Editor's Note

Alex Vincent's "Solve with Sustainability" develops an argument in support of a proposal or claim of policy. The question at issue here is of local concern, but the problem the writer defines carries significantly broader potential effects. The argument moves from a definition of the problem to feasible options for solution, including an example of such solutions at work elsewhere, followed by concession of the need for further research in the area, and, finally, detailed suggestions for implementation. Does that organizational pattern work effectively? Note how his evidence is drawn from both local campus resources and expert opinion. The essay begins and ends with a connection to the "big picture," giving the reader necessary context and a reason to care.

Following Vincent's essay you will find documents from his writing process. Compare the final draft to the first draft, prospectus, and outline to get a sense of how this paper grew from conception to execution through several stages of thoughtful revision. At the beginning, Vincent's topic area was broad and global, but in the final draft, he addresses a topic of global concern by offering a detailed proposal for a local solution. His first draft lacks adequate development. Can you see where he expanded his argument from that draft to the outline and final paper? The cover letter submitted with the final revision comments on Vincent's process during this project: the low point of finding himself "knee deep in 200+ page documents," the helpful advice he received from the classmate who reviewed his essay, and the need to revise for his particular audience.

Solve with Sustainability: A Proposal for a Zero-Emission Transit System at Cal Poly

Alex Vincent

The over-population of the World may not be a realistic problem if a recent scientific projection is true. The American Academy of Pediatrics published a report that predicts an increasing number of childhood fatalities due to global warming (American Academy of Pediatrics 1). Forecast increases in the occurrences of natural disasters and illnesses accompanied by decreased availability of food show a bleak future for the population of Earth (American Academy of Pediatrics 1). The human race may have a tough future if people do nothing to help protect the environment from the climate change that has already begun. The problem is how? What can people do? Some institutions and households have switched to

energy-saving technologies. Here at Cal Poly, there is a heavy emphasis on sustainability; so much of one, in fact, that the school's catalog features sustainability on its cover. And though the school has taken steps in the right direction, the university hasn't taken any definite and large-scale leaps at proving Cal Poly a leader in the green campus movement that has been sweeping through American campuses. Yes, many student organizations are making a grass roots effort to bring an environment-friendly message to campus. But this is Cal Poly, one of the top colleges in the nation, and the school can't even reach a silver LEED (Leadership in Energy and Environmental Design, a rating system created by the US Green Building Council, silver being the third greenest rating out of four) rating on the new housing complex? As the Master Plan Committee, the Committee has the power to determine the future steps that Cal Poly will take to improve the campus. To achieve the goals set forth by the Master Plan and prove Cal Poly as a leading sustainable campus, the Master Plan Committee should include renewable energy powered transit in the future plans for Cal Poly.

In 2000, Cal Poly worked with hired advisors and consultants to create the *Master Plan and Environmental Impact Report* that mapped out the needed campus improvements and goals that were to be completed by 2020. One of the major goals of the plan was to create better circulation around campus, so a Master Plan Circulation Group was formed after the plan's completion to suggest improvements by composing the *Master Plan: Circulation Element Suggestions for Implementation*. In chapter 2 of the Report, the main points of the Master Plan relating to circulation were discussed: sustainability, less dependence on cars, more emphasis on pedestrian transportation, and Cal Poly as an example for other campuses. The biggest issue that plagued these goals was that too many students and staff have been relying on cars.

Accident, traffic, parking, and pollution issues all arise from the large amount of personal vehicle use. Table 2.2 from the Master Plan Circulation Group's study shows that the results from a study model developed by compiling surveys from 2001 and 2003 showed that 60% of students and employees of Cal Poly came to and from campus using cars, while only 22% walked and 10% used the bus. On page 108 of the Master Plan, mass transit is emphasized when the report says: "Traffic congestion can be reduced by increasing the number of persons in a vehicle and substituting alternative transportation including public transportation, bicycles, and pedestrians" (Master Plan Circulation Group 72). With the demand for less personal vehicle use, many new changes are planned for the campus.

