Is it Really Green, or Just Marketing?

What can your humble dishwasher tell you about being green? Once considered an extravagance of electricity and hot water, can a dishwasher point the way to sustainability? Enter the laboratory of **Dr. Delcie Durham**, professor of mechanical engineering, for an applied lesson in cutting through the, ah, grease and getting down to the shine.

Three issues determine if a product or system is sustainable: societal, cost/economics and environmental impact.

The societal factor ranges from meeting the needs of developing countries to what is marketable and what will sell in a given society. "Sustainability is always collaborative across many disciplines and expectations. It involves public health, anthropology, sociology and other's feedback that I cannot do without," states Dr Durham. "Sustainability is always transdisciplinary."

"I look at the cost and environmental impact. What I choose to use in terms of materials and processes to *produce* a product, and what kind of resources are going to be *used* while the product is used, and then what is going to happen at the *end-of-life* with the materials in that product. This is the total product lifecycle. The impact and costs are associated with material, energy, water and waste." For the metals in our dishwasher, databases now provide embedded *environmental costs* for every pound of steel, aluminum, copper and lead. Not only the dollar cost, but the environmental costs to mine, refine and mill the metals.

The next generation of databases will provide process information. What are the ramifications of coating the steel with porcelain? Coating the trays with plastic? In the future we will have both the imbedded cost for the steel and the additional environmental costs for coating the interior with porcelain or plastic or other materials. This is the core concept of sustainability, knowing entire environmental impact of raw materials, manufacturing processes and distribution.

Manufacturers claim that costs will go up. Dr. Durham responds, "For those who are changing, this is a win/win situation, the triple bottom line" (accounting for ecological and social performance in addition to financial performance). For example, waste. Not only do sustainability practices reduce waste, they reduce the actual monetary cost of disposing of that waste. And some company's waste can be transformed into feedstock for other another industry, sometimes at great profit. And if you do "go green" you market that and take it to the bank.

Now we can determine the environmental issues in manufacturing our dishwasher, but what about the energy and water consumption during the use of the appliance? "This is where sustainability is creeping into thinking about the dishwasher", says Dr. Durham. The evidence is the bright yellow EPA Energy Star sticker. The cost associated with running a new appliance is now readily available to every consumer. In addition, engineers use the concept of "exergy" when evaluating a product for energy efficiency. Exergy can be thought of as "useful work." The engineer knows that heat is useful to run the dishwasher, so how do I eliminate useless heat loss? Exergy also involves something as basic as knowing when to stop washing dishes. Does your old dishwasher always work for 30 minutes, regardless of the fact that the dishes were probably clean in half that time?

Wait, that means my dishwasher has to "know" when the dishes are clean. This concept is called "resources on demand" and involves sensors or devices that can determine when to shorten or lengthen a given task. One

dishwasher that Dr. Durham's team investigated had this sensor. However, that unit cost three times the price of the average dishwasher. It was, however, the most efficient over the total life cycle.

So now your older dishwasher has washed its last load. Sustainability looks at the total lifecycle of the dishwasher, how much can be recycled, reused, or needs to be landfilled. This is called "end-of-life." Obviously the steel parts are candidates for recycling, but are you going to dismantle it? (Well, maybe you have already tried this). If it was designed to be recycled in the first place, the manufacturer might be very happy to collect several hundred pounds of quality steel. (In some countries, recycling is the responsibility of the manufacturer, known as "take-back" laws.) In a truly green product, end-of-life is designed into the product, not into the dump.

In addition to the three issues of societal, economics and environmental impact, the concept of sustainability also involves evaluating existing models and redesigning selected components. Ideally, for every product there would be a set of rules, or blueprint that incorporates sustainability from start to finish.

So, load up your current white, black or stainless steel dishwasher and press "Start" because someday it will be green.