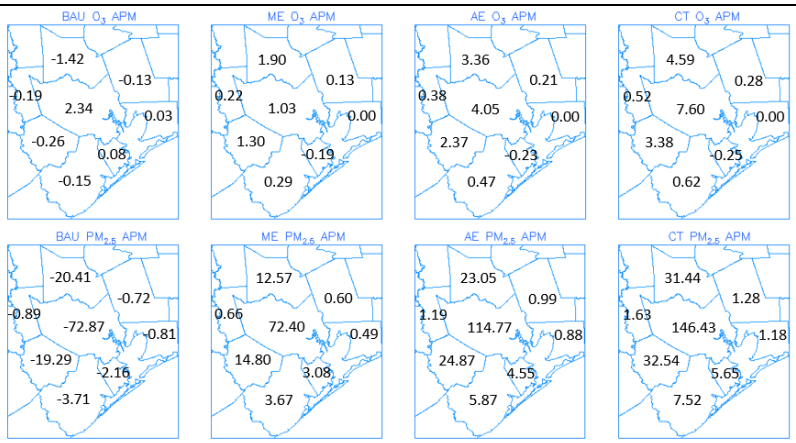
Grant Deliverables and Reporting Requirements for UTC Grants

UTC Project Information	
Project Title	Potential impacts of electric vehicles on air quality and health endpoints in the Greater Houston Area in 2040
University	Cornell University
Principal Investigator	H. Oliver Gao
PI Contact Information	hg55@cornell.edu 607-254-8334
Funding Source(s) and Amounts Provided (by each agency or organization)	USDOT: $57,607
Total Project Cost	$57,607
Agency ID or Contract Number	Sponsor Source: Federal Government CFDA #: 20.701 Agreement ID: 69A3551747119
Start and End Dates	Start date: 03/01/2019 End date: 02/28/2020
Brief Description of Research Project	Significant emissions from transportation contribute to the formation of O3 and fine particulate matter (PM2.5), exacerbating both air quality and health. In this study, we analyze multiple scenarios to understand how future fleet electrification and turnover of both gasoline and diesel vehicles affect air quality and health in the Houston area. For each scenario, we examine increased vehicle activity and various configurations of emissions controls. To capture urban features in significant detail, we model each scenario using the high-resolution (1km) WRF-SMOKE-CMA Q-BenMAP air quality and health modeling framework. Model predictions for 2040, compared to a base year of 2013, indicate a ~50% increase in emissions in the Business As Usual (BAU) scenario, and ~50%, ~75%, and ~95% reductions in the Moderate Electrification (ME), Aggressive Electrification (AE), and Complete Turnover (CT) scenarios, respectively. The emissions control cases show an increase in maximum 8h O3 of 1-4 ppb along highways but reductions in two regions—those enclosed by the highways and those downwind—and a decrease in simulated PM2.5 concentrations of between 0.5-2 μg m-3. The associated health impacts and economic benefits will be studied. The analytical framework developed in this study can be applied

	to other metropolitan areas.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	 County-level prevented premature mortality (APM) resulting from changes in O_3 and $PM_{2.5}$ concentrations in the future year scenarios. Estimating trends in transportation emissions and the impact of associated air quality can provide important insights for requisite control policy. The transportation sector is a major contributor to the concentrations of both nitrogen oxides (NO_x) and volatile organic compounds (VOCs), which react in the presence of sunlight, forming ozone (O_3). Vehicular traffic is also responsible for emissions of components of fine particulate matter ($PM_{2.5}$) such as organic and elemental carbon.. Research results from this study will be communicated to the general public, policy makers, and practitioners via outreach to multiple channels of media to influence practice and policy. A journal paper was published: Pan, S.P, A. Roy, Y. Choi, E. Eslami1, S. Thomas, X. Jiang, **H. O. Gao** (2019). Potential impacts of electric vehicles on air quality and health endpoints in the Greater Houston Area in 2040, *Atmospheric Environment*, Volume 207, 38-51
Impacts/Benefits of Implementation (actual, not anticipated)	The study drew wide public interest and attention, and was reported in media by CleanTechnica, Cornell Chronicle, Houston Chronicle, Public Citizen, Phys.org, Science Daily, AAAS EurekAlert!, TexasVox, Houston Public Media.
Web Links • Reports • Project website	http://ctech.cee.cornell.edu/final-project-reports/