

# Are electronic directories more eco-efficient than print directories ?

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## Introduction and Questions

The success of electronic information systems in relation to traditional printed data bases is the result of easy access, convenience in handling and efficiency in time and costs. However, little is known whether electronic information systems are also more eco-efficient. Aim of this Life Cycle Analysis was a close examination of the environmental impact caused by a search for a phone number in electronic and print directories (Reichart 2001). Questions of this study are:

- Are electronic directories more eco-efficient than print directories ?
- Where are environmental hot spots along the life cycle of the investigated media CD-ROM, teleguide – an electronic appliance in the public phone booths, online and phone book ?
- What recommendations can be given for the reduction of the environmental impact?

## Methods

### Life Cycle Analysis

Life Cycle Assessment (LCA) is a technique for assessing the environmental impact associated with products or services. In this study the Swiss method of environmental scarcity (Brand 1998) and the European Eco-Indicator 99 method (PRé 2000) have been applied.

### System boundary

Media are investigated along their entire product life including transportation (Fig. 1). The operation of necessary infrastructure, like data transfer in the internet etc. is also taken into account.

Power consumption during the life cycle of media was linked to the relevant national electricity mix, depending on location of use. In the case of print media production this is the Scandinavian, German, or Swiss national electricity mix. In the case of electronic media production it is the average European electricity mix. For use phase it is the Swiss electricity mix.

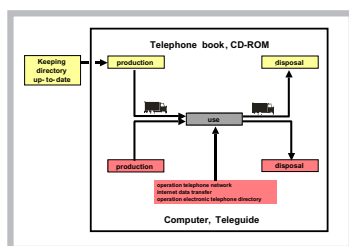


Figure 1: Generalised system boundary.

	Online	Teleguide	CD-ROM	Phone book
Duration of search	59 seconds	55 seconds	45 seconds	irrelevant
Frequency	irrelevant	12.5 / day	2 / week	2 / week

Table 1: Reference unit for a single search of a phone number

Specification	Online	Teleguide	CD-ROM	Phone book
• Modern, middle class desktop computer		• Ascorm Teleguide	• Swisscom CD-ROM Nr. 5/99	• Average size
• PC on: 2 h / d (145 W)		• Teleguide: see Table 1	• Modern, middle class desktop computer	• 1.5 books per household on average
• PC off: 22 h / d (0 W)			• CD-ROM: see table 1	• Phone book: see above
• 4 yr		• 7 yr	• PC on: 2 h / d (145 W)	
			• PC off: 22 h / d (0 W)	
			• 0.5 yr / CD-ROM	
			• 4 yr / PC	

Table 2: Specification of the product system

### Reference unit

The environmental impact of a single search for a phone number was determined by duration and frequency of a search. Duration of a search was determined empirically, while frequency of searches, was based on statistical data for the teleguide (Swisscom 1999) and on best guess for CD-ROM and telephone book (Tab. 1).

### Product system

User of the media is the average Swiss adult, who is living in an average household. Media were specified according to this assumption and their user behaviour and life time was based on average use in Switzerland (Tab. 2).

## Results and Discussion

The environmental impact of a search in the phone book or on CD-ROM is bigger compared to an online quest or a search via teleguide at the assumed low frequent use. Application of the method of environmental scarcity (Fig. 2) and the Eco-Indicator 99 (Fig. 3) lead to similar results, except for the CD-ROM, which gets a higher environmental burden when applying the Eco-Indicator 99.

There are two reasons for the high environmental burden of the phone book and the CD-ROM. First of all, it is the energy-intensive production of paper and board for the packaging and the manual of the CD-ROM as well as the phone book. About a third of the environmental burden of the CD-ROM can be reduced by leaving away the cardboard box and replacing the printed manual by an electronic file. Secondly the environmental impact is high because of the low frequency.

The influence of user frequency on the result was tested in a sensitivity analysis (Fig. 4). If search frequency increases beyond eight times a week the environmental impact of all media is the same. The environmental impact of the teleguide remains constant, because a change in the individual user behaviour has only marginal effect on the public teleguide user behaviour. In the case of an online quest a change in user frequency also has only marginal effect on the user behaviour of the computer in general.

As the environmental impact of online and teleguide search gets more important at higher frequencies a closer look at both media is necessary. The slightly dominating environmental impact of use phase is caused in both

cases only by power consumption. Important contributors to that impact are the teleguide especially during standby, internet data transfer and operation of the telephone network (Fig. 5).

In reality, results of a search in an online or CD-ROM directory are frequently printed. An extra seven ecopoints have to be added for every page of office paper printed, mostly because of the energy-intensive way of producing paper. The increase is shown as the box with red dashed lines in Figure 2. Printing itself causes little environmental impact.

Location of media use was tested in a sensitivity analysis by replacing the underlying electricity mix for the operation of (electronic) media. The replacement of the Swiss electricity mix with the average European electricity mix represents use of media somewhere in Europe instead of Switzerland. The increase is shown as the box with black dashed lines in Figure 2. The environmental impact of the CD-ROM rises only slightly, because power consumption of the PC is not the dominant part in this case. In contrast to that, the environmental impact of the teleguide and the online search triples. This brings the teleguide into the same range of the environmental impact as the CD-ROM or the phone book.

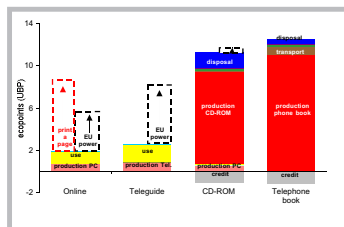


Figure 2: Environmental impact of a search for a phone number. Application of the environmental scarcity method. Red dashed box = Printing. Black dashed box = Replaced electricity mix.

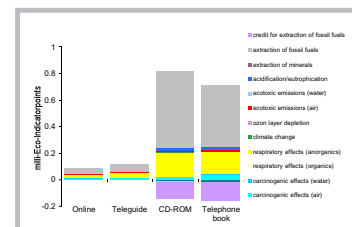


Figure 3: Environmental impact of a search for a phone number. Application of the Eco-Indicator 99 method.

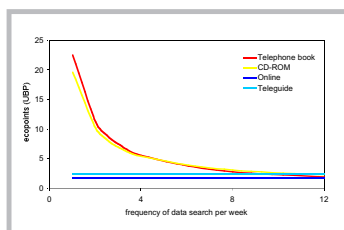


Figure 4: Influence of frequency on the environmental impact of a search.

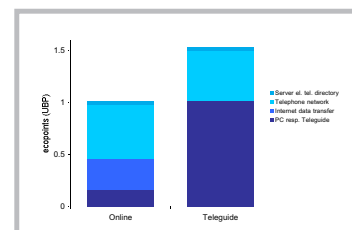


Figure 5: Detail: Environmental impact during use phase of an online or teleguide search.

## Conclusions

Electronic media offer only little environmental advantage compared to print media when comparing them under the aspect of information retrieval from a (telephone) directory or catalogue. Online quest and teleguide search cause less environmental impact than the phone book if:

1. The directory is used at low frequencies, which is typically the case for private use.
2. Search results are not printed.
3. Electricity consumed during use phase is generated mainly from renewable energy sources.

CD-ROM, as another electronic media, does not offer the same environmental advantage at low frequent use, but only at high frequent use or even in a network with extremely frequent use. Generally, the environmental impact depends on the way the information is stored. Decentralised ways of data storage like the telephone book and the CD-ROM lead to more environmental impact at least at low frequent use than centralised ways of data storage, like the teleguide or online directory.

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Presence of authors:  
 Morning and Afternoon Coffee break  
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