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# Policy Brief: Improving the energy performance of information and communication technology products

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# A Policy Brief for improving the energy performance of information and communication technology products

## Evidence, analysis, targets and indicative standards

### Overview

1. This Policy Brief represents the outcome of the public consultation on information and communication technology (ICT) products, which was carried out earlier this year. This is in accordance with the announcement in the Energy White Paper of 23 May 2007 where the Government said it would publish a series of consultation papers setting out its analysis of how the performance of energy using products will need to improve over the next 10–20 years, including proposals for product standards and targets to phase out the least efficient products[1]. This forms part of a wider annual review and policy development process, supporting delivery of the Government's objectives for energy and sustainable consumption and production.

2. To achieve the product standards and targets, a range of measures and approaches is required. These may include: international agreements, European and domestic legislation and voluntary action through the supply chain to enhance markets for the most cost-effective energy efficient goods and services. In the Energy White Paper, the Government announced a range of policies to support delivery.

3. We believe that the standards will provide retailers, manufacturers and service providers with a benchmark to improve the performance of products they provide. In addition, we are encouraging industry to deliver improvements in product standards.

4. This Policy Brief addresses in-use energy consumption and carbon emissions associated with the following ICT products: monitors, desktop PCs, laptop PCs, printers, multi-functional devices (MFDs) and photocopiers. It excludes servers and networks.

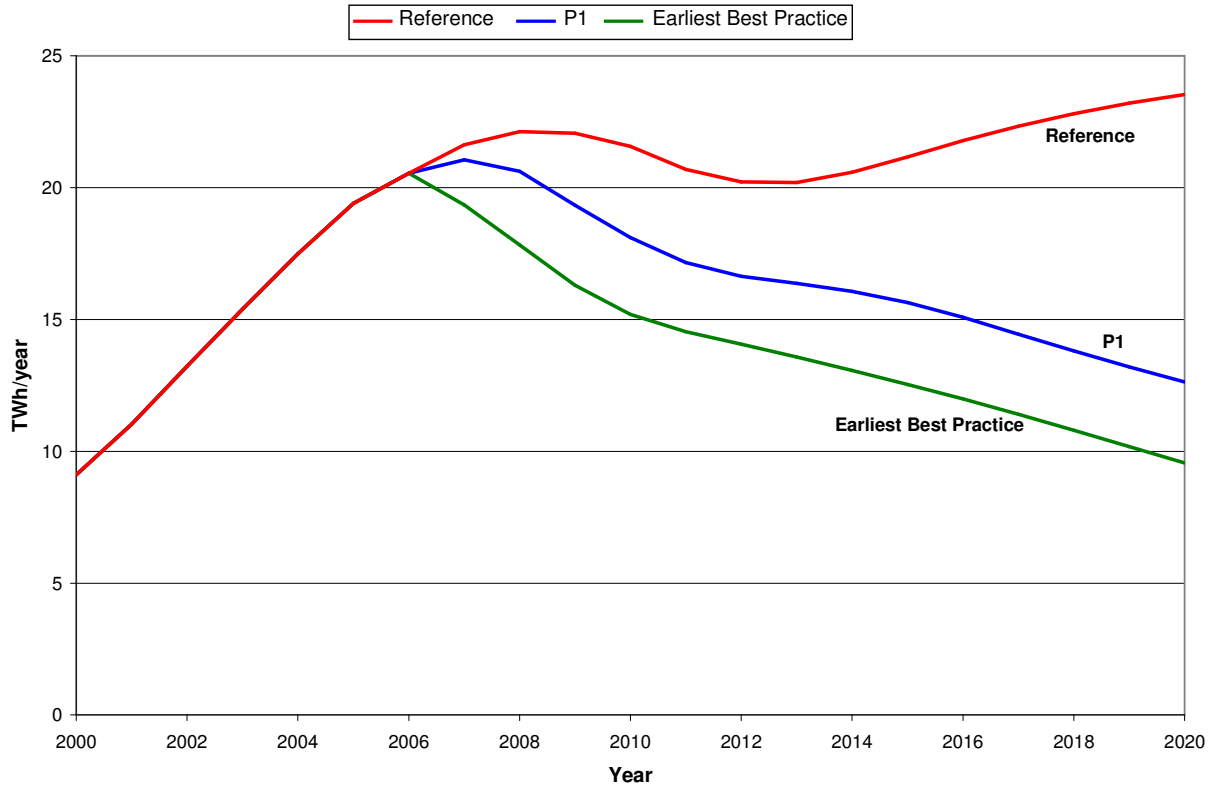
### How we expect ICT products to contribute to future energy consumption

5. The following two graphs show the Government's projections for energy use by ICT products (non-domestic and domestic, respectively)[2].

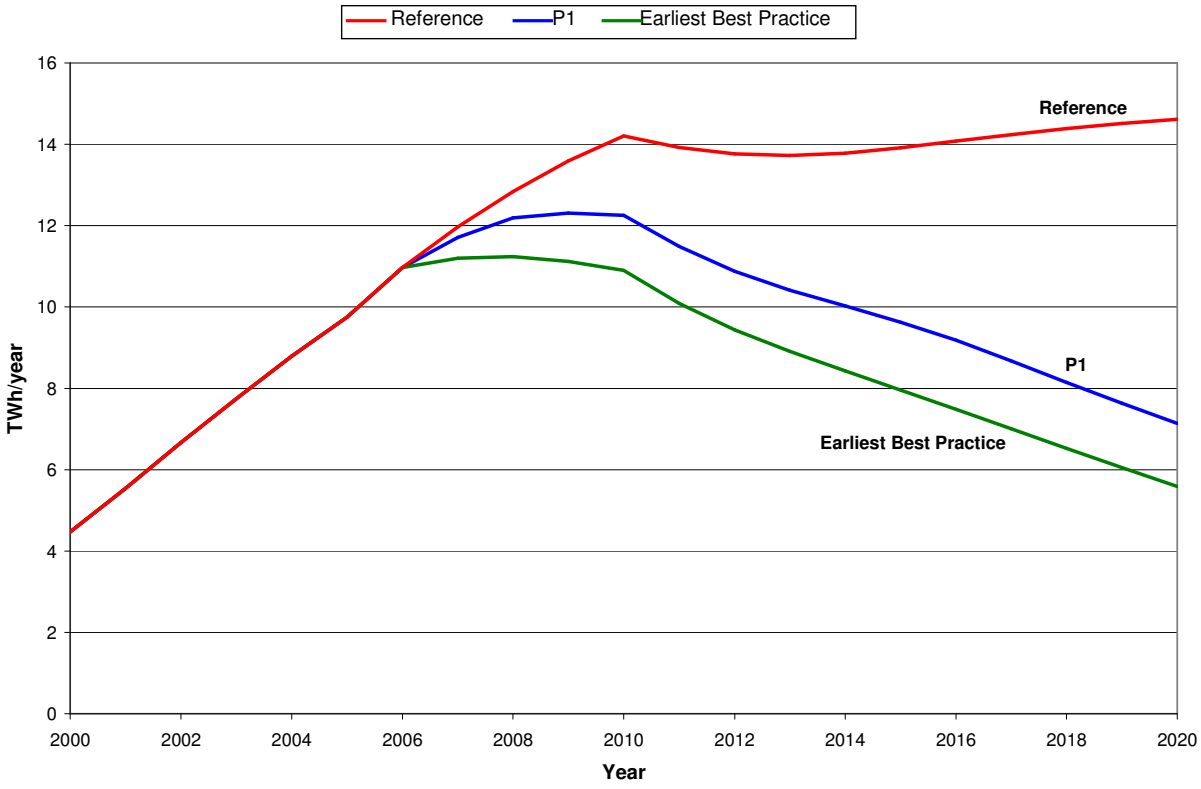
[1] See Energy White Paper (23 May 2007), para. 2.102.

[2] In deriving these projections we generally assume an extrapolation of the current service delivery modes, rather than engaging in speculation about major changes in product functionality or mode of service delivery. However, as soon as reliable evidence emerges about a new product or mode of service delivery, the projections are adjusted to take account of these. For example, multi-functional devices are already reflected in the current projections for ICT equipment.

## Total non-domestic energy consumption of UK ICT products (see scope in paragraph 4)




## Total domestic energy consumption of UK ICT products (see scope in paragraph 4)



6. The Reference[3] projection takes into account underlying trends in markets and technologies and the estimated or implicit impacts of historical and current policy measures. It does not, as yet, take account of the impact of policies announced in the Energy White Paper of 23 May 2007, which are still being developed and are not targeted at specific products (eg Carbon Emissions Reduction Target (CERT) and successor schemes). The intention is to revise these projections once it becomes clearer how these new policy measures will affect ICT products.

7. The Earliest Best Practice (EBP) projection shows what would happen if all new UK sales were based on the most resource efficient options, taking into account design and production cycles, but not taking account of price or other market barriers.

8. The P1 projection sets a target level of ambition that the Government is proposing could be delivered at low cost, taking into account such things as current UK and global performance benchmarks, economies of scale and the capacity of the supply chain to take coherent action to deliver more energy efficient products[4].

9. In theory, delivery of EBP would result in energy use from ICT products falling by about half to 9.6 TWh[5] for the non-domestic sector, and by about half to 5.6 TWh for the domestic sector by 2020, compared to 2006. This would represent an energy saving of 23.0 TWh (2.8 MtC, 10.4 $MtCO_2$)[6] over the Reference projections for 2020.

10. The proposed P1 target would result in energy use from ICT products falling to 12.6 TWh for the non-domestic sector and to 7.1 TWh for the domestic sector, by 2020. This would represent a combined energy saving of 18.4 TWh (2.3 MtC, 8.3 Mt $CO_2$)[7] over the Reference projections for 2020.

11. We estimate that the P1 target would be achieved if, on average, products supplied and brought into use each year were to meet the indicative performance

[3] The Reference line or 'REF' is included as a baseline against which progress towards absolute consumption targets can be monitored. It also permits us to measure the impact of market changes in response to published targets and delivered policy measures and to assess the need for additional action. REF is updated to estimate the aggregate impact of existing policy measures, superimposed on underlying market trends, on the supply, sales and use of ICT products. The effectiveness of market transformation policy, taken as a whole, may be assessed as the extent to which it modifies REF.

[4] These market-based estimates for P1 are cross-compared with the performance improvements that could be envisaged through a set of ambitious but feasible policy options, over and above those included in the Reference line to check their feasibility. Section 3 of this Policy Brief (Policies, risks and measures) describes these along with the associated risks and proposed strengthening initiatives.

[5] 1 terawatt-hour (TWh) = 1,000,000,000 kilowatt-hours (kWh)

[6] Carbon emissions for electricity are calculated from Government predictions of the electricity generation mix. Oil and gas are converted using standard Government factors. See MTP Briefing Note BNXS01 at: www.mtprog.com/ApprovedBriefingNotes/pdf.aspx?intBriefingNoteID=150.

[7] However, some of the energy an appliance uses provides useful heat and when this is reduced, the heating system will have to provide more heat (also known as the heat replacement effect, HRE), so the net carbon reduction taking the HRE into account is 1.5 MtC, 5.4 $MtCO_2$. See MTP Briefing Note BNXS05 for further explanation at: www.mtprog.com/ApprovedBriefingNotes/pdf.aspx?intBriefingNoteID=151

standards set out in the Appendix. These P1 targets and product standards take into account:

- Benchmark product designs and technologies.
- Underlying market and technology trends.
- The scope for delivering policy benefits at low cost.

12. We estimate this market shift could be delivered at low cost. For example, within the ICT sector, the specifications for a non-domestic PC in 2008 are 66 W (on-mode), 4 W (sleep) and 2 W (off/standby). Although many products are consuming more energy than this at present, there are products currently on the market, at a competitive price, which achieve about 19 W, 1 W and 0.5 W in these modes respectively.

13. If we are on track to deliver this target, we would expect to see substantial shifts in the market, for example:

2013: Average sleep mode for desktops - less than 3 W
2014: Average off/standby for laptops - less than 1 W
2020: Average on-idle[8] consumption for desktops - less than 45 W
2020: Average on-idle consumption for laptops - less than 9 W
2020: Average on-active consumption for monitors - less than 25 W

14. Our analysis indicates, in principle, that the P1 target is achievable through normal market mechanisms, supported by policies to be implemented as announced in the Energy White Paper.

15. This is in line with the approach taken in the EU's Eco-design of Energy-using Products (EuP) Framework Directive, which encourages voluntary actions where appropriate.

16. The Government is committed to working with retailers, manufacturers and suppliers to overcome barriers that might impede progress, and to promote delivery of these indicative standards more widely in the market. We will, therefore, work with the full range of policies outlined in the Energy White Paper. Where international or domestic measures rely on performance standards, we propose that we should seek to align them with the indicative standards outlined in this Policy Brief. In particular we will:

- Press for EuP measures to adopt performance requirements for ICT products in line with our indicative standards, while acknowledging the Single Market legal base for EuP and recognising that final performance requirements will need to be fully harmonised across the whole of the European Union.
- Encourage, for example through the International Task Force for Sustainable Products (ITFSP), harmonisation of international measurement standards for ICT products.

[8] On-idle is a mode representative of normal operation of the PC, although often unnecessary time is spent in this mode when the PC is not in use because it fails to enter low power modes automatically.

- Continue to support ENERGY STAR® on both a European and worldwide level – the second phase of the current ENERGY STAR specification revision will take place in 2009, with criteria set at the level of the top performing about[9] 25% of products in 2008. Subsequent ENERGY STAR specifications come into place in 2013 (or potentially as early as 2011), 2017 and 2021, set at the top performing about 25% level of market in the year prior to revision.
- Support the creation of a UK energy labelling initiative (the Energy Saving Trust's (EST's) Energy Saving Recommended (ESR) scheme and similar) and related initiatives for ICT.
- Use the indicative standards to identify the most appropriate minimum and/or forward looking standards for use in Government procurement.

