MARKET TRANSFORMATION PROGRAMME
Supporting UK Government policy on sustainable products

Disposal of TV equipment: possible impact of digital switchover

Project Report
January 2007

Authors: Matthew Armishaw
Sarah Winne
Mike Blanch

www.mtprog.com

Executive summary

In September 2005, the Culture Secretary, Tessa Jowell, announced the go-ahead for the switch to digital-only television in the UK. Under the 'digital switchover' policy, the UK will move to digital television and the analogue terrestrial signals will be switched off ITV region by ITV region between 2008 and 2012. Digital switchover policy is the responsibility of the Department of Trade and Industry (DTI) and the Department for Culture, Media and Sport (DCMS).

The switch to digital television will require a widespread switch of technologies - both in the equipment that consumers use to receive television pictures and in the infrastructure used to broadcast them. The Government therefore needs to understand all possible impacts of this challenge, including whether the digital switchover policy will present possible environmental issues.

Having provided an initial assessment[1] of the implications of digital switchover for the disposal of television equipment, the Market Transformation Programme (MTP) was asked by the DTI and DEFRA to develop and monitor projections of how much, if any, waste will arise specifically as a result of the digital switchover programme. Projections would be provided on a regional basis.

The study was conducted during 2006 and examined the disposal of three key types of consumer equipment which were likely to be affected by digital switchover - set-top boxes (digital TV adapters), televisions and video recorders. The key conclusions are:

- There is unlikely to be any significant net disposal of televisions or video recorders as a specific result of the digital switchover policy. However, the 'phasing' of equipment disposal will shift and some early (ahead of what might otherwise be expected without the digital switchover policy) disposal of equipment may occur.

- The disposal levels of set-top boxes are expected to remain broadly the same in the short-term. However, by 2015 a marked pattern of increased disposal of set-top boxes due to switchover policy begins to emerge.

[1] DCMS/DTI *Regulatory and Environmental Impact Assessment : the timing of digital switchover*, September 2005. Pages 27-28. http://www.digitaltelevision.gov.uk/consultations/con_ria_timingods.html

In addition to modelling the impact on the UK as a whole, the project provides an analysis of impact on a (TV) regional basis which regional stakeholders could use as the basis of future disposal handling plans.

As stated above, this project looked at the impact (in terms of units disposed) of the Government's digital switchover policy as distinct from the more general phenomenon of increased consumer electronics equipment within households. In addition to the specific digital switchover policy, the transition to new technology is being driven by a number of factors such as the demand for enhanced television and interactive services, technology convergence, and better picture quality. Whilst the specific digital switchover policy may or may not have any additional environmental implications, it should be recognised that it is the underlying trend towards more complex products and their increased penetration into households which will result in significant increased environmental impact - particularly in terms of the carbon emissions arising from the energy use of consumer electronics during the 'in-use' phase - if left unchecked.

The Government will continue to analyse the consumer electronics product market and is actively pursuing a package of policy measures which seek to mitigate the environmental impacts of the transition to new technologies and increased household penetration.

Table of contents

1 Introduction

In 2005, the Market Transformation Programme commenced work to extend its policy Evidence Base and modelling capability to predict future appliance disposal volumes. A basic spreadsheet model was developed which made a simple calculation of future disposal using data from the MTP integrated sales and stock model.

The results of this modelling were presented to Defra and the DTI (and DCMS) in 2005, and were used as the basis of the waste projections within the Regulatory Impact Assessment for the digital switchover policy programme. Following this work, both Defra and the DTI identified the need to refine the model mechanism, and the stock and sales projections used by MTP.

For efficiency and policy coherency reasons, the DTI and Defra commissioned and co-sponsored an MTP project to develop and monitor projections on a region-by-region basis of possible increased waste arisings associated with the rolling digital switchover programme. MTP carried out this work during 2006. This document provides an overview of the project and the modelling methodology, and highlights the key results obtained.

The project examines the implications of the specific 'digital switchover' policy and not the impact of the wider picture of the general uptake of more products, with greater size and number of features.

2 Agreed assumptions

The following project parameters and assumptions were agreed before commencing the project:

- The products to be considered were televisions, set-top boxes and video-recording equipment.
- The TV regions to be considered were Grampian, Scottish, Border, Tyne Tees, Yorkshire, Granada, Wales, Central, Anglia, London, Meridian, West, West Country, and Ulster.
- Depending on resources, MTP should estimate the percentage of products that upon leaving the home do not arrive at civic amenity sites or at retailer take-back points. This may be due to them being sold on the second-hand market, or disposed of in other ways, etc. By default, MTP may need to assume that 100% of units end up at civic amenity sites or with retailers.
- The key projections were to be derived from the MTP stock model and expressed in terms of the numbers of units disposed of.
- For some (or all) products, it may be found that there will be no additional disposal due to digital switchover.
- MTP should endeavour to use the most up-to-date sales data and stock analysis. However, as this market information is subject to frequent updates, at some point in the project it may be necessary to adopt a fixed date as the project reference point.

3 Deriving stock and sales projections

The methodology used in this project was to first create a regional stock and sales model for all the different digital technologies using relevant data sources and MTP projections. The projected stock figures for each technology and each region were then linked with a disposal model to calculate the projected disposal for each technology in each region from 2005 to 2020. This process has been completed twice - once for the Reference scenario (in which the analogue signal is not switched off) and once for the digital switchover scenario (in which the analogue signal is progressively switched off between 2008 and 2012, region by region across the country). The difference in the disposal projections between these two scenarios is then calculated for each to determine the additional disposal of digital products as a result of the digital switchover in each year to 2020.

3.1 Data sources

The regional element of this modelling exercise required considerable thought and investigation. A number of data sets were purchased in the early stages of this project to gain a better understanding of the regional differences in the purchase of digital products.

During the purchase of data sets it became apparent that the definitions of TV regions and sales ‘areas’ differed. Therefore, some redefinition of the areas for consideration was necessary. Twelve regions were considered for this project: Ulster, Wales, Scotland (Grampian), Tyne Tees, Yorkshire, Granada, Central East Midlands, Central West Midlands, Anglia, London, Meridian, and West Country.

The Border TV region posed a particular problem as both household and equipment ownership figures are not available for this region - they are split between Scotland and Granada. For this project we have therefore ‘split’ the Border region between Scotland/Border (for north Border) and Granada (south Border) to present a data set at this time. However, we have also made a basic estimation of the possible impact of disposal for the Border region through simply assuming that Border represents 10% of Granada households, and 25% of Scottish households.

Initially, a simple regionalised stock profile was derived for each technology by dividing the MTP projections of total UK ownership of each product by ONS data on the number of households in each region. While this provided a simplified model of the distribution of stock across the country, it lacked information on spending habits for each region. Sales data were purchased from GfK in order to gain information on the extent to which different regions purchase different quantities and types of digital product. GfK was able to provide annual sales data for 2000 - 2005 for all the regions in question, with the exception of Northern Ireland for which we have assumed a sales pattern similar to that of Wales. The data were provided for VCRs, DVD recorders, CRT TVs, LCD TVs, plasma TVs, and terrestrial (Freeview) set-top boxes.

The sales figures from GfK were incorporated into the stock model by creating a coefficient which was unique to each region and technology. The coefficients were created by dividing the number of units of a particular technology sold in a region in a year by the total number of households in that region. The coefficient for the UK as a whole was 1.0; each individual region's coefficient was in the range 0.3 and 3.5, depending on how far their per-household purchasing habits deviated from the national average.

The regional element proved to be a very significant factor in this model as the regional buying habits vary greatly from region to region, especially with the more high-tech digital products. For example, when plasma televisions were first introduced to the market, households in London purchased three or four times more plasma televisions than anywhere else in the country. That effect dampened over time as the technology became more common, but regional differences exist even with more well-established products. For example, between 2000 and 2005, households in the Tyne Tees region purchased 2.3 times more CRT televisions than the national average. These regional buying patterns clearly affect the stock of the product in that region, and therefore the predicted disposal of that product.

One factor that proved more difficult to incorporate into the model than the regional factor was the socio-economic factor. Data on household television, VCR, and DVD ownership by socio-economic group and region were purchased from CACI. The socio-economic grouping was done in terms of 'acorn' groups which are a categorisation of the income, lifestyle, age and location (urban, rural) of the people in a household. Unfortunately, these data proved to be not useful for our model for two reasons. First, CACI was unable to provide data on the different types of television and simply provided data on the total number of televisions owned per household. Second, the CACI data provided very little evidence to show that there is a link between socio-economic grouping and the number of digital products owned by a household. Therefore, the CACI data were not incorporated into the model and the regional factor was incorporated instead.

A full list of the data used is provided in Table 1 below.

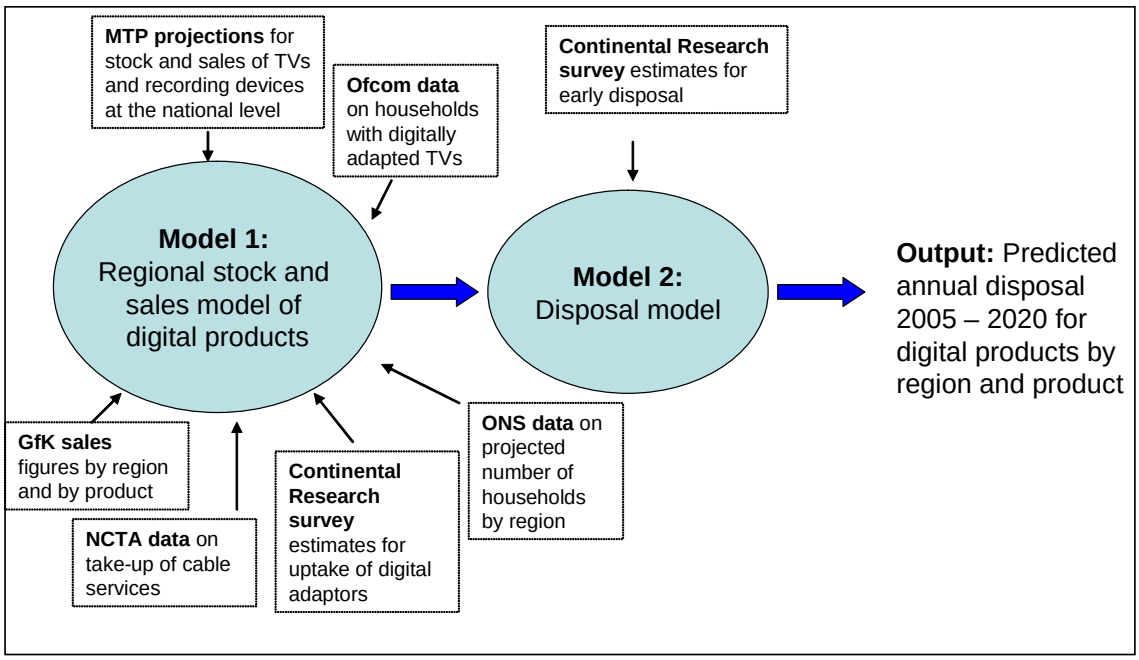
Table 1 Main data sources used

Name of data set	**Description**	**Dates available**	**Parameters to which the data *are applied***
GfK	Sales data for Freeview boxes, VCRs, plasma, CRT, and LCD TVs by ten regions.	2000 - 2005 (annual)	Regional sales coefficient for the different digital products.
Continental Research survey	Survey of household residents on intentions for adapting and disposing of TVs and recording devices.	2005	Early disposal rate. Rate of switch to satellite, cable or Freeview. Likelihood of adapting recording devices.
ACORN/CACI	Numbers of TVs per household by 12 regions and by socio-economic category. Number of households with a VCR or Sky+.	2001	
Ofcom	1) Household penetration rates of digital TV for each type of digital provider, nationally. 2) Overall digital penetration by region.	1998 - 2005 (annual) 2004	Percentage of households currently adapted (Freeview vs. paid subscription for 1998 - 2005).
NCTA (National Cable and Telecommunic-ations Association)	Percentage of households with a paid cable television service in the USA.	1950, 1960, 1980, 1985, 1990, 2001, 2005	Maximum penetration of a paid multi-channel service for non-switch case. General shape of the S-curve for take-up of multi-channel TV.
ONS (*Economic Trends*, 582 May 2002)	Projections and historical data for number of households, regional populations and housing types.	2001 - 2021 (data for 2001 but projections for the rest)	Regional growth rate (growth in the number of households which then decides the rate of growth in the number of primary digital adaptors).

3.2 Sales and stock model structure

Figure 1 shows the general arrangement of the models in this project and also where the different data sets are used in the models.

Figure 1 Sales and stock model structure



The output from the first model is a stock and sales profile for each technology for 2005 - 2020 for each region. These stock profiles are then linked with a disposal model (see later description) which calculates the projected disposal of that technology for each region. Stock and sales profiles and the resulting disposal are calculated for each of the technologies, for each of the 12 regions, for each of the two scenarios (the Reference scenario and the digital switchover scenario). The difference in disposal between the two scenarios can then be calculated to determine the additional disposal of digital products that can be attributed to the specific digital switchover policy.

3.3 Deriving stock and sales profiles

The general methodology for deriving the stock and sales profiles for televisions and recording devices for both scenarios is:

- For televisions and recording devices, the MTP model has been used to project the stock and sales profiles for the UK as a whole from 2005 - 2020.
- Regional stock and sales profiles for these technologies were then created using the MTP projections adjusted for regional sales patterns (using GfK data) and regional population/household figures (using ONS data).

The general methodology for deriving the stock and sales profiles for set-top boxes for both scenarios is:

- The stock and sales of set-top boxes are modelled at the national level using historical data from 1998 - 2005, and then a logistical growth curve to project forward from 2006 - 2020.
- These UK stock and sales profiles are then adjusted for regional population/household figures to create regional profiles.
- Since GfK could not provide data on the sales of digital cable and satellite set-top boxes, regional sales patterns for set-top boxes are accounted for by using a coefficient based on the sales of televisions in that region. This relies on the assumption that the sales of set-top boxes in a region should be proportional to the sales of televisions in that region.
- The regional stock figures are then adjusted for the different years that the switchover will occur in each region.

Stock and sales profiles were created for the following technologies for each of the 12 regions (see Table 2).

Table 2 Technologies modelled

Televisions*	Recording devices	Set-top boxes**
Large CRT	VCR	Terrestrial digital adaptor (Freeview) for a primary TV
Small CRT	DVD recorder	Terrestrial digital adaptor (Freeview) for a secondary TV
Large Digital Light Projector (DLP)	PVR	Cable or satellite digital adaptor for a primary TV
Large Plasma		Cable or satellite digital adaptor for a secondary TV
Large LCD		Terrestrial digital adaptor for a primary recording device
Small LCD		Terrestrial digital adaptor for a secondary recording device
Large Field Emission Display (FED)		Cable or satellite digital adaptor for a primary recording device
Large Organic Light-Emitting Device (OLED)		Cable or satellite digital adaptor for a secondary recording device
Small OLED		

* 'Small' refers to a television less than 24 inches; 'Large' refers to a television greater than or equal to 24 inches.

** Set-top boxes for televisions are modelled separately from set-top boxes for recording devices for calculation purposes, but there is no difference in the technology.

3.4 Stock and sales projections for televisions and recording devices

Stock and sales projections for televisions and recording devices from the MTP model have been used in the stock and sales model for this project. MTP projections are based on historical data and give stock and sales figures from 2005 - 2020 for the technologies listed above.

All available evidence, and the results of initial modelling, suggested that the switch to digital will not have a significant effect on the overall stock of televisions or recording devices, and this assumption was included into the modelling approach. The rate of disposal could increase as a result of the switch to digital, but the total stock of televisions and recording devices in the UK is assumed to be the same. For this reason, the same MTP projections for stock and sales of televisions and recording devices were used for both of the scenarios.

3.5 Set-top box stock and sales

To assess the additional disposal of set-top boxes resulting from the digital switchover, it proved necessary to create a new stock model for set-top boxes for both the Reference and non-Reference[2]. The general methodology for modelling the stock of set-top boxes was to first use existing historical data from Ofcom from 1998 - 2005 on the growth in household penetration of major digital platforms. These data are only available at the national level but do give the percentage of households with the three main types of digital service: digital satellite, digital terrestrial, and digital cable (cable and satellite have been combined as a category because they are similar from a disposal point of view in that the equipment is primarily taken away by the operator rather than being disposed of by the household). Satellite services are already all-digital. Owing to the lack of regional data, it was assumed that each region had the same percentage of households with the different types of digital service.

To project the penetration of digital service from 2005 - 2020 for the two scenarios, a logistical growth curve (S-curve) was modelled which fits the historical data. The S-curve is a simple model of logistical growth and a well-established model for the take-up of new technologies.[3] These curves capture the rapid growth of a technology during the early phases of expansion, and also the diminishing possibilities as market saturation levels are approached.

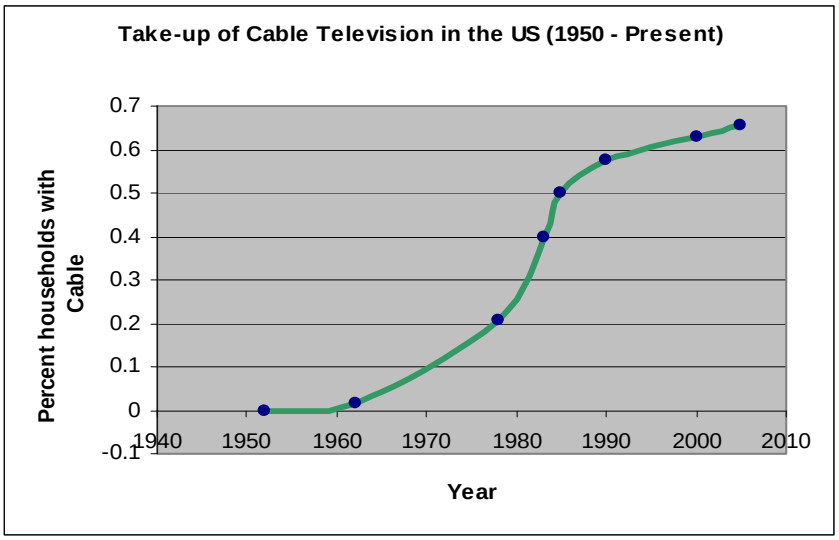
The stock values for set-top boxes are the same for the two scenarios from 1999 - 2008 (ie the stock is modelled by the same S-curve for both scenarios until the digital switchover occurs). In regions where the digital switchover occurs later than 2008, the S-curves remain the same until the digital switchover occurs. Once the switchover occurs in the non-Reference scenario, the key parameters in the S-curve are used to model the stock change, as specified by the results of the Continental Research survey.

[2] At the time of publication, the projections produced for this project may not be consistent with those published by MTP.
[3] Anderson, D. and Winne, S., (2004) *Modelling Innovation and Threshold Effects in Climate Change Mitigation.* Tyndall Centre Working Paper 59.

The main parameters that define the shape of an S-curve are the maximum value (in this case, the maximum penetration of digital service) and the rate of take-up of the new technology. For the Reference case, a key variable needed to develop the stock projections for set-top boxes is the maximum penetration of digital services driven by consumer preference rather than an imposed switch to digital. That is, an estimate is needed for the extent to which consumers would have switched to digital terrestrial, cable or satellite if the digital switchover had not been announced.

To obtain an estimate for the maximum penetration of digital television without the effect of digital switchover policy, the experiences of other countries (in particular, the USA) with more mature markets was referenced. Analogue cable television in the USA became available in 1948 as an alternative television service in areas where normal television reception was poor. Since then, it has expanded rapidly, with 67% of US homes currently receiving cable television. The take-up of cable in the USA was not driven by a switch to a digital signal, but rather by consumer preference for better reception and more television channels.

Figure 2 Take-up of Cable TV in the USA



Source: National Cable and Telecommunications Association (www.ncta.com)

Despite the availability of cable television and relatively inexpensive cable packages, over 30% of homes in the USA still do not subscribe to a cable service, owing to consumer preference and the cost of the service. Even in the wealthiest states, the cable subscription rate is still only 85 - 90%. This implies that additional channels and improved reception are not sufficient to entice all households to subscribe to a cable service and that there is some upper limit of the percentage of households willing to subscribe.

Whilst the US case will not match perfectly the situation in the UK, it can be used as an example to gain a better idea of what the rate of take-up of expanded television services would have been if the digital switchover had not been announced. Thus we have estimated that the upper limit of households in the UK that would have joined a subscription cable or satellite service in the Reference case is 75%. Based on the fact that 20% of UK households already have a digital terrestrial box on their primary TV, we have estimated that a maximum of 25% of households would be willing to make the one-off payment to buy a terrestrial digital box for their primary television. The upper limits of 75% and 25% are estimates, but they have been chosen to fit existing historical data and sales figures at the national level.

