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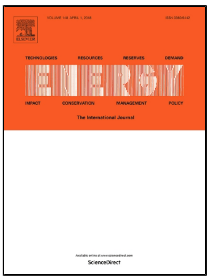

Optimizing innovation, carbon and health in transport: Assessing socially optimal electric mobility and vehicle-to-grid pathways in Denmark

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Optimizing innovation, carbon and health in transport: Assessing socially optimal electric mobility and vehicle-to-grid pathways in Denmark

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Abstract: This paper examines the social costs and benefits of potential configurations of electric vehicle deployment, including and excluding vehicle-to-grid. To fully explore the benefits and costs of different electric vehicle pathways, four different scenarios are devised with both today's and 2030 electricity grid in Denmark. These scenarios combine different levels of electric vehicle implementation and communication ability, i.e. smart charging or full bi-directionality, and then paired with different levels of future renewable energy implementation. Then, the societal costs of all scenarios are calculated, including carbon and health externalities to find the least-cost mix of electric vehicles for society. The most cost-effective penetration of electric vehicles in the near future is found to be 27%, increasing to 75% by 2030. This would equate to a $34 billion reduction to societal costs in 2030, a decrease of 30% compared to business as usual. This represents a projected annual savings per vehicle of $1,200 in 2030. However, current vehicle capital cost differences, a lack of willingness to pay for electric vehicles, and consumer discount rates are substantial barriers to electric vehicle deployment in Denmark in the near term.

Keywords: vehicle-to-grid; electric vehicles; renewable energy integration; externalities; climate change mitigation

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