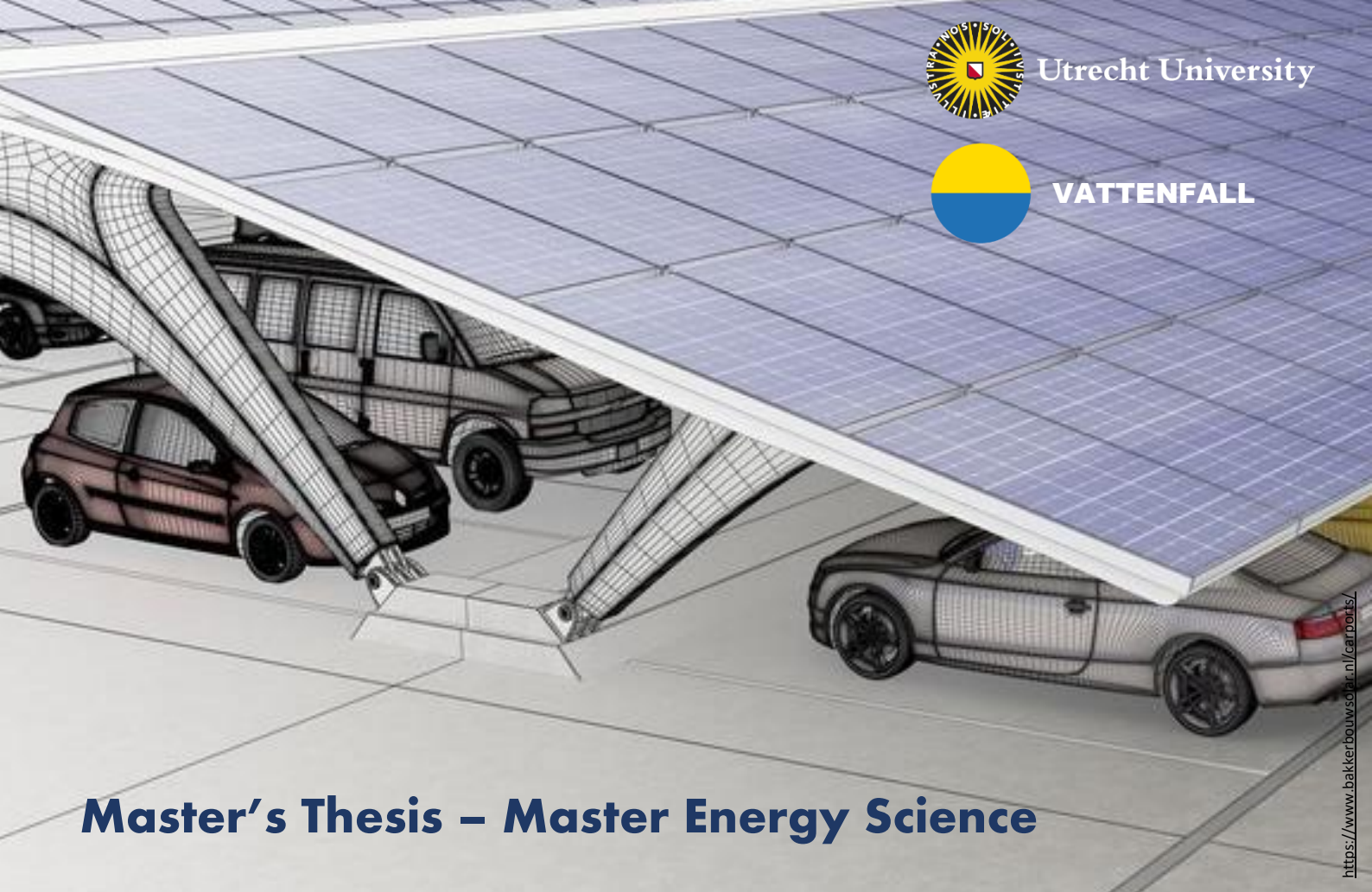




Utrecht University



VATTENFALL



Master's Thesis – Master Energy Science

Techno-economic analysis of solar carports with integration of EV-charging

Feasibility Study on solar carport systems in the Netherlands

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Abstract

Over the past years, the share of electric vehicles (EVs) on the Dutch roads has been rising, thereby taking the first steps towards a more sustainable vehicle fleet in the Netherlands. However, for the vehicle fleet to become more sustainable, the EVs are preferably charged with renewable energy. Therefore, the growth in the number of EVs is accompanied by an increasing (sustainable) energy demand, and consequently, more pressure on the electricity grid due to large peak demands resulting from simultaneously charging of large numbers of EV batteries. Solar carports pose a potential solution for this. By placing PV modules on top of carports located at offices, sustainable energy can be generated in the built environment. This way, a decentralized system – potentially disconnected from the electricity grid – can supply the energy required for EV batteries that are charging at the office's carport during business hours.

This study contains a techno-economic analysis of solar carports in the Netherlands. First, it was researched to what extent different sizes of solar carports in the Netherlands can supply the electricity required for charging the batteries of varying occupation rates of EVs parked at the carport during business hours. Second, an economic analysis was performed. The technical analysis shows that solar carports can potentially cover the electricity demanded for charging EVs at the carport, if only a relatively small part of the total number of parking spots at the solar carport have a charging point equipped. Potential problems and solutions for installing more charging points at a solar carport are discussed as well, including the use of additional utility-scale batteries and connecting the carport to the electricity grid. The economic analysis shows a positive NPV for solar carports. The study also discusses the impact of a change in the revenues on the NPV.