as to enhance global collaboration at the scientific and policy level.

Smart metering technologies and the associated energy monitoring system are being rapidly deployed in many countries. Policy development carried out so far has been mainly focused on the critical role the new generation meters play in the operation of national electricity markets and on competitiveness, as well as on access and management of consumer information. However is possible that the SMI-EM technologies themselves will have an impact on the energy use compared to the older systems. There energy impacts needs to be considered against the potential benefits of the programs and behavior changes that will improve energy efficiency over the long term.

Currently there is no concerted government action investigating the product and system wide energy use and potential benefits of SMI-EM technologies in a holistic manner. EDNA could profit from synergies with existing IEA Annexes such as the International Smart Grid Action Network (ISGAN) and the Demand-Side Management (DSM). Ideally this Task would seek input from various stakeholders, such as government, academia, suppliers/consultants, and energy utilities.

Collaboration by governments would be critical at this stage in the development of the SMI-EM systems to ensure the energy efficiency is integrated into the systems that eventually progress to market dominance. Policy makers will become familiar with the technically complex and rapidly changing environment of smart meters and energy monitoring systems. A policy framework for the assessment of own energy consumption of energy monitoring systems, outlining types of policies and policy combinations, and proposing a roadmap for adoption should be developed.

So far the countries expressing support for Task 1, apart from Austria, are Switzerland, Australia, Canada, and the Netherlands. This means also a clear positioning of Austria in providing expertise to other countries through EDNA work, as well as serving as channel to bring information from other countries and initiatives back to Austria. See also additional details next, under Section 5.2.

This can be undertaken in the form of technical workshops and publications, such as those delivered so far. For example the main results from the SP Annex work, with specific input for Austrian products are included in the 2013 IEA Publication of BMVIT "*Strategien für energieeffiziente Produkte – Ergebnisse der IEA - 4E Forschungskooperation*", prepared by the ECODESIGN company GmbH, available in PDF under:

http://www.nachhaltigwirtschaften.at/iea_pdf/endbericht_201314a_iea_effiziente_elektr_endverbrauchsgeraete.pdf.

5.2 Interested stakeholders in Austria

The priority areas mentioned before in Section 5.1 would seek input from various stakeholders, such as government, academia, suppliers/consultants, and energy utilities. The officials of the BMVIT dealing with energy efficiency in the end-use sector in Austria could benefit from the results of the SP Annex work, especially in the framework of larger initiatives.

The instruments produced by the SP Annex, especially the policy briefing pages, can help inform policy makers at national and international level, and contain updated information of policy recommendations derived from the SP Annex, which might suit the national objectives of the BMVIT.

There is a diverse audience interested in the matters of energy efficiency and product policy, such as the following Austrian stakeholders:

- Officials from BMVIT and BMWFJ.
- Austrian Energy Agency
- Austrian Association of Electric/Electronic product manufacturers and retailers (FEI)
- Industry and marketing stakeholders
- Chamber of Commerce (WKÖ)
- Austrian Energy utilities and energy service companies
- Participants in other IEA Annexes
- GfK Austria and Statistics Austria
- Technical University Vienna
- Technical University Graz, and other technical institutions
- Other technical institutes and research organizations
- The Austrian Institute of technology (AIT)
- Energy efficiency agencies and non-governmental organizations, e.g., OÖ Energiesparverband
- Product manufacturers and dealers.

The results of the SP Annex are now widely available through the SP Annex website http://standby.iea-4e.org . As mentioned before in Section 4, there were a number of publications and two major technical workshops completed in 2013, which served as channels to disseminate the results of the SP Annex work.

Of primary importance is to ensure maximum value for Annex participants, to support of specific needs of ministries and energy agencies, namely BMVIT in the case of Austria. Governments steer overall policy direction, so senior policy makers and officials are an audience of great importance to communicate the work of the 4E Annexes. Industry is clearly a group of importance, but rather large and diverse; therefore targeting this group is done through outreach events.

Examples have already been described with the technical workshops carried out in 2013 at the international level by the SP Annex, IEA Secretariat, and SEAD.
The collaboration of the SP Annex with the Network Standby group of SEAD is another ongoing effort to engage delegates from different countries and reach out to larger audiences and various stakeholders, from industry, research, governments, and standardizations bodies.