The proposal in chapter 7.2 of the circulation report describes improvements that the committee can consider as part of future projects. These improvements include expanding the SLO transit system to include two new routes, a two-route shuttle system, an on-call taxi system for educational purposes, a new circulation plan around

campus, more bus stops, and a new and permanent transportation center "in the area of the (expanded) Campus Market" (73; Table 7.2; Exhibit iii; Exhibit 7.5). If adopted, there would be a greater need for new buses to travel the added routes. Alternative fuel powered transit was already discussed in application to the new shuttle service. However, zero-emission transit, powered by electricity or hydrogen, could be used for the entire transit system and successfully achieve sustainability and leadership goals described in the Master Plan.

Technologies are currently available and in use in a handful of major cities that eliminate the majority of bus exhaust, the most popular being electric powered. A well-developed example of an electric powered transit system is located in Santa Barbara. Investing in electric vehicles since 1990, the Santa Barbara Metropolitan Transit District (MTD) has conducted numerous studies on the buses' performance (Master Plan Circulation Group 163). These studies have led to improved technologies. The newest "stingray" buses developed by the Santa Barbara Electric Transportation Institute have more reliable batteries called "zebra" batteries (Master Plan Circulation Group 163). The buses were tested in San Francisco against diesel counterparts and the electric buses "exceeded the diesel buses in power when climbing hills" (Master Plan Circulation Group 164). The San Francisco Municipal Transportation Agency was so impressed with the buses' performance that they ordered 25 for their transit system (Master Plan Circulation Group 164). Better batteries along with new rapid charging stations allow the buses to have very high ranges and little or no maintenance, so even an inexperienced driver could operate the new buses (Master Plan Circulation Group 164).

The introduction of electric buses in Santa Barbara has had an overwhelmingly positive response. Having had issues with rider numbers prior to the implementation of electric buses, the Santa Barbara MTD recorded a "ridership increase fivefold from 200,000 to 1,000,000," within the first year alone (Master Plan Circulation Group 163). After being amazed at the success of the Santa Barbara program, the fall 2003 CE 424 class from Cal Poly visited Santa Barbara to ride the "stingray" and to talk with Paul Griffith from the Santa Barbara Electric Transportation Institute. Mr. Griffith, being one of the buses' designers, gave the class a brief overview of the feasibility of such a system at Cal Poly. The conclusion was that "electric bus use could reduce vehicle traffic and air pollution, and provide a safe, efficient, and fun mode of travel" (Master Plan Circulation Group 164). If this is true, then the electric buses can accomplish all of the committee's circulation goals.

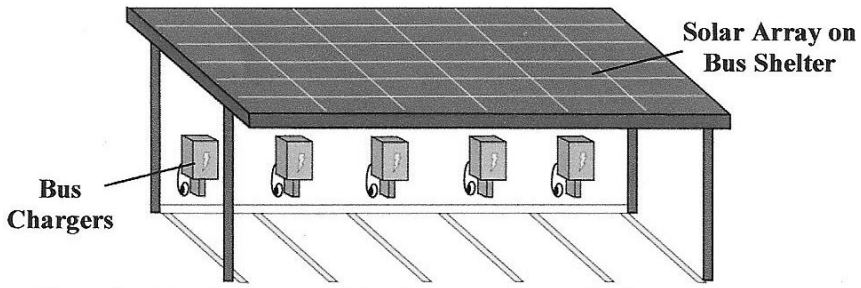
Though electric buses are the most common form of zero-emission transit, hydrogen buses have been looked at more favorably because fuel cell efficiency surpasses the efficiency of batteries. In November 2003, a Cal Poly student from an ENGL 149 class approached the transit administration about replacing the diesel buses on

routes 4 and 5 serving Cal Poly with the stingray buses, but the City Transit Manager preferred that any replacement buses be hydrogen powered (Master Plan Circulation Group 74). Hydrogen buses are powered using a fuel cell and an electric engine. The fuel cell creates electricity by recombining hydrogen with oxygen and producing water. Electricity produced goes directly towards powering the electric engine. Most hydrogen buses have hydrogen stored in a fuel tank, similar to cars today. However, hybrid electric-hydrogen buses have been created that are fueled by water and electricity. Electricity stored in batteries power an on-board electrolyzer that splits water into hydrogen and oxygen. The hydrogen and oxygen are then recombined in a fuel cell that powers an electric engine. Though this system loses efficiency by using batteries, an electric-hydrogen hybrid avoids the difficulty of storing and pumping hydrogen. Either system effectively powers buses and has similar ranges to gasoline counterparts.

