

# BN-NDICT MON01: Non-Domestic Monitors Government Standards Evidence Base 2009: Key Inputs

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.

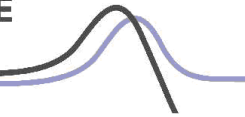
## 1 Introduction

- The aim of this Briefing Note is to provide details and reference sources of the underlying data in the model, along with the key assumptions used in the model.
- There are three main sections to this Briefing Note, corresponding to the main variables of the MTP modelling approach:
  - Ownership & stock
  - Sales
  - Usage & lifespan
- Each section also includes an indication of the overall confidence in the dataset, to provide a sense of the robustness of the model.

### 1.1 Product definition

- This Government Standard Briefing Note (GSBN) covers non-domestic monitors. The following definition of monitors is adapted from the EuP Preparatory study on PCs and monitors<sup>1</sup>:
- A commercially-available, electronic product with a display screen and its associated electronics encased in a single housing that is capable of displaying output information from a computer via one or more inputs, such as VGA, DVI, and/or IEEE 1394. The monitor usually relies upon a liquid crystal display (LCD) or less frequently cathode-ray tube (CRT) or other display devices such as plasma. This definition is

<sup>1</sup> 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)

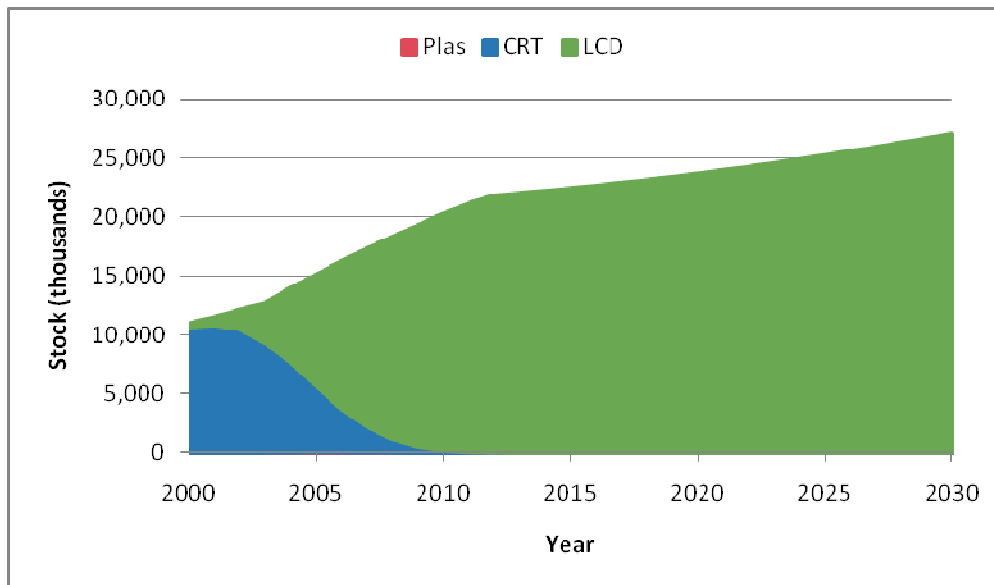


intended primarily to cover standard monitors designed for use with personal computers.

- The computer monitors included in this definition must have a viewable diagonal screen size greater than 9 inches and must be capable of being powered by a separate AC wall outlet or a battery unit that is sold with an AC adapter.
- Computer monitors with a tuner/receiver may be covered by this study as long as they are marketed and sold to consumers as computer monitors (i.e. focusing on computer monitor as the primary function) or as dual-function computer monitors and televisions. However, products with a tuner/receiver and computer capability that are marketed and sold as televisions are not included in the scope of this definition.