A communication strategy has been put in place as the work of the 4E Implementing Agreement as well as its Annexes goes forward. Clearly the first target for communication is the delegates from member countries and their agencies, ministries and other government bodies. The idea is to spread the results and the information not only at the international level, but also use the delegates as vehicles to bring results back to their own work. This is primarily done through Annex meetings, the Annex website and Annex events.

The work of the SP Annex before it comes to its end is about promoting and presenting the evaluation approaches and the horizontal policy framework results, as well as the results on the

Network Standby work. For this the two upcoming publications of 2014 are key; as mentioned in Section 4.3.4.

At the national level, the information of the SP Annex work is documented on the website of the ministry of Transport, Technology and Innovation (BMVIT) where there is a section on the IEA research cooperation and 4E: http://www.nachhaltigwirtschaften.at/iea/results.html/id6869

The website of the ECODESIGN company GmbH (*See Box above on page 31*) also includes a section explaining the work under the 4E Annexes in **English, German, and Spanish**: http://www.ecodesign-company.com/webpages/c1e1a71c-f58e-11e0-86e9-00163e00426

On the subject of Smart metering and energy monitoring systems, which is now officially included as the first Task in the new Annex EDNA, the ECODESIGN company GmbH provides also a dedicated website with all relevant completed work and events, under: http://ecodesign-company.com//smi.

6 Outlook and recommendations (Schlussfolgerungen, Ausblick und Empfehlungen)

It is likely that EDNA members will identify further worthwhile activities, and expand or integrate other Tasks (e.g., Smart Home technologies), and consider the development of measurement standards, or establish ideal performance standards that minimize energy use of SMI-EMS technologies.

These priority areas for further work are described below:

6.1 Efficient network services

Energy efficiency in ICT, and especially in consumer electronics, is related to both the hardware and the software. It has been observed that only a small amount of software applications are designed to minimize the energy consumption of the hardware, providing large untapped potential to save energy by designing software for energy efficiency. The importance of designing energy efficient ICT increases as miniaturized interconnected computing consumer devices quickly penetrate in all spheres of our lives under common umbrella of ubiquitous or disappearing computing.

This is also being reported as the "Internet of Things" (IoT), that is components/devices based on wireless mesh networking, 6LoWPAN, indoor-localization, plug'n'play/zero-engineering protocols. It is possible that the IoT will result in billions of devices worldwide or around 15 to 20 internet connected consumer devices per person by year by 2035. Even if the consumption of a single IoT node is quite low, the expected growth of energy consumption will be huge if the number of IoT devices connected to the internet grows as expected.

Internet traffic is growing at an exponential rate. During 2000 to 2010, global Internet traffic grew more than 100-fold, yet in some regions access is still very low: future growth will continue a steep upward curve. In 2012, 74% of Internet protocol (IP) traffic and 94% of consumer Internet traffic originated from personal computers (PCs). By 2017, analysts estimate that 49% of IP traffic and 39% of consumer Internet traffic will originate from devices such as smart TVs, as shown in Figure 8[7].

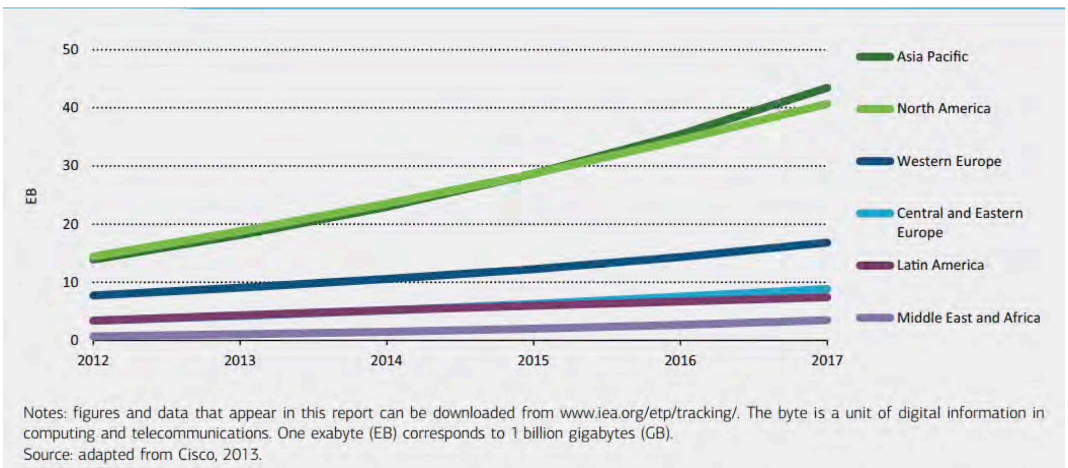


Figure 8: Projected growth of monthly IP traffic by region [Tracking Clean Energy Progress 2014 - IEA input to Clean Energy Ministerial: http://www.iea.org/etp/tracking/].