17. In this Policy Brief, we set our P1 target and indicative standards based on our current understanding of what is necessary and deliverable. That analysis may change over time, for example, if new efficient technologies enter the market faster than expected; or if consumer trends change; or through international or EU action; or policies on carbon emissions reduction more generally. We intend to maintain a continued active dialogue with businesses in the supply chain. The aim will be to review progress and to annually update this analysis, the P1 target and the indicative standards for ICT products, among others, following consultation and review.

[9] Criteria will be set for a number of modes and combined with other criteria such as requirements for energy saving functionality – therefore ENERGY STAR will aim for criteria to be set at the 25% level, overall although for some modes levels may be higher, and for others lower.

# Table of contents

# 1 Status of Policy Brief

18. This Policy Brief is issued as part of an annual process, as announced in the Energy White Paper, to review and update the Government's published analysis, projections, P1 target and indicative standards for more sustainable products. This updated version takes into account the views received following the first consultation and, so far as possible, addresses substantial issues raised.

# 2 Market overview

19. As set out above, this Policy Brief addresses in-use energy consumption and carbon emissions associated with the following ICT products: desktop PCs and laptops, monitors, printers, photocopiers and multi-functional devices (MFDs).

## 2.1 Trends

20. Overall, there is strong demand for ICT products. Development rates are fast and many products become obsolete before they are worn out. This stimulates upgrading and early replacement of ICT equipment, and provides an opportunity for inefficient solutions to be taken out of use.

21. An important trend is convergence of the functions provided by traditionally separate entertainment products, such as digital set-top boxes, with the broader range of functions provided by computers, games consoles and other household information and communication technologies.

22. At present, most in-use energy in this sector is consumed by desktop PCs and imaging equipment (83% of non-domestic and 71% of domestic consumption). Desktop PCs and laptops represent the largest proportion of ICT stock and will continue to have a dominant share going forward, although there will be a transition away from desktop PCs towards laptops[10].

23. Imaging equipment is expected to grow at a lower rate than PCs. However, the high energy consumption of imaging equipment, particularly that of laser printers in the non-domestic sector means that imaging devices will dominate non-domestic energy consumption to 2020 (53% of non-domestic consumption in 2020).

24. Total energy consumption due to the ICT products addressed in this Policy Brief (see scope in paragraph 4) is expected to increase from 31.4 TWh in 2006 to about 38 TWh in 2020 - an increase of over 20%. A greater increase is expected to occur in the domestic than in the non-domestic sector:

- In the non-domestic sector, consumption is projected to increase by 3.0 TWh between 2006 and 2020, to about 24 TWh – a 15% increase.

[10] Although a growing number of ICT peripheral products draw power from the shared desktop/laptop power supply via USB interfaces, these have not currently been shown to increase overall consumption to such an extent that it merits more in-depth energy modelling.

- In the domestic sector, while total consumption is projected to remain lower than in the non-domestic sector, at about 15 TWh in 2020, this accounts for a rise of 3.7 TWh from 10.9 TWh in 2006 – a 34% increase.

### 2.1.1 Desktop PCs and laptops

25. Non-domestic ownership of desktop PCs and laptops is growing. As prices become much more competitive and performance converges, sales of desktop PCs are slowing, but laptop sales are increasing rapidly. By 2020 it is expected that there will be about 22 million laptops and 23 million desktop PCs in the UK. This represents a 80% increase in laptop stock with a 2% increase in PC stock from 2006. Due to the low energy consumption of laptops, despite the large increase in stock, the share of consumption due to PCs and laptops is projected to decrease from 34% of non-domestic ICT consumption (for all products addressed in this Policy Brief) in 2006, to 33% of total non-domestic ICT consumption in 2020. Non-domestic PC and laptop energy consumption is predicted to rise from 7.0 TWh in 2006 to about 7.8 TWh in 2020, representing 27% of the total growth in ICT consumption expected over this period.

26. Domestic laptop stock is expected to quadruple by 2020 to reach similar stock levels to desktop PCs. Domestic ICT energy consumption due to laptops and desktops is expected to rise from 7.0 TWh in 2006 to 9.3 TWh in 2020.

### 2.1.2 Monitors

27. Cathode ray tube (CRT) monitors are being rapidly replaced with liquid crystal display (LCD) monitors, as the former have become undesirable from consumer and manufacturer[11] angles. It is estimated that by 2010 LCDs (or similar technology) will represent over 95% of non-domestic stock. It is also anticipated that falling prices will make larger monitors more affordable, thereby increasing sales. In the non-domestic sector the improvements in unit consumption and falling stock will be offset by the rise in screen size, and an increase in consumption will still be observed. The number of monitors in homes is expected to decrease by a small amount but this, coupled with the increasing screen size, will see energy consumption rise – a 1.2 TWh rise for only 276,000 additional products in stock. Non-domestic monitor share of total non-domestic energy consumption is projected to decrease slightly from 15% in 2006 to 14% in 2020. The domestic sector proportion of energy consumption due to monitors is anticipated to rise from 27% in 2006 to around 28% in 2020.

28. Energy consumed by non-domestic monitors is expected to rise from 3.1 TWh in 2006 to about 3.3 TWh in 2020. In the domestic sector, monitor energy consumption is also expected to rise from 3.0 TWh in 2006 to about 4 TWh in 2020[12].

[11] CRT monitors have a greater waste implications than LCD monitors. The manufacturer is now responsible for this impact of their products under the Waste Electrical and Electronic Equipment 2002/96/EC Directive.

[12] Distributions in monitor type are expected to be similar between domestic and non-domestic applications, but the different figures for consumption between domestic and non-domestic monitors is due to a greater stock of non-domestic monitors.

29. There is potential to improve the energy efficiency of LCD monitors through better electronic design and, for example, the use of light-emitting diodes (LEDs) to backlight LCD screens. New direct light-emitting screen technologies have a further potential to deliver efficiency improvements. The specifications included in the Appendix anticipate this improvement potential.

### 2.1.3 Imaging equipment

30. Over time, printing speeds are expected to increase as higher specification machines become more affordable. Sales are moving away from dedicated printers, copiers and faxes towards multi-functional devices (MFDs). The consumption of MFDs represents a considerable proportion of projected non-domestic consumption.

31. Photocopiers account for 5% of total non-domestic ICT consumption in 2006, falling to 0.5% in 2020 as they are replaced with new technology. Printers and MFDs account for 46% of non-domestic energy use in 2006, moving to 53% of energy use in 2020.

32. The domestic sector is currently dominated by inkjet printers/MFDs but photo printers and laser MFDs are expected to account for a growing share of stock as they become more affordable. The difference in consumption between MFD and single function devices is becoming less marked as technology becomes more advanced and parts more efficient. However, in general, laser devices (using more intensive thermal printing technology) have higher consumption in their respective modes to inkjet devices. A laser MFD could consume many times the average energy consumption of an inkjet MFD. It should be noted that laser based equipment is often preferred by customers who have higher monthly volumes, and that the cost and energy per printed page may be lower for either inkjet or laser-based products, depending upon application.

33. As well as increasing printer speeds, there is also a trend toward prevalence of colour printing (including domestic colour laser when price permits), which may also result in increased consumption. However, developments in miniaturisation may serve to minimise these potential consumption increases.

34. Printer, MFD and photocopier energy consumption in the non-domestic sector is estimated at 10.4 TWh in 2006 rising to 12.4 TWh by 2020. Domestic energy consumption by comparison is 0.9 TWh in 2006 rising to 1.3 TWh in 2020.

## 2.2 Price

35. In general, the market is extremely price sensitive with manufacturers under pressure to offer products at the lowest possible cost. This can be a barrier to improving energy efficiency as anything that is perceived to have the potential to add cost, such as the inclusion of best practice components, is treated with caution. The determining factor in price is usually specification level – the greater the price, the greater the level of specification and the more energy the device usually consumes in each mode of operation.

### 2.2.1 Desktop PCs and laptops

36. Market Transformation Programme (MTP) testing results show the following:

- In a comparison of high specification, high price desktop PCs (commonly domestic machines) with cheaper lower specification desktop PCs (commonly office machines) the following was observed:
  - No major differences in consumption for standby and sleep modes.
  - A marked increase in on-idle consumption[13] with increase in price/specification.
- In a comparison of more expensive, higher specification laptops (commonly domestic machines) with cheaper, lower specification laptops (commonly office machines) the following was observed:
  - No major differences in consumption for standby.
  - In some cases lower consumption for higher specification, higher priced machines for sleep and on-idle modes.

37. It can be observed that higher specification is achieved with increased price, and it is difficult to separate this from energy efficiency. Cheaper desktop PCs will therefore be likely to consume less energy in on-idle modes than more expensive desktops. For laptops, as battery life is an important commodity, improved efficiency is more likely to be gained with laptops that have a higher price and specification.

### 2.2.2 Monitors

38. Price increases with level of specification, as does energy consumption. Therefore a cheaper monitor will generally consume less energy. No finer analysis of pricing has been carried out.

### 2.2.3 Imaging equipment

39. For imaging equipment, price of the product itself is likely to increase with print speed and with technology (ie non-thermal, lower consuming products such as inkjet tend to be cheaper than thermal technologies, such as laser). The intended monthly print volume is a key parameter in efficient selection of an imaging device. For applications where there are high monthly print volumes, laser-based printing devices may in fact result in a lower cost per printed page, and require less energy per page than inkjet devices.

## 2.3 Innovation

40. Innovation is an important factor in market development and is covered in Section 4.1.

[13] On-idle is a mode representative of normal operation of the PC, although often unnecessary time is spent in this mode when the PC is not in use, because it fails to enter low power modes automatically.

# 3 Policies, risks and measures

41. In the Energy White Paper, the Government said it would:

- Take steps within the UK to improve the take up of energy efficient products and work internationally, and through the EU to stimulate global innovation and competition to raise standards and to bring a greater choice and efficient products to UK consumers.
- Deliver on our Gleneagles G8 commitments to promote international co-operation on product labelling and standards and help develop practical standards to reduce standby power.
- Work with the UK supply chain to encourage delivery of more efficient goods and services.
- Publish a series of consultation papers setting out our analysis of how the performance of energy using products will need to improve between now and 2020, including proposals for indicative product standards and initiatives to phase out the least efficient products.

42. As set out above, our analysis indicates, in principle, that the P1 target is achievable through normal market mechanisms, supported by policies to be implemented as announced in the Energy White Paper.

43. In this Section we consider the potential for policy to assist in delivering P1. We identify:

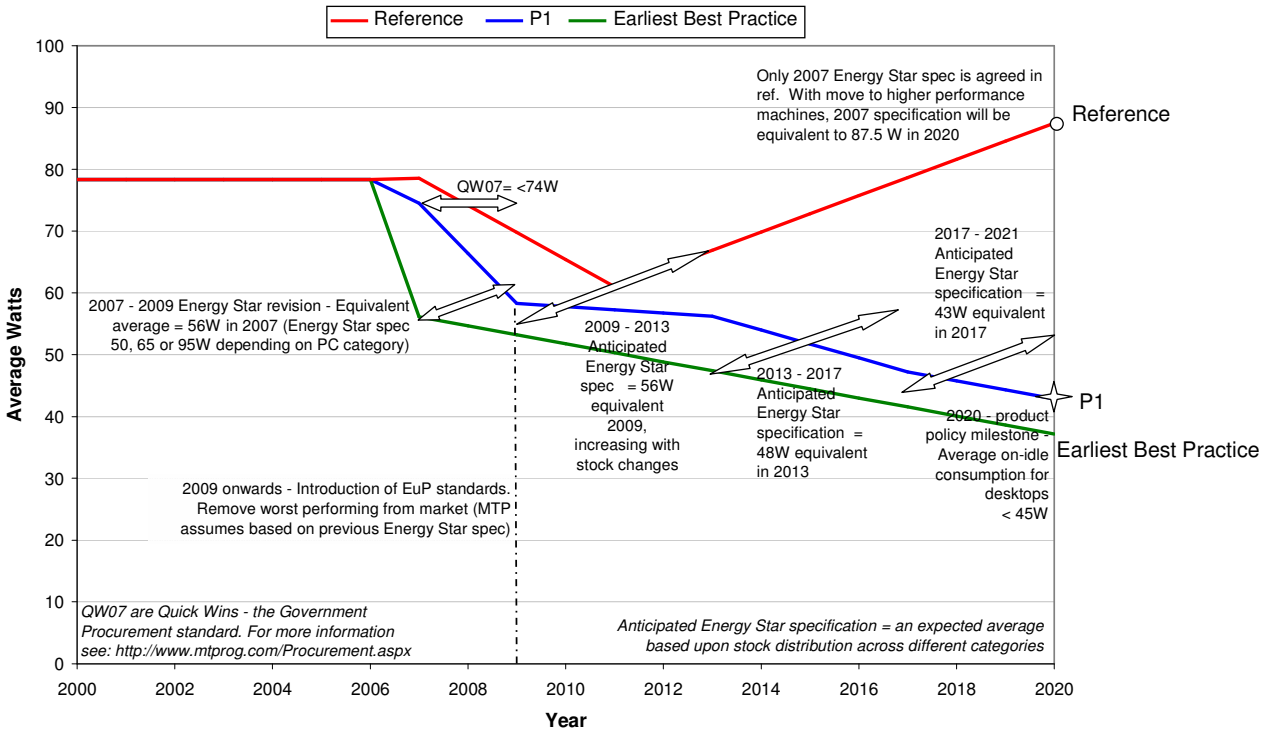
- Policies we believe are already helping to deliver higher environmental performance standards.
- Supporting policies that could assist in delivering P1 in the event that the market fails to deliver it.
- The risks that these policies may not deliver efficiency improvements.
- Further actions that may be necessary to achieve the Government's targets.

44. Figures 3.1–3.5 illustrate how existing policy instruments and initiatives could support delivery of more efficient new ICT products – specifically for a desktop PC, laptop, monitor, inkjet printer, and laser MFD.

45. The graphs plot the data in the Appendix (ie the indicative performance standards for the basket of new products), which correspond to the P1 projection. Also shown on the graphs are equivalent performance values for the Reference and EBP projections. These illustrate the sales-weighted average performance of new products under the different projections[14].

