BN-NDICT IM03: Non-Domestic Imaging 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 imaging equipment. The following definitions of imaging equipment types are adapted from the EuP Preparatory study on imaging equipment[1].

- **Office Imaging Equipment** is a commercially available product which was designed for the main purpose of producing a printed image (paper document or photo) from a digital image (provided by a network/card interface) through a marking process. Office Imaging Equipment is also a commercially available product which was designed for the main purpose of producing a digital image from a hard copy through a scanning/copying process. The definition covers products which are marketed as printers, photocopiers and multifunction devices (MFDs). For the purposes of this GSBN, "Office Imaging Equipment" is also used to cover imaging products used in a domestic environment.

- **Printer** is a commercially available imaging product that serves as a hard copy output device, and is capable of receiving information from single-user or networked computers, or other input devices (e.g. digital cameras). The unit must be capable of being powered from a wall outlet or from a data or network connection. The following products covered in this GSBN fall under this category; Laser printers, inkjet printers and dot-matrix printers.

- **Multifunction Devices (MFD)** is a commercially available imaging product which is a physically integrated device or a combination of functionally-integrated components combining two or more of the core functions of copying, printing, scanning, or faxing. The copy functionality as addressed in this definition is considered to be distinct from single sheet convenience copying offered by fax machines. The unit must be capable of being powered from a wall outlet or from a data or network connection. The following products covered in this GSBN fall under this category; Laser MFDs and Inkjet MFDs.

- Each type of imaging product detailed above can employ one or more of the following marketing technologies:

- **Electro Photographic (EP):** EP is a marking technology characterized by illumination of a charged organic photoconductor drum in a pattern representing the desired hard copy image via a light source (typically a Laser or LED). The image is created with particles of (dry) toner using the latent image on the photoconductor to define the presence or absence of toner at a given location. The toner is transferred to the final hard copy medium (typically paper or foil) and cured in a thermal fusing process while applying pressure to cause the desired hard copy to become durable. The process allows a very fast throughput and creation of hardcopy images. EP marking technology is normally applied in medium to high speed printers and copies. Products using EP marking technologies are defined as "thermal" imaging products

[1] European Commission DG TREN EuP Preparatory Studies "Imaging Equipment" (LOT 4) Draft Final Report on Task 1

due to the use of heat in the process. The following products covered in this GSBN fall under this category; Laser printer, laser MFDs and photocopiers.

- **Ink Jet (IJ):** Inkjet (IJ) is a marking technology where images are formed by depositing (jet) colorant (liquid ink) in small drops directly to the print media in a matrix manner. The print head of the inkjet printer scans the page in horizontal strips, using a motor to move it back and forth, as another motor rolls the paper in vertical steps. Products using inkjet marking technologies are normally defined as "non-thermal" imaging products as no heating is required to set the ink on the paper. The following products covered in this GSBN utilise inkjet marking technologies; inkjet printers and MFD inkjets.

- **Impact:** A marking technology characterized by the formation of the desired hard copy image by transferring colorant from a "ribbon" to the media via an impact process. Two types of impact technology are Dot Formed Impact and Fully-formed Impact. Products using impact marking technologies are normally defined as "non-thermal" imaging products as no heating is required to set the ink on the paper. The following products covered in this GSBN utilise impact marking technologies; dot-matrix printers.

- Products using EP marking technologies are defined as "thermal" imaging products due to the use of heat in the process. Conversely, products using inkjet or impact marking technologies are normally defined as "non-thermal" imaging products as no heating is required.

Non-thermal			**Thermal**		
Dot-matrix Printer	Inkjet Printer	MFD Inkjet	Laser Printer	MFD Laser	Photo-copier

2 Scenario outputs

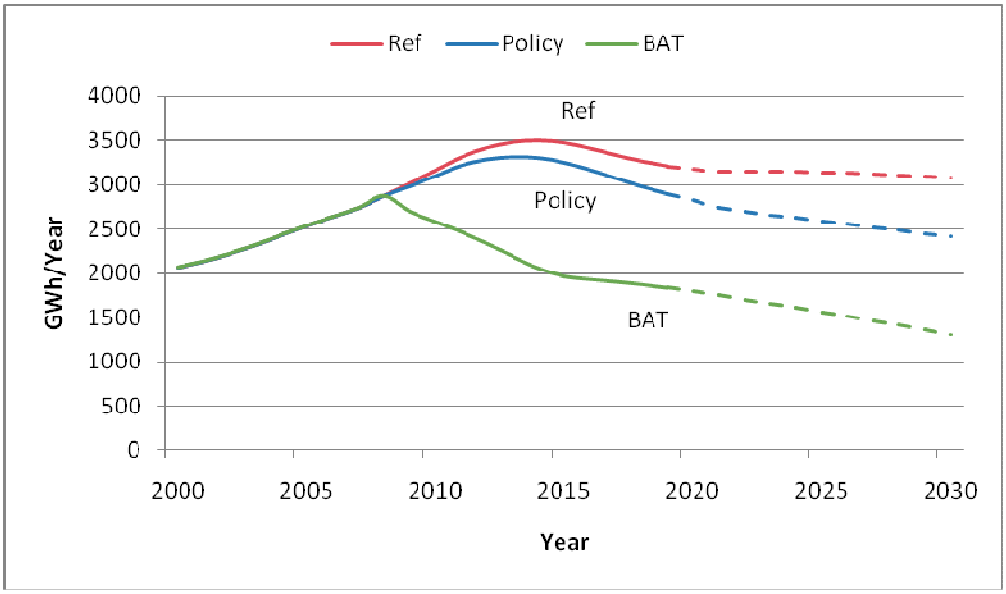

Figure 1 Total Non-Domestic Imaging Products Energy Consumption

- Total energy consumption from non-domestic imaging products in the policy scenario is expected to increase until 2014. After 2014 total energy consumption will decrease each year until 2030. Most of the decrease is due to increasing product energy efficiency but there is also decreasing stock of products.

