



The carbon impacts of recorded music products in a time of transition

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Introduction

Julie's Bicycle has a simple primary purpose: to support climate responsibility and carbon reduction. This is easier said than done; developing an effective strategy to do this in the recorded music sector is a case study in the highs and lows of doing the right thing.

Our first response to this challenge was to commission *First Step: UK Music Industry Greenhouse Gas Emissions for 2007*¹ which included an initial assessment of the physical recorded product, the CD. We identified that producing the compact disc (CD), plastic jewel case packaging and booklet are the most greenhouse gas (GHG) emission intensive parts of the supply chain up to retail. Together these three components contribute almost half of the recording and publishing sector's emissions.

Acknowledging the increasingly central role digital music has, *First Step* also included an estimate of the emissions resulting from servers hosting digital download masters. A broader consideration of the greenhouse gas (GHG) emissions impacts of digital music was beyond *First Step*'s scope owing to a lack of available data and the difficulty of analysing an emerging and extremely complex business model. However, this was – and remains – unsatisfactory. As the whole industry reconfigures itself in the aftermath of the digital revolution the thirst for good, scientific information to guide the business in how to minimise its environmental impact in the area of digital music becomes ever stronger.

First Step ambitions included:

- *Setting the digital emissions boundaries*: what supply chain emissions should be included? Should it start with server emissions and end with the final destiny of the MP3 players, or is it narrower?;
- *Understanding consumers*: including the energy use of listening devices, and the platforms used to access and play digital music;
- *Examining the potential for increasing energy efficiency*: delivering music file from studio to digital service provider (DSP) to consumer;
- *Improving data collection*: the scale of legal/illegal music downloading and its associated energy use.

Very little work has been conducted in this field to date. One study by Digital Europe: e-business and Sustainable Development (DEESD) (in cooperation with EMI)²

compared the material resources consumed by digital download delivery to retail or e-tail CD shopping, and found digital to use half the material resources of the physical format scenarios. A more recent study from the RESOLVE group at Surrey University analysed the future impacts of different trends in music buying and listening on material resources. It found that a substantial shift by consumers to digital music files away from CDs did not reduce total material resources below current levels, because of the proliferation in listening devices³.

More recently, a US study has emerged from researchers at Carnegie Mellon and Stanford Universities, commissioned by Microsoft and Intel⁴. It compares the energy and carbon dioxide (CO₂) emissions impacts of reproducing and delivering a CD versus a digital album to the consumer. They conclude that purchasing music digitally reduces the CO₂ emissions associated with delivering music to consumers by between 40 and 80%.

This result is based on assumptions that, if altered, would significantly reduce the difference in emissions between the physical and digital scenarios. In particular, it assumes that all music consumers drive to a retail store to purchase their CD. This means that consumer transport is the largest single contributor of emissions to the CD retail scenario. The study also assumes a constant factor for the CD packaging contribution to the scenario calculations, rather than varying this factor according to whether the packaging is plastic or card. Using this approach, the CD packaging is the next greatest contributor of emissions in the CD retail scenario. However, our research into CD packaging types⁵ has found that the emissions resulting from producing CD packaging can be virtually eliminated if a pure card package is used instead of a polystyrene 'jewel' case.

The US study is the first research we are aware of that investigates in detail the GHG emissions of digital music content, and is of particular interest to Julie's Bicycle and the music industry, given our focus on promoting climate responsibility. The study is a useful contribution to the discussion and it importantly reaffirms the – for some counterintuitive – fact that digital media has a real and enduring emissions profile. However the study excluded a consideration of producing, transporting and encoding the album master copy, and most critically – the consumer use and disposal of the album.

¹ Bottrill, C., Lye, G., Boykoff, M., and Liverman, D. (2008). *First Step: UK Music Industry Greenhouse Gas Emissions for 2007*. Julie's Bicycle/Environmental Change Institute, Oxford University, Oxford www.juliesbicycle.com/publications; www.eci.ox.ac.uk/publications/2008.php

² Digital Europe. (2003). Report for Digital Europe: eBusiness and Sustainable Development (DEESD) Project, IST-2000-28606. A Case Study with EMI: The Environmental and Social Impact of Digital Music. European Commission, Brussels

³ Hogg, N. and Jackson, T. (2009). "Digital Media and Dematerialization: An Exploration of the Potential for Reduced Material Intensity in Music Delivery". *Journal of Industrial Ecology*, vol. 13, no. 1, pp. 127 – 146

⁴ Weber, C.L., Koomey, J.G., and Matthews, H.S. (2009). *The Energy and Climate Change Impacts of Different Music Delivery Methods*. Carnegie Mellon University, Department of Civil and Environmental Engineering, Lawrence Berkeley National Laboratory and Stanford University. For Microsoft Corporation and Intel Corporation. <http://download.intel.com/pressroom/pdf/CDsvsdownloadsrelease.pdf>

⁵ Julie's Bicycle (ed.), Arup, Environmental Change Institute and Purchasing for Profit (2009). *Impacts and Opportunities: Reducing the Emissions of CD Packaging*. Julie's Bicycle, London www.juliesbicycle.com/research

The Importance of the Use Phase

The usefulness of directly comparing the CD and digital download is limited by the US study's exclusion of the consumer 'use' phase of the music product. In order to reduce the full emissions profile of digital music we need to understand how the consumer listens to, stores, and disposes of, their music products and listening devices. In particular:

