Track 2 - The smart energy system transition in cities and regions

Title of the proposed paper
OPTIMAL USE OF SOLAR ENERGY FOR ELECTRIC DRIVING

Name author
M.J. van der Kam

Affiliation author
Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, the Netherlands

E-mail address author
M.J.vanderKam@students.uu.nl

Name co-author (if applicable)
W.G.J.H.M. van Sark

Affiliation co-author (if applicable)
Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, the Netherlands

E-mail co-author (if applicable)
W.G.J.H.M.vanSark@uu.nl

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Text abstract (max. 300 words)
The main research question in this paper is how the agenda of electric vehicle drivers can help optimising the use of solar energy for electric driving. In order to answer the research question a model is proposed which intends to simulate several scenarios for use of an electric vehicle charging station including solar panels and optional inclusion of smart grid technology and energy storage in the tertiary and residential sector. The goal of the model is to determine for each scenario what combination of a charging station with solar panels, electric vehicle(s), smart grid technology and energy storage is optimal from an energy efficiency perspective. Also, results for the different scenarios are compared in order to find the most interesting business case for electric driving on solar energy.

The scenarios are distinguished by type of vehicle use, categorised as representative-, lease-, rental-, main family- and second family car. The simulated options for smart grid technology are charging when solar power is available and storing solar power in the vehicle battery in order to extract it to cover electricity demand from an office or household. Technical specification of electric vehicles are based on the Nissan Leaf and the Tesla Model S. Results from simulations are evaluated for amount of solar energy used per driven kilometre and self-consumption of solar energy.

Simulations show that smart charging combined with energy storage results in the highest use of solar power for electric driving in all scenarios. Also, smart charging or energy storage alone can significantly increase use of solar power. Using electric vehicle batteries as energy storage reduces solar power used for driving but increases self-consumption of solar power. The most interesting scenario for this concept from an energy efficiency perspective is the lease car-scenario and the least interesting scenario is the rental car-scenario.