## 2 Ownership & stock

### 2.1 Summary



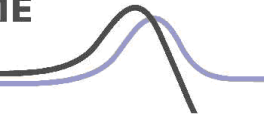
**Figure 1 – Total Non-Domestic Monitor Stock**

**Table 1 - Total Non-Domestic Monitor stock**

Year	Stock ('000)

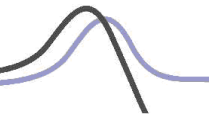
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	<b>CRT monitor</b>	<b>LCD monitor</b>	<b>Plasma monitor</b>	<b>Total Monitors</b>
2009	529	18,730	19	19,278
2010	213	20,033	12	20,259
2020	0	23,676	3	23,679
2030	0	27,089	0	27,089

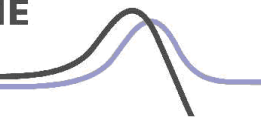
- Total monitor stock is expected to increase from 2009 onwards. All of this increase in stock will come from LCD monitors with the stock of both CRT and plasma monitors decreasing into the future. Stock of monitors is expected to increase primarily as a result of increased usage of external monitors with laptop PCs.



## 2.2 Data sources – ownership & stock

**Table 2 - Ownership & stock data sources**

<b>Year</b>	<b>Reference</b>	<b>Reference date</b>	<b>Author</b>	<b>Justification</b>	<b>Confidence in sources (High/Low)</b>
2000 - 2008	GFK Hitlist Data	2008	GFK	Market data sourced from a leading market research organisation.	High
1960, 1990, 1998, 2004, 2030	Expert Assumption	2009	MTP Technical Expert	Assumptions required for past and future stock of monitors.	Medium



## 2.3 Methodology & key assumptions – ownership & stock

- This section describes what has been done with the data listed in Table 2 along with a rationale for any key assumptions (in particular any expert judgements listed in Table 2) and detail of any background calculations behind the data points.

### 2.3.1 Historic data

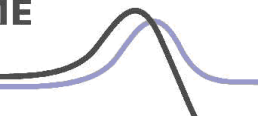
**Table 3 Interpolation & background calculations – ownership & stock**

Year	Methodology & assumptions
	<b>All monitors (total stock)</b>
1960	Total stock of monitor: equal to total stock of desktop PCs with an additional amount added for use as external monitors with laptop PCs. The number of monitors assumed to be used with laptop PCs varies according to years as detailed below. MTP models cover the years 1960 to 2030. Stock is only calculated from the years when the products first arrive on the market. MTP includes some assumptions back to 1960 for completeness and flexibility in the models. Based on an expert assumption in light of no further information being available.
1961 -2008	Total stock of monitor: follows same approach as in 1960
	<b>All monitors (laptop related stock)</b>
1960-1989	Assumed that 0% of laptop PCs will use an external monitor.
1990	Assumed that 25% of laptop PCs will use an external monitor.
1990	Total additional stock calculated by multiplying the laptop stock figures by the assumed percentage of external monitors.
1991 - 2008	Based on a straight line interpolation between the 1990 and 2030 (discussed below) values.
1991 - 2008	Total additional stock calculated using the same approach as in 1990.
	<b>All monitors (monitor type distribution)</b>
1998	Assumed that 100% of monitors are CRT. Based on an expert assumption.
1999	Based on a straight line interpolation between the 1998 and 2000 values.
2000-2008	Percentage of each type of monitor (CRT, LCD and plasma) based on distribution of monitor types in GfK data.
	<b>CRT monitors</b>
1984	CRT monitor – assumed to be the first year of stock.
	<b>LCD monitors</b>
2002	LCD monitor – assumed to be the first year of stock.
	<b>Plasma monitors</b>
2003	Plasma monitor - assumed to be the first year of stock.