Both hydrogen and electric-hydrogen hybrid technologies are very promising, but they have yet to be largely produced or tested. There have been many demonstrations throughout Europe of both technologies, yet none of these small implementations have collected as much substantial research as electric buses. Though a relatively new technology, many projects are in the works to create huge fleets of new hydrogen buses. The biggest hydrogen bus projects are proposed for the next three Olympic Games. China's government has requested a total of one hundred hydrogen, electric, electric-hydrogen, and electric-gasoline buses be created for the Beijing Olympic in 2008 (Air Resources Board 2). The Canadian government has a goal of 15–20 hydrogen buses for the 2010 Olympics and England has 70 hydrogen buses planned for the 2012 Olympics (Air Resources Board 1). With the use of hydrogen transit at these major events, hydrogen bus technology will be better understood.

Hydrogen and electric buses are called zero-emission transit because the buses themselves don't produce any emissions. However, the method of producing the electricity and hydrogen that power the buses often come from fossil fuels. Electric buses in Santa Barbara get their electricity from the local electric utility, Southern California Edison, and the most common way of producing hydrogen from splitting water, electrolysis, is often powered by electricity from fossil fuels (Gleason and Griffith 6). By using power from a local utility to produce fuel, electric and hydrogen buses don't completely solve the issue of fossil fuel dependency.

However, there are other ways of producing the fuel needed to power the buses. When adopting the zero-emission buses, the committee should include renewable energy sources in the Master Plan to produce electricity to power the two bus technologies. No other college campus has a large scale renewable energy powered transit system, so this is an opportunity for Cal Poly to prove itself an innovative university. A widely used renewable energy option, solar power has the potential to power a fleet of electric buses or a hydrogen production plant (see Figures 1 and 2). Photovoltaic panels, made



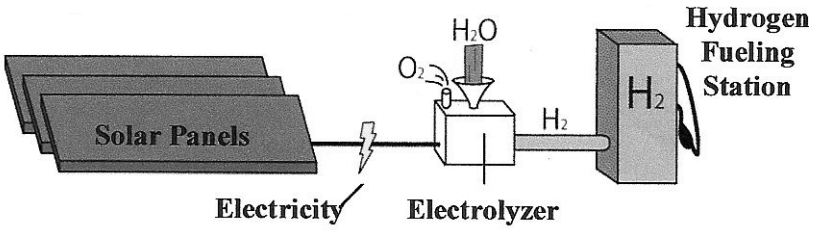
The solar panel array would act as a roof over the buses to protect them from weather as well as produce electricity that can be stored in charging stations located at each parking space. When buses stop at the transit center, they can plug into the chargers and recharge the batteries.

FIGURE 1 Solar Electric

of a silicon-based semi-conductor, use the photons of sunlight to produce electricity. These panels are expensive, but last over twenty-five years and need minimal maintenance. Another option to consider is wind power. The University of Minnesota powers over half of its Morris campus with one turbine (West Central Research and Outreach Center 1). Climbing nearly 230 feet in the air, the 1.65 megawatt turbine has three wind-capturing blades that extend 135 feet and begin producing energy with 7.8 mph winds (West Central Research and Outreach Center 1). A wind turbine of this size would cost less and cover less area compared to the equivalent solar panel system. A combination of wind and solar power can power San Luis Obispo's transit system without emissions and with minimal costs after the system's initial installations.

A feasible plan for implementing renewable transit at Cal Poly in the near future would be to invest in electric buses, which are already well researched, and solar panels (Figure 1). A solar electric system would be relatively easy to install and the bus technologies are better developed compared to hydrogen buses. Easy expansion is another benefit of solar electric system. As the renewable transit system continues to grow popular, wind turbines and a hydrogen production system (Figure 2) will become a better possibility. This way the transit system currently in place could continue to run while slowly adding new electric or hydrogen buses and replacing broken down buses with their zero-emission counterparts.

