

| PLEASE ROUND ALL ANSWERS UP TO THE SECOND DECIMAL POINT (or two significant digits) | |
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| Ohioans drive an average of approximately 39 miles per day | There are approximately 8,100,000 drivers in Ohio |
| The average fuel economy for vehicles is 20.5 miles per gallon | A car emits approximately 0.01 tons of CO2 per gallon of gas used |
| Step 1 - baseline for the average Ohioan... | |
| 1. How many gallons of fuel does the average Ohioan use per day | 1.90 |
| 2. How many tons of CO2 does the average Ohioan emit per day | 0.0190 |
| Step 2 - baseline for all Ohioans | |
| 3. How many gallons of fuel do all Ohio drivers together use per day | 15,409,000 |
| 4. How many tons of CO2 do all Ohio drivers together emit per day | 154,090 |
| Step 3 - Image all Ohio drivers reduce their driving by an average of 8 miles per day (making us comparable to Pennsylvania) | |
| 5. How many gallons of fuel would the average Ohioan use per day | 1.51 |
| 6. How many tons of CO2 would the average Ohioan emit per day | 0.0151 |
| 7. How many gallons of fuel would all Ohio drivers together use per day | 12,248,000 |
| 8. How many tons of CO2 would all Ohio drivers together emit per day | 122,487 |
| 9. How many fewer gallons would be used if Ohioans reduced their driving? | 3,161,000 |
| 10. How many fewer tons of CO2 would be emitted if Ohioans reduced their driving? | 31,610 |
| Step 4 - Imagine instead Ohioans drive as much as they do in Step 1 (cell B9) but that their cars get 26.4 miles per gallon (average for 2022 gas-powered cars) | |
| 11. How many gallons of fuel would the average Ohioan use per day | 1.48 |
| 12. How many tons of CO2 would the average Ohioan emit per day | 0.0148 |
| 13. How many gallons of fuel would all Ohio drivers together use per day | 11,965,000 |
| 14. How many tons of CO2 would all Ohio drivers together emit per day | 119,650 |
| 15. Compared to Step 2 how many fewer gallons would Ohioans use with more efficient cars? | 3,444,000 |
| 16. Compared to Step 2 how many fewer tons of CO2 would be emitted if Ohioans use more efficient cars? | 34,440 |
| Step 5 - Imagine instead Ohioans drive as much as they do in Step 1 (cell B9) but that everyone buys hybrid cars and get 50 mpg | |
| 17. How many gallons of fuel would the average Ohioan use per day | 0.78 |
| 18. How many tons of CO2 would the average Ohioan emit per day | 0.0078 |
| 19. How many gallons of fuel would all Ohio drivers together use per day | 6,318,000 |
| 20. How many tons of CO2 would all Ohio drivers together emit per day | 63,180 |
| 21. Compared to Step 2 how many fewer gallons would Ohioans use with hybrid cars? | 9,091,000 |
| 22. Compared to Step 2 how many fewer tons of CO2 would be emitted if Ohioans use hybrid cars? | 90,910 |

| Economic Implications | |
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| 23. If gas costs \$3.00/gallon, what are the total private benefits of the most efficient scenario above? | \$27,273,000/day |
| 24. If we use the US EPA figure of \$51/ton for the social cost of carbon, what are the total public benefits of the most efficient scenario? | \$4,536,410/day |
| 25. If we use the proposed value of \$190/ton for the social cost of carbon, what are the total public benefits of the most efficient scenario? | \$17,272,900/day |
| 26. If the difference between a new gas vehicle and it's hybrid counterpart is \$3,000, how long would the owner have to drive it to recoup the extra cost if they only consider private benefits ? (Hint: Easiest calculated in terms of days) | 893 days |
| 27. If the difference between a new gas vehicle and it's hybrid counterpart is \$3,000, how long would they have to drive it to recoup the extra cost if they consider both private and public benefits ? (use \$190 for the SCC) (Hint: Easiest calculated in terms of days) | 547 days |
| 28. Suppose the path to reducing miles driven is commuting by bike. Suppose average bike speed is 10 mph and average driving speed is 40 mph. Using the figures in Step 3, how much would you have to value your time, in \$/hour, for it to be rational to NOT bike, (Hint: The time you would have to spend would need to be worth more than the value of gas saved and the SCC of the carbon saved .) | At \$1.63/h |

29. Acknowledging the fact that we're ignoring discounting, do the payback periods in 26 and 27 seem like reasonable lengths of time in the context of vehicle ownership? Explain. (100-200 words)

Yeah, they do. For those people who have a hard time affording a car in the first place, the up front charge of an additional \$3,000 does seem like a lot, and may not be feasible for many. But, the period of between 2-3 years for that additional investment to pay off seems very reasonable! Most people will own a car for much longer than this period of time, or if they don't, they will sell it and recoup a good sum of money, which would be at a premium from the cheaper car. And, after the payback period, every day more is actually running at a profit compared to the gas vehicle.

30. Why do you think more people don't buy hybrid or electric vehicles? What do you think motivates the people who do? (100-200 words)

I think there are a number of factors that could prevent people from purchasing hybrid or electric vehicles. The upfront extra cost being one, lack of infrastructure like charging stations is another. In addition to this is that there is certainly a culture in the US which encourages large gas vehicles like trucks. I think that some of the people motivated to buy hybrid or electric vehicles are influenced by a perceived positive impact on the environment. I also think that other forms of consumerism influence them, especially the idea of a "luxury vehicle."

31. Do you personally give much thought to the carbon/environmental impacts of how you move (via car, bus, bike or walk)? Why or why not? What are some tradeoffs you consider (or would consider) when you think about this. (100-200 words)

I don't really think about it all that much. I think this is mostly because I feel like my individual actions won't have much influence on the problem itself, and also because I don't really feel like I have much other choice. I can't take public transportation for most things I want to attend at home, so I just get there the only way I usually can, which is to drive myself. I do often think about carpooling, and mostly as a means to save money for myself and friends. I usually am not thinking about the ecological ramifications of the decision, but they are a nice side effect.

32. Looking at the “wage” you got for #28, do you think this helps explain why people choose to bike commute or not? What are some of the costs and benefits we left out of this calculation? (100-200 words)

Yeah, I get it. I think that pretty much everyone values their time over \$2/h. That's why it's really unfortunate that public transport isn't more readily accessible. Some of the other benefits of this is that the biking could serve as a form of exercise in addition to transport, which makes the deal much more appealing. Especially considering the combination of these two important things (transportation and exercise) into the same time frame. A cost we didn't consider with this though is the purchase and maintenance of a bike, as well as accessibility and safety for bikes on nearby roads.