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**Citizen's Guide
to Clean Production**

By Beverley Thorpe
Produced for the Clean Production Network
In collaboration with the Center for Clean Products and Clean Technologies,
University of Tennessee Knoxville and the Lowell Center for Sustainable Production ,
University of Massachusetts Lowell
August, 1999

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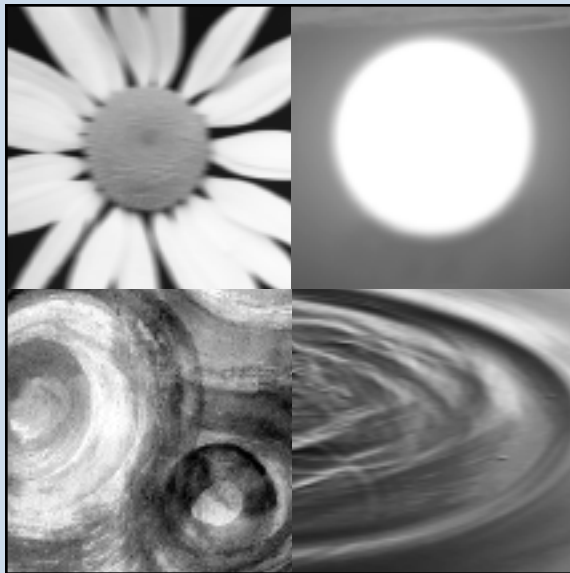
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Citizen's Guide to Clean Production



by Beverley Thorpe

C L E A N P R O D U C T I O N N E T W O R K

Citizen's Guide to Clean Production

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A c k n o w l e d g e m e n t

This guide is the result of 10 years of information gathering and creative brainstorming with many inspiring people — all listed in the Clean Production contact list. In particular, I would like to thank the Greenpeace toxics campaign for allowing many of these concepts years ago to first germinate; my colleagues in Clean Production Action who are all a constant source of inspiration; and the Clean Production Network for allowing this Guide to see the light of day.

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CITIZEN'S GUIDE TO CLEAN PRODUCTION Produced for the Clean Production Network

First Edition August, 1999

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Contents

1	INTRODUCTION	
3	PART I. OVERVIEW OF CLEAN PRODUCTION	
<hr/>		
3	A. WHAT IS CLEAN PRODUCTION?	
	4 / The Four Principles of Clean Production	
	5 / Clean Production Criteria	
6	B. TEN REASONS TO PROMOTE CLEAN PRODUCTION	
8	C. SIMILAR CONCEPTS AND INITIATIVES	
	8 / UNEP Cleaner Production Program	
	9 / The Natural Step	
	9 / World Business Council for Sustainable Development: Eco-Efficiency	
	10 / Business: Industrial Ecology	
	10 / Ecological Engineers: Ecotechnology	
	11 / U.S. EPA's Pollution Prevention/Design for Environment	
	11 / Some European Countries: Factor 4/Factor 10	
	11 / Some Designers: Clean Textiles	
13	PART II. STRATEGIES TO PROMOTE CLEAN PRODUCTION	
<hr/>		
13	A. MEASURING AND REDUCING RESOURCE USE	
	13 / Ecological Footprint	
	13 / MIPS and Ecological Rucksacks	
	13 / What You Can Do	
	14 / Backcasting	
15	B. EXERCISING THE RIGHT TO KNOW	
	15 / Tracking Chemical Use in Products	
	16 / Expanding Beyond Chemicals: Examining the Product Life Cycle	
	17 / Life Cycle Assessments (LCAs): From Cradle to Grave	
	20 / What you can do—what to look for in LCAs	
	20 / A Breakthrough: Environmental Product Declarations	
	21 / What about Eco-labels?	
	21 / Product Labeling	
22	C. HOLDING PRODUCERS RESPONSIBLE	
	22 / Corporate Reporting: CERES	
	23 / Supplier Responsibility	
	23 / Retailer Responsibility	
	24 / Social Responsibility	
	24 / SA 8000	
	25 / What you can do—questions to ask producers	
26	D. EXTENDED PRODUCER RESPONSIBILITY	
	26 / The Range of Responsibilities	
	27 / What you can do—questions on take-back	
	27 / Going Beyond Recycling	
	27 / EPR—Progress to Date	
	28 / Some Product Take-back Schemes	
	30 / How Can EPR Promote Cleaner Product Design?	
31	E. ARE THERE EPR INITIATIVES IN THE U.S.?	
	31 / Car Waste	
	31 / Battery Take-Back	
	32 / A U.S. Town Resolution on EPR	
	33 / What you can do	
33	F. FINANCING SUSTAINABILITY	
	33 / Increasing Pollution Charges	
	34 / Removing Tax Breaks to Polluting Industries	
	34 / Removing Subsidies to Polluting Industries	
	35 / What you can do	
36	G. CAN WE REDUCE OUR CONSUMPTION?	
	36 / Selling the Service—Not the Product	
37	H. CONCLUSION	
39	Part III. RESOURCES	
<hr/>		
39	REFERENCES USED IN THIS GUIDE	
43	GLOSSARY OF CLEAN PRODUCTION TERMS	
47	CLEAN PRODUCTION CONTACT LIST	

Introduction

[*“Clean production” is a new way of producing products and services to help reverse our current destructive production and consumption practices.*]

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The following guide will examine some key concepts and strategies and offer ways that individuals and groups can help move production and consumption toward a safe, sustainable future. It is not meant to be a detailed hands-on manual, but we hope the examples given and resources listed will empower citizens to take action.

This guide is meant for consumers, taxpayers, retailers, local authorities, labor organizations, producers, and planners; in other words, all of us along the chain of production—both makers and buyers.

The guide was developed to provide background, tools, and support for environmental and other advocates looking for a new, proactive way to campaign for change. The need for such a guide was enthusiastically supported by advocates participating in the University-Public Interest Partnership for Clean Production. The Partnership has been a two-year project among the Center for Clean Products at the University of Tennessee Knoxville, the Lowell Center for Center Production at the University of Massachusetts Lowell, and environmental, environmental justice, consumer, and labor organizations. The Partnership is now developing into a Clean Production Network that includes activists and university researchers throughout North America.

This is the first edition of the Citizen’s Guide to Clean Production. We hope to update it regularly as we collect information on clean production activities and campaigns in the U.S. and abroad. We hope that you will send us information on your clean production campaign strategies, models, and successes to include in future versions of this guide. If you have questions or comments on the guide, please contact Beverley Thorpe of Clean Production Action.

1

Overview and History of Clean Production

A WHAT IS CLEAN PRODUCTION?

Clean production is not just about producing things in factories in a cleaner way. Instead it is a holistic way of looking at how design and consumption of products is causing severe ecological problems. Clean production offers ways to reverse our current nonsustainable use of materials and energy. Clean production promotes renewable energy and materials and sustainable product design, which means non-toxic products and processes. More importantly, it protects biological and cultural diversity while encouraging an approach to production and consumption that is precautionary, preventive, and democratic.

*Clean production is rooted within **circular** concepts of **product life cycle**. It*

- questions the need for products in the first place
- takes a precautionary approach to material selection and system and product design
- designs products for durability and reuse
- minimizes the use of renewable energy, water, and raw materials
- uses safer or non-toxic inputs in production processes
- recirculates ecologically safe materials
- reduces consumption in current material-intensive economies while maintaining quality of life and materials
- assures sustainable work
- protects biological and social diversity

Clean production ultimately means the use of renewable energy and materials, the minimal use of resources, the design of sustainable products, the production of food in a sustainable way, and the generation of waste that is benign and returnable into the production process.

Clean production begins with a comprehensive look at the way material flows in society. In particular it looks at the product chain: where raw materials come from, how and where they are processed, what wastes are generated along the product chain, what products are made from the materials, and what happens to these products during their use and at the end of their commercial life.

It also questions the need for the product itself. Often the service that the product provides can be supplied by other means, that are cleaner, safer, and consume less materials and energy.

For example, one-use aluminum beverage cans—even if they are recycled—use a great deal of energy and displace tons of minerals in bauxite mining compared to refillable glass bottles that are reused on a local basis. Similarly, good, reliable public transportation is more efficient than cars because it moves more people with the same amount of resources and energy. We can redesign our systems of habitation to be even more effective. We can design cities and towns to incorporate a mix of residential, commercial, and retail service and reduce the need to move between suburb and city every day.

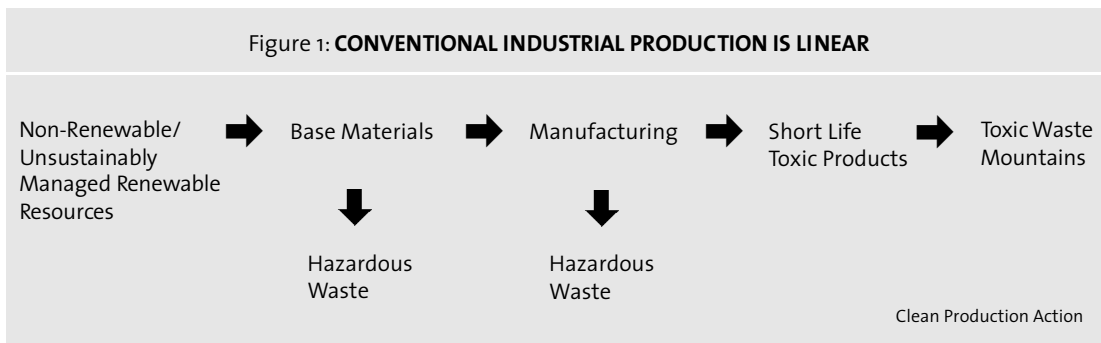


Figure 2: **CLEAN PRODUCTION IS BASED ON A CIRCULAR VISION FOR THE ECONOMY**



Clean production goes even beyond “pollution prevention,” which traditionally advocates reducing toxic materials at their source in manufacturing processes. Pollution prevention was, in turn, an advancement over “end-of-pipe” controls and other disposal technologies such as incinerators. End-of-pipe measures did not solve the problem of waste generation; rather, they only moved the hazard from one environmental medium to another. For example, in the case of incinerators, hazardous waste and garbage is collected from manufacturing processes and households. The wastes are then burned, polluting the air and water. Contaminants become concentrated in ash, which has to be buried in landfills—or, in some countries, such as the Netherlands, it may be used for road construction. But this is not a final solution: landfills will leak and road surfaces will disintegrate.

The pollution prevention approach has made manufacturing processes less toxic and more efficient but clean production takes a more holistic, systems view of production. Clean production has now been advocated in many international forums such as the OSPAR (Oslo-Paris) Convention for the Northeast Atlantic, the North Sea Declaration, and the Barcelona Convention for the Mediterranean Region.

The Four Principles of Clean Production

According to various definitions developed over the years, four main elements make up the concept of clean production:

The Precautionary Principle

The 1998 Wingspread Statement on the Precautionary Principle defines the principle in this way: “When an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause-and-effect relationships are not fully established scientifically.” Under this principle, the burden is on proponents of an activity to prove there is no safer way to proceed, rather than on victims or potential victims of the activity to prove it will be harmful.

The Preventive Principle

It is cheaper and more effective to prevent environmental damage than to attempt to manage or “cure” it. Prevention requires examining the entire product life cycle, from raw-material extraction to ultimate disposal. It encourages the exploration of safer alternatives and the development of cleaner products and technologies. For example, prevention requires changes in processes and products—designing non-toxic products from materials that can be safely recycled or composted—in order to avoid the generation of waste that is incinerated.

The Democratic Principle

Clean production involves all those affected by industrial activities, including workers, consumers, and communities. Access to information and involvement in decision-making, coupled with power and resources, will help to ensure democratic control. Clean production can only be implemented with the full involve-

ment of workers and consumers within the product chain.

