# NUDGING FLEXIBILITY – INCREASING ELECTRIC VEHICLE USER'S CHARGING FLEXIBILITY WITH DIGITAL NUDGES

*Extended Abstract*

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## Abstract

*Smart charging systems can prevent problems with the integration of battery electric vehicles (BEV) and allow the user to optimize the charging process according to his preferences. To do this, however, the user must enter his flexibility into the smart charging system. We propose that this flexibility can be increased by the means of choice architecture and digital nudging. Setting defaults and presentation of normative defaults can successfully encourage end users to conserve electric energy. We propose an online experiment to investigate the transferability of these nudges to the provision of charging flexibility.*

*Keywords: Digital Nudging, Green IS, Load Shifting, Electric Mobility.*

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## 1 Introduction

Uncontrolled charging of BEVs can cause high loads and thus require expensive peak generation technologies and cause grid congestion. The smart charging offers a solution for this. It controls the charging process according to various optimization goals (e.g., cost- or emission-minimizing), depending on the users' preferences. However, this only works if the user is willing to provide his flexibility (i.e., not charging immediately). To do this, the user must make a decision about his flexibility potential and enter it into the smart charging system. Many BEV users are willing to provide flexibility to avoid grid bottlenecks or to integrate more renewable energies [Will and Schuller 2016].

Users do not always make the best decisions because humans often rely on heuristics that can lead to biases [Tversky and Kahneman 1974], for example, when they do not use their charging flexibility to save money or protect the environment. [Thaler and Sunstein 2008] propose to intervene in such cases by choice architecture (i.e., a careful design of the decision environment). Digital nudging is the application of this principle on information systems [Weinmann et al. 2016].

(Digital) Nudges have been successfully used to motivate users to conserve water [Nayar 2017] and electricity [Loock et al. 2013, Schultz et al. 2007] or to choose electricity from renewable energy sources [Momsen and Stoerk 2014]. In particular, the setting of defaults and references to the positive behavior of other users have proven to be successful.

Since charging flexibility will be needed to successfully integrate BEV into the energy system, the question arises whether nudges can increase the charging flexibility provided by BEV users. We start by researching whether default setting and normative defaults transfer to the provision of charging flexibility and therefore investigate the following hypotheses.

***Hypothesis 1:*** *Providing a default nudge indicating high charging flexibility in an IS for charging management of BEVs increases the charging flexibility provided by the BEV user.*

**Hypothesis 2:** *Providing a social nudge indicating high charging flexibility of peers in an IS for charging management of BEVs increases the charging flexibility provided by the BEV user.*

**Hypothesis 3:** *Providing a social default nudge indicating high charging flexibility of peers in an IS for charging management of BEVs increases the charging flexibility provided by the BEV user.*

# 2 Methodology

In the first step, we want to test the hypotheses in an online experiment that reflects the incentives. In the experiment, the user can decide whether to use his hypothetical charging flexibility to avoid $CO_2$ emissions or to save charging costs by shifting the charging towards times with low emission factors or low electricity prices. In the second step, the user can enter his charging flexibility into the mock-up of the user interface of a smart charging system. The experiment will therefore feature a 2x4-between-subject design with two optimization targets ($CO_2$ and monetary) and four nudges implemented into the design of the user interface mock-up. The control treatment is a neutral interface, where the user can enter his flexibility. For the hypothesis, the user interfaces pre-selects a default for flexibility provision (H1, H3) or provides information on the flexibility provided by peers (H2, H3).

The $CO_2$ or monetary savings based on the flexibility provided in the experiment are linked to a payout. The flexibility provision is penalized with a penalty that occurs with a low probability and depends on the amount of flexibility provided. This is to ensure that the online experiment maps the real world situation, where the provision of flexibility could lead to a situation where the BEV is needed but not fully charged.

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