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Mobility and environmental impacts of car sharing in the Netherlands

Hans Nijland*, Jordy van Meerkerk

PBL Netherlands Environmental Assessment Agency, PO Box 30314, 2500 GH, The Hague, The Netherlands

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ABSTRACT

This research aims to quantify the effects of car sharing on car ownership, car use and CO_2 emissions. The results are based on a survey amongst 363 car sharing respondents in the Netherlands. We found over 30% less car ownership amongst car sharers and they drove 15% to 20% fewer car kilometres than prior to car sharing. The shared cars mostly replace a second or third car.

Due to reduced car ownership and car use, car sharers emit between 240 and 390 fewer kilograms of CO_2 per person, per year. This is between 13% and 18% of the CO_2 emissions related to car ownership and car use.

1. Introduction

Car sharing recently has drawn a great deal of attention, partly because of its green image. For instance, the website of Zipcar,[1] one of the big car sharing companies, claims that 'car sharing is about redefining transportation to make cities better places for you and me, and it helps us to ensure a healthier future for the planet'. Metz (2013) states that car sharing is environmentally beneficial as it reduces CO_2 emissions.

Our research intends to add to the academic knowledge on the environmental impacts of car sharing by answering the following question: What are the effects of car sharing on car ownership, car use and CO_2 emissions?

Our research contributes to the academic literature in three ways. Firstly, contrary to most other research on this subject, we considered the impacts of various forms of car sharing. Secondly, we took into account changes not only in car use, but also in other transport modes, which would have been used if no car sharing programme would have been in place. Thirdly, in addition to the CO_2 emissions associated with car use, we also took into account those related to the construction and demolition of cars. Our research focused on the Dutch situation.

There are various car sharing systems (for an overview, see Shaheen et al., 2012). For our study, we focused on formal, organised car sharing by private consumers. We distinguished between business-to-consumer organisations (with vehicles being owned by an organisation, such as Zipcar in Canada and the United States, and Car2go in several European and North American cities) and 'peer-to-peer' car sharing organisations (private individuals offering their own cars for rent on online platforms, such as Drivejoy in Spain and Snappcar in the Netherlands).

* Corresponding author.
E-mail addresses: hans.nijland@pbl.nl (H. Nijland), jordy.vanmeerkerk@pbl.nl (J. van Meerkerk).

[1] http://www.zipcar.com/ziptopia/inside-zipcar/zipcar-green-how-car sharing-helps-the-environment-infographic.

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Section 2 provides an overview of academic literature on the impacts of car sharing on car use, car ownership and CO_2 emissions. Section 3 describes the research methods used. Results are shown in Section 4, and Section 5 presents conclusions and discusses the research set-up.

2. Literature overview

A study by Shaheen and Cohen (2013) showed a steady increase in the number of countries participating in business-to-consumer car sharing, as well as in the number of cars and car sharers involved. By 2014, approximately 5 million people on 5 continents were sharing some 100,000 cars (Navigant Research, 2017). Peer-to-peer car sharing is growing even faster (Shaheen et al., 2012). The environmental impact of peer-to-peer car sharing is not a widely researched subject, but one might suppose that peer-to-per car sharing attracts a different type of users with different mobility patterns and different cars than business-to-consumer car sharing does. Until now, research on the environmental impacts of car sharing has been focused on business-to-consumer car sharing organisations. The environmental impact of car sharing has been examined to various extents; some studies take full life-cycle impacts into account, including upstream (vehicle and fuel production) and downstream (vehicle scrappage) effects, including or excluding the use of alternative modes of transport. Some studies include the impact of reduced car ownership due to car sharing on the demand for parking (see e.g. Engel-Yan and Passmore, 2013 and Stasko et al., 2013). Only a few studies (Briceno et al., 2004; Hertwich, 2005) consider the rebound effects of people saving on transportation expenditure by participating in a car sharing scheme and possibly spending that money on other, non-transport forms of consumption. The additional emissions from those forms of consumption may have negative environmental impacts.

2.1. North American studies

Car sharing usually leads to a reduction in vehicle kilometres travelled (VKT) and reduced car ownership. Cervero et al. (2007) did a survey amongst car sharers and a non-car-sharing control group in the San Francisco area, four years after the City CarShare programme was inaugurated. In that survey, respondents were asked to fill out a questionnaire about their shared car use over a 20-day period. A total of 619 responses were received. Car sharing was associated with reduced vehicle ownership, decreased VKT and lower greenhouse gas (GHG) emissions. Martin and Shaheen (2011), in collaboration with major car sharing organisations throughout North America, surveyed 9635 members of a car-sharing organisation about their travel behaviour both during the year before they started car sharing and at the time of the survey. The results indicated that the VKT dropped by 27% for those participating in a car sharing programme. They found that many participants in car sharing schemes drove slightly more kilometres, but some drove considerably less. When also incorporating the kilometres that would have been driven in the absence of a car sharing programme, they estimated a drop in VKT of 43%, whereas car ownership dropped by 44%, either due to vehicles having been sold or vehicle purchases having been postponed. Based on an internet survey amongst 1340 participants from all major car sharing organisations (except Zipcar) in the United States and Canada, representing 5% of all members, Millard-Ball et al. (2005) found that each shared car replaced 14.9 privately owned vehicles in North America, and, while individual VKT varied, net VKT decreased by 37%. An overview of impacts on car ownership and car use in North American studies until 2011 is presented in Table 1 (from Shaheen et al., 2012).

Sioui et al. (2012) compared similar neighbouring households and found that those participating in car sharing programmes used their cars 3.7 times less often. Taking estimates on car use and car ownership from previous studies, Chen and Kockelman (2016) performed an LCA of the potential impacts of car sharing. They found that participants in a car sharing programme may reduce their average individual transportation energy use and GHG emissions by approximately 51%. These energy and emission savings can be primarily attributed to modal shifts and foregone travel, followed by reduced demand for parking infrastructure and lower fuel consumption.

2.2. European studies

Based on surveys amongst car sharers, Rydén and Morin (2005) found that 34% of the 301 respondents in Bremen and 21% of the 272 respondents in Brussels disposed of their car, at least partly because of car sharing. They estimated a reduction in car use in Brussels and Bremen of 28% and 45%, respectively. This represents an average decrease of 3000 km per year, and the equivalent of 40%–50% decrease in CO_2, due to fewer kilometres driven and the use of smaller, more fuel-efficient cars. Firnkorn and Muller (2011) interviewed 308 inhabitants of the German city of Ulm about their current mobility behaviour. Those respondents were not participating in Ulm's free-floating car sharing system (Car2go). The study modelled the potential impact on CO_2 emissions if the respondents were to start using Car2go, using three different scenarios, and concluded that car ownership would probably decrease and annual CO_2 emissions would decrease by 146–312 kg per person.

Doka and Ziegler (2001) compared the environmental impact, in Switzerland, of cars that were being shared to that of the average Swiss passenger car. They conclude that the overall footprint of a shared car is 39% smaller than that of the average privately owned car, but the study does not provide specific figures on avoided CO_2 emissions.