

# Cost Benefit Analysis of Digital Radio Migration

Report prepared for Ofcom

6 February 2009

## Important notice

This report has been prepared by PricewaterhouseCoopers LLP ( PwC ) for Ofcom in connection with Cost Benefit Analysis of Digital Radio Migration under the terms of the PwC engagement letter with Ofcom dated 28 August 2008 (the Engagement ) and its contents are strictly confidential.

This report contains information obtained or derived from a variety of sources as indicated within the report. PwC has not sought to establish the reliability of those sources or verified the information so provided. Accordingly no representation or warranty of any kind (whether express or implied) is given by PwC to any person (except to Ofcom under the relevant terms of the Engagement) as to the accuracy or completeness of the report. Moreover the report is not intended to form the basis of any investment decisions and does not absolve any third party from conducting its own due diligence in order to verify its contents.

PwC accepts no duty of care to any person (except to Ofcom under the relevant terms of the Engagement) for the preparation of the report. Accordingly, regardless of the form of action, whether in contract, tort or otherwise, and to the extent permitted by applicable law, PwC accepts no liability of any kind and disclaims all responsibility for the consequences of any person (other than Ofcom on the above basis) acting or refraining to act in reliance on the report or for any decisions made or not made which are based upon such report.

We will restrict the right to circulation to Ofcom unless otherwise agreed. Without prejudice to the provisions in the Thought Partner Agreement, we understand that the DCMS, HM Treasury, BERR and/or the members of DRWG may refer to our report. Should this be the case, we will require the DCMS, HM Treasury and/or the DBERR to sign a letter in which it agrees that it will not acquire any rights against us and that it holds us harmless from the consequences of the provision to it of the report.

## Copyright notice

© 2009 PricewaterhouseCoopers LLP. All rights reserved. PricewaterhouseCoopers refers to PricewaterhouseCoopers LLP a limited liability partnership incorporated in England or, as the context requires, other member firms of PricewaterhouseCoopers International Limited, each of which is a separate legal entity.

# Contents

1. Executive Summary	1
1.1 Context and our role	1
1.2 Findings	1
1.3 Recommendations and further appraisals	4
1.4 Scope of the report	5
2. Introduction	6
2.1 Context	6
2.2 Background	6
2.3 Digital Radio Working Group	8
2.4 Cost Benefit Analysis	10
2.5 Structure of the report	10
3. Methods	12
3.1 Our approach	12
3.2 Phase 1: conceptual framework	12
3.3 Phase 2: empirical data collection	13
3.4 Phase 3: modelling, analysis and reporting	13
4. The CBA Framework	15
4.1 Defining the DRWG policy	15
4.2 Counterfactual – the “business-as-usual” scenario	19
4.3 Illustration of producer and consumer surplus	23
4.4 Methodological considerations	24
5. Model of Radio Listening	27
5.1 Approach	27
5.2 Digital Penetration and Listening	28
6. Incremental Benefits and Costs	32
6.1 Costs and benefits of DRWG policy	32
6.2 Producer benefits	33
6.3 Producer costs	34
6.4 Consumer benefits	39
6.5 Consumer costs	44
6.6 Results	53
7. Sensitivity Analysis	55
8. Distributional Effects	58
8.1 Vulnerable households	58
8.2 Nations and Regions	60
8.3 Community radio	60
8.4 Ethnic minority groups	60
9. Recommendations and Further Appraisal	62

## Index of Figures

Figure 1: Incremental benefit and cost to consumers and producers of the DRWG policy against a “business-as-usual” scenario .....	2
Figure 2: The benefits and costs of the DRWG policy in present value terms, £m.....	2
Figure 3: Sensitivity analysis of key aspects of the DRWG Policy (keeping all other parameters constant), Net present value terms, £m .....	3
Figure 4: Proposed digital radio migration.....	16
Figure 5: Model assumptions on coverage extension.....	17
Figure 6: Business-as-usual and DRWG policy .....	21
Figure 7: Illustrating Changes in Consumer and Producer Surpluses .....	24
Figure 8: Model approach.....	27
Figure 9: Annual set sales under BAU and DRWG policy .....	29
Figure 10: In-car DAB penetration for new cars .....	30
Figure 11: BAU Share of total listening by platform (end of year).....	31
Figure 12: Costs and benefits and incidence on consumers and producers .....	32
Figure 13: Changes in DAB Coverage at national level.....	33
Figure 14: Changes in transmission costs .....	34
Figure 15: Phasing of transmission costs under policy intervention (2008 - 2030).....	34
Figure 16: Frequency of radio listening by type of radio .....	37
Figure 17: Disposal cost of analogue radios .....	37
Figure 18: Comparison of marketing budget on government-led campaigns .....	38
Figure 19: Incremental benefit from consumers with extended coverage in-home .....	40
Figure 20: Incremental benefit from consumers with extended coverage in-car .....	41
Figure 21: Comparison of PwC estimates of radio spectrum value with other willingness to pay studies.	44
Figure 22: Proportion of Abstainers and Resisters .....	47
Figure 23: Adjustment for consumer benefit .....	47
Figure 24: In-home conversion costs (DRWG policy) .....	48
Figure 25: Energy consumption level .....	49
Figure 26: Number of licensed private and light goods vehicles and new registrations .....	50
Figure 27: Incremental cost of involuntary in-car conversion.....	52
Figure 28: NPV and summary of cost and benefit .....	53
Figure 29: Time profile of cost and benefit 2009 - 2030.....	53

Figure 30: Benefits and cost in present value .....	54
Figure 31: Sensitivity analysis of key aspects of the DRWG Policy (keeping all other parameters constant), net present value terms, £m.....	56
Figure B.1: Summary of Literature Review .....	69
Figure C.1: List of Stakeholders .....	79
Figure C.2: Data Sources.....	81
Figure D.1: Producer Compliance Schemes and Charging Structure .....	83
Figure D.2: Estimates of willingness to pay for additional digital stations.....	84

# 1. Executive Summary

## 1.1 Context and our role

In its final report, the Digital Radio Working Group (DRWG) recommended that the UK government (Government) should announce the digital migration of radio services once digital radio listening reaches 50% (as a proportion of total radio listening (commercial sector and BBC)) and implement the process within two years of the announcement<sup>1</sup>. This migration would involve DAB replacing FM as the primary platform for national, regional and large local radio stations. The coverage of BBC, national and large local commercial multiplexes would be extended to match their FM equivalent coverage by the time of migration. We refer to these recommendations as the DRWG policy.

The interim DRWG report suggested that the Government carries out a Cost Benefit Analysis (CBA) of the DRWG policy. In response to this suggestion, Ofcom commissioned PricewaterhouseCoopers LLP (PwC) to carry out the CBA. This CBA is based on the DRWG policy; it does not constitute a CBA of all of the options that could be considered to develop digital radio in the UK.

This CBA is based on the Green Book approach to CBAs and policy impact assessments, and relies on various data and plausible assumptions as well as consultations with relevant stakeholders within the DRWG. We have also drawn on our knowledge and experience of other CBAs, including those conducted on the digital switchover of television.

## 1.2 Findings

The CBA compares the incremental benefits and costs of the DRWG policy scenario against a baseline of no changes to the existing policies and regulations (in other words, a “business-as-usual” scenario). Figure 1 presents the key categories of expected incremental benefits and costs.

The CBA is conducted over the time horizon 2009-2030, which reflects the time between the publication of the DRWG’s final report and the end of a possible extension to the existing national and local digital commercial multiplex licences, as recommended by the DRWG<sup>2</sup>. The HMT recommended real discount rate of 3.5% is used.

---

<sup>1</sup> [http://www.culture.gov.uk/images/publications/DRWG\\_Final\\_Report.pdf](http://www.culture.gov.uk/images/publications/DRWG_Final_Report.pdf)

<sup>2</sup> With an extension of a further twelve years to the current licence for the D1 multiplex, the current expected end date of a licence is 2023. The DRWG recommended that licences are extended to 2030 (Section 4.7 of the DRWG final report).

**Figure 1: Incremental benefit and cost to consumers and producers of the DRWG policy against a “business-as-usual” scenario**

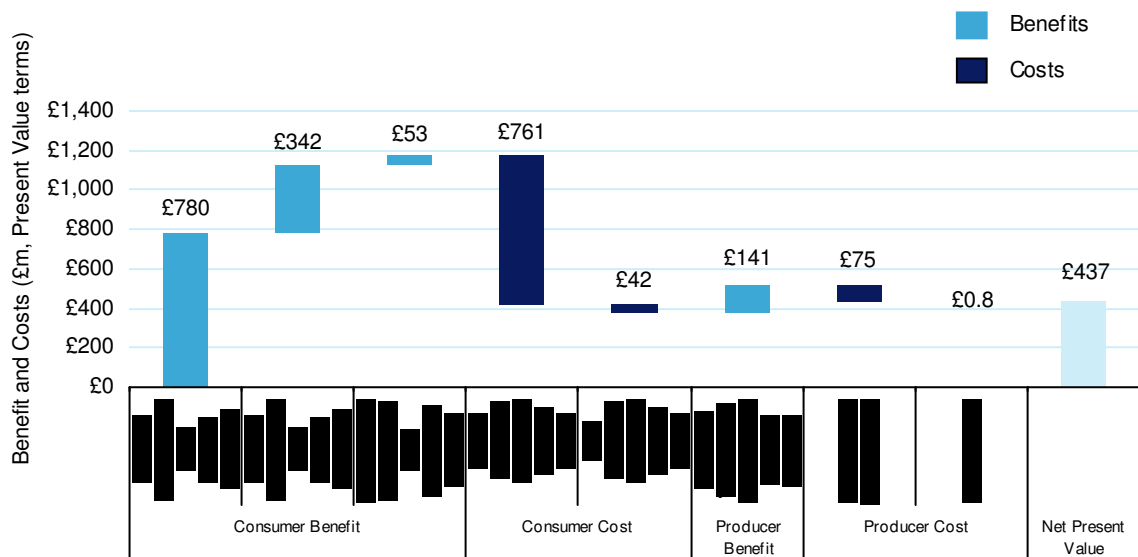
	Consumer	Producer
<b>Benefit</b>	<ol style="list-style-type: none"> <li>1. Extended coverage – access to new digital channels in-home and in-cars for consumers who are out of coverage.</li> <li>2. Benefits from the alternative uses of the spectrum.</li> </ol>	Savings in dual transmission, net of costs of extending coverage.
<b>Cost</b>	<ol style="list-style-type: none"> <li>1. Non-voluntary conversion costs, for both ‘average’ and ‘vulnerable’ households.</li> <li>2. Non-voluntary conversion costs for car owners.</li> </ol>	<ol style="list-style-type: none"> <li>1. Disposal costs of radio sets.</li> <li>2. Marketing and administrative costs.</li> </ol>

We estimate that the net present value (NPV) of the costs and benefits of the DRWG policy could be in the region of £437m. The most important elements of the CBA are:

- The benefits to existing out-of-DAB-coverage consumers, as a result of enhanced access to digital stations, both in-home and in-car (a present value of £1.1b);
- The costs to in-car consumers to enable in-car DAB listening (a present value of £760m); and
- The benefits to producers in terms of savings on transmission costs (net of the cost of extending coverage) as a result of the cessation of dual transmission (a present value of £140m).

A breakdown of the cost and benefit estimates is provided in Figure 2.

**Figure 2: The benefits and costs of the DRWG policy in present value terms, £m**



- 1 The CBA results are most sensitive to the following assumptions:
- 2 The expansion of the regional multiplexes;
- 3 A shorter time horizon or uncertainty over the long term future of radio industry, e.g. no extension to current licence period;
- 4 Willingness to pay estimates of consumer value from the use of digital radio;
- 5 Involuntary consumer conversion costs; and
- 6 Energy and carbon costs in the absence of efficiency improvements.

The results suggest that there are relatively few up-sides to the estimates, and several significant down-side risks.

The sensitivity analysis is presented in Figure 3 and explained in detail in Section 7. The analysis is conducted by assuming that only one parameter is varied, holding all others constant in the DRWG policy.

To a significant extent, the positive NPV of the CBA relies on two crucial parameters. The first is the DRWG recommendation that an enlarged regional multiplex network should be implemented.<sup>3</sup> Failure to implement would result in a substantial negative NPV.

The second critical parameter is the time horizon. The results suggest that there is a very long pay-back from the DRWG policy “investment” - the NPV turns positive after 2026. This result assumes that the existing multiplex licences are extended to 2030, as per the DRWG recommendations<sup>4</sup>. Without the licence extension or any other policy instruments that provide clarity on the long term future of commercial radio, the industry and consumers may fail to see the benefits of digital radio over the longer term.

Our analysis suggests that the NPV is negative should either of these two proposals not be implemented.

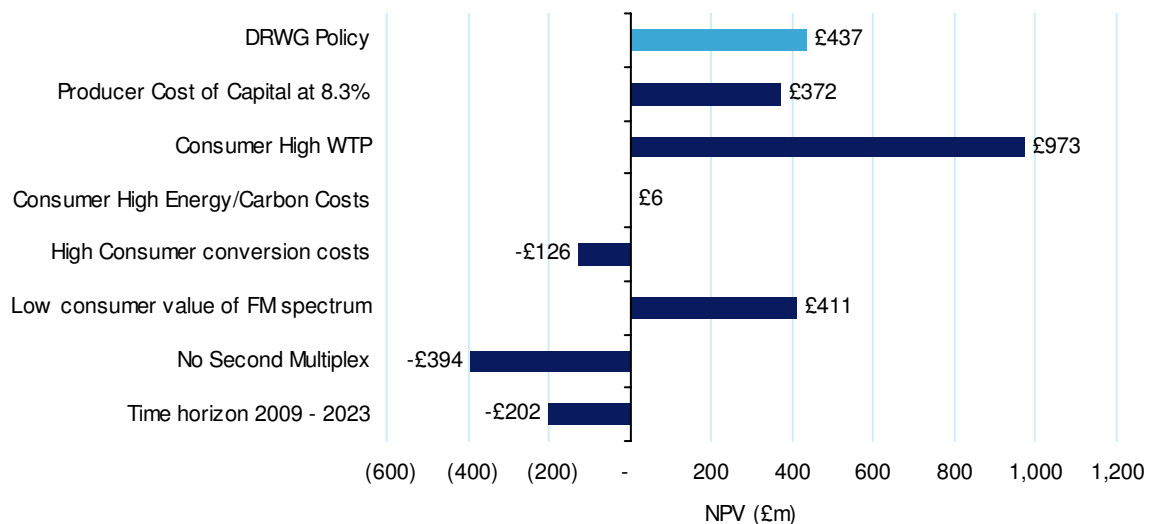
**Figure 3: Sensitivity analysis of key aspects of the DRWG Policy (keeping all other parameters constant), Net present value terms, £m**

---

---

<sup>3</sup> In its final report, the DRWG ‘urges’ the government to “introduce new legislation to give Ofcom the power to allow [mergers of local multiplexes with excess capacity] or reconfiguration of [multiplex areas] where the relevant licence holders deem it appropriate and where Ofcom deem it to be in the public interest.” (Section 4.10). Therefore, a second national digital multiplex formed from the existing regional multiplex network is not explicitly recommended by the DRWG in its final report. However, Ofcom requested that we explicitly model this state of the world in our cost-benefit analysis as one option of how the recommendations of the DRWG, if implemented, could affect the multiplex structure in the UK.

<sup>4</sup> We have not modelled a scenario in which the time period is extended to 2030 *without* an extension to the licences.



### 1.3 Recommendations and further appraisals

We recommend that Ofcom and the Government continue to update our work, as additional market data are released and if primary research is conducted. Accordingly, we consider that the CBA would benefit from:

- 1 Refinement to the willingness to pay estimates based on updated or new studies;
- 2 Greater certainty on the potential uses of FM/AM spectrum and the amount to be released;
- 3 More analysis of the potential impacts to different vulnerable groups and the form of assistance required;
- 4 Greater development of the marketing strategy and associated budget; and
- 5 An environmental impact assessment to consider the disposal of radios and the energy savings from the cessation of analogue transmission.

The scope of this study is limited to the assessment of the DRWG policy. The overall digital radio policy appraisal process would need to take into account other policy options and 'states of the world'. With this in mind, we highlight three issues in particular:

- 1 The impact of recession: We have assumed no change in commercial radio sector structure and health beyond a consensus view of advertising forecasts. As this CBA is conducted for the time period to 2030, short term recessionary impacts may have only a limited impact on the longer term outcome for the industry. On the other hand, the current economic downturn could still affect the short and medium term investments required for marketing or coverage extension, which in turn could delay the desired DRWG policy outcome.
- 2 Other policy options: We recognise that to reach a view on this question of how to drive digital radio penetration and listening (which in turn delivers consumers' and citizens' objectives) requires a full assessment of the costs and benefits of a number of policy options; this study has examined one, the DRWG policy. This is the only policy assessed in this study and the policy is at an early stage of its development; Government and Ofcom could give consideration to other possible policy options. In addition, we recommend modelling a number of other "business-as-usual" scenarios taking into account different assumptions, and assessing how they affect the CBA of the DRWG policy.
- 3 Other digital platforms: This CBA assumes that DAB listening will continue to be the leading platform for digital radio listening. The DRWG has reinforced the view that "a radio-specific broadcast platform

is an essential part of radio's future", and that DAB is the "most effective and financially viable way of delivering digital radio" for the medium to long term. A long term view needs to account for the possibility of technology obsolescence or replacement. At present, there is no consensus view that suggests otherwise. However, there are signs that internet listening may begin to take off if internet radios are more actively promoted and technologies such as WiFi or mobile broadband mature and become universally available. A number of the cost and benefit categories assume an impact from increasing the coverage of DAB (for example, consumer benefits from increased coverage is assumed based upon the incremental benefits to consumers who could not receive digital radio stations). Should these trends continue, or a more structural shift to internet to occur, there would be a smaller benefit from increasing the coverage of DAB; consumers either have alternative access to digital radio even within out-of-coverage areas, or would prefer a non-DAB solution when they receive DAB coverage.

## 1.4 Scope of the report

The assumptions, projections, findings and conclusions contained in this report represent our best professional judgement based on the information available to us during the project. The project has been based on publicly available information as well as data and research provided by Ofcom and the stakeholders consulted. Over the course of the study, Ofcom, DCMS, HMT and BERR have had an opportunity to input into the process, including approving key assumptions and providing feedback on preliminary results. Our definition of the DRWG policy is based on our interpretation of the DRWG interim and final recommendations, guided by Ofcom.

The cost and benefit estimates within the CBA framework should be viewed in the context of the current environment. At the time of writing this report, there are near daily announcements about the future of the commercial radio industry and individual organisations within it. Therefore, the recent rate of change in the commercial radio industry makes it particularly difficult to define a "business-as-usual" scenario and estimate the incremental costs and benefits of the DRWG policy.

Moreover, at this early stage of the policy analysis, there are considerable challenges in respect of data availability and research that could inform our analysis. In particular, industry participants may have refrained from sharing commercially sensitive plans or views which could inform more reliable estimates of key inputs. Also, no primary research, such as willingness to pay studies, has been conducted.

The CBA is an input into an impact assessment of the DRWG policy<sup>5</sup>; it does not include other aspects of an impact assessment, for example an assessment of the impact on competition or a consideration of the equity of the distribution of costs and benefits.

---

<sup>5</sup> See <http://www.berr.gov.uk/whatwedo/bre/policy/scrutinising-new-regulations/preparing-impact-assessments/page44077.html> for further details of the components of an impact assessment.

# 2. Introduction

## 2.1 Context

In its final report<sup>6</sup>, the Digital Radio Working Group (DRWG) recommended that the UK Government should announce the digital migration of radio services once digital radio listening reaches 50% (as a proportion of total radio listening (commercial sector and BBC)) and implement the process within two years of announcement. This migration would involve DAB replacing FM as the primary platform for national, regional and large local stations. The coverage of BBC, national and large local commercial multiplexes would be extended to match their FM equivalent coverage by the time of migration.

The interim DRWG suggested that the Government carry out a Cost Benefit Analysis (CBA) of the DRWG policy recommendation. In response to this suggestion, Ofcom commissioned PricewaterhouseCoopers LLP (PwC) to carry out this CBA.

## 2.2 Background

### 2.2.1 Overview of Digital Radio in the UK

Digital radio is the term generally used for linear audio services that utilise some form of digital coding of the audio signal by the broadcaster. That signal is delivered by broadcast, over the internet or by cable networks to consumer devices that decode the signal to enable it to be listened to. Digital radio offers a number of benefits over analogue radio. Digital error correction techniques minimise the effects of poor signal or interference. Digital radio can be accompanied by additional services which may add to the consumer experience – text describing the programme being received, an electronic programme guide, still pictures and diagrams, or on-demand audio services.

The main platforms currently in use for digital radio in the UK are Digital Audio Broadcasting (DAB), digital TV (Digital Terrestrial Television (DTT), satellite and cable) and the internet. Each digital radio platform has different characteristics, providing different consumer experiences, for example in terms of number of radio station available, and reception in car radios or portable radio devices.

The majority of UK radio households are now covered by one or more digital platforms carrying digital radio services. Broadband internet is available to over 99% of UK homes; while digital television is also widely available, with satellite covering approximately 98% of homes, DTT with 73% coverage, and digital cable available to around 49% of homes. DAB digital radio coverage has increased over recent years, with the installation of further multiplexes and transmitters. By summer 2008 approximately 90% of the population was covered by at least one DAB multiplex, with most areas being covered by three or more.

### 2.2.2 DAB radio

In the UK, digital radio listening over the last few years has been driven to a large extent by DAB set penetration, as well as by the ability to receive radio services over other digital platforms including digital television and the internet.

---

<sup>6</sup> [http://www.culture.gov.uk/images/publications/DRWG\\_Final\\_Report.pdf](http://www.culture.gov.uk/images/publications/DRWG_Final_Report.pdf)

The DAB European standard is the digital broadcasting system developed by the European Community Eureka 147 project<sup>7</sup>. The UK was the first country to receive a wide range of radio stations broadcast via DAB, using the VHF Band III spectrum (217.5 -230 MHz). Commercial DAB receivers were first sold in 1999. By 2001 there were over 50 commercial and BBC services in London.

The frequencies allocated to DAB in the UK, depending on location, can support up to 60 stations. The listener tunes into stations by station name rather than by station frequency. DAB carries a small amount of data services, which is utilised currently as a scrolling display feature on DAB radio units showing a small amount of programme-related information.

Currently DAB radio in the UK comprises over 400 services in total, including national and local stations broadcast by the BBC and commercial operators, as well as the simulcast of many analogue commercial licences. There are nearly 40 services available only on DAB (mostly commercial, such as Gaydar, and a handful of BBC stations). Some commercial radio brands operate on several different multiplexes, forming quasi-national or regional networks.

Some areas have a wider choice of DAB stations than others, as a result of spectrum allocation, the take-up of digital multiplex capacity or location overlap with another multiplex area. As a consequence, a listener in London may receive over 50 DAB radio services, while a listener elsewhere may currently only receive services available on the two national digital multiplexes (the BBC multiplex and Digital One (D1), a national commercial operator, owned by Global Radio and Arqiva).

All of the major analogue radio stations are already available on DAB, as the current licensing regime requires licensees to offer a DAB service when renewing their FM analogue licence. While most listening remains on FM and AM analogue radio, Ofcom has suggested that some 95% of total radio listening are accounted for by stations that broadcast on DAB<sup>8</sup>.

After a slow start, DAB digital radio take-up has risen rapidly over the last few years – cumulative sales of DAB radio sets exceeded 6.45 million mark by the end of 2007, and 8.53 million by the end of 2008.

### 2.2.3 Radio on Digital TV

Digital TV (including DTT, satellite and cable) take-up has been rapid in recent years, as the UK moves towards digital switch-over in television, a process which began in 2007 and is expected to be completed by 2012. Digital television household penetration in the UK has reached 88% by mid-2008 and is expected to continue to rise<sup>9</sup>. However listening on digital TV currently accounts for around 3% of all radio listening<sup>10</sup>.

Like the TV channels, each radio station has its own channel number and programme details are listed in the Electronic Programme Guide (EPG). There are around 25 radio stations available on DTT, around 90 on satellite and around 30 on cable.

### 2.2.4 Internet radio

Internet radio is audio services that are transmitted via the Internet, and listened to via a computer or an internet radio set. This is a continuous 'stream' of audio, which differentiates it from 'on-demand' services, such as podcasting or listen-again services. Many internet radio stations are simulcasts of an existing analogue radio station, but the unlicensed nature of internet radio means that there are thousands of independent internet-only radio stations broadcasting around the world, some of which operate on a subscription basis.

---

<sup>7</sup> A technical body funded by the European Union under the name of Eureka 147 Consortium initiated the original DAB system. The DAB project turned out to be the 147th project of the technical body of EUREKA, and to subsidise the project a consortium of members was created.

<sup>8</sup> Data provided to PwC from Ofcom, *Digital radio in the UK*, April 2008

<sup>9</sup> Source: Ofcom Digital Television Update - 2008 Q2 and Q3, <http://www.ofcom.org.uk/research/tv/reports/dtv/>

<sup>10</sup> Source: Rajar update on Listening via Platform, 2008 Q3

Penetration of the internet is currently around 70% of UK households. Broadband internet access, which is needed for internet radio streaming of acceptable quality, accounts for approximately 15 million homes. The growth in broadband in recent years can partially be attributed to availability, as broadband is now available to 99% of UK households. Listening on internet radio accounts for around 2% of total radio listening<sup>11</sup>.

The internet radio sector is less structured than other radio sectors. As it is not broadcasting over spectrum, there is no requirement to comply with broadcasting codes, and so these stations are not licensed or regulated by Ofcom.

In addition to live streaming of audio, stations broadcasting on the internet often offer on-demand audio services, or 'podcasts'. These are edited highlights of previously-broadcast radio programmes, extra content, or stand-alone shows created for podcasting which have not been broadcast. Some 'podcasts' available on the internet do not have any direct link to an existing streamed audio service, and some podcasts operate on a subscription basis.

A number of recent technical developments could have wider repercussions for the industry as online technologies and new digital formats offer the potential for new audio services. WiFi radio allows users access to live radio stations from around the world without a PC and provides access to archived on-demand programmes and podcasts.

With around 40 companies now manufacturing WiFi radio devices, a wide range of WiFi radio models is now available. The Ofcom Communication Report in July 2008 found that around 6% of people claimed to have a WiFi radio with a further 11% stated that they would be interested in WiFi radio services. Radio features can include the ability to search by country or by genre of programme, access to a database of podcasts and archive programming, and the ability to download music stored on a network or PC onto the player. Portable models, which allow users to access internet and analogue radio stations while on the move, are available at around £150.