- Total energy consumption from non-thermal non-domestic imaging products in the Policy Scenario is expected to increase until 2019 after which it will then start to decrease. Much of the increase is due to an increasing number of MFD inkjets in stock.

- Total Non-Domestic energy consumption from thermal imaging products in the policy scenario is expected to increase until 2014 and then start to reduce until 2024 when it will start to increase again. The increases and decreases are a result of varying power efficiency and changing stock levels.

Table 1 Non-Domestic Imaging Products Energy Consumption[2] and Energy Savings and CO_2 Emissions[3] and Savings

[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

Energy Consumption (GWh)	2009	2020	2030
Photocopiers	160	0	0
InkJ MFD	170	260	240
Laser MFD	740	1200	1250
Dot Matrix	10	10	0
InkJ printer	180	60	30
Laser printer	1730	1300	890
TOTAL	2990	2830	2410
Energy Savings (GWh)			
Photocopiers	0	0	0
InkJ MFD	0	70	90
Laser MFD	0	110	260
Dot Matrix	0	0	0
InkJ printer	0	20	10
Laser printer	0	150	310
TOTAL	0	350	670
CO_2 Emissions ($MtCO_2$)			
Photocopiers	0.06	0.00	0.00
InkJ MFD	0.06	0.09	0.09
Laser MFD	0.26	0.43	0.45
Dot Matrix	0.01	0.00	0.00
InkJ printer	0.06	0.02	0.01
Laser printer	0.61	0.47	0.32
TOTAL	1.05	1.01	0.86
CO_2 Emissions Savings ($MtCO_2$)			
Photocopiers	0.00	0.00	0.00
InkJ MFD	0.00	0.02	0.03
Laser MFD	0.00	0.04	0.09
Dot Matrix	0.00	0.00	0.00
InkJ printer	0.00	0.01	0.01
Laser printer	0.01	0.05	0.11
TOTAL	0.01	0.12	0.24

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.

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

Table 2 Summary costs and benefits[4]

	Average annual energy savings (£m)	Average annual product & policy cost increases (£m)	Net Benefit (£m)	Cost Effectiveness (traded) (£/tCO$_2$)
Imaging equipment	30	2	425	-151.2

Table 3 Government standard market average – non-domestic non thermal imaging products

Non-domestic, non- thermal imaging products			
	Dot Matrix	Inkjet printer	Inkjet MFD
Year	Sleep Power (W)	Sleep Power (W)	Sleep Power (W)
2009	13.1	10.9	4.4

Table 4 Government standard market average – non-domestic (thermal) laser printers

Non-domestic laser printer						
TEC (kWhr/week)						
Year	≤ 15ipm Mono	>15 ipm ≤ 40 Mono	>40 ipm ≤ 82 Mono	> 82ipm Mono	≤ 32ipm Colour	>32 ipm ≤ 58 Colour
2009	0.6	3.2	7.3	59.2	5.0	8.9

Table 5 Government standard market average – non-domestic (thermal) MFD laser products

Non-domestic MFD laser products						
TEC (kWhr/week)						
Year	>10 ipm ≤ 26 Mono	>26 ipm ≤ 68 Mono	> 68 ipm Mono	≤26 ipm Colour	>26 ipm ≤62 Colour	>62ipm Colour
2009	3.0	11.6	27.3	9.3	12.7	18.0

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

Table 6 Government standard market average – non-domestic photocopiers

(Non-domestic) Photocopiers							
TEC (kWhr/week)							
Year	≤ 15ipm Mono	>15 ipm ≤ 40 Mono	>40 ipm ≤ 82 Mono	> 82ipm Mono	≤ 32ipm Colour	>32 ipm ≤ 58 Colour	> 58ipm Colour
2009	1.0	4.5	14.0	27.7	12.3	11.3	20.2

3 Future potential policy & measures

- All policies and measures are discussed in detail within the Reference scenario GSBN for imaging products. This section of the document focuses on future measures included within each of the policies.

- Future, ENERGY STAR specifications have been modelled into the policy scenario discussed in this GSBN.
    - These future ENERGY STAR specifications are expected every four years from 2013 onwards (2017, 2021, 2025, 2029).
    - Future ENERGY STAR specifications for the Typical Energy Consumption (TEC) requirements of thermal imaging products and the on-ready mode of non-thermal imaging products are expected to reduce each four years by an assumed percentage rate.
    - The ENERGY STAR sleep mode specifications for non-thermal imaging products are also expected to fall by an assumed percentage each four years.
    - The ENERGY STAR requirements for the off mode of all domestic imaging products are expected to match the EuP Standby Implementing Measures.

- Future EuP Imaging Equipment Implementing Measures addressing the in use modes (TEC, on-ready and sleep modes) of imaging products are assumed to be implemented in 2012, 2016, 2020, 2024, 2028 with specifications levels assumed to based on the preceding ENERGY STAR specifications.

- Policy Scenario assumes improvement to 97% power management enabling rate by 2021 through the introduction of additional ENERGY STAR and EuP requirements resulting in a significant reduction in total product energy consumption.

- Government procurement is expected to continue mandating that all imaging equipment procured by central Government should meet ENERGY STAR specifications.