[7] Tracking Clean Energy Progress 2014, IEA Input to Clean Energy Ministerial - http://www.iea.org/etp/tracking/

This *draft* task will provide guidance on how to minimize energy consumption relating to the IoT by addressing three key areas, as follows:

- Architecture: decisions on the architecture level in systems operation modes of the distributed IoT components have important consequences for the hardware load and the resulting energy consumption.
- Power Management Strategies: the energy consumption of communication and computing purposes can be minimized for a single IoT node by implementing various software (such as sleep control) and hardware strategies (such as low powered wireless networks)
- Intelligent service discovery: the increasing number of IoT nodes will require a shift from "always on" – typical for WWW services – to "always response" mode.

Collaboration by governments would be critical at this stage in the development of the IoT systems and interconnected consumer electronics to ensure that energy efficiency is integrated into the systems that eventually progress to market dominance. Policy makers will become familiar with the technically complex and rapidly changing environment of IoT systems. Guidelines and information would be made available that provide a framework to system designers and manufactures to minimize the energy use of interconnected consumer electronics.

6.2 Grid-Smart appliances

> The number of wireless cloud users worldwide will grow to just over 998 million in 2014, up from 42.8 million in 2008; an annual growth rate of 69%.

This draft Task relates to the development of the capabilities, physical interfaces and operating protocols that will allow key appliances to be incorporated into smart grids. The deployment of such appliances on a large scale would enable electricity systems to be optimized with regard to their overall robustness, economic efficiency and ability to deal with more variable sources of electricity supply.

"Smart appliances" seem to have been just around the corner for over two decades. The benefits of smart appliances are more problematic and contingent. While many countries have energy labeling and minimum energy performance standards programs, there is as yet no standard way to define "smartness", let alone indicate degrees of smartness on a consumer-friendly label.

The goals for this Task would be to define the range of appliance interactions with electricity grids (Beyond energy consumption and energy efficiency), and determine how appliance characteristics can increase overall efficiency. There may be overlaps in that the same linking technologies that give appliances grid-smart capabilities may also contribute to or moderate their energy use.

6.3 Smart home technologies

This proposed task would focus on the automated or remote control of appliances and equipment in the home using networks (Proprietary, TCP/IP or other). Automated controls can be used to turn equipment on or off or adjust the operating settings at pre-determined times, can be triggered on-site or remotely, or can be set to adjust the operation of equipment in response to changes in the home environment, e.g. temperature.
Homes using these techniques, which may also involve the integration of broadband communications, are sometimes called "Smart homes" or "Smart houses".

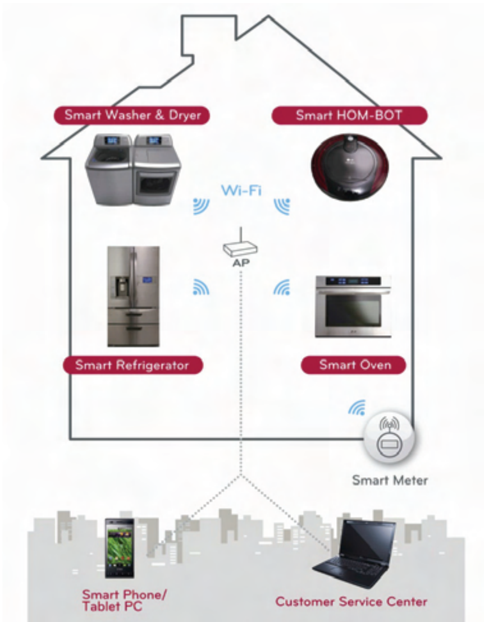


Figure 9: Wi-Fi based Smart home solutions [Slides from Ecova, Network Standby Workshop (September 2013), courtesy V. Rozite IEA Secretariat].

The use of mobile devices into the home is also increasing the variety of control technologies and systems, not only to control appliances (as shown in Figure 9), but also to display and control content on TVs and displays.

There is potential for Smart home technologies to enable the more efficient operation of appliances and equipment as well as increase the overall energy use in the home. Smart home technologies are also capable of linking with energy service providers to allow the control of appliances and respond to time of use energy pricing.