## 2.3 Digital Radio Working Group

The DRWG was established in November 2007 by the Secretary of State for Culture, Media and Sport to consider three questions:

- What conditions would need to be achieved before digital platforms could become the predominant means of delivering radio?
- What are the current barriers to the growth of digital radio?
- What are the possible remedies to those barriers?

The DRWG brought together senior figures from the radio industry and related stakeholders under an independent Chair, Barry Cox. The DRWG includes representatives from DCMS, Ofcom, BERR, DigitalOne, 4 Digital Group, RadioCentre, BBC, Intellect, Arqiva, SMMT, Community Media Association and the Consumer Expert Group. The DRWG published an interim report in June 2008<sup>12</sup>, which set out a broad outline of its recommendations for migration to 'mixed ecology' radio industry, with DAB at its core. The report called for the development of a long term plan to move all radio services across to digital. In the medium term, the group recommends that all national, regional and large local stations should be migrated to DAB, with FM continuing to be used by small local commercial and community radio stations.

---

<sup>11</sup> See footnote 10.

<sup>12</sup> [www.culture.gov.uk/images/publications/DRWG2008-interimreport.pdf](http://www.culture.gov.uk/images/publications/DRWG2008-interimreport.pdf)

The final report by the DRWG<sup>13</sup> provided further refinement on its interim recommendations, proposing that:

- The long term aim of Government policy should be to create three tiers of radio in the UK:
  - 1 A wide range of national digital radio services from the BBC and commercial radio sector;
  - 2 A sustainable set of local digital radio services from the BBC and commercial radio sector, covering as many areas of the UK as possible; and
  - 3 A tier of small-scale services available where there is local demand, some commercial and some community, but all focused on serving their local communities. These services would be transmitted in analogue in the short to medium term.
- Three broad criteria must be met in order to trigger the migration process:
  - 1 At least 50% of total radio listening is to digital platforms;
  - 2 National multiplex coverage will be comparable to FM coverage by the time of migration; and
  - 3 Local multiplexes will cover at least 90% of the population and, where practical, all major roads within their licensed areas by migration.
- Once these conditions have been met, the Government should announce a date for migration, proposed to be two years after the criteria have been met.
- At this point, all national radio services would migrate, along with local services that have met the third criterion. Local services on a multiplex that does not meet the third criterion at the time of migration would do so as soon as that multiplex reaches the threshold.
- All services on AM should be migrated to either DAB or FM and the frequencies should be re-assigned for other purposes.
- A number of steps needed to be undertaken by Government in order to overcome the barriers to digital radio adoption, including:
  - 1 Providing the radio industry with greater certainty and control of its future by reducing some of the existing regulatory burdens. This could involve allowing the roll-over of the existing national and local commercial multiplex licence until 2030;
  - 2 Investment in marketing DAB, including coordinated efforts from producers beginning from Christmas 2009;
  - 3 Ensuring the right level of coverage for migration. This could involve matching the population coverage of DAB to existing analogue levels for BBC and national commercial services, and maintaining access to commercial and/or community services either through DAB or FM at a local level; and
  - 4 Promoting take-up of in-car DAB listening. This could involve ensuring that all new cars are fitted with digital radios from 2014.

---

<sup>13</sup> [http://www.culture.gov.uk/images/publications/DRWG\\_Final\\_Report.pdf](http://www.culture.gov.uk/images/publications/DRWG_Final_Report.pdf)

## 2.4 Cost Benefit Analysis

Government consideration of the DRWG's policy recommendation requires an assessment of the extent to which the UK will benefit from this intervention to promote digital radio migration. All new policies, programmes and projects proposed by the Government are subject to a comprehensive, proportionate assessment, wherever it is practicable, in order to promote the public interest<sup>14</sup>.

A Cost Benefit Analysis (CBA) is an economic framework that employs specific techniques to assess the costs and benefits and their incidence on different stakeholders that result from a given (policy) intervention. In addition to gaining an understanding of the nature and potential scale of the costs and benefits (and their incidence) the CBA also considers the time frame under which the costs and benefits are incurred.

The Green Book<sup>15</sup> states that, prior to Government intervention, an analysis should be conducted to ensure that:

*“Firstly, that there is a clearly identified need; and secondly, that any proposed intervention is likely to be worth the cost.”*

The CBA must include an analysis of both the positive and negative consequences of intervention, as well as the results of not intervening. The scenario of no intervention is referred to as the “counterfactual” or “business-as-usual” scenario.

The costs and benefits of the policy option are then compared to the counterfactual. The time period over which costs and benefits are realised needs to be taken into account: the intervention takes place and its impacts are realised over a number of years. The value of a cost or benefit is not the same today as it is tomorrow because of the value attached to immediate costs or benefits. Therefore, a discount rate is applied so that all the costs and benefits are comparable. The net present value (NPV) of the net impact of the intervention is then calculated by applying the discount rate to the relevant costs and benefits.

CBAs are often iterated a number of times before policy proposals are implemented in full, to take into account additional information as it becomes available as well as refinement of proposals. This CBA is designed to inform the DRWG policy recommendations as outlined in its final report, providing discussions on the key methodological issues, and also to include sensitivity analysis of the major parameters. The result of this study will provide an indicative measure of the net benefit (or cost) of the proposed digital radio migration, and identify areas where further work is required to inform more accurately the likely impact of the chosen policy.

## 2.5 Structure of the report

The remainder of this report is organised as follows:

- Section 3 provides a description of methods employed and approach.
- Section 4 discusses the conceptual framework and key issues of the model.
- Section 5 presents the key underlying assumptions that drive the results.
- Section 6 presents the results of the study, i.e. the incremental benefits and costs of the DRWG policy over the business-as-usual scenario.
- Section 7 summarises the results of our sensitivity analysis.

---

<sup>14</sup> Ofcom itself publishes its guidelines on Better Policy Making, Ofcom's approach to Impact Assessment, [http://www.ofcom.org.uk/consult/policy\\_making/guidelines.pdf](http://www.ofcom.org.uk/consult/policy_making/guidelines.pdf)

<sup>15</sup> The Green Book, Appraisal and Evaluation in Central Government, [http://www.hm-treasury.gov.uk/d/2\(4\).pdf](http://www.hm-treasury.gov.uk/d/2(4).pdf)

- Section 8 discusses the distributional effects of the policy.
- Section 9 provides our recommendations on further appraisals.

In addition, the following appendices are attached to the report:

- Appendix A contains the Invitation to Tender (ITT) by Ofcom, the scope and timeline of which has changed over the course of the CBA.
- Appendix B presents a summary of the literature review.
- Appendix C lists the stakeholders consulted and data sources.
- Appendix D contains the supplementary charts and tables which support the CBA.

# 3. Methods

## 3.1 Our approach

The approach to the study included three phases:

- The development of the conceptual CBA framework;
- The collection of data; and
- The modelling and analysis of data.

We outline each of these in turn.

## 3.2 Phase 1: conceptual framework

### 3.2.1 Developing the conceptual framework

A key step of conducting the CBA is to establish the conceptual framework, identifying the key methodological issues, as well as the relevant scenarios for the analysis. In developing the conceptual framework for the CBA, we conducted a literature review of the following:

- Recent CBAs on related policy proposals, in particular digital TV;
- Responses and criticisms of the above CBA studies;
- Studies that provide guidance on best practices, including the Green Book; and
- Willingness to pay studies, which inform estimation of the potential consumer benefits in the CBA.

Appendix B sets out the findings of the review. The review, combined with our own views and discussions with Ofcom, allowed us to define the following:

- The DRWG policy;
- The counterfactual or “business-as-usual” scenario;
- Benefit categories;
- Cost categories;
- Incidence of benefits and costs;
- Time horizon;
- Discount rate; and
- Distributional issues.

Section 4 sets out a detailed explanation of the key aspects of the conceptual framework.

We presented our preliminary findings and assumptions to Ofcom in September 2008, together with commentary on the key issues associated with each element. Ofcom, in discussions with the Government stakeholder group<sup>16</sup>, approved our approach in this CBA following this presentation.

### **3.3 Phase 2: empirical data collection**

#### **3.3.1 Data collection**

The data collection process was guided by the findings of Phase 1. Some of the data were readily available via desk research and additional data were supplied by Ofcom and relevant stakeholders.

Data that we collected included:

- Forecasts for DAB uptake;
- Penetration of alternative digital radio platforms;
- Consumer cost and value inputs (e.g. results of willingness to pay surveys); and
- Producer cost and value inputs (e.g. studies on spectrum value).

Where relevant we have provided commentary on the robustness of the data in this report, as well as suggestions for future improvement.

#### **3.3.2 Stakeholder consultation**

We also consulted with several members of the DRWG to obtain more information and views on the likely costs and benefits. Appendix C provides the list of stakeholders we consulted with and the questions that formed the basis of our discussions with them.

During this phase we also explored specific distributional issues in relation to the Nations and Regions, ethnic minority groups and/or people with disabilities.

### **3.4 Phase 3: modelling, analysis and reporting**

Based on outputs from Phases 1 and 2, we constructed a cost benefit model, incorporating assumptions we developed in consultation with Ofcom and the Government stakeholder group. During the course of our analysis, a number of major developments emerged, creating uncertainty over the likely future development of digital radio. In September 2008, a series of collapses in the financial services industry coupled with fears of prolonged recessions in the UK and elsewhere have led to both businesses and consumers curbing investment and spending, which is likely to affect both the radio advertising market and the spend on DAB radios.

Channel 4 announced on 10 October 2008 its decision to withdraw from 4 Digital Group, the consortium that was awarded a licence for the second national commercial DAB radio multiplex in 2007. 2008 also witnessed the closure of many digital radio brands, including TheJazz, OneWord, Core, Virgin Radio Groove, Capital Life, and Mojo Radio.

In December 2008, the DRWG published its final recommendations, providing some clarity to the commitment by the Group's members towards a future of digital radio.

In light of these events, we established a DRWG policy scenario and a "business-as-usual" scenario, recognising that substantial uncertainties remain.

---

<sup>16</sup> Comprising BERR, HMT, and DCMS.

The final phase of the study produced the key deliverable to Ofcom in the form of this report. This report includes the results of our analysis, and where possible we have identified areas where further work is required in order to refine the CBA. This forms a useful basis for future iterations of the policy assessment process, as evident by the CBA on TV digital switch-over experience. That CBA was updated two years after the first study, as new information became available, including the results of further primary research.

# 4. The CBA Framework

## 4.1 Defining the DRWG policy

Based on the rate of digital radio take-up to date, the DRWG report states that DAB is “the most practical replacement for analogue” as a radio broadcast platform.

The DRWG has outlined the broad direction but not all the specific details of the policy intervention. At the time of writing, the Government has not accepted or rejected this proposal. As a result, we have made a number of working assumptions which are required in order to conduct the CBA. Our study sets out a DRWG policy option, which is defined in terms of the policy action as well as triggers or thresholds at which the Government is expected to take action. The assumptions are derived from the policy recommendations by the DRWG with input from Ofcom. We recognise this is only one policy option amongst others that could be considered by Government to increase digital radio penetration, should the Government decide to tackle this issue. Hence, for the purposes of clarity, the DRWG policy presented in this study refers to the DRWG policy recommendations only (and some specific assumptions we made to align with those recommendations). The DRWG policy also included aspirational milestones – for instance, dates by which aims on joint-marketing initiatives, or the development of the in-car market could be reached.

Figure 4 illustrates the elements of policy, which we call triggers or activities, assumed in the DRWG policy option. We describe each of these elements in detail in the subsequent subsections.

**Figure 4: Proposed digital radio migration**

Trigger or Activity	DRWG policy option
<b>Migration threshold</b>	<p>A threshold of 50% of total radio listening on digital platforms will trigger an announcement. National multiplex coverage will be comparable to FM coverage <i>by the time</i> of digital migration.</p> <p>Local multiplexes will cover at least 90% of the population and, where practical, all major roads within their licensed areas <i>by the time</i> of digital migration.</p>
<b>Announcement of policy intervention</b>	<p>When the migration threshold has been reached, the government will announce intention to migrate within 2 years.</p>
<b>Migration</b>	<p>All national and large local commercial services switch to DAB only.</p> <p>Small commercial services and community services remain on FM.</p> <p>All AM services are migrated to either DAB or FM. AM will no longer be used for analogue radio.</p>
<b>Use of spectrum after migration</b>	<p>Some contiguous FM spectrum is released for other uses after migration (this CBA assumes 10MHz of spectrum will be available for other uses).</p> <p>The remaining FM spectrum is used for community broadcasting, Restricted Service Licences (RSLs) and small local commercial services.</p> <p>AM spectrum is licensed for other uses.</p>
<b>Coverage</b>	<p>BBC digital coverage increased to match existing analogue FM coverage (geographic and population) by the time of migration.<sup>17</sup></p> <p>National commercial broadcasters build out transmitter network to match existing analogue coverage for Classic FM (geographic where possible in addition to population) by the time of migration.</p> <p>Existing regional multiplexes<sup>18</sup> to form the backbone of the second national multiplex, with build-out to reach the current level of coverage as Digital One.<sup>19</sup></p> <p>Coverage of this multiplex to match Digital One's enhanced network by the time of migration.</p>
<b>Marketing</b>	<p>The government will undertake a number of activities to promote and encourage the future of digital radio. These include:</p> <p>Allowing the roll-over of the national multiplex licence and local multiplex licences until 2030.</p> <p>Investment in marketing DAB from as soon as 2009.</p> <p>Promoting in-car DAB listening through ensuring that all new cars are fitted with digital radios from 2014.</p>

#### 4.1.1 Digital migration threshold

In its recommendations, the DRWG suggests that the trigger for any digital migration strategy should be tied to the extent to which digital services are consumed. In particular, the DRWG proposes that digital

<sup>17</sup> The BBC has already announced its national digital services will reach 90% of the population under the current licence fee settlement.

<sup>18</sup> This could include North West, North East, Yorkshire, Central Scotland, West Midlands, Severn Estuary and one of the existing London multiplexes.

<sup>19</sup> In its final report, the DRWG 'urges' the government to "introduce new legislation to give Ofcom the power to allow [mergers of local multiplexes with excess capacity] or reconfiguration of [multiplex areas] where the relevant licence holders deem it appropriate and where Ofcom deem it to be in the public interest." (Section 4.10). Therefore, a second national digital multiplex formed from the existing regional multiplex network is not explicitly recommended by the DRWG in its final report. However, Ofcom requested that we explicitly model this state of the world in our cost-benefit analysis as one option of how the recommendations of the DRWG, if implemented, could affect the multiplex structure in the UK.

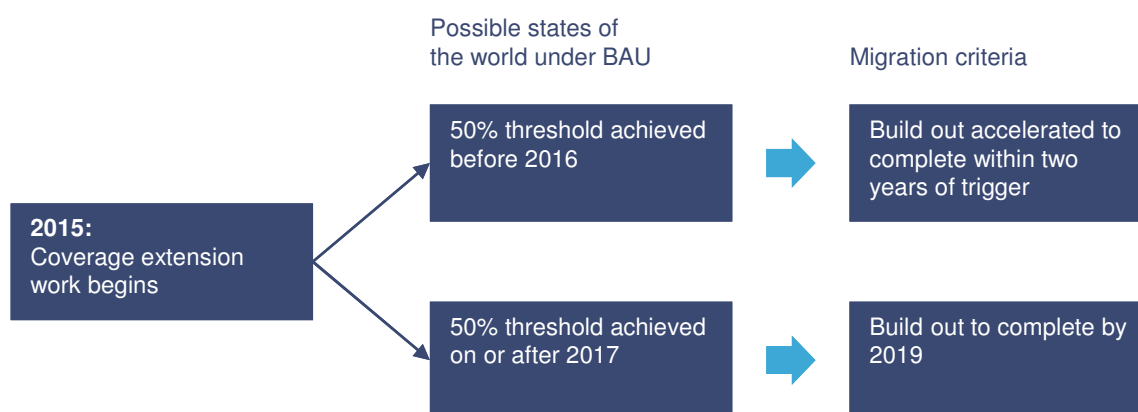
migration should only commence once listening on digital platforms constitutes at least 50% of total listening across all platforms.

The stakeholders we consulted support this view. A lower trigger point could result in more substantial adaptation costs for transmission and service providers over a two-year migration timeframe. The resulting cost of conversion for consumers could also be higher since the strategy would involve encouraging changes in listening pattern for a larger proportion of consumers. A higher trigger point, on the other hand, is likely to have too little incremental benefit to justify Government intervention. Digital migration would likely benefit only a small proportion of late adopters, who by definition would be likely to be those that derive small amount of benefits from digital radio.

Two conditions required to support a smooth digital migration process relate to coverage extension. These criteria suggest that the coverage for national and local multiplexes would need to be increased by the time of migration (i.e. two years after the trigger point has been reached). They are not explicit “triggers”, since the extension of coverage could in theory be built out during the two years after the 50% listening threshold has been met. However, they represent the commitment that broadcasters and transmission companies need to provide to enable a seamless migration. Thus, in the event that coverage cannot be reasonably extended within two years, digital migration could be delayed.

Our consultation with stakeholders suggests that coverage extension could take between one to four years, depending on the extent to which coverage has been extended prior to the listening trigger point. Our model assumes that the coverage extension work would begin on 2015. Depending on when the trigger point is achieved, this work would be accelerated or phased out such that the extension would be completed by the time of migration.

**Figure 5: Model assumptions on coverage extension**



#### 4.1.2 Migration and technology standard

The majority of services currently available on DAB are simulcasts that originated on an analogue platform<sup>20</sup>. The evolution of the balance between analogue and digital content is in part due to the current analogue licensing regime, which ties renewal of analogue licenses to provision of the service on a relevant digital multiplex (where one is available).

The DRWG policy scenario is the DRWG proposal of a “mixed-ecology” licensing regime. Under the mixed-ecology proposal, the majority of radio services – BBC national, regional and local, national commercial, and large local commercial services – will migrate from analogue to DAB. Community services and Restricted Service Licences (RSLs) would then occupy some of the vacated FM spectrum. This is likely to result in a rise in the total number of community services and RSLs licensed. Our

<sup>20</sup> Exceptions exist on both national and regional multiplexes. Planet Rock on the national Digital One multiplex is a digital-only station. Gaydar Radio, The Hits, Chill and Q operate as digital-only stations on some regional multiplexes. BBC provides five digital-only national stations – BBC1xtra, 5 Live Sports Extra, BBC 6 Music, BBC Radio 7 and BBC Asian Network.

discussions with relevant stakeholders suggest that there exists excess demand for spectrum for community broadcasting. Small commercial services would not be expected to migrate to a DAB platform, and would remain on FM.

We assume, in line with the recommendation of the DRWG in its final report, that existing AM service licences would not be renewed beyond migration, and would thus effectively cease analogue transmission on the platform.

Any remaining FM spectrum would not be relicensed for analogue radio, in addition to the AM spectrum, and would thus potentially be available for release for other use.

#### **4.1.3 Use of spectrum post-migration**

As outlined above, the “mixed-ecology” migration proposal outlined by the DRWG will involve the use of some of the vacant FM spectrum for community radio and small commercial services. Therefore, only a proportion of the 20MHz currently licensed for FM services would be available for alternative uses post digital migration. However, all of the AM spectrum could be available for redeployment.

As a working assumption, our characterisation of the DRWG policy assumes that Ofcom would seek to release 10MHz of contiguous spectrum currently used for FM broadcasting. AM spectrum could be released for other uses if the benefits of other uses exceed the costs.

##### *FM spectrum*

Analogue FM services currently occupy around 20MHz of radio spectrum between 88.0MHz and 108.0MHz. Taken as a whole, this is a reasonably large discrete block of spectrum and, given its propagation properties, may have commercial applications beyond audio broadcasting.

Any potential reuse of the existing FM spectrum is subject to two potential constraints: operations in adjacent spectrum bands; and international use of Band II. Licensed FM services are currently adjacent to private mobile radio (“PMR”) (80MHz to 87.5MHz) and aeronautical radio navigation (from 108MHz to 117.975MHz). Users of spectrum immediately adjacent to spectrum assigned for aeronautical radio navigation are subject to additional power restrictions compared to users of lower frequencies within Band II – this helps limit interference with aeronautical applications in the spectrum band above. These restrictions may constrain the type of application that could be deployed at the top end of Band II, and thus potentially reduce the value of any spectrum released under a digital migration strategy. PMR is subject to less protection from FM users and thus the spectrum toward the lower end of Band II may be suited to a wider range of potential applications.

Separately, Band II is internationally assigned for FM broadcasting purposes. The UK is one of the first countries in the world to be able to relicense Band II spectrum for non-radio applications. If other territories continue to use Band II for FM broadcasting purposes after digital migration in the UK, there are two potential issues which arise if the freed spectrum is redeployed: firstly, any new application which uses Band II spectrum may be subject in some parts of the UK to interference from high power transmitters in other countries (e.g. France); secondly, it may not be viable, due to a lack of economies of scale, for manufacturers to commit to developing and producing new technologies for deployment in Band II if the UK is the only country in which such technologies are used. Both of these considerations may reduce the value of any spectrum released under a digital migration strategy.

In the course of our analysis, we have not been able to identify any potential new uses of the spectrum beyond additional audio-broadcasting. Notwithstanding this caveat, we explain how we have attempted to quantify the potential consumer benefit from the released spectrum in Section 6.4.2.

##### *AM spectrum*

Around 1MHz of spectrum is currently used for licensing AM services in the spectrum range 515 kHz-1629 kHz. Whilst AM spectrum has in theory better propagation characteristics than FM, it is more prone to interference from applications in adjacent spectrum bands and is generally subject to significant background “noise” (e.g. disturbance from ASDL cables). The amount of bandwidth and the levels of interference the AM band is subject to makes it much less attractive spectrum, particularly for non-audio broadcasting applications.

As with the FM spectrum that could potentially be released, we have been unable to identify any potential uses of the spectrum beyond additional audio-broadcasting. Notwithstanding this caveat, we explain how we have attempted to quantify the potential consumer benefit from the released spectrum in Section 6.4.2.

#### 4.1.4 Announcement of digital radio migration

For most policy interventions/programmes, Government tends to provide sufficient notice to the consumers and producers affected. An announcement helps to generate a smooth adaptation process, and may also promote increased digital radio take-up in the period leading up to the switch-over of some analogue stations. The DRWG has recommended that the Government provides a two year notice period prior to commencement of the migration process.

#### 4.1.5 Marketing and administrative spend

A key element of a digital radio migration policy will be the active promotion and marketing of the benefits of digital radio, and DAB in particular. Thus, the DRWG policy proposed has assumed that there will be additional spend on marketing to consumers from as soon as Christmas 2009, to promote the take-up in DAB penetration as well as listening via the platform. There will also be administrative costs associated with the implementation of a policy.

#### 4.1.6 Coverage

Current analogue coverage (where coverage is defined as coverage of the UK population, not geographical coverage) of BBC national FM services is [redacted]%,<sup>21</sup> compared to DAB coverage of [redacted]%.<sup>22</sup>

The DRWG policy assumes that the coverage of the BBC's digital radio services is extended to a level equivalent to current analogue coverage of approximately [redacted]%,<sup>23</sup> [redacted] the BBC's current plan to reach 95% by 2011. The DRWG policy also assumes that Digital One is rolled out to [redacted]% at the time of migration. In addition, "regional" multiplexes are extended to form a new "national" multiplex, which involves a build out of coverage from around [redacted]%,<sup>24</sup> to [redacted]%.<sup>24</sup>

## 4.2 Counterfactual – the "business-as-usual" scenario

Establishing an appropriate counterfactual (a "business-as-usual" or status quo scenario<sup>25</sup>) is an important step in order to measure the incremental impact of the policy decision, i.e. the additional or incremental benefits over an alternative state of the world where the intervention has not taken place. One of Ofcom's key regulatory principles is a bias against intervention, guided by the Better Regulation Task Force<sup>26</sup>:

*"The option of not intervening...should always be seriously considered. Sometimes the fact that a market is working imperfectly is used to justify taking action. But no market ever works perfectly, while the effects of...regulation and its unintended consequences, may be worse than the effects of the imperfect market"*

*Better Regulation Task Force (September 2003)*

---

<sup>21</sup> At 54 dB  $\mu$ V/m (stereo FM equivalent). All other quoted analogue transmission coverage figures are at this quality unless specified otherwise.

<sup>22</sup> At 62 dB  $\mu$ V/m (intermediate coverage equivalent). All other quoted DAB transmission coverage figures are at this quality unless specified otherwise.

<sup>23</sup> At 62 dB  $\mu$ V/m. This equates to [redacted] population coverage at 65 dB  $\mu$ V/m (mobile coverage equivalent) and [redacted] at 58 dB  $\mu$ V/m (indoor coverage equivalent).

<sup>24</sup> Ofcom provided an estimate of around [redacted] for the current coverage of regional multiplexes.

<sup>25</sup> A "business-as-usual" scenario does not necessarily assume that there is no evolution in the market, rather that any such evolution can be predicted at the point at which the CBA is undertaken and that it could reasonably have been expected to have occurred in any event (i.e. it is not contingent on the policy intervention).

<sup>26</sup> Better Policy Making, Ofcom's approach to Impact Assessment, [http://www.ofcom.org.uk/consult/policy\\_making/guidelines.pdf](http://www.ofcom.org.uk/consult/policy_making/guidelines.pdf)

During the course of our analysis, a number of major developments emerged, injecting considerable uncertainty into making projections about the future. In September 2008, a series of collapses in the financial services industry coupled with fears of prolonged recessions in the UK and elsewhere have led to both businesses and consumers curbing investments and spending. Channel 4 announced on 10 October 2008 its decision to withdraw from 4 Digital Group, the consortium that was awarded a licence for the second national commercial DAB radio multiplex last year. Ofcom and the DRWG stated that they would be seeking means to secure “a viable outcome which in the interest of radio listeners and the industry”<sup>27</sup>. In December 2008, the DRWG published its final recommendations, providing some clarity to the commitment by the Group’s members towards a future of digital radio.

The speed of change and uncertainty in the radio industry makes it particularly difficult to define a “business-as-usual” scenario with a high degree of confidence. At the time of writing this report, there are near daily announcements about the future of the commercial radio industry and individual organisations within it. A CBA is limited to the extent that it represents a snapshot at a given point of time (i.e. the end of 2008), and does not capture developments after that point. Hence we recognise that this CBA may need to be revisited again at the time of any government policy decision-making in order to ensure that any new information on assumptions that are critical to the CBA modelling are captured<sup>28</sup>.