The Holistic Principle

Society must adopt an integrated approach to environmental resource use and consumption. We need to think in terms of systems. For each product we buy, we need to have access to information about the materials, energy, and people involved in making it. Access to this information would help build alliances for sustainable production and consumption. We must also take a holistic approach so that we do not create new problems while addressing old ones (e.g. replacing pesticides with genetically engineered plants) or shift the risk from one sector to another.

Example: Implementing the precautionary and preventive principles: banning softeners in soft vinyl plastic baby toys

Concern about the use of chemical softeners called phthalates in vinyl (polyvinyl chloride or PVC) baby toys has stirred an international debate among toy manufacturers, con-

sumers, and governments. Evidence about the safety or danger of phthalates, which can leach into babies' mouths, is still being collected and debated. Meanwhile, some countries such as Denmark, Sweden, the Netherlands, Greece, Austria, France, and Germany have taken their own initiatives based on the precautionary principle and banned the use of phthalates in soft baby toys. As the Danish Environment Minister stated in response to legal action by the toy industry: "The scientific proof will unfortunately only be available when the damage is done, and there is real solid basis for concern in this case." Consumer groups note that the banning of phthalates alone will not address the development of new softeners which might be hazardous or address the dangers of the PVC life cycle. They have called for vinyl to be phased out in children's toys (see description of PVC as a clean production campaign, below).

CLEAN PRODUCTION CRITERIA

Clean production systems for food and manufactured products are

- Nontoxic;
- Energy efficient.

They may be made

- Using renewable materials which are routinely replenished and extracted in a manner that maintains the viability of the ecosystem and community from which they were taken; or
- From non-renewable materials previously extracted but able to be reprocessed in an energy-efficient and non-toxic manner.

The products are

- Durable and reusable;
- Easy to dismantle, repair, and rebuild;
- Minimally and appropriately packaged for distribution using reusable or recycled and recyclable materials; or
- Compostable at the end of their life.

Above all, clean production systems

- Are non-polluting throughout their entire life cycle;
- Preserve diversity in nature and culture;
- Support the ability of future generations to meet their own needs.

The life cycle includes

- The product/technology design phase;
- The raw material selection and production phase;
- The product manufacture and assembly phase;
- The consumer use of the product phase;
- The management of the materials at the end of the useful life of the product.

TEN REASONS TO PROMOTE CLEAN PRODUCTION

North American production systems are inefficient, and our consumption is not sustainable. North Americans consume more resources than any other population on earth. Each American consumes about 23 times more goods and services than the average Third World citizen. The excessive consumption levels characteristic of Americans depend on the import of natural resources from other countries. Overall, America's material and energy efficiency is not more than 1 or 2 percent. In other words, American industry uses as much as 100 times more material and energy as theoretically required to deliver consumer services. Despite this, government agencies and businesses measure progress by the number of products produced and consumed by citizens.

The danger is to ourselves, our children, and our environment. It is compounded by the fact that governments, businesses, and advertisers globally push our present production and consumption model as progress to the rest of the world's citizens.

This situation presents important reasons for citizens and citizen groups to promote clean production. Clean production is a useful tool for campaigning for fundamental changes in environmental and public health protection efforts.

1. Our own resources are being depleted, poisoned, and wasted.

- *Water.* The U.S. is consuming its water at an unsustainable rate. Our consumption of water is 25% higher than the ability of groundwater or rivers to replenish themselves. In some locations like the Midwest Ogallala aquifer, annual consumption is 130% to 160% above replacement. If this continues, this vast aquifer is expected to run out in less than 40 years.
- *Soil loss.* Two hundred years ago, most cropland in the U.S. contained at least 21 inches of topsoil. Today the country has lost nearly one third of its prime topsoil—almost 7 billion tons—mostly due to overgrazing and overproduction of feed crops. It has been estimated that each pound of feedlot beefsteak costs about 34 pounds of eroded topsoil. It takes from 200 to 1,000 years to naturally produce an inch of topsoil.

- *Pesticides.* Pesticide use in the U.S. has grown 33-fold, yet crop losses to pests continue to increase. While the use of insecticides on corn was increasing 1,000-fold, corn losses to insects rose nearly 4-fold. Pesticide use has increased because agriculture is based on energy- and capital-intensive monocultures, or uniform crops.
- *Meat.* Our current practices of meat production and consumption are environmentally destructive, providing an inefficient source of nutrition. It takes about five to ten times more energy to produce meat than it does to produce grain that has equivalent food energy. About seven pounds of grain are needed to produce one pound of pork. The waste from industrial meat production generates nitrates and nutrients which pollute our rivers and groundwater.

U.S. citizens consume more meat than any other country—247 pounds of meat per person per year—giving average Americans almost 40 percent of their calories from fat and twice as much protein as they need. Lowering fat consumption to 15 percent of calories could prevent many cases of diseases of affluence such as heart disease, diabetes, and certain cancers.

2. Our waste generation continues to increase.

We are far better at making waste than making products. For every 100 pounds of product we manufacture in the United States, we create at least 3,200 pounds of waste. Only six percent of the materials we extract each year from the Earth becomes durable goods; the other 94 percent is converted into waste within a few months of being extracted.

Municipal solid waste production per capita in the U.S. increased from 2.7 pounds per day in 1965 to 4.0 pounds per day in 1988. The U.S. and Canada have the highest per capita rates of waste generation in the world. These wastes eventually land in landfills, where they cause hazardous leachate, or in incinerators which generate toxic ash and emissions.

3. Most of our chemicals are unregulated.

The incidence of reproductive cancers is on the rise in the U.S. Breast cancer used to affect one in 20 women in the 1960s. This has now risen to one in eight. Our production and use of known carcinogenic chemicals

continues in agriculture and manufacturing. Less than two percent of all 600,000 chemicals in commercial use have been adequately tested, yet we license up to 1,000 new chemicals every year. Recent reports by the EPA and the Environmental Defense Fund have demonstrated that we have adequate information to assess hazards for less than ten percent of even the largest production-volume chemicals in commerce (those produced in volumes of over 1 million pounds per year). We lack any toxicological data at all for more than forty percent. Yet these chemicals are still “permitted” to be released and incorporated into products.

4. Our transportation systems need radical rethinking.

Americans drive two trillion miles every year creating smog and acid rain, adding 2.2 billion metric tons of carbon dioxide to the atmosphere, and accelerating the risk of global climate change. The economic side effects of our petroleum-based transportation system loom over us, too: trade imbalances and defense expenditures grow alongside our appetite for imported oil, which cost \$60 billion in 1990 but is projected to top \$200 billion by 2010.

5. We offer a dangerous production and consumption model for the rest of the world.

Achieving the U.S. model of production and consumption is not only unwise but impossible for the rest of the world, based both on projections of future resource availability and population growth. If everybody lived like today's North American, it would take at least two additional planet Earths to produce the resources, absorb the wastes, and otherwise maintain life support. We urgently need to reduce our use of materials and energy if we are to sustain ourselves and others in the future. It is an issue of global social equity. Obviously not every individual consumes the same amount in North America, but the collective use of toxic materials and depletion of resources affects us all.

6. Products themselves often pose the biggest toxic threat.

In many cases the environmental releases from products can be larger and more dangerous than those from the associated industrial processes. For example, mercury, lead, calcium, chromium, and nickel mostly end up in products, not industrial wastes. In 1990 at least 55 to 99 percent of industrial inputs of these five

heavy metals were used in products. While some of these products are recovered and recycled, much of the heavy metal content of products is released into the environment (e.g. in paints and coatings) or enters landfills and incinerators (e.g. in plastics). Similarly, a large percentage of persistent and bioaccumulative chemicals (those that stay in the environment for long periods of time and accumulate in our bodies) are used in products, where they are emitted throughout the world without any control. Concern about the environmental release of these substances from products is the reason why some countries like Sweden have announced intentions to phase them out of production.

7. We are all involved in the product chain as workers, consumers, and taxpayers.

We can direct our collective forces to a more sustainable and just production and consumption system. Market surveys show that increasing numbers of American shoppers are sensitive to the health and safety aspects of retail products and would pay more attention to the environmental impacts if they knew them. Northern European citizens have demonstrated strong environmental preferences for years. Many Americans may be getting their largest doses of toxic exposure from the products that they buy and use daily.

Workers are employed to produce and provide products and services. Lobbying to reduce the environmental impacts of production technologies could be linked to labor or workplace campaigns to reduce the physical or chemical hazards of those technologies. Organizing to change products could have significant impacts on the workers who make those products. Canadian auto workers' initiative to promote “Just Transition” concepts has grown from a recognition that reductions in chlorine use could have severe impacts on the job security of rank and file members. Extending environmental protection campaigns to production and products, and lobbying for financial reform such as ecological tax reform, could promote alliances between labor and consumers.

A focus on production and products could offer a bridge between conventional environmentalists and environmental justice advocates. Toxic products and materials are first extracted and manufactured somewhere—often in Third World countries, where worker health and environmental protection are neglected, or

in communities of low income and social inequity. Building alliances along the product chain and demanding clean product design and manufacture will promote international social equity.

8. We need to set the agenda and push for what we want—not just for what we don't want.

The environmental movement has been criticized for being defensive and opposing all development. Groups sometimes spend much of their time fighting for cleanup of hazardous sites and problems, without advocating what they want instead. The concept of clean production has been developed mainly by academic scientists, industry representatives, and government officials to the exclusion of the public. Clean production, however, offers an opportunity for advocates to focus on proactive, innovative policies for change rather than fighting each potentially dangerous proposal that comes up. Advocates need to be defining clean production if the concept is not to be co-opted by those who might use it to continue potentially damaging activities.

A focus on safe and sound products can strengthen the market for alternative products such as organic foods and fibers, low-impact appliances, solar energy technologies, and bio-based materials. This can divide some manufacturers and retailers from material suppliers, equipment vendors, and other manufacturers who resist environmentally friendly and socially just production. Producer responsibility and clean products will only increase with consumer demand for them.

9. Clean production supports local and regional production systems.

Energy efficiency and closed material loops, which are crucial to clean production, are often best attained at the local level. This has major implications for work security and community cohesion. Clean production also supports social diversity and the different ways communities can achieve sustainable consumption and production. Clean production often uses traditional ideas and makes them more efficient in a sound ecological way.

For instance, organic food is a clean product because it uses no toxic inputs and generates waste that is fed back onto the land through composting. It follows a closed, clean material cycle. But the type of organic food and the way of producing it will differ from region

to region. We can say the same about different modes of transportation, housing design, and packaging materials.

10. Building international solidarity will increase corporate accountability.

Keeping corporate operations accountable will require coordinated, international organizing initiatives. Corporations may try to evade environmental, health, or workplace rights by moving about in capital and trade markets. But this also makes them vulnerable to local mobilizations. The strength of the local is magnified by international networking and support. The Internet provides a valuable tool for building international awareness and for mobilization. American activists have been less well informed about international treaty negotiations and the negotiating policies of the U.S. government than they could be. Promoting the concepts of clean production among American activists would increase solidarity with international environmental movements working toward the same goal.

SIMILAR CONCEPTS AND INITIATIVES

A **glossary** of clean production terms is provided as an appendix to this report as well as a **clean production contact list** with contact information for various organizations throughout the world promoting clean production. Below we provide a list of only some players involved in promoting their vision of clean production.

UNEP Cleaner Production Program

The United Nations Environment Program has a Cleaner Production Program (UNEP CPP) which networks national cleaner production centers around the world. The UNEP CPP provides an information database of international case studies, working groups focused on specific industrial sectors and products, ongoing conferences, and consulting services. Its workgroup on Sustainable Product Design (see contact list) gives many examples of indigenous product design as well as new industrial designs.

UNEP uses the term “cleaner” to reflect the need for constant improvement. Its official international definition of cleaner production is the following:

Cleaner production means the continuous application of an integrated preventive environmental strategy to processes and products to reduce risks to humans and the environment.

- For production processes cleaner production includes conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes before they leave a process.
- For products the strategy focuses on reducing impacts along the entire life cycle of the product, from raw material extraction to the ultimate disposal of the product.