[14] It should be noted that data on off/standby power used to develop the scenarios and Government indicative performance standards include any standby consumption of the power supply (whether internal or external).

**Figure 3.1 Indicative on-idle power consumption for new non-domestic desktop PCs**




46. The ENERGY STAR specification for on-idle of desktop PCs allows for three categories of PC, with increasing consumption allowance as desktop performance increases[15]. These categories have been equated to a single 'equivalent' average specification value based upon the understanding from the MTP stock models of the composition of the PC market across these three categories (see also the Appendix)[16].

47. Desktop PCs are expected to move into the higher consuming categories over time, and as a result the ENERGY STAR specification is expected to become less effective, and the 'equivalent' specification value will increase. For this reason, the arrows representing the specifications on the graph below slant upwards.

48. Revisions to the current version 4.0 ENERGY STAR requirements for computers are currently under way. These 'Tier 2' revisions will include an 'Energy Efficiency Performance Metric' approach[17]. This will require a benchmarking tool to be run on the computer to output a kWh per year consumption figure. As this tool is still in the process of being developed, it has not been possible to account for

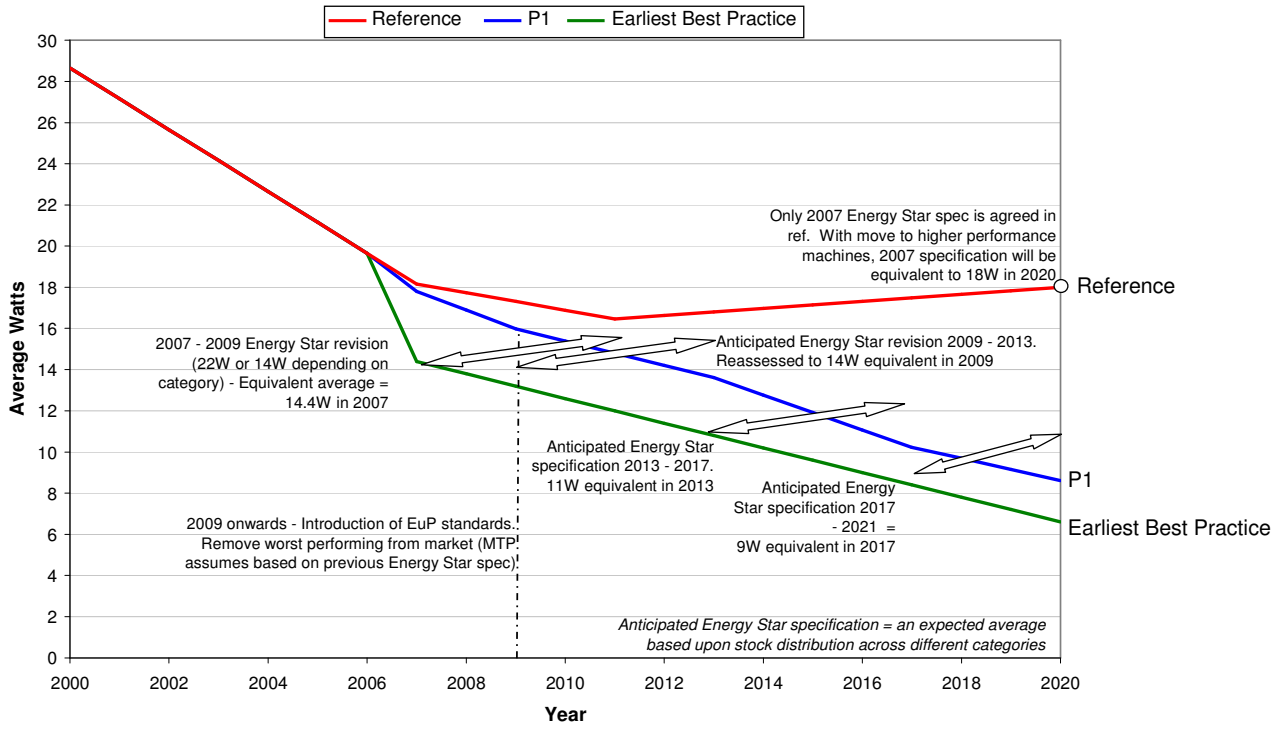
[15] The Reference scenario only includes policy that already exists and, therefore, only accounts for the version 4.0 ENERGY STAR specification for computers. Further specification revisions are assumed to have a similar impact to revision of the 4.0 for simplicity of modelling. Once the subsequent specification approach (based around an energy efficiency performance metric) is defined, the model will be updated to reflect this.

[16] For domestic desktops, from 2007 onwards there will be the additional influence of the introduction of a domestic energy labelling initiative (ESR) for ICT = 59 W equivalent (revised yearly to be slightly more stringent than ENERGY STAR).

[17] Currently being developed for the US EPA by ECMA TC28 TG2 and BAPCo.

potential impacts of this in the current modelling (it has instead been assumed that the revised specification will have a similar impact to downward revisions of the current 3 category approach). Once the Energy Efficiency Performance Metric has been finalised, modelling will be updated to reflect this.

**Figure 3.2 Indicative on-idle power consumption for new non-domestic laptops**



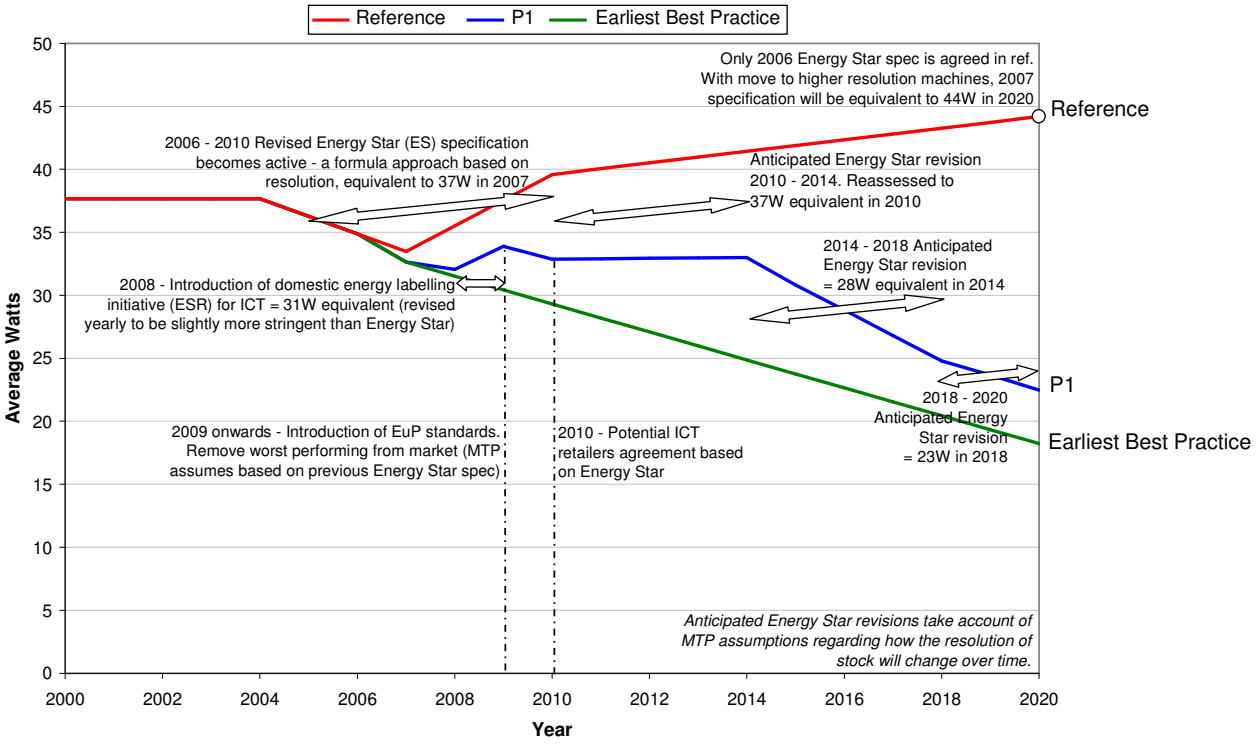

49. The ENERGY STAR specification for on-idle of laptop PCs allows for two categories of laptop, with increasing consumption allowance as laptop performance increases[18]. These categories have been equated to a single 'equivalent' average specification value based upon the understanding from the MTP stock model of the composition of the PC market across these two categories (see also the Appendix)[19].

50. Laptop PCs are expected to move into the higher consuming category over time, and as a result the ENERGY STAR specification is expected to become less effective, and the 'equivalent' specification value will increase. For this reason, the arrows representing the specifications on the graph below slant upwards.

[18] The reference scenario only includes policy that already exists and, therefore, only accounts for the version 4.0 ENERGY STAR specification for computers. Further specification revisions are assumed to have a similar impact to revision of the 4.0 for simplicity of modelling. Once the subsequent specification approach (based around an energy efficiency performance metric) is defined, the model will be updated to reflect this.

[19] For domestic laptops, from 2007 onwards, there will be the additional influence of the introduction of a domestic energy labelling initiative (ESR) for ICT = 15W equivalent (revised yearly to be slightly more stringent than ENERGY STAR).

## Figure 3.3 Indicative on-active power consumption for new domestic LCD monitors

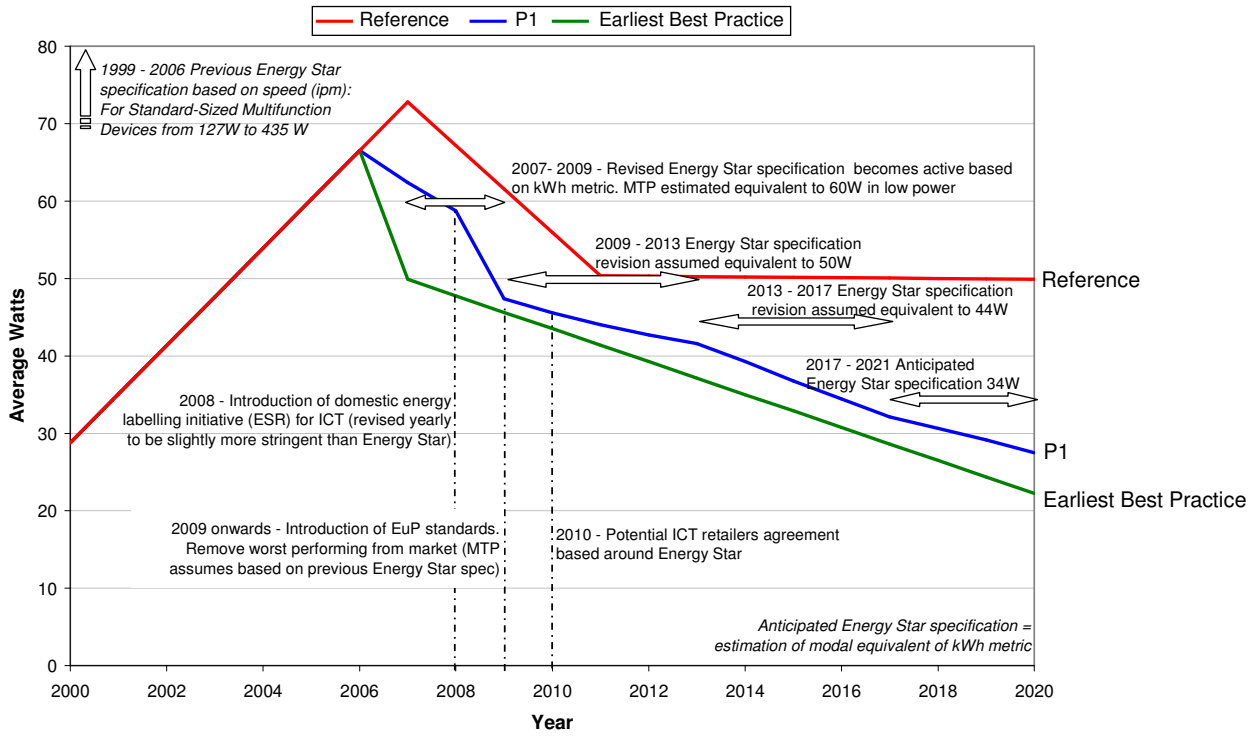



51. The ENERGY STAR specification for monitors is based upon a formula approach around screen resolution. As resolution increases, consumption allowance will increase. The formula has been equated to a single 'equivalent' average specification value based upon understanding from the MTP stock models of the composition of the monitor market across various resolution categories (see also Appendix).

52. Monitors are expected to become higher resolution (and therefore be allowed higher consumption under ENERGY STAR over time). As a result the ENERGY STAR specification is expected to become less effective, and the 'equivalent' specification value will increase. For this reason, the arrows representing the specifications on the graph below slant upwards[20].

[20] It is expected that future ENERGY STAR specifications will move away from a resolution based formula towards one based on screen area. Until such measures are defined, MTP will continue to base assumptions regarding future revisions around the basis of revisions to the current approach – on the basis that future approaches will have a similar impact in improving energy efficiency. When a new specification is available, the model will be updated accordingly.