Table 7 Future potential policies & measures, Policy Scenario

Policy name	Period in force	Description	Impact	Cost	Justification
ENERGY STAR	2013, 2017, 2021, 2025, 2029 (estimated)	Provides energy efficiency specifications for all imaging products covered in this GSBN.	ENERGY STAR label is set at levels which represent approximately the top 25% of products on the market (averaged across all categories). The large amount of influence associated with ENERGY STAR can, in part, be attributed to the fact that its specifications are mandatory criteria within public procurement contracts of some governments. Coverage levels of ENERGY STAR are highly dependent on the type and functionality of products.	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 Imaging Equipment 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. costs. Costs are assumed to occur one year ahead of EuP implementation. Costs alterations are assumed for power supply units, motors and where applicable drum and fuser units.	EuP Implementing Measures for on-idle and sleep mode power consumption were highlighted in the EuP Imaging preparatory study. Within the preparatory study it was suggested that future EuP IM's could be based on past ENERGY STAR specifications.
Government Procurement	2009-2030	Expected to be based on previous ENERGY STAR specifications.	Relatively small impact expected as does not go beyond ENERYG STAR	No cost assumed as based on ENERGY STAR	Important consideration as central Government

Policy name	Period in force	Description	Impact	Cost	Justification
					is largest single procurer of ICT products.
Power Management	2014-2030	Increased power management enabling requirements within EuP and ENERGY STAR specifications	Potential significant impacts on total energy consumption from imaging.	No cost assumed as technology already exists on most imaging products.	Could have significant impacts on total energy consumption without the need to change any product components.

Table 8: Test Standards

Test Standard name	Date in force	Description	Comments
ENERGY STAR® Qualified Imaging Equipment Typical Electricity Consumption (TEC) Test Procedure (thermal products only)	2007-2013 (Estimated)	Provides a means for manufacturers to test the Typical Electricity Consumption (TEC) of their equipment, arriving at a kWh/week figure. The methodology includes power testing in each power mode during a standardised use profile which is based on imaging speed and expected daily imaging output.	The use profile included in the ENERGY STAR TEC test procedure is widely understood to over represent actual usage.
ENERGY STAR® Qualified Imaging Equipment Operational Mode (OM) Test Procedure (non thermal products only)	2007-2013 (Estimated)	Provides a standardised method of measuring the sleep and off mode power consumption of Operational Mode (OM) (non-thermal) imaging products (as defined under ENERGY STAR). This test standard does not address active imaging or ready mode.	
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)	

3.1 Policy timeline

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

Table 9 Future policies & measures, Policy Scenario

Policy name	Current specification in force	2009	2010	2011	2012	2013	2014	2015	2016-2020	2021-2025	2026-2030
ENERGY STAR (future measures)	2007 (2009)					2013 Estimate			2017 Estimate	2021 and 2025 Estimate	2029 Estimate
EuP Implementing Measures (TEC, Ready and Sleep modes)	n/a				2012 Estimate				2016 and 2020 Estimate	2024 Estimate	2028 Estimate
Power Management Programme	n/a									2021 Est 97% PM Rate)	
Government Procurement	2009	Refreshed each year to reflect ENERGY STAR									

4 Efficiency

4.1 Summary

- This section provides details of the efficiency inputs assumed (for new sales i.e. not stock average).

- The tables below illustrate the expected ENERGY STAR coverage rate for a range of imaging products covered in this GSBN. Other imaging products follow a similar expected ENERGY STAR coverage rate pattern. The expected ENERGY STAR coverage rate 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 to the previous ENERGY STAR specification.

- Efficiency metrics for **thermal products are given in average TEC (kWh/week) values** for each speed category rather than as a formula (as provided by ENERGY STAR). MTP has taken this approach as it allows easier comparisons of total energy consumption between the different speed categories.

- Power consumption for **non-thermal products is communicated in operational mode (OM) power (W) values** and is based on the sleep mode of the products. It is not possible to use the on-ready mode as ENERGY STAR does not currently address this power mode.

- Details for the current metrics behind the ENERGY STAR programme can be found in the reference GSBN.

Table 10 Expected Non-Domestic Laser Printer (Mono ≤ 15ipm) ENERGY STAR Coverage Rates

	Specification Years						
Year	2007 Spec (Agreed)	2009 Spec (Agreed)	2013 Spec (Forecast)	2017 Spec (Forecast)	2021 Spec (Forecast)	2025 Spec (Forecast)	2029 Spec (Forecast)
2010	42%	37%	10%	6%	3%	2%	1%
2015	0%	41%	35%	10%	7%	5%	4%
2020	0%	0%	41%	35%	10%	8%	6%

	Specification Years						
Year	2007 Spec (Agreed)	2009 Spec (Agreed)	2013 Spec (Forecast)	2017 Spec (Forecast)	2021 Spec (Forecast)	2025 Spec (Forecast)	2029 Spec (Forecast)
2025	0%	0%	0%	35%	31%	26%	7%
2030	0%	0%	0%	0%	37%	34%	29%

Table 11 Expected Non-Domestic Laser MFD (Mono >26 ipm ≤ 68) ENERGY STAR Coverage Rates

	Specification Years						
Year	2007 Spec (Agreed)	2009 Spec (Agreed)	2013 Spec (Forecast)	2017 Spec (Forecast)	2021 Spec (Forecast)	2025 Spec (Forecast)	2029 Spec (Forecast)
2010	42%	33%	12%	7%	4%	2%	1%
2015	0%	45%	26%	11%	8%	5%	4%
2020	0%	0%	45%	28%	11%	9%	7%
2025	0%	0%	0%	44%	32%	15%	9%
2030	0%	0%	0%	0%	44%	36%	19%

