Standby Power and Low Energy Networks: Issues and Directions

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Commissioned by: Australian Government, DCCEE

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Focus of Report	This report was commissioned with three broad objectives in mind: • to explore technical issues related to the additional energy used by appliances and equipment when linked into networks; • to identify potential approaches and low energy solutions for networks; • to establish a pathway to realise policy solutions including identifying key areas where additional research would be required to enable energy saving within networks.
Description of Research	The research underpinning this report consisted of a comprehensive review of existing work into standby power and the additional energy associated with network functionality. This desk top research was supported by extensive consultation with key experts in the area. The initial concept for the report arose from discussion with the Asia Pacific Partnership (APP) Alignment of National Standby Power Approaches delegates and the 4E Standby Power Annex members. The research was also supplemented with a workshop on standby power and low energy networks in Paris in April 2010. Workshop participants, including technical experts, policy makers and component developers discussed the ideas already derived from the research and explored and further developed new ideas and concepts. Further discussions were held with the European EcoDesign Lot 26 project team who were undertaking parallel investigations into possibilities for network standby. Prior to publication the report was critiqued by several peer reviewers. EES was the commissioned author of the report; however, Bruce Nordman (USA) made a major contribution to the report and Robert Harrison (UK) also provided some assistance with the work.
Key Findings	The report begins by establishing the following definitions for products included in the scope of network standby. **Networked products** (also called edge devices) which connect to and communicate with other products over network infrastructure. The coverage of networked products in most existing policies that deal with low power modes has been limited. Networked products are likely to have multiple modes of operation beyond a simple on off state due to the addition of network functionality in several or all modes of operation. Therefore current policy approach of setting simple power limits by mode needs to be adapted to cater for more complex energy requirements. **Network equipment**, which is the equipment that makes up the network infrastructure itself – it provides the network connections between edge devices. Network equipment is generally not covered at all by current policies, because this type of equipment is required to remain in active mode virtually all the time in order to perform its primary function. However, there appear to be substantial energy saving opportunities available in this type of equipment.

The report proceeds to address the issues set out by the 3 objectives.

Technical issues related to energy in networks

A key issue arising from the study is that network protocols (and the equipment that is attached to or forms the network) rarely have energy minimisation as a key design parameter. This is due to many factors including energy experts and network developers having little understanding of each other's fields and the rapid technology development of networks in recent years. Designers have been focussed on the speed and capacity of the network. Raising awareness and the stressing the importance of energy efficiency in the field of network design will encourage the development of approaches to enable energy management and waste reduction across the whole network.

Any attempts to reduce energy waste in networks will face significant challenges in implementing effective energy management due to the complexity and interdependency of multiple devices and products on a network. Any strategy to reduce energy usage will need to understand the relationships between all connected products and any real needs those products have in terms of availability to receive and transmit information to each other.

Measurement and testing procedures for low power modes with network functions active have not be established and until an accepted test methodology is in place it would be difficult to implement an effective policy for these types of products.

The report identifies gaps in knowledge regarding technical issues and recommends undertaking further research in these areas including examining how technical standards could be developed to assist energy management; investigating how standard protocols could be used for energy management and reporting, develop a comprehensive understanding of the size of the energy wastage and possible savings, including looking at best available technologies and power management approaches.

Potential approaches and low energy solutions for networks

The report identifies that the best way to achieve low energy networks and eliminate excessive standby power is via an integrated policy framework approach. This approach would include the following elements:

- Refining and implementing guiding principles for good network design
- Incorporating power management as the default product design approach
- Capping power for all functions to existing reasonable levels (technology limits)
- Setting power limits for all secondary functions through a horizontal standby requirement (horizontal functionality).

Pathway to realise policy solutions

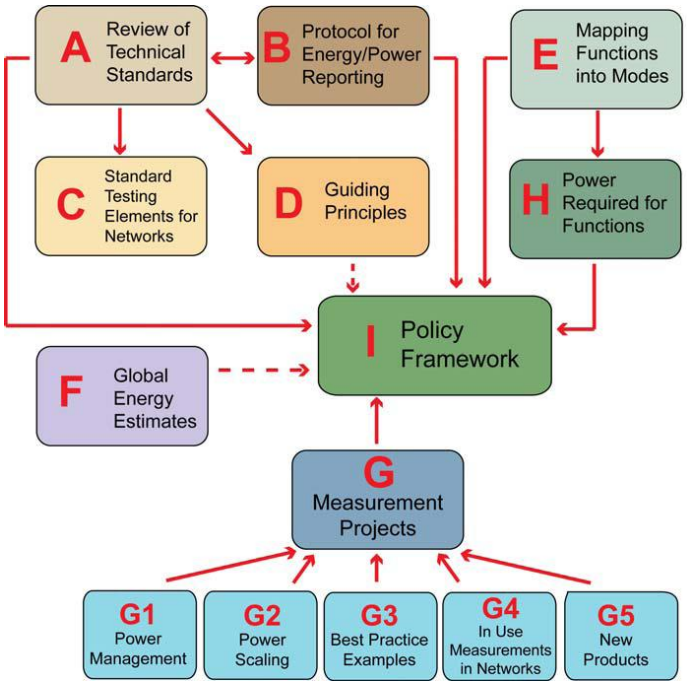
Technological developments in the field of networks are very rapid, so we need to be pragmatic and move quickly wherever we can. What is needed is a strategic approach to ensure that all the pieces required are available early in the development process. The report states that the main elements where further work is needed are:

- Better information on products and technologies (requiring measurement of networked products where possible)
- Active development of key technical standards that affect network related energy consumption of products connected to or that form part of networks
- Development of test and measurement procedures to assist with understanding the

scope of the problem, provide baseline data and aid implementation.

- A new policy framework with flexible, broad coverage to address standby in a horizontal sense that can include networked products and network equipment.

The key conclusion of the report is to enhance the knowledge and understanding in many critical areas and to identify and develop key protocols that will help develop low energy networks into the future through investment in a series of research projects. The graphic below demonstrates how each of these projects will become a building block enabling the development of comprehensive and manageable policy which can deliver energy savings and reduce needless energy waste in networked products and network equipment.



Conclusions

This report plays a crucial role in identifying the issues surrounding network standby and why existing methods for dealing with standby power and low power mode are not directly transferrable to the problem. The report identifies a number of areas where the existing knowledge is insufficient and proposes new research be undertaken to fill the gaps. The report asserts that while it was unable to produce an implementable policy solution in 2010, with investment into purposeful research there is a pathway to deliver such an outcome in the future. Key to tackling the challenge will be establishing energy management as an important issue for network designers. Additional knowledge required includes gathering baseline information, technological possibilities, and developing measurement tools. .

Standby power policy Implications

The results of this report establish network standby as a problem requiring new or modified solutions to those used previously to tackle standby power. If the issues of network standby are not addressed it has the potential to undermine previously successfully efforts to reduce energy wastage in low power modes as network functionality is rapidly becoming ubiquitous in appliances and equipment. The concepts of energy efficiency need to be raised in the technical arena of networks where the concept has been of little interest to the main protagonists to date. The basic concepts of a policy design are in place; however gaps in current knowledge need to be redressed to enable an all encompassing solution to the problem.