

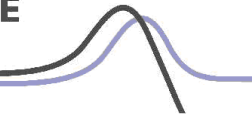
BN-NDICT PC03: Non-Domestic Computers Government Standards Evidence Base 2009: Policy Scenario

Version 1.0

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 Policy Scenario is a projection of what would happen if a defined set of new product-specific and related cross-cutting policies were implemented. The policies in the Policy Scenario have not yet been agreed or funded but represent those policies which are expected to be introduced as well as likely future revisions to existing policies and, in some cases, novel policy options. These policies aim to improve the average efficiency of products in the stock through a variety of mechanisms (e.g. minimum standards, product information and labelling, procurement, incentives) and thus reduce energy consumption and carbon emissions resulting from to these products.
- As product policy is considered within the context of climate change policy, the UK government considers policies with a net UK costs of up to around £20 per tonne of CO₂ saved (compared to the reference scenario). The ambition level, at a minimum, matches the Least Life Cycle Cost (LLCC) level to society of increased energy efficiency of products.
- The costs for each policy, where known, are also included, separated out for government, consumer and industry.



This Government Standard Briefing Note (GSBN) covers non-domestic personal computers. The following definitions of PCs are adapted from the EuP Preparatory study on PCs¹.

- **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.

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

2 Scenario outputs

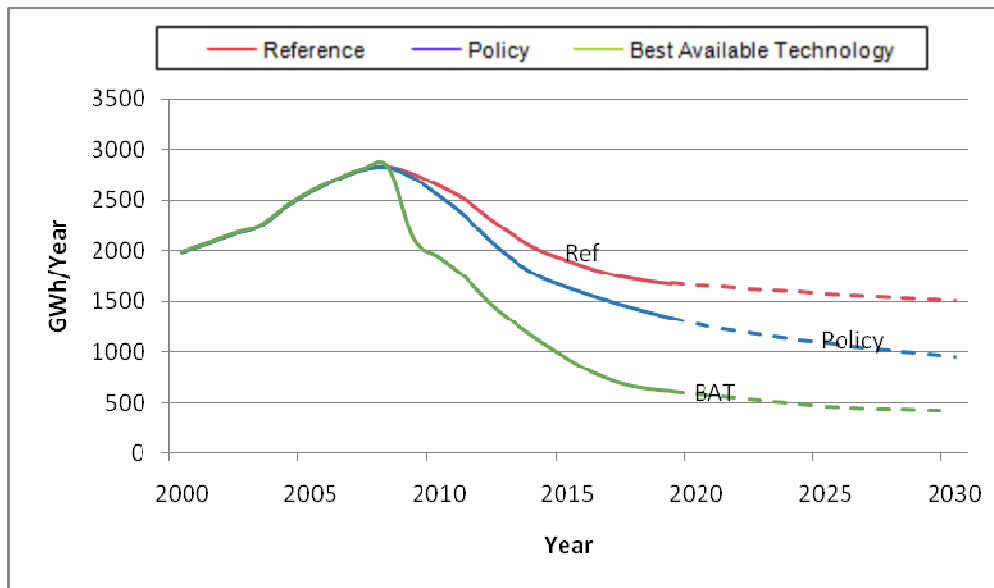


Figure 1 Total Non-Domestic PC Energy Consumption²

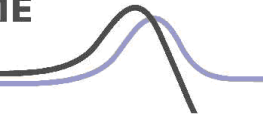
- Total non-domestic energy consumption from desktop and laptop PCs is expected to fall from 2009 under the policy scenario. This decrease is primarily due to a shift towards laptop PCs from desktop PCs. Desktop and laptop PC efficiency is also expected to increase under the policy scenario until 2030 due to current and new policy initiatives extending until this time. These policies help to offset some of the extra energy associated with the continued increase in laptop PC stock.
- Total energy consumption from non-domestic desktop PCs is expected to fall from 2009 onwards under the policy scenario. This reduction in energy consumption is almost entirely due to falling stock levels although the efficiency of the products is also expected to improve over time under the policy scenario.

² Energy consumption figures for the non-domestic sector in the 2009/2010 Consultation Document 'Saving energy through better products and appliances' were scaled down to match DECC projections for overall energy demand (www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx).

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 Consultation 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 Consultation Document.



- Total non-domestic energy consumption from laptop PCs is expected to increase under the policy scenario between 2009 and 2012. The increase in total energy consumption during these years is primarily as a result of increasing stock. Efficiency improvements in laptop PCs, as well as slower growth in stock levels, will result in total energy decreasing from 2013 onwards.

Table 1 Non-Domestic PC energy consumption³ and savings and CO₂ emissions and savings⁴

Energy Consumption (GWh)	2009	2020	2030
Lap	550	550	540
Desktop	2180	720	420
TOTAL	2720	1270	960
Energy Savings (GWh)			
Lap	0	180	340
Desktop	0	200	220
TOTAL	0	390	560
CO ₂ Emissions (MtCO ₂)			
Lap	0.19	0.20	0.19
Desktop	0.76	0.26	0.15
TOTAL	0.96	0.46	0.34
CO ₂ Emissions Savings (MtCO ₂)			
Lap	0.00	0.07	0.12
Desktop	0.01	0.07	0.08
TOTAL	0.01	0.14	0.20

³ Energy consumption figures for the non-domestic sector in the 2009/2010 Consultation Document 'Saving energy through better products and appliances' were scaled down to match DECC projections for overall energy demand (www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx).

