ECE 398GG

Homework 5 on Lecture on Efficiency and Environmental Analysis

Date due: Friday, March 10, 2023

- 1. This problem consists of two key subproblems, which are to **conduct** the
 - (i) efficiency analysis, and the
 - (ii) environmental analysis

on an *ICEV* of **your choice** and to perform a comparison with the results of the analyses on an *EV*, also of **your choice**. To carry out these analyses, you must **obtain** the requisite data to use in the calculations. For each data item used, you must provide the source of the data. You may use as a starting point the sources cited in the lecture 8 handout. For the comparison to be meaningful, it makes sense to select vehicle models of the same year and to use the manufacturer's data from the *EPA* and/or *DoT* data submitted by the manufacturer.

Please **provide** a set of comments that summarize the insights you garnered from the analyses that you carried out.

- 2. *EPA* designated the 2019 *Chevrolet Cruze* as the *most fuel-efficient* mass-produced diesel vehicle with *FE* of 37 *mpg* diesel. **Show** that the improvement of its performance with respect to the average car on the road that had a 25 *mpg* gasoline performance in 2019 is 30.8 %.
- 3. If we wish to take advantage of the higher energy efficiency of diesel fuel, we can use it as a fuel to power a diesel generator to produce electricity. Consider a generator that consumes 0.34 *gal* diesel to produce a continuous 4.5 *kW* electricity output. In the operation of this generator over an hour period, the injection of 0.34 *gal* diesel, with its energy contents of 0.34 *gal* x 38.3 *kWh/gal* = 13.02 *kWh*, results in the generated energy of 4.5 *kWh*. As such, the generator efficiency is 34.6 %. Suppose we use the diesel generator output to directly charge the Tesla 3 LR vehicle with the *FE* of 25 *kWh*/100 *mi*.

We assume a charging efficiency of 85 %. **Show** that the Tesla 3 charged by this generator travels 22 % farther than the Chevrolet Cruze for each diesel *gal* of fuel.