Network Standby: Policy Framework and Toolkit for Successful Policy Development

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Towards energy efficiency in the digital age
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Energy Efficient Strategies

Summary

- Overview of report for 4E
- Key components of a successful policy framework
- Policy toolkit - examples of approaches in use
- Future directions and work
- Issues for networks

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Background

- IEA 4E Implementing Agreement on Standby Power been in operation since 2009
- Has commissioned many important projects and reports, many cover networks
- Standby annex is coming to a close
- This new project is to wrap up achievements to date and map out some future directions
- Authors: Harrington and Nordman (see summary)
- Should be completed in October 2013

Standby Power and Low Energy Networks – issues and directions

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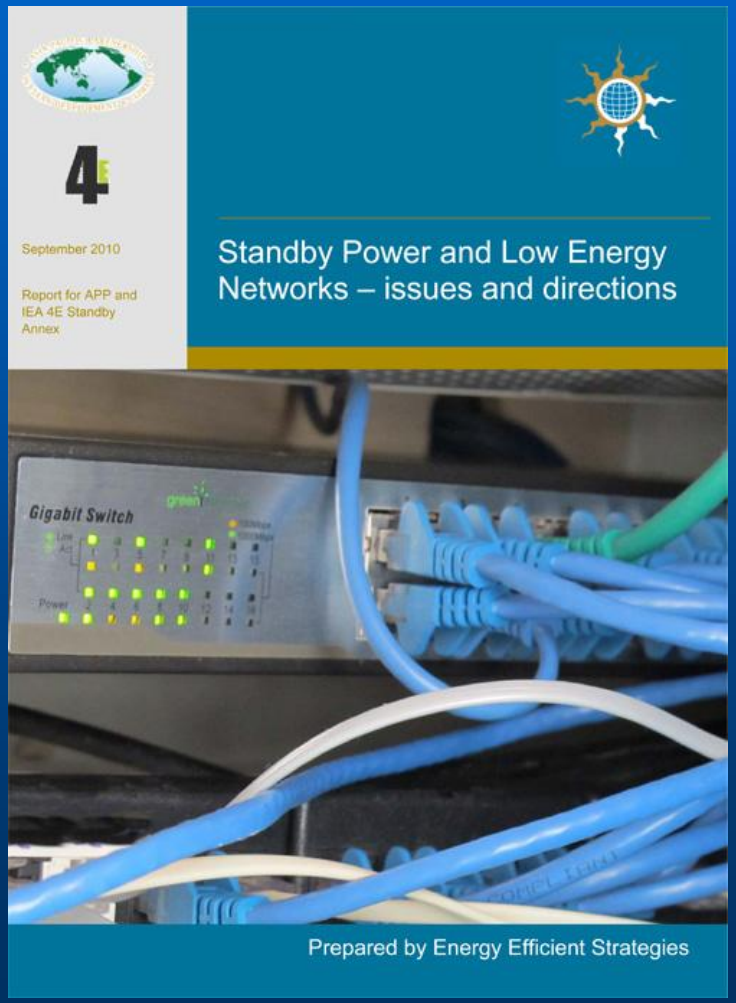
- APP and 4E Report
- Prepared by Harrington and Nordman
- Sets out many of the issues for networks
- Set agenda for research



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Guiding Principles

- ***Guiding Principles for Good Network Design*** **first proposed at an IEA workshop in 2007**
- **Reviewed by several organisations since**
- **Appear to give a robust framework for considering network related policies**
- **Needs to be expanded to recognise the option of cooperative and coordinated energy management of inter-related devices**

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Issues to consider

- Unlike other products, products connected to networks can be influenced by other devices on the network
- This is influenced by:
  - the manufacturer (product design, energy management and Technology Standards used)
  - Technology Standards available
  - user requirements and demands
- Presents challenges to policy makers - encourage energy saving and innovation

Issues to consider

- Manage complexity
- Resist inventing anything new
- Reward products that optimise their energy consumption under a range of typical usage conditions
- Allocate additional power only for additional functionality

Have we been looking in the wrong place?