### 2.3.2 Future analysis

**Table 4 Extrapolation & background calculations – ownership & stock**

Year	Methodology & assumptions
	<b>All monitors (total stock)</b>
2009-2030	Total stock of monitor: follows same approach as in 1960
	<b>All monitors (laptop related stock)</b>
2009 - 2029	Percentage continues straight line interpolation between the 2004 and 2030 values.
2030	Assumed that 80% of laptop PCs will use an external monitor.
	<b>CRT monitors</b>



Year	Methodology & assumptions
2009	Assumed that no further CRT sales occur. Based on an expert assumption with relevance to low (0.5%) CRT sales figure included in the 2008 GfK data.
2010-2030	Distribution of monitor type: CRT percentage assumed to be equal to the 2009 value at 0%.
	<b>LCD monitors</b>
2009	LCD monitor stock percentage equal to 100% minus percentage of CRT and plasma monitors.
2010-2030	Distribution of monitor type: LCD monitor stock calculated using the approach set out for 2009.
	<b>Plasma monitors</b>
2009	Distribution of plasma monitors based on a straight line interpolation between the 2008 and 2024 values.
2024	Assumed that no further plasma monitor sales occur. Based on an expert assumption with relevance to low (0.04%) CRT sales figure included in the 2008 GfK data.
2025 - 2030	Distribution of plasma monitors assumed to be the same as in 2024.

## 2.4 Data issues – ownership & stock

- 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 5 Data issues – ownership & stock**

Issue/risk	Approach taken/rationale
The ICT market changes rapidly. A sudden change in the ICT market can have large impacts on sales, and hence stock, of particular products. For example, stock and sales of monitors could quickly shift to another screen type e.g. organic light emitting diode (OLED) if sufficient advantages are present.	MTP takes account of probable changes in future sales within the current product types covered. MTP does not currently model OLED screen monitors due to uncertainties around when they will arrive on the market in significant numbers. MTP expects OLED displays to first enter the television market in significant numbers and then transfer into the monitor market. These assumptions are reviewed on an annual basis
Future stock levels of monitors to be used as external displays for laptop PCs are uncertain.	MTP reviews the sales and stock of monitors and compares against PC sales.

## 2.5 Confidence level – ownership & stock

- This section provides an indication of overall confidence in the data set (i.e. data points, calculations, interpolation and projections).
- Past and current stock levels are likely to be comparatively accurate. Future estimates of stock are based on assumptions and so become less accurate further into the future.

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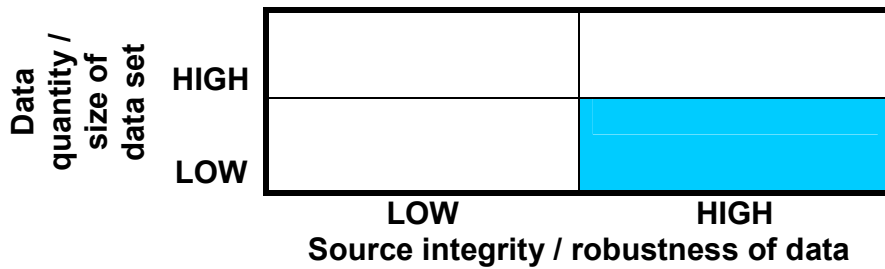


