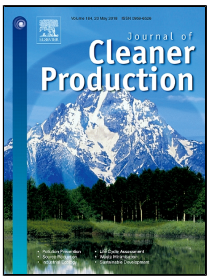
Accepted Manuscript



Life-cycle greenhouse gas emissions of e-books vs. paper books: a Japanese case study

Kiyotaka Tahara, Hirokazu Shimizu, Katsuhito Nakazawa, Hiroyuki Nakamura, Ken Yamagishi

PII:	S0959-6526(18)31008-4
DOI:	10.1016/j.jclepro.2018.03.321
Reference:	JCLP 12579
To appear in:	*Journal of Cleaner Production*
Received Date:	08 July 2016
Revised Date:	28 March 2018
Accepted Date:	31 March 2018

Please cite this article as: Kiyotaka Tahara, Hirokazu Shimizu, Katsuhito Nakazawa, Hiroyuki Nakamura, Ken Yamagishi, Life-cycle greenhouse gas emissions of e-books vs. paper books: a Japanese case study, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.03.321

Life-cycle greenhouse gas emissions of e-books vs. paper books: a Japanese case study

*Kiyotaka Tahara[1], Hirokazu Shimizu[2], Katsuhito Nakazawa[3], Hiroyuki Nakamura[4] and Ken Yamagishi[5]

[1] National Institute of Advanced Industrial Science and Technology (AIST), 16-1 Onogawa Tsukuba Ibaraki 305-8569 Japan

[2] Shimizu Printing Inc., 2-1-20 Otowa Bunkyo-ku Tokyo 112-0013 Japan

[3] Fujitsu Laboratories Ltd., 10-1 Morinosato-Wakamiya Atsugi Kanagawa 243-0197 Japan

[4] Dai Nippon Printing Co., Ltd., 1-1-1, Ichigaya Kagacho Shinjuku-ku Tokyo 162-8001 Japan

[5] The Japan Environmental Management Association for Industry (JEMAI), 2-1 Kaji-cho 2 chome Chiyoda-ku Tokyo 101-044 Japan

*Corresponding author (k.tahara@aist.go.jp, P: +81-29-861-8789 F: +81-29-861-8118)

Abstract

The increasing presence of e-books (electronic books) has become a major focus in countries around the world. In the United States, e-books represented 28% of the total book sales for 2012. In Japan, the conversion from paper books to e-books is expected to accelerate by the prevalent use of smartphones and tablet PCs. It is therefore important to quantitatively evaluate the environmental load of paper books and e-books for a sustainable society. In this study, paper books are compared to e-books read on different electronic devices (e-ink tablets, tablets, cell phones, smartphones, laptop computers, desktop computers and portable music players) through a case study on a 224-page book. The study is based on key primary data such as use time and reading speed for each device and aims to minimize assumptions made in other studies. GHG emissions for paper books are 1.24 kg-CO_2e/book, and are reduced to 1.11 kg-CO_2e/book when the effect of paper recycling is taken into consideration. The results for e-books under average use-time conditions range from 0.25 to 0.91 kg-CO_2e/book with the e-ink tablet having the lowest emissions. When the average use time of each e-book device is applied, the paper book has a higher impact than all the e-books. However, sensitivity analysis shows that the impact of paper books can be lower than that of e-books for larger screen devices such as tablets, laptops and desktops when the reuse of books is considered or the e-book reading device is hardly used during its life cycle.

Keywords paper book, e-book, questionnaire survey, GHG emission, consumer behavior