Table 12 Expected Non-Domestic Inkjet Printer ENERGY STAR Coverage Rates

	Specification Years						
Year	2007 Spec (Agreed)	2009 Spec (Agreed)	2013 Spec (Forecast)	2017 Spec (Forecast)	2021 Spec (Forecast)	2025 Spec (Forecast)	2029 Spec (Forecast)
2010	46%	22%	13%	7%	6%	4%	2%
2015	0%	45%	23%	12%	9%	7%	5%
2020	0%	0%	46%	26%	12%	9%	7%
2025	0%	0%	0%	47%	32%	12%	10%
2030	0%	0%	0%	0%	47%	37%	17%

- The tables below illustrate the MTP assumed Policy scenario efficiency metrics in terms of TEC (thermal imaging products) and power (non-thermal (OM) imaging products) values. The tables also list the estimated equivalent ENERGY STAR specifications in each year that they are expected to be refreshed. The ENERGY STAR specifications are slightly lower than the Policy scenario to account for the fact that not all products on the market will be expected to meet the current ENERGY STAR specifications.

Table 13 Non-Domestic Laser Printer Energy Consumption – Policy Scenario

	Laser Printer			
	(Mono >15 ipm ≤ 40)		(Colour >32 ipm ≤ 58)	
	MTP Policy scenario	Estimated ENERGY STAR Specifications	MTP Policy scenario	Estimated ENERGY STAR Specifications
Year	TEC (kWh/week)	TEC (kWh/week)	TEC (kWh/week)	TEC (kWh/week)
2009	3.2		8.9	
2010	3.0		8.5	
2011	2.9		8.0	
2012	2.9		7.6	
2013	2.7	2.0	7.4	6.8
2014	2.5		7.3	
2015	2.3		7.1	
2016	2.1		6.9	
2017	2.0	1.9	6.8	6.4
2018	2.0		6.7	
2019	2.0		6.6	
2020	1.9		6.5	
2021	1.9	1.8	6.4	6.1
2022	1.9		6.3	
2023	1.9		6.2	
2024	1.8		6.1	
2025	1.8	1.7	6.1	5.8
2026	1.8		6.0	
2027	1.8		5.9	
2028	1.7		5.8	
2029	1.7	1.6	5.8	5.5
2030	1.7		5.7	

Table 14 Non-Domestic Laser MFD Energy Consumption – Policy Scenario

	Laser MFD			
	(Mono >26 ipm ≤ 68)		(Colour >26 ipm ≤62)	
	MTP Policy scenario	Estimated ENERGY STAR Specifications	MTP Policy scenario	Estimated ENERGY STAR Specifications
Year	TEC (kWh/week)	TEC (kWh/week)	TEC (kWh/week)	TEC (kWh/week)
2009	11.6		12.7	
2010	10.5		11.7	
2011	9.6		10.6	
2012	8.3		10.1	
2013	7.6	5.5	9.2	6.3
2014	7.0		8.4	
2015	6.3		7.5	
2016	5.7		6.6	
2017	5.6	5.3	6.5	6.0
2018	5.5		6.4	
2019	5.4		6.3	
2020	5.3		6.2	
2021	5.3	5.0	6.1	5.7
2022	5.2		6.0	
2023	5.1		5.9	
2024	5.1		5.9	
2025	5.0	4.7	5.8	5.4
2026	4.9		5.7	
2027	4.9		5.6	
2028	4.8		5.6	
2029	4.8	4.5	5.5	5.2
2030	4.7		5.4	

Table 15 Non-Domestic Photocopier Energy Consumption – Policy Scenario

	Photocopier			
	(Mono >15 ipm ≤ 40)		(Colour >32 ipm ≤ 58)	
	MTP Policy scenario	Estimated ENERGY STAR Specifications	MTP Policy scenario	Estimated ENERGY STAR Specifications
Year	TEC (kWh/week)	TEC (kWh/week)	TEC (kWh/week)	TEC (kWh/week)
2009	4.5		11.3	
2010	3.8		11.2	
2011	3.1		10.7	
2012	2.0		10.1	
2013	1.8	1.2	9.2	6.4
2014	1.6		8.3	
2015	1.4		7.5	
2016	1.2		6.6	
2017	1.2	1.2	6.5	6.4
2018	1.2		6.5	
2019	1.2		6.4	
2020	1.1		6.4	
2021	1.1	1.1	6.4	6.4
2022	1.1		6.4	
2023	1.1		6.4	
2024	1.1		6.4	
2025	1.1	1.0	6.4	6.4
2026	1.1		6.4	
2027	1.0		6.4	
2028	1.0		6.4	
2029	1.0	1.0	6.4	6.4
2030	1.0		6.4	

- The average TEC values of all thermal laser printer, laser MFDs and photocopiers are assumed to decrease under the policy scenario. This forecast decreases in TEC are heavily dependent on reductions in ENERGY STAR requirements which are expected to be refreshed every four years. EuP mandatory implementing measures are also expected to have a large influence by removing the least efficient products from the market place.
- MTP has not calculated average TEC values for laser printers in the over 58 images per minute (ipm) or for laser MFD's in the under 10 ipm speed brackets due to a lack of data.

