Today, I'll give a short introduction to how technology might help promote sustainability from a consumer's viewpoint. Last year, the TaSED group focused on technologies for development that could improve the living conditions of people in developing countries. The group also looked at what sustainability meant, and at what the science and practical knowledge needed for designing technologies might involve. For example, we had a couple of sessions looking at "mundane science" and participatory design, using Professor Dan Kammen's work. Today, I thought it might be interesting to switch focus a little to look at actual ideas for how technology can advance sustainability by empowering consumers to demand safer, healthier, and more ecologically sound products. Then, we might be able to discuss just what it means to develop these types of technologies for use in developing countries – and therefore pull out key problems and issues for participatory design, science, and technology.

In the last decade, environmental activists, community groups, and policy-makers have realized that some of the biggest problems are to do with the "distances" between consumers and producers. Consumers are often not able to see how products like food, computers, cars, or toys were harvested or made, or what risks may lurk in these products.

[SLIDE] For example, take the case of food. You buy food at a supermarket, but you don't know where the food comes from because it has passed through so many distributors and processors that it has become untraceable. You can look at the food labels, but they don't tell you much, and nothing if the food comes from inside the US. The structures and processes behind agricultural production are largely invisible to consumers. You can't easily see how farmers produce vegetables, the specifications that retailers insist that farmers use, the ecological impacts of pesticide use, and the life cycle of a cow are not easily seen. So you can't tell if growing the food caused environmental damage, or led to exploitation of poor laborers. You can't tell what's in the food; it could contain pesticides, substances absorbed from the air or earth, or it could be treated with chemicals to make sure that it looks good and lasts long enough on supermarket shelves.

As a result, the feedbacks between people, companies, and governments regarding environmental impacts are weak or absent. People may not transmit information accurately, or may make it up, as you move through the production chain. People can't immediately see the environmental impacts of their everyday actions. They are less able to verify what others have done when

producing goods, or making land use decisions. People may not think of themselves as affected, or believe that they can engage in practical steps.

These problems aren't limited to industrial countries. Many developing countries also experience pervasive risks lurking in their consumer products. It might not seem that consumption and sustainability issues are important in developing countries. After all, it's the consumption of industrial countries that have helped create the world's environmental problems. But we need to remember that there are growing middle classes in India and China, for example, and that consumers in developing countries are even more exposed to ecological and health hazards than in developed countries.

[SLIDE] In India this summer, the Center for Science and Environment did tests on Coca-cola and Pepsi soft drinks for toxic chemicals. The results showed that there were hazardous levels of pesticides present in the drinks. These pesticides were in the water that the soft drink companies used in manufacturing the drinks. Pesticide use in agriculture had contaminated the water. Yet Indians did not know about the presence of the pesticides, nor did they have any ready way to find out. The Indian government has done its own tests and claims that there are no risks in the drinks. But the Indian government has a policy of encouraging foreign investment as a way to pursue development. So it does not want to challenge the large corporations. Similarly, few Indians know about the problems of computer wastes exported to India from America because they are not aware of the toxic substances that PCs contain. PCs have lead, mercury, beryllium, cadmium, and hundreds of other substances. When obsolete computers are recycled in places like New Delhi, workers and residents are exposed to the smoke and particles released by smashing, burning, or bathing in acid the computers. But consumers in the US have had few ways to see what is inside computers, and they can't put pressure on PC manufacturers to design the toxic substances out.

So, how can we overcome the distances between producers and consumers, and promote greater sustainability? One approach, as I said, is to find technological methods of enabling consumers to visualize what is inside products, where the products came from, and how they were made. It hasn't been until recently that we have seen experiments with technology focusing on consumers and the products that they buy and use. In terms of technology aid for sustainability, we have seen many geographical information system projects, especially around the Bay Area. But these aim at enabling communities to manage ecosystems or land resources, which raise quite different issues.

There are no clear signposts on how to do it. I'll give you several examples of how technology is being used, or could be used, to help make the sources and environmental impacts of consumer products more visible to people. These developments are happening in developed countries and use the technological infrastructure that already exists.

There are at least four major ways in which visualization can happen. I won't add a fifth way, ambient displays, because I think Morgan Ames, a stalwart TaSED member, can address this much better with her own work. These ways are: [read from SLIDE]

First, the internet can be used as a tool to collect data from consumers and to map flows of products around the world. A very good example of this is the Lobster Tales website. There is a group based in Maine that tries to support the economic development of fishing communities on the islands. Last year, the group had an idea: it could use the yellow bands that are put on lobster claws to track where lobsters are sold and eaten, and at the same time, educate consumers about who caught the lobsters. People are asked to log on at the Lobster Tales website and enter the band number, the date and location of their eating the lobster, and a few other details. They can then use the band number to see the fisherman who caught the lobster and the boat that was used. In reverse, fishermen can find out for themselves the destinations of their lobsters around the US, and feel connected to their markets. It's a very limited system, but it gives you ideas for further development.

PAUSE TO SHOW HOW THE LOBSTER TALES WEBSITE WORKS.

Second, electronic systems can be created to track the flows of foods and products from where they were harvested or produced. In Europe, these systems are becoming more important because there are new European laws that require meats and fishes to be traced back to their origins. Europeans are very aware of food safety problems, such as the "mad cow" disease, or BSE, that eating beef can transmit to humans.