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- 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 Consultation Document.

⁴ Refer to BNXS01 Carbon Dioxide Emission Factors for UK Energy Use for details on factors used.

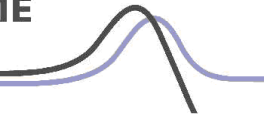


Table 2 Summary costs and benefits⁵

	Average annual energy savings (£m)	Average annual product & policy cost increases (£m)	Net Benefit (£m)	Cost Effectiveness (traded) (£/tCO ₂)
Desktop and Laptop PC	30	4	403	-145.6

Table 3 Government standards market average – non domestic computers

Non-domestic Computer Products		
	Desktop PC	Laptop PC
Year	on-idle power (W)	on-idle power (W)
2009	70.1	23.4

3 Future potential policy & measures

- All policies and measures are discussed in detail within the Reference GSN for computer products. This section of the document focuses on future measures included within each of the policies.
- Future ENERGY STAR revisions are expected every four years (occurring in 2013, 2017, 2021, 2025, 2029)
- Future EuP measures addressing the on-idle and sleep modes of desktop and laptop PCs are assumed to be implemented in 2012, 2016, 2020, 2024, 2028 with specifications levels assumed to be based on the preceding ENERGY STAR specifications. ENERGY STAR on-mode specifications levels into the future are based on a percentage reduction from the preceding year's specification level (until 2013) and then an assumed percentage decrease for each proceeding specification.
- Future EU Eco-label energy efficiency criteria included in the label are expected to refer to ENERGY STAR. Few ICT products currently hold the EU Eco-label. A modest increase in EU Eco-label coverage is expected into the future.
- Government procurement is expected to continue mandating that all desktop and laptop PCs procured by central Government should meet ENERGY STAR specifications. This follows the 2007 revised ENERGY STAR agreement which requires central government procurement to ENERGY STAR efficiency levels or equivalent (without prejudice to Community and national law and economic criteria). Government procurement specifications are assumed to be implemented through the "Quick Wins" programme.

⁵ Refer to BNXS26 Rationale for Policy Cost Estimates used in MTP Policy Briefs for details on factors used.

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- The Policy Scenario assumes improvement to 55% (desktop PCs) and 63% (laptop PCs) power management enabling rate by 2014, and a further improvement to 79% (desktop PCs) and 90% (laptop PCs) by 2020, resulting in a significant reduction in total product energy consumption.

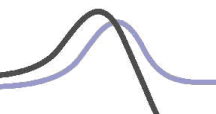
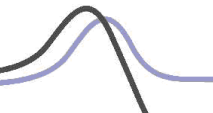


Table 4 Future potential policies & measures, Policy Scenario

Policy name	Period in force	Description	Impact	Cost	Justification
ENERGY STAR	Years policy in force (2009 – 2030)	Current ENERGY STAR specifications include maximum power (W) levels. The agreed 2009 specifications move to a Typical Electricity Consumption (TEC) approach and declare maximum kWh/year levels for each category of desktop and laptop PC). MTP has translated the ENERGY STAR TEC values into power (W) figures using results in the 2008 ENERGY STAR specification development dataset. Future ENERGY STAR specifications are assumed for 2013, 2017, 2021, 2025 and 2029 each with increased efficiency requirements.	ENERGY STAR is assumed to have a large impact on the energy efficiency of desktop and laptop PCs in their on-idle and sleep modes. ENERGY STAR will have less of an influence on off-mode power as this will be heavily impacted by the EuP Standby Implementing Measures.	No cost is assumed for ENERGY STAR compliance as it is a voluntary programme. ENERGY STAR compliance is heavily driven by the US market in particular its mandatory nature in US public procurement.	ENERGY STAR is the main energy efficiency policy impacting ICT products.
EuP desktop and laptop PC Implementing Measures	2012-2030	Expected to be based on previous ENERGY STAR specifications.	Expected to remove remaining products from the market which have not reached the 4 year old ENERGY STAR specification.	The cost of changing products to meet the future EuP measures varies across the different types of imaging devices. Please refer to section 5 in this GSBN for further information about costs.	EuP Implementing Measures for on-idle and sleep mode power consumption were highlighted in the EuP Computer preparatory study. Within the preparatory study it was suggested that future EuP IM's could be based on past ENERGY STAR specifications.
EU Eco-label	2011 - 2030	EU Eco-label is the European Commission eco-label. Covers wider lifecycle impacts as well as energy in use. Energy efficiency specifications expected to refer to ENERGY STAR.	Impact on market deemed to be minimal due to low coverage rates.	No costs assigned to the due to low coverage rates and the programme's voluntary nature..	EU Eco-label is the European Commission's own label. Whilst coverage rates are low they could

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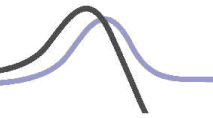
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Policy name	Period in force	Description	Impact	Cost	Justification
					increase if extra resources are put into the label programme.
Government Procurement	2009-2030	Expected to be based on ENERGY STAR specifications.	Relatively small impact expected as does not go beyond ENERGY STAR	No cost assumed as based on ENERGY STAR	Important consideration as central Government is largest single procurer of desktop and laptop PCs in the UK
Power Management	2014-2030	Increased power management enabling requirements within EuP and ENERGY STAR specifications	Potential significant impacts on total energy consumption from desktop and laptop PCs.	No cost assumed as technology already exists on most PCs.	Could have significant impacts on total energy consumption without the need to change any product components.