Table 16 Non-Domestic Inkjet Printer and Inkjet MFD Power Consumption – Policy Scenario

	Inkjet Printer		Inkjet MFD	
	MTP Policy scenario	Estimated ENERGY STAR Specifications	MTP Policy scenario	Estimated ENERGY STAR Specifications
Year	Sleep mode power (W)	Sleep mode power (W)	Sleep mode power (W)	Sleep mode power (W)
2009	10.9		4.5	
2010	9.4		4.0	
2011	8.1		3.4	
2012	7.2		2.4	
2013	7.0	6.4	2.1	1.3
2014	6.9		1.9	
2015	6.8		1.6	
2016	6.6		1.4	
2017	6.5	6.1	1.4	1.3
2018	6.4		1.3	
2019	6.3		1.3	
2020	6.2		1.3	
2021	6.1	5.8	1.3	1.2
2022	6.0		1.3	
2023	6.0		1.3	
2024	5.9		1.2	
2025	5.8	5.5	1.2	1.1
2026	5.7		1.2	
2027	5.7		1.2	
2028	5.6		1.2	
2029	5.5	5.2	1.2	1.1
2030	5.4		1.1	

- The average sleep-mode of inkjet printers and MFD inkjets has fallen in recent years. It is expected that the sleep-mode power consumption of these devices will continue to decrease under the policy scenario. ENERGY STAR will be the main driver of change in sleep mode power for these products, with EuP removing the least efficient products from the EU market place.

Table 17 Non-Domestic Dot-matrix Printer Power Consumption – Policy Scenario

	Dot-matrix Printer	
	MTP Policy scenario	Estimated ENERGY STAR Specifications
Year	Sleep mode power (W)	Sleep mode power (W)
2009	13.1	
2010	12.8	
2011	12.5	
2012	12.2	
2013	11.9	10.2
2014	11.7	
2015	11.4	
2016	10.6	
2017	10.4	9.7
2018	10.2	
2019	10.1	
2020	9.9	
2021	9.8	9.2
2022	9.7	
2023	9.5	
2024	9.4	
2025	9.3	8.7
2026	9.2	
2027	9.1	
2028	8.9	
2029	8.8	8.3
2030	8.7	

- The average sleep-mode power requirements of dot-matrix printers are assumed to reduce each year until 2030. This reduction illustrates that the policies discussed earlier in this document could have a significant impact on the sleep mode of dot-matrix printer.

4.2 Data sources – efficiency & sales-weighting

Table 18 Efficiency data sources – all imaging products

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2009, 2013, 2017, 2021, 2025, 2029	Expert assumptions	2009	MTP Technical Expert	Expert assumptions required to collate power figures in Reference, Policy and BAT scenarios.	Medium

Note: Historic data sources are included in BN-NDICT IM02 – Reference Scenario

4.3 Methodology & key assumptions – efficiency & sales-weighting

- Methodology & key assumptions for historic data are included in BN-NDICT IM02 – Reference Scenario
- This section describes what has been done with the data listed in Table 18 along with a rationale for any key assumptions (in particular any expert judgements listed in Table 18) and detail of any background calculations behind the data points.
- Table 19 describes the process taken when developing the MTP Policy scenario.
    - 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 scenario.
    - Stage 3 details how the ENERGY STAR coverage rates were calculated.

4.3.1 Future data

Table 19 Extrapolation & background calculations – efficiency

Year	Methodology & assumptions
Stage 1: Policy Specification Value Calculations	
2009	ENERGY STAR specification value (TEC): This value is based on the average TEC value for products in the EU ENERGY STAR database which meet the ENERGY STAR Tier II specification. This value is calculated separately for each speed bracket and thermal imaging product type.
2013, 2017, 2021, 2025, 2029, 2033	ENERGY STAR specification value (TEC) and power (all modes)): 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 and the 5% values for each subsequent refresh period to reflect diminishing gains. The percentage decreases are based on

Year	Methodology & assumptions
	expert assumption.
2010–2012, 2014–2016, 2018–2020, 2022-2024, 2026–2028, 2030-2032	ENERGY STAR specification value (TEC) and power (all modes)): The values for each year are based on a straight line interpolation between the preceding year's and future years' ENERGY STAR specification value.
2009	ENERGY STAR specification value (off mode (W)): The ENERGY STAR Tier II specification value of 1W is used.
2009-2013	ENERGY STAR specification value (off mode (W)): 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.
2014 - 2030	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	All products - Government Procurement: Specifications in all years equal to that of ENERGY STAR.
2010 - 2030	All products - Government Procurement: Specifications are expected to take the same approach as in 2009 (i.e. match that years' ENERGY STAR specifications)
2012, 2016, 2020, 2024, 2028, 2032	EuP specification value (TEC, on-ready and sleep mode): 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	EuP specification value (TEC, on-ready and sleep mode): 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	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	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.
Stage 2: Policy scenario Calculation	
2009 - 2030	Overall Policy scenario: this overall Policy scenario brings together the results of all the individual Policy scenario calculations. The scenario is based on the minimum value that occurs in either the Reference scenario or in any of the individual Policy scenarios. If the minimum value occurs in the Reference scenario it shows that the package of policies is having no impact.
2009 - 2030	ENERGY STAR coverage rates (all products): see stage 3 below.
2012, 2016, 2020, 2024, 2028, 2032	ENERGY STAR Policy scenario: Values (On-Ready (W), sleep mode (W) and TEC (kWh)) 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	ENERGY STAR Policy scenario: Values for (On-Ready (W), sleep mode (W) and TEC (kWh)): 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 scenario value.
2012	ENERGY STAR Policy scenario (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	ENERGY STAR Policy scenario (off mode (W)): The values for each year are