The attraction of automatic or easier control of appliances and equipment is also generating consumer interest, with the ability to turn lighting or heating/cooling equipment Off and On, according to pre-set schedules or remotely.

As the networking of controllers and their control ability increases, consumers will be able to use their mobile device to easily control temperatures of heating/cooling systems, enable lighting or view security applications.

The potential increase in energy use related to the Smart home is an issue that should be investigated as the systems evolve and the market for services changes. Smart Home technologies are increasing in use and penetration in homes in all countries. There is an existing market for Smart home systems in higher value homes; however the development of small ad-hoc systems is enabling control devices to be implemented and retrofitted in all types of houses.

For instance recent advances in wireless lighting control allow for individual lights to be controlled. Many of these new wireless technologies use the low powered Zigbee wireless standard; however this requires a wireless gateway to be installed. The prevalence of Wi-Fi connected lighting and appliance plugs also increases the marketability of low cost retrofit Smart home systems.

According to a study of the University of Melbourne in Australia[8], on the global energy consumption of wireless cloud, the total energy consumption of cloud services accessed via wireless networks could reach 43 TWh by 2015. In 2012, the figure was closer to 9,2 TWh. Wireless access network technologies account for 90% of total wireless cloud energy consumption while data centers account for only about 9%. The energy consumption of the whole smart home system has not been quantified. Key Issues to be explored are power consumption of the Smart Home devices, power consumption of Smart home networking infrastructure, user behavior and energy consumption impacts, market take up and projections for Smart home technologies.

Some aspects of this task are also covered in Task 1 SMI-EM and might be merged in the future development of the EDNA work plan.

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[8] CEET, 2013. *The Power Of Wireless Cloud*, Centre for Energy-Efficient Telecommunications (CEET) University of Melbourne. July, 2013: http://www.ceet.unimelb.edu.au/pdfs/ceet_white_paper_wireless_cloud.pdf

6.4 Recommendations

This section addresses two parts: the general recommendations concerning the (technical and policy) work of the SP Annex, and the recommendations at the National level in Austria.

6.4.1 Recommendations deriving from the SP Annex work

The Annex work has shown 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 ecosystem, 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. In the context for smart product deployment, it is also important to consider the role of smart products in wider approaches such as demand response.

Networked products are a fast moving diverse category which is difficult to regulate. The dilemma of a large part of these products is that they might be small to regulate individually, but have large collective energy consumption to be ignored. The might be the need for programs that pull at the high end, to stimulate and reward efficient products, while at the same time deal with the worst products. The focus on performance-based procurement has been suggested, as well as the 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 in the Annex work and discussions, because data is 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.

SP Annex work and discussions showed that there are ongoing efforts across national, regional and international standardisation bodies looking for harmonization. While some coordination mechanisms are in place, for instance joint technical committees, further coordination may be warranted in some cases. Another aspect that needs attention is the challenge for policy makers getting sufficient understanding of the standardisation landscape to know what is in place, and where are possible gaps. This is indeed not easy and might require expending a lot of resources and needing to follow the work of a large number of technical committees. There is a need for communication channels from policy makers to standardisation organisations on current and future standardisation needs.

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. However, it should also be noted that much of the work in developing standards in this area is done in other fora (not 4E), such as the Internet Engineering Task Force (http://www.ietf.org). 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 importance of good data was emphasised throughout the Annex discussions, as well as the need for improved methodologies and mechanisms to collect and 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. 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).

One of the most important network components is the human interface and there could be scope to explore the role and impact of human beings as nodes on the network. If energy efficiency options are provided in products, these should be automated and in the default settings when products are shipped to users, which most likely will stick to them. When it comes to networks, users themselves typically do not set these up, but if they do, they use the simple default configurations. 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.

There could also be a role in tasking the service providers that set up home networks to ensure energy efficiency. ENERGY STAR in the US is looking, for example, at possibilities to address installers. In the UK, some service providers are already given the task to provide some form of energy efficiency promoting activities.

Other recommendations include a better understanding of the drivers for making products more energy efficient. Many manufacturers design efficient products to keep heat levels down and thereby avoiding warranty (damage) costs.
The development supply chain for network connected products is complex. There is intellectual property (IP) into device designs, but there is also open source software (Most commonly Linux and Android), silicon, and customer software as well. All of these elements are combined to make products which are broadly used by consumers, as shown in Figure 10.