Table 5 Test Standards

Test Standard name	Date in force	Description	Comments
ENERGY STAR® Program Requirements for Computers Version 5.0	2009	Provides methodology for measuring the on-idle, sleep mode and off-mode of desktop and laptop PCs.	
IEC 62301	2005	Provides a measurement method for standby/off-mode power (W)	In the process of being revised.
IEC 62301 Ed.2	TBD	Will provide a revised methodology for measuring standby/off-mode power (W). The revisions in the standard are likely to focus on nomenclature of power modes.)	



3.1 Policy timeline

- The following policy timeline identifies when policies come into effect, including future revisions

Policy name	Current specification in force	2009	2010	2011	2012	2013	2014	2015	2016-2020	2021-2025	2026-2030
ENERGY STAR (future measures)	n/a					2013 Estimate			2017 Estimate	2021 and 2025 Estimate	2029 Estimate
EuP Implementing Measures (Desktop and laptop PC)	n/a				2012 Estimate				2016 and 2020 Estimate	2024 Estimate	2028 Estimate
Power Management Programme	n/a						Est. (55% to 63% PM Rate)		2020 Est 79% to 90%PM Rate)		
Government Procurement (Quick Wins)	2009	Estimated refresh each year. ENERGY STAR specifications used. →									

4 Efficiency

4.1 Summary

- This section provides details of the efficiency inputs assumed (for new sales i.e. not stock average).
- ENERGY STAR has adopted (for the revised 2009 specification) a Typical Electricity Consumption approach (TEC) which uses annual energy consumption thresholds (kWh/year) as requirements. TEC requirements have been



developed for four categories of desktop PCs and three categories of laptop PCs. The categories are based on the functionality and computing power offered by desktop or laptop PCs. Further information about the ENERGY STAR metrics can be seen in the reference scenario GSBN for desktop and laptop PCs.

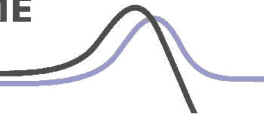
- The tables below illustrate the expected ENERGY STAR coverage rate for each product type covered in this GSBN. The expected ENERGY STAR coverage rate (the number of products which meet the ENERGY STAR specification) increases each year until the new specification is implemented. It is assumed that EuP Implementing Measures will be based on the previous ENERGY STAR specification (therefore within 8 years 100% of products will be compliant with the previous ENERGY STAR specification).

Table 6 Expected Domestic Desktop PC ENERGY STAR Coverage Rates

Year	Specification Years						
	2007 Spec (Agreed)	2009 Spec (Agreed)	2013 Spec (Forecast)	2017 Spec (Forecast)	2021 Spec (Forecast)	2025 Spec (Forecast)	2029 Spec (Forecast)
2010	41%	30%	13%	8%	4%	3%	2%
2015	32%	29%	20%	7%	5%	4%	3%
2020	0%	0%	43%	31%	11%	8%	7%
2025	0%	0%	0%	40%	31%	19%	9%
2030	0%	0%	0%	0%	42%	35%	23%

Table 7 Expected Domestic Laptop PC ENERGY STAR Coverage Rates

Year	Specification Years						
	2007 Spec (Agreed)	2009 Spec (Agreed)	2013 Spec (Forecast)	2017 Spec (Forecast)	2021 Spec (Forecast)	2025 Spec (Forecast)	2029 Spec (Forecast)
2010	39%	35%	12%	5%	4%	3%	2%
2015	31%	29%	22%	7%	5%	4%	3%
2020	0%	0%	42%	32%	11%	8%	7%
2025	0%	0%	0%	38%	31%	23%	8%
2030	0%	0%	0%	0%	39%	35%	26%



- The reference GSN provides a full description of the ENERGY STAR specification process and how MTP have interpreted the values.
- The on-idle mode power figures, developed from the ENERGY STAR specifications, are used as the main metric for desktop and laptop power consumption as they dominate the overall energy consumption of these products.

