BN-NDICT PC04: Non-Domestic Computers Government Standards Evidence Base 2009: Best Available Technology Scenario

Version 1.1

This Briefing Note and referenced information is a public consultation document and will be used to inform Government decisions. The information and analysis forms part of the Evidence Base created by Defra's Market Transformation Programme.

1 Introduction

- The Best Available Technology (BAT) Scenario is a hypothetical projection of what would happen if the best available technologies on the (current and future) market were bought or installed from now on.

- The best available technologies are defined as the most efficient, or lowest energy consuming technologies available on the market, or those which are close to market (where the development stage is completed, but it is not necessary available as a designed product).

- This Government Standard Briefing Note (GSBN) covers non-domestic personal computers. The following definitions of PCs are adapted from the ErP Preparatory study on PCs[1].

[1] European Commission DG TREN Preparatory studies for Eco-design Requirements of ErPs (Contract TREN/D1/40-2005/LOT3/S07.56313) Lot 3 Personal Computers (desktops and laptops) and Computer Monitors Final Report (Task 1-8)

- **Personal Computer:** A device which performs logical operations and processes data. Personal computers are composed of, at a minimum: (1) a central processing unit (CPU) to perform operations; and (2) user input devices such as a keyboard, mouse, digitizer or game controller. For the purposes of this study, personal computers include both stationary and portable units, including desktop computers, integrated computers, notebook computers and tablet PCs.

- **Desktop Personal Computer (PC):** A computer where the main unit is intended to be located in a permanent location, often on a desk or on the floor. Desktops are not designed for portability and utilize an external monitor, keyboard and mouse. Desktops are designed for a broad range of home and office applications including, email, web browsing, word processing, standard graphics applications, gaming, etc.

- **Laptop Personal Computer (PC):** A computer designed specifically for portability and to be operated for extended periods of time without a direct connection to an ac power source. Notebooks and tablets must utilize an integrated monitor and be capable of operation off and integrated battery or other portable power source. In addition, most notebooks and tablets use an external power supply and have an integrated keyboard and pointing device, though tablets use touch sensitive screens. Notebook and tablet computers are typically designed to provide similar functionality to desktops except within a portable device. Docking stations are considered accessories and therefore are not covered in this briefing note

2 Scenario outputs

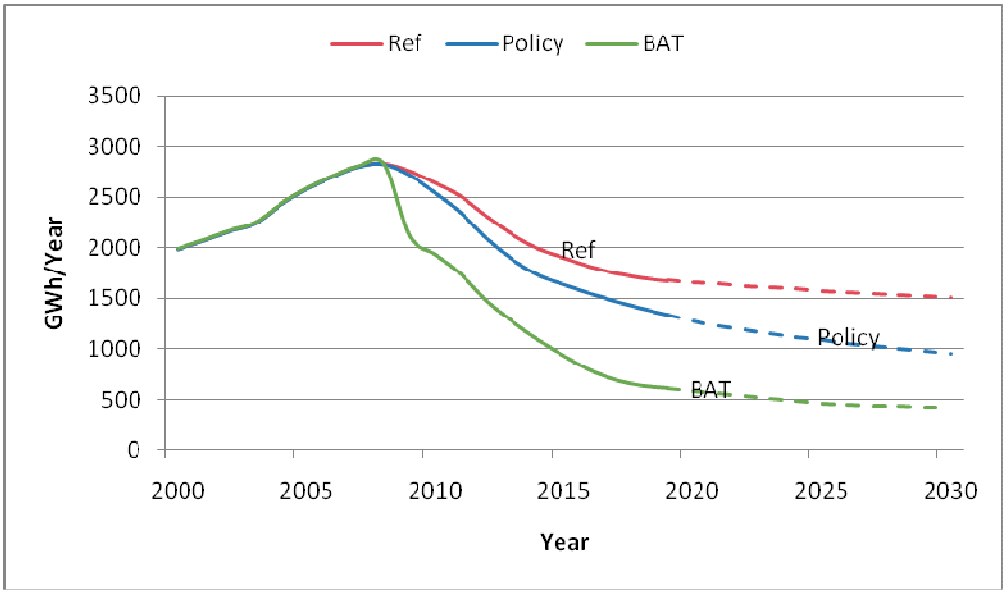

Figure 1 Total Non-Domestic PC Energy Consumption

- Total non-domestic energy consumption from desktop and laptop PCs is expected to fall from 2009 until 2030 under the BAT scenario. This reduction is primarily due to a switch from desktop to laptop PCs.

