# Sufficiency of Electric Vehicle Charging Infrastructure

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To meet the Finnish CO2 reduction goals, the Finnish government set a goal of increasing the amount of electric cars from 10,000 (0.352%) to 700,000 (25%) by 2035. We studied how the current charging infrastructure enables this. Our research method was stochastic agent based simulation. The steps were data collection, model development and coding, scenario development, design of simulation experiments and analysis and visualization of the results. The simulation software was programmed with Java. The parameters were the specifications of the electric vehicles, the traffic statistics and charging stations of the chosen highway, the 1300 km long Finnish highway 4 from Helsinki to Utsjoki. Starting point of each car in the vicinity of the cities was a random distance between 0 and 30 km. Currently, the daily number of cars is 30 000 with 100 e-cars. We varied the number of e-cars and the departure time's standard deviation. The number of cars ranged from 50 to 1800 with 50 car increments and single value 7000. The departure time parameter ranged from 1 hour to 36 hours with 1 hour increments. Each parameter combination was simulated 50 times. With 100 cars, 62% of the travel time was driving and 38% charging, and the maximum charger waiting time was 5 minutes. With 7,000 cars, 44% of the travel time was driving, 26% charging and 30% waiting, and the maximum waiting time was 7 days. The charging infrastructure must be increased in proportion to the growing amount of e-cars.

**Awards Won:**