Figure 2 Confidence indicator for ownership data

## 3 Sales

### 3.1 Summary

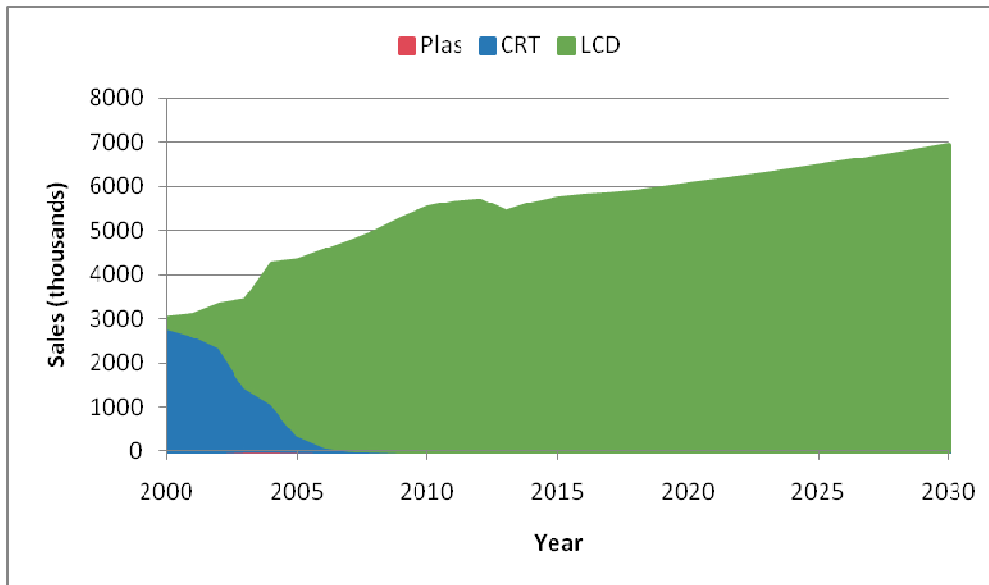
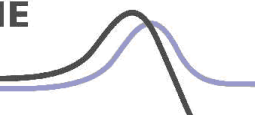


Figure 3 – Total Non-Domestic Monitor Sales

Table 6 - Total monitor Sales

Year	Sales ('000)			
	CRT monitor	LCD monitor	Plasma monitor	Total monitors
2009	0	5,252	2	5,254
2010	0	5,497	1	5,498
2020	0	6,032	0	6,032
2030	0	6,933	0	6,933



- Sales of non-domestic monitors are expected to continue increasing in the future predominately as external displays for laptop PCs become more popular. Nearly all future sales of monitors will be LCD monitors. Sudden changes in the sales graph are caused by interactions between the sales volumes of the different monitor types.

## 3.2 Data sources - sales

- This model is a stock-based model, which calculates sales automatically using the stock projection and the product lifetime. Real sales data is put in as a check only, to help evaluate the output sales calculated from the model. This data series is usually incomplete. The sales shown in the previous charts and tables were to illustrate the full generated (rather than input) sales data series

**Table 7 Sales data sources**

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2000 - 2008	GfK Hitlist Data	2000 - 2008	GfK	Best Data Available	High

## 3.3 Methodology & key assumptions - sales

- This section describes what has been done with the data listed in Table 7 along with a rationale for any key assumptions (in particular any expert judgements listed in Table 7) and detail of any background calculations behind the data points

### 3.3.1 Historic data

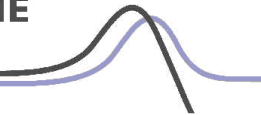
**Table 8 Interpolation & background calculations – sales data**

Year	Methodology & assumptions
All years	The MTP model is a stock-based model, which calculates sales automatically using a stock projection, the product lifetime and a stock churn calculation to account for products purchased in previous years gradually leaving stock. Real sales data is put in as a check only, to help evaluate the output sales from the model. This data series is usually incomplete.
2000 - 2008	GfK data used as input sales figures to models as no other evidence available. This is a potential issue for the non-domestic sector as GfK data is primarily focussed on the domestic market. Sales are only used as a check however to help evaluate output sales from the model

### 3.3.2 Future analysis

**Table 9 Extrapolation & background calculations – sales data**

Year	Methodology & assumptions
2009 -2030	The MTP model is a stock-based model, which calculates sales automatically using a stock projection, the product lifetime and a stock churn calculation to account for products purchased in previous years gradually leaving stock. Real sales data is put in as a check only, to help evaluate the output sales from the model. This data series is usually incomplete.