Year	Methodology & assumptions
	based on a straight line interpolation between the preceding year's and future year's ENERGY STAR value.
2010 - 2030	EuP coverage rates (all products): the percentage of products on the market meeting the EuP requirements is assumed to be 100% to ensure legal compliance.
2009 - 2011	EuP Policy scenario (Thermal products and all power modes): 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 scenario in these years does not fall below the 2012 implementing measure.
2012, 2016, 2020, 2024, 2028, 2032	EuP Policy scenario: Values (On-Ready (W), sleep mode (W) and TEC (kWh)) are based on a weighted percentage of products which are assumed to meet the EuP specification with the remaining percentage of products meeting the ENERGY STAR specification values.
2013–2015, 2017–2019, 2021–2023, 2025-2027, 2029–2031	EuP Policy scenario: Values for (On-Ready (W), sleep mode (W) and TEC (kWh)): The values for each year are based on a straight line interpolation between the preceding year's and future year's EuP Policy scenario value.
2010 and 2013	EuP Policy scenario (off mode (W)): Includes the EuP Implementing Measures as maximum power consumption values in 2010 and 2013.
2009 - 2030	Government Procurement Policy scenario: Assumes that 20% of market is Government procurement and contributes to the uptake of ENERGY STAR coverage in the marketplace. Not calculated separately as ENERGY STAR coverage rates already assumed to be impacted by Government Procurement.
2014 -2030	All Policy scenarios (off mode (W)): All values based on the 2013 EuP Implementing Measure of 0.5W.
Stage 3: Efficiency Sales Weighting	
2009	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	Sales weighting for ENERGY STAR coverage graphs: Coverage rates for 2009 against assumed 2013, 2017, 2021, 2025 and 2029 ENERGY STAR specification values are assumed.
2012, 2016, 2020, 2024, 2028	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	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,	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.

Year	Methodology & assumptions
2021-2027, 2025-2030	
2010, 2015, 2020, 2025 and 2030	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 & sales-weighting

Table 20 Data issues – efficiency

Issue/risk	Approach taken/rationale
ENERGY STAR coverage rates are subject to a number of assumptions which are largely based on observations in the current market. Actual future ENERGY STAR coverage rates could vary significantly from these assumptions.	MTP has assumed that future coverage rates for products meeting ENERGY STAR specifications will be similar to coverage rates seen in the current market. MTP will review these assumptions on an annual basis.
MTP have included a number of assumptions about the possible future efficiency of imaging products. Given the number of assumptions required, MTP cannot offer any guarantee about the future specification levels or market coverage of products against each policy.	MTP has made a number of informed assumptions about the possible future efficiency values of imaging products. These assumptions will be reviewed on an annual basis.

4.5 Confidence level – efficiency & sales-weighting

- A database of product information is used to estimate what could happen in future years to product energy efficiency. The fast moving nature of the ICT industry could result in these estimates needing to change considerably in future years.

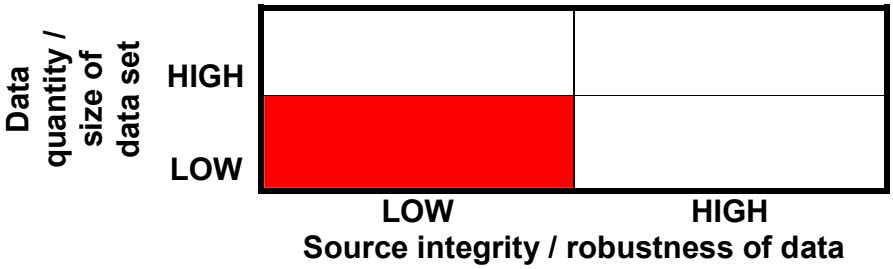

Figure 2 Confidence indicator for efficiency data

5 Usage

5.1 Summary

- This section of the GSBN details the usage assumptions included for the **non-thermal imaging products.**

- Thermal products are included under the TEC approach and therefore their usage is integral to the efficiency metrics section and cannot be drawn out in detail separately. The TEC approach under ENERGY STAR for thermal imaging products is based on an expected use profile (based on speed and colour) for a week's use. The TEC use profile under ENERGY STAR reflects an assumed usage pattern across all power modes in a non-domestic environment. MTP have "downgraded" the TEC use profile to better reflect assumed usage of thermal imaging products in the domestic environment.

- Two sets of use profiles are developed for non-thermal imaging products. 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 GSBN 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 21 Average Usage – Inkjet Printers and MFD Inkjet

	Inkjet Printer and MFD Inkjet				
	Policy (Use Hours/Year				Power Management Enabling Rates
Year	On-Ready	Sleep	Off	Off-Unplugged	%
2010	857	1,183	6,720	-	83
2020	736	1,304	6,720	-	92
2030	666	1,374	6,720	-	97

Table 22 Average Usage – Dot-matrix printer

	Dot-matrix Printer				
	Policy (Use Hours/Year				Power Management Enabling Rates
Year	On-Ready	Sleep	Off	Off-Unplugged	%
2010	289	1751	6303	417	100
2020	289	1751	6303	417	100
2030	289	1751	6303	417	100

- The average on-ready use hours of inkjet printers and MFD inkjets under the Policy Scenario are expected to fall in the future as more products are power managed. An increase in power management enabling will also see the sleep mode time increase as on-ready time is reduced.

- Power management enabling rates within the Policy Scenario are assumed to increase as a result of a new ENERGY STAR and EuP requirements increasing rates to 97% by 2021. In contrast power management rates in the reference scenario are only expected to remain at 80% into the future due to the lack of additional ENERGY STAR and EuP requirements focussing on power management.