Cleaner production is achieved by applying know-how, by improving technology, and by changing attitudes. How is cleaner production different? Much of the current thinking on environmental protection focuses on what to do with wastes and emissions after they have been created. The goal of cleaner production is to avoid generating waste in the first place, and to minimize the use of raw materials and energy.

The Natural Step

The Natural Step is an organization based on a set of ecological principles developed by a Swedish cancer physician. A pamphlet and cassette on the links between disease and environmental contamination and the need for a new vision for environmental protection have been sent to every household in Sweden.

The Natural Step puts forward four “system conditions” that must be followed to achieve sustainability. These principles are being adopted by many companies throughout the world and have served as a challenge for organizations to achieve:

- ① Nature cannot withstand a systematic buildup of dispersed matter mined from the Earth’s crust (minerals, oil, etc.);
- ② Nature cannot withstand a systematic buildup of persistent compounds made by humans (e.g. PCBs and DDT);
- ③ Nature cannot take a systematic deterioration of its capacity for renewal (e.g. harvesting fish

faster than they can replenish, converting fertile land to desert);

- ④ Therefore, if we want life to continue, we must (a) be efficient in our use of resources and (b) promote justice. Ignoring poverty will lead the poor, for short-term survival, to destroy resources that we all need for long-term survival (e.g. rainforests).

The Natural Step has influenced farmers, citizens, and businesses. For example:

- The Federation of Swedish Farmers is aiming at sharply cutting back its members’ dependence on artificial fertilizers and pesticides. Organic growers (about 2,000 and rapidly increasing in number) are regarded today as the cutting edge of agriculture. Conventional farmers will receive various kinds of help from the Federation if they wish to convert to more organic methods.
- In the Swedish retail trade, environmental issues have begun to assume a role that few people could have imagined a decade ago. Chlorine-bleached paper products are largely gone from shelves.
- Electrolux, the refrigerator and appliance company, decided not to replace its CFC Freon-based chemicals with a less toxic Freon because this still went against system condition #2. It opted instead to research a biologically harmless substitute.

World Business Council on Sustainable Development (WBCSD): Eco-Efficiency

According to the WBCSD, an organization of multinational corporations dedicated to sustainable development, eco-efficiency is reached by delivery of competitively priced goods and services that satisfy human needs and enhance quality of life. This is achieved while progressively reducing ecological impacts and resource use through the life cycle of a product to a level at least in line with the Earth’s carrying capacity. Criteria for eco-efficiency include: minimizing material and energy use in goods and services (**dematerialization**); minimizing toxic dispersion; and extending product durability and usefulness.

The WBCSD believes that proper corporate responsibility and a market free of subsidies that support inefficient extraction can solve environmental problems. There is little focus on the need to phase out toxic sub-

stances within the eco-efficiency model. It simply calls for better control of their dispersion. There is no focus on reducing net consumerism. Critics see this as business as usual but in a more efficient way.

Increased consumption can outstrip the benefits of dematerialization and eco-efficiency. For example, mobile phones are more eco-efficient than the telephone design of twenty years ago, but because more people now use them, material use has increased.

Various Industries/Academic Institutions: Industrial Ecology/Industrial Metabolism

Industrial ecology is the academic/industry-generated idea that one company's waste can become another's raw material if industries are clustered. It implements some ideas of eco-efficiency by optimizing the consumption of energy and materials. Critics say that while this is a more efficient form of recycling, it does not phase out toxic materials or products. Several examples exist of industrial ecology systems throughout the world and an entire journal dedicated to the subject is being published.

Example: Kalundborg, Denmark

An industrial park in the town of Kalundborg, 80 miles west of Copenhagen in Denmark, was the first example of "industrial ecology." The industrial park involves the cooperation of an electric power generating plant, an oil refinery, a biotechnology production plant, a plasterboard factory, a sulfuric acid producer, cement producers, local agriculture and horticulture, and district heating. The power station supplies power to the pharmaceutical plant, refinery, and district heating system. Gyproc, the wall-board producer, buys surplus gas from the refinery along with industrial gypsum, a byproduct of the desulfurization process that makes the gas cleaner. In addition, fly ash from the power plant is used for cement making and road building. The power plant also uses surplus heat for warming its own seawater fish farm. Sludge from the fish farm is used as fertilizer by local farmers.

Ecological Engineers—Ecotechnology

Ecotechnology is the concept of embedding technologies or manufacturing in the natural cycles of the ecosystem, with its capacity to produce renewable materials. Ecotechnologies are biodegradable and may use a range of biological processes in a holistic and noninvasive way, with the aid of efficient engineering. Ecological technologies fit into socio-cultural patterns and serve humankind.

Example: the zero waste concept

Zero waste means the elimination of waste by replicating the cycles of nature where all waste is food for other organisms within the ecocycle. This is being practiced with breweries in Fiji, Tanzania, China, and Namibia by an eco-engineer, Gunther Pauli. Breweries produce solid waste from spent barley grain composed of fibers and protein as well as liquid waste. Mushrooms are grown on the fibers found in the solid waste, producing five harvests of mushrooms in one batch of spent grain—including high-quality consumer mushrooms such as shiitake. (No mushroom experts around the world had ever thought of growing them on beer.) The mushrooms also break down the lignin content of the waste into high quality carbohydrates which are fed to local cattle.

Earthworms are cultivated in the protein content of solid waste, producing 287 pounds of worms from one ton of solid waste. These earthworms are fed to chickens in a chicken farm linked to the brewery, creating food for the local population.

Chickens and cattle produce manure rich in methane, which is collected and fed into a digester that generates steam and electricity. One of the largest breweries in China, producing 800,000 liters of beer a year, is powered by a digester running on the waste of the chickens and cattle. The liquid slurry waste of the digester has a very high biological oxygen demand, but this is put into fish ponds on which floating gardens produce flowers, rye grasses, and tomatoes. Within 24 hours the slurry is broken down and helping to produce seven kinds of fish.

Everything is maximized by applying the principles of natural cycles. Nothing is linear. The output is seven times more than a conventional brewery—seven times more food, fuel, and fertilizer. Interestingly, the system can only be used in a small brewery because of the biological limits of the system. The system has generated four times more jobs than a normal brewery because all that clustering with related industries requires workers. Another advantage is that every resource comes “free” because it had been simply considered waste. Infrastructure expense is minimal because everything is located around the brewery and transportation is unnecessary. The brewery is always located close to a consumption center, which means the mushrooms, chickens, eggs, and fish are sold locally.

U.S. EPA: Pollution Prevention

The U.S. EPA defines pollution prevention (1990 Pollution Prevention Act) as any technique that reduces or eliminates the quantity and/or toxicity of pollutants through source reduction:

Source reduction is defined as any practice which reduces the amount of any hazardous substance, pollutant, or contaminant entering the waste stream or otherwise released into the environment prior to recycling, treatment or disposal; and reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

Critics point out that the focus is solely on toxics and waste problems, the main focus of concern in the 1980s. There is no specific reference to products or their life cycles, nor of the unsustainable consumption of resources in production.

Design for the Environment (DfE)

This is the U.S. EPA's attempt, initiated in 1992, to expand its definition of pollution prevention. DfE is the application of systematic environmental criteria to product and process design. It is aimed at the prevention of waste and emissions and the minimization of environmental impacts along the material life cycle of the product. The aim is to help businesses incorporate

environmental considerations into the design and redesign of products, processes, and technical and management systems. To date most work has been on energy efficiency such as the DfE power saver on computer screens. EPA has also launched a “green chemistry” initiative to work with industry in developing more environmentally benign and bio-based chemicals and polymers.

Various European Countries: Factor 4 / Factor 10

In order to achieve both economic and ecological progress in a sustainable way, it will be necessary to sharply reduce the amount of material used (material intensity) per unit of service of products. To achieve a fifty percent reduction of global material flows, future installations, products and services would have to reduce their use of materials by a factor of 10. This concept is being promoted by several research institutions in the U.S. and Europe as critical to achieving sustainable development.

Examples:

Recently some European countries have committed themselves to such reductions. The Netherlands hopes to achieve a factor 4 reduction by halving resource use and doubling wealth; Austria hopes to achieve a factor 10 reduction over the next decade; and Sweden proposes a factor 10 reduction in materials and energy use over the next 25-50 years. Germany has gone for a more modest factor 2.5 reduction in non-renewable raw materials to be achieved by 2020.

Various Product/Architectural Designers: Ecological Intelligent Design

A variety of universities, institutes, and consultants now teach and research clean product and building design to demonstrate the feasibility of achieving factor 4 and factor 10 efficiencies in material and energy use.

Michael Braungart, an ecological chemist, and William McDonough, an architect and designer, have created products and buildings under the criteria of Ecological Intelligent Design. This is based on the idea that there are three different product types: *Consumables* are products that when eaten, used, or thrown away literally turn back into dirt and therefore are food for other living organisms. Service products, also known as

durables, are such products as cars and television sets, that provide services—food, entertainment, or transportation. To eliminate waste, service products would not be sold, but effectively leased to the user. The third type of products is called “*unsaleables*.” These are toxic products that no one should buy. In many cases, consumers do not realize they are buying them. Braungart and McDonough contend that these must cease to be sold and that those already sold should be stored in warehouses when their use is finished, until we can figure out a safe and non-toxic way to dispose of them. PCB (polychlorinated biphenols) oils were commonly used in electrical transformers, as well as in common products such as lipstick and carbonless copypaper. They are persistent organic pollutants that were finally banned from production in most countries in the 1970s. These chemicals have been dispersed around the globe, posing reproductive and carcinogenic risks to humans and wildlife. The majority of PCBs however are buried in landfills or are still being used in transformers, posing ongoing threats. Their collection and safe destruction are global priorities.

Example: clean textiles

McDonough and colleagues have designed a furniture fabric that can be composted when removed from the chair or sofa and decomposes with no toxic byproducts. The fabric is

made from ramie, a plant product similar to linen, which was found to be an excellent alternative to polyester. When combined with wool, the resulting fabric transports moisture away from the skin, allowing a person to remain comfortable when seated for long periods of time.

The dyes and chemicals used in the manufacturing process are essentially free from toxic substances. McDonough and colleagues asked sixty different chemical companies for a product that is free of mutagens, carcinogens, bioaccumulative compounds, persistent toxins, heavy metals, and endocrine disrupters. Ciba Geigy agreed to supply a dye with these criteria (after looking at 8,000 chemicals and eliminating 7,962 of them). The fabric was produced with a total of only 38 chemicals. Regulators who tested the effluent from the manufacturing mill thought that their instruments were broken because the water coming out of the factory was as clean as the water going in. McDonough, who calls this the next industrial revolution, believes regulations should be seen as signals of design failure. The fabric is now available under the DesignTex line.

Strategies to Promote Clean Production

A MEASURING AND REDUCING RESOURCE USE AND WASTE

Several methods of measuring resource and material use can serve as excellent tools in a campaign for clean production. They provide easily understood visual or numeric estimates of unsustainable practices and allow advocates to engage in discussions for change.

Ecological Footprint is a measurement of the space in land that we need in a year to supply all of our material uses and to absorb all of our wastes. The results are displayed on a map as a “footprint.” Global calculations show that humans are consuming over one third more than nature can reproduce. For industrialized countries, this rate is even higher. As mentioned earlier, North American consumption and waste generation would necessitate two extra planet Earths if the rest of the world copied our production and consumption model.

Examples:

- When this exercise was done for the lower Fraser Valley in British Columbia, Canada, researchers found the population is using an area 19 times larger than their community to satisfy present consumption levels of food, forest products, and fossil fuel.
- Researchers in the Netherlands found the country would have to be 14 times larger to supply all the resources, water, and energy used by Dutch consumers and absorb all the waste produced by Dutch citizens. This led the Dutch government to establish a factor 10 reduction target in their National Environmental Action Plan. Analysis of the Dutch footprint found fifty percent of the footprint is due to carbon dioxide absorption. This has spurred the Dutch government to focus on climate change remediation. It has also created eco-design centers where examples of factor 4 products can be demonstrated to small and medium-scale industries.