For the digital switchover scenario, it is estimated that the maximum penetration of digital cable/satellite will be 80% and that the maximum penetration of digital terrestrial will be 30% initially, dropping to 20% in 2013. This is due to the fact that in the Continental Research survey, respondents indicated that they will initially adapt their televisions with a Freeview box. As time progresses, however, it is expected that many households will switch to a digital cable or satellite service as the costs of these services decrease, or if the service provided by digital terrestrial is not as good as they hoped. A full list of parameter values for the model for set-top box stock for the two scenarios is provided in Table 3 below.

Table 3 Parameter values for set-top boxes

Parameter values for set-top boxes for primary TVs	**Reference scenario**		**Digital switchover scenario**	
	Cable/Satellite	**Terrestrial**	**Cable/Satellite**	**Terrestrial**
Max. penetration	75%	25%	80%	30%/20%
Growth rate until 2008	20%	18%	20%	18%
Growth rate from 2008 to 2020	20%	18%	23%	19%
Parameter values for set-top boxes for secondary TVs	**Reference scenario**		**Digital switchover scenario**	
	Cable/Satellite	**Terrestrial**	**Cable/Satellite**	**Terrestrial**
Max. penetration	75%	25%	75%	25%
Growth rate until 2008	18%	16%	18%	16%
Growth rate from 2008 to 2020	18%	16%	22%	25%

3.6 Key stock and sales assumptions

The stock and sales projections are created under the following assumptions for both the Reference scenario and the non-Reference ('policy') scenario:

- No television or recording device will have more than one digital adaptor attached to it (ie there is no need to have both a satellite service and a Freeview box on the same TV).
- MTP projections for the sales and stock of different kinds of televisions, DVDs and recording devices are used - digital switchover will not have any effect on the kinds or numbers of televisions that people buy.
- The number of households in the UK will continue to increase at an approximately linear rate (projections taken from ONS, *Economic Trends*, 582, May 2002).
- There are not sufficient data to be able to deduce any firm conclusions for the percentage 'mixture' of the different types of set-top box at the regional level. However, anecdotal evidence leads to the assumption that it reflects national trends. Moreover, evidence from other MTP projects suggests that the waste footprint is similar for different types of set-top box.
- Domestic equipment only is modelled in this study.
- The definition of 'cable' systems also includes DSL (broadband) based systems and other platforms which employ a copper-wire or fibre-optic delivery system. Similarly, the term satellite also covers advanced and future platforms based on satellite-delivered signals.
- When the switch to digital first occurs, people will initially tend to purchase Freeview boxes to adapt their televisions. However, as cable/satellite subscriptions become cheaper and as the limitations of the terrestrial platform (to deliver interactive, voice, data and broadband, and video on-demand services) become more apparent through time, people will slowly switch from a free-to-air terrestrial digital adaptor to a satellite or cable platform (which could include non-subscription type packages).

In addition, the following assumptions apply to just the non-Reference scenario where the analogue signal is switched off between 2008 and 2012, depending on the region:

- By 2012, all primary televisions will be linked to, or include, a digital adaptor of some variety.
- By 2013, all secondary televisions will be linked to, or include, a digital adaptor of some variety.
- The stock of set-top boxes will continue to increase at the current rate in each region until the analogue signal is switched off. Immediately before the signal is switched off, the rate of take-up of set-top boxes will increase so that 100% of televisions will be adapted by 2013.
- Results from the Continental Research survey indicated that 11% of consumers would take the opportunity to throw away non-adapted televisions when the analogue signal is turned off. This report assumes that this 11% will consist of secondary televisions only. A further 1% indicated that they would replace their televisions with IDTVs and throw away the old one (see section 3.7). In this case, the early disposal factor has been applied to primary screens only.

- Any increase in the early disposal of non-adapted digital products will begin two years before the analogue signal is switched off in a particular region, and will continue for two years after that (thus, the increased early disposal rate is applied to a five-year period).

3.7 Integrated digital equipment

At the time of producing the stock and sales models for this project, the position of integrated digital televisions (IDTVs) and integrated digital video recorders (IVRs) within the market was ambiguous. MTP's projections for the take-up of digital equipment do include an adjustment for IDTVs and IVRs. In addition, this project makes further minor adjustments to the integrated equipment projections. However, since the last major modelling exercise conducted by MTP, and during the course of undertaking this project, new evidence has begun to emerge which suggests that future ownership of this integrated digital equipment will exceed that currently forecast by MTP. MTP will be conducting a further re-projection shortly, at which time further analysis of the integrated digital equipment market will be conducted and the projections revised accordingly. Since the MTP projections have not yet been revised, it has not been possible to adjust the results of this report.

Increased ownership of integrated digital products is unlikely to alter the disposal of video recorders or televisions to any great extent. However, it might have a considerable impact on the projected sales of (mainly terrestrial) set-top boxes.

It is the intention to provide an updated version of this report as soon as the MTP revisions are made, so as to provide all stakeholders with the most accurate information. This is likely to be completed in 2007.

4 The disposal model

The disposal model is a spreadsheet-based calculation of disposals and sales derived from a stock projection from 1998 to 2020 and an initial sales value for 1998.

From the stock it calculates the sales for a given year and from the sales calculates the theoretical failures per year until 2020, based on a failure distribution. The theoretical failures are the failures that would happen if the product were used until it failed. The theoretical failures are then modified by the proportion of early disposals (ie what proportion of the stock remaining will be disposed of early (before failure) in any one year). This proportion can be different for each year and can thus allow for changes in the need or behaviour relating to that technology. This is the parameter that is varied to model the increased disposal of non-digitally enabled technologies.

Since it is unlikely for a new purchase to be immediately disposed of, there is also a disposal delay that can be entered, which means that the stock bought within that period of years does not have the early disposal proportion applied to it. This disposal delay was set to four years.

There is some iteration between sales and disposals across the years to give the final disposals profile over the 2005 to 2020 period. The model's inputs and outputs are in integer years.

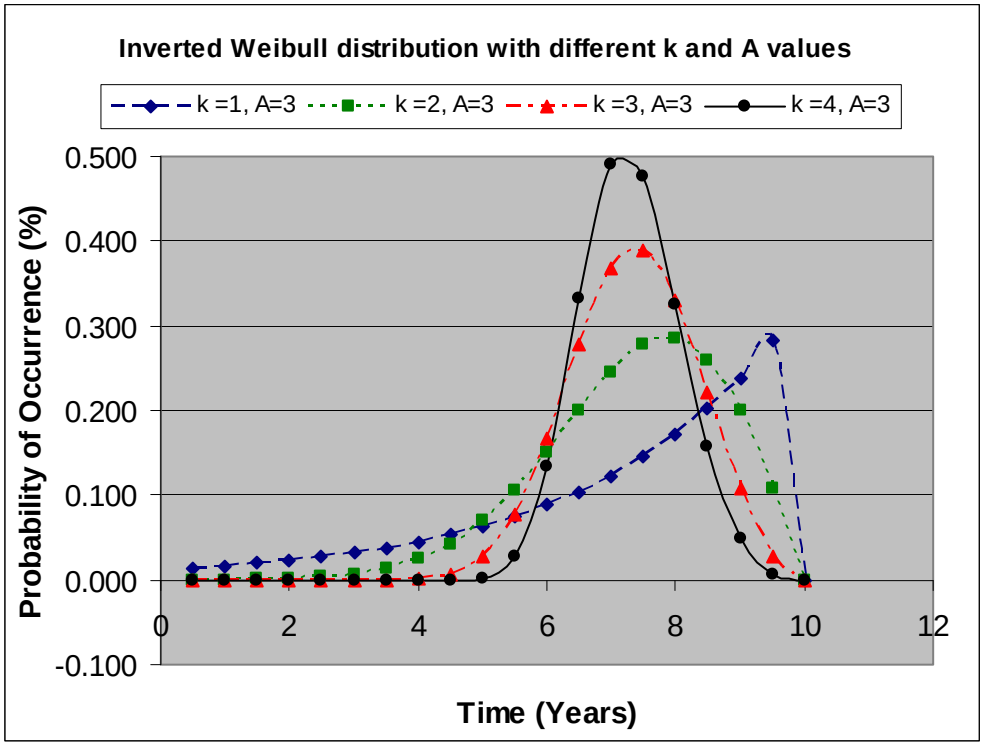
Because the model links stock, sales and disposals, it will produce some unusually shaped curves if the stock profile is not representative of the product life and early disposal rates. Where this happens, it indicates that at least one of the data input is not realistic (ie stock profile, the product lifetime, the disposal delay, the failure distribution, and the early disposal proportions).

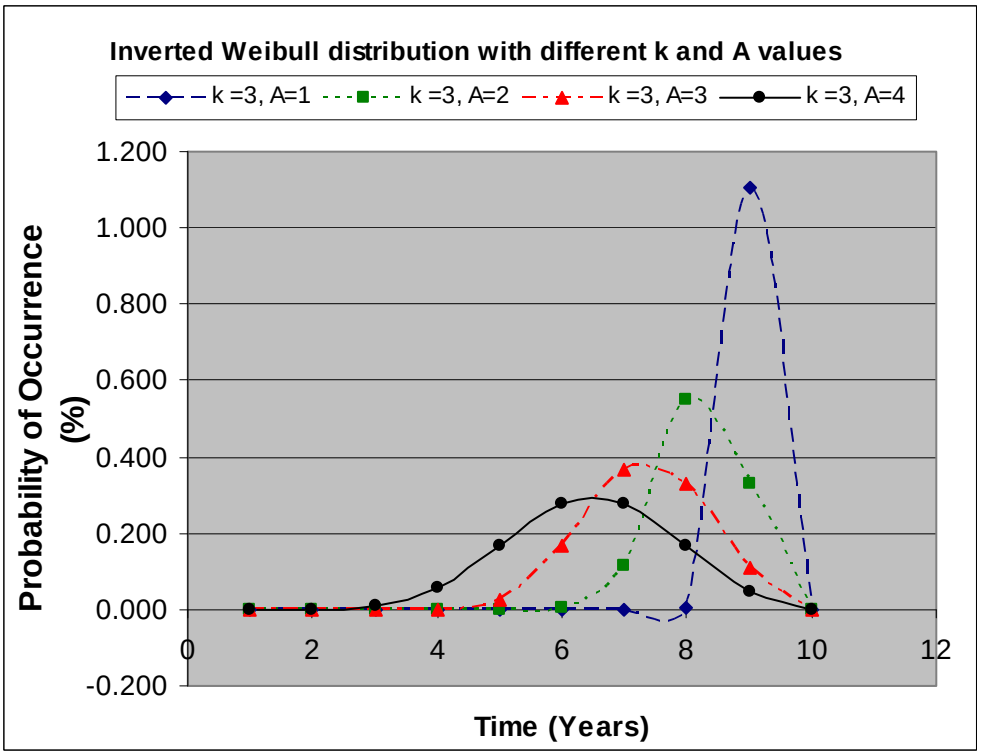
4.1 'Failure with time' distribution sub-model

The model contains a 'failure with time' distribution. This is currently based on a modified Weibull distribution which requires three input parameters that can describe a fairly complex failure versus time distribution. The decision was made to employ the Weibull distribution approach, which differs from the one currently employed by MTP in its waste projections, as it would allow a greater degree of flexibility and, therefore, accuracy.

The form of the modified Weibull 'failure with time' distribution can be modified to give a number of forms all based around a distribution about a mean product life. The three failure input parameters to describe the curve are the shape, k, the scale, A, and the maximum year Y (the number of years from manufacture that all products will have failed). These are adjusted to give the mean product life of seven years in this case where k = 3, A = 3.36, and Y = 10. Examples of the 'failure with time' distributions are shown in Figure 3 below where all products are also assumed to have failed within ten years.

Figure 3 Examples of typical Weibull distribution curves





4.2 Model inputs

The model requires:

1. A stock profile for years in the range 2000[4] to 2020. Stock can be 0 [Units].
2. A sales figure for 1998 [Units sold in year].
3. A disposal delay [Integer years].
4. The proportion of early disposals for each year (ie the proportion of the previous year's stock (excluding that added in the disposal delay period) replaced early in the year) [Number in range 0 to 1].
5. The three failure model parameters: k, shape parameter [Number], A, scale parameter [Number] and Y, maximum year [Integer years].
6. The number of whole years from manufacture by which time all units can be assumed to have been disposed of.

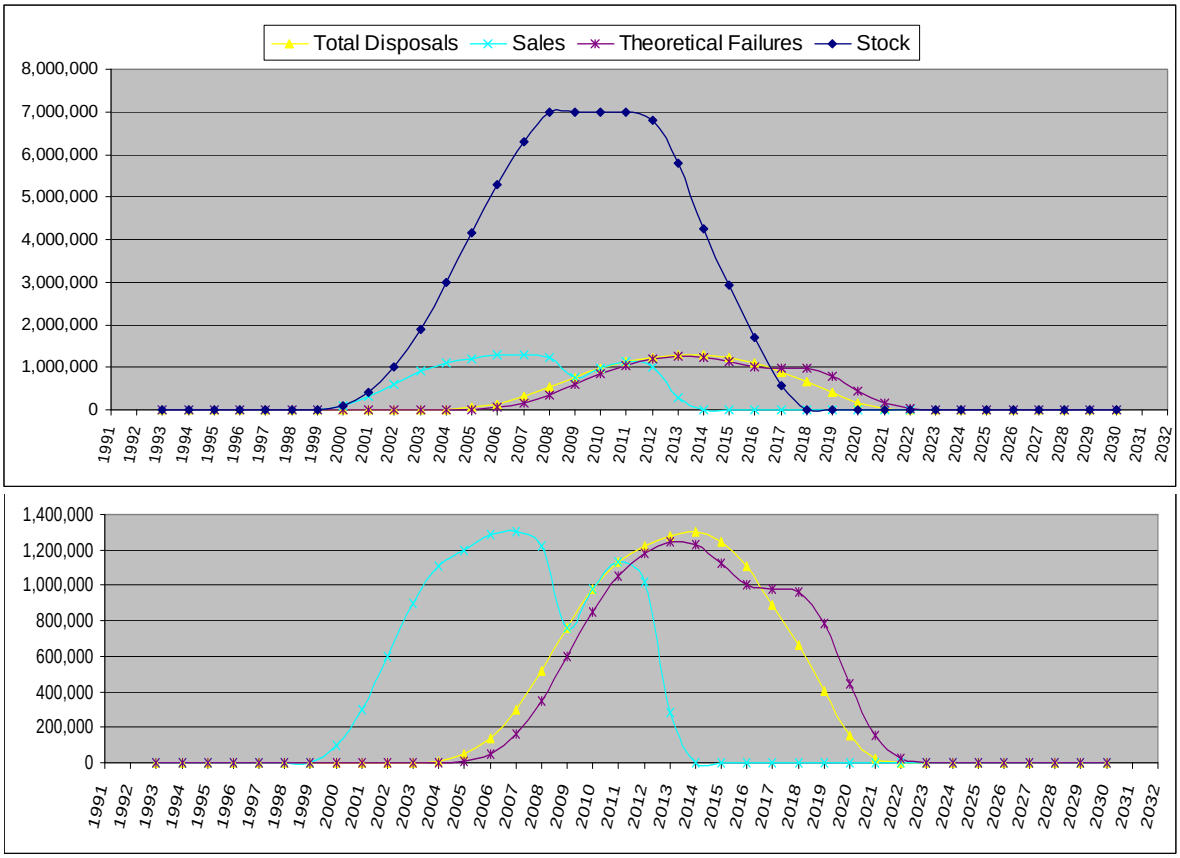
[4] Note that stock in 1999 and 1998 is inferred from stock 2000.

4.3 Model output

The following graphs show curves that are an example of a simple input stock profile and the resulting sales, disposals and theoretical failures for a product with a lifetime of seven years.

In this simple stock profile, reaching the peak stock level actually causes sales to fall but then they recover with time as sales to replace disposed of items. Interestingly, the resultant disposals curve looks remarkably smooth.

Figure 4 Sample result graphs



5 UK-wide results

The following graphs summarise the output results for total UK disposal (in basic form) of the disposal model. All disposal figures are provided in total units disposed of (not tonnage). Figures 5a and 5b show two extremes in the possible results. The results in Figure 5a assume that people throw away non-adapted televisions at the same rate regardless of the type of television. Figure 5b shows the results under the assumption that only CRTs are thrown away if they are not adapted at the time of the digital switchover.

Figure 5a Total UK television disposal: maximum possible disposal

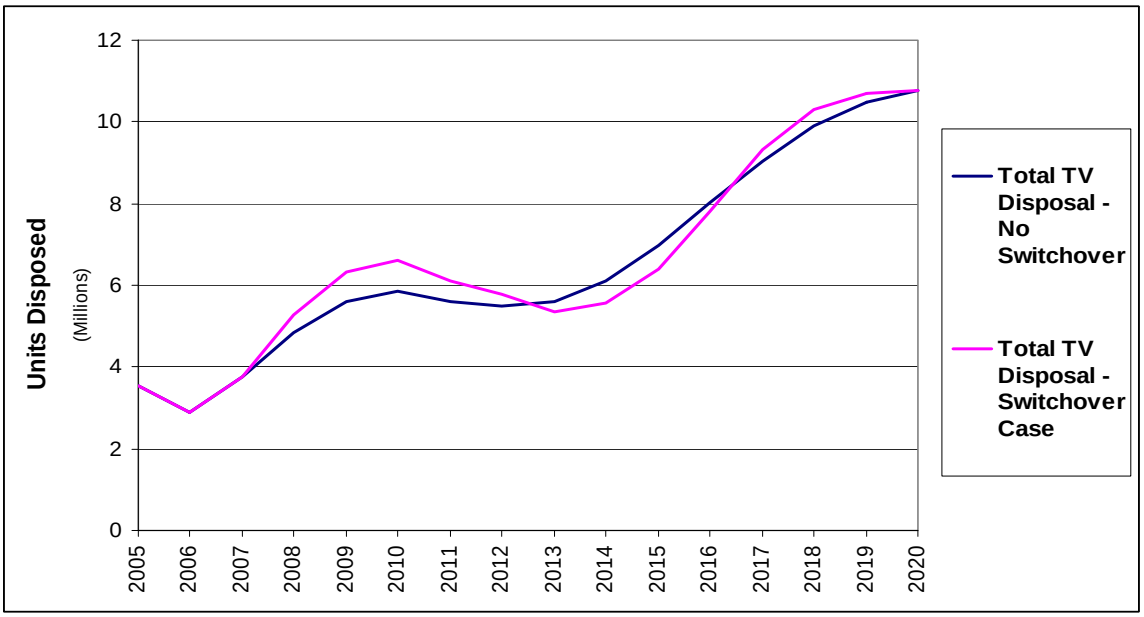


Figure 5b Total UK television disposal: minimum possible disposal

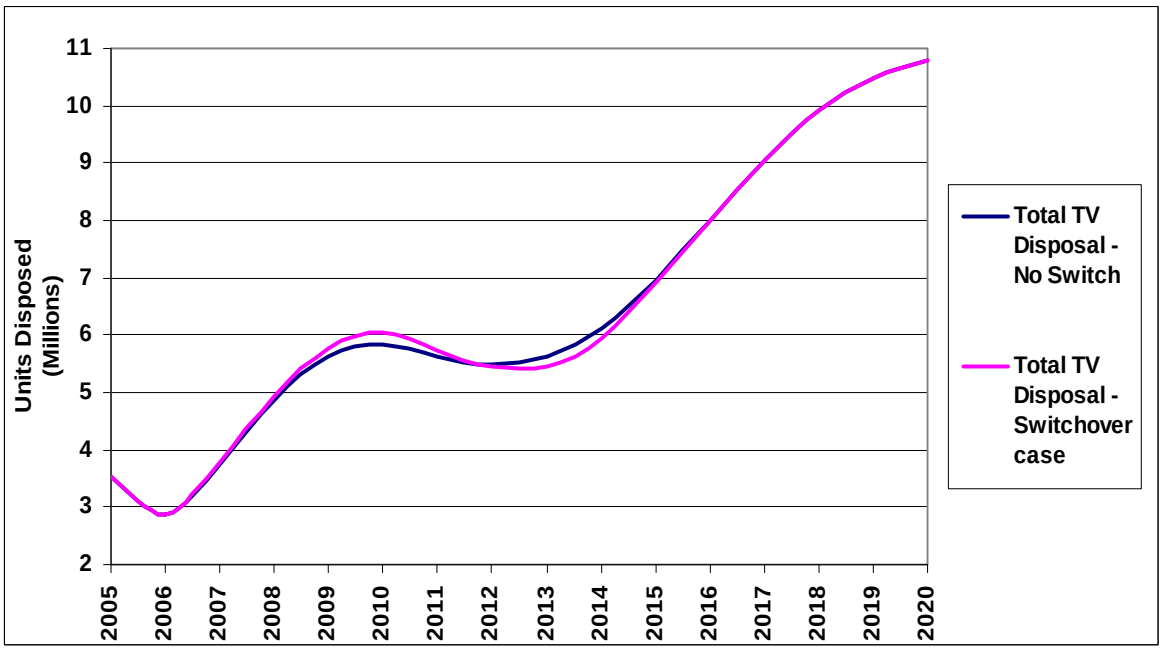
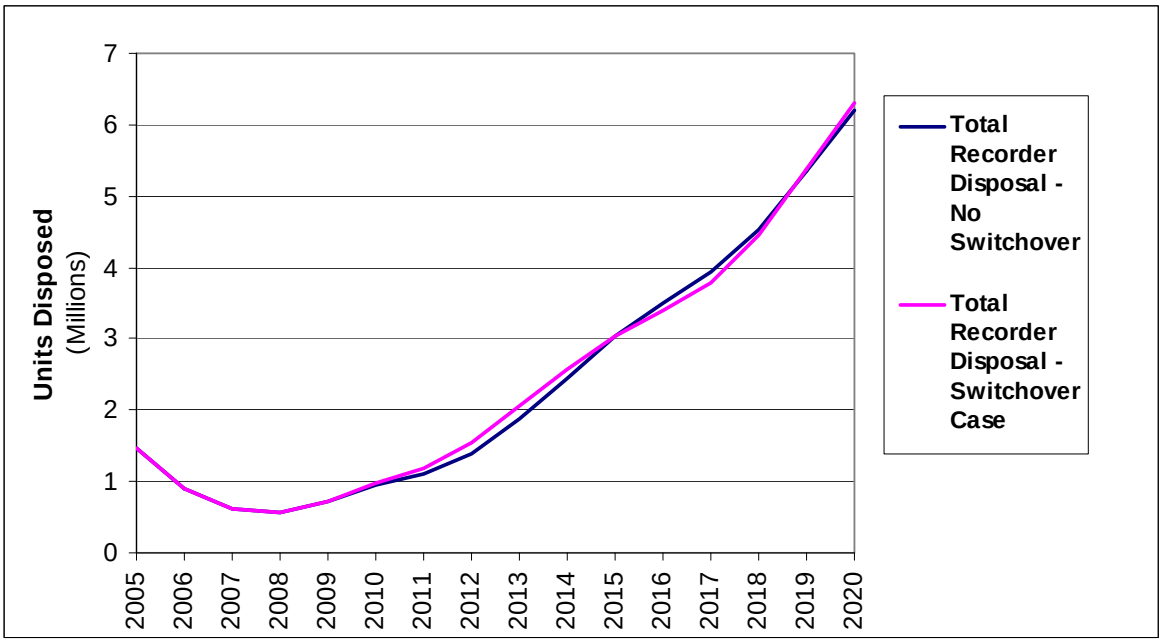


Figure 6 Total UK video recorder disposal (all technologies)



Note: Does not include DVD players.