- Total non-domestic desktop PC energy consumption is expected to fall quickly under the Best Available Technology (BAT) scenario due primarily to a decrease in stock.

- Total non-domestic energy consumption from laptop PCs under the BAT scenario is expected to fall until 2010 then begin to rise again until 2013 after which time it will begin to fall again. The changes in total energy consumption are due to interactions between increasing stock and increased efficiency.

Table 1 Non-Domestic PC energy consumption[2] and savings and CO_2 emissions[3] and savings

Energy Consumption (GWh)	2009	2020	2030
Laptop	390	340	260
Desktop	1720	250	160
TOTAL	2110	590	420
Energy Savings (GWh)			
Laptop	0	400	620
Desktop	0	680	470
TOTAL	0	1070	1090
CO_2 Emissions ($MtCO_2$)			
Laptop	0.14	0.12	0.09
Desktop	0.60	0.09	0.06
TOTAL	0.74	0.21	0.15
CO_2 Emissions Savings ($MtCO_2$)			
Laptop	0.06	0.14	0.22
Desktop	0.17	0.24	0.17
TOTAL	0.23	0.38	0.39

[2] MTP data represents the best currently available information based on a bottom-up modelling approach. MTP's data is the basis for detailed energy calculations in the 2009/2010 Product policy analysis and projections document. However, DECC projections indicate that overall energy demand in the non-domestic sector is lower than projected by MTP's detailed models. MTP has assumed that the differences between the DECC overall projections and its detailed bottom-up projections are due to incomplete data on the following inputs for some of its non-domestic products:

- existing product stock;
- existing product efficiency;
- product usage.

The energy consumption figures in these GSBNs have **not** been scaled down, in order to enable constructive stakeholder comment on the MTP input data, and therefore differ from the ones presented in the 2009/2010 Product policy analysis and projections document.

[3] Refer to BNXS01 Carbon Dioxide Emission Factors for UK Energy Use for details on factors used.

3 Efficiency

3.1 Summary

- This section provides details of the efficiency inputs assumed (for new sales i.e. not stock average)
- The reference GSBN provides a full description of the ENERGY STAR specification process and how MTP has interpreted the values.

Table 2 Non-Domestic PCs Power Consumption

	Desktop PC			Laptop PC		
Year	On-Idle (W)	Sleep (W)	Off (W)	On-Idle (W)	Sleep (W)	Off (W)
2010	57.0	3.0	0.8	18.4	1.1	0.6
2020	14.8	1.8	0.4	10.6	0.7	0.3
2030	14.8	0.7	0.4	7.0	0.3	0.3

3.2 Data sources – efficiency

Table 3 Desktop Efficiency data sources

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2009, 2011, 2015, 2030	Expert Assumptions	2009	MTP Technical Expert	Required expert assumptions to develop best practice and class leader figures for use in BAT line (based upon current efficiency data sets).	Medium

Table 4 Laptop Efficiency data sources

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2009, 2014, 2030	Expert Assumptions	2009	MTP Technical Expert	Required expert assumptions to develop best practice and class leader figures for use in BAT line.	Medium

3.3 Methodology & key assumptions – efficiency

- This section describes what has been done with the data listed in Table 3 and Table 4 along with a rationale for any key assumptions (in particular any expert judgements listed in Table 3 and Table 4) and detail of any background calculations behind the data points
- Methodology & key assumptions for historic data are included in BN-NDICT PC02 – Reference Scenario

3.3.1 Future analysis

Table 5 Extrapolation & background calculations – desktop and laptop PC efficiency

Year	Methodology & assumptions
2009	All PCs – best practice power figures for all are based on a top performing percentage of products found in all referenced datasets. The percentage market penetration level which determines the BAT figure is set varies depending on the range of products' performances found in each dataset. It is typically set at between 10-20%. Class leading products are defined as the single most efficient product over all datasets (per product group).
2009	Desktop on-idle - uses best practice figure
2010 - 2014	Desktop on-idle – based on a straight line interpolation between the 2009 and 2015 values
2015	Desktop on-idle - moves from best practice level to class leader level by 2015
2015-2030	Desktop on-idle - uses class leader value from 2015.
2009	Desktop sleep mode - uses best practice figure
2010-2029	Desktop sleep mode – based on a straight line interpolation between the 2009 and 2030 values
2030	Desktop sleep mode - moves from best practice level to class leader level by 2030
2009	Desktop off mode - uses best practice figure
2010	Desktop off mode - based on a straight line interpolation between the 2009 and 2011 values
2011	Desktop off mode - moves from best practice level to class leader level by 2011
2012-2030	Desktop off mode - uses class leader value from 2011.
2009	Laptop on-idle and sleep mode - uses best practice figure
2010-2029	Laptop on-idle and sleep mode - based on a straight line interpolation between the 2009 and 2030 values
2030	Laptop on-idle and sleep mode - moves from best practice level to class leader level by 2030
2009	Laptop off-mode - uses best practice figure
2010 - 2013	Laptop off-mode - based on a straight line interpolation between the 2009 and 2013 values
2014	Laptop off-mode - moves from best practice level to class leader level by 2013
2015-2030	Laptop off-mode - uses class leader value from 2013