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- Focus so far has been on the power of individual products in individual modes (inward)
- More outward looking – how to optimize energy of all devices connected to the network;
- Aggregate impact of all products together;
- Autonomous power management through coordination of status via the network avoids the need to set arbitrary time limits for activation of power management

Main approaches to network policies

- Vertical approach - low power modes are considered with the active (on) mode - typical usage pattern in estimate of total energy
- Horizontal approach - uniform (or relatively uniform) requirements are applied to one or more low power modes – many products
- Clustered horizontal - where requirements are applied to low power modes in groups of products of a similar type or function

Horizontal vs vertical

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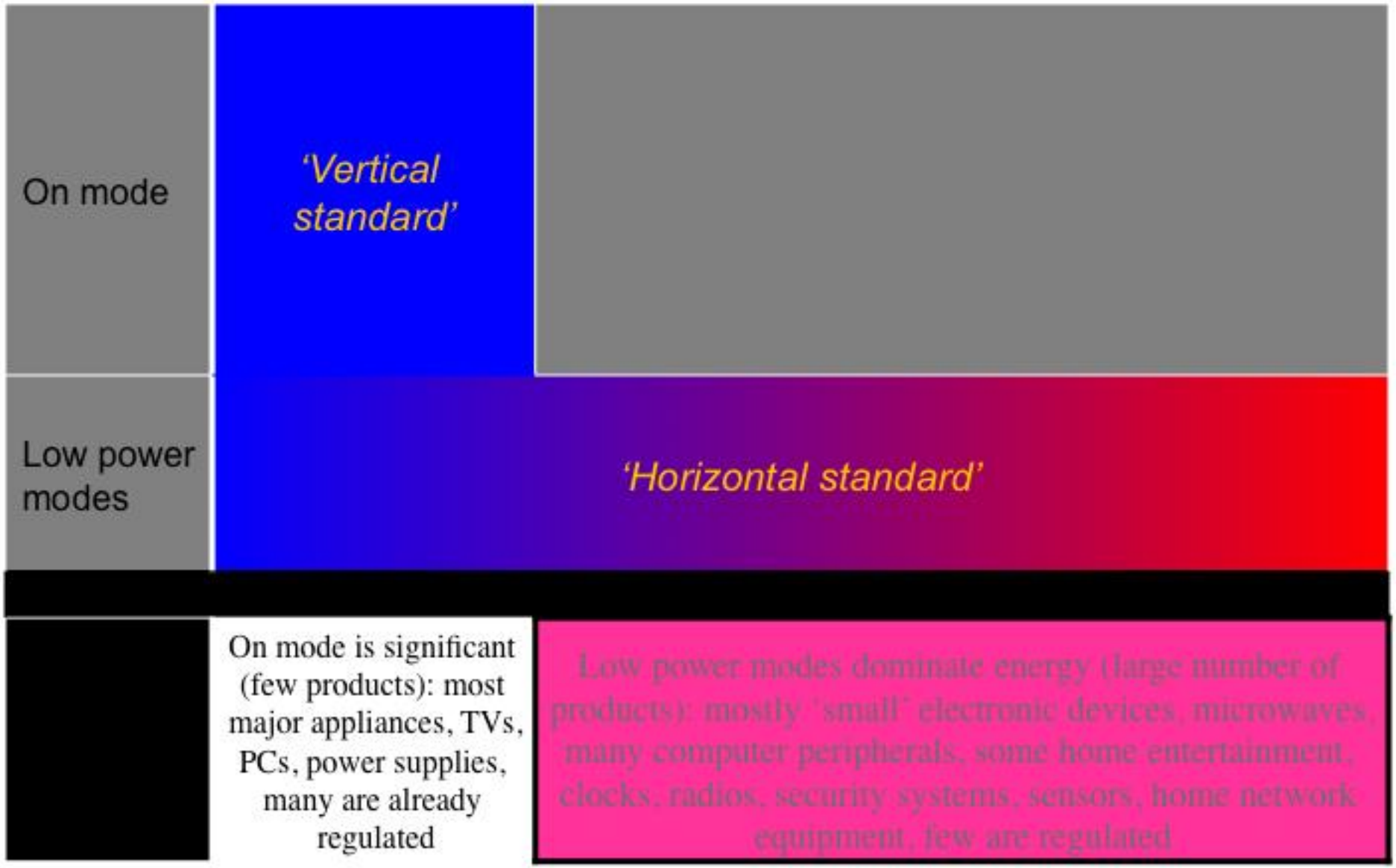