Figure 7 Total UK set-top box disposal (all technologies)

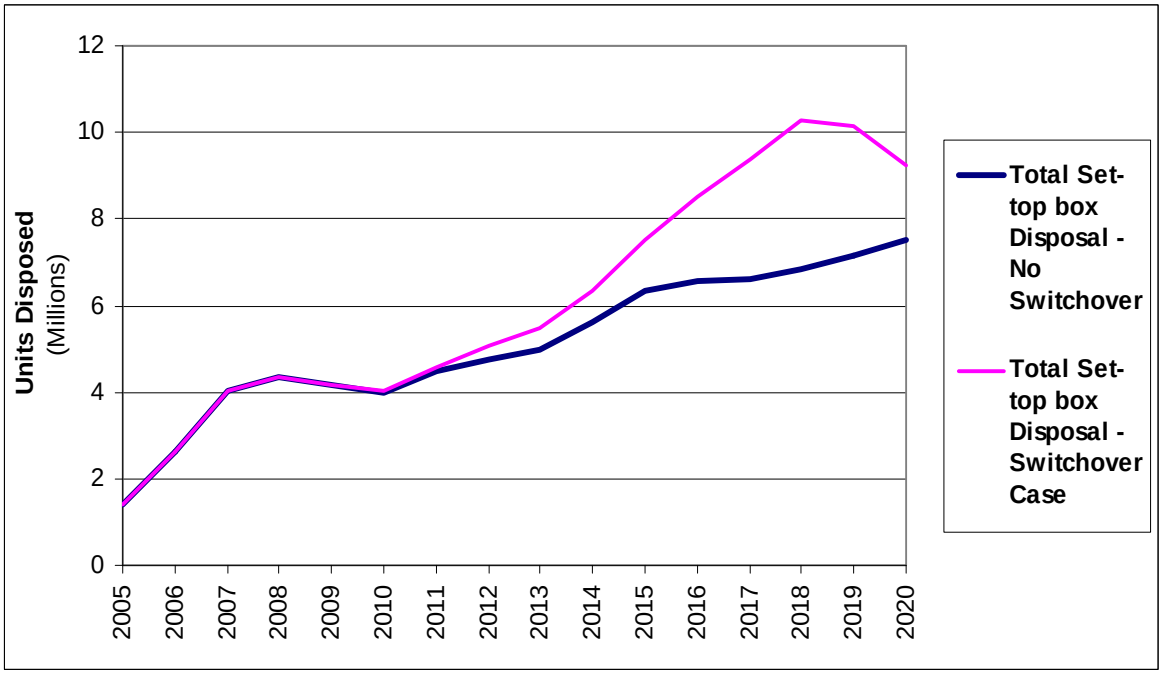


Table 4 Key figures for UK disposal

	Televisions		
	No Switchover	Switchover Case	Change
2005	3,539,615	3,539,615	0
2010	5,838,484	6,050,360	211,876
2015	6,970,022	6,912,772	-57,250
2020	10,788,760	10,781,043	-7,717

	Video Recorders		
	No Switchover	Switchover Case	Change
2005	1,476,481	1,476,481	0
2010	939,511	988,690	49,178
2015	3,028,119	3,046,261	18,142
2020	6,204,488	6,310,145	105,656

	Set-top Boxes		
	No Switchover	Switchover Case	Change
2005	1,389,284	1,389,284	0
2010	3,994,135	4,050,520	56,384
2015	6,328,153	7,530,283	1,202,129
2020	7,511,092	9,224,237	1,713,144

6 Example region data

The following graphs illustrate the results which can be obtained for a specific region - in this case, for the Anglia region and broken down by technology. Detailed information for all the regions is provided in the annex of this report and different breakdowns can be provided on request.

Figure 8 Television disposal by type in the Anglia region

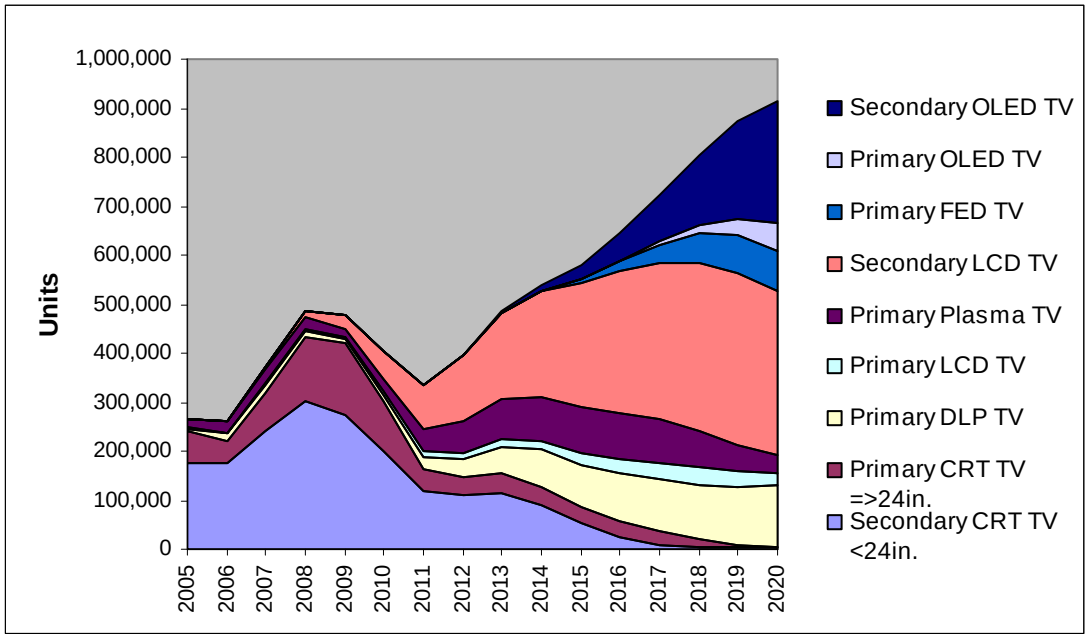
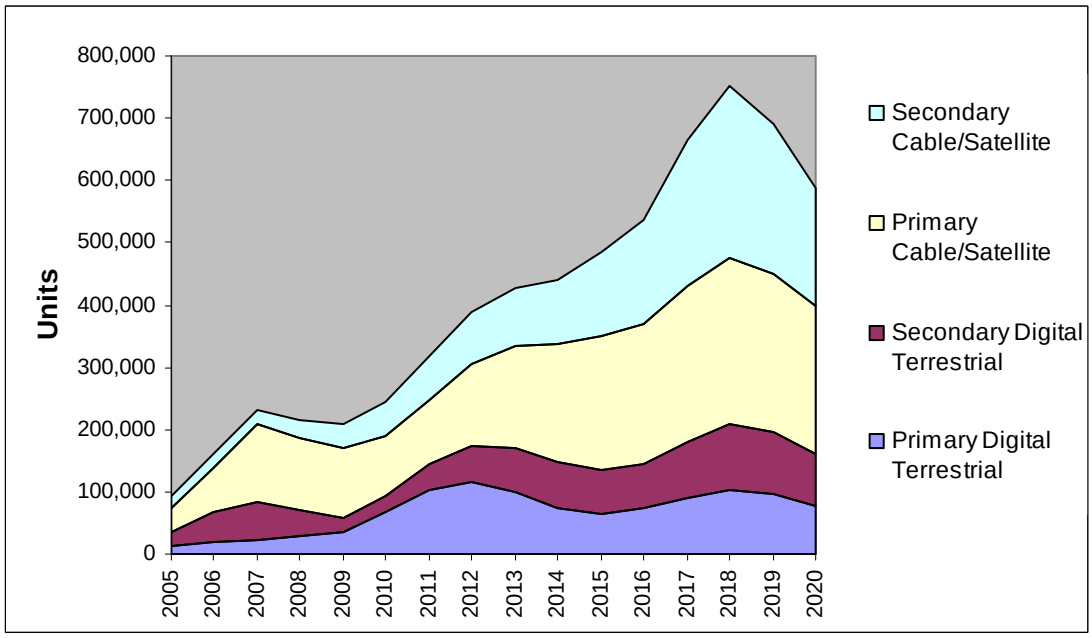


Figure 9 Set-top box disposal by application in the Anglia region



7 Key conclusions (for the UK)

The following points represent the main conclusions at a UK-wide level:

Televisions:

Although there will be a shift in the pattern of disposal of televisions as a direct consequence of digital switchover, total disposal during the period to 2020 is similar in both switchover and non-switchover scenarios.

The difference in the predicted timing of arrival of disposed-of televisions between the two cases is marginal and unlikely to produce a shortfall in treatment capacity in the UK; neither is it likely to produce significant issues at a regional level.

Video recorders

The projected difference between the switchover and non-switchover cases is negligible and it is unlikely that switchover will produce any additional disposal.

Set-top boxes:

The results indicate that the disposal levels of set-top boxes are expected to remain broadly the same in the short-term. However, by 2015 a marked pattern of increased disposal due to switchover policy begins to emerge. Whilst it is probable that the UK treatment infrastructure will be able to cope with this increase (and will have developed significantly by that date), this potential increase should be flagged to appropriate stakeholders.

It should be noted again that these conclusions are specific to the impact of the UK's digital switchover policy and not the general take-up of more complex consumer electronics equipment. The environmental impact of consumer electronics products will arise mainly from increased product ownership and functionality/size; the contribution of the digital switchover policy to the significant environmental impact of this overall trend will be minimal.

8 Next steps: improving accuracy

MTP has identified several possibilities for further actions to refine the projections and deliver further useful analysis. These could be carried out using existing MTP resources and as part of other on-going MTP activities. The recommendations are restricted to the immediate capabilities and currently planned activities of MTP. Further opportunities for using the results and methodology of this project are expected to result during stakeholder discussion.

Firstly, MTP is undertaking a waste scoping study to identify future top-level contributions to the waste stream arising from the disposal of consumer electronics appliances at a material level. The results of this project could be combined to produce estimates of specific materials and hazardous substance arisings (by weight) for each region, giving early warnings of potential future issues, if necessary, to policy-makers and regional stakeholders.

The waste scoping study might also be used in conjunction with this analysis to highlight if regional waste treatment capacity shortfalls might arise in future.

Throughout the project, the MTP project team has conducted sensitivity analysis to ensure that the assumptions that have been adopted are sensible and to assess the impact if they prove to be incorrect. Further sensitivity analysis on the MTP assumptions would be useful in showing a range of possible values should predictions not materialise.

Much of the data gathered, and the methodology employed, were specific to this project rather than to MTP as a whole. The results obtained are more detailed and refined than many of the current MTP projections. Therefore, there will be some inconsistencies between this project and MTP. The results of this project will be adapted for MTP use so that a greater consistency between MTP and this study is obtained.

Further integration of MTP sales and stock projections with those produced by Digital UK is desirable. Both organisations have produced projections of the take-up of digital television and future technology mix which, whilst similar, do have some variation. A single common data set is unlikely to emerge (owing to the way that source data and future trends are predicted), but by sharing information each organisation will undoubtedly strengthen their evidence base.

It was not possible to obtain any useful data on the percentage of products that upon leaving the home do not arrive at civic amenity sites or at retailer take-back points, and therefore conclusions on this cannot be drawn. However, this issue could present a problem for stakeholders involved in the take-back and disposal of digital equipment. MTP will continue to attempt to establish the volume of products that do not reach civic amenity sites because of either inappropriate disposal or other factors.

Finally, as highlighted previously, MTP is due to update projections of future take-up of integrated digital equipment. This may have a substantial impact on the projections made in this report. This is therefore a high priority action for MTP.

Annex: Regional disposal summaries

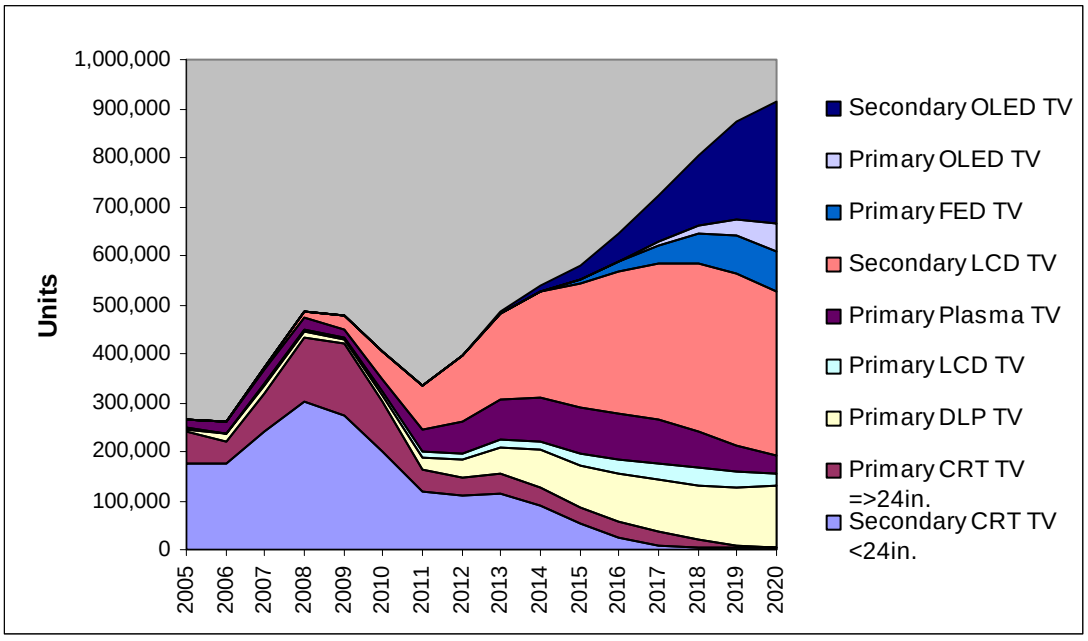
Annex: Digital ‘rollout’

The following map provides information about when television will start to go fully digital in each TV region. Some regions will complete the process in the following calendar year.
Further details can be found at:
www.digitaluk.co.uk

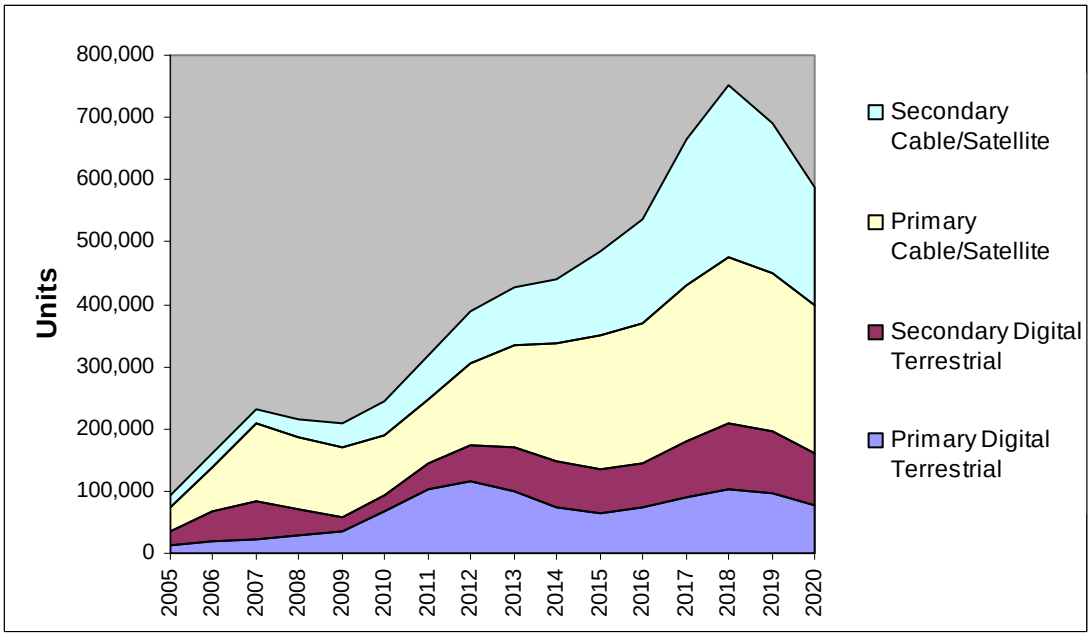
Annex: Regional Disposal Summaries

Anglia

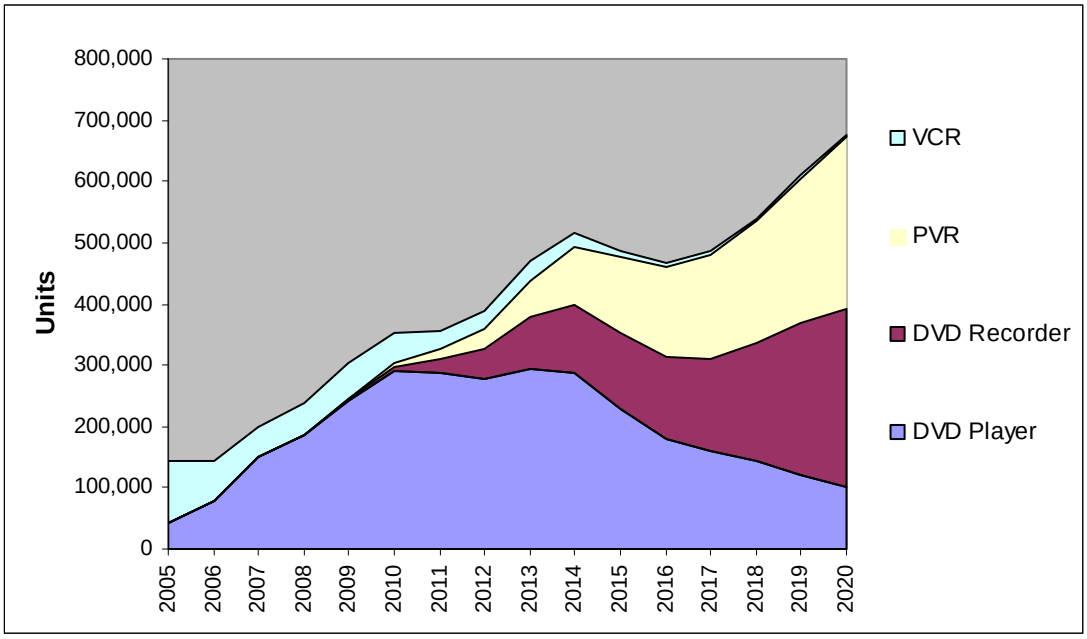
Disposal of Televisions 2005 – 2020



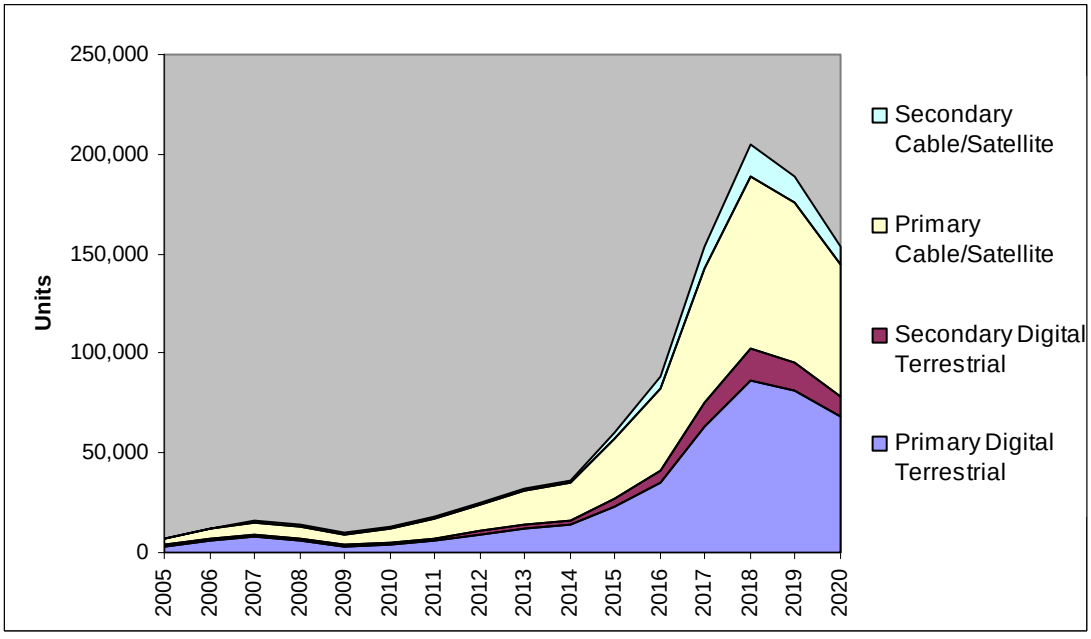
Disposal of Set-top Boxes for use with Televisions 2005 – 2020