3.4 Data issues – Efficiency

- This section flags any areas of uncertainty, both in general and for specific data points, along with a description of how this has been dealt with in the model

Table 6 Data issues – Efficiency

Issue/risk	Approach taken/rationale
Much of the power data sourced for desktop and laptop PCs comes from products compliant with ENERGY STAR. There is a risk that the best practice figures could be too low in relation to the "true" market best practice level which results in future values also being too ambitious.	MTP have commissioned their own testing and power figures are included in the datasets. Inclusion of these figures help to develop realistic best practice figures. MTP will review on an annual basis.
Product development in the ICT industry is rapid. The MTP future BAT line assumptions could change with a sudden uptake of an extremely efficient or inefficient product.	MTP can review the BAT line figures on an annual basis. This annual review will ensure that MTP BAT line figures reflect current best practice and class leading products.
Efficiency data for on-idle power are heavily dependent on the functionality of PCs. Should functionality increase significantly as a response to an external factor (e.g. increase software sophistication) then future power consumption could increase significantly.	Power consumption is assumed to decrease in on-idle into the future. MTP will review this assumption on an annual basis.

3.5 Confidence level – Efficiency

- This section provides an indication of overall confidence in the data set (i.e. data points, calculations, interpolation and projections)
- MTP utilise their current database of product information to estimate what could happen in future years to products' energy efficiency. The fast moving nature of the ICT industry could result in these estimates needing to change considerably in future years.

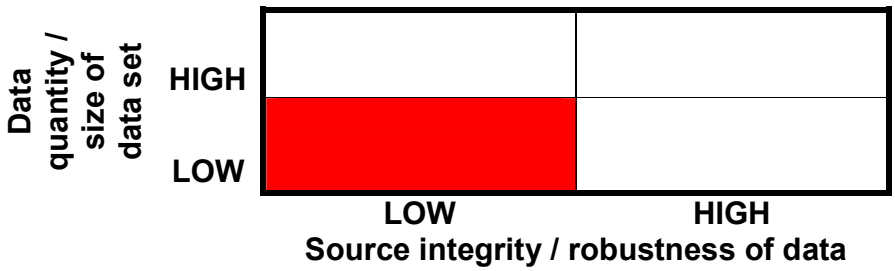

Figure 2 Confidence indicator for efficiency data

4 Usage

4.1 Summary

- Two sets of use profiles are developed for PCs. The first use profile is based on a situation where no power management is enabled and the second where power management is enabled (see Key Inputs for profiles). An "enabling rate" is used as a weighting factor between these two use profiles to arrive at overall use profile for each product.
- The table below shows average usage profiles, derived from the BAT scenario enabling rate and the power managed and non power managed profiles discussed in the Key Inputs briefing note.

Table 7 – Average Usage Desktop PC

	Desktop PC				
	Reference (Use Hours/Year)				Power Management Enabling Rates
Year	On-Active	Sleep	Off	Off-Unplugged	%
2009	1,507	533	6,431	289	100
2010	1,507	533	6,431	289	100
2020	1,507	533	6,431	289	100
2030	1,507	533	6,431	289	100

Table 8 – Average Usage Laptop PC

	Laptop PC				
	Reference (Use Hours/Year)				Power Management Enabling Rates
Year	On-Active	Sleep	Off	Off-Unplugged	%
2009	1,321	620	1,950	4,869	100
2010	1,321	620	1,950	4,869	100
2020	1,321	620	1,950	4,869	100
2030	1,321	620	1,950	4,869	100

- Average desktop and laptop PC on-idle use is expected to remain constant over time.

- A 100% power management enabling rate is assumed in the BAT scenario by 2009 (by comparison a 100% power management rate in the policy scenario is only assumed by 2020) as industry communicates ways of ensuring that any power management functionality does not interfere with the normal operation of products. With this potential barrier removed it is assumed that all products will be power management enabled as compulsory.

