

ENGR0012 – Spring 2007
Programming Assignment 9
Add Section on Sustainability to your Paper

Due: Thursday April 5, 2007

During every Engineering project there comes a time when you are almost done with the project and some type of change becomes necessary. For example, in the construction industry they call this a "Change Order". We are going to assume that you are writing this paper for your job, and after you submit the report to your boss, she tells you that the CEO, her boss, the client, the city council, the EPA or state DNR or some other government requirement, local concern, the investors, the company lawyers, or for some other reason, that you must modify the report to include a section on sustainability and how it impacts the report. Not only does this assignment address real world issues, it also addresses the ABET Engineering accreditation requirement, Criteria 3 that states students must show that they have "(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context" and "(j) a knowledge of contemporary issues". Don't believe me go see for yourself the ABET site is at (<http://www.abet.org>) and the criteria is at:

(<http://www.abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/E001%2006-07%20EAC%20Criteria%202-9-06.pdf>). So what is sustainability?

What is Sustainability?

"You cannot solve a problem by using the same thinking that created it." -*Albert Einstein*

Since the advent of civilization, engineers have sought to alter the environment and shape it in ways that would serve the various needs of society. While our lives today can attest to the success of this endeavor, it has not been without cost. Often times, the alteration of the environment - whether purposeful or unintentional - has led to undesirable consequences. Only in the past several decades have engineers become acutely aware of the consequences of their actions on the environment. As a result, growing public demand has led to various legislative and regulatory actions attempting to minimize the adverse consequences of civilization on the environment. Unfortunately, many of these measures - such as the "no net loss" of wetlands policy and the industrial restrictions placed on various parts of the US classified as air pollution "non-attainment" regions often have negatively impacted growth and development. A seeming contradiction between development and environmental protection exists.

In recent years, however, a realization has developed that both development and environmental protection are necessary and that either need not be sacrificed for the other. A growing movement recognizes that environmental protection can and must co-exist with development and must be planned for accordingly. Under the general umbrella of "sustainability", this movement encompasses various facets. "Green Engineering", "sustainable development", "environmentally conscious manufacturing", and "green construction" are some of the terms recently entering the engineering lexicon that describe the move towards "sustainability". The confusion surrounding sustainability, is each of these terms means different things to different people. Whether constructing a new highway, designing a new product, or improving a manufacturing process, "sustainability" issues are at the forefront of challenges today's engineers must face.

What exactly, is meant by "sustainability"? The 1987 Brundtland Report, prepared for the UN's World Commission on Environment and Development, defines it as "satisfying the needs of the present generation without compromising the ability of future generations to meet their own needs". The 1992 UN Rio Conference on Environment and Development offers a slightly modified version, describing "sustainability" as follows: "the right to development must be fulfilled so as to equitably meet development and environmental needs of present and future generations". Other organizations and individuals propose somewhat different definitions of sustainability. Through all the differing descriptions, however, a common thread remains: "sustainability seeks to minimize our footprint in nature, both now and in the future".

Most issues revolving around sustainability, quite naturally, involve subjects traditionally thought of as environmental. These include conventional environmental engineering topics such as waste minimization, pollution prevention and control, and water/wastewater treatment. A second set of issues revolves around energy/resource conservation. It incorporates such items as recycling, alternative fuel sources, alternative fuel vehicles/mass transportation, and energy

efficiency. A third group of subjects entails items thought of as environmental ecology. This subset comprises areas such as urban forestry, landscaping and biodiversity.

Although most sustainability issues deal with topics affecting the environment in some manner, one facet of sustainability is unique in that it generally has little to do with minimizing our footprint on nature, but deals with subjects commonly referred to as "quality of life" issues. Although sometimes not thought of as "sustainability" per se, "quality of life" concerns often are as important, and in some cases, more than the conventionally defined sustainability topics. What exactly is meant by "quality of life"? An admittedly imperfect definition is that they are issues that make human existence more enjoyable, less burdensome, or life extending. Most medical advances, for example, fall under the "quality of life" definition. These advantages might not impact the environment directly, but often improve human life. Whether it is nano-medicine, nano-probes, new antibiotics, new surgical techniques or new and improved prosthetics, these areas all directly impact the quality of life. Another area of engineering that could be thought of as impacting the "quality of life" is the computer industry. For example, a new piece of software might make it easier to do your taxes, but does not have a direct impact on the environment. There are a large number of other areas that could fall into the "quality of life" definition. Even though these areas do not directly impact the environment, all of the products must be manufactured, or operate in a computer that must be manufactured and have environmental issues involved with their production or use. Thus, they directly affect the quality of life and indirectly impact the environment.

The final area of "sustainability" that must be considered is that of "trade offs" or balancing environmental, societal and economic factors. Sustainability becomes a study in benefits versus cost. . No panacea exists for sustainability. There are no easy, obvious solutions. Each potential answer to a sustainability concern has potential drawbacks. As an example, assume you design a building to reduce energy consumption by using materials and using building practices that reduce the outside air that enters the building. This will reduce the energy use but also reduce the number of air exchanges in the building and could lead to a "sick building syndrome". A second example is the use of alternate energy sources to generate electricity. Wind and hydroelectric power do not produce greenhouse gases as burning fossil fuels do. However, both have other downsides. Areas favorable to wind are also common migratory pathways for certain birds. When a bird meets a metal turbine, the turbine always wins. Similarly, dams required for hydroelectric power often prevent fish from migrating. Economics also plays a part in sustainability. For example, computers and software development benefits the productivity of the average worker. However, the process used in the manufacture of the microchips presents significant environmental challenges. Environmentally friendlier procedures are available but at an added cost. As a final example, assume that an automaker could produce a car that achieves 100 miles/gallon, but costs \$100,000. How many of the cars would be sold?

What is more important? No loss of woodland or more homes and industry? Is energy efficiency more important than indoor air quality - or vice versa? Is it more important to produce clean energy or do the birds and fish take priority? What good is an environmentally safe computer or automobile if no one can afford it? The fact is the population will continue to grow, and energy, food supplies, and habitats will need to keep pace to ensure a consistent and acceptable quality of life. The task for all future engineers will be to balance the quality of life against the environment against the cost to develop the best solution for us and generations that will follow us.

Your task

Your task in this assignment is to include at least a half a page of discussion on how your topic impacts sustainability. You can use any definition for sustainability, however, there should be some form of discussion that deals with the trade off issues of cost versus environment versus quality of life.

In the Fall semester your writing assignments were to write what you felt, your position on a topic, that is the assignments were "creative writing". This semester we have changed the assignments so you are writing a report based on facts, that is "technical writing". This task is asking you to combine these two skills into a section that gives your view on this topic, but it should be supported with some facts. Have fun.