Disposal of Recording Devices 2005 – 2020

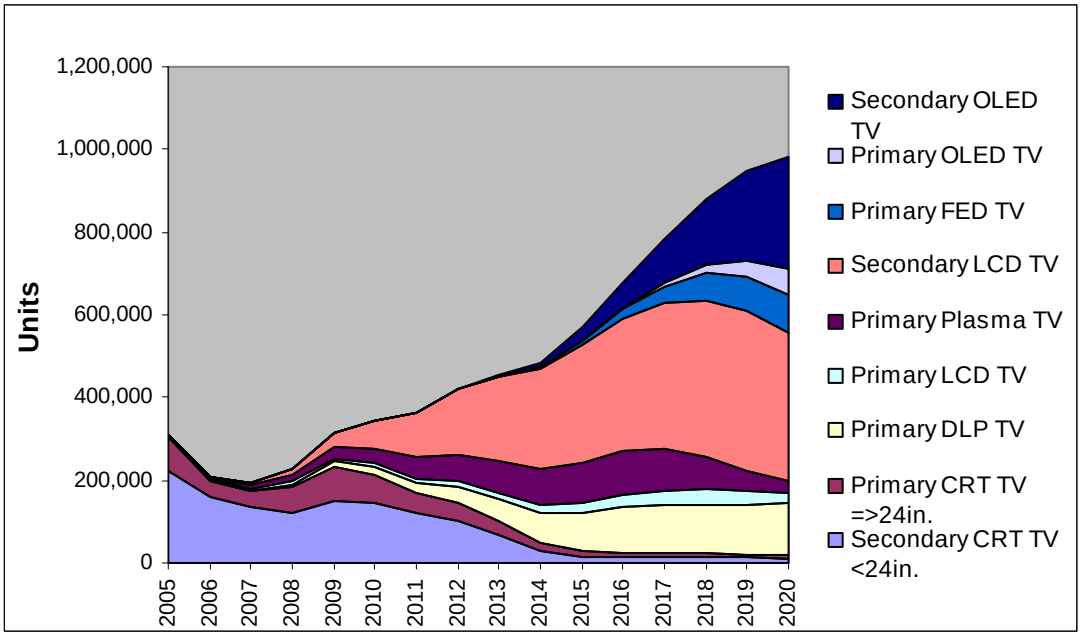


Disposal of Set-top Boxes for use with Recording Devices 2005 – 2020

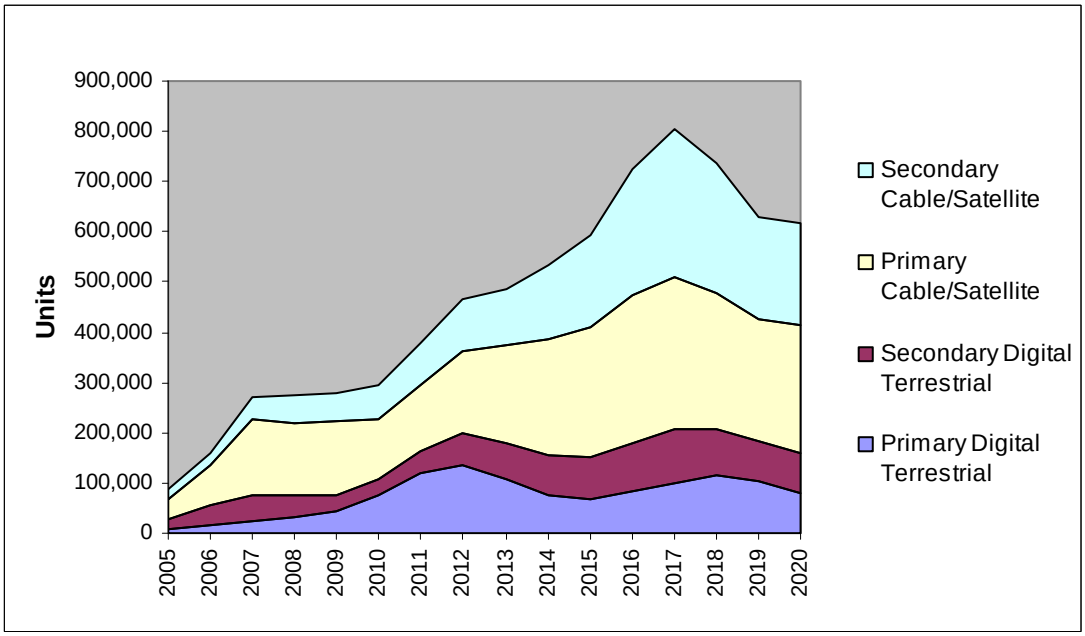


Scotland

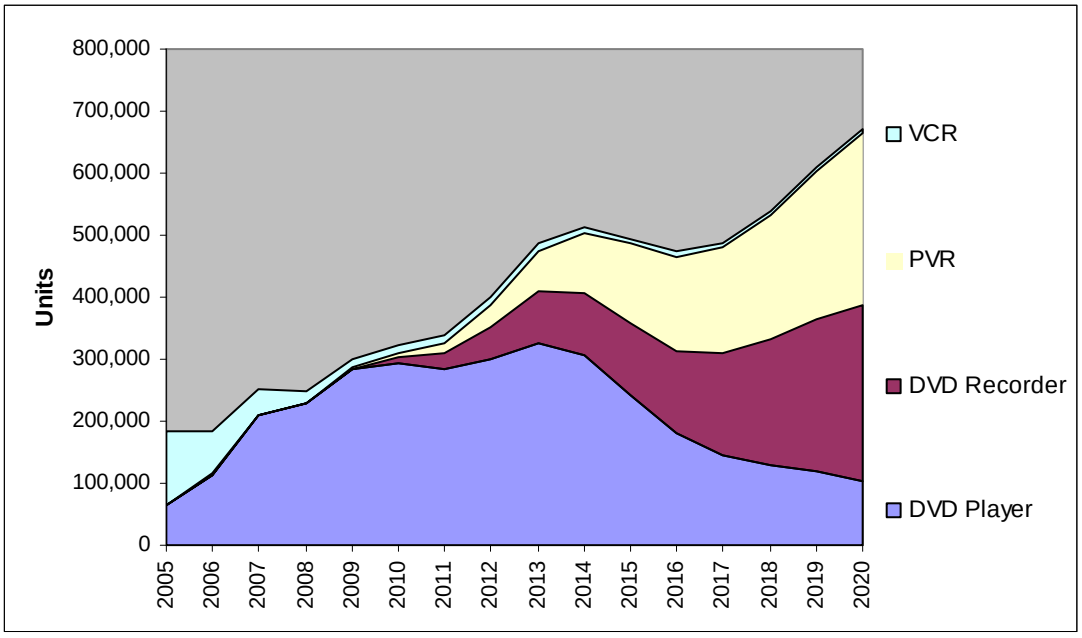
Disposal of Televisions 2005 – 2020



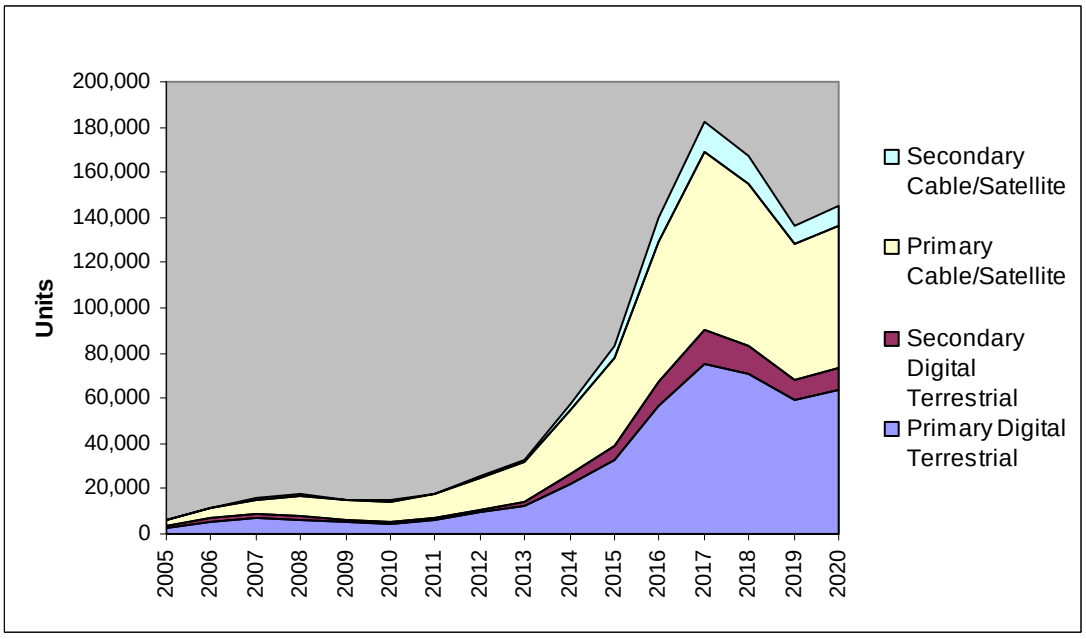
Disposal of Set-top Boxes for use with Televisions 2005 – 2020



Disposal of Recording Devices 2005 – 2020

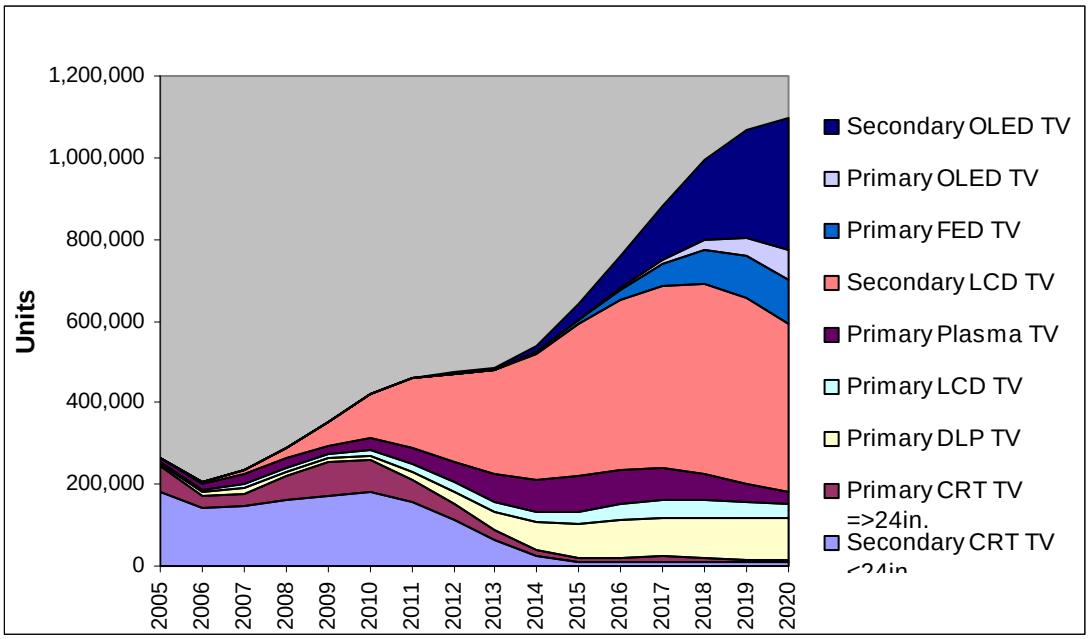


Disposal of Set-top Boxes for use with Recording Devices 2005 – 2020

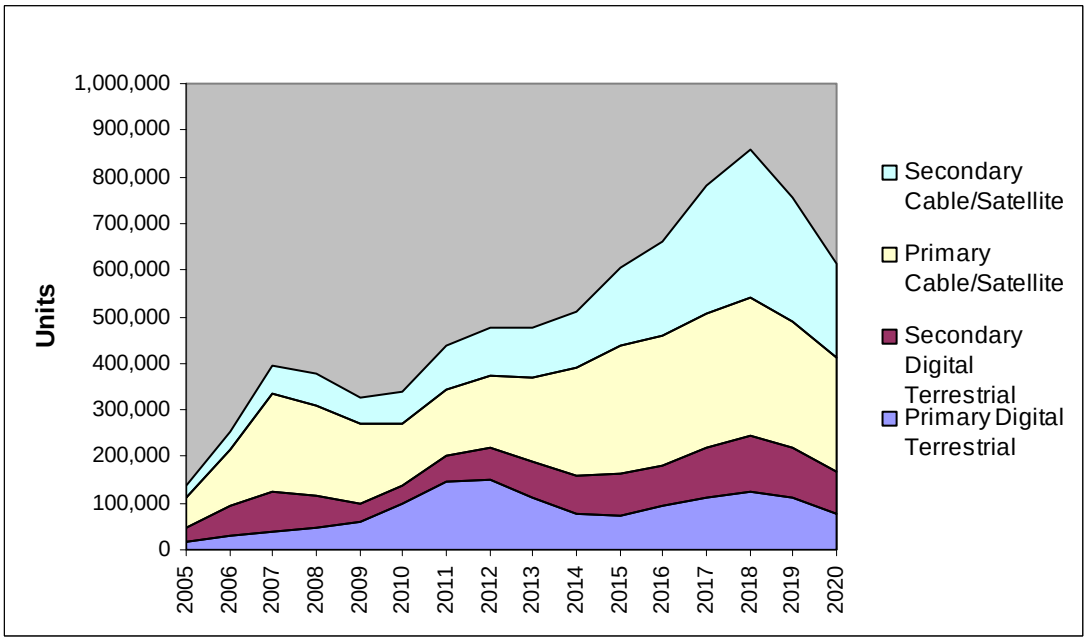


Central - West Midlands

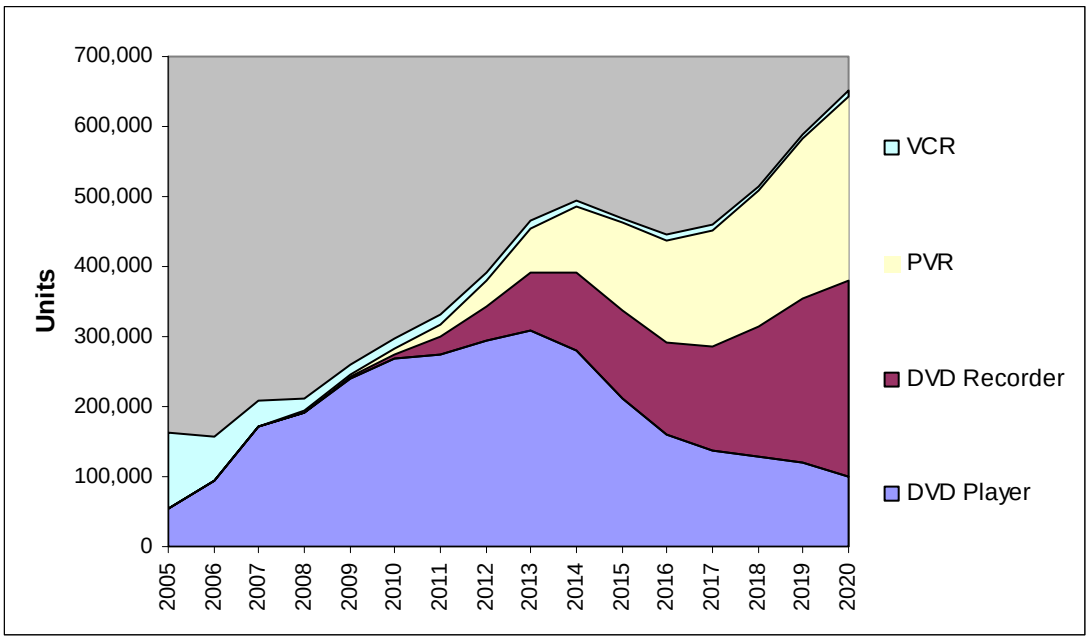
Disposal of Televisions 2005 – 2020



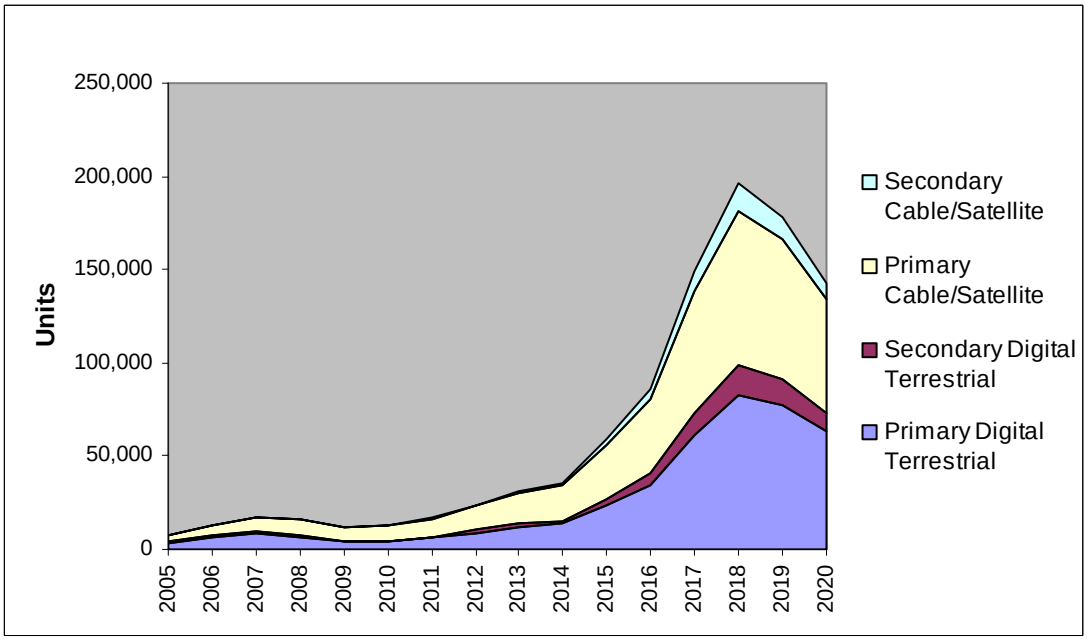
Disposal of Set-top Boxes for use with Televisions 2005 – 2020