4.2 Data sources – usage

Table 9 Usage data sources (enabling rates) – Desktop PC

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2009	Expert Assumptions	2009	MTP Technical Expert	Expert assumption required to develop power management enabling rates in each year (desktop PC)	Medium
2009	Expert Assumptions	2009	MTP Technical Expert	Expert assumption required to develop power management enabling rates in each year (laptop PC).	Medium

4.3 Methodology & key assumptions – usage

- This section describes what has been done with the data listed in Table 9 along with a rationale for any key assumptions (in particular any expert judgements listed in Table 9) and detail of any background calculations behind the data points

4.3.1 Future analysis

Table 10 Extrapolation & background calculations – usage data

Year	Methodology & assumptions
2009 – 2030	Desktop and laptop PC – two sets of use profiles are developed for each product type one based on a situation where no power management is enabled and the second where power management is enabled. An "enabling rate" is used as a weighting factor between these two use profiles to arrive at overall use profile for each product. See Key Inputs GSBN for details about use profiles.
2009	BAT scenario: Desktop and laptop PC – power management enabling rates assumed to be at 100%. The 100% rate would be achieved through compulsory power management enabling on all machines.
2010 - 2030	BAT scenario: Desktop and laptop PC – power management enabling rates assumed remain at 100% as in 2009.

4.4 Data issues – usage

- This section flags any areas of uncertainty, both in general and for specific data points, along with a description of how this has been dealt with in the model

Table 11 Data issues – usage

Issue/risk	Approach taken/rationale
The power management enabling rates can have a large impact on overall use profiles (especially for the sleep mode hours).	A number of assumptions have been made about future power management enabling rates. These enabling rates will be reviewed on an annual basis.

4.5 Confidence level – usage

- This section provides an indication of overall confidence in the data set (i.e. data points, interpolation and projections)
- Confidence levels about actual base use profiles are included in the key inputs GSBN's. Confidence levels of the power management enabling rates are relatively low, especially for future years, due to the large potential for users to disable functionality.

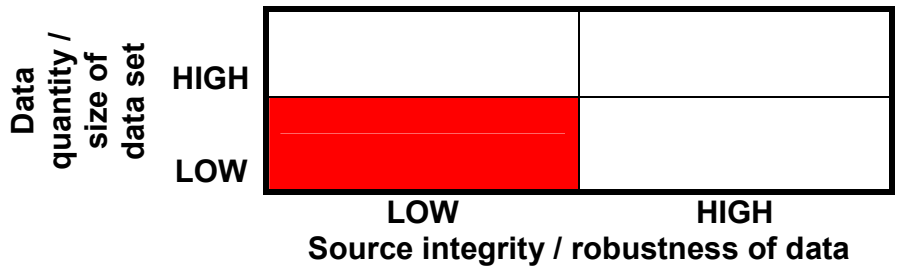

Figure 3 Confidence indicator for usage & lifespan data

5 Other issues

- None addressed

Related MTP information

- BN-NDICT PC 01: Government Standards Evidence Base 2009 – Key Inputs, Non Domestic Computers
- BN-NDICT PC 02: Government Standards Evidence Base 2009 – Reference Scenario, Non Domestic Computers
- BN-NDICT PC 03: Government Standards Evidence Base 2009 – Policy Scenario, Non Domestic Computers
- BN-NDICT PC 04: Government Standards Evidence Base 2009 – Best Available Technology (BAT) Scenario, Non Domestic Computers
- BN-DICT PC01: Government Standards Evidence Base 2009 – Key Inputs, Domestic Computers
- BN-DICT PC 02: Government Standards Evidence Base 2009 – Reference Scenario, Domestic Computers
- BN-DICT PC 03: Government Standards Evidence Base 2009 – Policy Scenario, Domestic Computers
- BN-DICT PC 04: Government Standards Evidence Base 2009 – Best Available Technology (BAT) Scenario, Domestic Computers
- BN-NDICT KO01: Government Standards Evidence Base 2009 – Key Outputs, Non Domestic ICT
- BN-DICT KO01: Government Standards Evidence Base 2009 – Key Outputs, Domestic ICT

Changes from Version 1.0

- Minor changes to the template.

Consultation and further information

Stakeholders are encouraged to review this document and provide suggestions that may improve the quality of information provided, email **info@mtprog.com** quoting the document reference, or call the MTP enquiry line on +44 (0) 845 600 8951.

For further information on related issues visit **http://efficient-products.defra.gov.uk**