The committee should strongly consider adopting a renewable energy transit system for Cal Poly's future to not only help the campus's traffic problems, but also to reduce carbon dioxide emissions and, over time, save money. A renewable energy transit system is becoming more economically feasible as wind and solar power systems are getting cheaper while gas prices are continuing to increase. Zero emission bus technologies are also improving in cost and in efficiency. The environmental bene-



The solar panels produce electricity that is used to power an electrolyzer. The electrolyzer takes in water and splits it into either liquid or gaseous hydrogen and oxygen. The hydrogen is then stored and pumped at a fueling station.

FIGURE 2 Solar Hydrogen

fits would be tremendous by reducing the number of personal vehicles at Cal Poly as well as eliminating the fossil fuels used to currently power the transit system. Cal Poly's future would be a lot greener with inclusion of renewable transit on campus. And in the big picture, offsetting fossil fuel use here on campus is a step towards saving the population of Earth from the severe consequences of global warming.

Works Cited

Air Resources Board. "Summary of Demonstration Projects." Zero Emission Buses. California Environmental Protection Agency. October 2, 2007. November 2, 2007. <http://www.arb.ca.gov/msprog/bus/zeb/zeb.htm>.

American Academy of Pediatrics. "Children At Increased Risk From Effects Of Global Climate Change, Report Says." *Science Daily*. 1 November 2007. 6 November 2007 <http://www.sciencedaily.com_ /releases/2007/10/071029121121.htm>.

Gleason, Gary, and Griffith, Paul. *Eight Years of Battery-Electric Bus Operation at the Santa Barbra Metropolitan Transit District*. Santa Barbara Electric Transportation Institute and the Santa Barbara Metropolitan Transit District. 1999.

Master Plan Circulation Group and Jud, Eugene. *Master Plan: Circulation Element Suggestions for Implementation.* December 19, 2001.

Master Plan Committee. *Master Plan and Environmental Impact Report*. Volume 1. March 21, 2001. 3 Volumes.

West Central Research and Outreach Center. University of Minnesota at Morris. "Winds of Change." <http://www.morris.umn.edu/greencampus/WindsOfChange.pdf>.

Alex Vincent is an architecture major.

The next six pages feature Alex Vincent's draft materials.

Alex Vincent
Pinto Eng. 134-24
10/17/07

Research Prospectus for Designated Audience

1. I want to do my paper on the lack of drinking water that may become more severe in the near future. This topic interests me because I don't know whether there is much action that addresses the issue of using up all the drinking water. I think there should be more research on how to avoid a global water shortage when many of the wells and springs begin to be overused and drained.

2. My research questions is should there be more federal funding for research on how to produce more drinking water from currently unusable sources? I will need to approach both scientific data as well as political stances on the issue for it to be successful.

3. My audience is the democratic presidential candidates for the 2008 election. Because I support the democratic party and hope that one of the candidates win the election, I am address them to make sure that if they do become president that they address the issue of water shortage.

a huge issue: can you narrow it down to a more "doable" scope (it's only a 4-6 pg essay, and you want to be able to offer detailed analyses

4. I don't know much about the subject. I do know that Canada has one of the largest supplies of fresh water on Earth. Also, I know that ocean water has too high of a concentration of salt to be purified economically. There are small-scale water purifiers that can purify polluted river and lake water.

As you learn more, perhaps you can find a single aspect of the problem to discuss.

5. I'm going to approach this by first finding data about water shortage and when it will affect the United States. Then I will research current technologies of water purification as well as current federal support of such research. To conclude, I'll see if I can find any expected advances in water purification technologies that may need federal funding to become economically feasible.

looks fine for now

6. Opposing viewpoints may say that it would cost too much or there is no threat of a water shortage. Others may argue that it is the individual citizens' responsibility to buy small purifiers and make their own fresh water.

7. The American government should support research for water purification technologies to guarantee American citizens access to fresh water.

OK for now - later on, you will need a much narrower scope.