Disposal of Recording Devices 2005 – 2020

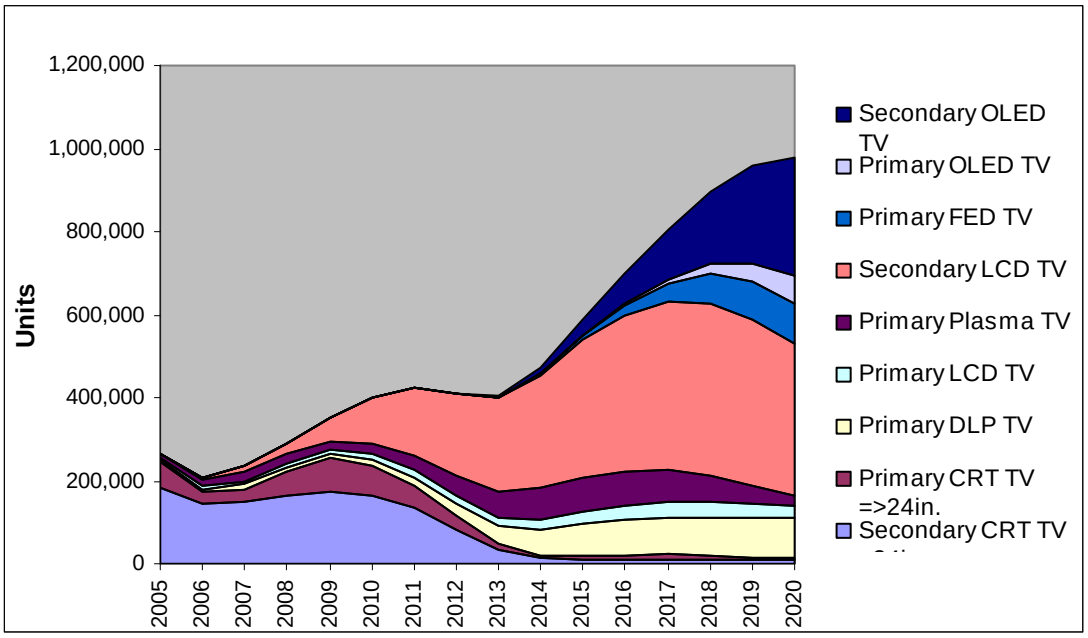


Disposal of Set-top Boxes for use with Recording Devices 2005 – 2020

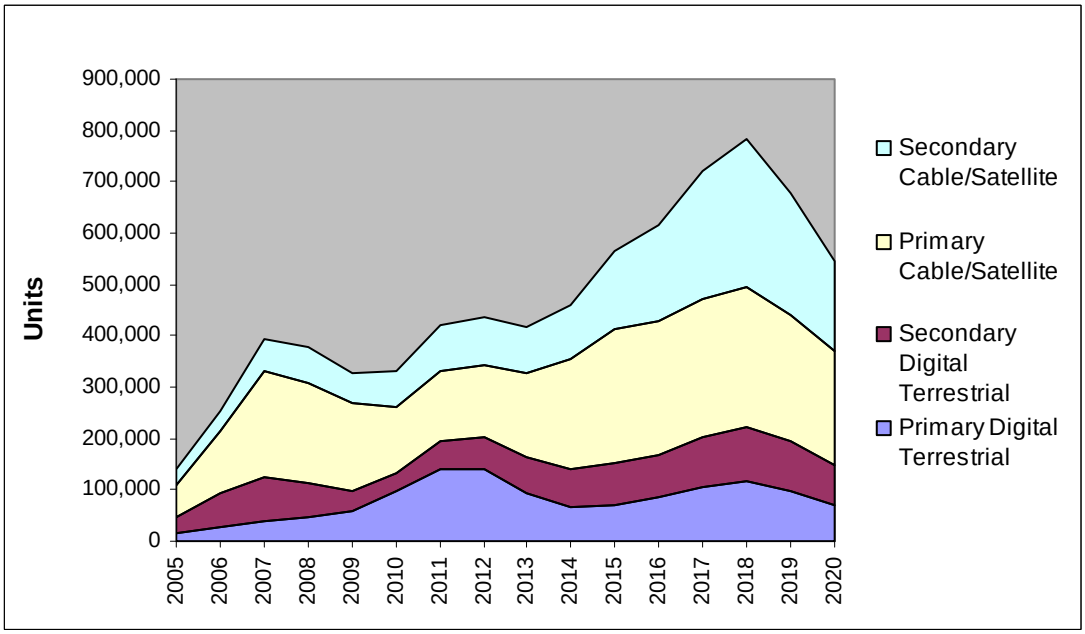


Central - East Midlands

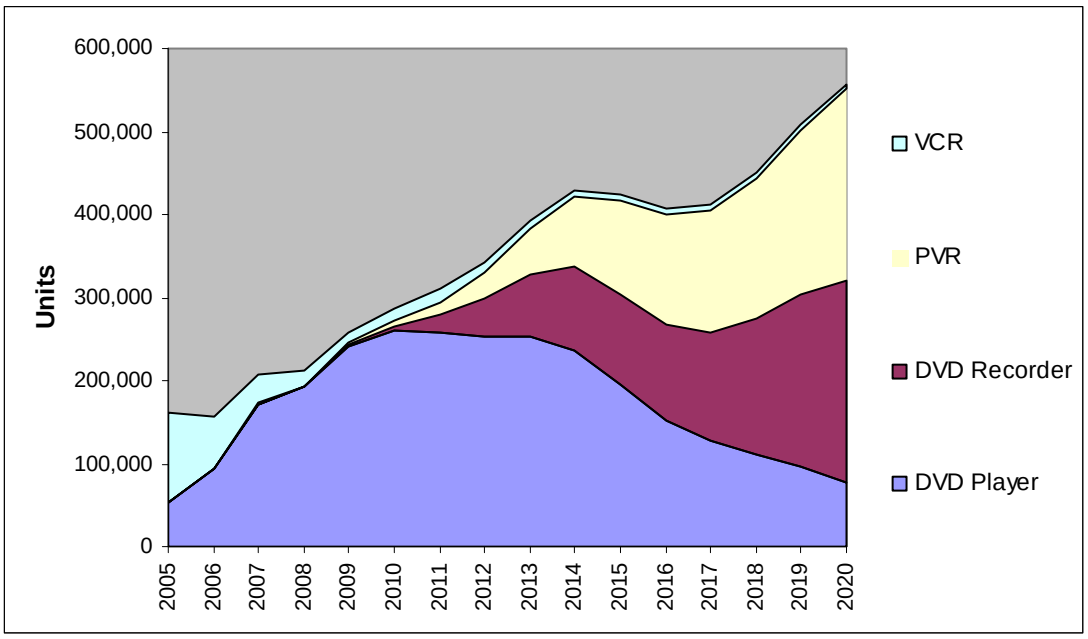
Disposal of Televisions 2005 – 2020



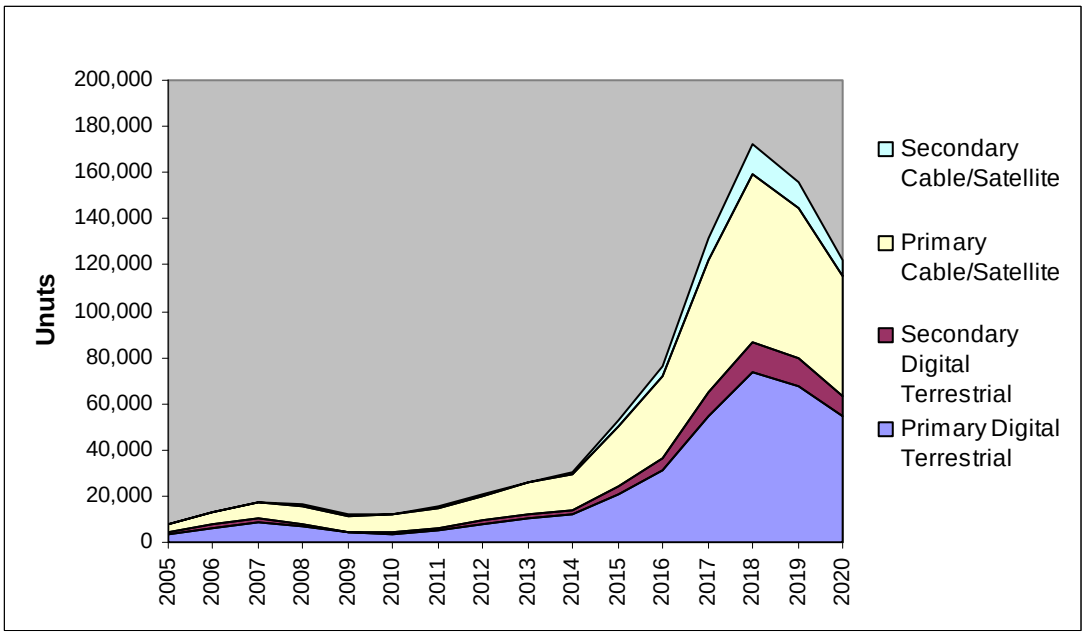
Disposal of Set-top Boxes for use with Televisions 2005 – 2020



Disposal of Recording Devices 2005 – 2020

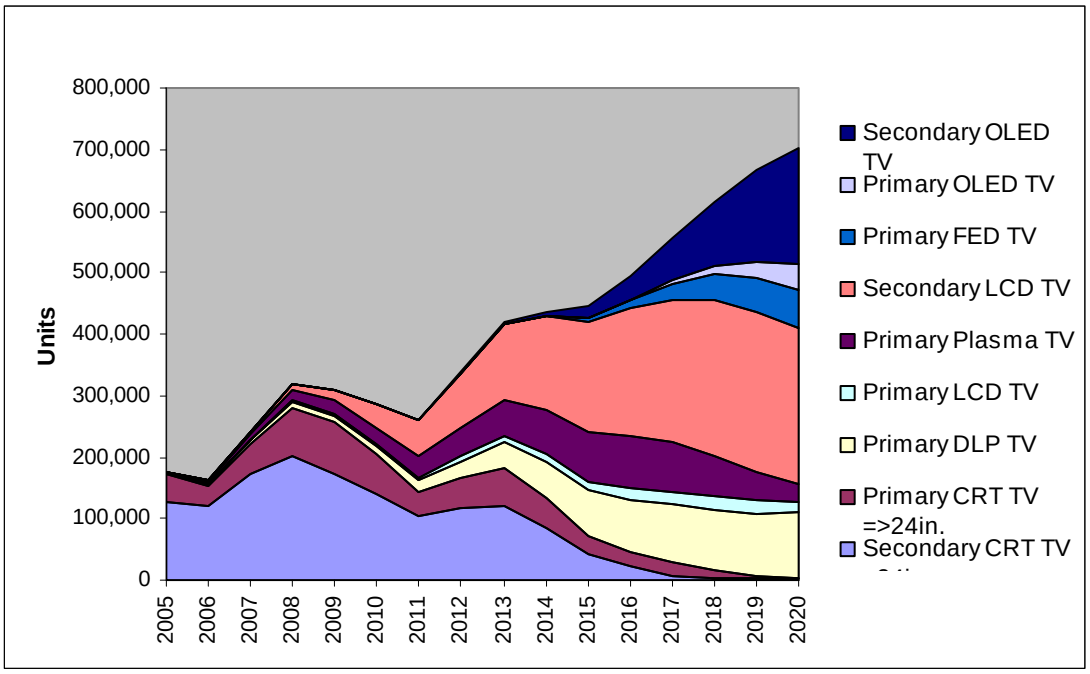


Disposal of Set-top Boxes for use with Recording Devices 2005 – 2020

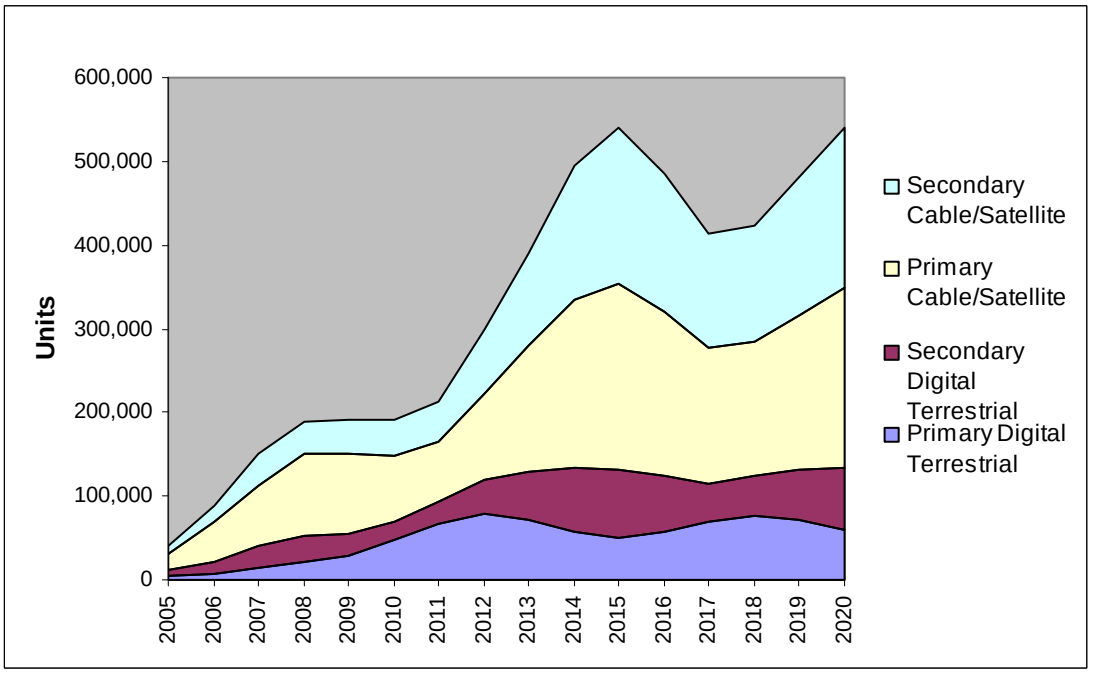


Granada and South Border

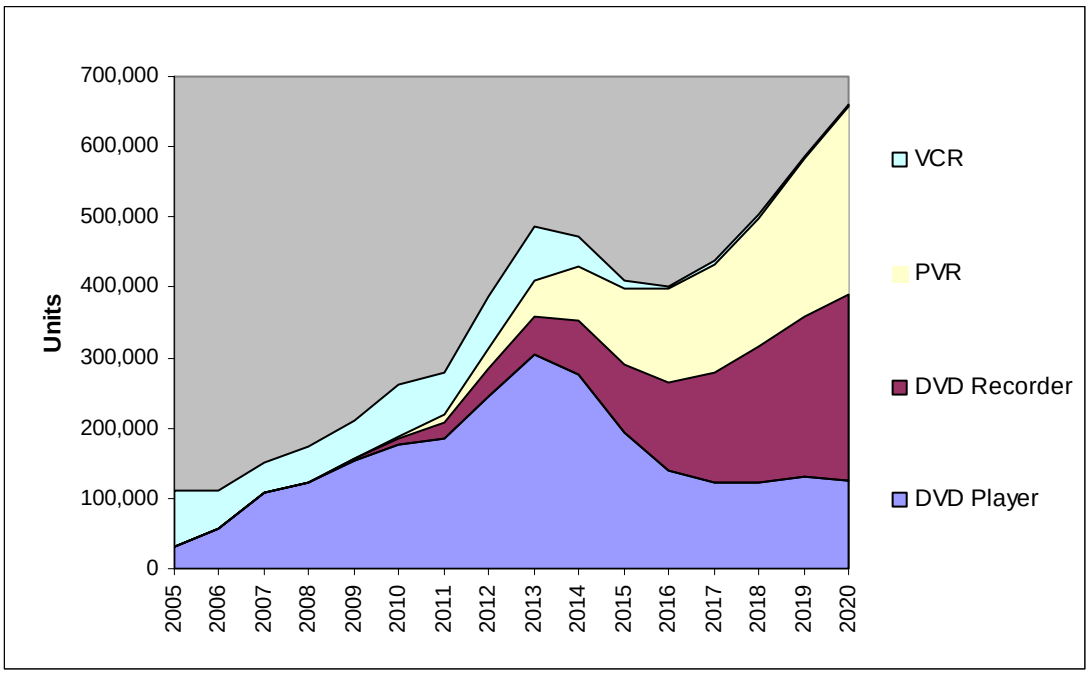
Disposal of Televisions 2005 – 2020



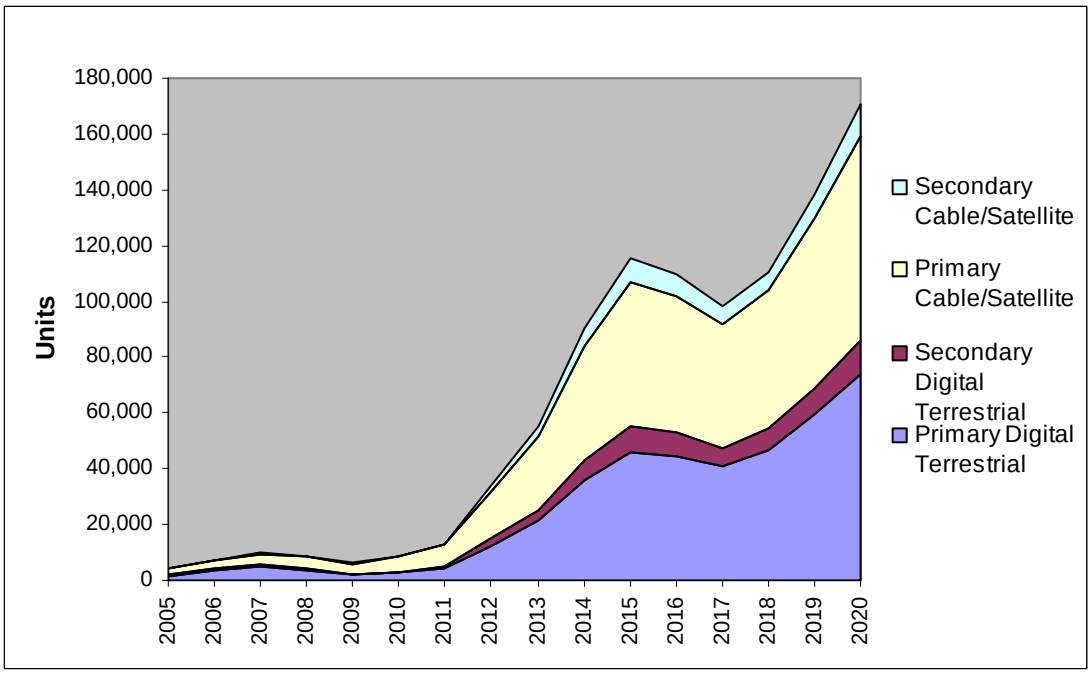
Disposal of Set-top Boxes for use with Televisions 2005 – 2020