A related tool called the **ecological rucksack** (backpack) is a term used in Europe to describe the amount of resources that goes into making a product. Also known as **MIPS** (or Material Input per Unit Service) this indicator measures the energy and waste (but not toxicity) that goes into providing a particular service.

Example:

The Wuppertal Institute in Germany calculated the environmental impact of drinking one glass of orange juice, that is, the amount of soil, energy, water, and other materials used or displaced to produce the glass of juice. They found that 1 kilogram of orange juice required 25 kilograms of materials and energy.

This led some consumer groups in Germany to advertise the benefits of drinking local cranberry juice which is just as rich in vitamin C but with a smaller ecological rucksack. In other words, the service that was provided (vitamin C in a tasty fruit drink) could be supplied by another product with a lower ecological impact.

WHAT YOU CAN DO

- Individuals, households, or communities can calculate their own ecological footprints. This is done by keeping a record of all consumption-related expenditures and categorizing them under headings such as housing, food, transportation, goods, and services. It will be necessary to account for your consumption not only in dollars but also in liters, gallons, pounds, or other physical measures. The Ecological Footprint Group supplies information to help translate this consumption data into land areas. Contact them at Redefining Progress (see contact list).
- A computer program using ecological footprinting to evaluate consumers' impact on the environment is also available. The goal of the Eco-cal,

which was designed in Britain, is to motivate companies, public bodies, and individuals to measure and understand the magnitude of their impact on the environment and determine what they need to do to promote sustainability. The software is limited by readily available data and the potential to change behavior. However, a project launched in the Netherlands by the consumer group, Consumentenbond, five years ago found that over 50% of those who tried the test reported a change in behavior. The software is available from Going for Green (see contact list).

Once an ecological footprint is done, **backcasting** can be used to figure out how to carry out the necessary reductions. Backcasting means setting goals and working backwards to determine how to achieve those goals. This differs from forecasting the uncertain outcome of current trends and taking measures to try to avoid that future.

When the Dutch Sustainable Technology Development group used backcasting to consider how to reverse current resource consumption, their conclusion was that “technology will not save us.” They pointed to the need for complete changes in our transportation systems, product use, and food supply. Such data collection gives added urgency to implementing such measures as reduced auto use, alternative fuels, city planning, renewable energy, eco-design, industrial clustering, local food production, and organic food supply.

Example: Friends of the Earth—backcasting for a sustainable Europe

Friends of the Earth in Europe commissioned a study by the Wuppertal Institute in Germany to quantify the effects of European consumption on their own environment as well as the social and environmental effects on developing countries.

Using the concept of ecological footprints, per capita consumption in Europe was quantified and then compared with a standard for equitable global consumption. The levels of reduction needed by the year 2010 and 2040 were indicated. Recommendations were made for achieving these reductions. Backcasting allowed a discussion of the solutions needed and how quickly they need to be implemented. The study was done to ini-

tiate national and Europe-wide debate, and to link consumption issues with local environmental campaigns.

The following is a summary of recommendations on reductions in resource consumption presented in the Friends of the Earth report, *Sustainable Europe*:

Energy: CO₂ reductions from 1987 levels of 20-30 percent by year 2005, 50 percent by 2020, and 80 percent by 2050.

Achievable through: increasing the efficiency of energy use and production, increasing the use of renewable energy sources, switching to lower carbon fuels, and limiting demand growth in energy intensive services.

Nonrenewable raw materials: Currently 20 percent of the world’s population consumes 80 percent of resources. Factoring the equity principle into resource consumption calculations, European reductions must be proportionately higher. Dematerialization (using less material to produce the same range of products) targets were drawn up for the following: cement reduction of 85 percent by 2040; iron, 87 percent by 2040; aluminum, 90 percent by 2040; and chlorine, 100 percent by 2040.

Achievable through: designing products that are repairable, have longer lifespans, are reusable, and ultimately recyclable; increasing reuse and recycling of materials; substituting nontoxic for chlorinated materials; and increasing use of services, through leasing and sharing, rather than products.

Land use: The European import of agricultural products from developing countries limits the available land those countries need to sustain their own population. Reductions in European land use must include reductions in land use in exporting countries. Europe must become more self-sufficient in food production.

Reductions in consumption are needed. Arable land use must be reduced by 58 percent, pasture by 47 percent, net import of

agricultural land from other countries by 100 percent, unprotected woodland by 16 percent, and urban areas by 3 percent.

Achievable through: ecological farming methods, the cessation of animal fodder imports by 2010, and adoption of more local crops.

Wood: Reduction by 15 percent of current wood use is needed by 2010.

Achievable through: multifunctional silviculture, selective cutting, and natural regeneration. Sustainable forestry involves ending the use of fertilizers, pesticides, and non-indigenous fast-growing species. This does not decrease total wood production but changes the use of wood harvested, e.g., less wood for energy generation and paper production. Hence an increase in energy efficiency, solar energy, and alternative fibers for paper is also needed.

Water: The sustainable extraction of water depends on natural replenishment through rainfall, which will vary from region to region. Europe-wide reductions in water use cannot be calculated but potential actions can still be planned: a reduction potential of 50 percent drinking-quality water in the public sector (for use in schools, swimming pools, other public facilities); a reduction potential of 40 percent for industry.

Achievable through: the use of nonpotable water when possible (e.g. toilets, car washing). Surface water can be collected for direct use, e.g. irrigation of parks; water can be recycled within buildings; separate water pipes for drinking water and nonpotable water can be installed in dense urban areas to collect rainfall—a common practice 40 years ago.

B EXERCISING THE RIGHT TO KNOW

Whether we live near factories or not, we are all affected by industrial, agricultural, and product production and waste emissions. The U.S. leads the world in community right-to-know legislation through the passage

of the Emergency Planning and Community Right to Know Act in 1986. This law gave the public information about what some factories in some industrial sectors have emitted to air, land, underground water supplies, rivers, publicly owned treatment plants, disposal sites such as incinerators, and even external recycling plants.

Tracking Chemical Use in Products

The **Toxic Release Inventory (TRI)** has been a groundbreaking and empowering tool for communities. Many communities have used the TRI to set up dialogues with their neighboring industries and have achieved emission reductions through forcing public accountability. The TRI has been one of the most powerful tools for advocates, government, and industry in encouraging the adoption of pollution prevention—reducing the amount of toxic chemical emissions and waste at source without the use of add-on pollution control equipment.

Who uses this information?

- **Communities** use TRI data to begin dialogues with local facilities and to encourage them to reduce their emissions, develop pollution prevention plans, and improve safety measures.
- **Governments** also use the data. For example, the state of Massachusetts financed its toxics use reduction program from company fees based on the number of TRI (and other) chemicals that they use and the number of employees. The U.S. government used TRI emissions as the basis for measurements under its 33/50 program.
- **Industry** uses the data to identify pollution prevention opportunities, set goals for emissions reductions, and demonstrate their commitment to and progress in reducing emissions. When the U.S. first initiated TRI reporting, industry was concerned that the public would misunderstand and misuse the data—a common reaction among industry and government officials. In reality, the public nature of the data has encouraged companies to improve their materials use.
- Increasingly, TRI data are being used in financial decision-making. Investment analysts use TRI data to provide recommendations to clients seeking to make environmentally sound investments.

Insurance companies look to TRI data for potential environmental liabilities.

The TRI has been the inspiration for the development of **Pollutant Release and Transfer Registers** in other countries. In fact, a specific recommendation from the Rio Summit of 1992 was that communities should have access to information about emissions in their country. The Organization for Economic Cooperation and Development (OECD) conducted a series of international workshops to draw up a Guidance Manual for Governments on how to implement community right-to-know about emissions.

In the United States, the TRI has been the foundation of many pollution prevention initiatives. It has forced companies to measure their use of materials—often for the first time—and to realize better efficiencies and savings. However, emissions reporting is only one small part of the product chain. The TRI reports on only seven percent of high-production chemicals used in the United States. While right-to-know has been a critically important tool for addressing environmental impacts around facilities, and for comparing companies and geographic areas, it is limited. There is no information on chemicals contained in products or on impacts throughout a product's life cycle: raw material extraction, production, use, and disposal. Nonetheless, this information is a powerful tool in democracy building and has become the basis for even better company reporting. Two states, Massachusetts and New Jersey, do require this type of materials accounting data.

Example: Massachusetts Toxics Use Reduction Act

Emissions reporting has now progressed to materials audits in some states. Materials audits track what happens to chemicals that enter the production process. A material or chemical can be followed from the time it enters the company gates, indicating how much is used in the production process; what byproducts/wastes it might form part of; what emissions to air, water, and land it might reside in; and finally, how much enters the final product.

The state of Massachusetts requires companies to conduct a materials audit and toxics use reduction plan. The plan shows in detail how a company could reduce its use of toxic materials through process changes, material

substitution, on-site closed-loop recycling, or product reformulation. The plan also examines the costs of using toxic substances and compares the costs of different toxics use reduction options over time. Since the law came into effect, no new incinerators have been constructed.

Companies are given help in completing their plans through training and research paid for by fees linked to TRI releases. It is therefore in a company's best interest to reduce its emissions through toxics use reduction techniques. Summaries of all the plans are made publicly available.

The 1997 data show real success in reducing the use of toxic chemicals in Massachusetts (adjusted for production volume). Over eight years:

- Companies generated 41% less toxic waste.
- Companies reduced use of toxic chemicals by 24%.
- Companies achieved an 80% reduction in emissions released to the environment.
- More than 80% of the firms reported implementing pollution prevention projects.
- Net savings to industries and the state amounted to \$15 million without considering environmental or public health benefits.

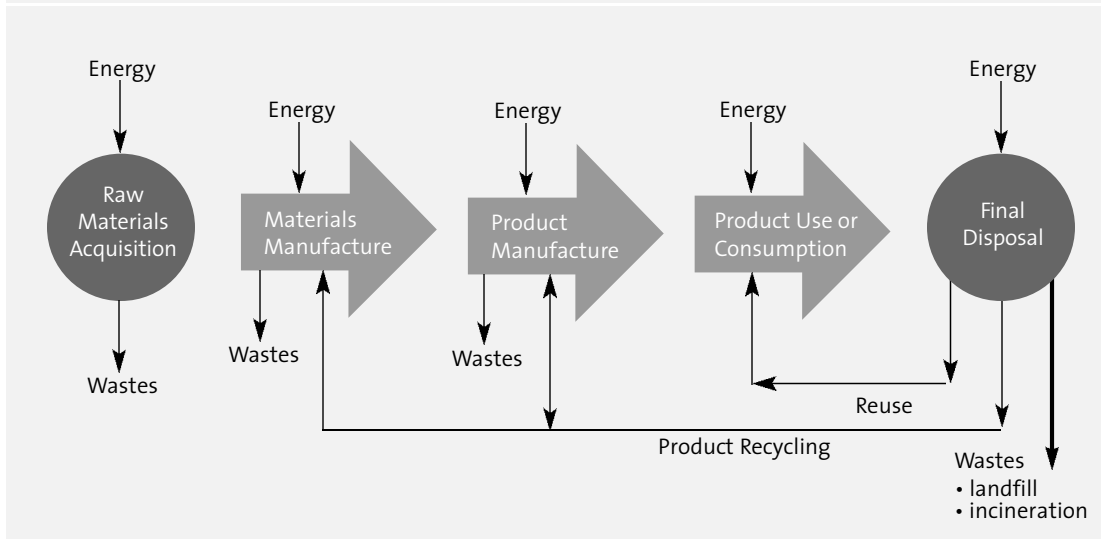
Expanding Beyond Chemicals: Examining the Product Life Cycle

Materials audits are a good beginning but do *not* give us sufficient information about the product for two main reasons:

- The audits only deal with a finite list of chemicals. They do not quantify water, energy, or other raw materials used in processing, products, or raw material extraction;
- The audit does not investigate where the chemicals come from, the impacts of that extraction, and what happens to the product at the end of its life. Are the materials recycled, landfilled or incinerated? What kind of waste and emissions are generated then?