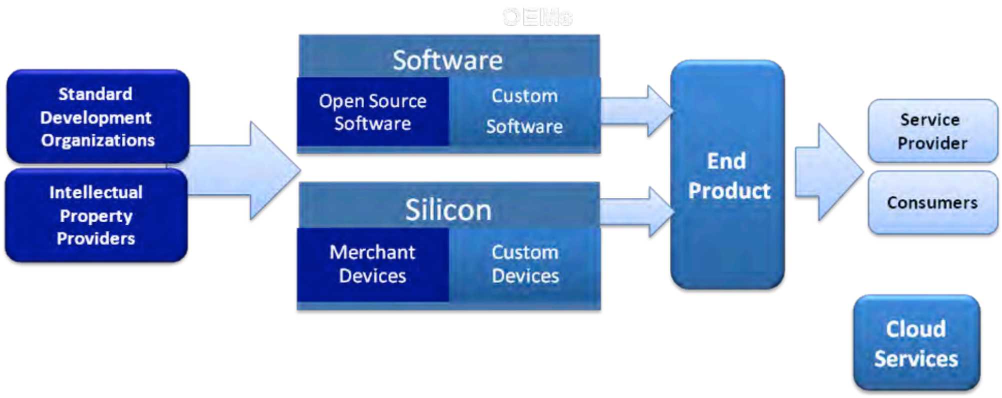

Figure 10: Network-connected product development supply chain [Slides Kumaran Siva (March 2013), courtesy of V. Rozite, IEA Secretariat].

There is a need to drive low power in technology standards, and low power in design and development of all elements of the supply chain (e.g., low power modes in silicon and options for software to control cores on products), as shown in Figure 11.

Regulators 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.

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.

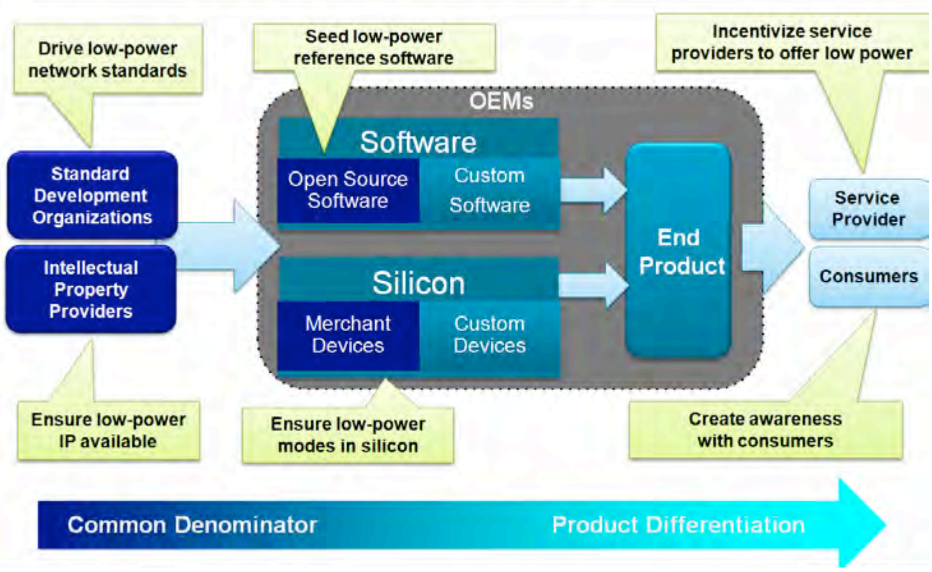

Figure 11: Making low-power networking possible [Slides Kumaran Siva (March 2013), courtesy of V. Rozite, IEA Secretariat].

Looking at the state of the art in mobile products indicates what might be technically feasible. Industry has created very efficient devices in the mobile space. As example, in a high-end mobile phone, multiple *cores* can be turned on and off in accordance with the load, and be on the network at 50mW. The processor has the ability to process information in different ways, including the smart operation of the hardware (Silicon).

For mobiles there is appropriate software to enable large 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 product cores. There is an opportunity to use this learning in other product classes. As summary it can be said that the *energy efficiency paradigm* in all product design is critical, and ensuring that this is top priority in all players involved product design. There needs to be a much greater dialogue between governments, industry, and test/standards developers.

Other further issues to possibly look at beyond network standby are:

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

6.4.2 Recommendations at the national level

The 4E Extension has been approved by the IEA as of December 2013. Energy efficiency is more than ever a top priority on the international and national agendas.