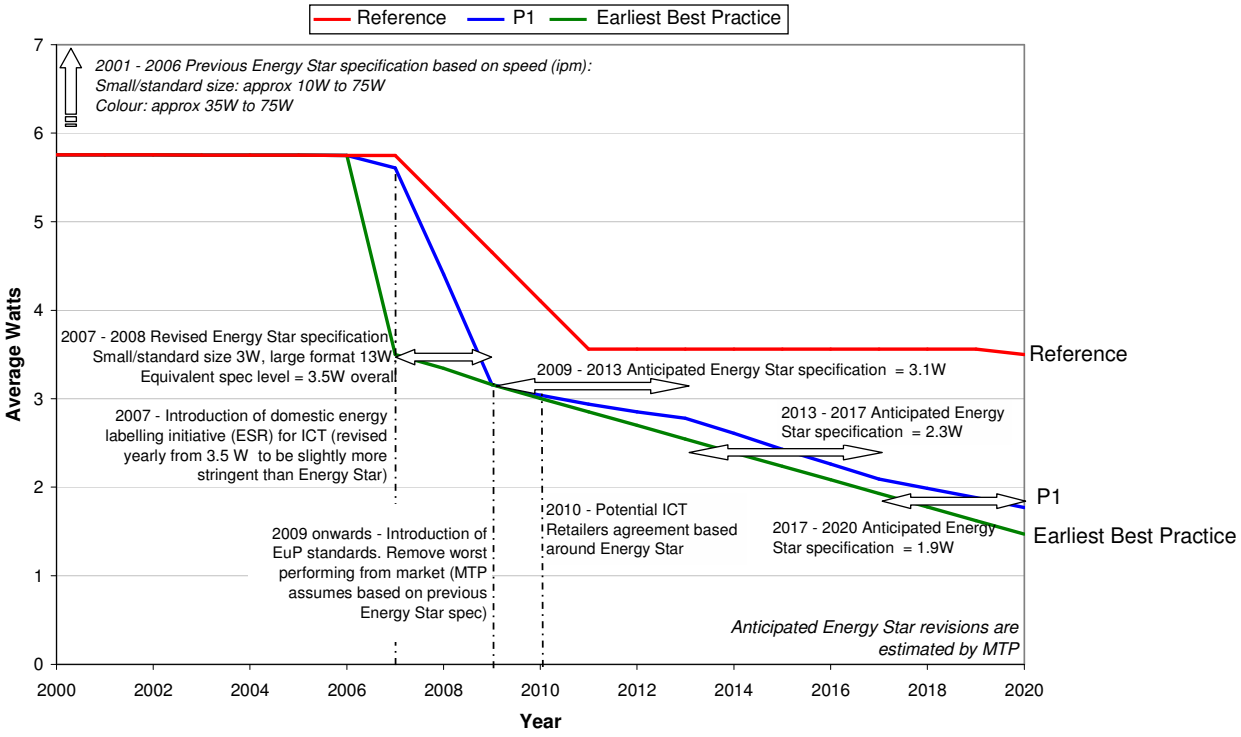
## Figure 3.4 Indicative low-power consumption for new domestic laser MFDs[21]




53. The ENERGY STAR imaging specification is based upon a Typical Energy Consumption (TEC) metric for laser MFDs. This metric utilises a set usage profile within a test method to arrive at a kWh per week criteria figure (formula based on print speed). Due to the complexities of this approach, MTP has made calculations based upon our evidence base, to interpret an equivalent average threshold value for each mode of operation. It is not expected that domestic devices will increase greatly in speed etc. over time, so the arrows illustrating these thresholds are horizontal in this case.

[21] The 'potential ICT retailers' initiative' refers to the Government asking major UK manufacturers and retailers to compete to supply ICT products in line with the Government indicative standards. These indicative standards would be set at the appropriate market coverage level, using standardised approaches (to defining modes, testing approaches etc) as defined in ENERGY STAR or similar initiatives.

**Figure 3.5 Indicative sleep mode power consumption for new domestic inkjet printers**




54. The ENERGY STAR imaging specification defines a set threshold for inkjet printer sleep mode, depending upon the format of the device (small, standard or large). This has been equated to a single 'equivalent' average specification value based upon understanding from MTP stock models of the composition of the inkjet printer market across the three format categories. No change over time is anticipated in the distribution between the three categories, so the arrows illustrating the equivalent average thresholds for ENERGY STAR are horizontal in this case.

## 3.1 Market analysis, projections and targets

Current status

55. This is our first Policy Brief resulting from the consultation process which addresses how the performance of ICT products will need to improve between now and 2020, including proposals for product standards and initiatives to phase out the least efficient products. The intention is to update this analysis on a yearly basis.

56. Tables showing the average performance levels each product group needs to achieve to realise the P1 target are provided in the Appendix. These tables also provide a metric against which developments in the market can be measured.

57. The intention is to monitor progress against the current projection for technology and market development, to consult on the evidence and, annually, to review and update the published analysis and policy response, including indicative product performance levels for new products supplied to the UK market.

**Policy:** Publish and update UK market and technology plans annually.
**Start date:** 2007.
**Reference:** Announcement in Energy White Paper 2007.
**Next deliverables:**
- 2008: Monitor market developments, refine models and consult on possible amendments to this Policy Brief.
- 2008: Publish an updated P1 target and indicative product standards.

Acknowledged risks

58. There is a risk that products will develop in a direction that differs from that which was initially expected in the projections (ie P1 target will not be met). To offset this risk, the Government may consider:

- Whether or not a more ambitious P1 target could be set as part of the review process.
- Pursuing measures designed to further accelerate the use of innovative technologies.

59. Weaknesses in knowledge about market and technology trends, and the relationship between the performance of products measured under test conditions and what is achieved in real life could all lead to reduced effectiveness of the policy programme.

Strengthening initiatives

- Ongoing: Government will continue to monitor areas to identify where it may be beneficial to strengthen the evidence base on trends in display size and emerging display technologies, imaging equipment speeds and emerging printing technologies, and convergence between consumer electronics and ICT in the domestic sector.

## 3.2 Engaging the supply chain

### 3.2.1 Supply chain initiatives

Current status

60. In line with announcements in the Energy White Paper, the Government will ask major UK manufacturers and retailers to compete to supply ICT products in line with the indicative standards set out in the Appendix.

Acknowledged risks

61. The supply chain initiative may not deliver the Government's P1 target or product standards.

Strengthening initiatives

- 2008: Government will continue to consider where further actions could be employed to encourage retailers to work to meet a more ambitious P1 target and product standards. This could help to sustain successful supply chain initiatives.

### 3.2.2 Metrics: market development

Current status

62. At present there are no tools developed to enable product designers and specifiers to assess product energy efficiency performance against the Government's indicative performance standards.

Acknowledged risks

63. Without a tool to enable evaluation of performance against Government targets, there may be no simple way to assess or report progress against indicative performance standards.

64. The complexity of the ICT product market is reflected in current ENERGY STAR specifications[22]. Any tool will need to take this complexity into account, otherwise it may become biased towards lower specification devices.

Strengthening initiatives

- 2008: A 'Red-Green calculator' has been developed for consumer electronic products using a simple points-based currency for ranking the impact of products over their life. The tool returns a red or green verdict on each parameter, product or basket of goods, taking into account sales-weighted averages. This tool could be adapted for ICT products, and used by retailers, manufacturers and service providers to assess and, possibly, report progress[23].

### 3.2.3 Initiatives to improve power management

Current status

65. As much as 18% of non-domestic computers are never switched off at night or weekends, with around 13% not switched off on some days each week[24]. This can either be as a result of individual behaviour or due to organisations requiring employees to leave their PCs on at all times to enable IT updates. Considerable energy savings can be achieved in the UK by:

[22] The ENERGY STAR label (as discussed in Section 3.4.2) is the main mechanism for development of test methodologies and metrics in the area of ICT. These methodologies can subsequently be used within other initiatives as the basis for setting more stringent criteria if required.
[23] Additional information on the Red-Green calculator is available at http://www.mtprog.com/retailer.aspx
[24] The PC Energy Report, National Energy Foundation and 1E, http://www.1e.com/energycampaign/downloads/1E_reportFINAL.pdf

- Ensuring that PCs and monitors, as well as other ICT equipment, go into a sleep mode automatically when not in use (power management). The difference between on mode and sleep mode is marked, with sleep mode usually representing only 5% to 11% of on-idle mode consumption for most devices.
- Enabling PCs to 'wake' from a sleep or off state so that centrally controlled updates can be implemented (without the need for PCs to be left on).
- Educating users to help them understand how power management works, and the savings they can contribute to.
- Educating IT departments/providers on the importance of power management in relation to energy consumption.

66. There are currently no Government initiatives in place to improve wider power management of ICT equipment. However, a number of local authorities and central government departments (including the Department for Children, Schools and Families, the Department for Work and Pensions) have implemented projects to improve their power management and reduce their energy usage. There is an increasing awareness of the importance of power management, with software solutions being offered to improve power management capability, and case studies being implemented to determine holistic approaches to best practice usage[25].

Acknowledged risks

67. If power management enabling rates[26] do not improve, many ICT devices will be consuming considerable amounts of energy when effectively not in use and the bulk of the energy savings that could be achieved by reducing consumption in sleep mode will not be realised. The P1 target will not be achieved.

68. There are a number of technical and user challenges to be overcome to enable power management to function successfully across the board. In technical terms, the demands on power management are considerable. Users will require instant accessibility to the PC, with work states being preserved and automatic system maintenance remaining possible. However, in the past, there have been compatibility issues with software and hardware, and a lack of standardisation in terms of interaction with networks when in sleep mode. These issues are more apparent with desktop PCs than laptops, as the demand for battery life in laptops has resulted in them being more compatible, historically, with power management. There may be lessons from laptop design that could be applied to desktops to improve power management savings.

69. Any initiative would depend on manufacturers improving the power management capability of ICT products, and consumer behaviour change to increase awareness and use of power management savings. An awareness-raising campaign would need to be carefully managed, as power management could be enabled on a proportion of existing stock (as well as new), but may not function as effectively as in new devices and may give rise to negative user response as a result.

[25] For example, activities for Global Action Plan on 'Employee and Student Behaviour and Greener ICT' http://www.globalactionplan.org.uk

[26] The percentage of devices set to enter a sleep/low-power mode automatically when not in use.

Strengthening initiatives

- Government will continue to monitor its engagement with manufacturers and encourage work towards technical solutions to improve power management capability, and educating users (be they IT departments or home users) as to how to make the most of power management:
  - 2008/09: Potential for user awareness raising initiatives on power management.
  - Ongoing: The Government will maintain close involvement in the revision of the ENERGY STAR specifications and consider whether to press for continued inclusion of power management. The Government will consider the value of carrying out risk assessments on any awareness-raising campaigns so that rebound effects can be mitigated.

## 3.3 EU and international policy actions, programmes and initiatives

70. ICT products are internationally traded goods where unilateral UK policy actions may have only a limited impact on the design of products placed on the UK market. Therefore, the Government has committed to work at the international level to promote action to bring forward more sustainable products.

### 3.3.1 International collaboration

Current status

71. The UK is committed to promoting international co-operation on product labelling and standards and, generally, on policy towards more sustainable products.

72. Defra has been instrumental in establishing the ITFSP[27] which seeks to encourage and facilitate, where appropriate, the harmonisation of standards and other product policy options, share information and disseminate best practice. Defra operates the secretariat for the ITFSP. The intent of the ITSFP is first to map global standards and national policy action, existing sustainable product networks and initiatives, and innovations, and then to highlight potential areas for activity such as harmonisation, exchange of practical experience, or sharing of relevant tools and information. ITFSP is not intended as an alternative to existing standards setting processes; rather it will act to encourage dialogue and collaboration where this will achieve better results.

73. The ITFSP has initiated a number of Global Sustainable Product Networks (GSPNs) - for lighting, electric motors, home entertainment equipment and compliance. These networks are formed to define and address key issues for specific products that have been signalled by ITFSP and agreed as ‘gaps’ in product policy among a group of interested countries. GSPNs can explore and progress opportunities for collaboration on harmonising standards or practices. They also provide a framework in which dialogue can be facilitated, including with other stakeholders, such as manufacturers, suppliers, trade bodies and international agencies.

[27] See http://www.itfsp.org for details.

74. A new GSPN on computers was initiated in February 2008 and facilitated by the US (EPA). It is anticipated that this GSPN will define and address issues associated with energy consumption and end-of-life issues. The opportunities identified for harmonising practices to reduce energy consumption and end-of-life impacts are likely to vary between countries and regions. ITFSP will identify and share information with participating countries on existing initiatives that are, for example, setting energy performance standards or developing test methodologies - this would, in part, assist in avoiding duplicative efforts, but would also enable additional stakeholders to engage, where necessary.

75. When considering end-of-life issues, the GSPN on computers will collate and disseminate information from ongoing projects, such as the Solving the e-waste problem (StEP) initiative or best recycling practices developed under the Basel Convention's Mobile Phone Partnership, with participating countries.

**Policy:** Supporting the ITFSP.
**Start date:** June 2006.
**Reference:** See www.itfsp.org
**Next deliverables:**
- *Computers*
  2008: Initiate and agree actions for the new GSPN on computers aimed at addressing problems associated with energy consumption and end-of-life issues.

Acknowledged risks

76. There is a risk that commitment to the ITFSP and the GSPNs will not be sustained by a sufficient number of international government partners or that insufficient implementation support will be provided.

Strengthening initiatives

- Ongoing: Government will continue to review the effectiveness of this initiative.
- It may be possible that the GSPN could be run on a more informal basis to continue influencing major international partners.

### 3.3.2 Mandatory standards

Current status

77. The EuP Directive (2005/32/EC)[28], adopted in 2005, allows the European Commission to set performance requirements for products placed on the EU market. Preparatory product studies exist for:

- Computers and monitors.
- Imaging equipment (printers, multi-functional devices and photocopiers).
- Standby – a cross-product study looking at all products that consume energy while in standby mode.

[28] See MTP Briefing Note BNXS03;
http://www.mtprog.com/ApprovedBriefingNotes/pdf.aspx?intBriefingNoteID=389

78. The UK has contributed evidence into the preparatory studies and the Government will be pushing for ambitious, but realistic and achievable, standards to be adopted.

79. The preparatory study for computers and monitors is complete[29]. This study recommended voluntary implementation of the ENERGY STAR scheme based upon current arrangements, combined with a number of mandatory requirements:

- Mandatory power management enabling[30] (2009).
- Mandatory high efficiency requirements for power supplies[31] (2009).
- Mandatory minimum sleep/off requirements[32] (2009).
- Mandatory information requirements on modal consumption in visible location (2009).
- Mandatory minimum monitor on power[33] (2011).