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Main approaches – horizontal limits

- Putting a horizontal (fixed) limit on various low power modes is the most common approach
- Fully horizontal (all products) or clustered horizontal (groups of similar products)
- Europe sets an across the board fixed power allowance for just a few product types
- Lessons
  - Product by product – lot of work to cover all types
  - Fixed – not really fair in more complex products
  - Product by Product (clustered) - many products not covered, lots of different requirements

Product by product (standby)

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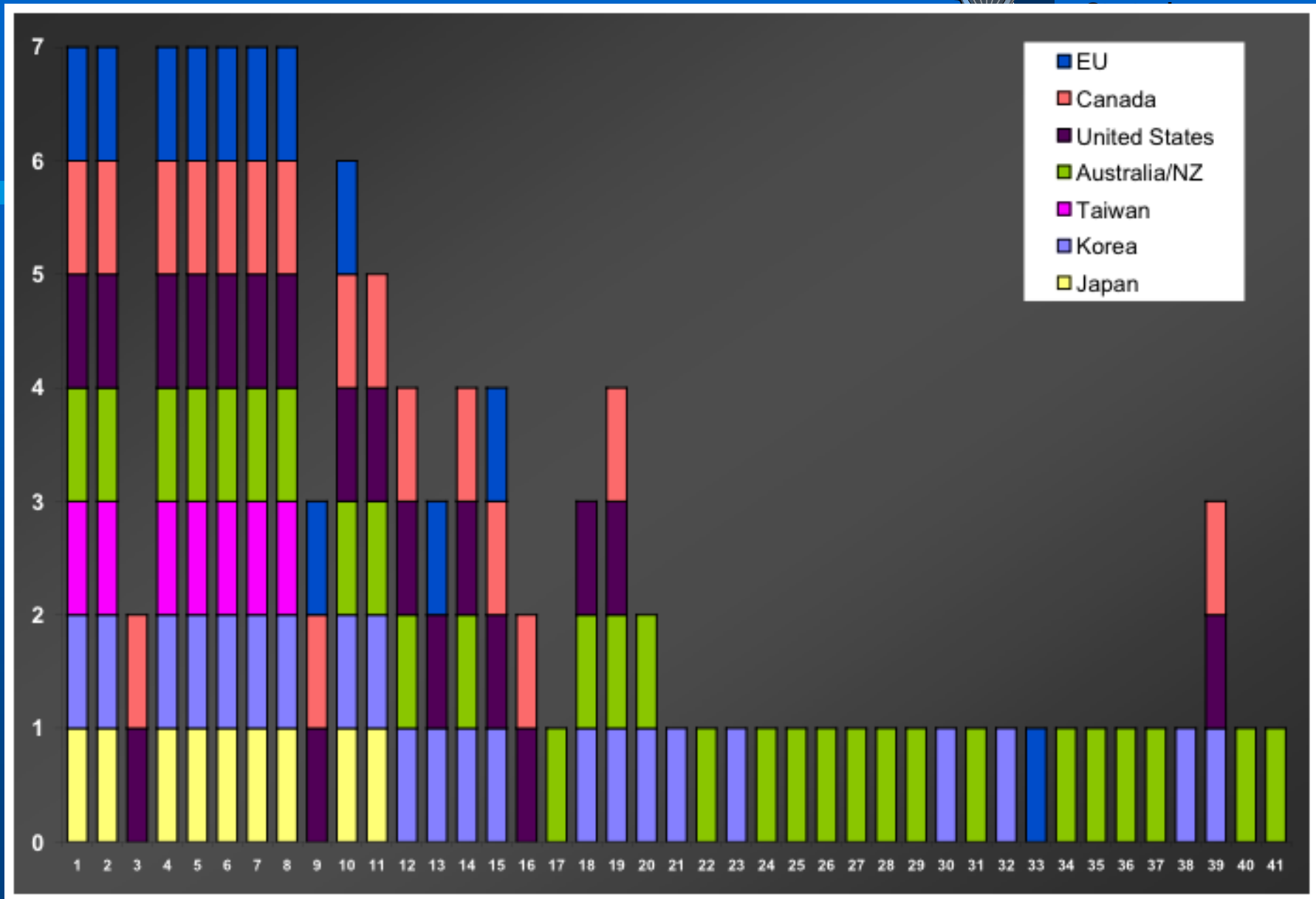