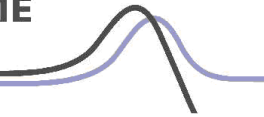
Table 8 Non-Domestic Desktop and Laptop PC Power Consumption – Policy Scenario

Year	Desktop PC		Laptop PC	
	MTP Policy Line	Estimated ENERGY STAR Specifications	MTP Policy Line	Estimated ENERGY STAR Specifications
	On-Idle (W)	On-Idle (W)	On-Idle (W) ⁶	On-Idle (W) ²
2009	70.2	50.7	23.4	21.3
2010	62.6		22.9	
2011	55.4		22.3	
2012	52.8		21.8	
2013	51.4	45.6	21.1	18.9
2014	50.0		20.3	
2015	48.5		19.6	
2016	47.1		18.8	
2017	45.9	41.1	18.3	17.3
2018	44.8		17.8	
2019	43.6		17.3	
2020	42.5		16.7	
2021	41.8	39.0	16.3	15.5
2022	41.0		15.8	
2023	40.3		15.4	
2024	39.6		15.1	
2025	39.1	37.1	14.7	14.0
2026	38.6		14.4	
2027	38.1		14.2	
2028	37.6		14.0	
2029	37.2	35.2	13.8	13.1
2030	36.7		13.6	

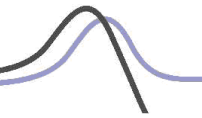
⁶ Includes estimated power for screen (W)

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- Table 8 shows the MTP power consumption requirements under the policy scenario for desktop and laptop PCs in on-idle mode. The table also lists the estimated ENERGY STAR specifications in each year that they are expected to be refreshed. The ENERGY STAR specifications are slightly lower than the policy line to account for the fact that not all products on the market will be expected to meet the current ENERGY STAR specifications.



4.2 Data sources – efficiency

Table 9 Desktop Efficiency data sources

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2009, 2010, 2012, 2013, 2015- 2017, 2020, 2021, 2024, 2025, 2028, 2029, 2032, 2033	Expert Assumptions	2009	MTP Technical Expert	Required expert assumptions to extrapolate sourced power data into the future	Medium

Table 10 Laptop Efficiency data sources

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2009, 2010, 2012, 2013, 2015- 2017, 2020, 2021, 2024, 2025, 2028,	Expert Assumptions	2009	MTP Technical Expert	Required expert assumptions to extrapolate sourced power data into the future	Medium

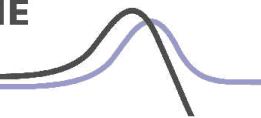
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2029, 2032, 2033					
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Note: Historic data sources are included in BN-NDICT PC02 – Reference Scenario



4.3 Methodology & key assumptions – efficiency

- This section describes what has been done with the data listed in the Policy Scenario GSBN along with a rationale for any key assumptions (in particular any expert judgements listed in Table 9 and Table 10) and detail of any background calculations behind the data points.
- Table 11 describes the process taken when developing the MTP policy line.
 - Stage 1 identifies how the specification levels for each policy were calculated.
 - Stage 2 describes how the individual specifications were combined to develop the MTP policy line.
 - Stage 3 details how the ENERGY STAR coverage rates were calculated.
- Methodology & key assumptions for historic data are included in BN-NDICT PC02 – Reference Scenario
- Note – for smooth modelling trends, some assumptions have been made beyond 2030, although the model itself does not project total figures beyond 2030.
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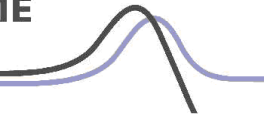
4.3.1 Future data

Table 11 Extrapolation & background calculations – Desktop and Laptop PC efficiency

Year	Methodology & assumptions
Stage 1: Policy Specification Values Calculations	
2009	Desktop and laptop PCs – ENERGY STAR specification (on-idle, sleep mode and off-mode power): Specification level is based on a model weighted distribution of ENERGY STAR specifications for each desktop and laptop PC category. Model weighting is based on the distribution of products found in the EU ENERGY STAR database during 2008.
2013, 2017, 2021, 2025, 2029, 2033	Desktop and laptop PCs – ENERGY STAR specification value (on-idle and sleep mode power): It is assumed that the ENERGY STAR specifications will be refreshed in these years. These values are based on an assumed increase in efficiency over the preceding ENERGY STAR specification value (which was developed four years in the past). The level of assumed efficiency gain ranges between 5% and 10%. The 10% value is used in the first refresh (new ENERGY STAR specification) and the 5% values for each subsequent refresh period to reflect diminishing gains. The percentage decreases are based on expert assumption.
2010–2012, 2014–2016, 2018–2020, 2022–2024, 2026–2028, 2030–2032	Desktop and laptop PCs – ENERGY STAR specification value (on-idle and sleep mode power): The values for each year are based on a straight line interpolation between the preceding year's and future year's ENERGY STAR specification value.
2013	Desktop and laptop PC – ENERGY STAR specification value (off-mode (W)) is assumed to be at 0.5W to match EuP.
2010–2012	Desktop and laptop PC – ENERGY STAR specification value (off-mode (W)): The values for each year are based on a straight line interpolation between the