### 3.4 Data issues - sales

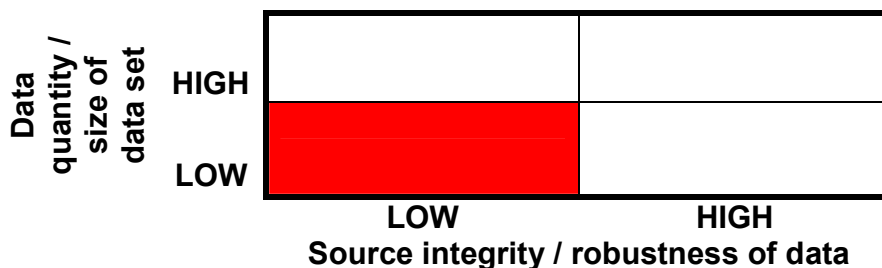
- This section flags any areas of uncertainty, both in general and for specific data points, along with a description of how this has been dealt with in the model

**Table 10 Data issues - sales**

Issue/risk	Approach taken/rationale
The ICT market changes rapidly. A sudden change in the ICT market can have large impacts on sales and hence stock of particular products. For example, stock and sales of monitors could quickly shift to another screen type (e.g. OLED) if sufficient advantages are present.	MTP takes account of probable changes in future sales within the current product types covered. MTP does not currently model OLED screen monitors due to uncertainties around when they will arrive on the market in significant numbers. MTP expects OLED displays to first enter the television market in significant numbers and then transfer into the monitor market. These assumptions are reviewed on an annual basis.
Future sales levels of monitors to be used as external displays for laptop PCs are uncertain.	MTP will continually review the sales and stock of monitors and compare against PC sales.
GfK data has been used for input sales data. GfK data is primarily focussed on domestic sales.	MTP has only used the GfK data as input sales for helping to evaluate the output sales from the models – model is stock based, which reduces the risk of errors being introduced via sales data.

### 3.5 Confidence level

- This section provides an indication of overall confidence in the data set (i.e. data points, interpolation and projections)
- There is a large amount of uncertainty in past and current sales of non-domestic monitors. Future estimates of sales are based on assumptions and so become less accurate further into the future.

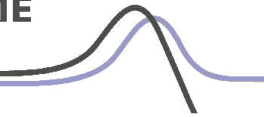


**Figure 4 Confidence indicator for sales data**

## 4 Usage & lifespan

### 4.1 Summary

- Two sets of use profiles are developed for CRT and LCD monitors. The first use profile is based on a situation where no power management is enabled and the second where power management is enabled. The non-enabled power managed



use profile is the same as the enabled use profile but with the sleep time added to the on-idle time.

- An “enabling rate” is used as a weighting factor between these two use profiles to arrive at overall use profile for each product. No enabling rates are developed for plasma monitors as it is assumed that these types of monitors do not have a sleep mode. Details of enabling rates can be seen in each scenario GSN.
- Enabling rates change in each scenario, as there is scope for improvement via best practice or policy measures.
- The table below shows the **fully enabled use profile** (i.e. what 100% enabling would look like). The non-power managed use profile is calculated by adding the sleep mode time to the on-ready time.

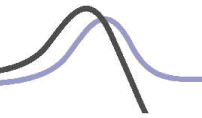
**Table 11 - Usage CRT & LCD monitors**

Year	CRT and LCD Monitor				Plasma Monitors			
	(Use Hours/Year)				(Use Hours/Year)			
	On-Active	Sleep	Off	Off-Unplugged	On-Active	Sleep	Off	Off-Unplugged
2008	1,356	684	6,431	289	1,920	-	6,840	-
2010	1,356	684	6,431	289	1,920	-	6,840	-
2020	1,356	684	6,431	289	1,920	-	6,840	-
2030	1,356	684	6,431	289	1,920	-	6,840	-

**Table 12 Monitor Lifespans**

	CRT	LCD	Plasma
Year	Years	Years	Years
2008	4.0	4.0	4.0
2010	4.0	4.0	4.0
2020	4.0	4.0	4.0
2030	4.0	4.0	4.0

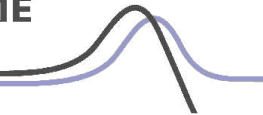
- Non-domestic monitor use time is expected to remain constant in the future due to limitations on office hours dictating maximum use times. Lifespan is expected to remain constant into the future as advances in monitor technology continue to encourage regular upgrading.