Number of programs

Product types

Main approaches – functionality limits

- Setting a limit that depends on the available and active functions is used in some programs
- Used in Energy Star for some products and various codes of conduct – functional adders
- Can take account of power required for functionality, but tends to be used for narrow product ranges
- Lessons
  - Concept of defining power levels depending on functions is practical and works well
  - Currently restricted to narrow product ranges
  - Important as limits become tighter on complex products

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Main approaches – vertical

- Adding low power modes into total energy consumption is quite common
- Energy Star for some products
- Needs a “duty cycle” (selection of modes) that is relevant and encourages designs that reduce energy under range of typical use
- Lessons
  - Balances low power mode energy with total energy to get optimum outcome (minimise total energy) (usage cycle)
  - Only really applicable to a few product types that are already covered (larger energy users)

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Test Procedures

- Test procedures underpin all energy policies and programs
- Basic measurement approach in IEC62301
- But it does not specify network components
- Currently range of policies and regulations that define network test elements
- Need a process to collect network content, collate, review and consolidate
- Objective is to get aligned approaches eventually

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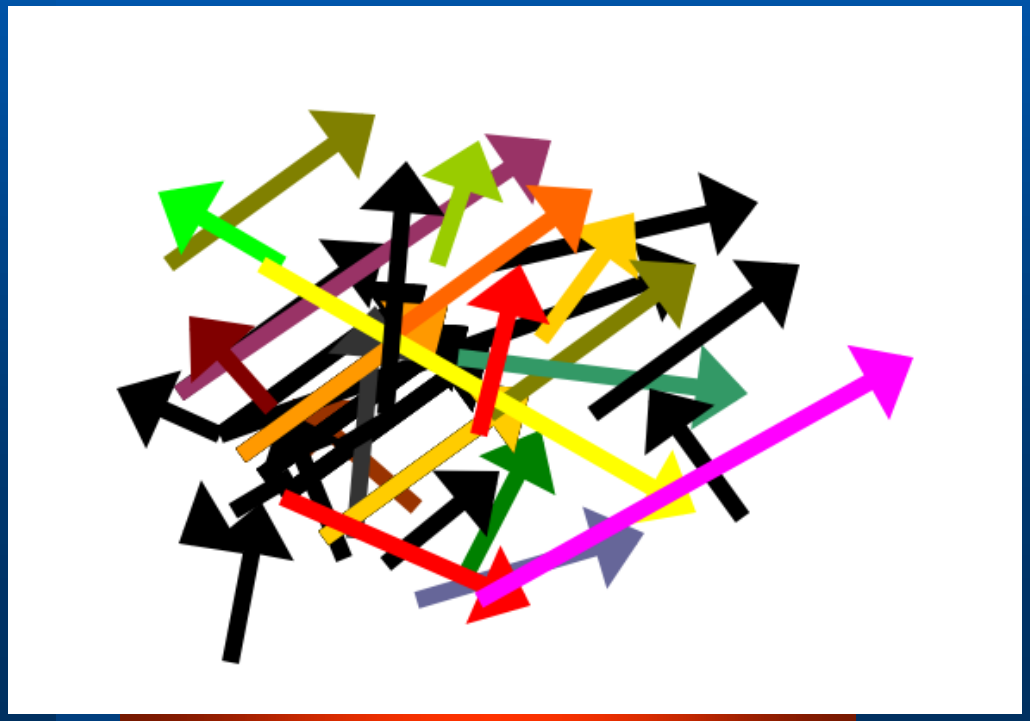
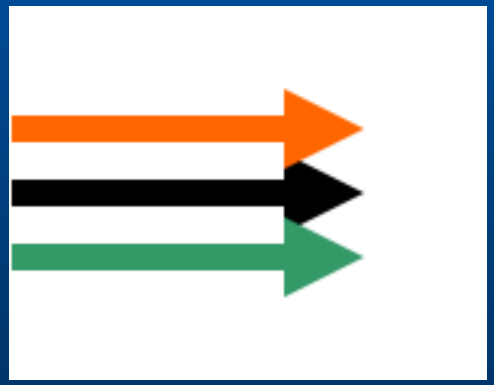
Test procedures