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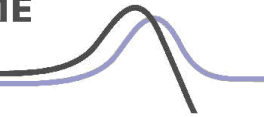
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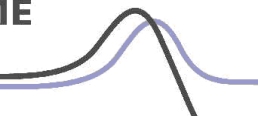
Year	Methodology & assumptions
	preceding year's and future year's ENERGY STAR specification value.
2014 - 2030	Desktop and laptop PC – ENERGY STAR specification value (off-mode (W)): It is assumed that ENERGY STAR will use the 2013 EuP Implementing measure of 0.5W as a specification to ensure that ENERGY STAR qualified products are legally compliant in the EU.
2009-2030	Desktop and laptop PC – Government procurement specification values (all power modes) match ENERGY STAR specifications for the same year. This assumption is based on current practice within the UK Government of using ENERGY STAR specifications within Quick Wins procurement specifications. Future use of ENERGY STAR specifications is assumed.
2012, 2016, 2020, 2024, 2028, 2032	Desktop and laptop PC - EuP specification value (on-idle and sleep mode power): The EuP specification value in these years matches the previously implemented ENERGY STAR specification value.
2013–2015, 2017–2019, 2021–2023, 2025–2027, 2029–2031	Desktop and laptop PC - EuP specification value (on-idle and sleep mode power): The values for each year are based on a straight line interpolation between the preceding year's and future year's EuP specification value.
2010 and 2013	Desktop and laptop PC – EuP specification value (off-mode power (W)): The EuP standby implementing measures are applied (as a maximum consumption value) in these years (1W in 2010 and 0.5 W in 2013).
2014 to 2030	Desktop and laptop PC – EuP specification value (off-mode power (W)): The EuP 2013 standby implementing measure of 0.5 W is applied linearly in each subsequent year as no further improvement is considered possible.
2011 - 2030	Desktop and laptop PC – EU Eco-label values (all power modes) are assumed to equal the ENERGY STAR specifications in the same year. This assumption is based on past practice seen in the EU Eco-label.
Stage 2: Policy line Calculation	
2009 - 2030	Overall policy line: this overall policy line brings together the results of all the individual policy line calculations. The line is based on the minimum value that occurs in either the reference line or in any of the individual policy lines. If the minimum value occurs in the reference line it shows that the package of policies is having no impact.
2012, 2016, 2020, 2024, 2028, 2032	Desktop and laptop PC - ENERGY STAR policy line: Values (on-idle and sleep mode) are based on a weighted percentage of products which meet the ENERGY STAR specification with the remaining percentage of products meeting the average Reference line value.
2009-2011, 2013–2015, 2017–2019, 2021–2023, 2025–2027, 2029–2031	Desktop and laptop PC - ENERGY STAR policy line: Values for (on-idle and sleep mode): The values for each year are based on a straight line interpolation between the preceding year's and future year's calculated ENERGY STAR policy line value.
2012, 2016, 2020, 2024, 2028, 2032	Desktop and laptop PC – EU Eco-label policy line: Values (on-idle and sleep mode) are based on a weighted percentage of products which are assumed to meet the EU Eco-label specification and the currently in force ENERGY STAR specification with the remaining percentage of products performing at the Reference line value.
2009-2011, 2013–2015, 2017–2019, 2021–2023, 2025–2027, 2029–2031	Desktop and laptop PC - EU Eco-label policy line: Values for (on-idle and sleep mode): The values for each year are based on a straight line interpolation between the preceding year's and future year's EU Eco-label policy line value.

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Year	Methodology & assumptions
2009 - 2011	Desktop and laptop PC - EuP policy line (on-idle and sleep mode): includes an assumed improvement in product performance ahead of EuP implementation in 2012. This reflects the thinking that manufacturers would improve product energy efficiency ahead of the EuP implementation date. The figures for these years are calculated on an assumed % reduction from the Reference line figures. The percentage reductions are based on expert opinion and are tailored to ensure that the EuP policy line in these years does not fall below the 2012 implementing measure.
2012, 2016, 2020, 2024, 2028, 2032	Desktop and laptop PC - EuP policy line: Values (on-idle and sleep mode) are based on a weighted percentage of products which are assumed to meet the EuP specification with the remaining percentage of products meeting the ESR policy line figures (ESR policy line includes the combined effects of the ENERGY STAR, EU Eco-label as well as the ESR specifications).
2013–2015, 2017–2019, 2021–2023, 2025–2027, 2029–2031	Desktop and laptop PC - EuP policy line: Values for (all power modes): The values for each year are based on a straight line interpolation between the preceding year's and future year's EuP policy line value.
2010 and 2013	Desktop and laptop PC - EuP policy line (off-mode (W)): Includes the EuP Implementing Measures as maximum power consumption values in 2010 and 2013.
2009 - 2012	Desktop and laptop PC - EuP policy line (off mode): includes an assumed improvement in product performance ahead of EuP implementation in 2013. This reflects the thinking that manufacturers would improve product energy efficiency ahead of the EuP implementation date. The figures for these years are calculated on an assumed percentage reduction from the Reference line figures. The percentage reductions are based on expert opinion. The off-mode and are tailored to ensure that the EuP policy line in these years does not fall below the 2013 implementing measure (as the 2013 implementing measure is assumed to be the lowest power requirement in the policy scenario).
2012	Desktop and laptop PC - ENERGY STAR policy line (off-mode (W)): based on a weighted percentage of products which meet the ENERGY STAR specification with the remaining percentage of products meeting the average Reference line value.
2009 - 2011	Desktop and laptop PC - ENERGY STAR policy line (off-mode (W)): The values for each year are based on a straight line interpolation between the preceding year's and future year's ESR policy line value.
2014 -2030	Desktop and laptop PC - All policy lines (off-mode (W)): All values based on the 2013 EuP Implementing Measure of 0.5W.
Stage 3: Efficiency Sales Weighting	
2009-2030	Desktop and laptop PC - sales weighting for ENERGY STAR coverage graphs: The ENERGY STAR coverage graphs illustrate an assumed mix of coverage levels in the market place against ENERGY STAR specifications set in 2007, 2009, 2013, 2107, 2021, 2025 and 2029.
2009	Desktop and laptop PC - sales weighting for ENERGY STAR coverage graphs: Current coverage of products in EU ENERGY STAR database to the 2009 ENERGY STAR specification value. This calculation provides a percentage compliance rate for those products already in the EU ENERGY STAR database. Where necessary, a correction factor is then added (value assumed by the technical expert) to account for the fact that the products in the EU ENERGY STAR database do not account for the whole market. The correction factor therefore provides an estimate of how many products on the whole market are likely to be meeting the ENERGY STAR specification value.
2009	Desktop and laptop PC - sales weighting for ENERGY STAR coverage graphs:



Year	Methodology & assumptions
	Coverage rates for 2009 against assumed 2013, 2017, 2021, 2025 and 2029 ENERGY STAR specification values are assumed.
2012, 2016, 2020, 2024, 2028	Desktop and laptop PC - sales weighting for ENERGY STAR coverage graphs: It is assumed 1 year prior to the implementation of new ENERGY STAR specifications the specifications are developed to cover approximately 25% of the most energy efficient products on the market.
2012, 2016, 2020, 2024 and 2028	Desktop and laptop PC - sales weighting for ENERGY STAR coverage graphs: It is assumed that 100% of products meet revised ENERGY STAR specifications 7 years after implementation. This is based on the assumption that EuP will require that all products sold in the EU market meet the previous ENERGY STAR specifications.
2010–2015, 2013-2019, 2017-2023, 2021-2027, 2025-2030	Desktop and laptop PC - sales weighting for ENERGY STAR coverage graphs: The values for each year are based on a straight line interpolation between the preceding year's and future year's ENERGY STAR coverage rates.
2010, 2015, 2020, 2025 and 2030	Desktop and laptop PC - sales weighting for ENERGY STAR coverage graphs: Coverage rates for the 2007, 2009, 2013, 2021, 2025 and 2029 ENERGY STAR specifications are normalised to 100% for graphing purposes.

4.4 Data issues – efficiency

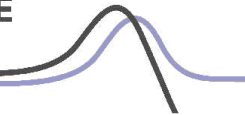
- This section flags any areas of uncertainty, both in general and for specific data points, along with a description of how this has been dealt with in the model.

Table 12 Data issues – efficiency

Issue/risk	Approach taken/rationale
Much of the power data sourced for desktop and laptop PCs comes from products compliant to ENERGY STAR. There is a risk that the policy figures could be too low which results in future values also being too ambitious.	MTP have assumed future specification values for ENERGY STAR based on estimated efficiency savings. The expected efficiency gains in each four year period are kept to a relatively low level.
Product development in the ICT industry is rapid. The MTP future policy line assumptions could change with a sudden uptake of an extremely efficient or inefficient product.	MTP review the reference line figures on an annual basis. This annual review will ensure that MTP policy line figures reflect current product performance as closely as possible.
Efficiency data for on-idle power 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 assumed to decrease in on-idle into the future. MTP will review this assumption on an annual basis.

4.5 Confidence level – efficiency

- 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.

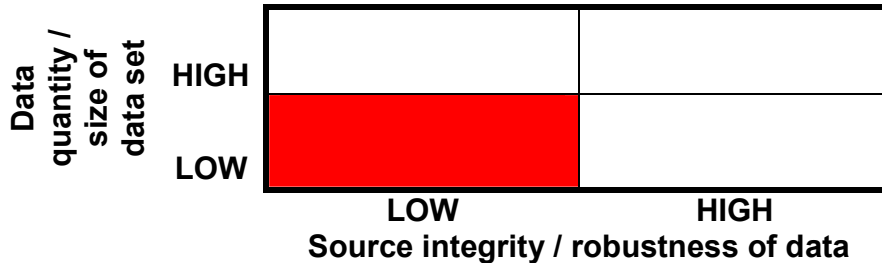


Figure 2 Confidence indicator for efficiency data

5 Usage

5.1 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 policy scenario enabling rate and the power managed and non power managed profiles discussed in the Key Inputs briefing note.

Table 13 – Average Usage Desktop PC

Year	Desktop PC				Power Management Enabling Rates
	(Use Hours/Year)				
	On-Active	Sleep	Off	Off-Unplugged	%
2010	1917	123	6431	289	23
2020	1619	421	6431	289	79
2030	1619	421	6431	289	79

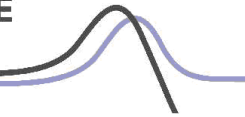
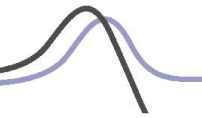


Table 14 – Average Usage Laptop PC

Year	Laptop PC				Power Management Enabling Rates %
	On-Active	Sleep	Off	Off-Unplugged	
2010	1718	223	1950	4869	36
2020	1383	558	1950	4869	90
2030	1383	558	1950	4869	90