4

Alex Vincent
S. Pinto Eng 132-24
10/30/07

5:15
Office Hours
Mrs. PINTO

Outline- Designated Audience Paper

I. Intro
- A. Hook- Perfect world or worst case scenario (too cheesy?)
- B. Background:
  1. Global Warming/ Renewable Technologies
  2. Transportation
  3. Green Campuses
- ✡ C. Thesis- To prove Cal Poly as a Green Campus and help student in the new dorms get to class, the university administration should adopt a system of alternative fuel-based transportation.

II. Body
- A. Global Warming
  1. Changing climate
  2. Melting ice/rising water
  3. Cause —> transportation
  4. Threat to humans + animals
- B. Renewable Technologies
  1. Types
  2. Applications
  3. Relation to transportation
- C. Solar/Electric or Solar/Hydrogen
  1. Describe solar power
  2. Electric engines
  3. Hydrogen fuel cells
  4. Electric vs. Hydrogen
- D. BioFuel
  1. Types
  2. How it works
  3. Benefits
  4. Downsides
- E. Solar vs. BioFuel
  1. Cost
  2. Environmental impact
  3. Best choice
- F. Green Campus
  1. Environmental benefits
  2. Display
  3. Recognition
  4. Other campuses?

III. Conclusion
- -Describe ideal system (imagery), maybe tie to into image (contrast?)
- -Reiterate benefits of system
- -Green Campus
- -Tie finish to hook

This cover letter was included with Alex's final draft.

Alex Vincent

Pinto, Eng 134-24

11/14/07

This paper was tough for me to write because I chose to bite off a lot to try to chew. Having done research papers in the past, I chose a topic like I had before. But in those instances, I had much more time to research and write the paper than I had on the audience paper. I ended up knee deep in 200+ page documents about how to improve the school and little research about hydrogen buses. Though my draft was not complete when I gave it to Renee to peer review it, I was able to take away valuable suggestions on how to make a better, complete draft for my final paper. The biggest thing Renee helped e with was pointing out my lack of audience. She said she was a little confused about who I as addressing because it had broad fact that could pertain to anyone as well as specific terms that only certain groups would understand. Though I realized I need to improve my audience, Renee found the rest of my paper very clear and fluid, which gave a boost of confidence to continue on through the paper. Though the paper lacked in the departments of conclusion and a full body, I was able to use Renee's advice to improve my thesis and better introduce my topic. Now that the paper is complete, I'm feeling good about my body paragraphs because I followed a similar flow to what Renee had read.

This is Alex's first draft.

Interesting Fact

Everyday a new global warming horror story comes on the news, the headlines often predicting an oncoming apocalypse. Though these reports may be a little extreme, the human race may have a tough future if people do nothing to help protect the environment from the climate change that has already begun. The problem is how—what can people do? Some institutions and households have switched to energy-saving technologies. Here at Cal Poly, there is a heavy emphasis on sustainability; so much of one, in fact, that the school's catalog features sustainability on its cover. And though we have taken steps in the right direction, the university hasn't taken any definite and large-scale leaps at proving Cal Poly a leader in the green campus movement that has been sweeping through American campuses. Yes, many student organizations are making a grass roots effort to bring an environment-friendly message to campus. But this is Cal Poly, one of the top colleges in the nation, and the school can't even reach a silver LEED rating on the new housing complex? To make a large positive impact on the environment and become a leading sustainable campus, Cal Poly should work with the town of San Luis Obispo to adopt a zero-emission transit system.

In 2003, Cal Poly worked with hired advisors and consultants to create the Master Plan and Environmental Impact Report that mapped out the needed campus improvements and goals that were to be completed by 2020. One of the major goals of the plan was to create better circulation around campus, so a Master Plan Circulation Group was formed after the plan's completion to suggest improvements by composing the Master Plan: Circulation Element Suggestions for Implementation. In chapter 2 of the report, the main points of the master plan relating to circulation were discussed: sustainability, less dependence on cars, more emphasis on pedestrian transportation, and Cal Poly as an example for other campuses. The biggest issue that plagued these goals was that too many students and staff have been relying on cars.

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