Disposal of Recording Devices 2005 – 2020

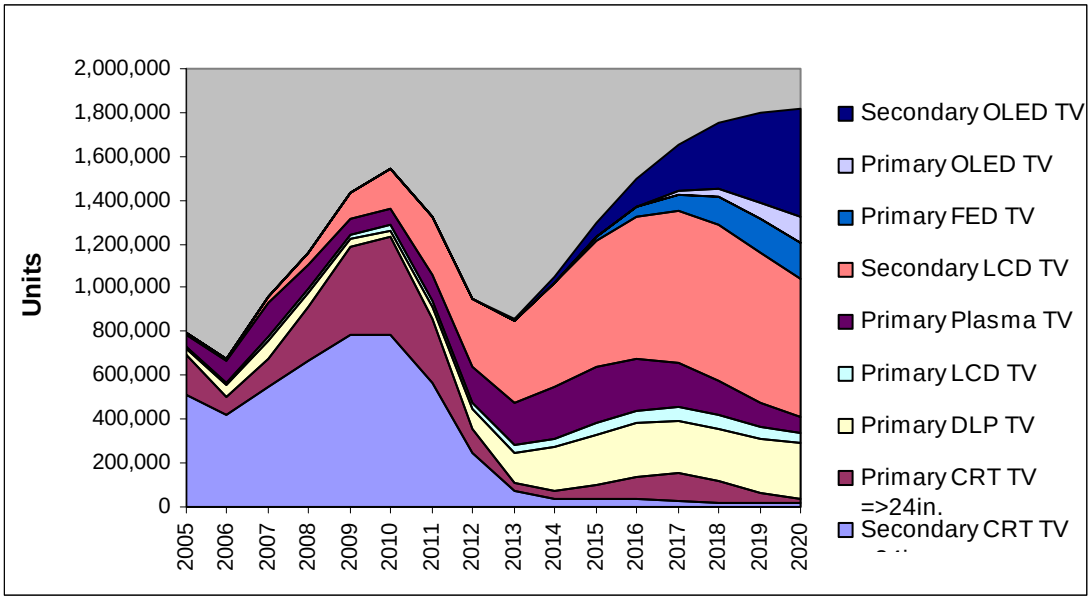


Disposal of Set-top Boxes for use with Recording Devices 2005 – 2020

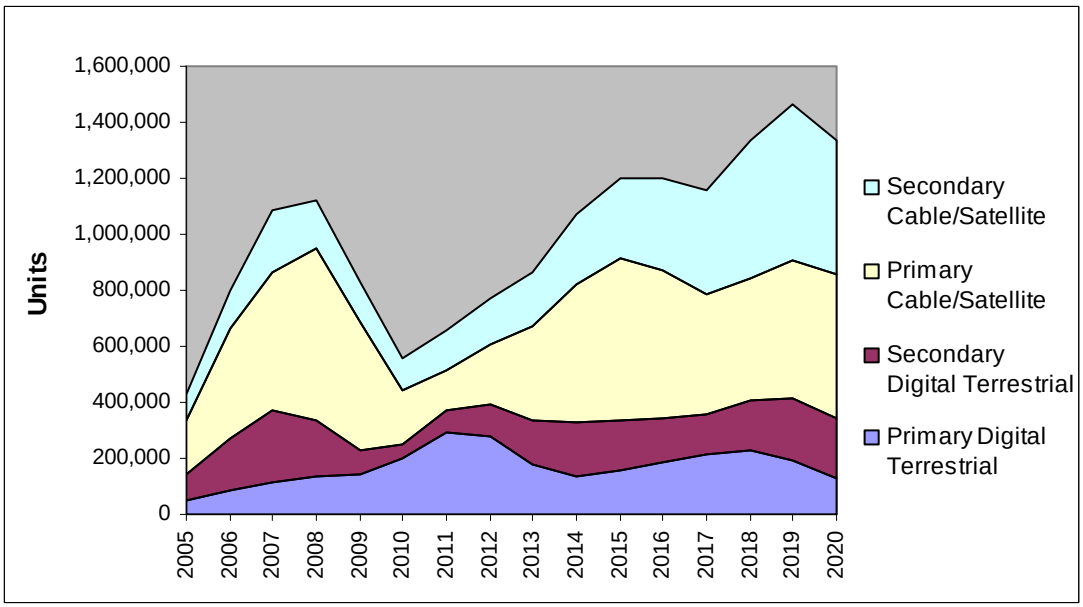


London

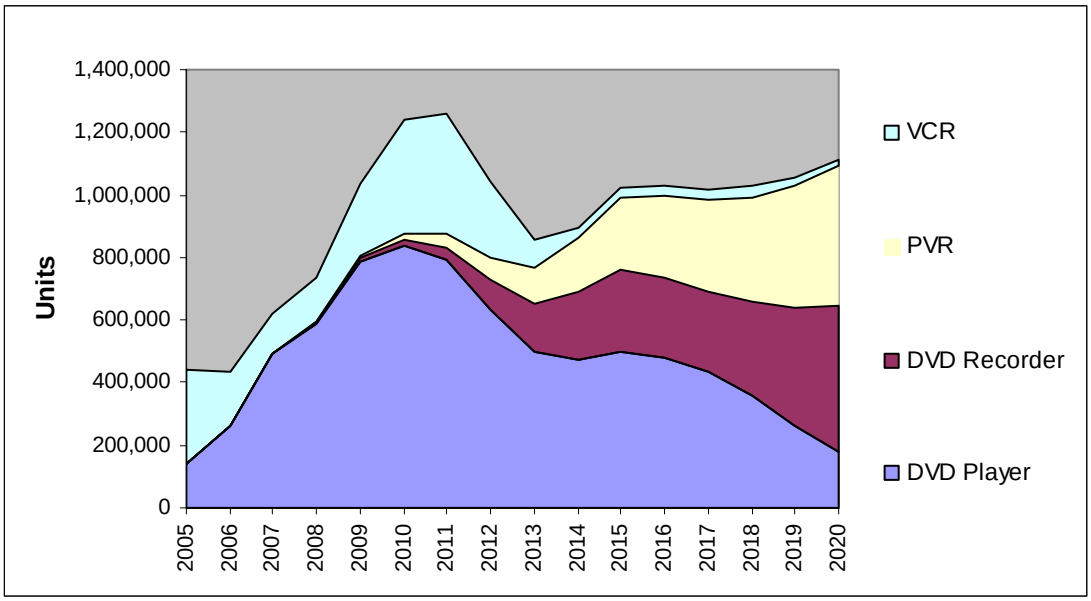
Disposal of Televisions 2005 – 2020



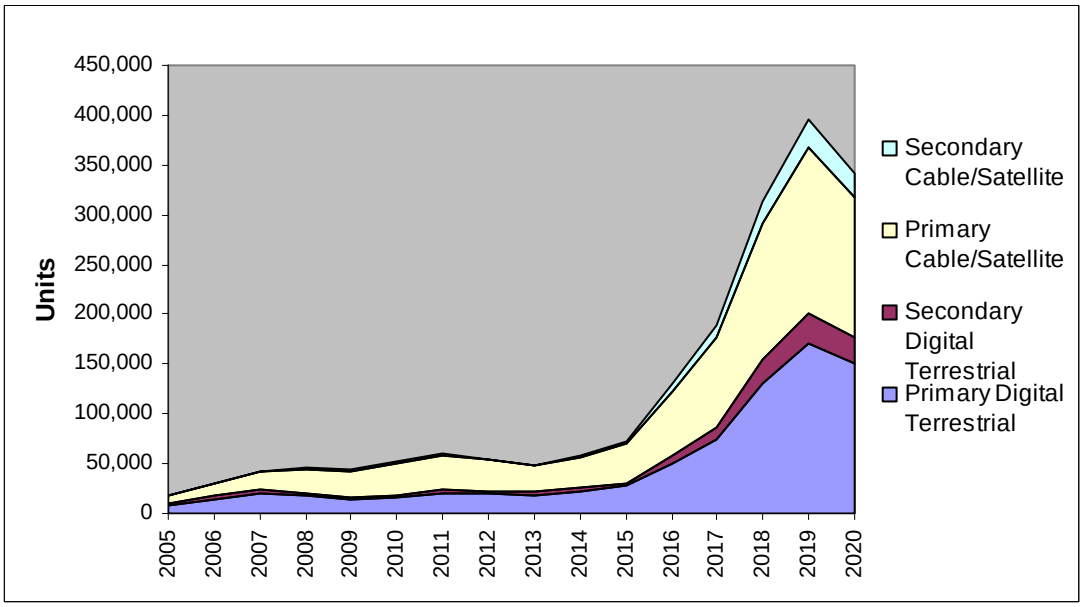
Disposal of Set-top Boxes for use with Televisions 2005 – 2020



Disposal of Recording Devices 2005 – 2020

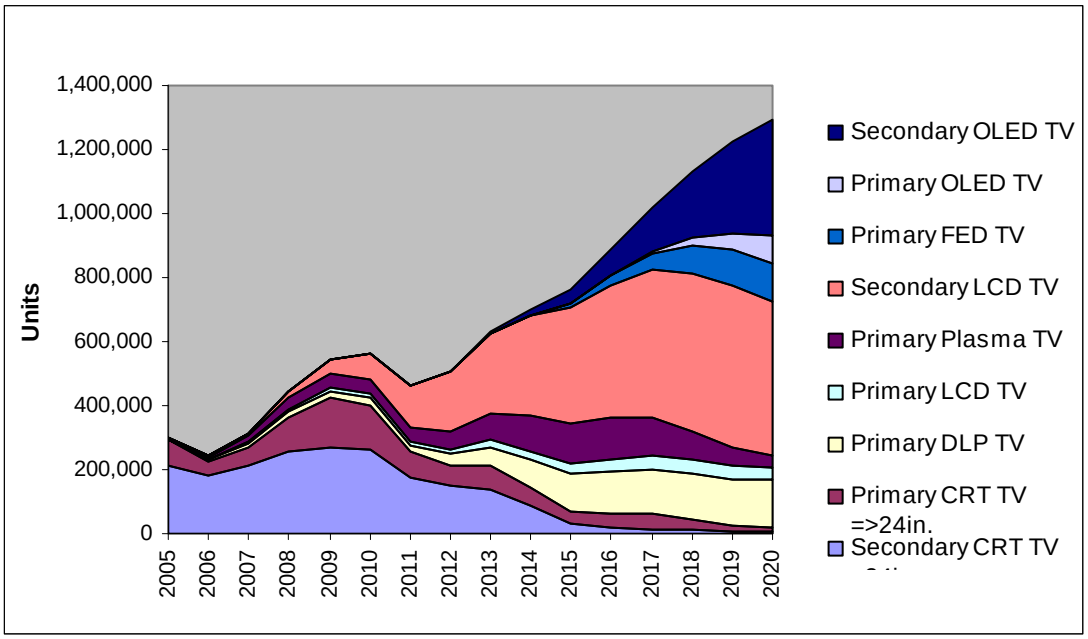


Disposal of Set-top Boxes for use with Recording Devices 2005 – 2020

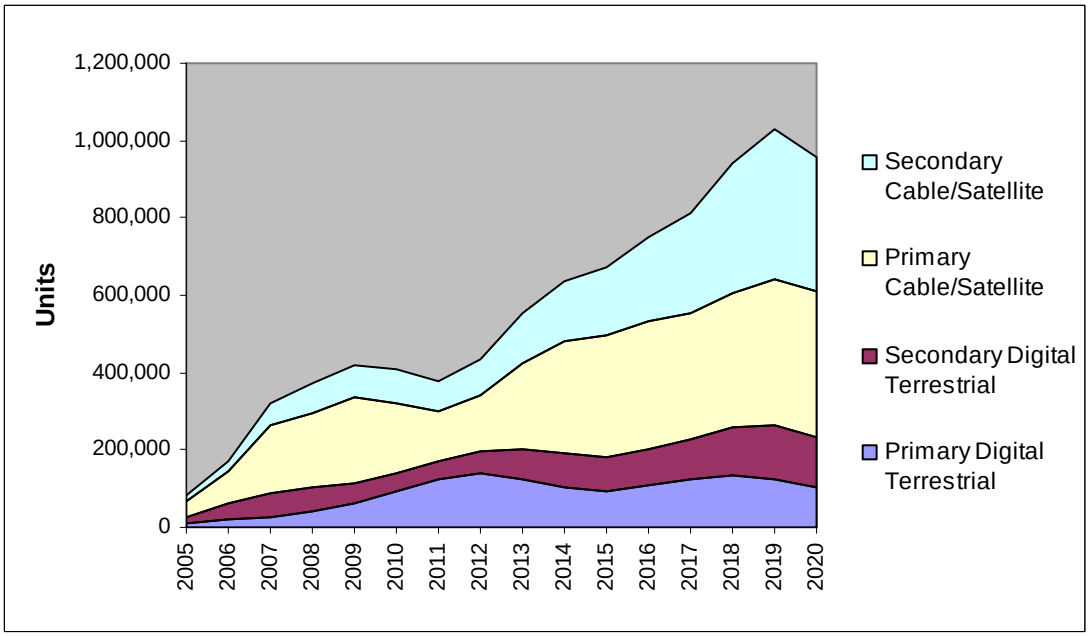


Meridian

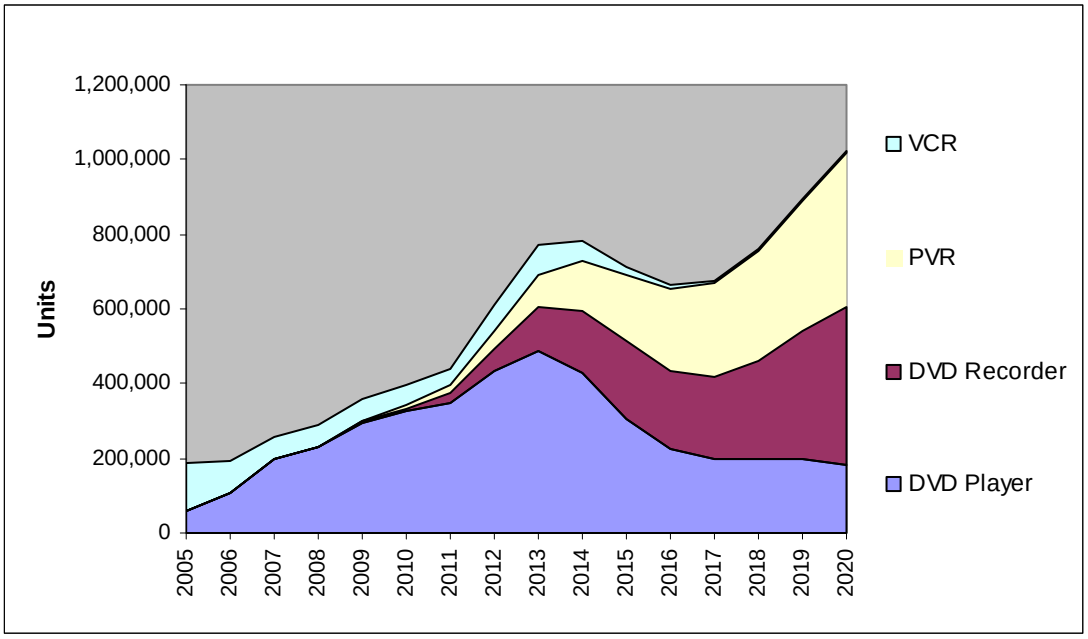
Disposal of Televisions 2005 – 2020



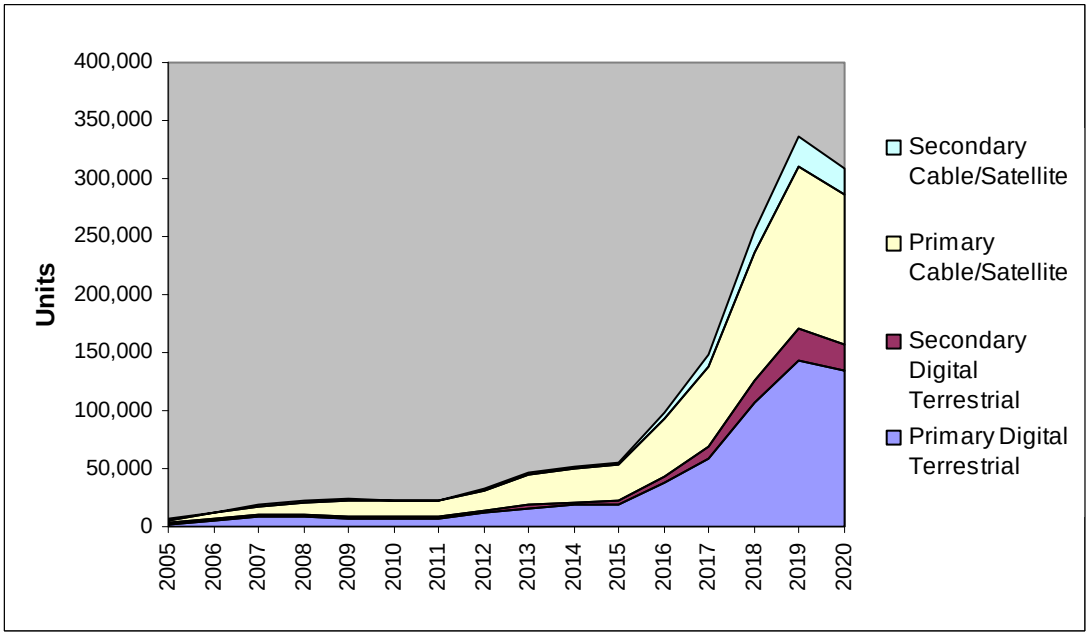
Disposal of Set-top Boxes for use with Televisions 2005 – 2020



Disposal of Recording Devices 2005 – 2020

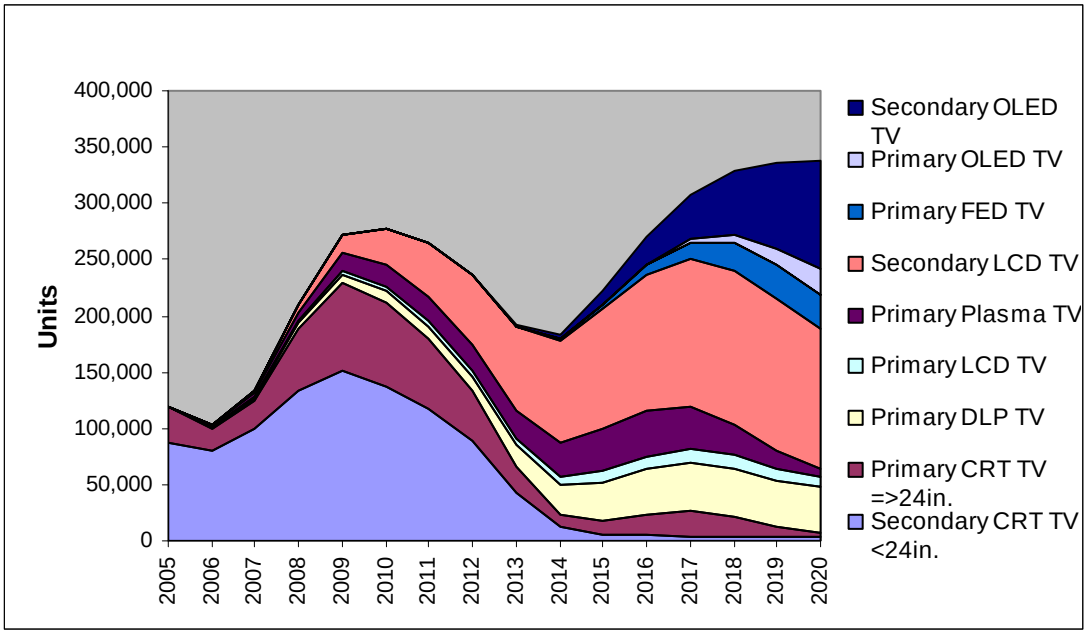


Disposal of Set-top Boxes for use with Recording Devices 2005 – 2020

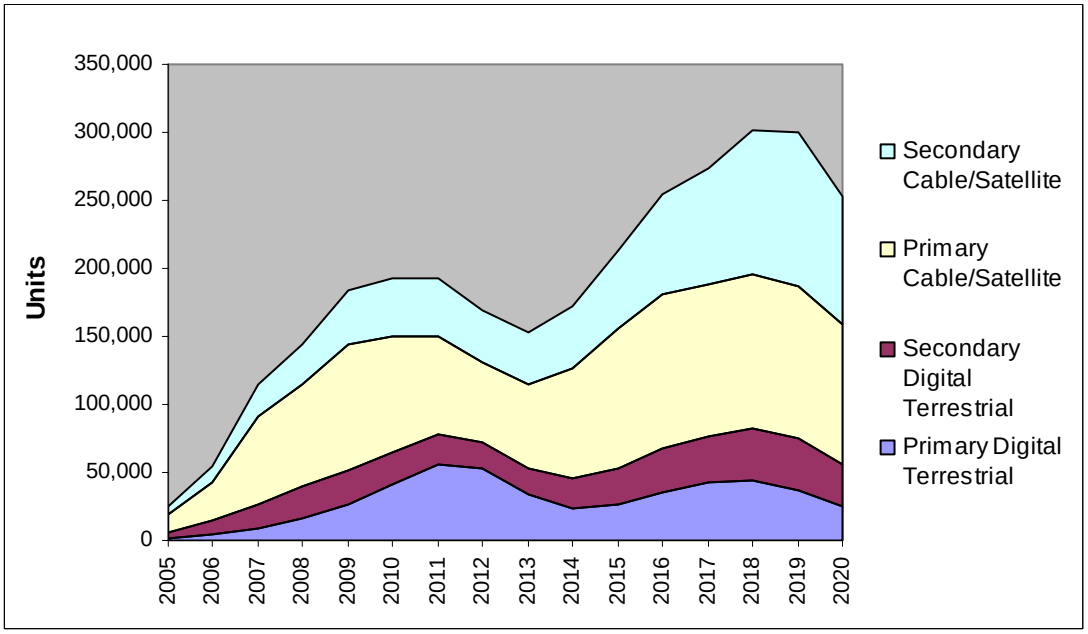


Northern Ireland

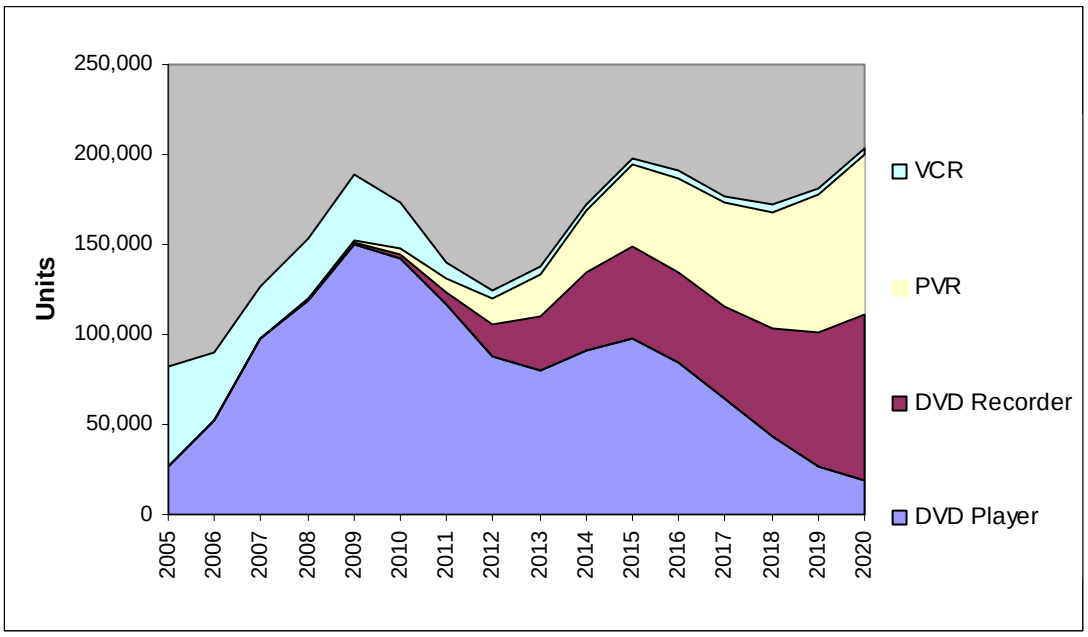
Disposal of Televisions 2005 – 2020



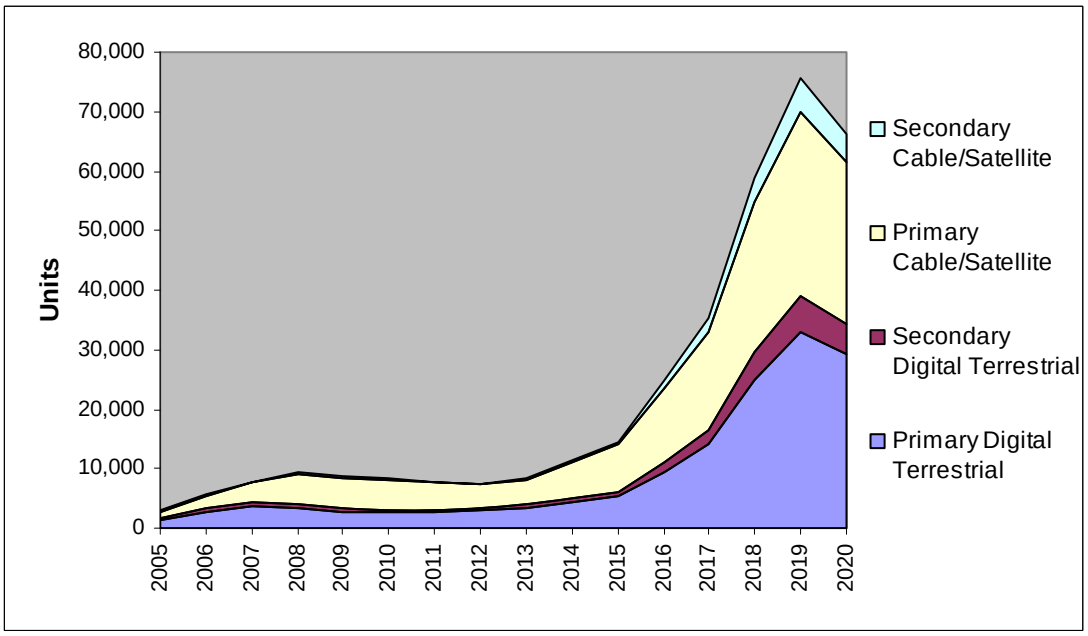
Disposal of Set-top Boxes for use with Televisions 2005 – 2020