This is what we have……..maybe this is what we want





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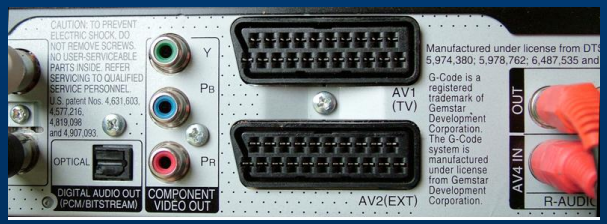
Technology Standards

- These are the operating protocols that make things work
- In the world of networks, technology standards define how data is transported through the network and ultimately how things talk to each other i.e. function correctly
- Example 1: IEEE 802.3 Ethernet
- Example 2: HDMI Version 1.4



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Technology Standards

- Technology standards are about making things work smoothly and efficiently
- Often they do not cover any energy matters
- Where there is no facility for energy management, energy cannot be saved in normal operation
- Some network technology standards need to address energy issues

Report Annexes

- Energy Reporting Protocols – may allow energy and use to be tracked, will allow coordinated power management of inter-related products
- Smart grids and building networks - types of requests the smart grid could make, what appliances could respond

Network considerations 1

- Energy management needs to be automatic rather than rely on user intervention
- Including modes or operating states that are rarely used during typical use does not drive product innovation in the right direction
- Network equipment (modems, routers and switches) rarely have a “low power mode”
- Reducing energy during periods of low traffic needs to be encouraged and rewarded in test procedures and in energy policies

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Network considerations 2

- Networks are growing quickly:
  - This was barely a consideration in the 1990's: computers were not common, networks were rare
  - Networks in IT equipment are now standard
  - Home entertainment are increasingly networked
  - Within a decade most appliances in the home could be on some sort of network
  - Energy outcomes could be poor if networks are energy hungry
  - Networks provide great opportunities

Network considerations 3

Networks will grow because consumers want the functionality it offers. We have to deal with the energy of networks and networked products in an effective way

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Future networks

- Theodore Hook said:
  "The best way to predict the future is to invent it."
- Most of the energy consumed in 2030 will be from products and buildings that are not yet built or even designed
- So we have an opportunity to shape our low energy future

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Future networks

Here is a idealistic view of 2020:

- **Products offer great functionality, but only when required**
- **Super low power designs are used for all functions, including network elements**
- **Products manage themselves into the lowest power mode possible, despite lazy users**
- **Networked products manage themselves**
- **Low total energy is the key paradigm**

Other points

- We always saw a clear line dividing standby (low power modes) and active modes
- This distinction is becoming very blurry as products become more complex, have more functions
- Power management (in its many forms) is an important solution to this problem

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Future Work Required

- Power scaling
- International cooperation on policies
- Encourage Technology Standard development in key areas
- Energy reporting on networks
- Test procedures for networks – pathway towards alignment
- Real world data and evaluation – always need to understand how products are used and what policies and approaches actually work

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The End

- **- thank you**

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Designing our future

"It was never easy to look into the future, but it is possible and we should not miss our chance."

Andrei Linde

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GP - hardware

- Products should support power management
- A network function should not stop power management internally
- A network function should not stop power management in other devices on the network
- Products should cope with legacy equipment (poor behaviour, no energy management)
- Products should scale power requirements in proportion to the service being provided

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GP – supporting policies

- Automatic power management into low power modes (wherever possible)
- Reasonable power limits on low power modes
- Encourage networked products to minimise their total energy consumption through ”establishment of industry-wide protocols for power management” [in networks]
- Keep performance requirements generic, require specific hardware or software only after careful consideration