80. These requirements are consistent with the potential outcome built into the policy line for EuP, and are, therefore, consistent with the indicative performance standards in the Appendix (although these standards will become significantly more stringent than EuP over time if EuP requirements are not revised). Eco-design requirements for an implementing measure for computers and monitors have yet to be proposed by the European Commission.

81. The preparatory study on standby is also complete[34]. This study recommended the following mandatory requirements:

- Off mode of 1 W (2010), then 0.5 to 0.75 W (2012).
- Passive standby of 2 W (2010), then 1 W (2012).
- Networked standby of:
  - 3 W (2010) for type I (simple networks), then 1 W (2012).
  - 4 W (2010) for type II (standard rate networks), then 2 W (2012).
  - 10 W (2010) for type III (high speed networks/continuous broadcast), then 5 W (2012).

82. A working document on possible eco-design requirements was produced by the European Commission with the following proposals:

- Off mode of 1 W (2010), then 0.5 (2012).

[29] Available at: http://extra.ivf.se/ecocomputer/downloads/Eup%20Lot%203%20Final%20Report%20070913%20published.pdf

[30] Often, savings due to power management are not guaranteed, as this depends on user behaviour and can be disabled by the user/IT department at any time. However, in some cases a centrally administered software solution can ensure that corporately set power settings cannot be disabled by users.

[31] Requirements are combined from ENERGY STAR v4.0 Tier 1 2007 specification and ENERGY STAR EPS specifications.

[32] Requirements based on ENERGY STAR v4.0 Tier 1 2007 specification

[33] Requirements based on an estimated new ENERGY STAR specification in progress.

[34] Available at: http://www.ecostandby.org/finalised_documents.php

- Standby of 1 W (2010), then 0.5 W (2012), except for status/information display where allowance is 2 W (2010), then 1 W (2012).
- No requirements for networked standby.

83. As can be observed above, the preparatory study recommendations differed from the proposals put forward in the working document by the EC, as the EC was aiming to simplify upon requirements. Definitions of off and standby differ in both, so a direct comparison with UK indicative standards cannot be easily made (and mode definitions cannot be harmonised until a final draft of the implementing measure is in place). Most of the standby modes of ICT equipment would not be addressed by the proposals as they stand, as these modes would be considered networked, even although they are often termed 'off'. A European consultation forum meeting has been held to discuss these proposals, and a further potential revision and impact assessment is pending. Standby for networked products will be addressed through the product-specific implementing measures.

84. The preparatory study for imaging[35] is not yet complete, so observations on these proposals cannot currently be made.

**Policy:** EU Framework Directive for Eco-design of Energy-using Products.
**Start date:** 2005 (Framework Directive adopted).
**Reference:** http://ec.europa.eu/energy/demand/legislation/eco_design_en.htm
**Next deliverables:**
- 2009: Potential implementing measures in place on standby, computers and imaging.

Acknowledged risks

85. Timing for delivery of standards via EuP is uncertain. Delivery of the UK's preferred standards via EuP is also uncertain since the EuP has a Single Market legal base so any final performance requirements will need to be fully harmonised across the whole of the European Union.

86. There is also a significant risk that current regulatory processes will not be able to respond sufficiently nimbly to a rapidly changing market, leading to ineffective regulation and market drivers.

Strengthening initiatives

- 2008: The Government will consider the value of including a mechanism for regular review and updating of product criteria in the product implementing measure.
- Ongoing: The Government will continue to monitor the effectiveness of the regulatory processes in question and consider whether to press the European Commission to:
  - Address products at a component level (ie for high consuming components such as graphics cards).
  - Apply a power-budget/formula-based approach to setting targets.
  - Address product-common issues such as standby power.

[35] Latest documents available at: http://www.ecoimaging.org/underreview_documents.php

However, the current timetable indicates that an implementing measure will not come into force before 2009 with the phase-out schedule beginning in subsequent years. The Government will work with the supply chain to encourage striving towards new standards in advance of this measure (see Section 3.2.1 above).

### 3.3.3 Product information - voluntary 'ENERGY STAR' label

Current status

87. The main mechanism for labelling of ICT energy efficiency in Europe is the ENERGY STAR label. The EU ENERGY STAR programme follows an Agreement between the Government of the US and the European Union (EU) to co-ordinate energy labelling of office equipment. It is managed by the European Commission. The US partner is the Environmental Protection Agency (EPA) that initiated the scheme in the US in 1992. Products qualify if they meet the energy consumption requirements specified under the label. Within the ICT sector, the specifications are as follows:

- Computer specification: covering computers, workstations, games consoles and laptops (revision in place 20 July 2007).
- Imaging equipment specification: covering copiers, fax machines, multi-functional devices (MFDs), printers, scanners (revision in place 1 April 2007).
- Monitor specification: covering monitors (revision in place 1 January 2006).

88. Defra is actively involved in the development of ENERGY STAR specifications on a European and international level, providing expert input and test data to facilitate the development of robust and challenging specifications. Discussions are currently underway regarding revision of the computer, imaging and monitor specifications.

**Policy:** Voluntary ENERGY STAR Label.
**Start date:** 2003 (First agreement with EC initiated).
**Reference:** European Council decision of 8 April 2003 the coordination of energy efficient labelling programmes for office equipment (2003/269/EC) and Council decision on 18 December 2006 (2006/1005/EC).
**Next deliverables:**
- 2009: Updated specifications for computers, monitors and imaging equipment in force.

Acknowledged risks

89. Most policy initiatives are expected to have a reliance on ENERGY STAR, but subsequent specifications (2009 onwards) may not occur to expected timescales[36], or be sufficiently ambitious or robust to meet UK needs.

[36] It is estimated that specifications will be revised on a four yearly basis. However, there is as yet no firm commitment from the EPA on a timescale for revision past 2009.

90. ENERGY STAR specifications aim to accommodate the top performing 25% of products, across the range of the market. This approach means that the top performing of larger, more power hungry devices will still qualify under the label. This presents a risk that as the market moves to more highly specified products, there is potential for overall energy consumption to increase in the future.

91. The ENERGY STAR database, used by MTP to assess market consumption levels depends on industry self-declaration, and current levels of compliance and data cleaning may not be sufficient to ensure the reliability of this source.

92. Savings due to the ENERGY STAR label may not be fully accessible currently, as awareness of the label may be low. There is an opportunity to investigate awareness of the label, and if an issue with label recognition is identified, to promote the label to strengthen its influence to consumers and access greater savings as a result.

Strengthening initiatives

- Ongoing: The Government will consider working with the European Commission and US EPA to:
  - Ensure detailed knowledge of future specification development plans with frequent specification revision.
  - Monitor trends in product specifications against product consumption and adapt specifications accordingly.
- The Government will consider whether to carry out testing wherever possible to inform EPA specifications and compliance work.

### 3.3.4 Product information – mandatory labels

Current status

93. At present, there are no effective EU-wide mandatory energy labelling schemes for ICT.

Acknowledged risks

94. Proliferation of labelling schemes could confuse consumers and create a barrier to trade.

Strengthening initiatives

- 2008: Government will consider whether to press the EC (via EC Energy Labelling Framework Directive[37] and the EuP Directive (see Section 3.3.2)) and suppliers to provide harmonised product information.

[37] MTP Briefing Note BNXS37; http://www.mtprog.com/ApprovedBriefingNotes/BriefingNoteTemplate.aspx?intBriefingNoteID=396

### 3.3.5 Voluntary Code of Conduct – external power supply units

95. ICT products may have an external or internal power supply, depending upon product design. Most laptop PCs have an external power supply unit (ePSU). Desktop PCs tend to have internal power supplies, which are enclosed within the main product casing. For ICT products, the efficiency of power supplies (both internal and external) is addressed predominantly via the ENERGY STAR specifications for the relevant products.

96. For the main ICT products addressed in this Policy Brief, power supplies tend to be reasonably efficient – in the region of 65 to 85% efficiency. For other miscellaneous products, not addressed by the EU-US ENERGY STAR agreement, supplies can be less efficient. The EU Code of Conduct on ePSUs provides a means of addressing the efficiency of miscellaneous external power supplies. ePSUs are also being addressed under the EuP Directive[38].

97. The combination of products into multi functional devices and the move towards standardised power supply designs (such as mini USB for phone chargers) is likely to result in a reduction in the number of ePSUs used in the home in future.

98. The EU currently operates industry 'Codes of Conduct' (CoCs)[39] which set voluntary performance targets for a range of products. In most cases, these agreements have been developed using information and support from MTP. There is a CoC on ePSUs, requiring 80% efficiency or above, which impacts on some ICT equipment.

99. The dialogue which takes place between stakeholders in a 'voluntary' context has proven to be of a different nature than that which tends to occur during the course of developing a mandatory standard. In general, stakeholders' discussions are more open and more constructive when they centre on a voluntary agreement, and stakeholders tend to be more willing to share information and evidence. This has been helpful in building up an accurate picture of best available and best practice technologies when developing policy criteria.

**Policy:** EU Code of Conduct – External Power Supplies.
**Start date:** 2003.
**Reference:** EU Standby Initiative (http://re.jrc.ec.europa.eu/energyefficiency/html/standby_initiative.htm).
**Next deliverables:**
- No current timescales to revise the code of conduct for ePSUs.

Acknowledged risks

100. As there is no future timetable for revision of this agreement, it is likely to become obsolete over time as technology improves. In addition, recent decisions by the European Industry Association for Information Systems, Communication

[38] External power supplies are addressed at www.ecocharger.org. Internal power supplies will be addressed under individual product measures (ie http://www.ecocomputer.org).
[39] http://ec.europa.eu/energy/demand/vol_agreements/conduct_en.htm

Technologies and Consumer Electronics (EICTA) regarding termination of the CoCs they are involved in, may also impact the stability of this CoC. If the agreement is terminated, there is a risk that replacement activities may not be taken up by an alternative steering body, resulting in the voluntary agreement and its associated technical discussion forum being discontinued. Development of future policies for ePSUs may then become more difficult, and evidence gathered becomes less robust, leading to less reliable and less cost-effective policy measures.

Strengthening initiatives

- Ongoing: Government will engage with industry to explore the scope for implementing standards in advance of mandatory EuP measures.
- Ongoing: Government will consider whether to investigate the potential for revision of the CoC when the market becomes saturated at the level of the current agreement.

### 3.3.6 Metrics: test and measurement

Current status

101. Adequate performance test and measurement methodologies are a critical pre-requisite for all product policy. In fast-moving product sectors such as ICT, it is important that formal standards keep pace with the development of new technologies, products and patterns of usage.

102. In the ICT sector, where products are designed for global markets, harmonised standards are likely to encourage competition and investment in improved designs.

103. There are currently test standards available for:

- Standby performance – IEC 62301: 2005 Household Electrical Appliances – Measurement of Standby Power.
- ePSUs – Test Method for Calculating the Energy Efficiency of Single-Voltage External AC-DC and AC-AC Power Supplies published by Calwell, Foster, Reeder and Mansoor (11 August 2004)[40].

104. While the former is adequately harmonised, the latter is less consistently applied. In addition, the industry body ECMA (TC38-TG2 group) is developing a test standard to evaluate energy efficiency against performance for desktop and laptop computers. It is likely that this will input to the 2009 revision of the ENERGY STAR specification.

105. In addition, the ECMA International[41] TC38-TG2 group is in the process of developing a standard to input to the Tier 2 revision of the ENERGY STAR specification for computers (in co-ordination with BAPCo[42], which is developing the benchmarking tool that will act as the foundation for the standard). ECMA intends to

[40] http://www.efficientpowersupplies.org/methods.asp
[41] http://www.ecma-international.org/
[42] http://www.bapco.com/

continue to develop energy efficiency standards for other ICT products after finalising the computer benchmark/energy efficiency standard.

**Policy:** Developing harmonised test methodologies.
**Start date:** Ongoing.
**Next deliverables:**
- 2009: ECMA TC38–TG2 standard for computer energy efficiency released.

Acknowledged risks

106. Development of formal test standards may not keep pace with policy needs. For example:

- The test standard for ePSUs is not an internationally 'recognised' methodology (ie it is not endorsed by the International Organization for Standardization (ISO)) and would benefit from being standardised through the ISO route if the risk of it not being widely adopted is to be fully averted.

Strengthening initiatives

- The Government will consider whether to identify areas where standards are a critical issue and work with appropriate formal bodies to agree effective and reliable performance measurement methodologies. For example, it will consider encouraging the adoption of the ECMA TC38-TG2 standard as an international standard.

## 3.4 UK policy actions, programmes and initiatives

### 3.4.1 Public procurement

Current status

107. The Government published its Sustainable Procurement Action Plan (SPAP) in March 2007, re-affirming its commitment to use Government procurement to drive the market for energy efficient products. Alongside the Action Plan, it published updated and extended standards for an increased range of products that are mandatory for Central Government departments. Defra consulted on energy efficient products which has informed the minimum mandatory standards for this product group in the revised **Buy Sustainable Quick Wins** (published in July 2008). We are reviewing the approach to setting mandatory standards with the newly formed Centre of Expertise for Sustainable Procurement.

108. Guidance on energy efficiency and energy savings as possible assessment criteria in public sector tendering was published in July 2008 as part of the Energy Services Directive. The Directive also sets out a number of options relating to public sector procurement of energy using products, buildings and energy services, which the Government consulted on during the winter of 2007. The outcome of this consultation will be announced shortly.

109. The NHS (England) published its Sustainable Procurement Action Plan in August 2007. Similar action plans for local authorities are being produced.

110. The Government is also committed to identifying stretching-forward looking standards to provide longer-term signals to business and to encourage innovation, for example, through the use of the 'Forward Commitment Procurement' Model[43].

**Policy:** UK Government Sustainable Procurement Action Plan
**Start date:** 2007
**Reference:**www.sustainable-development.gov.uk/publications/pdf/SustainableProcurementActionPlan.pdf
**Next deliverables:**
- 2008: Revised Government procurement standards announced.

Acknowledged risks

111. Specifying fixed threshold values in procurement specifications may result in 'lock in' to incumbent technologies by excluding alternative products and lead to innovation being stifled. Outcome-based specifications, along with challenging and progressive threshold values, can help to minimise this.