Disposal of Recording Devices 2005 – 2020

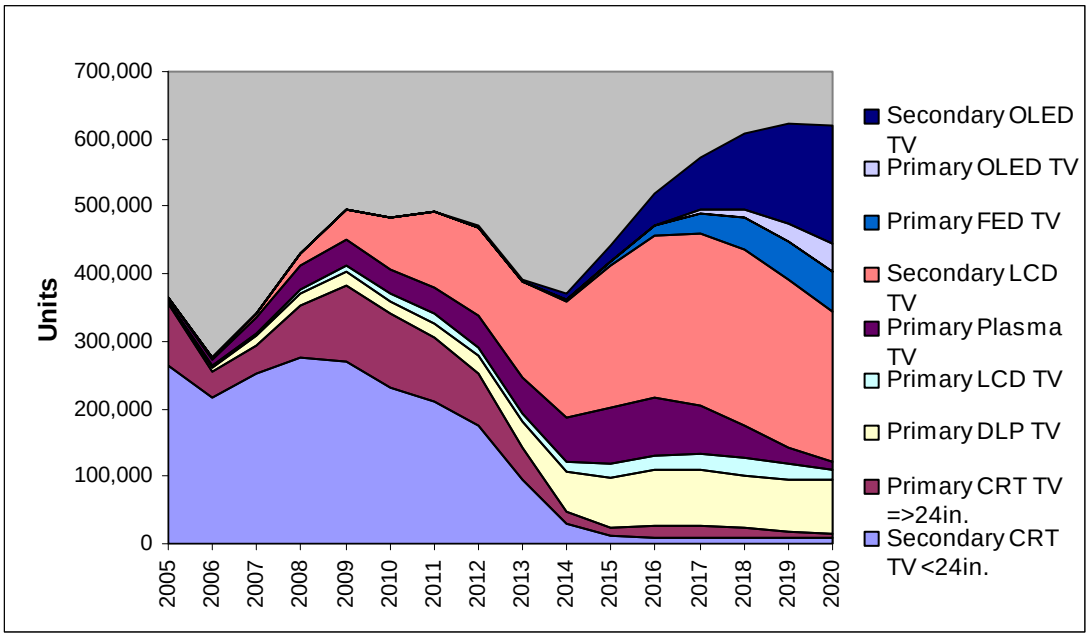


Disposal of Set-top Boxes for use with Recording Devices 2005 – 2020

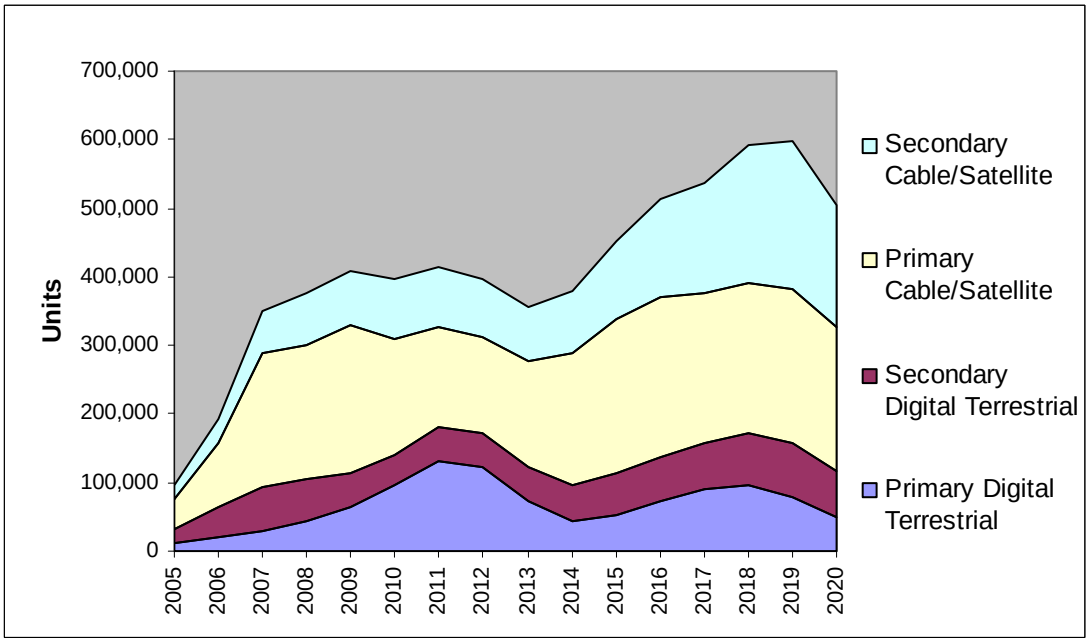


Tyne Tees

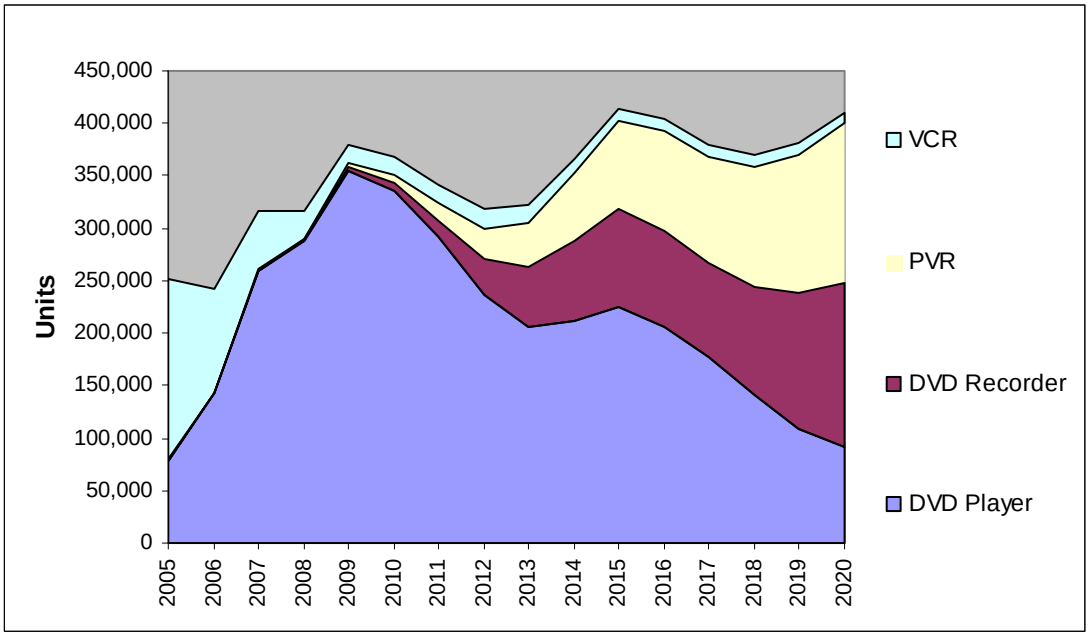
Disposal of Televisions 2005 – 2020



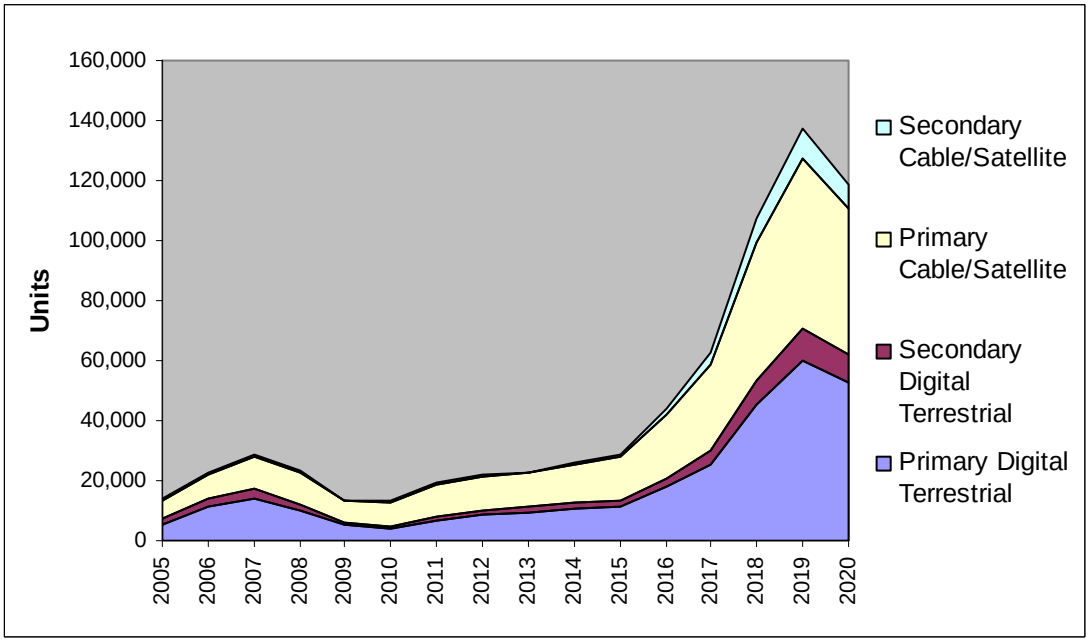
Disposal of Set-top Boxes for use with Televisions 2005 – 2020



Disposal of Recording Devices 2005 – 2020

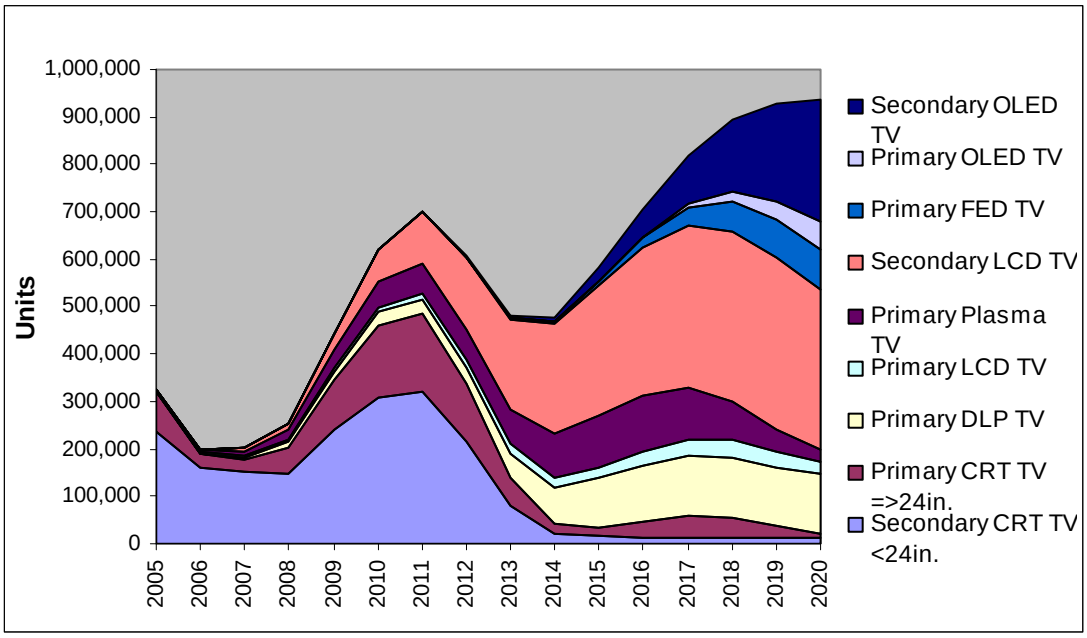


Disposal of Set-top Boxes for use with Recording Devices 2005 – 2020

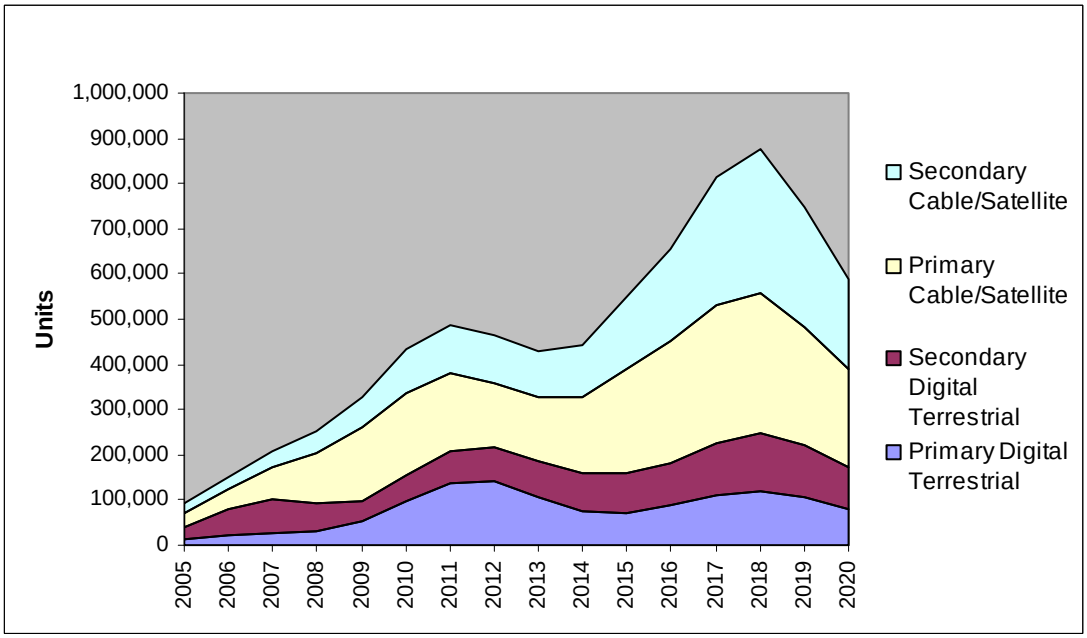


Yorkshire

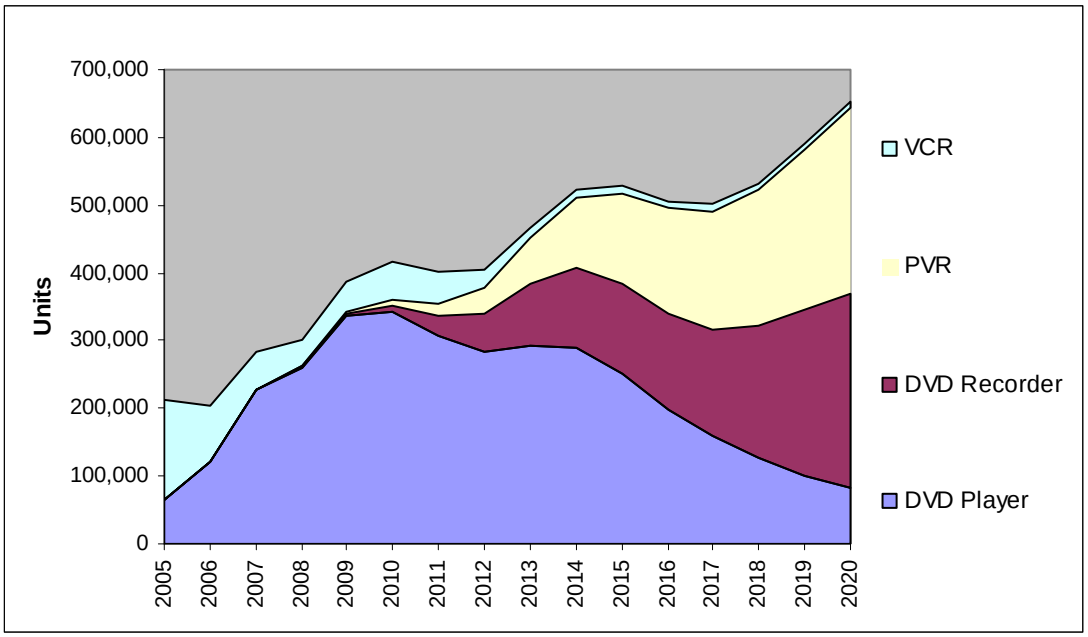
Disposal of Televisions 2005 – 2020



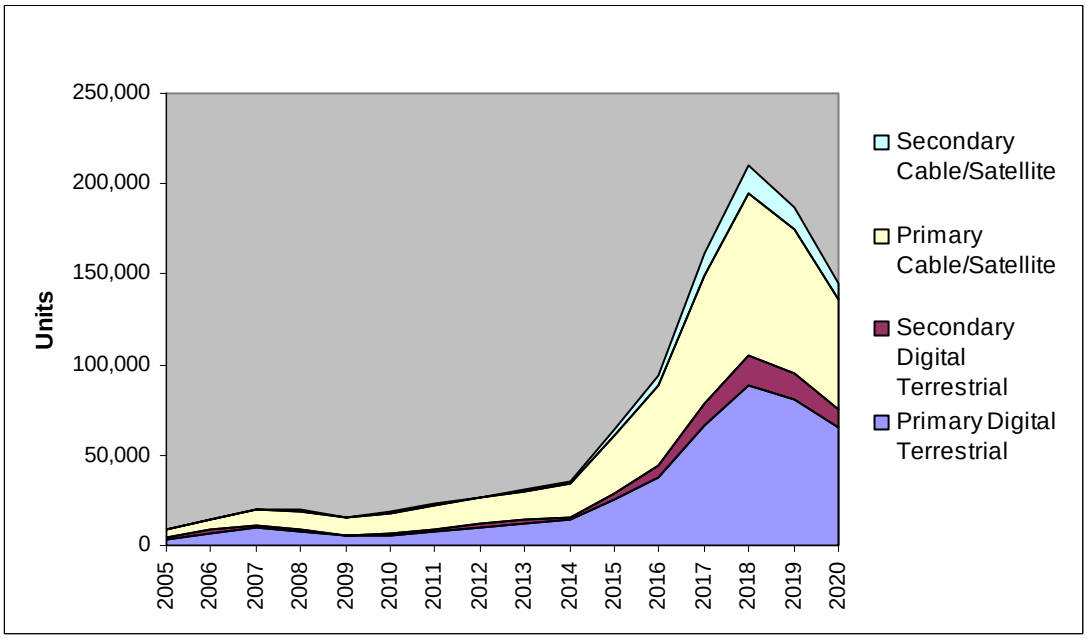
Disposal of Set-top Boxes for use with Televisions 2005 – 2020