The “**business-as-usual**” (**BAU**) scenario considers forecasts of listening hours and set sales based on actual historic data, as set out in detail in Section 5. The assumption on the forecast of digital radio listening hours is one of the most critical in the CBA modelling. Digital listening patterns define a number of key parameters, including: (a) the listening threshold of migration; (b) the phasing of costs and benefits; and (c) the level of incremental cost or benefits. In the absence of an announced digital radio migration policy, digital radio take-up is assumed to continue, albeit arguably at a much slower pace<sup>29</sup>, and so many of the costs and benefits may have been incurred anyway albeit over a different timeframe. The DRWG policy scenario therefore only considers costs and benefits that are truly incremental over the BAU scenario.

Figure 6 compares the key assumptions that need to be addressed, under both the “business-as-usual” and DRWG policy scenarios. We have considered developments under the following categories:

- **Producers:** radio set manufacturers, transmission companies, and radio stations (both commercial and non-commercial (BBC, community)); and
- **Consumers:** changes in consumer behaviour in radio listening and digital adoption.

---

<sup>27</sup> Ofcom statement on Channel 4 and DAB radio, press release on 10<sup>th</sup> October from Ofcom.

<sup>28</sup> The CBA TV digital switch-over was updated two years after the first study, as new information became available, including the results of further primary research.

<sup>29</sup> We recognise that a step-change increase in marketing and the growth of new DAB services along with a significant reduction in set prices together with universal availability in cars could lead to almost universal penetration absent a migration announcement.

**Figure 6: Business-as-usual and DRWG policy**

	<b>“Business as usual” (BAU)</b>	<b>Intervention: DRWG policy</b>
<b>Producers</b>		
<b>Services on AM and FM</b>	No significant change from the current radio landscape.	Community and small local commercial only on FM. AM dormant.
<b>Services on DAB</b>	Existing services will remain on DAB. New channels are launched on Digital One (filling all available capacity).	Migration of all major services towards DAB platform. A second ‘national’ multiplex is formed by expanding the existing regional multiplex layer, subject to licence changes with permit quasi-national brands to convert into national stations. This study assumes that the additional transmitters required to create this second national multiplex are rolled out between 2011 and 2015, and that the multiplex to carry a full complement of services.
<b>Coverage of DAB</b>	BBC to increase coverage to 95.2% by 2011 and maintain coverage at this level after 2011. Commercial digital radio coverage does not increase beyond the current level of D1 coverage ([ $\geq$ (S.44)]%).	Increase BBC coverage to analogue equivalent by migration date (including services covering the nations and regions and local services). National commercial digital radio coverage matches analogue equivalent.
<b>Transmission costs</b>	For stations with dual transmission: Maintain dual transmission. For stations with only AM / FM transmission: Maintain single transmission.	For stations with dual transmission: Maintain dual transmission until migration date. For all national and large local stations: DAB transmission only post-migration.
<b>Spectrum use</b>	Analogue: AM and FM audio services. Digital: DAB audio and data services.	FM: Proportion of FM released for other uses (assumed to be 10MHz). The remainder retained for FM broadcasting. AM: dormant, potentially licensed for other uses. Digital: DAB audio and data services.
<b>Marketing and promotion of DAB</b>	Some promotion of DAB involving the BBC and commercial broadcasters/DRDB.	Increased and fully coordinated marketing and promotional activity involving the BBC and commercial broadcasters/DRDB.
<b>Disposal costs (environment)</b>	Waste of Electrical and Electronic Equipment (WEEE) Directive in place from 2007 onwards requires producers to comply with end of life disposal costs of electronic goods, and provide this free of charge to consumers.	Increased disposal costs for producers from analogue radios that are disposed ahead of their useful life. This study assumes that: Radios with limited other uses are affected. Other radio sets are assumed to follow BAU (i.e. retained to the end of their useful life) because of other functionalities (e.g. hi-fis).

	<b>“Business as usual” (BAU)</b>	<b>Intervention: DRWG policy</b>
<b>Producer Issues: Distributional</b>		
<b>Share of commercial vs. BBC</b>	Market shares affected by new national digital content.	This study assumes that total listening hours for radio remains unchanged. However, radio stations which capitalise on the advantages of digital listening may benefit more than others. Commercial sector gain market share from BBC. No changes anticipated at the aggregate level.
<b>Advertising revenues</b>	Maintain current market trends: use existing forecasts of advertising revenue <sup>30</sup> .	Increasing competition focused on DAB, with potentially more effective advertising targeting on DAB away from FM. This study assumes that total “pot” of advertising revenue for radio remains unchanged. However, listening share of radio stations may vary (see above). No changes anticipated at the aggregate level.
<b>Consumer</b>		
<b>DAB penetration in-home</b>	Market develops in line with DRDB sales forecasts. Long term set sale forecasts driven by S-curve projection based on DRDB projections.  We assume DAB functionality will be incorporated into all audio sets (e.g. through common chip-set technology), such that all radios will eventually be DAB-enabled.	Market develops at an accelerated rate compared to business-as-usual forecasts. The rate of take-up is underpinned by our sales forecasts.
<b>DAB penetration in-car</b>	Projection based on take-up rate of DAB in new cars, which in turn depends on turnover rate of new cars.	Projection based on take-up rate of DAB in new cars, which in turn depends on turnover rate of new cars.  This study assumes that the DRWG aspiration that all new cars are to be fitted with DAB by 2014 is realised i.e. DAB will be fitted as standard in new cars. Stakeholders indicated that the price of new cars will increase in alignment with the increase in costs of DAB over FM in-car radio. Existing cars on the road are expected to convert using external tuners.
<b>Number of radio sets per household</b>	Based on sales projection of radios (see above on DAB penetration in-home).	Based on sales projection of radios (see above on DAB penetration in-home).  Total number of radio sets largely unchanged, except for a short period around migration where there are a high number of non-voluntary households that purchase/replace analogue radios for DAB on the year of digital radio migration.

<sup>30</sup> We acknowledge that many forecasts of radio industry advertising revenues are currently subject to significant uncertainty owing to wider economic factors.

	<b>“Business as usual” (BAU)</b>	<b>Intervention: DRWG policy</b>
<b>Total radio listening including split by analogue vs. digital</b>	Total radio listening remains unchanged, although digital listening hours will increase as the share of all radio stocks accounted for by DAB-enabled sets increases.	Total radio listening remains unchanged, although digital listening hours will increase. This study assumes that from announcement date onwards, there will be faster and greater switch from analogue to DAB.
<b>Improved listening experience for consumers who are currently out-of-coverage coverage</b>	Out-of-coverage consumers do not derive benefits from digital radio.	Assume that benefits to out-of-coverage consumers include access to digital-only radio stations. This will be approximated by the willingness to pay for digital radio stations (assuming full national multiplexes). <sup>31</sup> This is applicable for both in-home and in-car consumers.
<b>Energy consumption</b>	FM radios currently consume less energy than an “average” DAB radio. However, the most efficient DAB radios are comparable to FM in terms of energy consumption. We assume that all DAB-enabled radio sets meet energy efficiency guidelines as standard.	This study assumes that all DAB-enabled radio sets meet energy efficiency guidelines under “business-as-usual”, so there are no incremental energy costs.
<b>Vulnerable consumer groups (elderly, people with disabilities)</b>	No change.	This study assumes additional cost for vulnerable consumer groups to convert to DAB over and above the “average” household. The cost could be in the form of a new modified kit or learning costs of the new technology.
<b>Consumers: Distributional</b>		
<b>Nations and Regions</b>	Some regions do not receive DAB coverage now and in the future.	Coverage will increase and become more universal. However, the difficulties in building out coverage may result in some regions having difficulties gaining coverage and access.

### 4.3 Illustration of producer and consumer surplus

The CBA is designed to estimate changes in producer and consumer surpluses in response to a policy proposal. This is illustrated conceptually in Figure 7. The purpose of this illustration is to set out the main aspects of our approach; it simplifies the CBA by presenting a static analysis – it does not set out the timing of the incidence of the costs and benefits.

In this illustration, consumers derive benefits from listening to digital (DAB) radio. This is shown by the consumer surplus for DAB radio in the blue area. We assume that producers, or radio stations, generate profits from providing DAB radio services; we recognise that this may or may not be the case in reality, given the recent experience of a number of radio operators<sup>32</sup>. Notwithstanding this caveat, their profits are limited by the coverage of radio, or the number of radio services that can be provided. This is graphically represented by a vertical line in Figure 7. Profits are shown by their producer surplus in the orange areas (A + B)<sup>33</sup>.

<sup>31</sup> We assume the same willingness-to-pay for existing services is applied to potential new services.

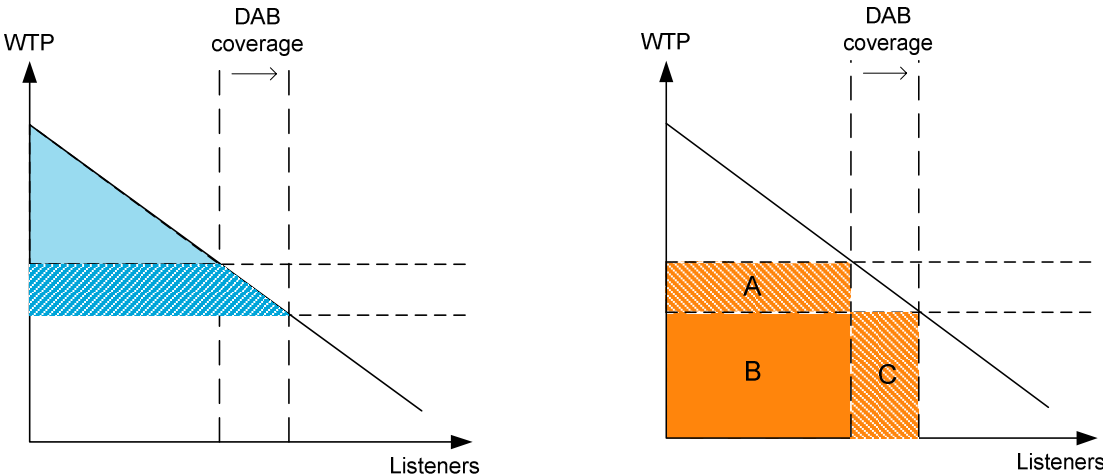
<sup>32</sup> The composition of the digital radio roster has changed over the year, with four of the national digital stations having closed, while GCap closed or disposed of a number of its digital stations prior to the sale to Global Radio. Source: Ofcom Communications Report 2008.

<sup>33</sup> Producer surplus is typically represented graphically as the area below the horizontal line which marks the intersection between the vertical supply curve and the downward sloping demand curve.

The DRWG policy of digital radio migration involves a number of policy actions to promote digital radio. This illustration considers the effect of extending coverage. Extending coverage allows more listeners to be served (moving the vertical line rightwards), leading to greater consumer benefit as represented in the blue striped area<sup>34</sup>. However, consumer benefit is difficult to measure. A common proxy is the average willingness to pay for digital radio services by consumers.

On the other hand, extending coverage requires setting up more DAB transmitters, which is a cost to producers. Producers lose A as margins are eroded as a result of increasing coverage. However, more consumers are captured, increasing their producer surplus by C. The extent to which the final producer surplus has changed is estimated through quantifying the net benefits or costs for increasing coverage. In the context of DAB radio, the producer could be a commercial national broadcaster which has to pay additional transmission costs associated with greater DAB coverage, but receives higher listening share (and, therefore, possibly more advertising revenue) in return. However, a competitive landscape could mean that this additional advertising revenue is competed away, resulting in little gain in producer surplus (i.e. a net decrease in producer surplus).

**Figure 7: Illustrating Changes in Consumer and Producer Surpluses**



Using a similar approach, we can also analyse other elements of our study such as gains in producer surplus as a result of lower transmission costs associated with terminating FM coverage; fall in consumer surplus for non-voluntary consumers as a result of conversion etc.

**4.4 Methodological considerations**

**4.4.1 The Discount Rate**

A CBA is “an analysis which quantifies in monetary terms as many of the costs and benefits of a proposal as feasible, including items for which the market does not provide a satisfactory measure of economic value”<sup>35</sup>. In addition to gaining an understanding of the nature and potential scale of the costs and benefits (and their incidence) the CBA also considers the time frame under which the costs and benefits are incurred.

Costs and benefits should be discounted using a suitable discount rate in order to obtain the net present value (NPV) of the policy intervention. Discounting is a technique used to compare costs and benefits that occur in different time periods. For example, under a digital migration strategy, the costs of marketing and information promotional activities may be incurred as soon as the threshold for digital migration is

<sup>34</sup> Consumer surplus is typically represented graphically as the area above the horizontal line which marks the intersection between the vertical supply curve and the downward sloping demand curve.  
<sup>35</sup> Green Book, Chapter 2.

achieved, but the benefits incurred from the use of the spectrum released may not be realised until after FM stations have migrated. The concept behind discounting is 'time preference', in short: that people prefer to receive goods and services now rather than later.

The choice of the rate of time preference (or discount rate) can be a contentious issue in a CBA study. The HMT guidance suggests that for individuals, time preference can be measured by the real interest rate on money lent or borrowed, which is an indication of their individual pure time preference rate. Similarly, the discount rate used by private investors should in principle represent the cost of capital of a project. Society, as a whole, may have a different rate of social time preference; the 'social time preference rate' (STPR) is the rate at which society values the present compared to the future, net of taxes. We have used the Green Book recommendation of the social rate of time preference at 3.5% (in real terms), as it most closely reflects the time preference rate of government.

However, if the digital migration project is to be undertaken privately, the cost of capital would most likely exceed 3.5% as private investors will factor in the minimum rate of return needed to compensate them for both the time value of their money and risk, which is higher than the HMT STPR in most sectors. As much of the investment would be carried out by producers, a more suitable representation to account for the investments incurred by producers would be taking into account a higher discount rate.

We factor this into our sensitivity analysis through a higher blended rate which assigns a real discount rate of 3.5% to consumers and the cost of capital to producers. The cost of capital to producers is suggested by Ofcom's use of a nominal, post-tax discount rate of 10.5% for all licence valuations for an independent commercial national radio licence<sup>36</sup>. We adjust the nominal discount rate to real terms to 8.3% (at an average inflation rate at the Bank of England's target rate of 2%).

#### 4.4.2 Time horizon

The time horizon over which the CBA is conducted is a key determinant of the NPV. A sufficiently long horizon is required for the benefits of investments to be realised. In many large scale public investments, a relatively long horizon is often assumed in the CBA as the investment is expected to generate benefits for some time even after the end of the government intervention. However, in the case of technology, the CBA also has to take into account that new technology may arise which replaces DAB or at least diminishes the producer or consumer appeal in DAB. Under this case, accounting for benefits too far ahead would overestimate the payoffs of DAB switchover. The Green Book (2003) states that:

*"Costs and benefits considered should normally be extended to cover the period of the useful lifetime of the assets encompassed by the options under consideration."*

It is therefore important to consider the permanence of post-migration technologies as an input to the time horizon decision. This is difficult to do in practice – predicting the development, deployment and success of future technologies is a significant challenge. The larger the time horizon of the analysis, the greater is the possibility that a disruptive technology emerges, affecting (positively or negatively) the take-up of digital radio, and in particular DAB radio. Consequently, the longer the time period of the analysis, the definition of the BAU scenario is subject to more uncertainty.

---

<sup>36</sup> Source: Methodology for the review of the financial terms for the extensions to the independent national radio licences, Ofcom, February 2006, <http://www.ofcom.org.uk/consult/condocs/methodology/statement.pdf>.

For this CBA we selected the time horizon 2009-2030, or 22 years. The start date takes into account that the policy recommendations from the DRWG were published at the end of 2008 and may thus begin to impact on the expectations of both consumers and producers. The end date is chosen to tie in with the extension of national and local commercial multiplex licences to 2030, as recommended by the DRWG. The chosen period of 22-year horizon is aligned to the time horizon of the CBA of digital TV switchover (2004-2026, or 22 years)<sup>37</sup>, as well as the CBA of digital free-to-air (FTA) television in New Zealand of 20 years (2006-2025, or 20 years)<sup>38</sup>. However, we also provide a sensitivity scenario with a time horizon of 2009-2023. The choice of the end date is chosen to coincide with the expected expiry of the D1 multiplex after a twelve-year extension in 2011. This shorter time horizon reflects a scenario where the future beyond 2023 is uncertain, and therefore costs and benefits of the DRWG policy cannot be taken into account. This scenario is indicative of a policy without licence extensions, or other similar instruments that provide “the radio industry with greater certainty and control of its future”, as suggested by the DRWG.

---

<sup>37</sup> DCMS/DTI Memorandum - the Costs and Benefits of Digital Switchover (TV)

<sup>38</sup> Spectrum (2006), “Cost benefit analysis of the launch of digital free-to-air television in New Zealand”

# 5. Model of Radio Listening

## 5.1 Approach

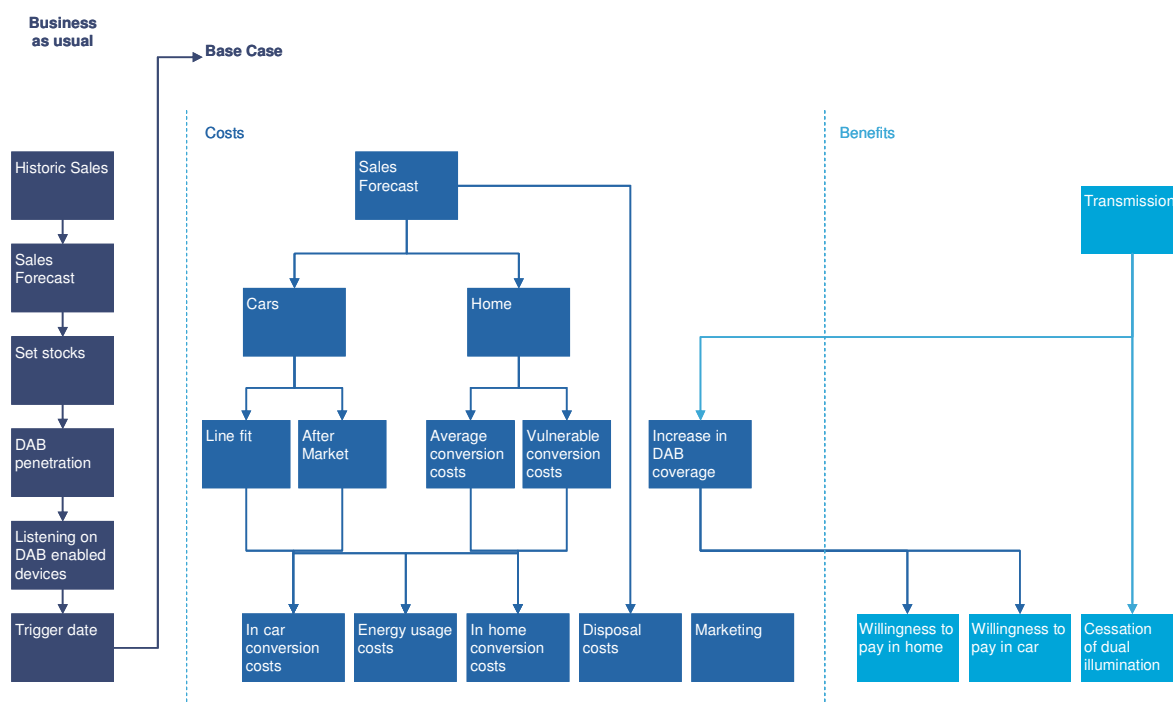
The CBA is underpinned by a model which includes bottom-up forecasts of consumer take-up of DAB-enabled radio sets. Figure 8 sets out a summary of the model framework. Set sales are driven by promotion of take-up through marketing and standardisation of in-car radios. In turn, digital and DAB penetration of radio will drive listening behaviour, which is one of the key criteria for digital migration under the DRWG policy proposal. At the same time, investments in extending coverage and transmission are incurred, in order to fulfil the remaining two criteria by the time of migration.

Once these conditions are satisfied, the digital radio migration is “triggered”, and various other costs and benefits are incurred, including non-voluntary conversion and disposal costs and benefits from the use of released spectrum.

All costs and benefits are compared against the BAU scenario, in order to arrive at the incremental net benefit/cost of the digital radio migration policy. These are all measured in 2009 prices for consistency.

The remainder of this section sets out the key assumptions of the BAU and DRWG policy scenarios.

**Figure 8: Model approach**



## 5.2 Digital Penetration and Listening

### 5.2.1 Set sales and stocks

In this section we outline how we construct set sales forecasts in our business-as-usual scenario (i.e. absent any policy intervention) and how these are affected by the proposed DRWG policy option. The set sales forecasts underpin estimates of when a policy intervention may be triggered.

#### *BAU scenario*

Using historic DRDB set sales data, supplied by [§< (S.44)], we have forecast set sale data by product group for both DAB and analogue-only sets to 2030 using the following method:

- A logistic function is used to model uptake for each individual DAB-enabled radio product category, assuming an average annual set sale saturation level for each product category.
- Whilst set sales for most DAB product groups are increasing, some are declining due to product obsolescence. These product lines are: CD portable; Personal Stereo; Radio Cassette; and Tuners. We assume the trends for each product group continue.
- We excluded set sales in the following product categories to be consistent with published annual data from the Digital Radio Development Board (DRDB): Set-top boxes; Mobile Phones; and MP3 Accessories.
- We also use a logistic function to model declining analogue-only set sales. This reflects the assumption that in the future all radio receivers will be DAB-enabled.
- Our set sales forecasts assume implicitly that the development of integrated chipsets, and the trend towards cheaper entry-level DAB devices, will result in a rapid decline in the manufacture and sale of analogue-only receiver sets. We understand that sets capable of receiving all Eureka-147 digital radio standards will be available on the retail market from late 2009, and sets are already on the market which could integrate DAB and analogue technologies.
- For some product categories, historic sales figure do not support a logistic decline function, For example, clock radio remains popular as an analogue only device and there has not been a decline in sales for analogue only clock radios. Similarly, MP3 radio as a relatively new type of technology has been offered in analogue only. This trend is not expected to continue as most other forms of radio sets include DAB receivers. Therefore, for these categories, a linear depletion in set sales was applied.

Our forecasts are broadly consistent with DRDB set sale forecasts.

The net stock of either analogue-only or digital-enabled sets is calculated by adding the previous year's stock to the net additions (sales minus disposals) for the current year. Using the set sale forecasts, disposal estimates, and total stock estimates from an Ofcom omnibus survey<sup>39</sup>, we calculated net DAB stock levels.

The net stocks forecast are used to construct forecasts for DAB household penetration, with assumptions about the number of DAB sets each DAB household owns (this is consistent with the approach used by the DRWG to build their forecasts). Our forecast suggests that the saturation level of around 95% of households will be reached by 2015.<sup>40</sup>

By 2015, our forecasts assume that all households acquire at least one DAB-enabled receiver (and are therefore considered to be DAB-penetrated), although they may not utilise the DAB functionality. Historic

---

<sup>39</sup> Digital Radio Omnibus data, Gfk NOP, September 2008. Base of 976 respondents.

<sup>40</sup> The results of the Ofcom omnibus survey suggest current radio penetration is around 95%, implying that some of the population does not own a radio. Our saturation level for digital radio penetration therefore also assumes a 95% level, consistent with the findings from the Ofcom omnibus survey data.

RAJAR data suggests that listening via DAB-enabled sets lags set penetration: DAB listening reached 11.3% of total hours in Q3 2008<sup>41</sup>, whereas household set penetration was just under 30%.

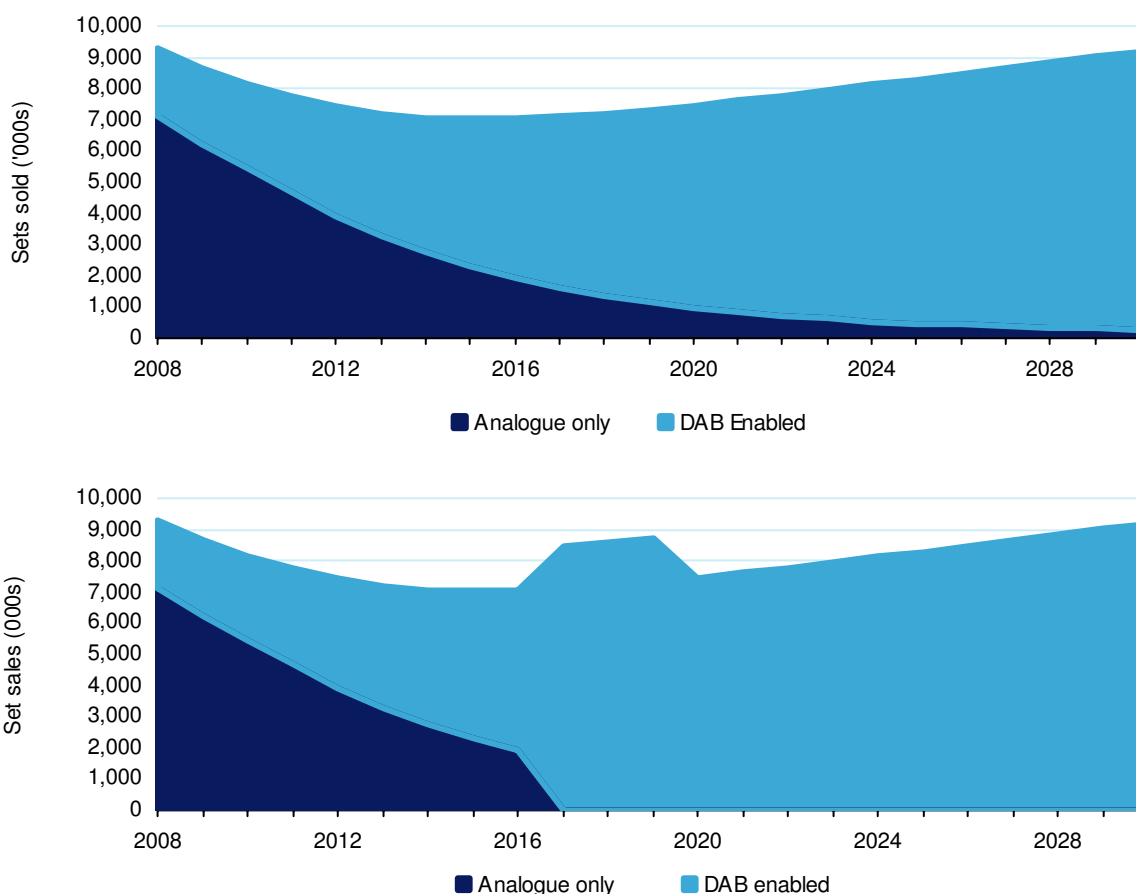
### DRWG policy option

The following changes are made in the event of an intervention:

- We assume that manufacturers take two years from a policy announcement to cease supplying analogue-only sets.
- Total sales level peak during migration as consumers purchase new sets or replace old analogue radios, and then return to BAU post-migration. Analogue-only set sales therefore decline linearly to zero within two years of the trigger date.