How can community and labor groups get information about the entire product chain of material and energy use? How can we assure producer accountability for the product itself, including its life cycle, and force cleaner

Figure 3: THE PRODUCT LIFE CYCLE



Clean Production Action

product design? How can consumers become more responsible about product choices?

The life of a product consists of a number of steps, each of which uses energy and creates waste and potentially toxic emissions. Clean production requires that we look at all of these impacts to determine the best course of action for evaluating alternative products or product designs and improving production processes.

Life Cycle Assessments (LCAs): From Cradle to Grave

Life cycle assessment is a tool to holistically evaluate the environmental consequences of a product across its entire life, or from “cradle to grave.” It can be used to support a decision about a purchase, innovation in production processes, or product approval. LCA evaluates the environmental effects associated with any given activity from the initial gathering of raw material from the earth to the point at which all residuals are returned to the earth. An LCA has three components: inventory analysis, impact analysis, and improvement analysis. LCA is designed as a comparative tool and is always linked to improvements in product design.

Many manuals, software programs, and consultants are available to help companies do life cycle assessments. People involved with company LCAs are designers, engineers, managers, and all staff in accounting, marketing, distribution, strategy, environmental, health and safety, legal, purchasing, and service departments.

How useful is an LCA to a consumer?

- Life cycle assessments and product information are increasingly used in government procurement of environmentally beneficial products and services.
- Since 1990, companies have used LCAs in marketing to advertise their products over their competitors'. The credibility of these LCAs is often called into question because of the tendency of results to come out in favor of the company that sponsors the study. Unless the assumptions of the LCA are made public, the conclusions a company can draw from them have little meaning. In fact, different LCA results can be compiled for the same product, much the same as two different groups can come up with two different risk assessment results for the same problem.
- Not all producers carry out LCAs for their products. Those that do may keep this information confidential and only give consumers the summary of their studies, without indicating how the studies were done.
- LCAs are only as good as the data on which they are based. It is impossible to design a complete LCA because the study must limit the data to be included. The researcher must decide how far up the chain to go, what is considered relevant regarding the impact of a product's material on

human health and the environment, and how to rank and score all this information.

Often persistent and toxic materials are given the same scoring as other raw materials and thus undervalued in their importance. In some ways, the pitfalls of LCAs mirror the pitfalls of attempting to do a “scientifically sound” risk assessment for chemicals. It depends on the assumptions used and the availability of data at hand.

- LCAs never factor in social criteria such as who is affected, where the materials are extracted, or where the product is made. This is considered even more difficult to quantify than all the other assumptions necessary in analyzing material and energy flows. Worker and consumer health is included to some degree in environmental assessments of the data.

Example: PVC versus concrete pipes

Polyvinyl chloride (PVC) producers conducting LCAs on PVC plastic products find little scientific basis to label PVC environmentally less preferable than other materials. LCAs conducted by the clay industry have found vitrified clay pipes better than PVC, and concrete manufacturers have found concrete materials to be better than PVC.

A recent Dutch study compared concrete and PVC for production of pipes, including transport to a construction site, transportation from the site to a waste processor, and waste processing. The study found that concrete pipes score better than PVC on all counts mainly because of energy consumption. For concrete pipes, the largest amount of energy is consumed in producing cement clinker and crushing of cement. For PVC pipes, production of virgin PVC granulate is the main energy consumer.

This study shows the problem with deciding what to measure in LCAs. Other considerations could have been brought in such as toxicity of raw materials and recyclability of material at the product’s end of life—in which case PVC would have scored even lower.

Why should we demand life cycle assessments?

- Public availability of this type of information will promote environmental responsibility on the part of producers. This will lead to process and product innovation and more environmentally sound product design.
- It will allow consumers and public interest groups to independently verify environmental claims made by producers to ensure that they are not merely “greenwash.”
- It allows advocates to form new coalitions with people affected along the chain of production, such as trade unions and consumer groups. In particular it allows advocates, producers, and government agencies to identify “hot spots” – points where damage is done or could be done to susceptible populations or parts of the ecosystem — during the life cycle of a product.

Example: The Greenpeace campaign against PVC (vinyl) plastic

The Greenpeace campaign against PVC or vinyl plastic has used hot spots throughout the product chain in order to press for a full PVC phaseout worldwide. The origins of the Greenpeace PVC campaign arose from the campaign to protect the marine environment against ocean incineration of PVC and solvent wastes during the 1980s. Fisherfolk supported the campaign to rid the oceans of floating incineration ships. When a ban was secured, PVC wastes then went to land incineration. This galvanized affected communities and farmers to form alliances against toxic transportation and burning. It became increasingly apparent, however, that the product presented problems throughout its life cycle and only a phase out of production would suffice.

The campaign increased its dissemination of information on the problems of the product life cycle to architects, local government procurement departments, packagers, consumers, and firefighters. The campaign recently focused on the problems of PVC production in Louisiana, highlighting not just the toxic exposure to workers and the com-

munity but also the environmental justice issue of siting toxic industries in low income communities of color.

The campaign has resulted in phase outs of PVC material in Nike shoes, IKEA retail products, and Baxter Healthcare intravenous products, to name a few. However, PVC production is expanding in Asia.

It is essential that international negotiations to eliminate Persistent Organic Pollutants (POPs), such as dioxin, adopt a materials policy rather than depending on pollution control technologies, such as incineration. A materials policy would mandate the substitution of safer materials for products such as PVC that generate these toxic pollutants.

- Increased public demand for LCAs would provide an economic incentive for firms to reduce environmental and health impacts throughout the life cycle of their products and to search for cleaner product design.
- It would allow government agencies and public interest groups to target specific products for substitution. This would form new alliances, including among health coalitions, labor groups, and clean product designers.

Example: Forging new alliances—moving from tobacco to hemp

Responding to public campaigns against smoking, tobacco farmers in southern Ontario, Canada, became concerned over the health effects and economic long-term sustainability of their product. They realized industrial hemp production was an ecologically benign substitute, both during processing and in final product use. They teamed up with university biologists and lobbied for deregulation of hemp cultivation in Canada. Industrial hemp producer societies, with help from one of Canada's major banks, have expanded market outreach to include top fashion designers, the Body Shop retailer of natural cosmetics, non-tree paper producers,

and food suppliers of new hemp products such as hemp cheese and burgers.

Farmers from Kentucky are supporting this Canadian initiative. In April 1999 North Dakota became the first state to legalize the production of industrial hemp in the U.S. and is now developing regulations to implement the law.

Example: Health Care Without Harm (HCWH)—adopting safer products

The Health Care Without Harm Campaign encompasses over 180 organizations working to provide a remedy for the pollution from health care practices. The aim is to promote pollution prevention practices within hospitals, support the use of safer materials and technologies, and educate suppliers, workers, and consumers. This is accomplished by eliminating nonessential incineration of medical waste and promoting safer treatment practices; phasing out the use of PVC (polyvinyl chloride) plastics, persistent toxic chemicals, and mercury; enhancing the public's right to know about chemical usage in the health care industry; developing socially just siting and transportation guidelines for waste management; and developing an effective communication structure among campaign allies.

Recently shareholders—two Roman Catholic groups and a trade union—lobbied Baxter International, one of the largest manufacturers of infusion medical devices in the world, to agree to develop alternatives to PVC products such as intravenous bags. Much of the impetus for this phaseout came from European practices. Baxter's Swiss-based company, Bieffe, markets non-PVC bags. European groups and Greenpeace International, who are working to implement PVC phaseouts, have provided information to the U.S.-based Health Care Without Harm, demonstrating the success of working internationally on product-focused campaigns.

Moving on from TRI: How to get and understand product life cycle information

Even with the limitations of LCAs, they are useful tools for consumer right to know. However, because advocates and consumers have not been demanding product life cycle information, their availability is very limited or even lacking. Industry's excuse for not producing and disseminating these data is that they cost a great deal to produce, use confidential information, and are too burdensome for the public to use.

In many ways these arguments mirror early opposition to public dissemination of TRI data. Just as the Environmental Defense Scorecard and Right-to-Know Network have enabled easy access and interpretation of TRI data for the public, so should life cycle information be made more accessible.

Example: Difficulties in finding product information

The Ecology Center of Ann Arbor attempted to find background information on the automobile life cycle as part of an initiative with the Environmental Defense Fund to clean up the car life cycle. They were able to find out where final assembly plants were located, what Toxic Release Inventory data existed, what VOC (volatile organic compounds) data existed under both the EPA and state air programs, as well as information about hazardous waste from EPA's Resource Conservation and Recovery Act (RCRA) biennial report database. Regarding the product itself, emission and mileage data were available because some states require this information for car sales.

Not available were environmental impacts related to materials production and manufacture of parts. Data related to specific models were confidential. It was particularly difficult to find information on emissions and energy use for the end-of-life/disposal stage of the car.

This exercise demonstrates the urgent need for the consumer to have easy access to information on product life cycles.

WHAT YOU CAN DO: WHAT TO LOOK FOR IN A LIFE CYCLE ASSESSMENT

As a minimum, a product life cycle profile could contain the following types of information:

- *Emissions:* air, land, water emissions in raw material extraction, product component production, and product assembly and waste disposal.
- *Waste generation:* in raw material extraction, product component production, and product assembly and end of life.
- *Energy use:* energy requirements for raw material extraction, product component production, and product assembly. Energy use during product lifetime.
- *Toxicological information:* on emissions, chemicals used in production, and those in the product itself.
- *Transportation:* locations of raw material extraction, component production, and distribution and sales.
- *Packaging:* type and amount of packaging used for the product.
- *Disposal:* recyclability of the product or percentage of components that can be reused or recycled.
- *Improvements:* How is the company moving toward a policy of returning materials and waste from the process and product safely to the earth? How is the company planning to reduce its net use of resources in product design? How is the company planning to phase out hazardous materials?

A Breakthrough: Environmental Product Declarations

The Swedish Environmental Protection Agency has initiated a project on Environmental Product Declarations (EPD). The idea is that EPDs would be tailored to a particular product chain but would include general and comprehensive life cycle information as well as guidelines for using and repairing the product. The goal of the Swedish initiative is to stimulate manufacturers to develop products with improved properties. The EPDs would mainly be prepared for companies and public authorities; however, they could also be easily adopted for use by public interest groups as an educational tool.

Example: The EPD by Electrolux for its refrigerator/freezer

The EPD supplied by Electrolux is a one-page summary of useful information for the consumer. It lists:

- *Materials:* the percentage and types of materials used in the product as well as a description of how they have improved materials choices. For example, plastics do not contain cadmium, lead, mercury or their compounds or chlorinated or brominated flame retardants; metals are not coated with cadmium, chromium, or nickel; and metal paints do not contain pigments and additives based on heavy metals.
- *Energy and Product Performance:* the daily and yearly energy consumption and noise levels.
- *Production:* where the product was made, and the main processes used. For example, painting of flat doors requires solvents that are chlorine free. In production processes, there is no use of heavy metals.
- *Packaging and Distribution:* weight of polyethylene and polystyrene plastics used in packaging that are marked and recyclable; 75% of the product within Europe uses the railway system.
- *Recycling and Disposal:* The product is designed for easy disassembly, shredding, and separation; composites as well as potentially harmful materials are avoided as far as possible; 80% of the steel is made from recycled metals; plastic parts over 20 grams are marked for recycling; the refrigerant can be easily recovered; 80% by weight of the product is recyclable.

What About Ecolabels?

Ecolabels provide a snapshot of the environmental aspects of a product and have been successful in giving consumers information on most often one or two aspects of a product such as its degradability, its recyclability, or its recycled content. Sometimes it lists the absence of a toxic material such as PVC-free cling film, or non-chlorine bleached paper. In the U.S., Green Seal and Scientific Certification Systems do ecolabeling. Both organizations conduct product profiles and award labels to products that meet their criteria. U.S. businesses and the EPA have expressed opposition to

ecolabels, whereas ecolabeling is prominent in European countries, providing consumers useful information to guide purchasing choices. Most ecolabeling programs throughout the world are completely voluntary.