- Power management enabling rates and average use times for the dot-matrix printers are expected to stay unchanged as products are always considered to be power managed as the basic nature of the products means that when they are not printing they are always in a sleep or off mode.

5.2 Data sources – usage

Table 23 Usage data sources (enabling rates) – Non-thermal Imaging Products

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2009, 2021	Expert Assumptions	2009	MTP Technical Expert	Expert assumption required to develop use profiles in each year.	Medium

5.3 Methodology & key assumptions – usage

- This section describes what has been done with the data listed in Table 23 along with a rationale for any key assumptions (in particular any expert judgements listed in Table 23) and detail of any background calculations behind the data points.

5.3.1 Future analysis

Table 24 Extrapolation & background calculations – usage data

Year	Methodology & assumptions
2009-2030	Dot-matrix printers –100% enabling rate is assumed as the products are considered to enter a sleep mode as soon as active printing is complete.
2009 - 2020	All other non-thermal printers – power management enabling rates are based on an interpolation between the 2008 and 2021 values.
2021	Power management enabling rates for non-thermal products assumed to be 97% as new ENERGY STAR and EuP requirements are implemented. ENERGY STAR and EuP requirements could focus on identifying ways to ensure power management functionality does not impact product function and therefore can be enabled on every product.
2022 - 2030	All non-thermal printers - power management enabling rates equal to 2021 assumption

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 25 Data issues – usage

Issue/risk	Approach taken/rationale
Power management enabling rates can have a large impact of overall use profiles. Over or under-estimation of power management enabling rates could have a consequentially large impact on overall use hours.	MTP has included a number of expert assumptions which estimate power management enabling rates. MTP can continue to evaluate new use profile data.

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 in the power management enabling rates are relatively low, especially for future years, due to the large potential for users to disable functionality.

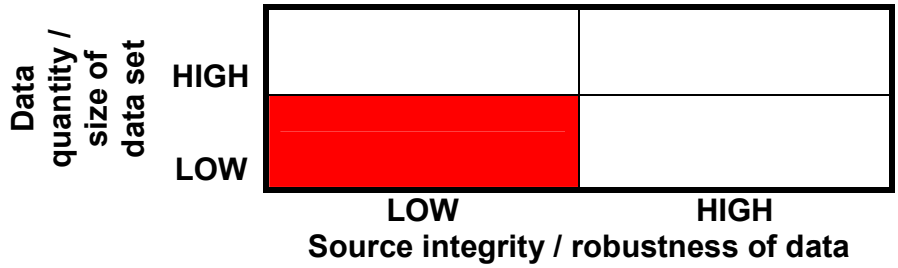

Figure 3 Confidence indicator for usage data

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 fee or costs attached.
- All of the measures suggested are either within the bounds of existing technology already in use on imaging products, or future refinements of those existing technologies.
- Cost data is commercially sensitive and not discussed openly within industry – for this reason, all cost data is based on expert opinion from within the MTP team.
- Costs to consumers have only been assumed for the future EuP TEC, on-ready and sleep mode requirements. Other policies have not been costed due to low coverage rates or their voluntary nature.
- 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 26 Summary costs - undiscounted (real)

	Undiscounted costs £'s (£2009)					
Year	Inkjet Printer	Laser Printer	MFD Inkjet	MFD Laser	Dot-matrix Printer	Total
2011	175,498	762,158	1,316,234	1,076,240	18,922	1,095,161
2015	98,973	602,018	1,435,026	689,637	11,544	701,181
2019	109,618	659,490	1,589,376	976,301	8,497	984,797
2023	112,624	716,861	1,632,954	1,061,233	5,450	1,066,683
2027	110,818	774,210	1,606,778	1,146,132	2,402	1,148,534

6.2 Data sources – cost

Table 27 Cost data sources

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2011, 2015, 2019, 2023, 2029	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 cost data available	Low

6.3 Methodology & key assumptions – cost

- This section describes what has been done with the data listed in Table 27 along with a rationale for any key assumptions (in particular any expert judgements listed in Table 27) and detail of any background calculations behind the data points.
- This product group encompasses a vast range of devices. The policy scenario assumes that power supplies will need to be more energy efficient. Because of the variety of products and applications the costs of manufacturing compliance with efficiency requirements are assumed to vary from £0.50 for simple products like inkjet and photo printers, up to £5 for complex multifunction devices and high speed lasers (Most power supplies are less efficient when operated at partial load than they are at full load[5]. To compensate for this, it has been assumed that where an imaging device has a single function, the change to the power supply will be relatively simple as it will affect the full load power consumption. However for MFDs, where the power supply has to be engineered to power multiple functions at once, the reality is that in normal operation, the user only uses one function at a time. This makes the design of the power supply more complex to achieve good efficiencies at partial load).
- It is assumed that MFD devices will incorporate an light emitting diode (LED) scanner lamp to eliminate the time taken for a conventional scanner lamp to warm-up. It is assumed that laser MFD's will require a heavier duty lamp than inkjet MFDs, and costs of compliance have been adjusted to recognise this - £5 for laser MFD and £2 for inkjet MFD.

[5] "Power Supplies: A Hidden Opportunity for Energy Savings" – NRDC, May22, 2002

- For all thermal devices, it is assumed that drum heaters will be changed to designs which warm up from standby more quickly (e.g. internal or ceramic heaters). Cost of manufacturing compliance is estimated at £2.

- Costs have only been assumed for the future EuP TEC, on-ready and sleep mode requirements. Other policies have not been costed due to low coverage rates.