Figure 9 presents diagrammatically our forecasts of radio set sales under BAU and DRWG policy scenarios, split by analogue only and DAB-enabled radio sets.

**Figure 9: Annual set sales under BAU and DRWG policy**



<sup>41</sup> This figure rises to 12.6% if "digital unspecified listening" is distributed amongst digital platforms in proportion to specified digital listening.

## 5.2.2 In-car radio set sales

The Ofcom Communications Market Report 2008 provides survey evidence that 20% of all radio listening occurs in-car. Therefore the in-car market will be an important contributor towards the DAB listening threshold necessary for an intervention announcement.

We have modelled for the penetration of DAB-enabled devices in-car, as presented in Figure 10.

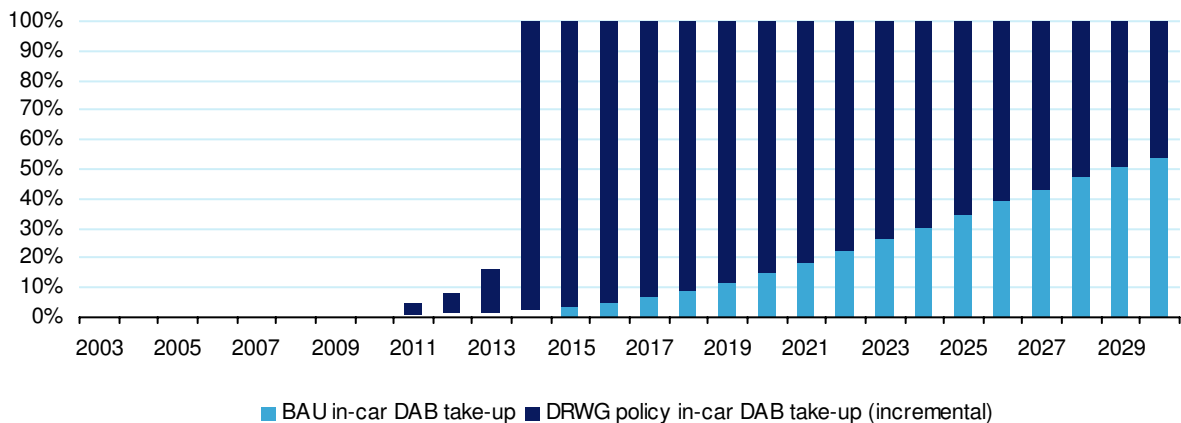
### BAU scenario

- Sales of in-car DAB-enabled sets is modelled using a logistic function and historic survey data collected by the DRDB on line-fit installations;
- After-market sales starts at 15,000 units per annum and grow at 25% per annum across the entire period of analysis, reflecting the growth of after-market devices such as Pure Highway; and
- Cars are replaced at the average annual replacement rate between the years 2003 and 2007.

### DRWG policy option

- Car manufacturers install DAB-enabled devices in all new line-fit cars as standard from 2014 onwards. It also implicitly assumes that car manufacturers begin planning for their installation as standard by 2010, allowing four years lead time to be able to install them as standard in all car models; and
- All other assumptions are unchanged.

**Figure 10: In-car DAB penetration for new cars**



### 5.2.3 Listening on digital devices

The listening trigger for the DRWG policy is based on the share of listening on digital devices (rather than household penetration of digital radio).

Using net DAB stock levels we estimated the share of total listening hours on DAB-enabled devices using the following approach:

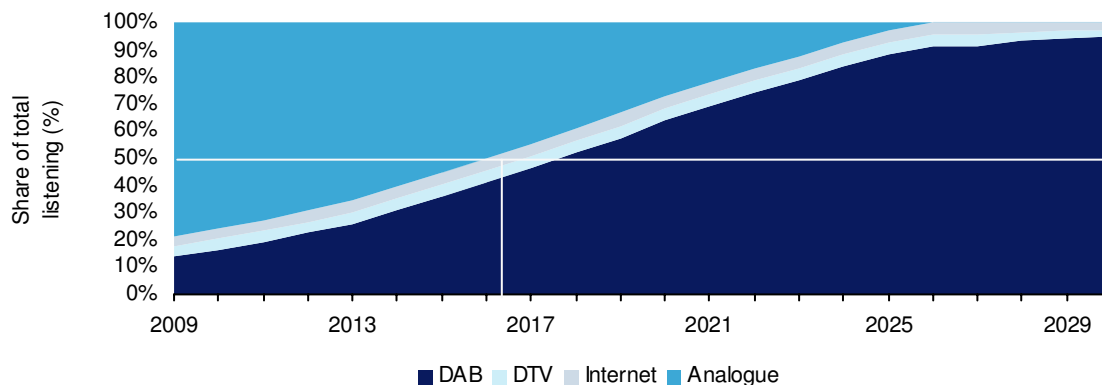
- 1 Net stock levels are used to determine the proportion of sets in the market which are DAB enabled rather than analogue only.
- 2 We apportion listening hours to devices based on data identifying the location where most listening is undertaken (e.g. outdoors, car, work)<sup>42</sup>.
- 3 Using these data, we then identify the proportion of listening hours by DAB-enabled devices. These are aggregated to derive a share of total listening hours.
- 4 Total radio listening hours have been broadly constant in the last decade, so we assume there will not be behavioural changes, and that total listening hours will remain constant over the entire period of analysis.

At the same time, we forecast listening on other forms of digital radio, including listening on internet and TV. These are projected using standard logistic functions based on historic data. The projections on listening on DAB, internet and digital TV collectively form the basis of our forecasts on digital listening, presented in Figure 11.

Our forecasts assume that the proportion of listening attributed to internet and digital TV remain broadly unchanged from current levels, in other words DAB listening will be the primary driver of digital listening. This is based on the historically low or no growth in internet and digital TV listening, as well as the lack of consensus forecast that suggest otherwise. However, there are some signs (as described earlier in this report) that internet listening may begin to take off if internet radios are more actively promoted and technologies such as WiFi or mobile broadband mature and become universally available.

The DRWG proposes that when 50% of total listening is on digital platforms, the migration policy will be “triggered”. Our forecasts suggested that the trigger date - the year in which the share of total listening on digital radio surpasses 50% - is identified as occurring in 2017.

**Figure 11: BAU Share of total listening by platform (end of year)**



<sup>42</sup> Taken from the Ofcom Communications Market Report 2008.

# 6. Incremental Benefits and Costs

## 6.1 Costs and benefits of DRWG policy

The comparison between the DRWG policy option and the business-as-usual scenario enables us to map the expected outcome of the policy option to costs and benefits, and identify the incidence of these costs and benefits. This comparison is summarised in Figure 12.

**Figure 12: Costs and benefits and incidence on consumers and producers**

Expected outcomes of DRWG policy relative to BAU	Benefits		Costs	
	Consumers	Producers	Consumers	Producers
<b>Increased coverage</b>	Out-of-coverage consumers receive coverage, and hence DAB digital radio channels			
<b>Reduced need for dual illumination</b>		Savings on transmission and energy costs post-migration, net against transmission cost of maintaining coverage pre-migration		
<b>Energy costs</b>			Potential for increase in energy costs to consumers	
<b>Non-voluntary consumers take up DAB</b>			Incur conversion costs, net of benefits of listening <ul style="list-style-type: none"> <li>• At home</li> <li>• In vehicles</li> </ul>	
<b>Old radio sets disposed</b>				Disposal costs
<b>Marketing and administrative activities</b>				Marketing and administrative costs
<b>Spectrum released for other uses</b>	Derive consumer value of the use of spectrum			

## 6.2 Producer benefits

### 6.2.1 Savings in dual transmission net of costs of extending coverage

Using a variety of sources<sup>43</sup>, we produced estimates of current analogue and digital transmission costs incurred by both the BBC and the commercial sector, at both the national and local level.

Under the migration plan, the main cost saving to stations would be the cessation of dual transmission. Additional transmission costs above and beyond the BAU scenario would be incurred in order to increase DAB coverage levels to the current analogue transmission levels.

Extension of existing digital multiplex networks to match current analogue population coverage will result in increased infrastructure costs as a result of the need to install new transmitters and transmission equipment. However, the capital expenditure costs of building out and maintaining transmitter networks are usually recovered by Arqiva over the course of a transmission contract in the form of higher transmission fees. Therefore, coverage extension costs are not explicitly modelled in our analysis. Rather, they are implicit in the increased transmission costs faced by broadcasters.

Ceasing dual transmission also presents potential environmental benefits, as energy costs could be reduced from the cessation of analogue transmissions. However these benefits have not been estimated explicitly, as transmission costs presented to us implicitly take into account all costs including energy. However, as more granular information becomes available more work can be conducted to estimate the environmental benefits, in particular the potential carbon savings.

The changes in coverage at the national service level, and transmission costs for all service levels, are set out in Figure 13 and Figure 14. [§< (S.44)], although we have not independently verified transmission cost data supplied to us obtained from the public domain. In addition, these data neither reflect the cost savings which will be passed on to the radio industry as a result of the Arqiva/National Grid Wireless merger nor do they accurately reflect costs to organisations that do not currently use Arqiva's services<sup>44</sup>.

**Figure 13: Changes in DAB Coverage at national level**

Service	"Business as usual" coverage	DRWG policy coverage
<b>BBC National</b>	95.2% <sup>45</sup>	[§< (S.44)]% <sup>46</sup>
<b>National Commercial</b>	[§< (S.44)]%	[§< (S.44)]% <sup>47</sup>
<b>All Regional Multiplex</b>	c. [§< (S.44)]%	[§< (S.44)]% (or in line with National Commercial)

<sup>43</sup> Sources include: discussions with relevant stakeholders, [§< (S.44)], press reports, and "The BBC's Efficient and Effective use of Spectrum", Deloitte (2007)

<sup>44</sup> These are likely to represent a small proportion of total industry transmission costs.

<sup>45</sup> Assumes the planned extension of the current BBC National DAB multiplex network is completed.

<sup>46</sup> This assumption is based on the DRWG spectrum sub-group method [§< (S.44)].

<sup>47</sup> Assumes increase in transmitter network and transmitter power increases.

**Figure 14: Changes in transmission costs**

Service	“Business as usual” annual transmission cost	DRWG policy annual transmission cost
<b>BBC National Analogue (excludes LW)</b>	£[>< (S.44)]	£[>< (S.44)]
<b>BBC National DAB</b>	£11m <sup>48</sup>	£[>< (S.44)] <sup>49</sup>
<b>INRs</b>	£[>< (S.44)]	£[>< (S.44)]
<b>DigitalOne</b>	£[>< (S.44)]	£[>< (S.44)]
<b>Regional digital multiplex network</b>	£[>< (S.44)]	£[>< (S.44)] (assumes this multiplex layer becomes a second national digital multiplex)
<b>Local digital multiplex network</b>	£15.9m <sup>50</sup>	£23.4m <sup>51</sup>
<b>Local FM commercial services which will migrate</b>	£[>< (S.44)]	£0m
<b>Local FM commercial services which will not migrate</b>	£[>< (S.44)]	£[>< (S.44)]
<b>Total</b>	<b>£87.9m</b>	<b>£64.0m</b>

**Figure 15: Phasing of transmission costs under policy intervention (2008 - 2030)**

[>< (S.44)]

## 6.3 Producer costs

### 6.3.1 Radio sets end-of-life costs

As new DAB radio sets are bought, old analogue radio sets may be disposed by households. This is relevant to our CBA to the extent that the digital migration policy brings forward the end of the useful life of an analogue radio set.

We have assumed that there are no direct costs involved to households in disposal. Producers, however, will incur additional end-of-life costs. These producers would traditionally include waste collection or management companies. Additionally, the incremental waste would contribute to adverse environmental impacts. New regulations, however, have changed the way electronic waste is managed. We estimate the end-of-life costs of obsolete radio based on these regulations, which we assume will be standard practice over the time horizon of our study.

The EU Directive on Waste Electrical and Electronic Equipment has been introduced to ensure a more sustainable approach to managing electrical and electronic waste by increasing the volume of material recycled and reducing the amount sent to landfill. In the UK, new waste electrical and electronic equipment (WEEE) regulations came into effect from 1st July 2007. Under the regulations, retailers and manufacturers take responsibility for disposal of WEEE, and are responsible for paying for the collection and recycling of WEEE. Their household customers can now dispose of their waste equipment free of

<sup>48</sup> Assumes the planned extension of the current BBC National DAB multiplex network is completed and is an estimate as provided in “The BBC’s Efficient and Effective use of Spectrum”, Deloitte (2007). We have not verified this estimate.

<sup>49</sup> [>< (S.44)].

<sup>50</sup> This figure does not include the cost of transmission for local digital multiplexes licensed by Ofcom but yet to launch.

<sup>51</sup> This figure includes an assumption about the transmission costs for local digital multiplex.

charge on a like-for-like basis<sup>52</sup>.

Radio sets fall under Consumer Equipment (or Category 4) of the WEEE groupings, which also includes hi-fis, musical instruments, videos, camcorders etc. The targets set for this category are to achieve 75% recovery and 65% recycling.

Retailers selling electrical goods must now provide their customers with explanations of how they can return their WEEE, whether the old equipment was bought from them or not. Every retailer must either offer to take back the old kit in-store, or be part of the Distributor Take back Scheme and tell customers how the kit can be recycled. If retailers opt to take back a kit in-store ("in-store take back scheme"), the requirement that producers accept like-for-like equipment ensures that for every DAB set bought, consumers can "return" an obsolete FM radio set. If a retailer joins the Distributor Take back Scheme, a fee is paid to the scheme which develops WEEE designated collection facilities across the UK that consumers can use free of charge.

All producers are required to join a Compliance Scheme (or set one up) that has been approved by the Environment Agency. At the time of writing, 37 Producer Compliance Schemes (PCSs) operate in the UK, including REPIC, Transform and ERP. Appendix IV presents a summary of their charging structure. Separately, Valpak has been approved as the operator of the Distributor Take back Scheme in the UK. (Large) Retailers pay Valpak a per unit sold fee which is intended to cover the cost of the take-back scheme. On top of the fees charged by these providers each producer pays an agency fee to the Environment Agency, collected by their respective providers.

In practice, at the time of migration, retailers and manufacturers could potentially end up with a stock of unsold analogue sets. These sets would also need to be recalled and disposed of accordingly. The extent to which there is unsold stock would depend on the ability of manufacturers to plan their production. We assume that all manufacturers and retailers are able to plan their production to minimise this impact - and therefore have not factored this cost into our calculations explicitly.

The estimates of the environmental costs associated with analogue radio disposals are based on the following assumptions:

- 1 All analogue radios disposed will be recycled. This can be encouraged via informational marketing associated with the promotion of DAB.
- 2 The incremental environmental costs are approximated by the recycling and treatment costs of the WEEE Directive. These costs are based on the 2008 charges of Valpak and Transform, on the basis that this information is publicly available. Fees for the other two providers are commercially sensitive.
- 3 We calculate the total cost of recycling using the following approach:
  - £0.02 per unit disposed incrementally, based on the costs charged by Valpak. This cost is charged on a per unit sold basis, but is intended to cover the cost of recycling units taken back into stores;
  - Tonnage operational costs (at £100/t) based on Transform's rates and the estimated incremental tonnage. Based on the range of portable or clock radios available for sale which weighs just under 500g<sup>53</sup>, we have therefore assumed an average of 0.5kg per radio set. This works out to be approximately £0.05 per unit disposed.
- 4 Assumptions on incremental units disposed:
  - The counterfactual BAU scenario: The current disposal rate of radio, television and audio

---

<sup>52</sup> The regulation distinguishes between household and non-household consumers, but we have looked at regulations targeted on household consumers only.

<sup>53</sup> Portable radios, in particular, tend to be marketed as light-weight.

equipment is around 12 million units a year. We assume this trend to continue. We have apportioned the disposal rate of radios based on the share of ownership of radio as a proportion of 'brown goods' of 50%<sup>54</sup>. This amounts to approximately 6m sets a year. There are currently 84m in-home analogue radio sets. We have therefore assumed an average radio life span of 15 years<sup>55</sup>.

- We assume that at the beginning of the timeframe considered, all 6m sets annually disposed are analogue radios. Disposal of DAB radio are assumed to start from 2014 - 15 years after the first launch of DAB sets<sup>56</sup>.
- When the digital radio migration policy is in effect, the remaining stock of analogue radios would have limited uses, and may therefore be disposed ahead of its useful life. This represents the potential environmental cost.
- However, we assume that radios that are most likely to be disposed ahead of their useful life in favour of DAB comprise radio sets/portable radio sets and clock radios only, which tend to have limited additional functionality beyond radio listening. More sophisticated music/audio systems, for example hi-fis, iPod docks, MP3 players etc. with multiple functionalities are assumed to be retained for other uses or replaced at the end of their useful life. Out of the above categories, we assume that households that listen to these analogue radios regularly (at least once a week) will dispose their current FM sets as a direct result of the policy. Ofcom's survey found that 58% of analogue radio/portable radio sets and 60% of analogue clock radios are listened to regularly.

---

<sup>54</sup> Brown goods comprise six types of household appliances: televisions; DVD and video players/recorders; digital, cable and satellite receiving equipment; camcorders; non-portable audio equipment; and portable audio equipment. Currently approximately half of all brown goods are radio sets (or audio equipment). We have therefore assumed that half of all disposed brown goods are radios.

<sup>55</sup> 84m sets/6m disposals per year  $\approx$  average life span of 15 years.

<sup>56</sup> We recognise that some DAB sets may be disposed of between 2009 and 2013, in addition the replacement rate of radios may change in the future (in particular DAB versus analogue radio). Our assumption on the disposal rate of DAB radio does not fundamentally change our analysis, since we are looking at the disposal of analogue radios only. This assumption helps simplify our calculation of net stock of DAB and analogue radios.

- Given our bottom-up approach in estimating the sales by types of radio as illustrated in Section 5.2, we are able to calculate the remaining analogue radio/portable radio sets and analogue clock radio/alarm clock radio on the year of switchover would be disposed of incrementally as a result of the policy intervention. This amounts to around 15.7m radios under our DRWG policy scenario<sup>57</sup>.

**Figure 16: Frequency of radio listening by type of radio**

Radio type	Average number of radio per household	Percentage of analogue radios	Frequency of listening	
<b>Radio / portable radio sets</b>	0.8	72%	Every day	29%
			Most days	15%
			At least once a week	14%
			At least once a month	5%
			Less often	23%
<b>Clock radios/radio alarm clocks</b>	0.7	84%	Every day	36%
			Most days	15%
			At least once a week	9%
			At least once a month	3%
			Less often	13%

Our calculations suggest that over 15.7m household radios are disposed incrementally as a result of the DRWG policy. Figure 17 presents the cost of conversion on the year of migration, based on the per unit cost of recycling at £0.07. This is equivalent to £750k in present value terms.

**Figure 17: Disposal cost of analogue radios**

Incremental Cost	PV (millions)		Cost of conversion on year of migration (millions)
	2009	2030	
<b>DRWG policy</b>	£0.75		£1.10

These assumptions provide a lower bound of quantifiable environmental costs. A number of factors suggest that the true environmental costs (borne by both producers and consumers) would be higher, including assumptions on recycling rate and the environmental costs of the recycling process. In theory we would expect that the cost of recycling is lower than the environmental costs of not recycling (taking into account negative externalities of not recycling). Therefore our assumption that all sets are recycled implicitly assumes that the 'least-cost' option to disposal of radios is undertaken.

However, the current low of recycling of consumer electronics suggests that this assumption may be too simplistic. The consumer awareness of the WEEE directive remains low at around 30%. Only 7% of consumers return electronic goods to the retailer. Less than half of consumers use recycling facilities, and around 11% dispose their equipments in a dustbin or at the local dump<sup>58</sup>. Our optimistic assumption of fully recycled radios could be underestimating the true environmental costs.

<sup>57</sup> Our forecasts on sales and stock of radios suggest that there are approximately 16.1m analogue radio/portable radio sets and 10.6m analogue clock radio/alarm clock radio on the year of migration. Thus total affected sets = 58% x 16.1 + 60% x 10.6 = 15.7m

<sup>58</sup> Ofcom Communication Report 2008, Section 1.3, Communications and the environment.

We have also assumed that the cost per unit recycled at £0.07 is representative of the environmental cost. In practice, this cost reflects the average cost to producers of creating the facilities for equipments to be recycled, and not the true environmental costs. For example, there could be components within radio sets which cannot be recycled, or are hazardous to the environment. A massive rate of disposal over a short period of time may also pose additional strain on the environment. Moreover, we have not taken into account the cost that consumers might incur in returning the goods for recycling, for example the additional transport cost travelling to the local dump. A full life cycle analysis would have to be conducted to understand the costs in more depth, although this is beyond the scope of this study.

**6.3.2 Marketing and administrative costs**

Marketing and administrative costs also need to be incorporated to account for the increased efforts to help drive digital radio take-up and the communication and implementation of policy. In Ofcom’s Consumer Engagement studies, some consumer groups, particularly the group of so-called “Abstainers” will require help in learning and adapting to new technology. The report describes this group as:

*“unable to advance without more thorough guidance ... Phrases such as ‘I need someone to hold my hand’ are common. ... Without support many will take the easier option of turning their back on digital services.”*

The CBA on digital TV switchover estimated marketing, educational spend and administration costs of DigitalUK (SwitchCo) to be around £200m in total, spread out over six years. The major areas of cost were expected to be advertising, publicity and management of a call centre contract. In 2007/08, DigitalUK spent £21.2m. We have assumed that the drive for digital radio will require the same activities as for digital TV switchover, but could complement other existing activities promoting digital TV, and therefore the associated costs may be lower than for digital TV. In addition, the DRWG has recommended that a co-ordinated marketing campaign for digital radio is launched from as soon as end 2009. Our assumption is an incremental marketing and administration budget of £100m, to be phased equally over twelve years (or £8.3m p.a.) from 2009 to 2020, up to the period where digital radio migration is anticipated to be completed. Figure 18 provides a comparison between our assumption and the costs of other marketing efforts by the government, indicating a fairly conservative budget relative to other national campaigns on an annual basis.

In practice, the phasing of the costs is unlikely to be as straightforward, as the marketing campaign is likely to comprise of different components and incentives, and will also tend to be geared up around the period of migration. More precise estimates of the marketing costs would only be known when the nature and strategy of the marketing campaign is more fully developed.

An important objective of the marketing campaign is to encourage digital radio take-up and listening. In the short term where recessionary impacts could limit consumer spending, it is difficult to attribute the extent to which consumers would react to the marketing. This study has not explicitly included the impacts of marketing e.g. the potential increased sales of DAB radio or listening on digital platforms, but recognises that an effective marketing campaign may bring forward the trigger date of migration. If this happens, the consumer benefits and costs are brought forward as a result of the marketing campaign.

**Figure 18: Comparison of marketing budget on government-led campaigns**

Organisation and Programme	Marketing/Campaign Cost p.a. £m
DigitalUK (2008)	21.2
DoH (2007/08): Tobacco Control	19.0
DoH (2007/08): Sexual Health	6.9
<b>Average Marketing Budget for Digital Radio Migration</b>	<b>8.3</b>

## 6.4 Consumer benefits

### 6.4.1 Extended coverage – access to new digital channels in-home

Households that are currently in DAB coverage will be able to receive radio stations that are broadcasting in digital-only formats. There are about 50 stations, at the national and local level, broadcasting in digital-only, providing more choice to digital listeners. However, households which value having more choice but are out of DAB coverage could not receive (via DAB) these stations. The DRWG policy assumes that coverage of national DAB multiplexes would be extended to the same level of coverage as FM, therefore allowing those that are currently out of coverage access to digital channels, and deriving consumer benefits.

Currently such national stations include BBC's BBC 1xtra, 5 Live sports extra, BBC 6 Music, BBC 7 and BBC Asian Network as well as one commercial station (Planet Rock). If the D1 multiplex is filled with new digital stations to full capacity, then consumers will have up to six more new digital stations to choose from. The extension of the regional multiplexes to a second national multiplex also means that some consumers gain access to "new stations"<sup>59</sup>. We estimate the incremental consumer surplus of radio listening by calculating the proportion of households that benefit from increased coverage and making assumptions on their willingness to pay for the additional radio stations, as illustrated in Section 4.3. We have based our willingness to pay for digital radio estimates on several studies including:

- 1 BBC Human Capital 2004: considers the willingness to pay (WTP) of consumers (and citizens) to BBC services, both from a top-down approach (i.e. the bundle of BBC services) as well as bottom-up approach (i.e. the WTP for each type of service).
- 2 Aegis 2000: WTP for radio stations including digital radio, based on assumption that digital radio will have improved data services and CD quality sound.
- 3 Radiocommunications Agency 2001: considers the economic impact of radio, including the consumer benefits of radio based on a survey of how much consumers are willing to pay for radio.
- 4 Europe Economics 2006: estimates the consumer surplus based on BBC Human Capital WTP.

Our approach is as follows:

- 1 Given the different measures in each of the studies, we adjust the figures to a consistent measure, by uplifting the willingness to pay to 2009 prices, measured per household per year.
- 2 The willingness to pay for digital radio stations relative to analogue radio stations is based on the BBC Human Capital study, which we consider to be most relevant in terms of distinguishing between digital radio and analogue radio stations. In constructing our DRWG policy, we adjusted these figures downwards (to be more consistent with the Aegis study) for the following reasons:
  - The BBC approach is bottom-up, which values services individually and tends to be higher than a top-down approach which values services as a bundle.
  - The willingness to pay for additional radio stations tends to fall as the number of radio stations increases. Over 90% of listeners do not listen to more than 4 radio stations<sup>60</sup>. Only around one-third of UK adults find access to more stations a valuable feature of digital radio<sup>61</sup>.
  - We assume that the willingness to pay for the commercial national stations is the same for each

---

<sup>59</sup> Some of these stations would be regional stations merged and rebranded as national stations. The extent to which consumers gain access to stations they previously did not have access to will depend on how these stations are amalgamated.