Ecolabels are not as comprehensive as Environmental Product Declarations. However, if the certification body uses a comprehensive method for evaluating and comparing products, the ecolabel could relieve consumers of wading through large quantities of information on product life cycle impacts.

Product Labeling

The amount of information available on a product's packaging is limited both by what the manufacturer perceives as important and by the space available. Food labeling is deemed comprehensive in North America, but genetically engineered ingredients are not listed for the consumer. (In fact, efforts have been made to prevent responsible companies from labeling their products *free* of genetic engineering.) Labeling of genetically modified products has become the basis for a major international campaign on consumer right to know to Europe.

Example: Genetically modified foods

The recent use of genetically modified organisms (GMOs) poses unique threats to the biosphere because these organisms possess traits that do not exist in nature. Plants have now been modified to produce more commercially valuable traits. Examples include implanting fish DNA into tomatoes to give them better frost protection or scorpion DNA into corn to give it pest resistance. Most of the GMOs have been altered to withstand intense herbicide use, thereby allowing surrounding weeds to be eliminated with little harm to the crop. For example, genetically engineered soybeans, produced by Monsanto and now prevalent in the U.S., are made immune to the glyphosate herbicide called Roundup—also produced by Monsanto—and labeled as “Roundup ready.” In 1996 only 2% of the U.S. soybean crop was genetically engineered. Today it is over 50%. Sixty percent of all processed food bought and consumed in the U.S. contains some genetically engineered ingredients.

Numerous concerns exist around genetically engineered species: Natural species could be driven out and “foreign” genes could spread throughout the environment causing unpredictable, unstoppable changes. Intellectual property rights and the development of “terminator seeds” (seeds modified to be sterile so plants cannot reproduce) mean that farmers must now buy new seeds every year from the controlling corporations and are prohibited from saving seeds for the next year’s planting. Recent concerns over risks associated with eating genetically modified food escalated when research results showed that rats fed engineered potatoes suffered damage to vital organs and had a weakened immune system

These and other public concerns have resulted in massive consumer concern in Europe, prompting bans on genetically modified food imports in many European countries. Restaurant chains and major grocery chain retailers are promoting their produce as “genetically engineered-free.” Sainsbury’s, one of Britain’s largest grocery chains, announced it would ban these foods after receiving over 600 phone calls a day from concerned consumers. The level of public concern has been such that U.S. producers of non-genetically altered soybeans are expanding their markets in Europe while losing ground in North America.

There is no consumer labeling for GM food in the U.S. or Canada. In fact the U.S. Food and Drug Administration has ruled that it is illegal. Nor is there adequate public consultation on this technology. This is one of the biggest tests of public right to know in the U.S. and Canada today.

C HOLDING PRODUCERS RESPONSIBLE

This section describes a series of tools to promote producer responsibility and accountability for environmental and health protection in production.

Corporate Reporting: CERES

Multinational corporations are increasingly realizing the need to make corporate reports available to the

public. The biggest question for them to resolve is what the public wants to know and how they can deliver this information.

Glossy corporate reports are hard to verify. Equally difficult is knowing what political lobbying companies might be doing behind the scenes. One way to attempt to find this out is to investigate what financial contributions corporations have made to political parties.

A voluntary initiative to standardize reports is the Global Reporting Initiative (GRI) being developed by the Coalition for Environmentally Responsible Economies (CERES). The goal is to develop a Corporate Sustainability Reporting form (not yet available) which will be disseminated and used by member companies.

CERES is a non-profit coalition of corporations, investors, public pension funds, foundations, labor unions, and environmental, religious, and public interest groups, working to promote corporate environmental responsibility. CERES has developed a series of principles which member companies must endorse and use to measure their progress. Members range from the Body Shop, Ben & Jerry’s Homemade, Inc., and Baxter International Inc. to Coca-Cola, General Motors, Polaroid, and Sunoco. Endorsers of the CERES Principles claim to work to disclose “publicly meaningful” environmental performance data, to engage in dialogue, and to identify opportunities for constant improvement.

The CERES Principles, also known as the Valdez Principles, encompass 10 standards for corporate responsibility dealing with: protection of the biosphere; sustainable use of natural resources; reduction and disposal of waste; wise use of energy; risk reduction; marketing of safe products and services; damage compensation; disclosure; environmental directors and managers; assessment and annual audit. The standards that companies voluntarily agree to include community protection from their processes, disclosure of possible hazards from production to the surrounding community, risk reduction to employees in the plant, and protection of consumers through information about the environmental impacts of their products or services.

ISO 14000

While not as complete or verifiable, the International Organization on Standardization (known by its French acronym, ISO) has developed its ISO 14000

Environmental Management System (EMS) program. This program requires companies to develop a system for managing their environmental impacts (an EMS), undergo audits of their EMS, examine their product impacts, and make its environmental policy public. There is no requirement for environmental improvement, however.

Supplier Responsibility

Some corporations are recognizing the need to exert some control earlier in the product life cycle to ensure more environmentally-friendly products. Some firms require this type of commitment from suppliers under the ISO 9,000 Total Quality Management Standard. For example, the sportswear manufacturer Patagonia is in continuous contact with suppliers to ensure that the company obtains the most environmentally friendly materials produced with minimal impacts.

Example: Hewlett-Packard and its supply chain

Hewlett Packard (HP), the manufacturer of telecommunication and computer equipment, adopted a product stewardship program in 1992 that analyzes environmental performance of its suppliers. HP suppliers worldwide are expected to adopt a policy focused on continuous environmental improvement and a plan to implement this policy. Environmental improvement policies include cleaner manufacturing processes, information and labeling, recycling and reuse, power consumption reduction, packaging, and safe disposal.

HP seeks to obtain safer plastic resins from suppliers through the following procurement guidelines. Each potential supplier is rated through a simple scoring system, and HP chooses those that score best. Some of the questions HP asks its plastic suppliers:

Recycling

- ① Is there a program to take back post-consumer plastics from HP for formulation of recycled resin?
- ② Can the supplier offer a minimum 25 percent recycled-content plastic resin?
- ③ Can the supplier offer recycled plastic resin at parity or lower prices compared to comparable virgin grades?

Environmental Awareness

- ① Is the supplier aware of and in compliance with country-specific requirements (such as Sweden's bans on some polybrominated flame retardants)?
- ② Can the supplier inform HP about potential bans on plastic additives and offer alternative solutions?

Waste Reduction

- ① Does the supplier have a program to help HP reduce the amount of materials used in all applications?
- ② Does the supplier have processes to reduce and responsibly dispose of production-related and non-recyclable wastes?
- ③ Does the supplier minimize, reuse, or recycle packaging materials?

Retailer Responsibility

Some retailers are responding to consumer pressure to obtain sustainable products.

For instance B&Q, a major do-it-yourself housewares and sporting goods chain in Britain, ensures that all of its wood products are from sustainable-forestry-certified sources. When consumers asked if B&Q used wood from the Amazon or from clear-cut forests, the company realized that "didn't know" really meant "didn't care" and set out to correct this lack of information. The Swedish retailer IKEA has a similar environmental commitment. It does not allow the sale of products produced using unsustainable forestry practices or PVC plastics. The cosmetics retailer Body Shop has a similar policy for environmentally sustainable products.

Example: Major retailer seeks transparency in supply chains

In 1992 B&Q launched its program to audit the environmental performance of its suppliers. By 1994 the proportion meeting certain criteria had increased from less than 10% to 95%. Last year the company launched an action program for all of its stores known as QUEST (Quality, Ethics, and Safety) and by May 1999 it intended to have drawn up "a vision of a retailer in a sustainable society." B&Q suppliers must have a thorough under-

standing of the key impacts of their products' life cycles and a systematic program to address them by the end of 1999. The policy must be backed up by an action plan with specific targets and deadlines. Commerce with suppliers who do not know where their products come from will be discontinued.

Targets for the year 2000 include becoming "carbon neutral"—offsetting CO₂ emissions caused by its distribution of goods as well as heating and lighting of stores and offices with support for tree planting programs around the world. All carpet suppliers must demonstrate their involvement in trials to develop a recyclable carpet. All suppliers of bathroom products containing PVC must eventually seek alternatives.

Social Responsibility in the Product Chain

There is currently no common standard by which clean production and social justice or job security are combined. Life cycle assessments, environmental product declarations, and eco-labels focus only on the environmental effects of production.

Finding out about the working conditions of people along the product chain is also difficult because a product's label seldom provides this kind of information. Once in a while a union-certified label is found on products. To date there is no standard social audit available similar to the quality control standards that have been in place for years and to which companies can subscribe. However, the concept of producer responsibility throughout the product life cycle is increasingly being merged with social responsibility.

Worker right to know and participation in the processing and recycling/disposal part of the product chain is still an urgent necessity. Much of the world's newly industrializing countries could benefit from closer collaboration with U.S. labor and public advocacy groups who are proficient in worker right-to-know lobbying and could teach skills for achieving these rights.

Consumer campaigns such as Fair Trade, which obtains and sells organic teas, coffee, and other products in the North that are produced by locally run cooperatives in the South, have set some of the early criteria for socially just and clean production. Other more corporate

campaigns such as the campaign against the sweatshops of Nike have met with some success, although most Nike consumers are unaware of these issues. Coalitions do work, however, and more campaigns are promoting standards of conduct among different product sectors.

Example: The Clean Clothes Campaign: merging environment with labor

The Clean Clothes Campaign is an international campaign based in the Netherlands. It aims to improve the working conditions in the entire subcontracting chain of the garment industry worldwide by focusing on the safety of the materials and labor involved in producing textiles. It is an alliance of consumer groups, retailers, the Center for Research on Multinational Corporations, and several country solidarity groups in India, the Philippines, and Bangladesh. Further cooperation exists with a large number of other groups such as unions, women's organizations, and church groups.

The campaign focuses on the responsibility of retailers and clothing companies to be accountable for bad working conditions in the garment trade and hazards of pesticide use on cotton crops. Evidence has shown that Western companies profit from different labor standards in other countries such as low wages, firing workers for joining a union, long work weeks, forced and unpaid overtime, and bad health provisions. The campaign has negotiated a code of conduct for retailers and buyers called the Fair Trade Charter for Garments. The campaign has been successful in getting retailers to obtain organic cotton and institute just labor practices.

Social Accountability 8000 (SA 8000)

The SA 8000 was developed by a coalition led by the Council on Economic Priorities and the independent nonprofit Council on Economic Priorities Accreditation Agency. SA 8000 is based on various conventions of the International Labor Organization, the Universal Declaration of Human Rights, and the United Nations Convention on the Right of the Child.

The SA 8000 covers issues such as: child labor, forced labor, health and safety, freedom of association and the right to collective bargaining, discrimination, disciplinary practices, working hours, compensation, and management systems. The standards associated with these topics will be applied within the company and by their suppliers, and audits will be done by certified bodies. Individual workers and NGOs are allowed the right to appeal to a certification body if they want to challenge the decision to certify a supplier, seek revocation of a certification, or have evidence to support major violations. So far three companies have made a commitment to adopting SA 8000: Toys 'R Us will require its 5,000 suppliers to adopt the standard; Avon Products will implement the standard at its 19 facilities; and the German mail order company Otto-Versand will implement SA 8000 with its key suppliers.

WHAT YOU CAN DO: STIMULATING THE MARKET FOR CLEAN PRODUCTION

Consumer pressure on retailers and manufacturers is often a more effective and faster way than regulation to move the market to cleaner products. Attempts to phase out hazardous materials are increasingly being met by free trade restrictions and challenges (see EPR section). Stimulating market demand for cleaner products by demanding direct accountability by the producer may be the public's most effective tool.