Strengthening initiatives

- The Government will consider including standards specifically for the procurement of ICT products, where applicable, within its formal procurement guidelines that are at or above the indicative standards in the Appendix.
- The Government will consider whether to embed energy efficiency through requirements for operational aspects of the Government Estate – for example through addressing usage profiles and power management (see Section 3.2.3).
- The Government will consider whether to specify requirements through a formula-based approach (where applicable) so that the range of ICT products could be addressed through simple requirements.

### 3.4.2 Product information

Current status

112. At present there is no mandatory energy labelling scheme for ICT in the UK. The main voluntary label for energy efficiency of ICT equipment in Europe is ENERGY STAR.

113. Building upon ENERGY STAR criteria and test methodologies, the Government has worked closely with the EST to develop a UK ESR label for certain ICT equipment.

114. The EST's ESR scheme[44] is a voluntary labelling scheme that endorses products that comply with specified product performance criteria (which can be revised on an annual basis). It serves both as a recognition of manufacturers' efforts towards efficiency best practice and as a straightforward consumer label, with high

[43] See www.berr.gov.uk/files/file35312.pdf
[44] www.energysavingtrust.org.uk/energy_saving_products/

visibility in retail environments. When newly developed, criteria cover a maximum of the top 20% of energy efficient products on the market.

115. Four new product groups have been established within the ESR Scheme. Desktops, laptops and imaging equipment were announced in August 2007, and computer monitors was announced in September 2007. Applications for endorsement from manufacturers are now being accepted.

**Policy:** Energy Saving Recommended Label
**Start date:** 2007
**Reference:** 31 August Industry Announcement (Desktop PCs, laptop PCs, Imaging Equipment)
**Next deliverables:**
- 2008: Assessment of label coverage and criteria to ensure sufficient stringency.
- 2008 - 2009: Potential laser printer specification

Acknowledged risks

116. ESR criteria for ICT have generally been based on ENERGY STAR methods and approaches. However, ENERGY STAR is limited in frequency of revision and gradually, over time, will reach saturation level in the market (where the majority of products qualify). It also has low visibility in retail environments, reducing the impact it can have on the domestic market[45].

117. The lack of visibility of reliable or effective consumer information to identify the best performing products could prevent consumers making an informed choice and prevent effective competition on energy efficiency issues.

Strengthening initiatives

- 2008: Government will continue to monitor the effectiveness of product information and, if necessary, consider whether to task the EST to increase the level of support it provides to retailers to improve consumer information and awareness of the significance of energy efficiency labels for ICT.

## 3.5 Other policies with potential to impact on ICT products

### 3.5.1 Act on $CO_2$

118. The Government has initiated an 'Act on $CO_2$' campaign to help the general public make the link between their individual actions and climate change. A carbon calculator at www.direct.gov.uk/actonco2 allows an individual or household to calculate the carbon footprint resulting from their home, appliances and personal travel. It then offers a tailored action plan with simple tips for reducing that footprint. The calculator takes ICT products into account in its 'home' section.

[45] This risk is countered to some extent by the ESR label, which builds upon ENERGY STAR criteria and test methodologies, but is revised on a more frequent basis, with a greater level of compliance monitoring.

### 3.5.2 Promoting pro-environmental behaviour

119. The Government is developing a stronger consumer-facing strategy to promote pro-environmental behaviour, covering the four major consumption impacts of homes, food, personal transport and tourism. This includes setting prioritised behaviour goals (which include better energy management and buying more energy efficient products), audience segmentation and consumer insight, re-organisation of structures and programmes, and partnership working. As this work is still in its infancy, there are no ICT-specific initiatives yet in place. However, there are opportunities to access sizable savings through encouraging purchase of ICT products on the basis of energy efficiency and through working towards more efficient operation of ICT products (eg through improving implementation of power management).

### 3.5.3 Smart metering

120. The Energy White Paper set out a number of policies on energy billing and metering, designed to reduce energy consumption. The Department for Business, Enterprise and Regulatory Reform (BERR, formerly the DTI) recently consulted on the implementation of these policies (the consultation period closed on 31 October 2007). In summary, these are:

- To promote awareness of domestic energy use through a requirement on energy suppliers to present consumption data (preferably in graphical form) on consumers' bills to allow them to compare different periods of energy consumption.
- To provide real-time display units to certain customers so that they can see in real time, and in a way that is relevant to them, how much electricity they are consuming
- To require the installation of smart meters for business customers above a certain energy usage threshold, where it has been proven to be cost-effective.

121. The Energy White Paper also set out the Government's expectation that smart metering would be introduced in the remainder of the business sector and the domestic sector over the next decade.

### 3.5.4 Promoting energy/carbon savings in industry and commerce

122. Since 2001,Climate Change Agreements and since 2005 the EU Emissions Trading Scheme require industry to improve their energy performance and reduce emissions. This encourages, for example, savings due to the more efficient use of ICT. There are various energy using products that will contribute to the savings required. The Carbon Reduction Commitment is expected to start in 2010. This will place similar pressures on the service and retail sectors. Given that ICT products can account for a considerable percentage of organisations' carbon emissions this scheme could encourage a switch to more energy efficient equipment and increased enabling rates of power management functionality.

# 4 Other potential measures

123. This Section looks towards other measures that may need to be developed to enable the desired average energy performance to be achieved.

124. Within the ICT sector, innovation remains one of the key focus areas to take forward product sustainability. This innovation can sometimes be driven through challenging specifications in mechanisms such as the ENERGY STAR label. For example, at the start of the recent revision of the ENERGY STAR specification for computers, a proposal was tabled to require 80% efficient power supplies. Many manufacturers raised concerns that this could not be achieved as their suppliers would not be able to supply them with the volume of efficient and reliable power supplies they would require. The early inclusion of this requirement in the specification created a concerted demand from industry for these supplies, enabling investment to ensure higher volumes of quality power supplies could be produced. The requirement has been retained in the final specification, becoming active mid 2007, and will result in a potential 10% to 15% improvement in the energy consumption of computers that strive for the label.

125. In many areas of ICT, the path of innovation is having an impact on energy consumption. In some cases this is positive (eg where multi-core machines are resulting in improved processor efficiency in the higher performance machines or where processors are gradually moved from high value, high efficiency laptops to desktop platforms over time). However, in other areas the force of innovation can have a negative impact on energy efficiency (eg where printing technologies are moving from low energy intensity to high intensity mechanisms, such as laser or LED based print technologies). Mechanisms such as ENERGY STAR cannot always be so effective in these situations, as they will allow for the higher consumption of different product types. In such situations, a greater improvement could be achieved through additional mechanisms to drive innovation with a focus on exposing and promoting latent or hidden innovations that could provide more efficient solutions.

126. Two ideas for initiatives which could help bring forward more innovative product designs and, indirectly allow higher targets to be set are:

- A simple ‘environmental’ product award, which would stimulate innovation competition between manufacturers.
- Support schemes could continue to identify and support ad-hoc opportunities, working with manufacturers and within collaborative arrangements, to bring forward and promote promising generic design routes.
- Sustainability could be incorporated into 'Product Design' teaching in secondary and higher education to encourage eco-friendly innovation in the next generations of designers.

# 5 Potential impacts

127. This Section provides a partial analysis of the more significant potential impacts of the proposals contained herein.

## 5.1 Consumer cost/benefit analysis

128. Consumers could benefit from reduced energy costs by purchasing ICT products that consume less energy. However, the linkages between price and energy consumption in ICT products are not always linear. For instance, while many higher priced desktop PC's tend to consume more energy than cheaper versions they also offer the consumer increased functionality. The consumer may therefore prioritise functionality above energy consumption. In contrast, higher cost, higher specification laptops can sometimes use less energy, due to the functional importance of battery life.

129. Choosing an energy efficient laptop in place of a desktop PC system (desktop PC and LCD monitor) could save a consumer about £34 a year[46] in electricity costs but upfront costs may vary – traditionally a laptop has been more expensive than a desktop of similar specification.

## 5.2 Business impacts

130. Most ICT products are manufactured outside of the UK. Of the three main companies based in the UK, volumes are at the lower end of the market. There are also component manufacturers for the ICT industry based in the UK, who may be impacted by product policy. The percentage of UK GDP in 2000[47] due to ICT manufacturing was 1.8% and 5.3% due to ICT services industries. This was slightly higher than the EU as a whole, which saw 1.6% due to ICT manufacturing, and 4.3% due to ICT services. However ICT manufacturing in the US contributed 44% more, and in Japan contributed 61% more to their GDPs (2.6% and 2.9% GDP respectively). Business impacts are, therefore, likely to be more notable in the ICT services, rather than the ICT manufacturing industries in the UK.

## 5.3 Waste impacts

131. There are a number of environmental impacts associated with ICT products during their end-of-life phase. These impacts will vary according to the ICT products in question. However, it is unlikely that any of the energy related policy measures detailed in this Policy Brief would either positively or negatively influence the amount of waste arising from ICT products.

### 5.3.1 Waste impacts per product

Monitors

132. Most monitors that are currently discarded contain CRTs. These monitors must be handled as hazardous waste due to the phosphorous coatings on their glass and the lead in the CRTs. While the disposal of LCD monitors is currently relatively low, this will increase considerably over the next few years as the early LCD monitors reach the end of life. There are a number of waste considerations relating to LCD monitors. They contain small amounts of mercury in the backlight used to illuminate the panels. The

[46] Based on a domestic electricity price of 10p/kWh, taken from EEC.
[47] Figures from 'The Industrial Dynamics of the New Digital Economy', Jens Frøslev Christensen, Peter Maskell, Edward Elgar Publishing, ISBN 1-84376-376-1

colour filter may contain chromium, printed circuit boards may have a high lead content, and post assembly finishing process may involve many hazardous chemicals.

133. The ENERGY STAR monitor specification[48] is encouraging a move from higher impact CRTs to lower impact LCDs.[49] The Restriction of Hazardous Substances (RoHS) Directive (2002/95/EC) limits lead, cadmium, mercury, hexavalent chromium, and two groups of flame retardants in products as of 1 July 2006. However, RoHS exemptions currently allow mercury in fluorescent lamps and lead in CRT glass[50]. The Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) aims to reduce the environmental impacts of electrical and electronic equipment by requiring producers to finance the costs of collection, treatment and recycling of WEEE.

Desktop and laptop PCs

134. Computers can contain hazardous material like cadmium, barium, lead and mercury. In particular, printed circuit boards can contain a mixture of hazardous and valuable materials such as gold, silver, platinum, lead, mercury, chromium and cadmium.

135. It is believed that because of their perceived value, many ICT products are often stored until space is needed for another purpose, delaying the entry to the waste stream[51]. In light of legislation such as WEEE and RoHS, computer manufacturers and retailers are offering take back/recycling schemes to customers and rates of recycling and re-use have been increasing. When computers are taken back through such schemes, they must be recycled or re-used. In the EU, exports of waste for disposal to non-EU/EFTA countries and of hazardous waste for recovery to non-OECD countries are prohibited under the Waste Shipment Regulation. Waste for disposal may be shipped only to other EU Member States and EFTA countries (Norway, Switzerland, Iceland and Liechtenstein). Under the WEEE Regulations, WEEE can be exported for recovery as long as the export is carried out in accordance with legislation on shipments of waste and the exporter can demonstrate that the recovery operation took place under conditions equivalent to those set by the WEEE Directive.

136. Recoverable raw materials include metals, glass or plastics. Metals represent around half the weight of a typical desktop PC, and with recycling of metals well established due to the higher value and ease of recycling, a range of metals can be recovered[52]. There can be barriers to the extent to which plastics can be recovered, due to variations in plastic composition and type, lower inherent value of plastic, bonding methods and less established separating technologies. However, the WEEE Directive has resulted in the recycling of plastics increasing as producers are required to meet weight-based recycling targets.

[48] Under the 28/12/2006 agreement between the US Government and EC. See http://www.eu-energystar.org/downloads/legislation/20061228/l_38120061228en00260104.pdf.
[49] However, screen size is on the increase which could mean increasing waste impacts of LCD monitors.
[50] Allowances only to certain thresholds. This will be reviewed in future.
[51] 'Computers and the Environment', Ruediger Kuehr & Eric Williams (Eds.), Kluwer Academic Publishers 2003/04.
[52] 'Computers and the Environment', Ruediger Kuehr & Eric Williams (Eds.), Kluwer Academic Publishers 2003/04.

Printers, photocopiers and MFDs

137. Many of the points discussed under the monitors and PC headings also apply to imaging equipment. In addition, some imaging products may be viably refurbished - whereby a product is rebuilt to 'as-new' condition to enable it to be used for a second, operational life (extent of parts replacement will vary from product to product). This practice has operated for many years for photocopiers[53] and a range of other ICT products.

### 5.3.2 ICT waste initiatives

138. Apart from the WEEE and RoHS Directives, a number of initiatives are underway to address the growing problem of waste due to ICT products (e-waste). The two largest initiatives with an impact in Europe are detailed below:

The StEP initiative

139. StEP[54] is an initiative driven by various UN organisations working towards the sustainable handling of e-waste. StEP works with industry, governments, international organisations, NGOs and the science sector. Within StEP, five task forces (addressing policy, redesign, re-use, recycling and knowledge) develop feasible solutions for the e-waste problem through analysis, planning and pilot projects.

140. StEP aims to work towards harmonisation on e-waste recycling best practices and legislation, to encourage use of more upgradable components, and to promote recycling/re-use to end users. StEP is currently investigating the effectiveness of the WEEE Directive, to support the review being carried out by the European Commission in 2008.

Development of a global Partnership for Action on Computing Equipment (PACE) addressing Environmentally Sound Management (ESM)

141. PACE is a Basel Convention[55] initiative, being developed in accordance with the Nairobi Declaration and Decisions (VIII/2 and VIII/5)[56]. The Secretariat of the Basel Convention is in the process of initiating the partnership.

