

Potential impacts of electric vehicles on air quality in Taiwan

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The prospective impacts of electric vehicle (EV) penetration on the air quality in Taiwan were evaluated using an air quality model with the assumption of an ambitious replacement of current light-duty vehicles under different power generation scenarios. With full EV penetration (i.e., the replacement of all light-duty vehicles), CO, VOCs, NO_x and PM_{2.5} emissions in Taiwan from a fleet of 20.6 million vehicles would be reduced by 1500, 165, 33.9 and 7.2 Gg yr⁻¹, respectively, while electric sector NO_x and SO₂ emissions would be increased by up to 20.3 and 12.9 Gg yr⁻¹, respectively, if the electricity to power EVs were provided by thermal power plants. The net impacts of these emission changes would be to reduce the annual mean surface concentrations of CO, VOCs, NO_x and PM_{2.5} by about 260, 11.3, 3.3 ppb and 2.1 μg m⁻³, respectively, but to increase SO₂ by 0.1 ppb. Larger reductions tend to occur at time and place of higher ambient concentrations and during high pollution events. Greater benefits would clearly be attained if clean energy sources were fully encouraged. EV penetration would also reduce the mean peak-time surface O₃ concentrations by up to 7 ppb across Taiwan with the exception of the center of metropolitan Taipei where the concentration increased by ~2 ppb. Furthermore, full EV penetration would reduce annual days of O₃ pollution episodes by ~40% and PM_{2.5} pollution episodes by 6–10%. Our findings offer important insights into the air quality impacts of EV and can provide useful information for potential mitigation actions.

Keywords: Electric vehicle, air quality, AQI, CMAQ, Taiwan