Disposal of Recording Devices 2005 – 2020

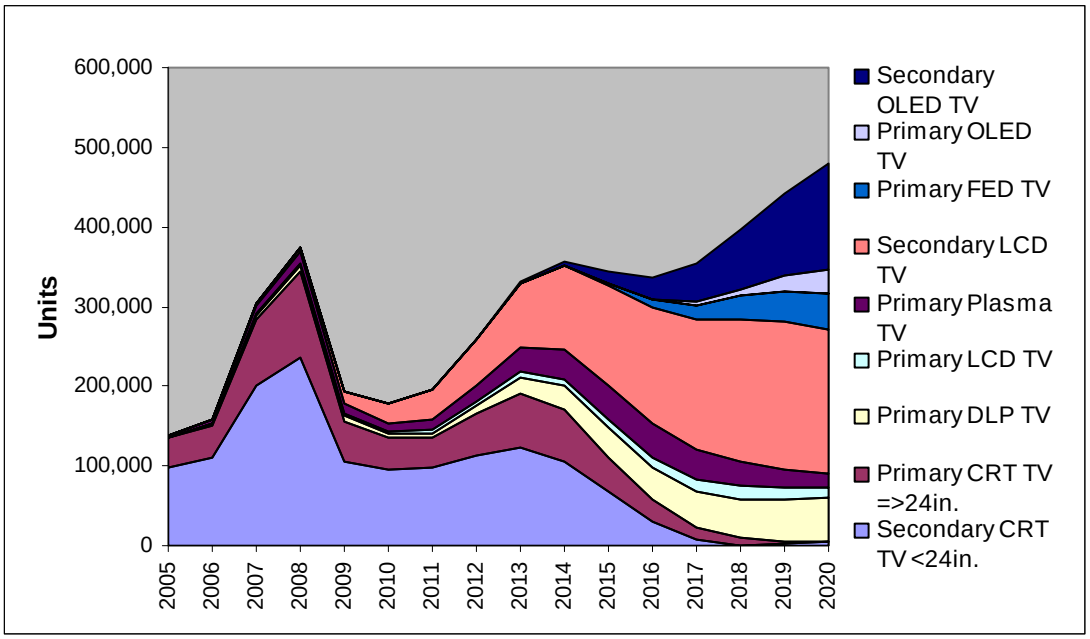


Disposal of Set-top Boxes for use with Recording Devices 2005 – 2020

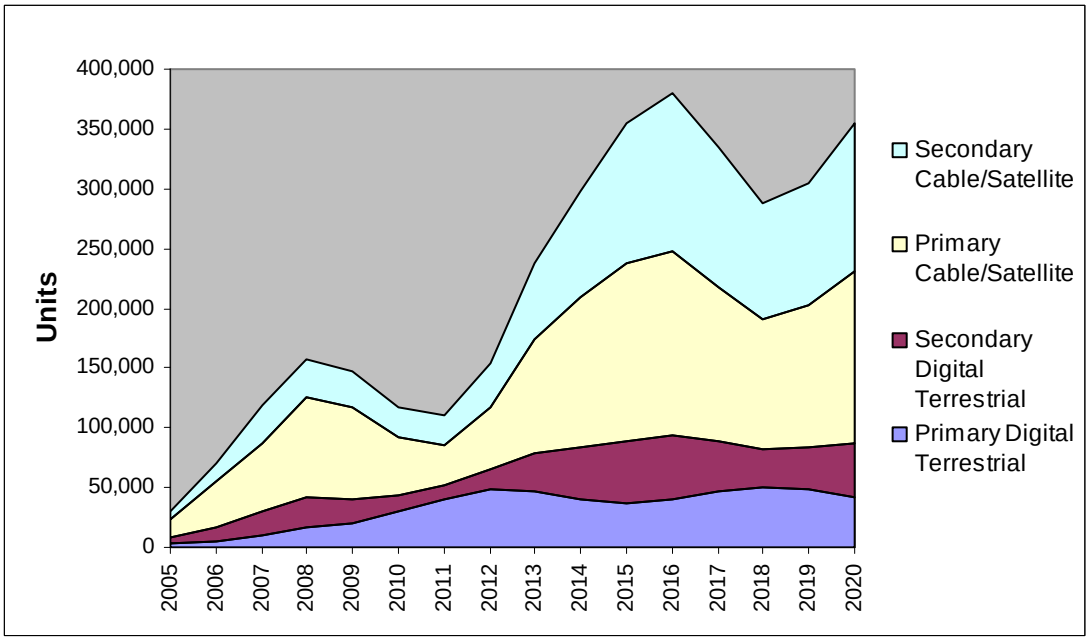


West Country

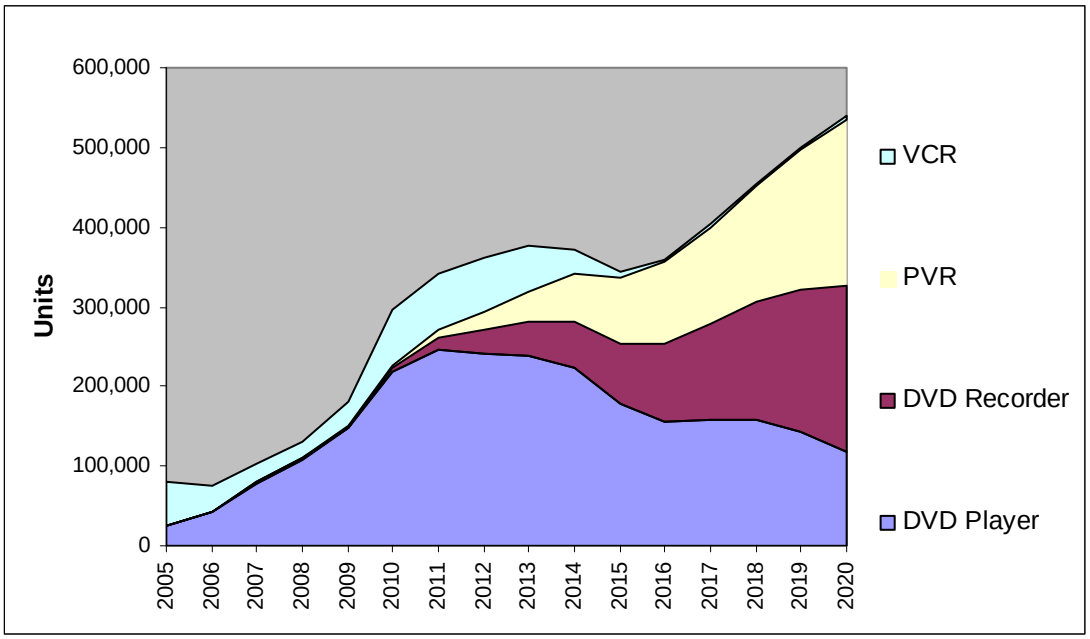
Disposal of Televisions 2005 – 2020



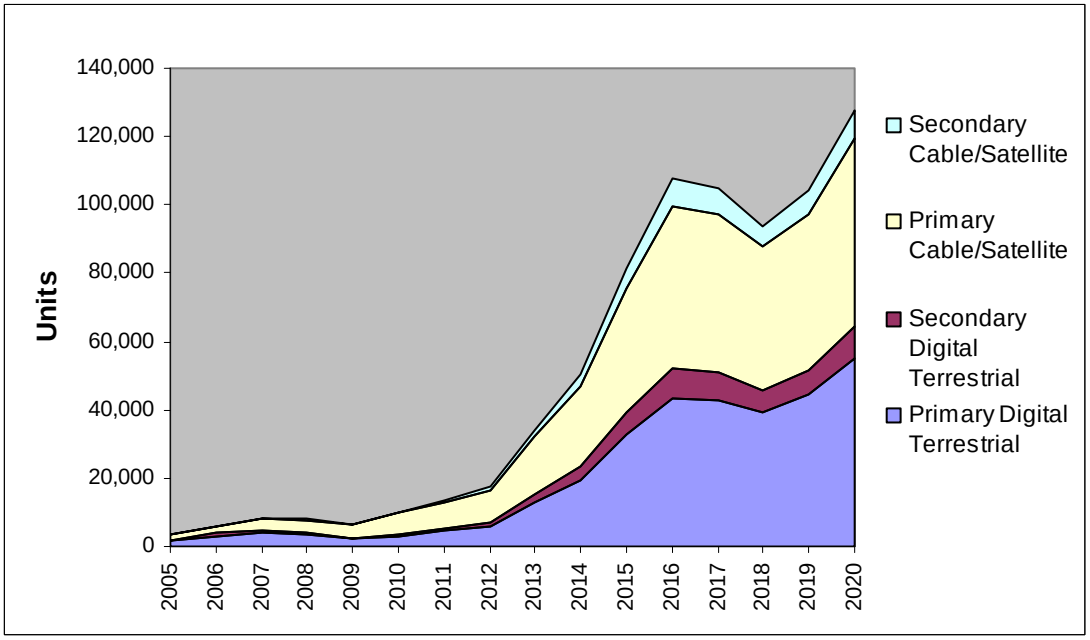
Disposal of Set-top Boxes for use with Televisions 2005 – 2020



Disposal of Recording Devices 2005 – 2020

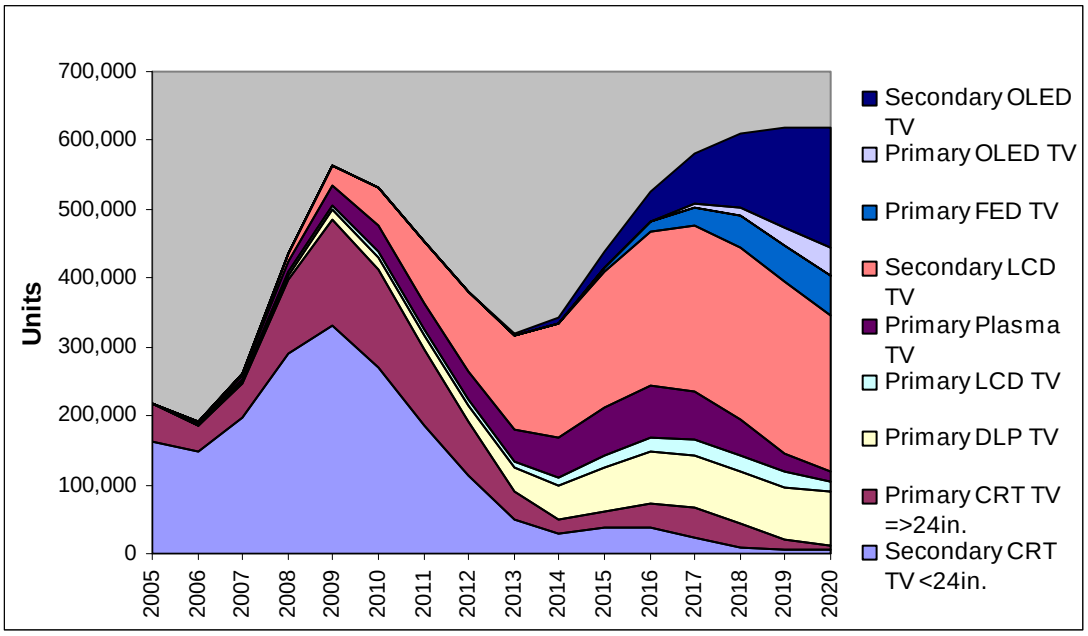


Disposal of Set-top Boxes for use with Recording Devices 2005 – 2020

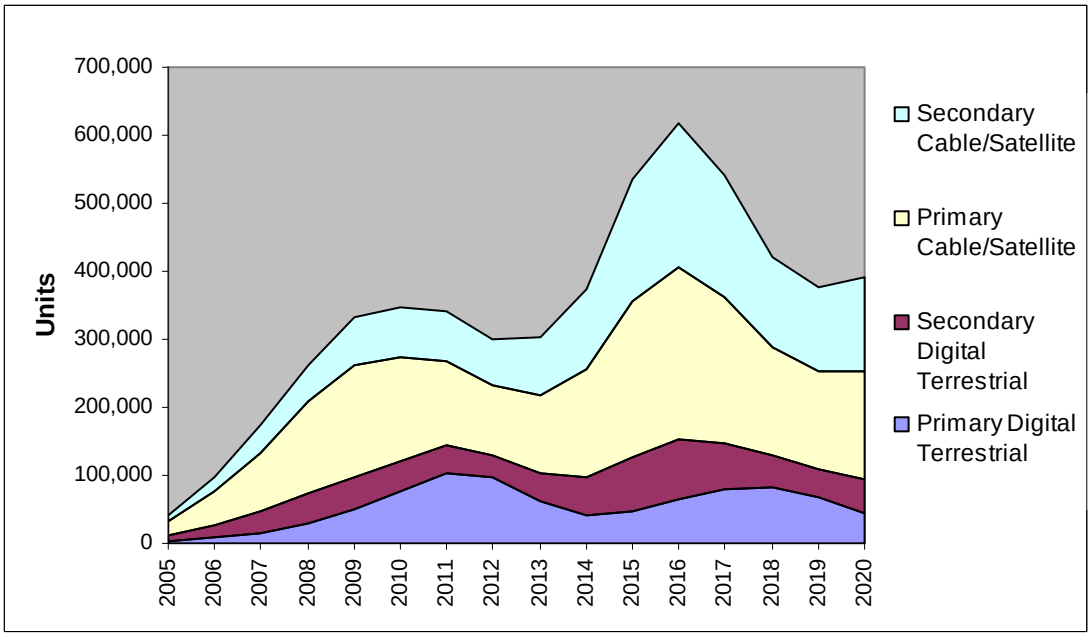


Wales

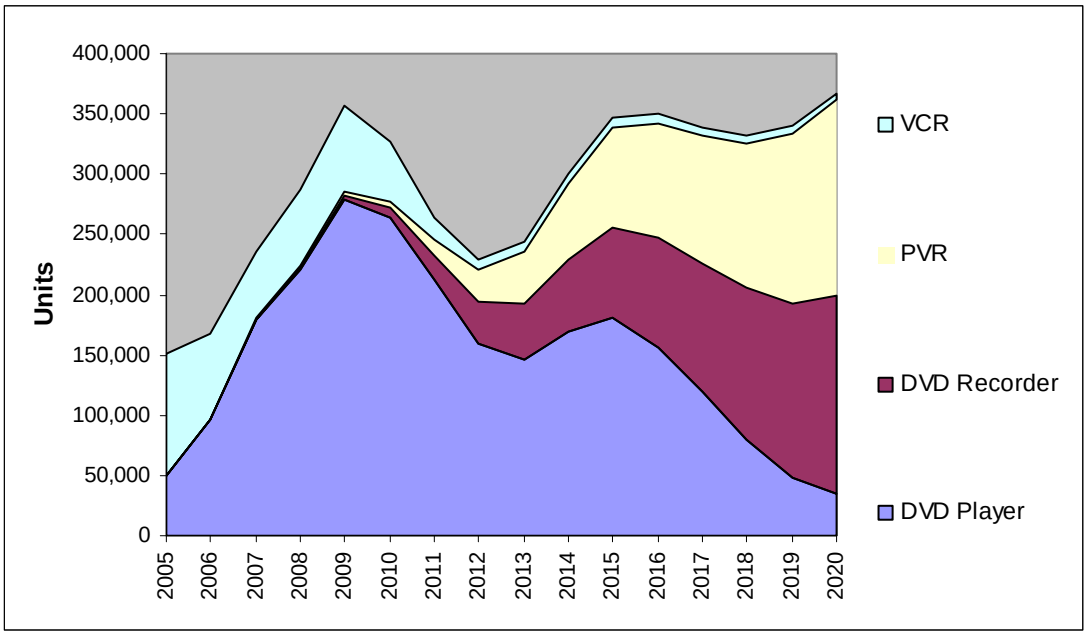
Disposal of Televisions 2005 – 2020



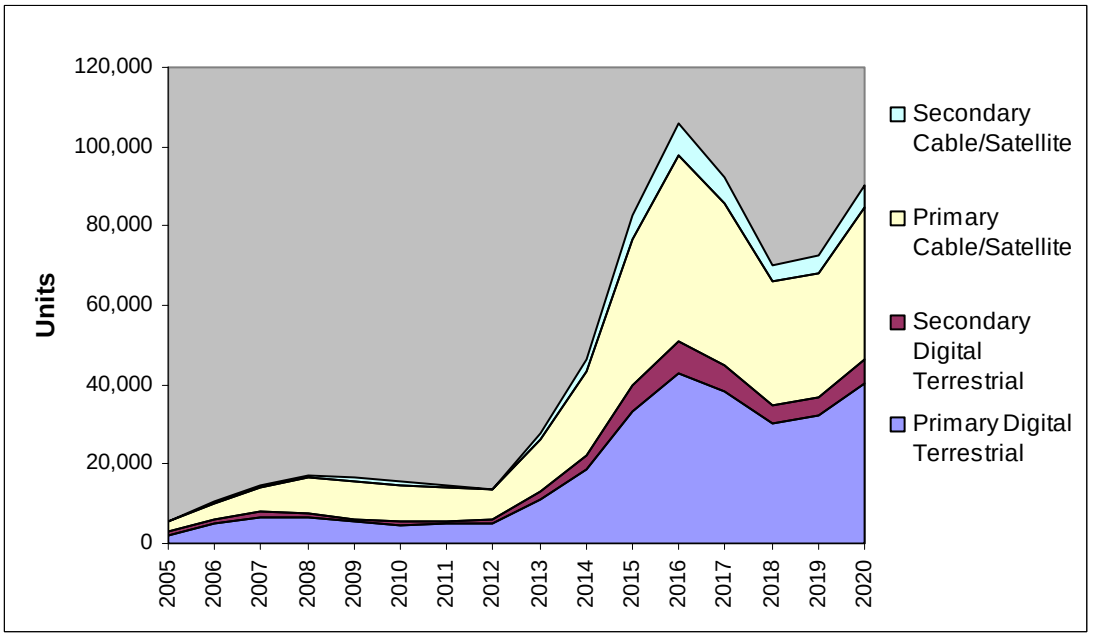
Disposal of Set-top Boxes for use with Televisions 2005 – 2020



Disposal of Recording Devices 2005 – 2020



Disposal of Set-top Boxes for use with Recording Devices 2005 – 2020



Parameters and Data Sources

Televisions

Parameter/Data	Reference Scenario	Digital Switch Scenario	Comments
Early disposal rate	0.05	0.15 – Secondary CRTs 0.06 – Primary CRTs	Based on Continental survey results. Additional early disposal is applied to two years before and after the switch. Additional disposal is only applied to CRTs.
k, shape parameter (disposal model)	3.0	3.0	
A, scale parameter (disposal model)	3.36	3.36	
Maximum lifetime of a product (years)	10	10	
Average technical lifespan of a product	7.0	7.0	
Disposal delay (number of years in storage)	4	4	
Number of households in each region	Housing statistics/ projections for 1998 – 2020 from ONS	Housing statistics/ projections for 1998 – 2020 from ONS	
Sales data for Plasma, CRT, LCDs by 10 regions	Regional sales figures from GfK for 2000 – 2005		

DVD/Recording Devices

Parameter/Data	Reference Scenario	Digital Switch Scenario	Comments
Early disposal rate	0.05	0.13	Based on Continental survey results. Additional early disposal is applied to 2008 – 2012 in each region in switch scenario. Additional disposal is only applied to VCRs and DVD recorders.
k, shape parameter (disposal model)	3.0	3.0	
A, scale parameter (disposal model)	3.36	3.36	
Maximum lifetime of a product (years)	10	10	
Average technical lifespan of a product	7.0	7.0	
Disposal delay (number of years in storage)	4	4	
Number of households in each region	Housing statistics/ projections for 1998 – 2020 from ONS	Housing statistics/ projections for 1998 – 2020 from ONS	
Sales data for DVD players and VCRs for 10 regions	Regional sales figures from GfK for 2000 – 2005		

Set-top boxes

Parameter values for set-top boxes for primary TVs	**Reference Scenario**		**Digital Switch Scenario**	
	Cable/Satellite	**Terrestrial**	**Cable/Satellite**	**Terrestrial**
Maximum penetration	75%	25%	80%	30%/20%
Growth rate until 2008*	20%	18%	20%	18%
Growth rate after 2008*	20%	18%	23%	19%
Current percentages of households with digital service for primary TV	1998 – 2005 figures taken from OfCom			
Parameter values for set-top boxes for secondary TVs	**Reference Scenario**		**Digital Switch Scenario**	
	Cable/Satellite	**Terrestrial**	**Cable/Satellite**	**Terrestrial**
Maximum penetration	75%	25%	75%	25%
Growth rate until 2008*	18%	16%	18%	16%
Growth rate after 2008*	18%	16%	22%	25%
Current percentages of households with digital service for secondary TV	Estimated based on OfCom figures for primary TV			

* Estimated based on Continental Survey results