## 4.2 Data sources – usage & lifespan

**Table 13 – Usage & lifespan data sources**

<b>Year</b>	<b>Reference</b>	<b>Reference date</b>	<b>Author</b>	<b>Justification</b>	<b>Confidence in sources (High/Low)</b>
2008	Fraunhofer	2006	Fraunhofer	Best data available	Medium
2008	ENERGY STAR Use profiles	2005 and 2006	ENERGY STAR	Best data available	Medium
2008	Lawrence Berkely National Laboratories (LBNL) use profiles	2005	LBNL	Best data available	Medium
2008	TIAX	2006	TIAX	Best data available	Medium
2008, 2009, 2014, 2020	Expert Assumptions	All	MTP Technical Expert	Required expert assumptions to collate external use profiles	Medium



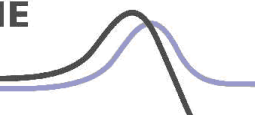
## 4.3 Methodology & key assumptions – usage & lifespan

- This section describes what has been done with the data listed in Table 13 along with a rationale for any key assumptions (in particular any expert judgements listed in Table 13) and detail of any background calculations behind the data points

### 4.3.1 Historic data

**Table 14 Interpolation & background calculations – usage & lifespan data**

Year	Methodology & assumptions
	<b>General monitor usage</b>
1960 - 2008	CRT and LCD monitors – 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. MTP models start in 1960 and this year is used as the base year but no use of products occurs until the first date they are assumed to have first arrived on the market.
1960 – 2008	Plasma monitor has one use profile as it is assumed that these types of monitors have no power management functionality. Based on expert opinion.
1960-2007	All monitors – annual use profiles developed in the same way as in 2008.
1960 - 2007	All scenarios: CRT and LCD monitor non-enabled use profile based on same approach used for 2008.
2008	All monitors – daily use profiles as detailed above are multiplied by 240 days to arrive at annual use profiles for on-active and sleep mode (no sleep mode for plasma monitors). Off-mode daily usage profiles are multiplied by 365 days.
2008	All scenarios: CRT and LCD monitor non-enabled use profile are the same as the enabled use profile but with the sleep time added to the on-idle time. This is to account for the fact that non-power managed enabled products will not spend any time in sleep mode. Assumptions based on expert opinion as no further information available.
	<b>On active mode:</b>
1960 - 2007	CRT, LCD and plasma monitor on-active mode use profiles based on same assumption as in 2008.
1960 - 2007	Plasma monitor on-active time is the same as in 2008.
2008	CRT, LCD and plasma monitor on-active mode use profiles based on 90% of the desktop PC use profile to account time when individuals are away from desks and therefore monitors not in use (on active represents when the monitor is fully on, regardless of whether or not it is in active use by the user).
2008	Plasma monitor on-active time is 8 hours as it is assumed these products are used for display purposes rather than as desk based products.
	<b>Sleep mode:</b>
1960 - 2007	CRT and LCD monitor sleep mode use profiles calculated in the same way as in 2008.
2008	CRT and LCD monitor sleep mode use profiles based on desktop PC sleep mode time plus the difference between the monitor and desktop on-active time. This additional amount accounts for time spent away from desks and therefore monitors not in use.
	<b>Off / unplugged modes:</b>
1960 - 2007	CRT and LCD monitor off mode and off unplugged use profiles calculated in the same way as in 2008.