This new 4E period will see work under a broader scope, which includes *other types of energy* using equipment (not only electricity), *coverage of systems* and individual products, and the creation of the Electronic Devices and Networks Annex - EDNA.
The areas of priority for the continuation of the work that was taken forward from the SP Annex include smart homes, smart grid appliances and the efficiency of network services, as explained in detail in Sections 6.1 to 6.3.

Austria positioned its current work on Smart metering and Energy Monitoring Systems as the first official Task of the newly created 4E Electronic Devices and Networks Annex – EDNA. This means that Austria and BMVIT will be task leader for this activity at the international level. As strategic objectives for the Austrian BMVIT programs, the energy efficient end-use of products can be seen as a factor in other larger energy systems (including their CO_2 emissions), as a factor in the economy (through the household and commercial product manufacturers in Austria), and for their research and development (R&D) relevance.
Perspectives for integrating EDNA Annex results into models for future scenarios of technology that can be adopted for autonomous energy buildings and houses are of potential interest, especially when combined with energy management and energy savings.

One aspect that remains as a challenge are the re-bound effects, namely the loss of the energy gains from more efficient devices due to the increasing number of devices. Understanding and regulating the exploding number of complex products such as Networked devices is relevant. This is an area where critical work is needed, and can be supported with existing results from the SP Annex. New areas for policy development could be explored in the future as well.

An area, which is not yet sufficiently explored, is the awareness of end-consumers on energy efficiency related to ICT services, and the design of instruments which allow public discussion and active decision making towards a more sustainable lifestyle. The “virtual life” is bound to material and energy needs, emissions and waste, from e.g., data centers, network services and devices. This growing “invisible infrastructure” that enables our connected lifestyle needs to be critically examined beyond the “environmentally enabling” and “energy efficient” image that ICT currently has. Through the coming work of 4E there might be opportunities to bring these critical views at the national level and inform larger audiences.

7 Further information (Verzeichnisse)

- ➔ Standby Power Annex website: http://standby.iea-4e.org
- ➔ All publications from the SP Annex are available under: http://standby.iea-4e.org/documents-results

7.1 List of Figures

7.2 List of Tables

7.3 List of selected abbreviations

BMVIT:	Austrian Federal Ministry of Transport, Innovation and Technology
DSM:	Demand Response Management
EDNA:	Electronic Devices and Networks Annex
EU:	European Union
ExCo:	Executive Committee
FFG:	Austrian Research Promotion Agency
IEA:	International Energy Agency
IEA – 4E (4E):	Implementing Agreement for Efficient Electrical End-Use Equipment.
ISGAN:	International Smart Grid Action Network
MEPS:	Minimum energy performance standards
OA:	Operating agent
R&D:	Research and Development
SEAD:	Super Efficient Appliance Deployment Initiative
SMI-EMS:	Smart metering and energy monitoring systems
SP:	Standby Power (Annex)
UK:	United Kingdom
US:	Unites States of America

8 List of Appendices (Anhang)

Appendices are included as separate documents (in PDF format), as follows:

Appendix 1: Work plan of the Standby Power Annex and Budget 2013-2014. (APP1)

Appendix 2: ECODESIGN company GmbH - Working Plan for the Standby Power Annex. (APP2)

Appendix 3: Achievements of the Standby Power Annex as of February 2014. (APP3)

Appendix 4: Report on Power requirements for functions (APP4).

Appendix 5: Report on Mapping secondary product functions to products and operational modes (APP5).

Appendix 6: Guiding principles for energy efficiency in networked consumer electronics (APP6).

Appendix 7: Policy Brief SP 0 Standby Power Annex Overview (APP7).

Appendix 8: Policy Brief SP1 Standby power global cooperation in action (APP8).

Appendix 9: Policy Brief SP2 Standby power in televisions (APP9).

Appendix 10: Policy Brief SP3 Network standby: finding solutions to energy waste (APP10).

Appendix 11: Policy Brief SP4 Measuring success: Evaluation methodology for standby power policies (APP11).

Appendix 12: Policy Brief SP5 Tackling standby power wastage with a horizontal policy approach (APP12).

Appendix 13: Policy Brief SP6 “Basket of products” - A global approach to measuring standby power (APP13).

Appendix 14: Newsletter “Load Down, Edition 13, September 2013(APP14).