<sup>60</sup> Ofcom Communication Report 2008, Source: Ofcom Residential Tracker 2007

<sup>61</sup> Communications Market: Special Report, Consumer Engagement with Digital Communications Services, Report on research findings, July 2006.

multiplex, even though the second “national” multiplex potentially offers up to ten new stations for out-of-coverage consumers, whereas the first multiplex (D1) would only carry up to seven new digital-only stations. This is a broad assumption intended to reflect the falling willingness to pay for additional radio stations on the second multiplex.

- 1 Our high case scenario uses the BBC estimates without the downward adjustments.
- 2 Based on the expected increase in coverage for BBC, national commercial and regional commercial multiplexes, we phase out the incremental benefit to consumers accordingly.

**Figure 19: Incremental benefit from consumers with extended coverage in-home**

Incremental Benefit	NPV (millions)		WTP per household per year for new households that receives coverage after migration (for BBC and national commercial)
	2009	2030	
<b>DRWG policy</b>	£780m		£24.90
<b>High</b>	£1,152m		£36.75

The estimation of willingness to pay, and consequently, the benefits of extended coverage, is an imprecise science and we provide a number of caveats in respect of our results. While we consider that they are based on the best available studies in this area in the UK together with “reasonable” judgments, they are not based on specific primary WTP research. Importantly, the WTP surveys rely on the understanding of respondents of what “digital radio” would entail. The Aegis report, for example, informs its respondents that digital radio would include “improved data services, CD quality sound and radio could be streamed to the internet anywhere in the world”. The BBC report, on the other hand, reflects on digital services available in 2004, but applies a bottom-up approach which tends to overestimate the total value of radio<sup>62</sup>.

The BBC estimates are also based on valuation of BBC services, which may reflect WTP that are specific to the nature of BBC’s services. The range of content and services offered by commercial broadcasters, which are profit motivated, would be driven by advertising revenues. With the proliferation of stations, the extent to which advertising revenue is diluted may impact upon the quality and quantity of content. This in turn would impact upon the willingness to pay by consumers for these additional stations. Behavioural changes such as changes in listening patterns are also important aspects that could not be captured quantitatively at this point. For example consumers may listen to more stations as a result of increased choice, and whether this implies diluting the listening time on each station, or increasing the total radio listening time is not certain. This uncertainty is reflected to some extent in the quantum of our estimates, where the high case (which is based on BBC valuations) yields an estimate up to 50% greater.

A second caveat in respect of our estimates is that the study implicitly assumes that consumers who are currently out-of-coverage could not access the digital-only stations. This is true strictly for DAB radio sets and radio stations that broadcast on DAB only. However, in practice, some digital TV or broadband-enabled households are able to access radio stations that are available on multiple platforms – implying that the incremental benefit as a result of extended coverage may be exaggerated. Having said that, consumers nevertheless receive benefits from increased choice of platforms on which to access the stations, thus there would still be some benefits attributed to increased coverage. Also, the current low rate of radio listening on digital TV and the internet suggests that these are yet to be perfect substitutes

<sup>62</sup> In the Human Capital study, what is called the “non-normalised chip allocation method” was used to value the constituent parts of the BBC. The respondents were asked to imagine that the licence fee no longer existed. They were then asked what each of the BBC’s services is worth per month, to the average person. Then the value of the BBC to consumers is calculated as the sum of the values of the constituent parts. Behaviourally, the prompting involved in the bottom-up method to value each constituent part tends to create slightly higher survey values than a top-down approach, which involves the respondents value the BBC services as a whole.

for DAB radio, although this may change in the future.

**6.4.2 Extended coverage – access to new digital channels in-car**

An important aspect of the digital migration policy is to ensure that cars in regions that are currently out-of-coverage will also be able to receive coverage of digital-only radio stations.

Therefore, car owners will also receive benefits from the extended coverage through access to new digital channels. To account for this benefit, we have considered only “car households” (i.e. households that have access to cars). There are currently approximately 25% of UK households without cars. The car ownership rate has been rising marginally in the last 15 years, but we assume that future ownership rate would remain constant, as a result of low forecasts of growth in car sales over the next few years.

[3< (S.44)]<sup>63</sup>

From our findings on in-home benefit estimates, the consumer value (DRWG policy) of radio with digital stations is £89.10, [3< (S.44)]<sup>64</sup>.

The high case mirrors the methodology for the DRWG policy estimates, making use of the high case of the in-home estimates.

**Figure 20: Incremental benefit from consumers with extended coverage in-car**

Incremental Benefit	NPV (millions)		WTP per household per year for new car households that receives coverage after migration (for BBC and national commercial)
	2009	2030	
DRWG policy	£342m		£[3< (S.44)]
High	£505m		£[3< (S.44)]

**6.4.3 Consumer benefits from alternative uses of the spectrum**

In order to identify the consumer benefits that would be realised by the release of spectrum currently used for audio broadcasting post-digital migration, we need to identify potential uses of that spectrum.

The consumer value of the released spectrum is not the revenue which is collected by the UK Government when reallocating the spectrum, but the value to the consumer of the applications which then utilise the released spectrum. Once those applications have been identified, the value can be evaluated by understanding the consumer willingness-to-pay for the new services.

It has been difficult to establish alternative uses for the spectrum which would be released post-digital migration for reasons we identified earlier in the report:

- 1 Demand for Band II (the FM spectrum) non-radio applications will be limited without collaboration with countries outside the UK. Given the UK is at a relatively more advanced stage of the development of its digital radio sector compared to most other countries, the reassignment of Band II for alternative (non-audio broadcasting) uses is unlikely to provide manufacturers with the scale they would require to launch new consumer applications.
- 2 Both AM and FM bands are subject to interference issues. The properties of the AM band make it susceptible to interference from a variety of factors, including environmental factors (e.g. topography)

<sup>63</sup> [3< (S.44)].

<sup>64</sup> Admittedly, this adjustment is arbitrary given that the estimates of £89.10 and [3< (S.44)] are from different sources, but we are constrained by the lack of comparative studies of the benefits of in-home versus in-car listening.

as well as from international uses of AM spectrum, in addition to other forms of interference (e.g. from ASDL lines or adjacent spectrum uses). In certain parts of the country, Band II could be subject to interference from high-power audio transmissions from neighbouring countries, or from domestic 'pirate' audio broadcasts.

- 3 Use of Band II spectrum is subject to a number of international restrictions which may limit the potential for new services. For example, high power applications are restricted due to the potential for interference with adjacent spectrum uses (e.g. aeronautics).

The potential alternative applications for Band II which have been identified through discussions with industry experts and stakeholders are:

- 1 PMSE use: low power wireless microphones are already manufactured for use in Band II and there could be demand amongst PMSE users for additional cleared spectrum. However, Ofcom's views based on analysis prior to auction designs suggest that individual PMSE users are unlikely to be able to participate in a competitive award process. In addition, given there are already many other spectrum bands which are licensed for PMSE use; it is unclear how much demand there would be for additional capacity.
- 2 Data services: FM broadcasts in the UK already make use of the data-carrying capability of Band II in the form of "RDS" (Radio Data System). Band II could in theory be used for additional data transmission; however most of the consumer value of current data use in Band II is generated by the link between data and audio broadcasts. It is therefore currently unclear what the value to consumers of a stand-alone data service using Band II would be.
- 3 Additional audio broadcasting: the vacant spectrum could also be used as additional capacity for audio broadcasting, including<sup>65</sup>:
  - Community radio and RSLs; and
  - Information services: FM spectrum could also be licensed for non-commercial information services (e.g. tourist or traffic information).

Currently, the extent of potential demand for spectrum from producers is unclear, although an award process for the released spectrum may result in potential bidders coming forward. Nonetheless, for the purposes of our analysis, we need to be able to place a consumer value on the released spectrum and have made a number of assumptions as set out in the following subsections.

### **FM spectrum**

Based on DRWG recommendations, some or the entire FM spectrum which will be released when radio stations migrate to the digital multiplexes will be available for other uses. The remaining spectrum will be retained for small local, community radio broadcasting and RSLs. The opportunity cost of releasing each MHz of spectrum is the cost of retaining the spectrum for small local commercial and community radio stations.

Using a similar approach, an Indepen, Aegis and Warwick University study estimates the benefit for freed analogue television spectrum. By estimating the marginal opportunity cost of TV spectrum, the study valued the spectrum at £1m to £1.2m per MHz respectively in 2004 prices. The same study, however, was not able to quantify the marginal value of FM spectrum, noting the difficulties in identifying an

---

<sup>65</sup> During discussions with stakeholders, the possibility that the FM spectrum vacated following migration could be used by 'pirate broadcasters' (i.e. unlicensed broadcasters) was raised. Increased use of spectrum by pirates could generate significant costs to both producers (in the small commercial and community sectors) and consumers, who are unable to access their desired services. In addition, tackling these 'pirate' broadcasters may require additional regulatory resources over and above those currently used. However, pirates currently tend to locate their broadcasts on frequency close to large commercial services, so as to benefit from mistuning of radios. Absent such large commercial services on FM, it is open to question how successful pirate stations may be. For simplicity, we have not explicitly taken into account the effect of 'pirate' broadcasters in our modelling.

equivalent service for FM.

We have assumed that the value of the consumer benefits from use of the released spectrum is approximated by the value of community radio broadcasting. Community stations currently have a median (average) revenue of approximately £65k p.a., and there are 180 stations licensed, generating a current market value of £11.7m p.a.

The community radio market has potential for growth, as evidenced by the number of applications Ofcom received compared to licences awarded. By the end of 2005, Ofcom awarded 62 community radio licences, out of 194 applications. Between 2006 and 2008, a further 82 licences were granted out of 213 applications<sup>66</sup>. The substantial over-subscription for licences suggests that there is potential for more community stations when the spectrum is released. However the increase in the number of stations could then dilute revenue for each station unless the creation of new stations would tap into new sources of advertising revenue (which is unlikely, especially in the current economic and advertising environment).

A simplifying assumption would be to assume that the community radio market could accommodate 310 stations (180 existing licences plus approximately 130 additional licences), each with an average revenue of £50k p.a. (scaled down to reflect revenue competed away). This gives a potential market value of £15.5m p.a., which translates to an average of £775k per MHz, if we assume that services are equally distributed across band II.

Our DRWG policy scenario assumes that 10MHz of FM spectrum could be available for alternative uses, generating a value of £7.8m p.a. after digital radio migration occurs.

### **AM spectrum**

The current services on AM will migrate onto relevant digital multiplexes under the proposed DRWG digital migration strategy. The vacant AM spectrum could thus be relicensed or auctioned for reuse. However, we have not been able to identify any potential new consumer applications which could be deployed using the spectrum, aside from additional use for audio broadcasting.

Therefore we will assume that the AM spectrum band could be digitised post-digital migration, and used for DRM (Digital Radio Mondiale) broadcasting, or equivalent.

Digitisation of the AM frequency band would allow national stations on AM to broadcast over a single frequency network, whereas at present national services have to split frequencies due to interference issues. Local AM services could operate in a similar way to current local AM transmission.

There are several potential consumer benefits to digitisation of the AM frequency band:

1. The quality of transmission would increase;
2. National services could operate on single frequency network, thus allowing the potential for additional services in the spectrum currently assigned to national stations; and
3. In theory, DRM allows multiplexes of up to two stations, which could potentially provide additional capacity for new services.

Some consumers may face conversion costs in the form of acquiring sets which are capable of receiving DRM transmissions. Common chipset technology may limit those conversion costs under a migration strategy.

Producers may benefit from lower ongoing operating costs. However, some costs would be incurred in adapting the existing AM infrastructure in order to carry DRM services, including some modification of the transmitter sites and expenditure on new transmission equipment.

---

<sup>66</sup> Based on Ofcom updates on awards [http://www.ofcom.org.uk/radio/ifi/rbl/commun\\_radio/Communityfund/](http://www.ofcom.org.uk/radio/ifi/rbl/commun_radio/Communityfund/)

The largest producer cost of digitising AM would occur as a result of the switch to single frequency networks which would require the building out of transmitter networks currently used for analogue transmission. For example, BBC Radio 5 Live splits transmission over the frequencies of 693 and 909 KHz given there are technical constraints which prevent it from broadcasting on one single frequency network. Each frequency could be used for one national service, however each would require the transmitter network to be built up to full national coverage, whereas at present only the two frequencies combined have full national coverage.

Given the difficulties presented in estimating the value of the uses for the AM spectrum, we have assumed that there is no incremental benefit associated with the value of the uses for the AM spectrum. The AM spectrum would only be digitised if the benefits exceed the costs, and therefore the opportunity cost of using the AM spectrum is close to zero given the lack of other available uses.

**Sense check of our results**

A comparison with the value of TV spectrum as estimated by the Indepen et al. study to other studies on consumers’ willingness to pay for both types of services suggested that our estimate is at the higher end of the range. One aspect of our sensitivity analysis would consider a lower valuation, consistent with the lower estimates on the relative willingness to pay of radio to TV of 35%. This translates to £400k per MHz, slightly over half of our central estimate.

**Figure 21: Comparison of PwC estimates of radio spectrum value with other willingness to pay studies**

	Ratio of radio spectrum value to TV spectrum value
<b>CBA</b>	57% - 68%
Willingness to pay studies	Ratio of radio willingness to pay to TV willingness to pay
<b>Europe Economics</b>	35%
<b>Radio Communications Agency</b>	37%
<b>Human Capital</b>	46% - 60%
<b>Aegis</b>	60%

**6.5 Consumer costs**

**6.5.1 Conversion Costs: Household**

The incremental conversion costs for consumers are the costs that are incurred by non-voluntary consumers, i.e. those who would not have migrated to digital radio in the absence of the policy.

Ofcom distinguishes how the different groups of consumers value digital services by looking at the following categories<sup>67</sup>:

- Enthusiasts;
- Functionalists;
- Economisers;

<sup>67</sup> Consumer Engagement with Digital Communications Services, Ofcom 2006. One of the key conclusions of the study was that the majority (68%) of UK consumers have the same broad attitude towards each of the four main digital communications platforms: television, radio, the internet and mobile phones (cross-platform attitudes). A minority (32%) of consumers think about and see value in one platform differently from the others (platform-specific attitudes). This CBA has assumed that segmentation of all UK households based on Ofcom’s cross-platform group segmentation. The two radio-specific Mindsets were the Radio-Centrics (9%) and the Radio Agnostics (16%). Ofcom likens the Radio-Centrics to Resisters and the Radio Agnostics to Functionalists.

- Abstainers; and
- Resistors.

Broadly speaking, this study considers Enthusiasts, Functionalists and Economisers to be voluntary converts. We assume abstainers to be non-voluntary converts. Resistors are considered to be the group of consumers who do not take up digital radio who could lose access to radio listening (for services not retained on FM) as a result of the migration.

We estimate the proportion of non-voluntary consumers by projecting the take-up of DAB under the counterfactual and DRWG policy scenario.

Through consultation with stakeholders, we understand that the cost of non-voluntary conversion of consumers differs for groups of consumers. We assume that the total cost of non-voluntary conversion for consumers comprises:

- 1 Cost of non-voluntary conversion for an ‘average’ household;
- 2 Incremental cost of non-voluntary conversion for a ‘vulnerable’ household; and
- 3 Loss of access to radio stations as a result of non-conversion.

### ***Cost of non-voluntary conversion for an ‘average’ household (Abstainers / Resistors)***

The non-voluntary converts incur the cost of a DAB-enabled receiver kit<sup>68</sup>. Some of the non-voluntary conversion cost would be attributed to conversion of second or third radio sets in the home, as these are no longer able to receive FM transmissions. There are also non-quantifiable costs such as learning costs (learning to use a new radio set and additional functionalities) or search costs (buying a new radio). However, we assume that the learning and search costs are negligible (for non-vulnerable households), especially if sufficient marketing and informational campaigns have been carried out.

Given our bottom-up methodology in the estimation of DAB radio sets take-up, we are able to estimate the non-voluntary conversion costs by comparing set sales of DAB and analogue radios under the DRWG policy and the “business-as-usual” scenarios. The current cost of an average DAB radio set is around £75, and we project that the cost of a set would fall over time to reflect the economies of scale of production – such that the cost would be comparable to an analogue set by 2030. We assume that all incremental sales after the trigger year are non-voluntary purchases. Our model projects that approximately 4m DAB radios are non-voluntary purchase between 2017 and 2019, at an assumed average price ranging between £20 and £25 (the actual price assumption will depend on the year considered).

This analysis assumes that households would convert to digital via the purchase of a DAB-enabled radio set or portable internet radio set. As for the estimation of the consumer benefit from extended coverage, in practice some households may choose to access digital radio via digital TV and the internet *instead* of purchasing a new kit. Based on the low rate of listening on these alternatives, we assume the proportion of households that choose to do so would be low to negligible. Again, this assumes that consumer behaviour would not change substantially, but there could be a number of drivers that may affect this:

- Consumers who are already digital TV and broadband-enabled may find that there are little incremental costs to access digital radio via these platforms rather than via DAB, since they are already subscribing to these services (in particular digital TV has a high household penetration rate). This could be especially relevant for conversion of second/third sets.

---

<sup>68</sup> As described earlier in this report, consumers can also access internet radio via a portable internet radio (i.e. without the need of a PC/laptop). Given that a) the forecast for digital radio listening is driven primarily by DAB listening and b) the price range of internet radios is not substantially different from a DAB radio, we have based our estimates on the cost of DAB radios only. In practice, the estimates in this section on conversion cost could be easily extended to include costs of converting to DAB and internet radio.

- The convergence of multiple services onto one receiver (an example is mobile phones that could also function as radio/MP3 player, camera etc.) may encourage listening to digital radio through DTV or broadband.
- The encouragement of digital radio migration by the government, while favouring DAB, is likely to be platform neutral. The consumer awareness of being able to listen to radio on the TV or PC may increase.
- Radio stations may shift their focus onto alternative platforms, especially internet radio. Consumers could also access stations broadcast outside the UK from the internet.

### ***Incremental cost of non-voluntary conversion for a 'vulnerable' household***

We define vulnerable households to consist of particular 'vulnerable' groups that are likely to incur additional costs of conversion, for example the blind or partially-sighted, those with other disabilities and the bedridden, and the elderly who are living alone. Our consultation with stakeholders suggested that those who are blind or partially sighted may require a modified receiver set, which are typically more expensive than a standard radio set. Furthermore, this group of 'vulnerable' consumers needs more help on the learning and search costs, which can be assumed to be greater than the 'average' household.

Views from stakeholders suggests that a modified kit currently costs around £160, just over twice as much as the cost of an average DAB radio set of £75. Clearly different group of vulnerable consumers may require different forms of assistance. In particular, elderly people who are living alone may not necessarily require a modified kit, but may instead need practical assistance to learn how to operate a new DAB radio set. Our consultation with stakeholders suggests that a home visit typically could cost around £60 - £90. Given the evidence presented to us where the range of potential cost to the vulnerable have not varied substantial between different types of vulnerable groups, we have assumed simplistically that the costs to 'vulnerable' groups (regardless of type) are twice as much as the 'average' households<sup>69</sup>. This assumption is clearly high level and indicative and further work would be required to identify how costs vary across vulnerable groups, but at the aggregate level it would be more instructive to understand the *total* costs for the vulnerable.

Our research on the proportion of vulnerable has indicated that 5.2% of UK households would constitute our definition of 'vulnerable'. We have also assumed at all 'vulnerable' households are non-voluntary converters. This forms the basis of our estimate on total cost of non-voluntary conversion for vulnerable households. Further discussion on the composition of vulnerable households is presented in Section 8.1.

### ***Adjustment of consumer benefits***

As for the CBA on digital TV switchover, although these consumers convert involuntarily (their perceived incremental benefit from conversion is less than their incremental cost), they still derive some benefit from DAB listening, such that their economic costs is less than the cost of a DAB set.

In the left panel of Figure 23, the total cost of a DAB-enabled set is marked by the areas A and B. However, most consumers derive benefits from DAB listening, although to varying extent. The benefit to them is the area A.

In other words, as digital migration comes closer, some consumers will have been very close to buying DAB as their willingness to pay for DAB is close to the cost of a DAB-enabled set (the left end of the area A). For others, the perceived value of digital radio listening is substantially less than the cost of a set. We reflect this variation in consumers' benefit by assuming a straight line interpolation between zero and the cost of a DAB radio – by halving our estimates on non-voluntary conversion costs. This is analogous to assuming a linear downward-sloping demand curve.

---

<sup>69</sup> The concept of twice the costs rather than a specific cost per radio estimate is intended to reflect the same rate of declining costs as with the case of the average household. This fall in costs could be a result of mass production of modified kits, or a systematic home visit or targeted assistance program that is more cost efficient.

This approach, as adopted by the CBA on digital TV switchover, has been criticised by some commentators<sup>70</sup> as over-estimating consumer benefits. Arguably a linear demand curve does not apply as a small proportion of consumers (for example, the group of Resistors) have a very small perceived value on listening. We have therefore attempted to account for a high-cost scenario by considering this group of low willingness to pay group.

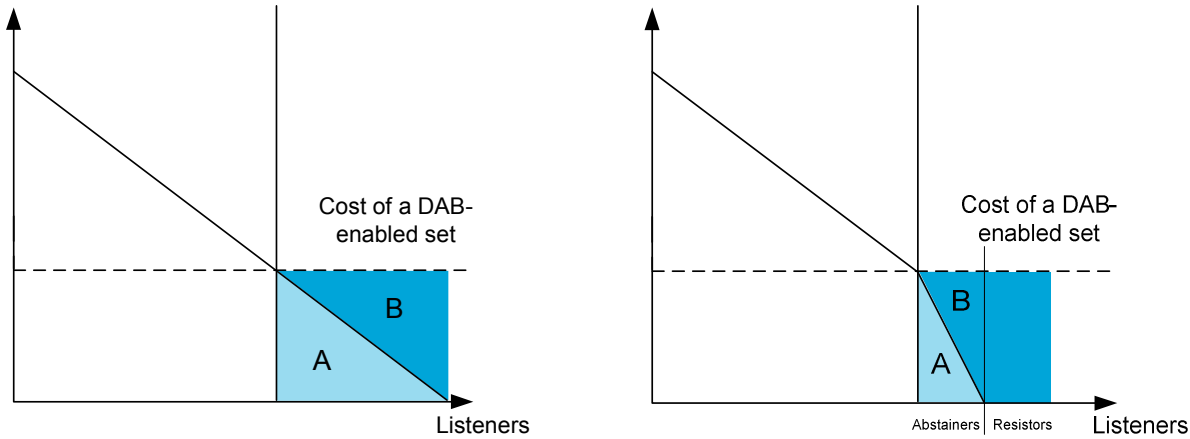
Based on the Ofcom Consumer Engagement study, there are 21% of Abstainers and 11% of Resistors. Using this segmentation, Ofcom found that 69% of Abstainers and 36% of Resistors currently have access to digital radio. From this, we are able to provide an estimate of the proportion of UK households without access to digital radio split by Abstainers and Resistors.

**Figure 22: Proportion of Abstainers and Resistors**

Segment	Proportion of Households	Proportion within group with access to digital radio	Proportion of UK household without access to digital radio
<b>Abstainers</b>	21%	69%	6.5%
<b>Resistors</b>	11%	36%	7.0%
<b>Total</b>			<b>13.5%</b>

The proportions of Abstainers and Resistors without access to digital radio are nearly equivalent. We have therefore split our non-voluntary converted sets in half to Abstainers and Resistors, and assumed the same approach on straight line interpolation for Abstainers and the full cost for Resistors. This is equivalent to adjusting the full cost downwards by 25% (rather than 50% as in the DRWG policy) and is presented in our sensitivities analysis. The right panel in Figure 23 illustrates this approach diagrammatically.

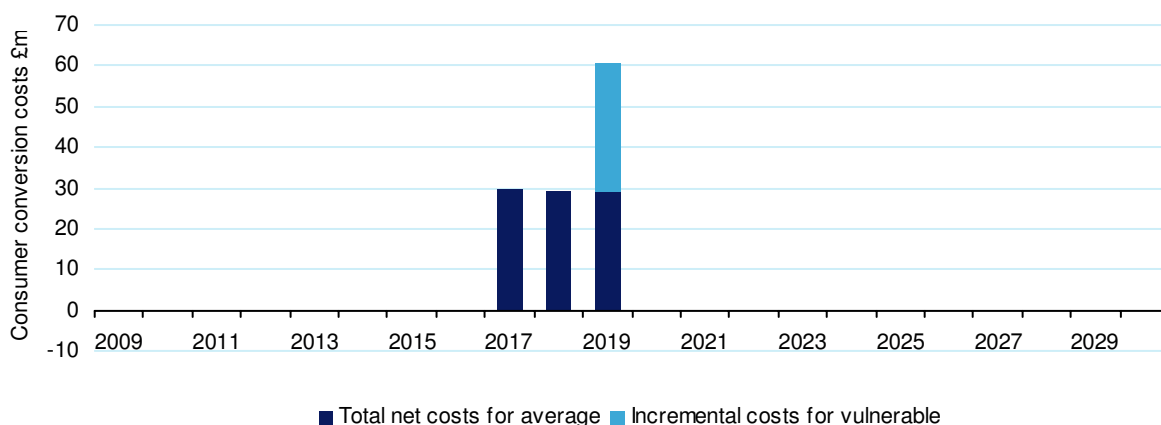
**Figure 23: Adjustment for consumer benefit**



<sup>70</sup> For example the Consumer Expert Group argued that “the perceived benefits of digital television are not normally distributed across households, and unconverted households are likely to be those who least value digital television.”

Figure 24 presents the time incidence of the involuntary consumer conversion costs under our DRWG policy assumption, where costs are assumed to be involuntary beginning from the trigger date up to the year of migration. All vulnerable costs are assumed to be incurred on the year of migration. A more conservative estimate of consumer benefit adjustment as suggested by Figure 23 would be 50% greater conversion costs.

**Figure 24: In-home conversion costs (DRWG policy)**



### **Loss of access to radio stations as a result of non-conversion**

The CBA also needs to take into account the proportion of households that do not wish to convert to DAB/digital listening (or Resistors) that would lose access to (some) radio stations as a result of failure to convert to DAB. However, our forecasts on digital penetration suggest that technological trends would lead to nearly all radio receivers to be DAB-enabled by the time of migration, such that even if there were Resistors they would continue to have access to DAB coverage. We have therefore assumed zero loss of access.