Year	Methodology & assumptions
1960 - 2007	Plasma monitor off mode assumed to be the same way as in 2008.
2008	CRT and LCD monitor off mode and off unplugged use profiles assumed to be the same as desktop PCs. Based on an expert assumption as no further data available.
2008	Plasma monitor off mode assumed to be 16 hours.
	<b>Lifetime:</b>
2008	Lifetime of all monitor types assumed to be 4.0 years to match desktop PC lifetime.
1960 – 2007	Lifetime assumed to be the same as in 2008

## 4.3.2 Future analysis

**Table 15 Extrapolation & background calculations – usage & lifespan data**

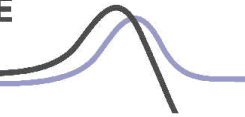
Year	Methodology & assumptions
	<b>Usage</b>
2009 - 2030	CRT, LCD and plasma monitor use profiles (all power modes) based on same approach as in 2008.
	<b>Lifetime</b>
2009 - 2030	Lifetime of all monitor types assumed to be the same as in 2008.

## 4.4 Data issues – usage & lifespan

- 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 16 Data issues – usage & lifespan**

Issue/risk	Approach taken/rationale
Estimates of the time ICT products spend in each power mode varies considerably from source to source. The amount of time products spend in “on-modes” has a large impact on total energy consumption calculations. Large divergences in estimates suggest that knowledge in this area needs to be improved.	MTP has collated the most widely known use profiles and applied expert assumptions to derive expected use profiles for ICT products in the UK. MTP will continue to evaluate new use profile data.
The ICT industry can change rapidly. Rapid changes such as uptake of new technologies can have large impacts on the use of products as organisations take up new or altered practices.	MTP attempts to model the most likely set of use profiles to reflect current product usage and take possible future uses into consideration.
Lifetime data may vary considerably. Likelihood that monitors have a second lifetime after first 4.0 years (i.e. they are passed on to be used in another environment).	It is recognised that some additional energy consumption may be derived from monitors during second lifetimes. MTP assumes that use from these products will be minimal in the UK as most consumers would purchase a new monitor, and the number of monitors in use will be closely linked to the number of laptop and desktop PCs in use.



## 4.5 Confidence level – usage & lifespan

- This section provides an indication of overall confidence in the data set (i.e. data points, interpolation and projections).
- Use profile figures vary considerably between published sources. Calculating simple averages of the published figures resulted in unrealistic use profiles. For this reason, MTP needed to make some assumptions surrounding expected use profiles.

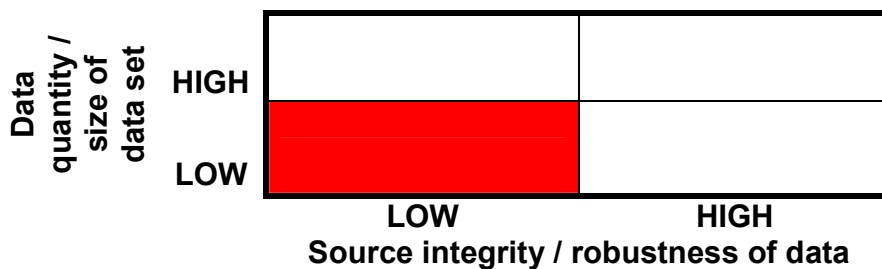
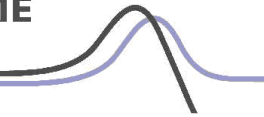


Figure 5 Confidence indicator for usage & lifespan data

### Related MTP information

- BN-NDICT MON02: Government Standards Evidence Base 2009 – Reference Scenario, Non Domestic Monitors
- BN-NDICT MON03: Government Standards Evidence Base 2009 – Policy Scenario, Non Domestic Monitors
- BN-NDICT MON04: Government Standards Evidence Base 2009 – Best Available Technology (BAT) Scenario, Non Domestic Monitors
- BN-DICT MON01: Government Standards Evidence Base 2009 – Key Inputs, Domestic Monitors
- BN-DICT MON02: Government Standards Evidence Base 2009 – Reference Scenario, Domestic Monitors
- BN-DICT MON03: Government Standards Evidence Base 2009 – Policy Scenario, Domestic Monitors
- BN-DICT MON04: Government Standards Evidence Base 2009 – Best Available Technology (BAT) Scenario, Domestic Monitors
- 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](mailto: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](http://www.mtprog.com)