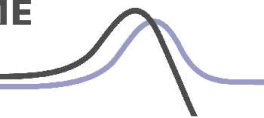
- Average desktop and laptop PC on-idle use under the policy scenario is expected to reduce slightly over time as more products are power managed.
- Power management enabling rates are assumed to increase over time largely as a result of new EuP and ENERGY STAR requirements which increase enabling rates to 55% (desktop PCs) and 63% (laptop PCs) by 2014 (by comparison the reference scenario power management rate is only assumed to reach 40% for desktop PCs and 50% for laptop PCs by 2014).
- Power management enabling rates are assumed to increase to 79% (desktop PCs) and 90% (laptop PCs) by 2020 as technical issues become less of a barrier, and power management becomes more engrained in ENERGY STAR and EuP requirements. By comparison the power management rate in the reference scenario is assumed to remain at 40% for desktop PCs and 50% for laptop PCs in 2020 as no further change is expected without the extra policy influence.



5.2 Data sources – usage

Table 15 Usage data sources – Desktop and laptop PCs

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2009, 2014, 2020	Expert Assumptions	2009	MTP Technical Expert	Expert assumption required for power management enabling rates (desktop and laptop PCs).	Medium



5.3 Methodology & key assumptions – usage

- This section describes what has been done with the data listed in the Reference Scenario GSBN along with a rationale for any key assumptions (in particular any expert judgements listed in Table 15) and detail of any background calculations behind the data points.

5.3.1 Future analysis

Table 16 Extrapolation & background calculations – usage data

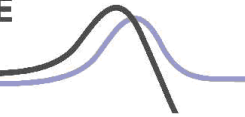
Year	Methodology & assumptions
2009 - 2030	Desktop and laptop PC – two sets of use profiles are developed for each product type one based on a situation where no power management is enabled and the second where power management is enabled. An “enabling rate” is used as a weighting factor between these two use profiles to arrive at overall use profile for each product. See Key Inputs GSBN for details about use profiles.
2009	Desktop and laptop PC - enabling rate increases are based on expert opinion. Enabling rates for desktop PCs start at 15% in 2009 and enabling rates for laptop PCs start at 29% in 2009 (based on a straight line interpolation between the 2008 value and the policy target in 2014). Enabling rates based on expert opinion in light of no further evidence being available.
2010 - 2013	Desktop and laptop PC - enabling rates based on a straight line interpolation between the 2009 and 2014 values.
2014	Desktop and laptop PC - enabling rate increases to 55% (desktop PCs) and 63% (laptops PCs) as a result of a new ENERGY STAR and EuP specifications including enhanced power management requirements..
2015 - 2019	Desktop and laptop PC - enabling rates based on a straight line interpolation between the 2014 and 2020 values.
2020	Desktop and laptop PC - enabling rate increases to 79% (desktop PCs) and 90% (laptop PCs). Power management enabling rates are assumed to increase as ENERGY STAR and EuP requirements on power management become more stringent
2021 - 2030	Desktop and laptop PC - enabling rate same as the 2020 value

5.4 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 17 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.



5.5 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.

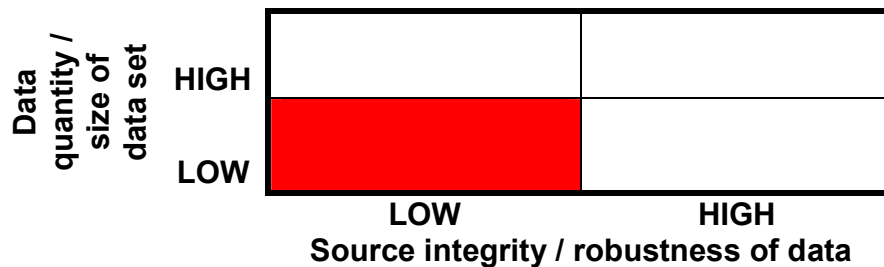


Figure 3 Confidence indicator for usage data

6 Cost

6.1 Summary

- The cost of adapting products to meet each set of future EuP specifications has been estimated below. No other policy costs are included as they are either voluntary in nature or adaptation would have no costs attached.
- All of the measures suggested are either within the bounds of existing technology already in use on PC products, or future refinements of those existing technologies.
- Microprocessors are shown to have a cost of improvement, although it is feasible that some of this cost could be taken as a “business as usual” cost of on-going development by the chip manufacturer. For this reason, the cost of improvement of microprocessors is held low.
- Cost data is at the heart of commercial competition and not discussed openly within industry – for this reason, all cost data is based on expert opinion from within the MTP team, including knowledge of current product prices.
- All costs stated are marginal costs related to the introduction of a specific energy efficiency improvement in the Policy Scenario, and above the normal purchase cost implied in the Reference Scenario.

