

Cars: Part I

Physics and Mathematics of Sustainable Energy

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A few facts:

- Gasoline: 10 kWh per liter or 38 kWh per gallon
- Average gas mileage for car in US: 25mpg, but this ranges considerably.
- Carbon intensity of gasoline: 240g per kWh.
- Burning one gallon of gasoline releases around 9 kg of CO₂.
- Carbon intensity of electricity in grams of CO₂e per kWh:
 - US: 376
 - Brazil: 102
 - China: 531

1. Suppose you drive 20 miles each way to work every workday in an average US gas car.
 - (a) How much gas does this use?
 - (b) How much energy does this use? Answer in kWh per person per day. Is this a lot or a little?
 - (c) How much carbon dioxide is emitted by the car in one year? Answer in tons per year. Is this a lot or a little?
2. Suppose you buy a 10kW (nameplate) solar PV system.
 - (a) How much electricity will you generate in one year? Assume a capacity factor of 0.12.
 - (b) Assuming that the solar PV saves 350 grams of emissions for every kWh, how much CO₂ will have been prevented due to your purchase of the solar PV panels?
3. Suppose you have two lights on your desk that you leave on for an average of 2 hours a day. You switch from a compact fluorescent bulbs that draw 14 watts to LEDs that draw 7 watts.
 - (a) About how much energy will you save in one year?
 - (b) How much less CO₂ will be emitted as a result?
 - (c) How far would you have to drive to emit an amount of carbon dioxide equivalent to that which you saved by switching bulbs?