There will also be a proportion of households that typically make use of more than one radio in the house, but have yet to convert their secondary (or subsequent) sets at the time of migration. During the period that it takes for the household to convert their secondary sets, they are unable to receive radio services from secondary sets – which could imply a fall in the consumers’ utility in terms of their listening behaviour. In our analysis, we have assumed that all secondary conversions take place over the period of three years from the trigger date (i.e. 2017 – 2019), such that analogue radio will continue to be broadcast until some time in 2019. Thus, only a small minority within our model (those who converted in 2019 but after the migration date) is expected to incur this fall in utility – which we assumed away. However, more importantly, should some consumers decide to convert secondary sets after migration (as opposed to our assumption) this loss in utility may not be insignificant. Further studies into understanding of consumer behaviour may help to inform the extent to which this happens.

### **6.5.2 Incremental energy and carbon costs**

An argument against the use of DAB radio relative to traditional analogue radio is the higher energy requirement of a standard DAB set. Our data research and consultation with stakeholders revealed that an “average” DAB radio could use more than twice the amount of energy than an analogue radio when active, and five times greater when on standby. However, the most energy efficient DAB radios have become comparable in terms of energy usage. The Energy Saving Trust has a series of DAB radios (currently 7 models) that are recognised as Energy Saving Recommended, which use around 75% less electricity annually than a standard DAB radio.

Our DRWG policy scenario assumes that consumers replace their analogue radio sets for the energy

efficient DAB radio sets, thus resulting in negligible incremental energy costs. This assumption is consistent with the technology industry's views that improving the energy efficiency of their products will be one of the key priorities, in response to the challenge of climate change and other environmental concerns<sup>71</sup>. Our sensitivity analysis considers a scenario where the energy consumption levels of DAB radios remain at the current levels, i.e. taking into account the additional cost of electricity consumption to consumers<sup>72</sup>. The result for this scenario is presented in the section on sensitivity analysis.

**Figure 25: Energy consumption level**<sup>73</sup>

Clock Radio, by type	Active (W)	Standby (W)
DAB (eco)	~ 2W	< 1W
DAB (average top 10 best selling)	~ 7.5W	~ 5.5W
Analogue	~ 3W	< 1W

### 6.5.3 Conversion costs: vehicles

The analysis in this section focuses on vehicles classified as 'private and light goods' by the Department for Transport (DfT). These constitute approximately 80% of all licensed motor vehicles, and we assume that this category represents all vehicles with in-car radios. Other categories of vehicles (including motorcycles, heavy goods vehicles, and buses) are excluded from the analysis on the assumption that they do not have built-in radio sets.

Figure 26 shows the historical trend of licensed vehicles and the rate of new registrations. Based on these figures, we can assume that the rate of replacement of vehicles is the difference between new registrations and the increase in total licensed vehicles. Thus for example around 2m cars in 2007 have been replaced with new cars and taken off the road, and approximately 500k cars were added to the road. The past five-year trend has been relatively stable, with approximately 2m cars being replaced every year, and 400k to 1m new cars added to the road annually.

The take-up in-car DAB market has been relatively slow. DRDB<sup>74</sup> estimated that since 2004, when DAB car line-fit (DAB ordered and fitted at the time of purchase of new cars) first became an option, only 153,000 new car buyers would have opted for DAB by the end of 2008. Existing car owners can only retrofit DAB radios to their cars (known as DAB car retail or after-market radios). Forecasts predicted that by the end of 2008, an estimated 57,000 after-market radios would have been sold<sup>75</sup>. This represents less than 1% penetration of the vehicles radio market.

<sup>71</sup> Many industry reports have expressed this view, including 1) Smart 2020: Enabling the low carbon economy in the information age, The Climate Group and GESI, June 2008 and 2) High Tech: Low Carbon, The role of technology in tackling climate change, Intellect February 2008.

<sup>72</sup> The incremental cost per radio are based on the average rate of incremental energy consumption (4.5W) multiplied by the central electricity price estimates published by DEFRA in December 2008, adjusted to 2009 prices. The total cost to UK household is then measured by the number of incremental DAB radios, as projected in our model. Carbon costs are calculated using the published social cost of carbon by DEFRA, adjusted to 2009 prices.

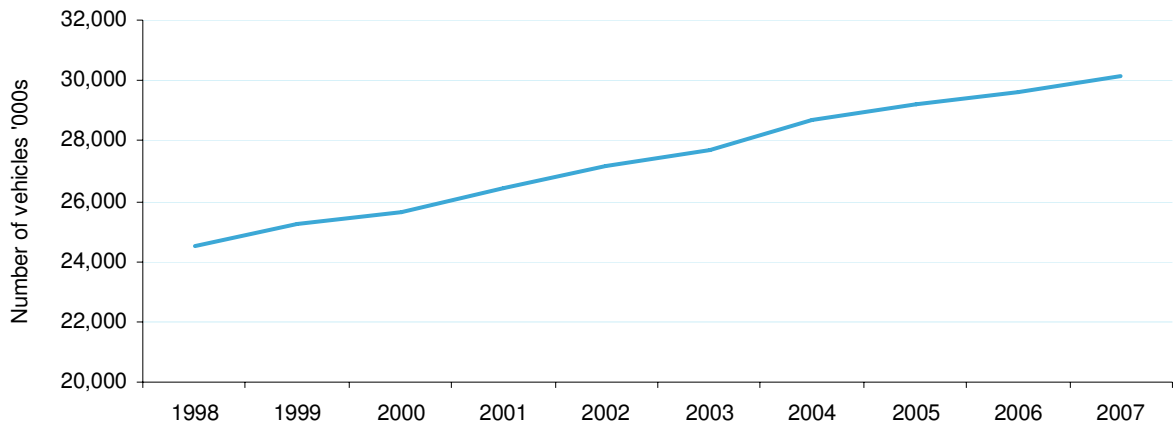
<sup>73</sup> Data sources: <http://www.pure.com/ecoplus/> and through consultation with stakeholders

<sup>74</sup> 2007 DAB Digital Radio Forecast, Set Sales & Household Penetration 2007-2011, Digital Radio Development Bureau and independently audited by Oliver & Ohlbaum Associates Ltd.

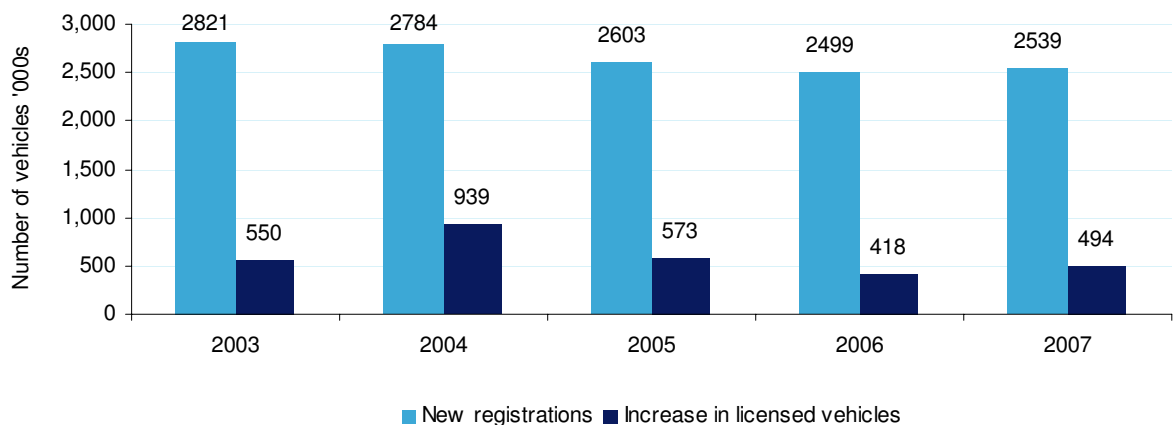
<sup>75</sup> However, more recent news suggested that sales in after-market DAB tuners may have been boosted by the sales of PURE Highway, an external non-intrusive tuner. At the time of writing, sales data are not available for verification.

**Figure 26: Number of licensed private and light goods vehicles and new registrations**

**Private and light goods vehicles**



**Private and light goods vehicles**



Car owners would have a number of options to receive DAB signals in their cars<sup>76</sup>. Many mainstream car brands could now factory-fit a DAB radio to new cars as a standard or option. Our consultation with a number of car manufacturers suggested that the incremental costs of DAB radio over a FM radio would likely to translate in higher prices for the cars for consumers. Current prices range from £100 to over £300. With the assumption that all new cars are fitted with DAB from 2014 onwards, car manufacturers are likely to exploit economies of scale, and costs can be expected to fall or at the lower end of the cost spectrum.

Existing car owners could upgrade their analogue radios through one of the following options:

- Replace the existing radio: swap the analogue radio for an integrated DAB system. Current prices for an integrated DAB system start at around £150.
- Adaptor: this option involves the car owners keeping the analogue radio and purchasing an adaptor that turns the existing radio into a DAB receiver. A DAB aerial and fitting is required. The device plugs in to the lighter socket and sits on the dashboard. Current prices for an adaptor start at around £55.

<sup>76</sup> Source: DRDB website ([www.digitalradionow.com](http://www.digitalradionow.com)), desk research on available models from Halfords, and consultation with stakeholders. Note that starting prices reflect findings from desk research and may not be exhaustive or representative of all available models.

- Hideaway box: There are hideaway box options on the market – where car owners place an additional DAB receiver kit in the vehicle with a DAB aerial (which tends to be ‘hidden’ under the seats). Current prices for a hideaway box start at around £100, and this requires a DAB specific aerial.

In addition to the DAB radio sets, whether integrated systems or hideaway boxes, car owners will require a DAB specific aerial. This can either be a combined DAB/FM aerial, or a second DAB only aerial to sit alongside the FM aerial. Choice of the aerial could depend on both practical and aesthetic factors. Prices currently start from just under £40. There are two types of DAB aerials available:

- A body mounted aerial (which may mean drilling a small hole in the roof of the car). On some cars you can use the existing manufacturer’s mounting hole for a body mounted aerial as a direct replacement.
- A glass mounted aerial. Some car DAB radios come pre-packaged with a suitable aerial, but on some models, the aerial has to be bought separately.

Some car owners, particularly those who choose to replace the existing analogue radio, would require help in installation/fitting. Some retailers could offer free fitting, but the typical fee of installation is around £20.

The total financial costs involved in receiving DAB in car for an existing car therefore range from £55 to £210 and above (replacing radio, new aerial, and installation fees).

Calculating non-voluntary conversion costs for in-car radio sets requires a number of assumptions:

- 1 Projections of growth in private and light goods vehicles based on extrapolation of SMMT forecasts for 2008-2009. The economic climate in 2008 has presented significant uncertainties in the outlook for car sales. This projection is based on forecasts in September/October 2008.
- 2 Projections of growth in the penetration of in-car radios by line-fit and DAB tuner.
- 3 All new cars from 2014 are assumed to have DAB line-fitted as standard. We have assumed that the current incremental cost per car is £100, at the lower end of the cost spectrum to reflect potential economies of scale in DAB roll-out.
- 4 Some car owners who may purchase an after-market set at a later point under BAU will have been forced to purchase the set during the migration year to avoid loss of coverage. These consumers incur a cost attributed to their “time preference”. This is factored into our model accordingly<sup>77</sup>.
- 5 All remaining unconverted car stocks are assumed to be non-voluntary. DAB penetration at the year of migration is 47%. We assumed that the remaining 53% of cars are assumed to convert using an additional after-market DAB receiver<sup>78</sup>. The cost per tuner is assumed to be £50 in current prices.
- 6 As with the in-home costs, non-voluntary consumers derive some benefits from conversion. The economic costs are discounted by half to account for listening benefits.

---

<sup>77</sup> This is incorporated into our model as follows. Under BAU consumers continue to convert and incur the associated costs beyond 2019. Under the DRWG policy scenario, these consumers convert in 2019. The incremental change in costs therefore depends on the time period the costs are incurred. This difference in costs is captured by comparing the conversion costs of BAU and DRWG policy at an annual basis and discounted to present value terms. This method captures the shift in the costs which are incurred ahead of BAU.

<sup>78</sup> [3< (S.44)] suggests that 79% of drivers would fit a DAB system “if analogue radio were switched off”. Almost half of respondents would investigate buying a fully-featured DAB-based system, although price would be a key factor in their decision. 31% of respondents would buy the cheapest DAB system they could find, and 21% would not change their in-car entertainment system; would listen exclusively to personal music until they changed their vehicle.

7 A 'high' case scenario takes into account that:

- 20% of non-voluntary after-market conversion opt for the more expensive option of replacing the radios (£210); and
- The adjustment for listening benefits discounts the costs downwards by 25% rather than 50%.

An interesting note of caution on the interpretation of the results is the trade-off between early conversion through line-fitting DAB radio and the lower cost of conversion by retro-fitting a tuner. The DRWG has indicated its aspiration of all new cars to be fitted with DAB radios from 2014. However, the assumed cost of a tuner (at £50) is cheaper than fitting a DAB radio at the factory (assumed at £100), suggesting that a new car owner may find it less costly to acquire a tuner at a later stage than opting for the DAB radio when purchasing a car. At the same time we assume that the same car owner would tend to prefer an integrated DAB radio to an external tuner, all else being equal, given the improved 'look and feel' of the car. In other words, encouraging factory-fitted DAB for all new cars is likely to generate greater consumer benefit as well as cost, than retro-fitting an after-market DAB receiver. The net benefit or cost of encouraging all new cars to be fitted with DAB radios would depend on the relative willingness to pay for an integrated DAB radio. Our analysis assumes an adjustment to the conversion costs attributed to the benefits of listening to digital radio only. Arguably this adjustment could also take into account the preference for an integrated radio, which we have not considered explicitly<sup>79</sup>.

**Figure 27: Incremental cost of involuntary in-car conversion**

Incremental Cost	NPV (millions)	
	2009	2030
<b>DRWG policy</b>	Line-fit	£ 592m
	After market	£ 169m
<b>High</b>	Line-fit	£ 888m
	After market	£ 415m

<sup>79</sup> One possibility of doing so is discounting for the benefits to line-fitted DAB radios more than retro-fitted radios. We have refrained from this exercise given the potentially contentious issue of the extent of discount.

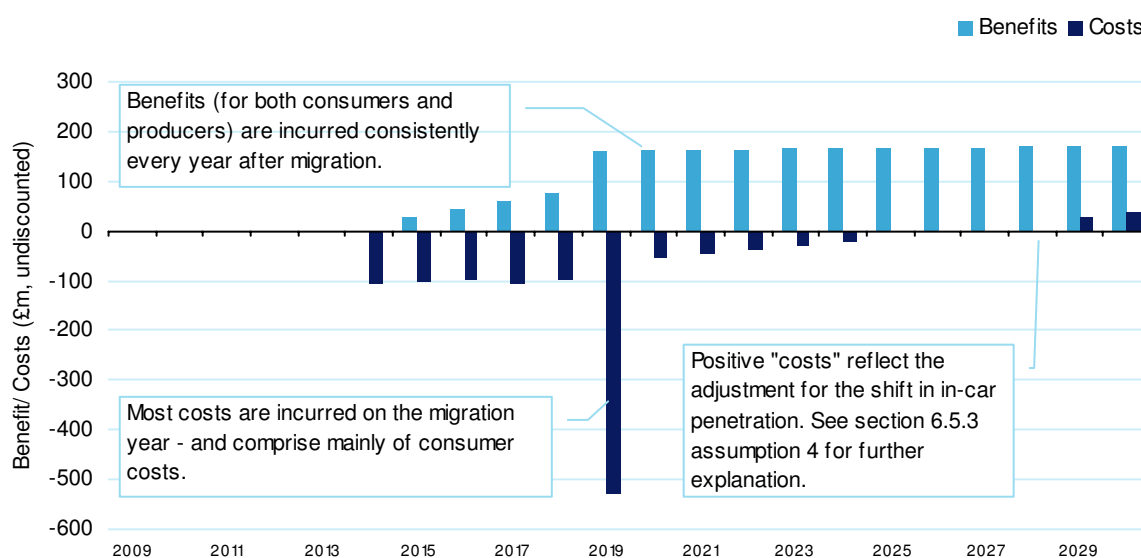
## 6.6 Results

Figure 28 summarises our estimates of the incremental costs and benefits of the DRWG policy scenario relative to the “business-as-usual” scenario. Figure 29 illustrates the incidence of the costs and benefits over the time horizon of our analysis, which suggests that a substantial proportion of the costs are front-loaded, up to the year of migration. Benefits, on the other hand, are back-loaded and incurred consistently once migration is achieved. The use of a discount rate of 3.5% implies that these benefits are weighted strongly in present value terms, yielding substantial net present value as a result of the DRWG policy relative to BAU.

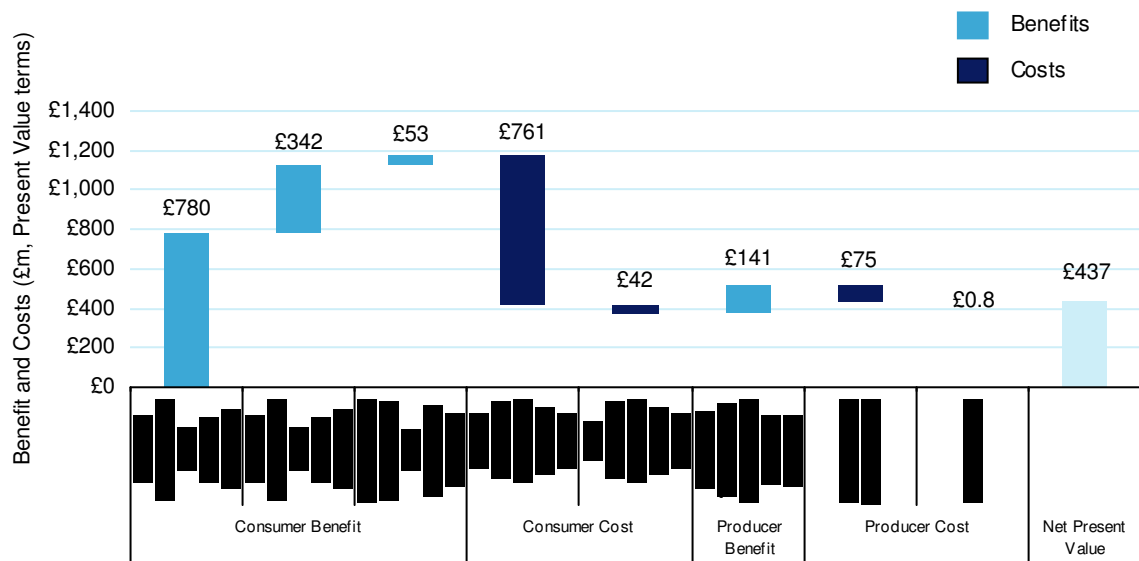
**Figure 28: NPV and summary of cost and benefit**

Incidence	Benefit / Cost	Category	PV £m
<b>Consumer</b>	Benefit	Enhanced experience for out of coverage consumers: More stations in-home	780
		Enhanced experience for out of coverage consumers: More stations in-car	342
		Benefit arising from the value of the spectrum for other uses	53
	Cost	In-home conversion cost (net of consumer benefit)	42
		In-car conversion cost (net of consumer benefit)	761
<b>Producer</b>	Benefit	Savings on Transmission (net of cost of extending coverage)	141
	Cost	Marketing and Administration	75
		Disposal Cost	0.8
<b>Net Present Value £m</b>			<b>437</b>

**Figure 29: Time profile of cost and benefit 2009 - 2030**



**Figure 30: Benefits and cost in present value**



# 7. Sensitivity Analysis

This section considers a selection of sensitivity analyses, reflecting those with the most significant impact on the results. We have considered two broad forms of analyses. The first considers the impact of varying the assumptions on the quantum of benefits or costs, as outlined in (1) and (2) below. The second considers the implication of changing/not implementing a policy lever, in the case of (3) below the expansion of the regional multiplex, and in (4) the extension of multiplex licences to 2030 (or taking a shorter term outlook).

## 1 Producer

- Real discount rate at cost of capital of 8.3% (based on Ofcom’s nominal rate of 10.5%)

## 2 Consumer

- Higher willingness to pay for increased coverage in-home and in-car based on estimates in Figure 19 and Figure 20.
- Higher energy consumption costs in energy inefficient radio sets based on estimates in Figure 25.
- Higher consumer conversion costs as outlined in Sections 6.5.1 and 6.5.3:
  - (i) More conservative adjustment of consumer benefits for in-home and in-car usage
  - (ii) Higher after market conversion costs of in-car radios
- Lower estimate of consumer value for the spectrum of £400k per MHz

## 3 No expansion of regional multiplex

- We have also considered a separate scenario where the recommendation of regional multiplex expansion to become a national multiplex is not implemented. This particular recommendation is the key driver of the consumer benefits in our model, as the coverage expansion would provide access to “new stations” to a wide geographic / population area (with an estimated improvement in coverage of 50% of UK population).
- This would also affect the producer benefits of savings on transmission costs. Producers derive lower benefit as a result of factoring in the cost of coverage extension.

## 4 Shorter time horizon

- Our CBA assumes the time horizon to 2030, assuming the expiry of multiplex licences as proposed by the DRWG. This sensitivity considers a shorter time frame, to 2023. This end date is chosen to tie in with the extension (if any) of the existing national licence for D1 for a further twelve years upon expiry in 2011.
- This sensitivity should not be viewed as explicitly related to the length of licences, but a reflection of the time period over which the government / industry base their decision, and the trade-off

between a short-run and long-run view.

- These sensitivities are presented in Figure 31 both in tabular and diagrammatic form. The analysis is conducted by assuming that only one parameter is flexed, holding all others constant at DRWG policy. The results show that the most significant parameters are
  - (i) The expansion of the regional multiplexes;
  - (ii) Shorter time horizon or uncertainty over long term future of radio, e.g. no extension to current licence period;
  - (iii) Willingness to pay estimates of consumer value;
  - (iv) Involuntary consumer conversion costs; and
  - (v) Energy and carbon costs in the absence of efficiency improvements.

The results suggest that there are relatively few up-sides to the estimates, and several significant down-side risks.

To a significant extent, the positive NPV of the CBA relies on two crucial parameters. The first is the recommendation of an enlarged regional multiplex network be implemented.<sup>80</sup> Failure to do so would result in a substantial negative NPV.

The second critical parameter is the time horizon. The results suggest that the pay-back from the DRWG policy “investment” is over a long time frame, i.e. beyond 2023; the NPV turns positive after 2026. This result assumes that the existing multiplex licences are extended to 2030, as per the DRWG recommendations<sup>81</sup>. Without the licence extension or any other policy instruments that provide clarity on the long term future of commercial radio, the industry and consumers may not be able to forecast beyond 2023 (the expected expiry date of current licences), and fail to see the benefits of digital radio over the longer term.

Our analysis suggests the NPV is negative should either of these two proposals not be implemented.

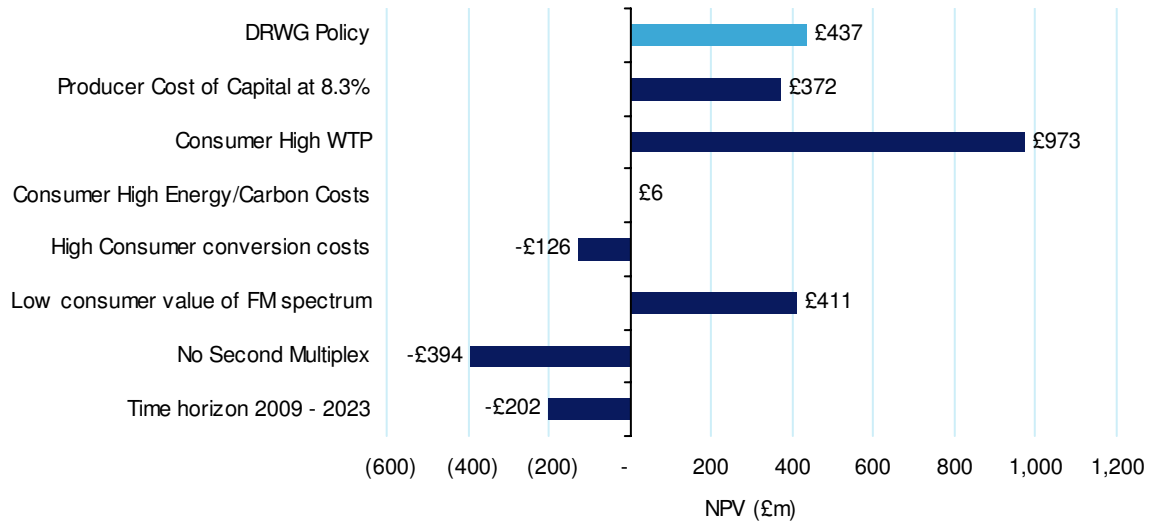
**Figure 31: Sensitivity analysis of key aspects of the DRWG Policy (keeping all other parameters constant), net present value terms, £m**

---

---

<sup>80</sup> In its final report, the DRWG ‘urges’ the government to “introduce new legislation to give Ofcom the power to allow [mergers of local multiplexes with excess capacity] or reconfiguration of [multiplex areas] where the relevant licence holders deem it appropriate and where Ofcom deem it to be in the public interest.” (Section 4.10). Therefore, a second national digital multiplex formed from the existing regional multiplex network is not explicitly recommended by the DRWG in its final report. However, Ofcom requested that we explicitly model this state of the world in our cost-benefit analysis as one option of how the recommendations of the DRWG, if implemented, could affect the multiplex structure in the UK.

<sup>81</sup> We have not modelled a scenario in which the time period is extended to 2030 *without* an extension to the licences.



# 8. Distributional Effects

## 8.1 Vulnerable households

### 8.1.1 Consumer conversion costs

Earlier sections on consumer conversion cost distinguish between the average household and the incremental costs of conversion borne by vulnerable individuals. Some consumer groups, for example the blind or partially sighted, the bedridden and some elderly groups, may require modified radio sets which provide greater ease of use, and practical assistance in helping them replace their analogue sets and learn the functionalities of the new sets. However, not all individuals who are blind, bedridden, or elderly incur conversion costs to the same extent, particularly if they live with family or carers. Conversely, consumers outside these categories might also incur greater costs of conversion. Therefore, we have defined the 'vulnerable' consumer groups suitably to comprise particular groups of individuals, in particular to account for the number of households requiring support.

The following raises other possible groups not included in our study, but could potentially incur greater conversion costs.

#### 1 Blind people:

- There are around 365,000 individuals who are registered as sight impaired/severely sight impaired. Our group of 'vulnerable' includes only those registered as severely sight impaired (formerly known as "registered as blind"), approximately 184,000 individuals.
- Around one-quarter of all registered blind people who had an additional disability were also recorded as deaf or having a hearing impairment. Approximately two-thirds of all registered blind people are aged over 75. These groups could incur further conversion costs over and above our estimates for the blind.
- In addition, the Royal National Institute of Blind People (RNIB) reported that about 2 million people in the UK have significant sight loss, and approximately 1.2 million of these individuals are aged over 75. This highlights the potential underestimate of national statistics.