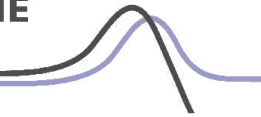


Table 18 Summary of Costs in each specification year - Undiscounted (real)

Year	Undiscounted cost £000's		
	Desktop	Laptop	Total
2011	3,445	9,409	12,854
2015	1,819	4,718	6,537
2019	1,597	5,120	6,717
2023	1,374	5,545	6,919
2027	1,150	5,963	7,114

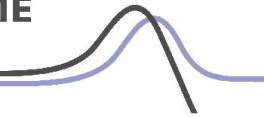
6.2 Data sources – cost

Table 19 Cost data sources

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2011, 2015, 2019, 2023, 2027	Expert assumption of cost per improvement option	2009	MTP Technical Expert	No cost data available	low
2011, 2015, 2019, 2023, 2027	Expert assumption of percentage of products on the market requiring adaptation to meet EuP specification	2009	MTP Technical Expert	No data available	low

6.3 Methodology & key assumptions – cost

- This section describes what has been done with the data listed in Table 19 along with a rationale for any key assumptions (in particular any expert judgements listed in Table 19) and detail of any background calculations behind the data points.
- Power supply units (PSU) differ between desktop and laptop PCs. Desktop PCs use (physically) large higher power (up to 1000W) PSUs whereas laptop PCs use lower power (up to 100W) physically smaller external PSUs. The cost of improvement due to policy has been assumed to be the same for both types as desktop PCs may require larger more powerful components than laptop PCs, but laptop PCs have space constraints which require greater miniaturisation.

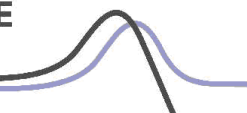


- Microprocessors continue to follow Moore’s Law (with chip capacity doubling every 18 months) as each year more transistors are packed onto the same size silicon substrate. This does not necessarily mean that the newer generation devices will be more efficient than the previous generation as any benefit derived by closer packing of transistors could be offset by having a greater number of transistors. The policy assumes that chip manufacturers will address these issues by “shutting down” cores (portions of the chip) when the processing load is light to effect efficiency improvement.
- The microprocessor’s clock speed directly influences its power consumption. The policy assumes that chip manufacturers will incorporate “speed switching” in their microprocessors to reduce the clock speed (to improve energy efficiency) when the processing load is light.
- While estimates have been made of current and future costs, the confidence level reduces into the future as uncertainty around specification levels and cost of component changes increases. The cost in each policy year is therefore the same, but can be updated in any future studies.
- Estimated costs shown are to the consumer.

6.3.1 Future analysis

Table 20 Extrapolation & background calculations – cost

Year	Methodology & assumptions
2011, 2015, 2019, 2023, 2027	<p>Multiple rounds of EuP specifications assigned to desktop and laptop PCs. Measures based on previous ENERGY STAR specification More energy efficient power supply – assumed £2.00 More energy efficient microprocessor architecture/design – assumed £7.50 More energy efficient hard disk drive – assumed £1 Adaptive processor technology assumed no additional cost</p>
2011, 2015, 2019, 2023, 2027	<p>It is assumed that each EuP specification will be the same as the voluntary specification from 3 years previous. Therefore, it is assumed that in the EuP specification year, the majority of products placed on the market will be compliant. Expert assumptions have been made of the remaining percentage of products placed on the market which require adaptation in the EuP specification year as follows:</p> <p>For desktop PCs 2011 12.5% 2015 7.4% 2019 7.4% 2023 7.4% 2027 7.4%</p> <p>For laptop PCs 2011 12.5% 2015 5.7% 2019 5.7% 2023 5.7% 2027 5.7%</p>



2011, 2015, 2019, 2023, 2027	The costs are derived from multiplying the assumed cost of change by the number of products requiring adaptation in each specification year.
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6.4 Data issues – cost

- 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 21 Data issues – cost

Issue/risk	Approach taken/rationale
Cost data is at the heart of commercial competition and not discussed openly within industry. Costs vary according to specification and with quantity of material purchased. While estimates have been made of current and future costs, the confidence level reduces into the future as uncertainty around specification levels and cost of component changes increases.	The approach has been to take indicative feedback provided by industry of current costs to prepare an expert opinion within MTP (taking into account current prices and past trends). These assumptions have been extrapolated linearly into the future. MTP will review on an annual basis

6.5 Confidence level – cost

- This section provides an indication of overall confidence in the data set (i.e. data points, calculations, interpolation and projections)
- Cost data for changing certain components of PCs is difficult to source. Any assumptions are highly dependent on assumed future specification levels and potential energy savings from each component change.

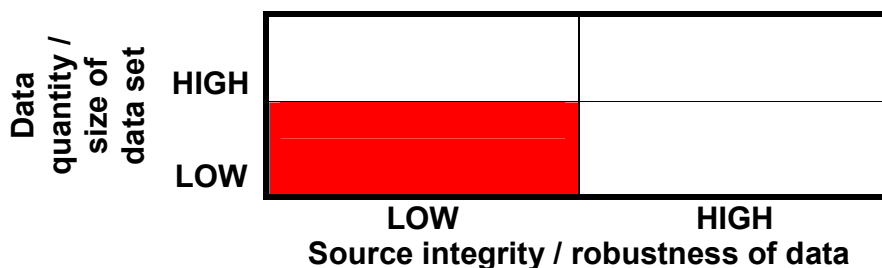
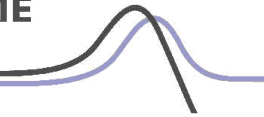


Figure 4 Confidence indicator for cost data

7 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 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 previous version

- No changes. This is the first published version.

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 www.mtprog.com