1. *Ease of access*: it is now much easier for people to access and accumulate music. The sheer size of digital collections means that they have significant energy requirements and therefore emissions impact – unlike a CD, which once manufactured and distributed, only becomes 'energy alive' when it is played, the download stays animated in use and in storage.
2. *New models*: a recent study conducted in partnership with Julie's Bicycle shows streaming to have nudged ahead of downloading as the most popular method of accessing music by 11–21 year olds⁶. Streaming requires internet access to play music files, and may have a higher emissions profile than downloading, over the life of the track use.
3. *Persistence of physical formats*: many music listeners continue to buy and/or burn physical albums.
4. *Hardware*: rapid technological innovation interacts with consumer demand for new models of listening devices. While most people do not buy the latest mobile phone or MP3 player as soon as it is released, many replace their devices before they are worn out, whether because of upgrade offers, fashion obsolescence, or technical obsolescence (i.e., software upgrades no longer available, functionality no longer as sophisticated or the end of life of the integrated chargeable battery). Convergence of functions could reduce the impacts of devices, as people require fewer devices to perform the same number of functions. However, proliferation is currently the trend with only 15% of music listeners in a recent survey saying they use their mobile phone to playback music⁷.

The Comparative Approach

We would suggest that the comparative approach undertaken by the US study, while providing some very useful new insights, may not be the most informative for understanding the material and emissions impacts of recorded music.

In a nutshell these are the dilemmas of the comparative approach:

1. Comparing a single digital album to a single CD album assumes that they are representative of the consumer's collections. However digitisation enables radically different music collecting behaviours. An average digital music "collection" of more than 8,000 tracks can conceivably rival the emissions of the average CD collection of 84 albums⁸.
2. There is no straightforward way to compare the floor space of a "bricks and mortar" store to an online store or platform. For example iTunes has an 80% market share, but outsources their music delivery infrastructure to Akamai, who run a global Content Delivery Network for many organisations⁹.
3. The area of music playback is also not strictly comparable. Portable music devices and multi-functionality mean that music is played across a more diverse range of devices than even 10 years ago. The hardware required is also replaced more frequently than previous generations of products.
4. The consumer does not necessarily "choose" between digital or physical. In many instances a music lover may download or stream a music file but still choose to buy, or burn on CD, an album. This may be because they appreciate the aesthetics of the physical object's design, artwork and booklet; want to maintain a physical collection of favourite albums; or simply for the security of having a hard copy of the data¹⁰.

There is currently very limited understanding of the emissions associated with digital music. Only when we understand the 'use' phase will we understand its carbon content, enabling us to focus our knowledge and behaviours and build our business models on low impact digital culture.

⁶ Chapman, T.R. (2009). Digital Music Behaviour and User Perceptions of Carbon Impacts. Cranfield University, MSc Thesis, p.25 www.juliesbicycle.com/research

⁷ Ibid, p.26

⁸ Bahanovich, D. and Collopy, D. (2009). Music Experience and Behaviour in Young People. UK Music/University of Hertfordshire, pp. 8 – 11 <http://www.ukmusic.org/research>

⁹ Bottrill, C. et al, p. 36

¹⁰ Bahanovich, D. et al, p. 11

Conclusion

So, the pertinent question the music industry needs to have answered is – what does a climate responsible digital music product/service look like and how can it be achieved?

In the age of the physical music product, the record company controlled the production of the recording, as well as the distribution and to a large extent the use of, music. Today, the delivery and playback infrastructures for digital music content are disaggregated and diverse. In order to minimise the energy and emissions profile associated with digital music, we need to undertake new research which will identify how the music industry can work together with the information and communications and consumer electronics sectors to minimise emissions.

The record industry is ahead of any other creative sector in terms of a maturing market for digital content: in 2009 98.6% of singles sales in the UK were in “digital formats”¹¹. Digital music is therefore a useful lens through which to examine the broader implications of a rapidly growing digital content sector. Solutions developed by the music industry will have applicability for other digital content providers such as film, games and publishing.

With digital markets and consumer behaviours rapidly evolving this is a pivotal time for the recorded music industry to play a proactive role in addressing the climate impacts of digital music. This is also a powerful opportunity to engage consumers with the all too often overlooked impacts of a digitising world.

In order to fully analyse digital music’s emissions profile, and determine whether a comparison is a useful approach, we recommend a research programme that will:

1. Delineate an appropriate GHG emission for digital music including the use and disposal phases of digital music;
2. Explore the GHG emissions impacts of different digital music delivery models such as digital download and streaming;
3. Understand consumer behaviour around digital music in the broadest sense;
4. Understand the relationships and partnerships necessary to ensure the digital music supply chain is lower carbon.

Irritatingly it’s not so simple to do the right thing and understanding climate impacts is particularly tricky.

The volume of research into digital energy demand and CO₂ is slowly increasing but still far from complete. If the music industry hopes to shape the business so that it is mindful of climate concerns it needs a more comprehensive analysis looking ahead at current and emerging digital platforms and behaviours: with a little more endeavour we can embrace the digital universe with a better understanding of the full implications of its global impacts.

¹¹ The Official Charts Company, 2009