

Natural Science Inquiry

Final Project

Reducing CO emissions in the Portland metro area

Assignment Due Date: Thurs., June 1 (Presentations begin Tues., May 30)

Imagine that we have an additional \$1 billion to invest in transit solutions for the area. Your team has been commissioned to do a study to determine whether this money would be better spent on expanding light-rail or on expanding bus systems, (or on some other alternative, or a combination of alternatives) if the *goal is to minimize emissions which contribute to air pollution*. To keep the project manageable, we'll focus specifically on carbon monoxide (CO) emissions. The quantity we'd like to minimize is the total amount of CO emitted into the air, by all sources involved in powering Portland metro area transportation (i.e. including local auto emissions, bus emissions, and emissions from electric power plants required to run light rail).

As a group, research the available information on transit options, then write a report and design a poster presentation that describes and defends your proposal. The minimum length of the report is 15 pages (typed and double-spaced, not including pictures, graphs, etc.). It is up to your group to decide how the writing of the report will be divided among group members (i.e., all can write equal amounts or one or two can write most of it, while the others do more of the research). The paper will receive a single grade as a complete project, unless a problem arises with a group member not pulling his or her weight. Usually we don't have any serious problems in this area, but please talk to me if a problem arises or if you have concerns about this.

The report will be graded on the clarity of writing (including grammar and spelling), the presentation of your proposal, and the persuasiveness of your arguments to defend it. Present (or refer to) data to support any claims you make and address opposing arguments that could be raised. Identify the uncertainties in the data and don't cover up contrary evidence. Be sure to indicate your references using footnotes or endnotes.

You only need to submit one copy of the report for your group. Please give me both a hard copy, and an electronic version in Adobe Acrobat (pdf) format. Some of the computers on campus have the software to convert your files, or you can do the conversion on-line at <http://cpdf1.adobe.com>.

The format of your poster presentations will be as follows: Half of the groups will present their posters on Tuesday, May 30, and the other half will present on Thursday, June 1. The set up will be like a science fair, in which you display your conclusions and supporting information on a poster board which other class members will walk around to look at and ask questions about. At the beginning of the poster sessions, each group member will have **1 minute** to "advertise" their solution and get the rest of the class interested in what you have to say. This means that a 3-person group has only 3 minutes to argue their case, so choose your words and facts carefully. This is good practice for arguing your point of view in normal conversation, when you often don't have someone's attention for very long.

An outline of your report will be due at the end of the class period on May 23 (Tuesday). The final report will be due on June 1. Presentations will begin during class on May 30.

We will devote most of the rest of the class time to working on this project as a "research community." I don't know the answers either. You're likely to find this frustrating at first, as you try to figure out where to start and what questions to ask and what information to believe. That's always how these projects seem at first, because they are real-life projects. We'll work together to sort out the information, and we'll have small mini-lectures on topics that may emerge as important in the course of your research. Write about the process in your journals, as you go from confusion to being very well-informed on local transit.

On the back of this sheet are some questions that may help you structure your research as you get started.

Links to resources you may find helpful (including some of the reports from last term) can be found at: www.scienceintegration.org/nsi.htm

These are the questions I think you'll need to answer in some way, in order to come to a defensible proposal for minimizing CO emissions. Remember that specific numbers obviously matter - so be critical in interpreting the numbers you find in your research. You will certainly find conflicting claims and information, so try to always ask yourself what the numbers mean and how they were determined.

1) What are the "marginal" CO emissions reductions per passenger mile for moving people out of their cars and into each of the alternatives (light rail or various types of buses)? Use single-occupancy cars (SOVs) as a baseline. I'm assuming all the alternatives are less polluting than cars, and so will result in lower emissions than what we would have with everyone in cars. To do this, you'll need to find good numbers for CO emissions from cars, buses, and electric power plants which power MAX.

2) Estimate riders' behaviours in response to various options- how many people are likely to switch from SOVs to a particular alternative? This takes into account convenience, reliability, etc. (Obviously this will be a crucial, and tricky, thing to estimate.) Once you make estimates for this behaviour, you can multiply the marginal emission reduction for each transit mode by the number of people expected to switch, to get the total emission savings for that alternative.

3) What are the costs for each of the alternatives? This is obviously related to (2), since by spending more we might be able to make a particular transit mode more attractive to people. As much as possible, I want to include **total** costs here - including money from federal grants, capital investment, operating costs, etc. - since this is the real cost to society for choosing that option. One of the things I'm hoping you'll think about is the tradeoffs involved whenever we choose to allocate resources a certain way. What we care about in this case is the bottom-line reduction in CO emissions. Any resources we spend on one means of reducing emission are resources lost for implementing other solutions.

A good point to keep in mind here as you start to form an opinion: try to indicate how expensive that option would have to become before you would change your mind. If we decide, for example, that an expanded light rail system is the best use of our resources, then we ought to be prepared to specify a price (per mile, say) for the light rail expansion at which it would no longer be the best alternative (i.e. for that price, we could implement enough other options to achieve an even greater reduction in pollution). Or, if light rail is not the best option, we ought to be able to specify how much its cost would have to drop before it **would** be the best option.

4) Based on (1), (2) and (3), what is the overall cost per unit of CO emission reduction for each alternative? These numbers and their uncertainties are the information we need in order to make policy decisions.