One example is the Tracefish approach. This is an attempt by some European seafood industry people to set up standards for how fish can be traced from the sea to the dinner table. [SLIDE] This slide shows a typical production chain for seafood in Britain; you can see that it's very complex and opaque. No-one really knows how it works, not even the seafood companies

involved. So it is easy for seafood health risks to slip through the system. Consumers don't know if the seafood was harvested responsibly. Tracefish is a voluntary group that argues: "Not only do we need to be able to physically trace the products, but also we need to know their production history – who was responsible for them, what they are made of, and what has happened to them." In the system that they envisage, each unit of food will be given a unique identifier. Data will be recorded electronically – not in paperwork as was the case before – at each point in the production chain: boat, wharfside, processor, distributor, and retailer. If the system goes ahead, a massive amount of data will have to be collected and recorded, which would be impossible without electronic support. This is all about food safety. But it can also be used to promote sustainability. If consumers are able to trace their seafood back to at least the area and harvesting boat, they can demand that fishermen use sustainable methods to catch seafood.

PAUSE TO SHOW THE TRACEFISH WEBSITE.

Third, electronic tools can be built to enable consumers to see where their products came from, or what the environmental impacts of production are. It's already possible to download data wirelessly on PDAs, to give the background on wine bottles that you are thinking of buying in the shop. That's if the shop offers wireless connections, which most shops don't.

James Patten – a doctoral student at the Media Lab at MIT – announced last August that he had made a new device called the Corporate Fallout Detector. It's a very primitive system but it is interesting to look at. The system has a bar code reader, a built-in database of environmental pollution and corporate ethics complaints, and a sound emitter inside an old computer casing. As you can see, it's a very handsome technology. It's not wirelessly connected to anything so its access to data is very limited. But you can take the device to the supermarket and read product bar codes; the device can emit sounds, increasing in pitch and intensity according to how "evil" the producer is judged by the database to be. It is cumbersome, but the concept can be developed much more. For now, bar codes are ubiquitous and easily used to identify who made a product.

PAUSE TO SHOW THE PATTEN WEBSITE AND PLAY THE VIDEO.

RFID, or radio frequency identification, technology is probably a much better approach in the long run. That is, you put a tiny radio-equipped chip in each product, or even product part, that lets you use a wireless device – like a PDA or a Tablet PC – to extract the identification number

and then "talk with" various databases to build a profile of the product that you can read on the screen. There is a research center, the Auto-ID Center, based at MIT that is trying to build the standards for a universal RFID system. As you can see, its ambitions are very big: "Put a tag on a can or axle and suddenly a computer can see it. Put tags on every can, every car axle, and suddenly the world changes. … No more guessing how much is in the supply chain." The system is supposed to improve industry's cost performance, but it could also help promote sustainability by reducing product wastage and helping consumers track products. However, sustainability does not seem to be part of the standards. Also, there are huge concerns with privacy and control over consumer data. RFID could be abused in many ways to impose controls over consumers.

PAUSE TO SHOW THE AUTO-ID WEBSITE.

Finally, interactive tools can be created to let people generate their own risk assessments, or at the very least to see what the risks might be.

An interesting example is the body burden report of the Environmental Working Group that was released this summer. "Body burden" means the amount of chemicals that you find in people's bodies. This is a much better measure of the actual risks of exposure to chemicals than trying to measure how much chemicals are found in the environment. But chemical companies don't like this method because it's very threatening to their way of doing business. Up till the late 1990s, there were few scientific tests that could be used to find out what chemicals existed in bodies without being invasive. Now you can look at blood, saliva, breath, and other body fluids. There is a growing range of information on the body burdens of Americans. The Environmental Working Group did a study of nine people this summer and you can see the results on their website. You can click on each individual to generate a profile of the chemicals found in his or her body, and more importantly the products that these chemicals may have come from. You can get a list of products and their manufacturers to get a glimpse into where body burdens come from. If you are interested, you can provide input in an interactive on-line questionnaire as to the products that you use, like cosmetics, shampoos, synthetic clothes, and cleaning agents. The questionnaire can then generate a list of the chemicals that you may have been exposed to. This website is only a very early, limited version of what might be developed eventually.

PAUSE TO SHOW THE BODY BURDEN WEBSITE.

But there are lots of issues that come out of these developments. I'll leave the details to discussion later. For now, let me ask:

How are the developments applicable or relevant to developing countries? If the technologies require lots of information gathering, databases, and equipment, they may not be so workable in developing countries. Some developing countries are already moving to widespread use of cell phones and mobile technology, which would facilitate the growth of indigenous initiatives. India has a number of very active, technically savvy environmental and consumer groups who could set up their own projects. However, there are many financial, technical, political, and institutional obstacles in the way. All of the systems that I discussed depend on the availability of basic information about environmental conditions, corporations, and governments. But this data is often not available in developing countries – nor in industrial countries. In other words, the freedom of information is a key precondition for building the systems.

What does technology mean? It's important not to assume that all relevant technology is always "information technology". As we saw with the device that James Patten created, the technology can be based on engineering materials, without having to be exclusively information technology-based. An important problem is: Can non-IT approaches be developed to support consumers in developing countries? For example, the technologies that I've described depend greatly on literacy and text, but illiteracy and different languages are much more prevalent in many developing countries. It may be better to develop approaches that don't rely so much on technology, but on social networks and everyday methods of representing information. If so, what is the place of technology?

Other questions that we can ask include:

What is the role of mundane science in shaping technology design that reflects the conditions of developing countries?

Will these developments really empower poor people, or strengthen corporate power?

If the developments are appropriate for developing countries, who is going to design the technology? Are participatory approaches going to be used?