142. The partnership is intended to involve Government, NGOs, private sector, civil society and academia. The focus of the partnership will be on the Environmentally Sustainable Management of used and end-of-life computing equipment, taking into consideration:

- The entire product lifecycle.
- Transboundary e-waste movement.

[53] Product Remanufacturing, MTP report, 2005
[54] http://www.step-initiative.org/
[55] The Basel Convention is part of a wider network called the Global Compact within the United Nations Environment Programme (UNEP). The Global Compact is an initiative of the Secretary General of the United Nations which gives businesses worldwide the opportunity to adhere to nine principles for a sustainable and inclusive global economy.
[56] http://www.basel.int/industry/compartnership/index.html

143. The first phase will focus on personal computers, CRT monitors and printers, as they present an environmental challenge due to reaching their end-of-life at an accelerated pace.

144. A Preparatory Meeting of Experts was hosted by the Secretariat of the Basel Convention in June 2007 to prepare the public-private partnership, to discuss scope, objectives and working structure of the potential partnership.

145. Partnership goals may include the development of guidelines for the sound recycling and refurbishment of computing equipment, as well as pilot projects on collection and treatment especially in developing countries.

146. Potential initiatives may include:

- Development of tools such as a Green Computer Procurement Tool, similar to the US EPEAT approach, but global.
- Development of programmes and pilot projects, such as a e-Waste collection programmes for countries lacking take-back legislation or infrastructure.
- Research into barriers to recycling and ESM facility development, and exploration of the economic viability of recovery of different computer waste materials.
- Incentive development to achieve the highest standards for e-waste management globally.
- Guidelines for material recovery/recycling of end-of-life computing equipment, and for refurbishment of used computing equipment.
- Awareness raising to promote high standards for e-waste management, develop and disseminate training (at a regional level), and highlight industry achievements in eco-design.

# 6 Further information

147. The following MTP publications (available from www.mtprog.com) are linked to this Policy Brief and present the underlying evidence base of information such as further explanations, definitions, assumptions and important background information:

| | |
|---|---|
| BNXS1 | Carbon Emission Factors for UK Energy Use |
| BNICT01 | Underlying Assumptions for Non Domestic Information and Communication Technology (ICT) |
| BNICT02 | Underlying Assumptions for Domestic Information and Communication Technology (ICT) |
| BNICT06 | UK and International Energy Efficiency Labelling |
| BNICT12 | Power Management Summary for Information and Communication Technology (ICT) |
| BNICT16 | ENERGY STAR Specification for Monitors |
| BNICT17 | ENERGY STAR Specification for Imaging Equipment |
| BNICT18 | ENERGY STAR Specification for Computers |
| BNICT20 | International Promotion of the ENERGY STAR Programme |
| BNICT23 | Waste considerations relating to printer cartridges |

# Appendix
# Indicative performance standards for ICT products

148. Tables A1–A10 show the indicative average performance standards for new products supplied to UK end users. These correspond with the Government's underlying published stock models and projected energy consumption in each sector (the P1 target presented in this Policy Brief). Please note that the standards are based upon an average of products of widely varying specification.

149. These specifications may be used directly in suitable policy instruments (eg the supply chain initiative) and provide a metric against which developments in the market can be measured.

150. The underlying stock modelling is subject to an ongoing consultation and review process. More detail on the modelling, current market analysis and data downloads is available via the MTP's What-If tool (http://whatif.mtprog.com)

### Table A1 Desktop computers

| | Desktop PC – Non Domestic | | | Desktop PC - Domestic | | |
|---|---|---|---|---|---|---|
| Year | On Idle (W) | Sleep (W) | Off (W) | On Idle (W) | Sleep (W) | Off (W) |
| 2000 | 78.3 | 6.1 | 3.1 | 79.8 | 6.1 | 3.4 |
| 2001 | 78.3 | 5.9 | 3.1 | 82.7 | 5.9 | 3.4 |
| 2002 | 78.3 | 5.7 | 3.1 | 85.5 | 5.8 | 3.4 |
| 2003 | 78.3 | 5.5 | 3.1 | 88.3 | 5.6 | 3.4 |
| 2004 | 78.3 | 5.3 | 3.1 | 91.1 | 5.5 | 3.4 |
| 2005 | 78.3 | 5.2 | 3.1 | 94.0 | 5.3 | 3.4 |
| 2006 | 78.3 | 5.0 | 3.1 | 94.0 | 5.2 | 3.4 |
| 2007 | 74.5 | 4.6 | 2.8 | 81.4 | 4.9 | 3.3 |
| 2008 | 66.4 | 4.2 | 2.4 | 69.3 | 4.2 | 2.6 |
| 2009 | 58.3 | 3.8 | 1.9 | 58.7 | 3.6 | 1.8 |
| 2010 | 57.8 | 3.6 | 1.8 | 57.0 | 3.3 | 1.7 |
| 2011 | 57.3 | 3.4 | 1.7 | 55.9 | 3.0 | 1.6 |
| 2012 | 56.8 | 3.1 | 1.6 | 54.9 | 2.8 | 1.6 |
| 2013 | 56.3 | 2.9 | 1.5 | 54.0 | 2.6 | 1.5 |
| 2014 | 54.0 | 2.8 | 1.4 | 51.3 | 2.5 | 1.4 |
| 2015 | 51.7 | 2.7 | 1.4 | 48.4 | 2.4 | 1.3 |
| 2016 | 49.5 | 2.6 | 1.3 | 45.8 | 2.3 | 1.2 |
| 2017 | 47.2 | 2.6 | 1.2 | 43.1 | 2.2 | 1.1 |
| 2018 | 45.8 | 2.5 | 1.2 | 41.5 | 2.1 | 1.1 |
| 2019 | 44.3 | 2.5 | 1.1 | 39.8 | 2.0 | 1.1 |
| 2020 | 42.9 | 2.4 | 1.1 | 37.9 | 2.0 | 1.0 |

## Table A2 Laptop computers

| | Laptop – Non Domestic | | | Laptop – Domestic | | |
|---|---|---|---|---|---|---|
| Year | On Idle (W) | Sleep (W) | Off (W) | On Idle (W) | Sleep (W) | Off (W) |
| 2000 | 28.7 | 2.6 | 1.1 | 28.6 | 2.6 | 1.8 |
| 2001 | 27.2 | 2.5 | 1.1 | 27.1 | 2.4 | 1.7 |
| 2002 | 25.7 | 2.3 | 1.1 | 25.5 | 2.3 | 1.6 |
| 2003 | 24.2 | 2.2 | 1.1 | 24.0 | 2.2 | 1.5 |
| 2004 | 22.7 | 2.1 | 1.1 | 22.4 | 2.1 | 1.5 |
| 2005 | 21.2 | 2.0 | 1.1 | 20.9 | 2.0 | 1.4 |
| 2006 | 19.7 | 1.9 | 1.1 | 19.3 | 1.9 | 1.3 |
| 2007 | 17.8 | 1.8 | 1.1 | 17.3 | 1.7 | 1.2 |
| 2008 | 16.9 | 1.7 | 1.1 | 15.7 | 1.6 | 1.1 |
| 2009 | 16.0 | 1.6 | 1.1 | 14.8 | 1.5 | 1.0 |
| 2010 | 15.4 | 1.5 | 1.1 | 14.0 | 1.4 | 1.0 |
| 2011 | 14.8 | 1.5 | 1.0 | 13.2 | 1.3 | 1.0 |
| 2012 | 14.2 | 1.4 | 1.0 | 12.6 | 1.2 | 0.9 |
| 2013 | 13.6 | 1.3 | 1.0 | 12.0 | 1.1 | 0.9 |
| 2014 | 12.8 | 1.3 | 1.0 | 11.4 | 1.1 | 0.9 |
| 2015 | 11.9 | 1.2 | 1.0 | 10.8 | 1.0 | 0.8 |
| 2016 | 11.1 | 1.2 | 0.9 | 10.2 | 1.0 | 0.8 |
| 2017 | 10.2 | 1.2 | 0.9 | 9.7 | 0.9 | 0.8 |
| 2018 | 9.7 | 1.1 | 0.9 | 9.3 | 0.9 | 0.8 |
| 2019 | 9.1 | 1.1 | 0.9 | 8.8 | 0.9 | 0.7 |
| 2020 | 8.6 | 1.1 | 0.9 | 8.4 | 0.9 | 0.7 |

## Table A3 Monitors

| | Monitor – Non Domestic | | | Monitor - Domestic | | |
|---|---|---|---|---|---|---|
| Year | On-Active (W) | Sleep (W) | Off (W) | On-Active (W) | Sleep (W) | Off (W) |
| 2000 | 60.9 | 3.4 | 2.4 | 60.9 | 3.4 | 2.4 |
| 2001 | 58.6 | 3.2 | 2.2 | 58.6 | 3.2 | 2.2 |
| 2002 | 54.9 | 2.9 | 2.0 | 55.0 | 2.9 | 2.0 |
| 2003 | 51.2 | 2.5 | 1.8 | 51.3 | 2.5 | 1.8 |
| 2004 | 47.8 | 2.1 | 1.6 | 47.8 | 2.1 | 1.6 |
| 2005 | 44.4 | 1.7 | 1.4 | 44.6 | 1.7 | 1.4 |
| 2006 | 39.7 | 1.4 | 1.2 | 39.7 | 1.4 | 1.2 |
| 2007 | 37.1 | 1.1 | 1.0 | 36.4 | 1.1 | 1.0 |
| 2008 | 38.5 | 1.1 | 1.0 | 36.0 | 1.0 | 0.9 |
| 2009 | 39.8 | 1.1 | 0.9 | 38.1 | 1.0 | 0.9 |
| 2010 | 40.9 | 1.1 | 0.9 | 37.1 | 1.0 | 0.8 |
| 2011 | 40.4 | 1.0 | 0.9 | 37.0 | 0.9 | 0.8 |
| 2012 | 39.8 | 1.0 | 0.8 | 37.0 | 0.9 | 0.8 |
| 2013 | 39.3 | 0.9 | 0.8 | 36.9 | 0.8 | 0.7 |
| 2014 | 38.7 | 0.8 | 0.8 | 36.8 | 0.8 | 0.7 |
| 2015 | 36.5 | 0.8 | 0.7 | 34.5 | 0.7 | 0.7 |
| 2016 | 34.5 | 0.8 | 0.7 | 32.5 | 0.7 | 0.6 |
| 2017 | 32.5 | 0.7 | 0.7 | 30.6 | 0.7 | 0.6 |
| 2018 | 30.5 | 0.7 | 0.6 | 28.7 | 0.6 | 0.6 |
| 2019 | 29.3 | 0.7 | 0.6 | 27.6 | 0.6 | 0.6 |
| 2020 | 28.1 | 0.6 | 0.6 | 26.4 | 0.6 | 0.6 |

## Table A4 Dot matrix printers

| | Dot Matrix Printer – Non Domestic | | | Dot Matrix Printer - Domestic | | |
|---|---|---|---|---|---|---|
| Year | On-Ready (W) | Sleep (W) | Off (W) | On-Ready (W) | Sleep (W) | Off (W) |
| 2000 | 29.5 | 16.7 | 0.00 | 29.5 | 16.7 | 0.00 |
| 2001 | 28.4 | 16.3 | 0.00 | 28.4 | 16.3 | 0.00 |
| 2002 | 27.4 | 16.0 | 0.00 | 27.4 | 16.0 | 0.00 |
| 2003 | 26.5 | 15.6 | 0.00 | 26.5 | 15.6 | 0.00 |
| 2004 | 25.6 | 15.3 | 0.00 | 25.6 | 15.3 | 0.00 |
| 2005 | 24.9 | 15.0 | 0.00 | 24.9 | 15.0 | 0.00 |
| 2006 | 24.1 | 14.7 | 0.00 | 24.1 | 14.7 | 0.00 |
| 2007 | 15.5 | 13.8 | 0.00 | 15.5 | 13.9 | 0.00 |
| 2008 | 15.5 | 12.5 | 0.00 | 15.5 | 13.0 | 0.00 |
| 2009 | 15.5 | 11.2 | 0.00 | 15.5 | 10.8 | 0.00 |
| 2010 | 15.5 | 10.9 | 0.00 | 15.5 | 10.4 | 0.00 |
| 2011 | 15.5 | 10.6 | 0.00 | 15.5 | 10.1 | 0.00 |
| 2012 | 15.5 | 10.3 | 0.00 | 15.5 | 9.8 | 0.00 |
| 2013 | 15.5 | 9.9 | 0.00 | 15.5 | 9.6 | 0.00 |
| 2014 | 15.5 | 9.5 | 0.00 | 15.5 | 9.1 | 0.00 |
| 2015 | 15.5 | 9.0 | 0.00 | 15.5 | 8.6 | 0.00 |
| 2016 | 15.5 | 8.5 | 0.00 | 15.5 | 8.1 | 0.00 |
| 2017 | 15.5 | 8.0 | 0.00 | 15.5 | 7.7 | 0.00 |
| 2018 | 15.5 | 7.7 | 0.00 | 15.5 | 7.4 | 0.00 |
| 2019 | 15.5 | 7.3 | 0.00 | 15.5 | 7.1 | 0.00 |
| 2020 | 15.5 | 7.0 | 0.00 | 15.5 | 6.7 | 0.00 |

