35c Getting to Sustainability: Life Cycle Analysis and Incentives

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People want to move toward a more sustainable world, if the sacrifice is not too great. The first step toward sustainability is to get information on the implications of our decisions: How can we design products and services and choose materials that move the economy toward sustainability? This question is much harder to answer than it may appear. For example, California requires that a proportion of the new cars sold be zero emissions vehicles. That meant battery powered vehicles, which contain large quantities of heavy metals such as lead, cadmium, and nickel. Some nations have been pushing for photovoltaic cells to generate electricity, although the costs are extremely high and the total use of energy and materials is high. To be able to answer what is sustainable, we must conduct a life cycle analysis of a good or service, from the extraction of raw materials through processing the materials, making the product, using the product, and then recycling or disposal at end of life. These analyses have been time consuming and expensive, since they require energy and materials balances for each of the processes involved in making, using, and disposing of the product or service. We have developed a tool, available free at www.eiolca.net, that provides a first approximation of the life cycle of goods and services. An analysis can be done in an hour and is free. Speed is important here since designers don't have the luxury of waiting months, or even weeks for a life cycle analysis to tell them which design and materials are more sustainable.

Having determined which designs and materials are more sustainable, society has to provide incentives to adopt them. The first step is to provide consumers with information on sustainability. Again, this is not straightforward to do. For example, the Corporate Average Fuel Economy standards for automobiles (CAFE) have provided consumers with an estimate of fuel economy for 30 years. However, the test is done in a laboratory and overestimates the fuel economy that consumers will experience in practice. However, we can expect that cars with better fuel economy in the tests will have better fuel economy in practice. Unfortunately, the tests are not done with the air conditioner running on a simulated hot day. When that happens, the automobile is providing almost as much energy to power the air conditional as to turn the wheels. This means that greater fuel economy of cars such as hybrid-electric cars will lose much of their advantage over regular vehicles. Since there vehicles are inherently more expensive to make, the more realistic operating conditions undermine the advantage of the hybrids and should lead to fewer purchases of these vehicles.

In general, Americans are unwilling to pay much of a premium for more sustainable products. For example, a few Americans are willing to pay a premium price for renewable electricity. However, motivating consumers to buy more sustainable products requires that the price of the products be competitive with their less sustainable competitors and that the performance of these products be at least comparable. That could be done by placing a tax on less sustainable products that made them prohibitively expensive. This is unlikely to be acceptable in a democratic, market oriented society. Another approach is to estimate the environmental, sustainability, and other externalities associated with each product, translate these externalities into dollars, and add them to the price of each product. For example, the externality price tacked onto a threatened fish species might raise the price enough to induce consumers to choose another fish. The higher energy content of virgin aluminum would raise its price compared to virgin steel, but both would have considerable saving in recycling them, with aluminum becoming the lower energy material after a certain number of recycles.

In this paper, I present the theory involved in each step and present examples to illustrate the theory.