You can contact producers directly via their 1-800 number, as well as mail, fax, phone and website. Here are some suggestions for questions to ask of manufacturers and retailers, on such matters as genetically engineered food policy. Public advocacy groups can link with other groups to focus on different parts of the same product chain.

Sample Questions to Ask a Manufacturer:

- ① Has your company conducted life cycle assessments for its products? How international is the scope of these assessments?
- ② Are these studies available to consumers? How?
- ③ Do you use any carcinogens, mutagens, or endocrine disrupting chemicals in your products? Do you use persistent or bioaccumulative chemicals?
- ④ Do you support producer responsibility for managing product waste? Do you take back your products for reuse, repair, or recycling?

- ⑤ Social criteria: What is your policy on labor practices? Do these extend to your suppliers? How do you monitor labor practices in developing countries? Is this independently certified?
- ⑥ Are results of your LCAs discussed with workers?
- ⑦ Do you use LCAs when evaluating your suppliers?
- ⑧ What happens to your product at the end of its life?
- ⑨ Do you have plans to improve your product profile? If so, how? For example, do you have plans for your company and your suppliers to:
 - Prolong the durability of the product?
 - Make it repairable?
 - Reduce its material and energy use?
 - Phase out toxic materials?
 - Reduce packaging?
 - Reduce transportation needs?

Sample Questions to Ask a Food Producer

- ① Has your company conducted Life Cycle Assessments for its products? How international is the scope of these assessments?
- ② Are these studies available to consumers? How?
- ③ Are results of your LCAs discussed with workers?
- ④ Do you use LCAs when evaluating your suppliers?
- ⑤ Do you use, or do you plan to use, genetically modified crops?
- ⑥ Will you label your food as containing GE or being GE-free?
- ⑦ What happens to packaging at the end of its life?
- ⑧ Social criteria: What are your policies on labor practices? Do these extend to your suppliers? How do you monitor labor practices in developing countries? Is this independently certified?
- ⑨ Do you have plans to improve your product profile? If so, how? For example, do you have plans for you and your suppliers to:
 - Reduce chemical and energy inputs into your crops?
 - Adopt organic standards?

- Reduce packaging?
- Reduce transportation needs?

Sample Questions to Ask Retailers:

- ① Does your company obtain products from sustainable businesses?
- ② In particular, where does your wood come from? Paper? What types of plastics do you sell? Do you have a PVC-free policy? What is your policy on genetically modified food?
- ③ Social criteria: What are your policies on labor practices and do these extend to your suppliers? How do you monitor labor practices in developing countries? Is this independently certified?

Sample Questions to Ask School Cafeteria Managers, Restaurants:

- ① Do you use organic food?
- ② Do you supply vegetarian food?
- ③ Do you supply genetically modified food?
- ④ How do you limit your use of potentially toxic cleaning chemicals?

If producers, suppliers, and retailers have no policy on producing or procuring cleaner products and food, tell them that you as an individual, as shareholders, and as coalitions will no longer buy from them. It is essential that retailers and producers hear clear consumer demands. The success of the anti-genetically engineered food campaign in Europe has shown the power of the consumer lobby.

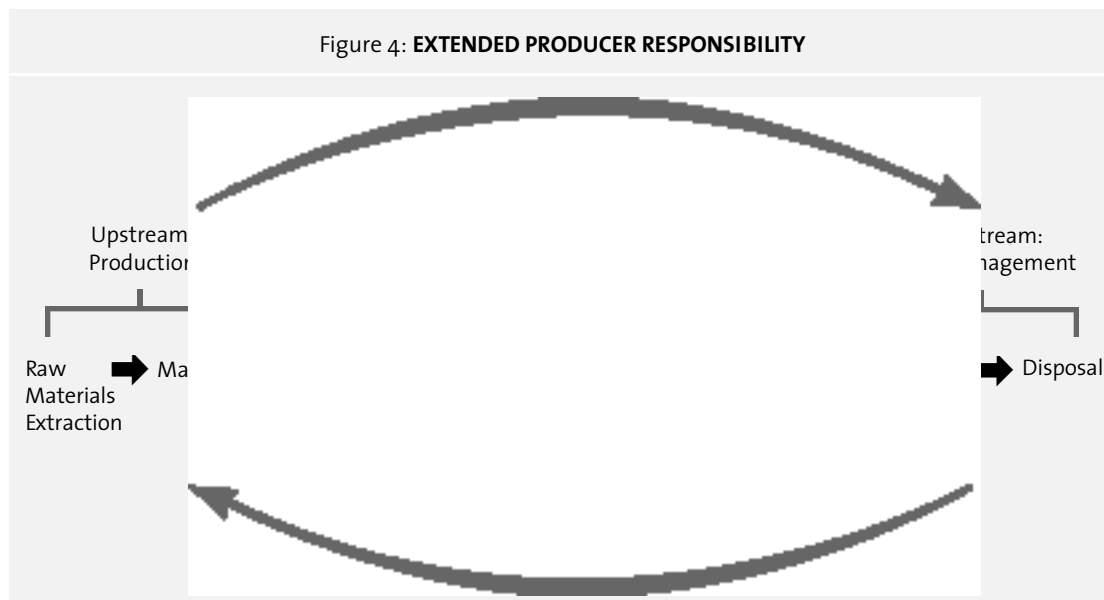
In parallel, alternative consumption methods can be created. One such initiative is Community Supported Agriculture projects which are now growing in popularity. Individuals pay money up front to farmers in the spring to grow organic produce and deliver food in season under a local distribution scheme. Church groups and community associations have been instrumental in increasing the popularity of this direct producer-consumer link.

D Extended Producer Responsibility: A Tool for Cleaner Production Design

Producer responsibility extends to the waste management of products as well. Known as **Extended Producer Responsibility (EPR)**, this makes the producer financially and/or physically responsible for taking back products. The model example of EPR is when a producer takes back a product at the end of its useful life (i.e., when discarded), either directly or through a third party. Other terms used are “take-back,” “product liability,” or “product responsibility.”

The Range of Responsibilities

Conceptually, the ultimate form of EPR is leasing: the producer never terminates ownership. Many companies such as Xerox advocate leasing of their products because it gives them (as producers) control over the entire life cycle of their products and allows them to repair and reuse components. However, this is imprac-



tical or impossible for many product categories and so other policy tools are used such as:

- *Physical responsibility*, in which the producer is involved in the physical management of the products, used products, or the impacts of the products through development of technology or provision of services;
- *Economic responsibility*, in which a producer covers all or part of the costs for managing wastes at the end of a product's life (e.g. collection, processing, treatment, or disposal);
- *Liability*, in which responsibility for environmental damages caused by a product—in production, use or disposal—is borne by a producer; and
- *Informative liability*, in which the producer is required to provide information on the product and its effects during various stages of its life cycle.

WHAT YOU CAN DO: KEY QUESTIONS TO ASK WITH ANY TAKE-BACK SCHEME

- What will be the fate of used products or waste when they are returned?
- Will EPR result in less per capita consumption of resources?
- Will EPR encourage use of less hazardous materials, capable of being safely recycled?
- Will EPR result in more reuse and less use or simply more recycling?
- Will EPR shift the idea of product ownership to product leasing?

Going Beyond Recycling

We should recycle, but it is not the first thing we should do, it is the last. Redesign first, then reduce, reuse and finally recycle, if there is no other alternative (William McDonough).

One-use throwaway products usually leave a large ecological footprint—raw materials and energy are used through a long product chain involving transportation, manufacturing, packaging, and distribution. The product may be used for less than ten minutes and then discarded. Even if the materials, such as one-use plastic forks, are recycled, this again necessitates collection, transportation, and energy to recycle the plastic into a “downcycled” product.

“Downcycling” is producing secondary material that is somehow inferior to the virgin post-consumer materi-

al that it is made from. Eventually, downcycled materials become of such poor quality that they become waste. If the material has been made of toxic substances, it poses waste management problems. This includes toxic waste generation from incinerators or leachate from hazardous landfills. If burned in cement kilns, the hazards are diluted in cement.

The goal of EPR is to bring about better and cleaner product design—e.g. the conservation of resources and the use of less or nontoxic materials. Thus, an effective EPR program goes beyond recycling programs.

Because it is costly to change product design, extended producer responsibility could prevent the production and sale of short-life, disposable goods designed for obsolescence. It would question the economic feasibility of reprocessing toxic materials contained in used products. It would question the use of multiple and composite materials as well as the design of products whose components cannot be reused or their materials recycled.

More immediately, EPR can be a way to shift waste management costs from the public sector back to the private sector. Today, responsibility for the disposal of used products rests ultimately on local government and the general taxpayer, not on the producer. As solid waste burdens have increased and more stringent disposal regulations have made waste management more expensive, the budgets of local governments have been stretched thin, and local taxes have been increased. The siting of solid waste facilities has become a major political battleground. Local governments have been saddled with the responsibility for a problem that is not of their own making and which they can do little to prevent.

Of course, consumers also have responsibility but the producer has ultimate choice over materials and product design. Many consumers would welcome more reusable and repairable products, but such products are becoming less available.

Extended Producer Responsibility— Progress to Date

Ever since the Ordinance on Avoidance of Packaging Waste was enacted in Germany in 1991, product take-back and related forms of EPR have spread across industrialized countries, industry sectors, product categories, and waste streams. Although some of the appli-

cations of EPR may be new, the idea is not. After all, deposit refund systems on refillable glass bottles are some of the earliest forms of EPR.

The extension of producer responsibility throughout the product cycle has been enacted or is under serious consideration in Austria, Germany, Belgium, France, the Netherlands, Sweden, Japan, Taiwan, Korea, the U.K., and Canada, as well as in numerous local and regional governments. The range of products and waste streams targeted under these emerging EPR policies includes packaging, paper goods, consumer electronics, office machinery, cars, tires, furniture, electric appliances, buildings and construction materials, mercury, batteries, and household hazardous wastes. The epicenter of the movement to increase the environmental responsibility of producers remains in Northern Europe.

Many industrial sectors are particularly alarmed at the prospect of EPR and are lobbying to dilute their responsibilities for used products. Instead of EPR, they favor “Extended Stakeholder Responsibility” or “Shared Product Responsibility,” which transfers much of their liability onto consumers, or the even weaker term “Product Stewardship.” However, if the objectives are indeed to reduce the use of resources through a better choice of materials and product design, producers should be targeted. Producers are the actors with the greatest leverage over environmental improvement.

EPR is still in its infancy and time will tell if legislation will promote no use, extended use and reuse—and thus a drop in resource consumption—or an expanded recycling industry that simply perpetuates resource-intensive and hazardous production for expanding markets.

Some Product Take-Back Schemes

Product take-back programs have been enacted for the following product categories: packaging, batteries (particularly small consumer batteries), electric and electronic products, and end-of-life vehicles.

Germany's Packaging Law

In December 1991, the Ordinance on the Avoidance of Packaging Waste (*Verpackungsverordnung*) was introduced in Germany. It has since been adapted for use in Austria, France, Belgium, Luxembourg, Spain, and Portugal. However, unlike other countries that put costs on local authorities and consumers as well as

producers, Germany puts full financial responsibility on manufacturers and distributors for the packaging they create. The idea behind the ordinance is to make industry pay for managing the waste generated by its packaging by taking back packaging materials and either reusing or recycling them. Its goals are to reduce packaging waste requiring disposal and to develop sound materials use practices.

The ordinance is implemented by setting government-mandated recycling and refilling (for beverage containers) targets and allowing industry to impose fees on packaging materials. It imposes a minimum 72% quota for refillable bottles. On average, from January 1, 1999, the following quantities of materials, by weight, must be recycled: glass—75%; tinplate—70%; aluminum—60%; paper, cardboard—60%; composites—60%. From January 1, 1999, 60% of plastic packaging must be recovered. Currently 33% of plastic waste is mechanically recycled, most of it polyethylene and polypropylene. The rest is sent to chemical depolymerization plants for “feedstock” recycling whereby the plastic is reduced to its original chemicals—these now take the bulk of plastic waste (58%). Chemical recycling of plastics—which is itself highly energy intensive—extracts the gas and oils in the plastic for use as a substitute for heavy oil in blast furnaces to make pig iron or to liquify the polymer for recycling into other plastics. In 1997, 9% of plastic waste was shipped to other countries for recycling.