## Table A5 Inkjet printers

| | Inkjet Printer – Non Domestic | | | Inkjet Printer - Domestic | | |
|---|---|---|---|---|---|---|
| Year | On Ready (W) | Sleep (W) | Off-mode (W) | On Ready (W) | Sleep (W) | Off-mode (W) |
| 2000 | 19.8 | 11.4 | 2.0 | 19.8 | 5.8 | 1.9 |
| 2001 | 22.4 | 10.7 | 1.9 | 21.2 | 5.8 | 1.9 |
| 2002 | 25.0 | 9.9 | 1.9 | 22.6 | 5.8 | 1.8 |
| 2003 | 27.6 | 9.2 | 1.8 | 24.0 | 5.8 | 1.7 |
| 2004 | 30.3 | 8.5 | 1.7 | 25.4 | 5.8 | 1.6 |
| 2005 | 32.9 | 7.7 | 1.6 | 26.8 | 5.8 | 1.6 |
| 2006 | 35.5 | 7.0 | 1.5 | 28.1 | 5.8 | 1.5 |
| 2007 | 38.2 | 6.1 | 1.4 | 29.5 | 5.6 | 1.5 |
| 2008 | 38.2 | 5.7 | 1.2 | 29.5 | 4.4 | 1.3 |
| 2009 | 38.2 | 5.3 | 1.0 | 29.5 | 3.2 | 1.0 |
| 2010 | 38.2 | 5.0 | 0.9 | 29.5 | 3.0 | 0.9 |
| 2011 | 38.2 | 4.7 | 0.9 | 29.5 | 2.9 | 0.9 |
| 2012 | 38.2 | 4.4 | 0.9 | 29.5 | 2.9 | 0.8 |
| 2013 | 38.2 | 4.2 | 0.8 | 29.5 | 2.8 | 0.8 |
| 2014 | 38.2 | 3.9 | 0.8 | 29.5 | 2.6 | 0.8 |
| 2015 | 38.2 | 3.7 | 0.7 | 29.5 | 2.4 | 0.7 |
| 2016 | 38.2 | 3.5 | 0.7 | 29.5 | 2.3 | 0.7 |
| 2017 | 38.2 | 3.2 | 0.6 | 29.5 | 2.1 | 0.6 |
| 2018 | 38.2 | 3.1 | 0.6 | 29.5 | 2.0 | 0.6 |
| 2019 | 38.2 | 2.9 | 0.6 | 29.5 | 1.9 | 0.6 |
| 2020 | 38.2 | 2.7 | 0.6 | 29.5 | 1.8 | 0.5 |

## Table A6 Laser/LED printers

| | Laser Printer – Non Domestic | | | | Laser Printer - Domestic | | | |
|---|---|---|---|---|---|---|---|---|
| Year | On-Active (W) | On-Ready (W) | Low-Power (W) | Sleep/ Off (W) | On-Active (W) | On-Ready (W) | Low-Power (W) | Sleep/ Off (W) |
| 2000 | 854.5 | 234.9 | 80.0 | 14.2 | 640.9 | 176.9 | 80.0 | 14.2 |
| 2001 | 854.5 | 259.7 | 80.0 | 14.2 | 640.9 | 173.6 | 80.0 | 14.2 |
| 2002 | 854.5 | 284.6 | 80.0 | 14.2 | 640.9 | 170.3 | 80.0 | 14.2 |
| 2003 | 854.5 | 309.4 | 80.0 | 14.2 | 640.9 | 167.0 | 80.0 | 14.2 |
| 2004 | 854.5 | 334.3 | 80.0 | 14.2 | 640.9 | 163.7 | 80.0 | 14.2 |
| 2005 | 854.5 | 359.1 | 80.0 | 14.2 | 640.9 | 160.4 | 80.0 | 14.2 |
| 2006 | 854.5 | 384.0 | 80.0 | 14.2 | 640.9 | 157.1 | 80.0 | 14.2 |
| 2007 | 794.7 | 368.4 | 81.0 | 13.6 | 640.9 | 153.8 | 72.8 | 14.2 |
| 2008 | 660.2 | 286.4 | 70.2 | 12.2 | 554.5 | 135.6 | 67.9 | 13.0 |
| 2009 | 525.7 | 204.5 | 59.4 | 10.7 | 395.7 | 101.3 | 57.0 | 10.4 |
| 2010 | 492.2 | 199.6 | 58.1 | 10.4 | 365.5 | 99.0 | 54.3 | 10.1 |
| 2011 | 458.7 | 194.8 | 56.9 | 10.1 | 335.6 | 97.7 | 51.9 | 9.8 |
| 2012 | 425.2 | 190.0 | 55.6 | 9.8 | 309.7 | 96.5 | 49.8 | 9.6 |
| 2013 | 391.7 | 185.2 | 54.3 | 9.5 | 287.7 | 95.5 | 48.0 | 9.4 |
| 2014 | 373.4 | 173.5 | 51.2 | 9.1 | 274.7 | 89.8 | 45.5 | 8.9 |
| 2015 | 355.2 | 161.8 | 48.0 | 8.6 | 260.5 | 83.6 | 42.7 | 8.4 |
| 2016 | 336.9 | 150.1 | 44.9 | 8.1 | 247.5 | 77.9 | 40.1 | 7.9 |
| 2017 | 318.7 | 138.4 | 41.7 | 7.6 | 234.6 | 72.1 | 37.5 | 7.4 |
| 2018 | 303.0 | 134.1 | 39.8 | 7.3 | 223.2 | 68.8 | 35.8 | 7.1 |
| 2019 | 287.4 | 129.8 | 37.8 | 6.9 | 211.7 | 65.5 | 34.0 | 6.8 |
| 2020 | 271.7 | 125.5 | 35.9 | 6.6 | 199.3 | 61.8 | 32.1 | 6.4 |

## Table A7 Inkjet MFD

| | Inkjet MFD – Non Domestic | | | Inkjet MFD - Domestic | | |
|---|---|---|---|---|---|---|
| Year | On Ready (W) | Sleep (W) | Off-mode (W) | On Ready (W) | Sleep (W) | Off-mode (W) |
| 2000 | 38.2 | 13.6 | 6.5 | 25.5 | 20.5 | 6.5 |
| 2001 | 38.2 | 12.5 | 6.1 | 25.5 | 18.5 | 6.1 |
| 2002 | 38.2 | 11.5 | 5.7 | 25.5 | 16.5 | 5.7 |
| 2003 | 38.2 | 10.5 | 5.3 | 25.5 | 14.4 | 5.3 |
| 2004 | 38.2 | 9.5 | 4.9 | 25.5 | 12.4 | 4.9 |
| 2005 | 38.2 | 8.4 | 4.5 | 25.5 | 10.4 | 4.5 |
| 2006 | 38.2 | 7.4 | 4.1 | 25.5 | 8.4 | 4.1 |
| 2007 | 38.2 | 5.7 | 3.2 | 29.5 | 6.4 | 3.7 |
| 2008 | 38.2 | 4.3 | 2.1 | 29.5 | 5.1 | 2.7 |
| 2009 | 38.2 | 3.0 | 1.0 | 29.5 | 2.9 | 1.0 |
| 2010 | 38.2 | 2.9 | 1.0 | 29.5 | 2.8 | 0.9 |
| 2011 | 38.2 | 2.9 | 1.0 | 29.5 | 2.8 | 0.9 |
| 2012 | 38.2 | 2.9 | 1.0 | 29.5 | 2.8 | 0.9 |
| 2013 | 38.2 | 2.8 | 1.0 | 29.5 | 2.8 | 0.9 |
| 2014 | 38.2 | 2.6 | 0.9 | 29.5 | 2.6 | 0.9 |
| 2015 | 38.2 | 2.4 | 0.8 | 29.5 | 2.4 | 0.8 |
| 2016 | 38.2 | 2.2 | 0.8 | 29.5 | 2.2 | 0.8 |
| 2017 | 38.2 | 2.1 | 0.7 | 29.5 | 2.0 | 0.7 |
| 2018 | 38.2 | 2.0 | 0.7 | 29.5 | 1.9 | 0.7 |
| 2019 | 38.2 | 1.9 | 0.7 | 29.5 | 1.9 | 0.6 |
| 2020 | 38.2 | 1.9 | 0.6 | 29.5 | 1.8 | 0.6 |

## Table A8 Laser MFD

| | Laser MFD – Non Domestic | | | | Laser MFD - Domestic | | | |
|---|---|---|---|---|---|---|---|---|
| Year | On-Active (W) | On-Ready (W) | Low-Power (W) | Sleep/Off (W) | On-Active (W) | On-Ready (W) | Low-Power (W) | Sleep/ Off (W) |
| 2000 | 1104.7 | 460.7 | 30.5 | 7.9 | 753.3 | 218.4 | 28.8 | 7.4 |
| 2001 | 1104.7 | 460.7 | 38.4 | 8.2 | 753.3 | 218.4 | 35.1 | 7.8 |
| 2002 | 1104.7 | 460.7 | 46.4 | 8.6 | 753.3 | 218.4 | 41.4 | 8.2 |
| 2003 | 1104.7 | 460.7 | 54.4 | 9.0 | 753.3 | 218.4 | 47.7 | 8.7 |
| 2004 | 1104.7 | 460.7 | 62.3 | 9.3 | 753.3 | 218.4 | 53.9 | 9.1 |
| 2005 | 1104.7 | 460.7 | 70.3 | 9.7 | 753.3 | 218.4 | 60.2 | 9.5 |
| 2006 | 1104.7 | 460.7 | 78.2 | 10.0 | 753.3 | 218.4 | 66.5 | 10.0 |
| 2007 | 996.7 | 437.7 | 70.4 | 9.8 | 753.3 | 218.4 | 62.4 | 10.4 |
| 2008 | 769.2 | 388.3 | 63.9 | 8.6 | 680.7 | 197.4 | 58.8 | 9.3 |
| 2009 | 541.6 | 338.9 | 57.3 | 7.4 | 536.7 | 155.6 | 47.4 | 7.1 |
| 2010 | 517.3 | 328.6 | 55.4 | 7.2 | 526.6 | 150.4 | 45.6 | 6.9 |
| 2011 | 493.1 | 318.4 | 53.4 | 7.0 | 521.6 | 146.2 | 44.0 | 6.8 |
| 2012 | 468.8 | 308.1 | 51.5 | 6.8 | 517.3 | 142.7 | 42.7 | 6.7 |
| 2013 | 444.5 | 297.8 | 49.5 | 6.6 | 513.7 | 139.7 | 41.6 | 6.6 |
| 2014 | 439.9 | 281.2 | 46.8 | 6.2 | 496.0 | 131.7 | 39.3 | 6.2 |
| 2015 | 435.3 | 264.5 | 44.1 | 5.9 | 475.8 | 123.2 | 36.8 | 5.8 |
| 2016 | 430.7 | 247.8 | 41.4 | 5.5 | 458.0 | 115.3 | 34.5 | 5.4 |
| 2017 | 426.1 | 231.2 | 38.6 | 5.1 | 440.2 | 107.3 | 32.1 | 5.0 |
| 2018 | 422.3 | 220.2 | 36.8 | 4.9 | 428.3 | 102.4 | 30.7 | 4.8 |
| 2019 | 418.6 | 209.3 | 35.0 | 4.6 | 416.4 | 97.4 | 29.2 | 4.5 |
| 2020 | 414.9 | 198.3 | 33.1 | 4.4 | 402.5 | 92.0 | 27.5 | 4.3 |

## Table A9 Photocopier

| | Photocopier - Non Domestic | | | |
|---|---|---|---|---|
| Year | On-Active(W) | On-Ready (W) | Low-Power (W) | Sleep/Off (W) |
| 2000 | 1272.0 | 217.8 | 80.5 | 1.7 |
| 2001 | 1272.0 | 252.5 | 84.9 | 2.0 |
| 2002 | 1272.0 | 287.3 | 89.4 | 2.2 |
| 2003 | 1272.0 | 322.0 | 93.8 | 2.5 |
| 2004 | 1272.0 | 356.8 | 98.3 | 2.8 |
| 2005 | 1272.0 | 391.5 | 102.7 | 3.1 |
| 2006 | 1272.0 | 426.3 | 107.2 | 3.3 |
| 2007 | 1208.0 | 430.4 | 106.8 | 3.4 |
| 2008 | 1076.7 | 366.6 | 100.8 | 3.1 |
| 2009 | 945.4 | 302.8 | 86.5 | 2.8 |
| 2010 | 932.2 | 293.5 | 83.7 | 2.7 |
| 2011 | 919.1 | 284.2 | 81.5 | 2.6 |
| 2012 | 905.9 | 274.9 | 79.6 | 2.5 |
| 2013 | 892.8 | 265.6 | 78.0 | 2.4 |
| 2014 | 864.2 | 247.3 | 74.9 | 2.2 |
| 2015 | 835.7 | 229.1 | 71.5 | 2.1 |
| 2016 | 807.2 | 210.8 | 68.5 | 2.0 |
| 2017 | 778.6 | 192.6 | 65.4 | 1.8 |
| 2018 | 766.3 | 181.7 | 63.3 | 1.8 |
| 2019 | 753.9 | 170.8 | 61.1 | 1.7 |
| 2020 | 741.5 | 159.9 | 58.6 | 1.6 |

## Table A10Photo printer

| | Photo Printer – Domestic | | |
|---|---|---|---|
| Year | On Ready (W) | Sleep (W) | Off-mode (W) |
| 2000 | 39.6 | 12.7 | 1.4 |
| 2001 | 36.1 | 11.3 | 1.5 |
| 2002 | 32.6 | 10.0 | 1.6 |
| 2003 | 29.1 | 8.6 | 1.7 |
| 2004 | 25.6 | 7.3 | 1.7 |
| 2005 | 22.0 | 5.9 | 1.8 |
| 2006 | 18.5 | 4.6 | 1.9 |
| 2007 | 15.0 | 3.2 | 2.0 |
| 2008 | 15.0 | 3.2 | 1.6 |
| 2009 | 15.0 | 3.0 | 1.0 |
| 2010 | 15.0 | 2.9 | 0.9 |
| 2011 | 15.0 | 2.7 | 0.9 |
| 2012 | 15.0 | 2.5 | 0.9 |
| 2013 | 15.0 | 2.4 | 0.9 |
| 2014 | 15.0 | 2.3 | 0.9 |
| 2015 | 15.0 | 2.2 | 0.9 |
| 2016 | 15.0 | 2.1 | 0.8 |
| 2017 | 15.0 | 2.0 | 0.8 |
| 2018 | 15.0 | 2.0 | 0.8 |
| 2019 | 15.0 | 1.9 | 0.8 |
| 2020 | 15.0 | 1.8 | 0.8 |