#### 2 Bedridden people:

- The TV and Radio Charity (formerly Wireless for the Bedridden) has placed approximately 125,000 number of radios with their beneficiaries. We use this figure as an indicator of vulnerable bedridden individuals which may incur additional costs replacing their radios.

### 3 Elderly people:

- We considered one-person pensioner households in the bottom income quintile as the group of ‘vulnerable’ elderly in our study. There are approximately 3.8m pensioners living alone in the UK, of which 32% lies in the bottom income quintile. This amounts to 1.22m households<sup>82</sup>.

### 4 People with other disabilities:

- We have not considered other disabilities in our ‘vulnerable’ consumer groups. However, statistics on disabled households suggest that 4.16m households in the bottom income quintile have one or more disabled adults or children, or around 16% of UK households.
- Disability here is defined as having any long-standing illness, disability or infirmity that leads to a significant difficulty with one or more areas of the individual’s life, hence could include the other consumer groups mentioned above. Nevertheless this suggests that around 16% of UK households could be considered ‘vulnerable’, three times greater than the assumption in our study (5.2%).

### 5 Low income households:

- We have not explicitly considered other low income households, i.e. other than those containing the elderly or people with other disabilities. These households are not likely to require practical assistance, but may need financial incentives to help drive digital take-up. The costs are therefore equivalent to those of an ‘average’ household.
- In the context of wider distributional issues, specific targeted help schemes may need to include low income households, presenting additional costs to the government (and hence consumers).

## 8.1.2 Targeted help

There is a comprehensive targeted assistance scheme to support the digital television switchover process. The scheme offers practical support, including teaching the vulnerable how to configure and use the set-top box through home visits. A compulsory digital radio migration could entail some form of assistance from the government or the third sector to aid the process, for example, through providing a free DAB radio set or free home-visits to set up the new radio set.

The introduction of a targeted assistance scheme by producers would involve a transfer of (vulnerable) consumer conversion costs to producers in our CBA, a redistribution of costs rather than additional costs. The structure of the targeted assistance scheme and how the scheme overlaps with marketing and administrative costs may have bearings on the results of our study. For example, the policy may favour a more intensive marketing strategy (thus increasing marketing and administrative costs) in order to encourage take-up amongst the vulnerable.

## 8.1.3 Moral hazard

Targeted assistance also suffers from the issue of ‘moral hazard’ especially in the case of financial assistance. Moral hazard refers to the situation where an incentive structure leads individuals to behave in the opposite way to the desired outcome. In the case of DAB radio take-up, the marginal households who might have voluntarily purchase a DAB set may decide to postpone and wait for the financial incentives from the government. Therefore any definitive commitment from the government, e.g. identifying the targeted group to receive assistance, may result in delays in digital migration within these groups.

---

<sup>82</sup> Source: Households Below Average Income, An Analysis of the income distribution, 1994/95 – 2006/07, Department for Work and Pensions 2008

## 8.2 Nations and Regions

In determining the process for analogue television switch-off, strict coverage criteria were developed. The DTT network (for public services) is to cover the same proportion (in terms of percentage of the population) as analogue. Owing to technical issues, while this equates to 98.5% of the population, this coverage does not coincide with the exactly the same households that are covered by the analogue signal.

A potential geographical issue is that of poor DAB coverage in parts of Scotland, Wales and Northern Ireland. DAB set penetration varies across the Nations and Regions, from 30% in the North West of England to 13% in Northern Ireland. Similarly, urban DAB penetration (22%) currently exceeds rural DAB penetration. This differential does not appear to be limited to DAB – listening to radio via internet or digital TV is highest in Scotland (36% of radio listeners have accessed radio via digital TV; 24% of radio listeners have accessed radio via the internet) and then England (34%; 22%). Wales has similar rates of access via digital TV (21%) but a relatively lower proportion for access via internet (14%). Northern Ireland (22%; 11%) lags behind the other nations in access via these platforms.

This is likely to change with time – for instance, current plans include BBC's plan to contribute £2.9 million annually to the new Gaelic Digital Service in partnership with Gaelic Media Service, which will provide, amongst others, BBC Gaelic radio programming. Furthermore, in Wales three local digital radio multiplex licenses were awarded in 2007/08, covering Northeast Wales, Mid and West Wales, and North Wales.

DAB coverage extension to equal that of analogue would be required otherwise the population affected by the loss of analogue radio transmission may be restricted to non-DAB digital radio, or lose radio access completely. This represents an acute distributional issue, especially as the lack of coverage tend to affect some regions more than others, and because (as described above), particular Nations and Regions, and rural areas would be catching up on DAB (and digital radio) penetration from a lower base.

Extension of DAB coverage to ensure parity of coverage for BBC services is likely to pose particular engineering challenges in Scotland, Wales and Northern Ireland. If parity of coverage proves more challenging than assumed, the impact is likely to be disproportionately concentrated in these areas. Similarly, if commercial digital networks are not extended beyond their current analogue footprint then it is likely that some listeners in Scotland, Wales and Northern Ireland will have less choice of digital stations.

## 8.3 Community radio

One of the possible advantages of the migration to digital radio is the freeing up of potential spectrum for local and community services. The FM spectrum made available under the digital migration policy will enable increased licensing of RSLs and community radio services. These services are likely to be targeted at geographic communities or other communities within a given geographic area (e.g. ethnic minorities, discussed in further detail below). These benefits are likely to be difficult to estimate especially the wider benefits associated with community initiatives.

Discussions with stakeholders in the community radio sector suggested that demand for spectrum is greatest in urban areas, and many applications are rejected simply because of a lack of available spectrum. Increased availability of spectrum for community radio licensing will thus help reduce the need to make so many choices between competing causes.

## 8.4 Ethnic minority groups

Research recently released by Ofcom (Media Literacy Audit: Media literacy of UK adults from ethnic minority groups (2008)) suggests certain ethnic minority groups may be relatively early adopters of new technologies, but this is likely to rely on content being available to serve their needs. This can also be attributed partly to their younger age profile (under-45s), but also to socio-economic and cultural factors. For instance, BBC 1Xtra targets this demographic. More stations made available by the digitisation of radio broadcasting and the expected increase in community radio may also encourage niche radio stations catering to specific ethnic minority stations.

Interestingly, certain minority groups have a greater interest in learning about digital technology in using DAB is higher than the national average. More extensive use of digital radio may allow more services

targeted at ethnic minorities to be delivered. Additionally, synergies with digital TV and the Internet can be explored.

Ofcom and the Government would have to consider the benefits of providing greater diversity and community-level involvement through this use of the spectrum, against the relatively high costs of provision of services to small minorities.

The social benefits and costs of this are difficult to quantify, and are beyond the scope of this study.

Discussions with stakeholders also revealed there may be pockets of ethnic minority listeners around the country which disproportionately listen to services on AM. Under a digital migration strategy, the AM spectrum would at some stage cease to be licensed for radio services. This may have a disproportionate impact on the listeners to these services.

# 9. Recommendations and Further Appraisal

We recommend that Ofcom and the Government continue to update our work, as additional market data are released and if primary research is conducted. Accordingly, we consider that the CBA would benefit from:

- 1 Refinement to the willingness to pay estimates based on updated or new studies;
- 2 Greater certainty on the potential uses of FM/AM spectrum and the amount to be released;
- 3 More analysis of the potential impacts to different vulnerable groups and the form of assistance required;
- 4 Greater development of the marketing strategy and associated budget; and
- 5 An environmental impact assessment to consider the disposal of radios and the energy savings from the cessation of analogue transmission.

The scope of this study is limited to the assessment of the DRWG policy. The overall digital radio policy appraisal process would need to take into account other policy options and 'states of the world'. With this in mind, we highlight three issues in particular:

- 1 The impact of recession: We have assumed no change in commercial radio sector structure and health beyond a consensus view of advertising forecasts. As this CBA is conducted for the time period to 2030, short term recessionary impacts may have only a limited impact on the longer term outcome for the industry. On the other hand, the current economic downturn could still affect the short and medium term investments required for marketing or coverage extension, which in turn could delay the desired DRWG policy outcome.
- 2 Other policy options: We recognise that to reach a view on this question of how to drive digital radio penetration and listening (which in turn delivers consumers' and citizens' objectives) requires a full assessment of the costs and benefits of a number of policy options; this study has examined one, the DRWG policy. This is the only policy assessed in this study and the policy is at an early stage of its development; Government and Ofcom could give consideration to other possible policy options. In addition, we recommend modelling a number of other "business-as-usual" scenarios taking into account different assumptions, and assessing how they affect the CBA of the DRWG policy.

- 3 Other digital platforms: This CBA assumes that DAB listening will continue to be the leading platform for digital radio listening. The DRWG has reinforced the view that “a radio-specific broadcast platform is an essential part of radio’s future”, and that DAB is the “most effective and financially viable way of delivering digital radio” for the medium to long term. A long term view needs to account for the possibility of technology obsolescence or replacement. At present, there is no consensus view that suggests otherwise. However, there are signs that internet listening may begin to take off if internet radios are more actively promoted and technologies such as WiFi or mobile broadband mature and become universally available. A number of the cost and benefit categories assume an impact from increasing the coverage of DAB (for example, consumer benefits from increased coverage is assumed based upon the incremental benefits to consumers who could not receive digital radio stations). Should these trends continue, or a more structural shift to internet to occur, there would be a smaller benefit from increasing the coverage of DAB; consumers either have alternative access to digital radio even within out-of-coverage areas, or would prefer a non-DAB solution when they receive DAB coverage.

# Appendix A. Invitation to Tender (ITT)

Note: The timetable presented in the ITT has been subsequently revised to incorporate the results of the final recommendations of the DRWG.

ITT TO DEVELOP COST BENEFIT ANALYSIS FOR DIGITAL RADIO MIGRATION IN THE UK.

## A.1 Background

- 1 As part of the development of the policy for Digital Switchover (“DSO”) for TV, economists from DCMS and (what was) the DTI carried out a series of Cost Benefit Studies. Those studies were aimed at identifying the scale of the net benefit to be realised by DSO for TV with a view to informing the final decision to commit the UK to the transition to an all-digital world for TV broadcasting.
- 2 Since the announcement of DSO for TV attention has turned to consideration of the future of digital broadcasting for radio in the UK.
- 3 The Digital Radio Working Group (“DRWG”) was established in November 2007 by the Secretary of State for Culture, Media and Sport. Its purpose was to bring together senior figures from the radio industry and related stakeholders under an independent Chair, to consider three questions:
  - What conditions would need to be achieved before digital platforms could become the predominant means of delivering radio?
  - What are the current barriers to the growth of digital radio?
  - What are the possible remedies to those barriers?
- 4 The DRWG was asked to report its findings to the Secretary of State by the end of 2008. It submitted an interim report in June 2008<sup>83</sup> which made a number of recommendations, namely that:
  - DAB is the most appropriate replacement for analogue radio in the UK;
  - The future radio landscape should at least in the medium term be a mixed ecology with:
    - DAB as the primary platform for national, regional and large local stations
    - FM capacity for small local and community radio stations; and,
    - IP delivery to complement the above and provide opportunities for greater interactivity

---

<sup>83</sup> The interim report of the DRWG can be found at: <http://www.culture.gov.uk/images/publications/DRWG-interimreport.rtf>

- Future receivers should be developed to move all services to digital.
  - MW should be re-allocated for other uses, while more work is needed to consider the future of LW.
- 5 The report called upon the government to lay down a set of criteria that would need to be satisfied before a migration process could be triggered along with an aspirational timetable for migration. The DRWG anticipated that a realistic set of criteria could be satisfied between 2012 and 2015, and that migration could be accomplished by 2020.
  - 6 The interim report noted that the government would want to consider a cost-benefit analysis before any digital migration process could begin.
  - 7 Following on from the DRWG interim report, DCMS has now asked Ofcom to commission a Cost Benefit Study for the digital migration process recommended by the DRWG. Ofcom is the independent regulator for the UK communications industries, with responsibilities across broadcasting, spectrum management and telecoms and would be likely to have a role in the development of policy and implementation of any digital switchover for radio.

## A.2 The Role of a Cost Benefit Assessment

- 1 Good practice in policy making decisions requires an understanding of the costs and benefits that different policy options would impose on different stakeholder groups. Ofcom is also required to carry out Impact Assessments for major policy decisions.
- 2 A Cost Benefit Analysis (“CBA”) provides an economic framework not just for quantifying the costs and benefits associated with the particular options under consideration, but also for taking into account the timing of when those costs and benefits might be realised.
- 3 Against this background, we want to develop our understanding of the costs and benefits associated with the digital migration policy that the DRWG is recommending for national, regional and large local stations. As a result, we consider that an appropriately constructed CBA would be one way of approaching this issue. A CBA for migration to digital radio will therefore provide an important input into the decision about how to take forward the recommendations of the DRWG interim report.
- 4 The intention is that the CBA will be discussed with the DRWG and could therefore be used to inform the final DRWG report due to be submitted to government at the end of 2008.
- 5 Given the technical nature of some aspects of the proposal for a digital migration for national, regional and large local radio services, there will be a number of areas where the consultants will be required to liaise with relevant Ofcom colleagues.

## A.3 Project requirements

### A.3.1 High-level requirement

- 1 A fully developed CBA for the migration to digital radio as recommended in the DRWG interim report i.e. one in which DAB is used for national, regional and large local stations and FM retained for smaller local and community services.
- 2 The CBA should include a discussion of the key methodological issues which have arisen in carrying out the analysis that could have a direct bearing on the validity of the results of the CBA. It should also include sensitivity analysis of the major parameters or assumptions in order to identify what are the key determinants of the analysis.

### A.3.2 Detailed requirements

- 3 The final report of the CBA should not only identify the scale of any net benefit (or cost) in total but also identify the impact in terms of costs and benefits to consumers and producers separately.

- 4 The starting point of the CBA should be a counter-factual in which the current situation – where a number of services are transmitted in both analogue and digital (so-called “dual illumination”) – is maintained. However, we would expect the consultants to critically evaluate this assumption.
- 5 Where relevant it would also be useful to identify whether there could be particular costs and benefits in relation to consumers/producers in the Nations and Regions of the UK (i.e. England, Scotland, Northern Ireland and Wales) as well as ethnic minorities and people with disabilities.
- 6 The CBA will need to include a specific discussion and analysis of the issues that arise in respect to migration of in-car radios.
- 7 It will also need specifically to include any potential environmental issues in relation to digital migration e.g. in relation to collection/disposal of radio sets, additional power consumption for broadcasting and receiving in DAB etc.
- 8 In considering the benefits of a digital migration policy, the report should also include a discussion of the potential uses for the spectrum released by DSO.
- 9 In relation to the costs and benefits to consumers the CBA report should make clear the data sources or assumptions used in relation to:
  - the pattern of take-up of DAB radio up to any formal announcement about digital switchover;
  - the impact on take-up of any formal announcement
  - the number and type of radio sets that will need to be converted to DAB given projections on the pattern of take-up
  - the costs of conversion for different types of DAB reception equipment;
  - the benefits to consumers of new services available as a result of the release of spectrum from a digital migration policy
  - a consideration of the benefits to consumers from the result of additional and/or enhanced DAB services that would not otherwise occur without migration
- 10 In relation to producer costs the report should set out:
  - The costs to producers of maintaining the current system of dual illumination
  - The costs to producers of transmitting only in DAB
  - The costs to producers of offering new services over DAB
- 11 In relation to environmental issues the report should distinguish between:
  - the costs of collection and disposal of radio sets which would be rendered obsolete by a digital migration process
  - the incremental environmental costs (e.g. in terms of power consumption) from transmission in DAB.

### A.3.3 Deliverables and timescales

- 1 Preliminary report giving:
  - Indicative results of both the CBA and sensitivity analysis.
- 2 Preliminary report to include:
  - A discussion of methodological issues
  - A discussion of potential implications of sensitivity analysis.
- 3 Assuming the contract is let by the end of July 2008, we would expect the preliminary report to be delivered to Ofcom in the week commencing 15<sup>th</sup> September 2008.
- 4 Final report covering answers to all high-level and detailed requirements by the week beginning 13<sup>th</sup> October 2008.

# Appendix B. Literature Review

We conducted a literature review to inform the overall CBA approach and specific key issues. We have incorporated the lessons and insights into our study as appropriate. The literature can be categorised into three broad areas:

- 1 Key cost benefit studies in related fields (e.g. CBA of DTT switchover in UK and elsewhere);
- 2 Criticisms and responses from experts to cost benefit studies (e.g. articles from commentators); and
- 3 Informational or methodological guidance (e.g. Green Book, willingness to pay studies, methodological paper on spectrum valuation etc.).

The first two categories helped us identify key costs and benefits categories, as well as apply best practices or avoid common pitfalls. In particular, the following observations are relevant to our study:

- A detailed and clear description of the approach is necessary. Criticisms or responses from experts tend to comment on the studies failing to address particular issues, potentially because of the lack of coverage in describing the process of the study.
- The need to provide a range of sensitivities, in particular when the parameters involved could affect the results substantially.

Informational or methodological guidance have been useful in providing the approach or base data to this study.

This appendix presents a summary table of the key findings of the literature that are of particular relevance to this CBA.

**Figure B.1: Summary of Literature Review**

Aspect of CBA	Literature	Summary of Findings relevant to this CBA
<b>Discount rate</b>	DCMS/DTI Memorandum - the Costs and Benefits of Digital Switchover (TV)	Following the Green Book, the Social Time Preference rate of 3.5% is used.
	Ogier, T., Rugman, J. and Spicer, L (2004) The Real Cost of Capital	The discount rate should in principle represent the cost of capital used in a project. The (real) discount rate is impacted by the time preference of consumption and the risk attached to investing in a project. In other words, investors require a return in order not to spend their money today and to bear risk. The Social Time Preference Rate assumes a project to be risk free. However, for commercial producers there is likely to be some risk attached to investment, and so a higher return on capital is required to incentivise investment.
<b>Time horizon</b>	DCMS/DTI Memorandum - the Costs and Benefits of Digital Switchover (TV)	The length of DTT licences is used to determine the time horizon. The analysis starts in 2004 and ends in 2026, when the licences granted for the BBC and National Grid Wireless expire for a second time.
	DRWG - Interim report for the Secretary of State for Culture, Media and Sport	A completion date for migration date is set for 2020. The DRWG believe that after discussions with the government, criteria to trigger migration could be set between 2012 and 2015, allowing for completion around 2020.
	Spectrum (2006), Cost benefit analysis of the launch of digital free-to-air television in New Zealand	A switchover date of 2015 is used as a central case, with the analysis starting in 2006 and ending in 2025. The rationale for this time horizon is not explicitly set out.
<b>Factual (i.e. policy intervention) vs. Counterfactual</b>	Spectrum (2006), Cost benefit analysis of the launch of digital free-to-air television in New Zealand	Two policy scenarios are modelled: 1. Digital FTA is launched but there is no ASO; and 2. Digital FTA is launched and there is ASO.
	DTI & DCMS, Cost Benefit Analysis (CBA) of Digital Switchover (TV)	Counterfactual: No digital FTA platform is launched and TV broadcasting remains analogue. Policy: The analogue TV signal is switched off; Spectrum released for other uses; Coverage of DTT increased. Counterfactual: Dual transmission.
<b>Regulation</b>	Ofcom (2007), the Future of Radio	Ofcom considers 5 proposals for future radio regulation in this work: 1. Content regulation on analogue and DAB should be aligned at the appropriate time – this will make sure there is variety and localness of stations in a digital world as there are in an analogue world; 2. Government may have to merge ownership rules for analogue and DAB stations into one set of rules as digital radio listening increases – this will ensure plurality in a digital world; 3. There should be flexibility surrounding licence expiry dates to allow flexibility of migration;

Aspect of CBA	Literature	Summary of Findings relevant to this CBA
		<ol style="list-style-type: none"> <li>4. Radio services (those designed to deliver public purposes included), should be able to be licensed on any spectrum in a technology neutral way;</li> <li>5. Ofcom will allow a downgrade from stereo to mono output if the costs of broadcasting stereo are larger than the benefit to consumers of better quality sound; and</li> <li>6. Ownership rules for community radio may benefit from being simplified – current funding limits may be reduced as they may be too strict, the one station ownership rule may be too restrictive and the need to consider the economic impact of licensing a new community station may be abolished.</li> </ol>
<b>Other methodological issues</b>	HM Treasury Green Book	The Green book states that a cost benefit analysis should be conducted using the following framework: <ol style="list-style-type: none"> <li>1. Establish exactly what is to be evaluated and how past outturns can be measured;</li> <li>2. Choose alternative states of the world and/or alternative management decisions as counterfactuals;</li> <li>3. Compare the outturn with the target outturn, and with the effects of the chosen alternative states of the world and/or management decisions;</li> <li>4. Present the results and recommendations; and</li> <li>5. Disseminate and use the results and recommendations.</li> </ol>
	Spectrum Value Partners (2006), Cost benefit analysis of the launch of digital free-to-air television in New Zealand	Impacts that are included should affect the consumption of end goods only. An example an end good is the digital FTA service Costs and benefits should be broken down into direct and indirect costs and benefits and externalities Non-adopters (last 10% of the population to convert to digital) are treated differently as consumer benefit derived from the policy intervention is much lower
	DCMS/DTI Memorandum - the Costs and Benefits of Digital Switchover (TV)	Equity of costs and benefits between consumers and broadcasters is not considered, as is standard practice for a CBA.
	DTI & DCMS, Cost Benefit Analysis (CBA) of Digital Switchover (TV)	Sunk costs are ignored, as is normal for a CBA. The counting of costs was taken from a 'decision point' where it would be possible to decide to not carry out DSO.
<b>Willingness to Pay</b>	BBC & Human Capital (2004), Measuring the Value of the BBC	The use of conjoint analysis to evaluate the willingness to pay for the BBC is found not to be useful because respondents found it difficult to choose between different bundles offered by the BBC and did not believe that the BBC would be taken away. Instead, respondents were asked what they thought the value of different BBC services was. This was done in two ways; by asking 'total value' respondents what they thought the BBC was worth to the country and 'consumer value' respondents were asked what the BBC was worth to the respondent. The total value of BBC digital radio using this method is estimated to be £2.70 per month, while the consumer value is £1.70 per month.

Aspect of CBA	Literature	Summary of Findings relevant to this CBA
	BMRB Omnibus Survey (2006)	<p>The survey asks participants whether they would be willing to pay a higher licence fee in order to pay for targeted assistance of digital switchover. 51% of respondents said that they would, while 47% were opposed to the idea. This outcome remains largely unchanged if the temporary increase is to occur in a stepwise manner, but the number of respondents in favour falls to 43% if there is to be a one off increase in the licence fee (even though in nominal terms there is no difference financially).</p>
	Barwise, P. (2006), the BBC Licence Fee Bid: What Does the Public Think?	<p>The study finds that there is no tipping point for the willingness to pay for BBC services, but there does seem to be a kinked demand curve - the curve of respondents' willingness to pay is kinked around the price that they pay for the BBC per month so making them sensitive to any movement in price away from the current licence fee. This may be because consumers use the monthly licence fee price as a reference point, against which all hypothetical prices are judged.</p>
	Radiocommunications Agency (2000) Survey to determine the consumers' surplus accruing to TV viewers and radio listeners	<p>Using stated preference, the willingness to pay for improved digital radio is estimated to be £6.20 per month, although this may be an over estimate. The estimated willingness to pay for current radio services is £2.30.</p>
	Pretio (2004) Validation Results	<p>The survey, targeted at respondents in Italy and Germany, finds that more than half of respondents would pay up to €250 for a DAB radio set and more than 80% valued having a DAB service at over €10 per month.</p>
<b>Benefits</b>	DCMS/DTI Memorandum - the Costs and Benefits of Digital Switchover (TV)	<p><b>Consumer Benefits</b></p> <p>Access to existing digital services for those who currently do not have access. Coverage of DTT was 80% at the time of publication, and this will rise to 98.5% at DSO. This is estimated by using willingness to pay estimates from a survey undertaken by Steer Davis Gleeve and work done by the Spectrum Planning Group.</p> <p>Access to new services from increased DTT services and services from the interleaved spectrum for TV and for other services, estimated using the same willingness to pay data as above.</p> <p><b>Producer Benefits</b></p> <p>Transmission savings from the end of dual transmission as a result of savings from the running and upkeep of analogue transmission sites. This is estimated using Ofcom and ITC and TDN estimates.</p>
	Spectrum Value Partners (2006), Cost benefit analysis of the launch of digital free-to-air television in New Zealand	<p>Consumer Benefits include access to new services and current services for those who were not previously covered and better reception quality of current services.</p> <p>Survey data collected as part of a wider study is used to estimate the willingness to pay for digital TV for the whole of the population. This analysis suggests that consumers are prepared to pay NZ\$7.36 per channel per year. This figure is tested by benchmarking it to other studies, using conservative methodology and treating the last 10% of the population (non-adopters) differently to the other 90%.</p>

Aspect of CBA	Literature	Summary of Findings relevant to this CBA
		<p>Producers benefits include:</p> <ul style="list-style-type: none"> <li>• Transmission savings from the end of dual transmission, calculated by taking the analogue transmission ratio and applying it to capital expenditure (which is used to maintain analogue transmission sites);</li> <li>• Value of released spectrum, valued using recent spectrum awards in New Zealand, previous research by Spectrum in New Zealand, review of data of private spectrum transactions in New Zealand and international benchmarking of spectrum transactions;</li> <li>• End of analogue licence fees; and</li> <li>• Rise in demand for digital in-house and external equipment and its installation.</li> </ul>
	DCMS, DTI (2005), Regulatory and Environmental Impact Assessment: the timing of digital switchover	<p>Consumer benefits include access to new services through greater spectrum efficiency and more choice of FTA TV channels.</p> <p>Producers benefits include:</p> <ul style="list-style-type: none"> <li>• Efficiencies and long term cost savings on transmission due to greater efficiency of digital transmission and savings from learning by doing;</li> <li>• Benefits from the release of spectrum. The study assumes it is used for more DTT channels;</li> <li>• Easier access to Pay TV services for consumers;</li> <li>• More routes to market for independent producers of TV content;</li> <li>• Increased demand for aerial installers; and</li> <li>• Opportunities for city spectrum licences for local services (e.g. Solent TV).</li> </ul>
	Ofcom (2006), Consumer engagement with digital communications services	The study finds that improved sound quality and greater ease of use bring the largest benefits to consumers of digital radio. Less important is the improved choice of stations that more efficient digital broadcasting allows.
	Ofcom (2007), The Future of Radio	<p>In a Mori survey commissioned by Ofcom:</p> <ul style="list-style-type: none"> <li>• 57% of respondents have accessed digital radio;</li> <li>• 47% of digital users cite better sound quality as digital radio's best attribute. This rises to 56% for DAB digital users. More choice, content and diversity of channels are also seen as advantages;</li> <li>• 40% of DAB users listen to the radio more after first accessing digital radio. 61% listen to new stations and 57% listen to more stations; and</li> <li>• Both DAB and non DAB users believe that the price of sets will fall further in the future. £60 appears to be a threshold in buying a set.</li> </ul>
<b>Costs</b>	1. DCMS/DTI Memorandum - the Costs and Benefits of Digital Switchover	<p><b>Consumer costs</b></p> <ul style="list-style-type: none"> <li>• Cost of set-top boxes for primary sets to consumers who have not already switched to DTT. A retail cost of £50</li> </ul>