- 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 implementation year is therefore assumed the same, but can be updated in any future studies.

- Estimated costs shown are to the consumer.

6.3.1 Future analysis

Table 28 Extrapolation & background calculations – cost

Year	Methodology & assumptions
2011, 2015, 2019, 2023, 2027	Multiple rounds of EuP specifications assigned to imaging equipment. Measures based on previous ENERGY STAR specification For all inkjet and laser printers: • More energy efficient power supply – assumed £0.50 • More energy efficient motors – assumed £0.50 For dot-matrix printers • More energy efficient power supply – assumed £2.00 • More energy efficient motors – assumed £1.00 For laser MFDs • More energy efficient power supply – assumed £5.00 • More energy efficient motors – assumed £0.50 • More efficient LED scanner – assumed £5.00 For Inkjet MFDs • More energy efficient power supply – assumed £5.00 • More energy efficient motors – assumed £0.50 • More efficient LED scanner – assumed £2.00 In addition for laser printers and laser MFDs • More efficient drum heater – assumed £2.00 • Lower temperature toner – assumed £3.00
2011, 2015, 2019, 2023, 2027	It is assumed that each EuP specification will be the same as the voluntary ENERGY STAR 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 For inkjet printers 2011 12.5% 2015 5.5% 2019 5.5% 2023 5.5%

Year	Methodology & assumptions
	2027 5.5% For photo printers 2011 12.5% 2015 2.9% 2019 2.9% 2023 2.9% 2027 2.9% For MFD inkjet 2011 12.5% 2015 12.5% 2019 12.5% 2023 12.5% 2027 12.5% Laser printers and laser MFD's are subdivided by print speed and the detail is given in Table 29and Table 30
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

Table 29 percentage of laser printers requiring adaptation in EuP specification year

	Percentage Products Requiring Adaptation to Meet EuP					
Year	mono ≤ 15 ipm	mono 15 < x ≤ 40 ipm	mono 40 < x ≤ 82 ipm	mono > 82 ipm	colour ≤ 32 ipm	colour 32 < x ≤ 58 ipm
2011	5.0%	14.5%	13.0%	12.7%	10.4%	12.9%
2015	3.6%	10.4%	9.3%	9.1%	7.5%	9.2%
2019	3.6%	10.4%	9.3%	9.1%	7.5%	9.2%
2023	3.6%	10.4%	9.3%	9.1%	7.5%	9.2%
2027	3.6%	10.4%	9.3%	9.1%	7.5%	9.2%

Table 30 percentage of laser MFD requiring adaptation in EuP specification year

	Percentage Products Requiring Adaptation to Meet EuP					
Year	mono 10 < ipm ≤ 26	mono 26< ipm ≤ 68	mono > 68 ipm	colour ≤26 ipm	colour 26 < ipm ≤62	colour >62 ipm
2011	12.5%	12.5%	5.0%	12.5%	12.5%	12.5%
2015	7.9%	6.9%	3.6%	6.3%	8.3%	4.6%
2019	9.4%	9.4%	3.6%	9.4%	9.4%	9.4%
2023	9.4%	9.4%	3.6%	9.4%	9.4%	9.4%

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.

- Section also to list those data sources collected but not used in the model and the rationale for their exclusion.

Table 31 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 the MTP. These assumptions have been extrapolated linearly into the future. MTP will review on an annual basis

6.5 Confidence level – cost

- Cost data for changing certain components of imaging products is difficult to source. Any assumptions are highly dependent on assumed future specification levels and potential energy savings from each component change.

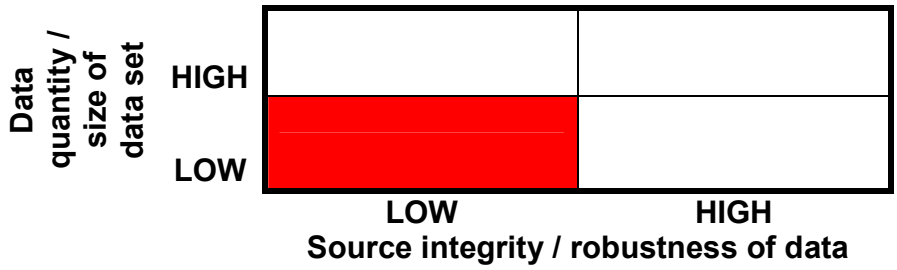

Figure 4 Confidence indicator for cost data

7 Other issues

- There are also environmental impacts associated with the use of consumables for imaging products.

Related MTP information

- BN-NDICT IM01: Government Standards Evidence Base 2009 – Key Inputs, Non Domestic Imaging Products
- BN-NDICT IM02: Government Standards Evidence Base 2009 – Reference Scenario, Non Domestic Imaging Products
- BN-NDICT IM04: Government Standards Evidence Base 2009 – Best Available Technology (BAT) Scenario, Non Domestic Imaging Products
- BN-DICT IM01: Government Standards Evidence Base 2009 – Key Inputs, Domestic Imaging Products
- BN-DICT IM02: Government Standards Evidence Base 2009 – Reference Scenario, Domestic Imaging Products
- BN-DICT IM03: Government Standards Evidence Base 2009 – Policy Scenario, Domestic Imaging Products
- BN-DICT IM04: Government Standards Evidence Base 2009 – Best Available Technology (BAT) Scenario, Domestic Imaging Products
- BN-NDICT KO01: Government Standards Evidence Base 2009 – Key Outputs, Non Domestic ICT
- BN-DICT KO01: Government Standards Evidence Base 2009 – Key Outputs, Domestic IICT

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**