Aspect of CBA	Literature	Summary of Findings relevant to this CBA
	<p>(TV) and</p> <p>2. DTI &amp; DCMS, Cost Benefit Analysis (CBA) of Digital Switchover (TV)</p>	<p>is assumed, but this figure is likely to over estimate the net economic cost of conversion. This is because some consumers would never go digital without requirement, while others may be on the verge of going digital. Therefore, the cost of switching ranges from £50 to virtually zero. Assuming there is a linear distribution of consumers between £0.01 and £49.99, an economic cost of £25 is used.</p> <ul style="list-style-type: none"> <li>• Cost of converting secondary sets minus the assumed (25%) number of sets that will not be converted.</li> <li>• Cost of upgrading aerials for DSO, especially for multi-dwelling buildings. The CBA assumes that 10% of non-adopters will need to upgrade their aerial at a cost of £150.</li> <li>• Extra energy cost of the new equipment, net of transmission savings. For set top boxes, two electricity consumption scenarios are constructed to estimate consumption in stand-by and on modes. These figures are based on research on power consumption of set top boxes on the market.</li> </ul> <p><b>Producer costs</b></p> <ul style="list-style-type: none"> <li>• Investment in capital and cost of running the DTT network. It is assumed that there will be 1154 transmission sites, and cost estimates are drawn from estimates by the ITC and the Spectrum Planning Group and the Digital Network.</li> <li>• Marketing communications costs to advertise DSO.</li> </ul>
	<p>Chris Goodall, submission to the Analogue Switch-Off Report of 2005-06 Volume II</p>	<p>Targeted assistance - Goodall uses analysis of the Ferryside DTT trial to illustrate the potential costs of assisted help for the new technology. The Ferryside trial found that it took many months for some residents to become comfortable with using the technology with much assistance. He says that the government has no plans to offer assistance to the 25 million homes in the UK, and this will create a large consumer cost.</p> <p>Electricity costs – Goodall estimates that DTT switchover will increase electricity consumption by 1.9 units a day, or 700 units a year to power the set top boxes (assuming they are switched on all of the time). This was estimated to cost an extra £50 a year (at 2006 electricity prices).</p>
	<p>Spectrum Value Partners (2006), Cost benefit analysis of the launch of digital free-to-air television in New Zealand</p>	<p><b>Consumer costs</b></p> <ul style="list-style-type: none"> <li>• Cost of new equipment to receive DTV, including new aerials where necessary. This is estimated using the cost of the cheapest set top box, as this price is adjudged to be the entry price to digital TV. Set top boxes are assumed to decline by 10% in real terms over time until the price reaches a floor where profit margins are 3.5%, as in the UK.</li> <li>• Installation costs, which were modelled using previous research into the cost of aerial and satellite dishes and their installation.</li> <li>• Electricity costs, which were modelled using estimates used in the CBA of UK DTT.</li> </ul> <p><b>Producer costs</b></p> <ul style="list-style-type: none"> <li>• Cost of dual transmission, calculated by taking the analogue transmission ratio and applying it to capital</li> </ul>

Aspect of CBA	Literature	Summary of Findings relevant to this CBA
		<p>expenditure (which is used to maintain analogue transmission sites).</p> <ul style="list-style-type: none"> <li>• Cost of digital licences, benchmarked against other studies.</li> <li>• Programming costs for digital channels. An assumption is made on the number of channels on New Zealand DTT.</li> <li>• Marketing and promotion of switchover, determined from stakeholder interviews.</li> <li>• Cost of converting the non-adopters. The cost of who this falls on is unclear but is irrelevant for CBA (as noted above).</li> <li>• Incremental advertising is excluded as there is likely to be redistribution of advertising across media rather than an overall increase in it.</li> <li>• Value from released spectrum (measured in terms of the benefit of its new use).</li> </ul>

DCMS, DTI (2005), Regulatory and Environmental Impact Assessment: the timing of digital switchover

#### Consumer costs

- Research undertaken by Scientific Generics for the Digital TV project estimated that around 2 million people over the age of 75 (48%) would require assistance in installing a set top box. This could cost £50-£100 if installed professionally.
- Extra 157kW usage of electricity per year per household. The increase in consumer energy use of completing DSO is estimated to be around 966GWh to 2816GWh.

#### Producer costs

- Cost of extending DTT to remote communities, where marginal cost of extending coverage increases.
- Cost of upgrading communal TV reception systems.

Scientific Generics (2005), Cost and power consumption implications of digital switchover

Typical power consumption of a typical household is estimated to increase by 0.1 to 0.4kWh per day – a monetary cost of £2-£8 per year.

#### Externalities

Spectrum Value Partners (2006), Cost benefit analysis of the launch of digital free-to-air television in New Zealand

Externalities include:

- Increased skills of the workforce through educational programming;
- PSB TV can increase in democracy by stimulating opinions;
- Support of cultural activities;
- Giving a voice to minority populations; and
- Increased national identity through encouragement of native culture.

#### Use and value of released spectrum

Europe Economics (2006), Economic impact of the use of radio spectrum in the UK

The economic benefit from the use of radio spectrum in 2005/06 is estimated to be £42bn based on consumer and producer surplus calculations. This is higher than the £28bn estimation for 2002.

The radio sector is modelled as comprising of seven sectors:

- Public mobile, including cellular mobile, paging, public mobile data networks, and public access mobile radio;
- Broadcasting, including analogue and digital TV, and analogue and digital radio;
- Satellite links, meaning the operation of satellite links, such as VSATs and permanent earth stations;
- Fixed links, meaning the operation of radio fixed links, for example to substitute for or supplement cable links in telecommunications infrastructure;
- Wireless broadband, meaning the provision of WiFi and other wireless access services;
- Private mobile radio, meaning mobile radio communications services provided for non-public use, such as by emergency services, taxi companies and transport companies; and
- Other, including non-commercial aviation, amateur radio, citizen's band and other radio uses (but excluding commercial aviation and government, including MOD, use).

Indepen (2004), An Economic Study To

Other uses of analogue radio spectrum are limited because of international allocations of spectrum through

Review Spectrum Pricing	agreements. A marginal value for sound broadcasting is not given because of a lack of reliable data.
DCMS/DTI Memorandum - the Costs and Benefits of Digital Switchover (TV)	There are four issues with the value assigned to released spectrum: <ul style="list-style-type: none"> <li>• The technical constraints to the usage of released spectrum e.g. television or mobile telephony;</li> <li>• International agreements on the use of spectrum bands;</li> <li>• Conditions of the use of the spectrum e.g. PSB broadcasting; and</li> <li>• Amount of spectrum available to potential competitors.</li> </ul>
Analysys, Econ, Mason (2004) Assessment of options for allocating available spectrum within VHF Band III (174–230MHz) and L-Band (1452–1492MHz)	The analysis suggests that an auction could be used to reallocate released radio spectrum. A ‘demand evaluation’ contest could be run first in order to gauge demand for the spectrum. This is because markets allow a more flexible response where by the most efficient outcome is achieved through individuals privately maximising their benefit. A regulated distribution is inflexible as it imposes allocations upon producers.
Doyle, C. (2004) The Economics of Spectrum Pricing	Smith-Nera (1996) devises an opportunity cost method to value spectrum. This method calculates the willingness to pay for spectrum by determining what the least cost way to the incumbent of delivering its service using its current spectrum allocation.
Cave, M (2002), Review of Radio Spectrum Management	Spectrum should be allocated to broadcasters through a market based mechanism to allow all broadcasters to consider the full opportunity cost of spectrum use. Broadcasters should be able to lease their spectrum to other users once they have fulfilled their public service obligations.
Digital Radio Working Group - Interim report for the Secretary of State for Culture, Media and Sport	Community radio and smaller local radio stations should remain on FM as analogue remains the cheapest and most effective option to deliver services to small geographical areas in the foreseeable future. In the areas where DAB coverage can not be rolled out, the BBC should retain an analogue service for those that already receive one.
<b>Coverage</b>	
PKF (2006), Review of the BBC Value for Money and Efficiency Programmes	The cost of extending coverage of BBC radio stations from 90% to 95% of the country may not match the benefits of doing so because of the large increase in costs to extend coverage to 95% (the estimated cost of this coverage is blanked out). PFK therefore suggests that it may be more efficient to aim for 90% coverage unless there is a strong policy steer from government.
Ofcom (2007), The Future of Radio	The BBC should aim for universality of coverage for DAB radio.
Caroline Thomson, The BBC and the future – a public purpose in a changing world (17 <sup>th</sup> October 2005)	The BBC will extend DAB coverage to 95% of the economy.
<b>Take-up of</b>	
Ofcom (2008), Media Literacy Audit:	Consumers under the age of 45 have a higher engagement with digital media. As the age profile of ethnic

<b>digital services</b>	Media literacy of UK adults from ethnic minority groups	minorities is much younger than the UK, digital media take up is higher among these groups than the UK average.
	Ofcom (2006), Media Literacy Audit: Report on media literacy amongst adults from minority ethnic groups	Penetration of digital radio is higher for ethnic minorities (54%) than the overall UK population (44%). However, these groups listen to less radio than the average UK adult.
	DCMS, DTI (2005) Regulatory and Environmental Impact Assessment: the timing of digital switchover	Research undertaken by Scientific Generics found that a significant minority are happy with their current analogue services and are sceptical of digital services, but a DSO deadline would speed up take-up before DSO – 15% of households who had not converted their primary sets would do so before DSO.
<b>Outcomes</b>	DTI & DCMS, Cost Benefit Analysis (CBA) of Digital Switchover (TV)	A net benefit in the range of £1.1bn to £2.2bn is estimated. The central estimate is £1.69bn; £6.2bn in benefits and £4.55bn in costs. 44% of the benefits are accrued by consumers that currently live in areas without DTT coverage, while 52% of the costs were as a result of non-voluntary reception equipment costs.
	Spectrum (2006), Cost benefit analysis of the launch of digital free-to-air television in New Zealand	There is a range of outcomes (NZ\$40 to 575 m). For the central case in the scenario where there is DSO, willingness to pay for digital services is the largest contributor to benefits, while the cost of programming is the largest contributor to costs.
<b>Sensitivity analysis</b>	DCMS/DTI Memorandum - the Costs and Benefits of Digital Switchover (TV)	Parameters considered included: <ul style="list-style-type: none"> <li>• Variation of the completion switchover date, from 2010 to 2015;</li> <li>• Low/high consumer benefits;</li> <li>• Low/high energy consumption; and</li> <li>• High infrastructure and reception costs.</li> </ul>
	Spectrum (2006), Cost benefit analysis of the launch of digital free-to-air television in New Zealand	Parameters considered included: <ul style="list-style-type: none"> <li>• Year of ASO was varied;</li> <li>• Platform mix varied from all DTT and all DTH to a mix of the two;</li> <li>• Take-up rate with different platform mixes flexed;</li> <li>• Value of released spectrum varied; and</li> <li>• Willingness to Pay flexed.</li> </ul>
<b>Current landscape</b>	BBC Trust (2007), The BBC's Efficient and Effective Use of Spectrum	The UK's DAB services operate in Band III. The BBC broadcasts in the block band 12B. Digital One operates in band 11D in England and Wales and in Band 12A in Scotland. Digital Two will operate in the 11A block. Five blocks are reserved for 46 local and regional commercial radio multiplexes. Ofcom will licence three more blocks to carry local and regional services. As of September 2007, BBC broadcast its DAB services from 98 transmitter sites to 86% of the population. The BBC plans to extend its coverage to broadcast from 230 sites. Broadcasting DRM on AM spectrum would give a more cost effective solution to the problem of extending

coverage to more remote and geographically challenged areas of the UK, as it would require fewer transmitters due to the properties of AM radio waves.

The BBC spends £8.2m per year on FM and AM broadcasting costs.

---

YLE Press Release, February 2005

YLE, the public service broadcaster in Finland, abandoned DAB for DVB (Digital Video Broadcasting) at the end of 2005. It is in a position however to readopt DAB should it become European standard.

---

Oxera (2003), Study on Interoperability, Service Diversity and Business Models in Digital Broadcasting Markets

DAB penetration across Europe has been limited thus far because the benefit to consumers of purchasing a DAB set, which is three times the cost of a low cost analogue set, do not outweigh the costs of purchasing a set. This is partly because there is too little differentiation in the service, the future of DAB is unclear and consumers are unsure if they will be able to receive a uniform service if on the move.

A premium of 35-55% for DAB radio is assigned those most interested in the additional features of DAB, below the current cost of a DAB set.

On the supply side, there is little incentive for producers to create further differentiation in the digital radio product, such as interactive services, because of the inability to charge consumers for these services.

There are three recommended policy options to these issues:

- Reduce the cost of DAB sets, perhaps with focus on car manufacturers;
  - Encourage expansion of the range of content and create differentiation from analogue radio; and
  - Put effective licensing regimes for DAB broadcasting in place to encourage investment through increased certainty of the commitment to DAB technologies.
-

# Appendix C. Stakeholder Consultations and Data Sources

**Figure C.1: List of Stakeholders**

	Topics discussed
<b>Barry Cox / DCMS</b>	<ul style="list-style-type: none"> <li>• Representative views of the DRWG</li> </ul>
[§< (S.44)]	<ul style="list-style-type: none"> <li>• Industry views</li> <li>• Coverage extension and transmission</li> <li>• Willingness to pay studies</li> </ul>
<b>RadioCentre</b>	<ul style="list-style-type: none"> <li>• Industry views</li> <li>• Coverage extension and transmission</li> </ul>
[§< (S.44)]	<ul style="list-style-type: none"> <li>• Industry views</li> </ul>
<b>DRDB</b>	<ul style="list-style-type: none"> <li>• Forecasts of digital penetration and DAB radio sales</li> </ul>
<b>Community Media Association</b>	<ul style="list-style-type: none"> <li>• Community radio</li> </ul>
[§< (S.44)]	<ul style="list-style-type: none"> <li>• Coverage extension and transmission</li> </ul>
[§< (S.44)]	<ul style="list-style-type: none"> <li>• Views of radio manufacturers</li> <li>• Energy use of new radio sets</li> </ul>
<b>RNIB</b>	<ul style="list-style-type: none"> <li>• Help for vulnerable groups</li> </ul>
<b>Wireless for the Blind</b>	<ul style="list-style-type: none"> <li>• Help for vulnerable groups</li> </ul>
<b>The TV and Radio Charity</b>	<ul style="list-style-type: none"> <li>• Help for vulnerable groups</li> </ul>
<b>2 Car manufacturers and 1 in-car radio manufacturer (via SMMT)</b>	<ul style="list-style-type: none"> <li>• Conversion costs for consumers</li> </ul>

The following lists of questions formed the basis of our discussions with stakeholders.

- Overall industry perspective and views:
  - With respect to DRWG interim paper: (i) what are the main drivers of reaching DRWG goals (ii) what are the main challenges/obstacles to achieving goals and (ii) what are the main benefits of the proposed pathway.
  - What are your views on the impact of the consolidation of commercial stations for digital radio? For example: Will it lead to more/varied content? How will it impact the national vs. local balance? What are the likely impacts on listening and penetration of digital?

- Content
  - In the event of a digital migration announcement, how would the digital radio offering change (either with respect to content or additional services – e.g. interactivity)? What are the estimated benefits of this?
  - Do you have your own projections for DAB penetration or DAB listening a proportion of total listening? What impact will an announcement regarding digital migration have on these projections?
- Radio Sets
  - What is the current consumer offering in terms of DAB receivers (across home, portable, in-car, personal etc)? What are the main trends in set manufacturing?
  - What are the current obstacles to greater innovation and cheaper DAB handsets?
  - Do you have any views on the extent to which pan-European harmonisation of receiver chipsets is feasible? If so, in what sort of timeframe will sets be available to consumers?
  - Do you have any views on the extent to which existing FM receiver sets would be disposed of under a digital migration policy?
  - What are the key issues for the digital migration strategy in relation to the in-car market? How might these obstacles be overcome?
  - What is the typical cost of conversion to the consumer at present? How is that likely to change a) going forward and b) going forward under a digital migration strategy?
- Transmission/Coverage
  - Have you undertaken consumer research on the benefits of extending DAB coverage?
  - What is the likely cost savings post-digital migration compared to at present?
  - How would a digital migration policy be practically implemented – what are the processes that would need to be undertaken in order to achieve migration?
- Energy use
  - What is the likely energy saving post-digital migration compared to under dual-illumination?
  - What is the difference in average energy consumption between the average analogue set and the average digital set (at present)? How might this energy footprint change in future?
- Marketing
  - Have you undertaken any research into the impact (on take-up, awareness, listening) of DAB marketing campaigns to date?
- Spectrum
  - Do you have any views on the potential uses of any released spectrum under digital migration?
- Ethnic minorities and nations and regions
  - What impact will the digital migration proposals have on nations and regions to coverage and take-up?

- Do the digital migration proposals raise any issues with respect to ethnic minorities?
- Consumer costs of conversions
  - What are going to be the key challenges for vulnerable groups in relation to the digital migration strategy?
  - Can you give a description of the key groups which might be affected, and the ways in which they might be affected? How many households might be affected? Are there any groups which are not served by your organisation which you feel may also need similar assistance?
  - Will those you help require specially adapted sets or any special features which are not currently available on the market? In what ways will sets have to be modified? Do you have any estimates as to the likely retail cost of such sets were they available?

**Figure C.2: Data Sources**

Section of analysis	Information Used	Sources
<b>Listening projections</b>	<ul style="list-style-type: none"> <li>• Analogue-only and DAB-enabled set sales data</li> <li>• Existing analogue stock data and radio penetration</li> <li>• Total listening hours</li> <li>• Share of radio listening by location</li> <li>• Broadband Penetration</li> <li>• Digital Television Penetration</li> <li>• Car stocks and replacement data</li> <li>• Radio Set life-cycle</li> <li>• Car replacement life-cycle</li> </ul>	<ul style="list-style-type: none"> <li>• DRDB/[§&lt; (S.44)]</li> <li>• Ofcom Omnibus Survey, September 2008</li> <li>• RAJAR Q3</li> <li>• Ofcom Communications Market Report 2008</li> <li>• Office for National Statistics</li> <li>• Ofcom Digital Television Updates</li> <li>• Office for National Statistics</li> <li>• PwC assumption</li> <li>• Stakeholder consultation</li> </ul>
<b>Transmission coverage data</b>	<ul style="list-style-type: none"> <li>• Coverage projections - BBC National and National Commercial</li> <li>• Coverage estimate - Local and Regional commercial multiplexes</li> <li>• Transmitter Network information</li> <li>• Existing transmission costs</li> <li>• Costs of increasing transmission</li> </ul>	<ul style="list-style-type: none"> <li>• Ofcom</li> <li>• RadioCentre</li> <li>• Ofcom, RadioCentre</li> <li>• Ofcom, RadioCentre, BBC Annual Accounts, "The BBC's Efficient and Effective use of Spectrum: Review by Deloitte &amp; Touché LLP commissioned by the BBC Trust's Finance and Strategy Committee" (December 2007), GCap annual accounts, other public sources (e.g. news articles), stakeholder consultation</li> <li>• Ofcom, RadioCentre (based on [§&lt; (S.44)] information)</li> </ul>
<b>In-home consumer conversion costs</b>	<ul style="list-style-type: none"> <li>• Willingness to pay estimates</li> <li>• Types of consumer by share of all consumers</li> <li>• Estimates of 'vulnerable groups'</li> </ul>	<ul style="list-style-type: none"> <li>• "Measuring the Value of the BBC: A report by the BBC and Human Capital" (October 2004), "Survey to determine the consumers' surplus accruing to TV viewers and radio listeners", Aegis (October 2000), "The Economic Impact of Radio: a study produced by the Radiocommunications Agency", (February 2001), "Economic Impact of the use of radio spectrum in the UK: a report by Europe Economics" (November 2006)</li> </ul>

Section of analysis	Information Used	Sources
<b>In-car consumer conversion costs and benefits</b>	<ul style="list-style-type: none"> <li>Willingness to pay estimate</li> <li>Costs of conversion</li> </ul>	<ul style="list-style-type: none"> <li>"Consumer Engagement with Digital Communications Services", Ofcom (July 2006)</li> <li>Office for National Statistics, Department for Work and Pension statistics website, stakeholder consultation</li> <li>[3] (S.44)</li> <li>Stakeholder consultation, desk research (DRDB website)</li> </ul>
<b>Energy costs</b>	<ul style="list-style-type: none"> <li>Radio energy use</li> <li>Electricity costs</li> <li>Carbon conversion factor and calculation</li> </ul>	<ul style="list-style-type: none"> <li>Desk research on radio models (through retailers' websites e.g. Pure)</li> <li>PwC assumption based on desk research on electricity prices (prices subject to change but not relevant for base case)</li> <li>HM Treasury Green book</li> </ul>
<b>Disposal costs</b>	<ul style="list-style-type: none"> <li>Producer's costs of recycling</li> <li>Radio average weight</li> </ul>	<ul style="list-style-type: none"> <li>Retailers' websites (Transform, REPIC, Valpak)</li> <li>PwC assumption based on desk research on radio models (through retailers' websites e.g. Pure)</li> </ul>
<b>Marketing costs</b>	<ul style="list-style-type: none"> <li>Comparable marketing costs</li> </ul>	<ul style="list-style-type: none"> <li>Department of Health website, Memorandum on Digital TV Switchover</li> </ul>

# Appendix D. Supplementary tables and charts

## D.1 Producer Costs: Disposal

All producers have to join a Compliance Scheme (or set one up) that has been approved by the Environment Agency. 37 Producer Compliance Schemes (PCSs) operate in the UK, including REPIC, Transform and ERP. Separately, Valpak has been approved as the operator of the Distributor Take back Scheme in the UK. (Large) Retailers pay Valpak a per unit sold fee which is intended to cover the cost of the take-back scheme. On top of the fees charged by these providers each producer pays an agency fee to the Environment Agency, collected by their respective providers.

**Figure D.1: Producer Compliance Schemes and Charging Structure**

Producer Compliance Scheme	Charging structure	Charges for Category 4
<b>REPIC (not-for-profit)</b>	Fee per tonne for collected & treated	Fees commercially sensitive – unknown
<b>Transform</b>	Annual fixed membership fee depending on size Two-part pricing: Tonnage management fees: to manage the logistics, treatment and contracts with Local Authorities. They are applied to the actual obligation that arises from the tonnage placed on the market by a member. Tonnage collection, treatment and recycling charge: This is the actual cost for Transform to manage the necessary tonnage required to meet the obligations of its members	£300 to £2,500 depending on size <b>Tonnage management fees</b> 1st 50 tonnes - £10/t Next 150 tonnes - £5/t Next 800 tonnes - £1/t Any additional tonnage - £0.10/t <b>Tonnage operational costs</b> Range from £0 - £200/t Mixed WEEE expected to cost around £100/t
<b>ERP</b>	Annual fixed membership fee Fee per tonne for collected & treated	£1,500 for 2008 regardless of size Fees commercially sensitive – unknown
Distributor Take Back Scheme	Charging structure	Charges for Category 4
<b>Valpak</b>	Annual fixed fee for small retailers; Per unit sold fee for large retailers	£400 or £1,500 fixed fee (small retailers) £0.02 per unit sold (large retailers)

## D.2 Consumer Benefits: Willingness to pay estimates

**Figure D.2: Estimates of willingness to pay for additional digital stations**

Source	Stations	Per year per household inflated to 2009	Comments
<b>Aegis</b>	All BBC stations (analogue and digital)	£51.74	
	Other National	£15.09	Based on approximately 4-5 national stations
	Other Local	£22.28	
	<b>Total Radio</b>	<b>£89.10</b>	
<b>Human Capital (Consumer value)</b>	BBC local stations	£16.38	
	BBC digital only stations	£23.21	
	BBC national analogue stations	£36.86	
[< (S.44)]	[< (S.44)]	[< (S.44)]	[< (S.44)]
<b>PwC Estimate – Low</b>	BBC digital radio	£15.71	Using relative value of BBC digital to All BBC stations from Human Capital and re-based to Aegis estimates $WTP(BBC) = 23.21 / (16.38 + 23.21 + 36.86) * 51.74$
	Other national digital (per multiplex)	£4.58	Using relative value of BBC digital to All BBC stations from Human Capital and re-based to Aegis estimates on national stations $WTP (Comm National) = WTP (BBC) * 15.09 / 51.74$
	<b>Total In-home</b>	<b>£24.87</b>	<b>WTP (total) = WTP (BBC) + 2 WTP (Comm National)</b>
	In-car	£16.58	Adjusting downwards the willingness to pay for BBC digital and other national digital (PwC Low estimate) by relative willingness to pay for in-car (Strategy Analytics) to in-home (Aegis) $WTP (car) = WTP (total) \times 2/3$

Source	Stations	Per year per household inflated to 2009	Comments
<b>PwC Estimate – High</b>	BBC digital radio	£23.21	Using Human Capital estimate WTP (BBC) = 23.21
	Other national digital (per multiplex)	£6.77	Using relative value of BBC digital to All BBC stations from Human Capital and re-based to Human Capital estimates on national stations  WTP (Comm National) = WTP (BBC) * 15.09 / 51.74
	<b>Total In-home</b>	<b>£36.75</b>	<b>WTP (total) = WTP (BBC) + 2 WTP (Comm National)</b>
	In-car	£24.50	Adjusting downwards the willingness to pay for BBC digital and other national digital (PwC High estimate) by relative willingness to pay for in-car (Strategy Analytics) to in-home (Aegis)