The original ordinance specifically prohibited incineration but this was changed in 1998 to allow energy recycling under strict conditions: the waste must only be used as fuel and not burned simply for disposal; the caloric value of the waste must be high; the incineration efficiency must be high; and any additional waste arising during recovery can be disposed of without further treatment. Of the 57 incinerators operating in Germany today, only two or three can fulfill these requirements.

A small amount of PVC (2.5%) is still used in packaging. This has proved a problem since it contaminates other plastics in mechanical recycling and creates additional waste disposal problems in feedstock recycling. For this reason PVC packaging waste is sent to landfill.

The ordinance also requires retailers to provide bins so that consumers can leave outer packaging in the stores. Under pressure from retailers, the *Duales System Deutschland (DSD)*—a consortium of 600

companies—started operating in January 1993. Under this system, all products licensed by DSD carry a green dot and are collected by the consortium-funded private service. Over seventy-five percent of all packaging in German stores carries the green dot. Consumers pay an increased price for the packaging, based on what material it is made from, to cover the cost of recycling. Because of this, manufacturers have an incentive to reduce the price by using materials which have a lower disposal fee or by reducing the amount of packaging.

Impact of the Packaging Ordinance. The law generated a mountain of recyclable waste, the majority of which in the early days was exported and disposed of abroad. However, the law has subsequently reduced per-capita packaging use. According to the DSD there has been a total drop in per-capita consumption of packaging from 94.7 kg in 1992 to 82.3 kg in 1997. This 13 percent drop in consumption compares to the 15 percent increase in per-capita packaging use in the U.S. over the same time period. The proportion of beverages sold in refillable containers has increased. The transportation packaging sector, which has seen the greatest drop in packaging, has developed reusable shipping containers. Furthermore, the ordinance has also raised awareness among packaging producers of the need to radically rethink materials use, both types and amounts, in packaging.

Has the take-back system resulted in real reductions in resource use? Critics of the system point out that material bans need to accompany take-back targets. For instance, aluminum has a large environmental footprint throughout its life cycle, from mining bauxite in tropical countries to the intensive use of electricity to process the ore. The use of aluminum in disposable Tetra Paks or drink cartons cannot be justified. Similarly, a ban on PVC and other halogenated materials would alleviate the problems of hazardous emissions throughout manufacturing, use, and disposal (this has happened to some degree through changes in packaging). For heavy metals, the revised ordinance stipulates a reduction in the total use of lead, mercury, cadmium, and hexavalent chromium in packaging from 600 parts per million (ppm) in 1998 to 100 ppm in 2001. This could be better achieved with a total ban. A ban on all one-use beverage containers, which could later be extended to all food and cleaning packaging, as well as incentives for more regional recycling, would further reduce the use of resources. The Oko Institut in Germany has further recommended a Red Dot labeling scheme to warn consumers of non-recyclable materi-

als. Obviously incineration is still not an acceptable disposal option.

Take-Back for Waste from Electrical and Electronic Equipment

An important initiative in the European Union (EU) is the drafting of legislation to tackle the growing amount of waste from electrical and electronic equipment (WEEE), estimated today at more than 6 million tons. The life cycles of some electronic goods, such as computers, have become increasingly shorter due to innovations. Miniaturization of electronic equipment reduces the volume of waste but makes collection, repair, and recycling more difficult. Also, the relative costs of repair and buying new electronic equipment have changed, so that repair is economically feasible only for very expensive and large electronic goods. The problem of WEEE is not only the quantity, but also the hazardous impacts associated with final disposal. WEEE often contains heavy metals, arsenic, halogenated organic substances such as brominated flame retardants, and toxic plastic such as PVC that create problems when landfilled and especially when incinerated.

The EU draft legislation on WEEE aims to promote electrical products designed for repair, upgrade, reuse, dismantling, and safer recycling. (Similar legislation was proposed recently for automobiles.) The latest draft of the proposed Directive from August 1998 has sharpened producer responsibility and tightened the recovery targets. Environmental groups support the following elements of the draft Directive (a European Union form of legislation ratified by individual countries):

- financial responsibility of producers for collection, treatment, recovery and disposal;
- the inclusion of tough re-use and recycling targets, a minimum recovery rate of 90% by weight for large household appliances and 70% for other categories by January 2004;
- the inclusion of targets for use of recycled materials—the share of recycled plastic in new equipment should be 5% of total plastic content by 2004;
- the phase-out of the use of hazardous substances—lead, mercury, cadmium, hexavalent chromium and halogenated flame retardants—by 2004;
- the exclusion of energy recovery as a means of meeting the recycling targets.

Some member states, such as Sweden, are strong in their support for the directive with its focus on producer responsibility and hazardous material phase outs. A few progressive electronic manufacturers, that can easily meet the criteria, support harmonized legislation to avoid “free-riders.” The draft directive is a good attempt at moving toward cleaner design but it needs more emphasis on reuse and upgradability rather than recycling. The phaseouts should also include PVC plastic, but the European Union backed down in the face of industry opposition during a previous attempt at car take-back legislation. The EU is attempting to deal with PVC materials under a separate study of the problems of PVC waste from all product sectors. In reality this has been an effective stalling tactic by the PVC industry to prevent quick action on PVC bans.

How Can EPR Promote Cleaner Design for Electronic Products?

Electronic products entering the waste stream today were not designed with reuse and recycling in mind. Designing for durability by making products easily upgradeable has not been a feature of the electronics sector, where product design changes rapidly. A lack of information on product composition, material variety, and hazardous constituents presents obstacles to recycling, particularly for plastics. Cost-effective reuse and recycling in the future will require product design changes that will increase the reuse and recyclability of components, phase out toxic materials, reduce disassembly time, and make products upgradeable to prevent more junking.

Examples: Initiatives by some manufacturers

At Sony Europe, new television designs incorporate more snap-together parts and fewer screws to facilitate product disassembly. They also include fewer material types to reduce the amount of sorting required for recycling. PVC plastic has been phased out.

Nortel’s office communication systems introduced in the 1970s were “backwards compatible”: even in the 1990s a customer can easily upgrade and expand to provide enhanced communication capabilities without replacing the entire system. The company has now adopted a modular product philosophy for its new line of telephones, allowing the customer to upgrade the unit with-

out scrapping the old one. The new model is designed in two parts—a standard base with basic telephony features and an upgradeable slide-in module that can add features such as caller ID, call waiting, a larger screen size, or a better graphics display. The module can be replaced to provide the latest features at half the cost of replacing the telephone. It also reduces the volume of product going to recycling or disposal.

The countries most actively pursuing EPR for electronic products are Germany, the Netherlands, Sweden, Japan, Taiwan, Austria, UK, Switzerland, and France. One reason why EPR is slow to get started in North America is that significant landfill space is still available for waste disposal. Other countries faced with landfill scarcity have had to address product-based environmental legislation much sooner.

Example: Surveying product manufacturers on their life cycle: the Clean Computer Campaign

The Clean Computer campaign is developing a report card for each manufacturer. The results will be widely publicized. At the same time, groups in the Silicon Valley are working with workers in Silicon Glen, Scotland, to disseminate information on reproductive hazards associated with high-tech manufacturing, the status of U.S. class-action suits for cancer clusters against major computer manufacturers, and U.S. worker right-to-know legislation. The campaign has also linked up with waste activists and recyclers in both North America and Europe who are concerned with the rising amount of computer junk. One strategy currently being used to pressure manufacturers to design products with nontoxic materials and fewer resources is extended producer responsibility for computer take-back.

The U.S. Trade Representative and the American Electronics Association have opposed a recent legislative proposal in Europe that would phase out certain hazardous substances in electronic products, make the producer responsible for taking back old products, prohibit incineration as a form of recycling, and mandate a certain percentage of recycled plastics in new products.

Both claim these measures run counter to free trade.

A coalition of waste activists and public advocacy groups is highlighting the obstruction by the U.S. government of this proposal. They believe that effective legislation in Europe would force U.S. exporters to comply and thus stimulate the development of EPR legislation and cleaner product design in the electronic industry.

E ARE THERE U.S. EPR INITIATIVES?

Extended Producer Responsibility is far better developed in Europe than it is in the United States, but there have been several EPR initiatives in this country. These programs and campaigns are a mixed bag. The most promising efforts are still in their infancy, while the better-known programs, especially the battery take-back scheme, do not go far enough.

An Early Attempt to Solve Car Waste Problems

The U.S. House of Representatives proposed legislation in 1991 that would have required manufacturers to take back end-of-life vehicles. Called the Automobile Recycling Study Act of 1991 and introduced by Representative Torricelli of New Jersey, the act did not pass and was not reintroduced in subsequent Congresses. Included in the findings of the bill was the statement:

Automobile manufacturers must work in tandem with the producers of raw materials for automobiles, materials suppliers, the automotive dismantling industry, the scrap processing industry, chemical process engineers, and the recycling industry to develop a more recyclable automobile.

The proposed study would have included “methods for incorporating recyclability into the planning, design, and manufacturing of new automobiles” and the “feasibility of establishing design standards for automobiles that would result in a gradual phaseout of hazardous and nonrecyclable materials used in automobiles.”

Approximately 10-11 million vehicles are junked in the U.S. every year. The 25 percent of the vehicle that is not recycled represents a major solid waste problem. This

waste, which is composed primarily of plastics and fibers, is called auto shredder residue (or fluff). About 3 million tons of it are disposed of in landfills every year. The shredder waste is classified as hazardous in California and Europe because it contains heavy metals and can leak chemicals.

The Clean Car Campaign

A new initiative to increase fuel efficiency, phase out toxic materials such as PVC plastics and heavy metals, and lobby for EPR has been developed by the Ecology Center of Ann Arbor and Environmental Defense Fund. The campaign is building alliances along the product chain to force producers to adopt cleaner material and product design. In particular the campaign has prepared

- a life cycle perspective on the environmental impacts of the motor vehicle and ways to reduce them;
- a description of the processes, associated wastes, and pollution prevention opportunities at different life cycle stages;
- facility-specific information on pollution, compliance, and community demographics;
- pollution prevention rankings, and information on which models are made at each plant;
- a green vehicle consumer pledge form challenging the companies to make more environmentally sound vehicles.

Battery Take-Back in the U.S.

EPR has been most effective with battery take-back. In 1996 Congress passed The Mercury Containing and Rechargeable Battery Management Act, which eliminates barriers to the take-back system caused by hazardous waste laws. It establishes national uniform labeling requirements for rechargeable batteries deemed toxic such as nickel cadmium (Ni-Cd) and sealed lead-acid batteries. The law also mandates that rechargeables be easily removable from consumer products and restricts the sale of mercury-containing batteries. The law does not apply to alkaline rechargeables which are considered non-toxic under this Act, and can therefore be disposed of with regular trash.

Laws affecting rechargeable batteries had previously been enacted in Minnesota in 1990 and in New Jersey in 1992. Both states required that rechargeable batteries be easily removable from products, be labeled as to

content and proper disposal, and be banned from the municipal waste stream. They also require producers to be financially responsible for recycling or disposal. A major incentive for New Jersey to push battery take-back is that the state depends heavily on incineration and wishes to get heavy metals out of its waste stream for both economic and environmental reasons. The New Jersey Department of Environmental Protection estimates it costs \$17 million a year to control cadmium, lead, and mercury (from discarded products) in municipal incinerators.

While the technology was available in the U.S. to recycle Ni-Cds prior to passage of the Minnesota and New Jersey laws, very few were actually recycled. State legislation spurred the development of a recycling infrastructure. The legislation requiring removability is important since Ni-Cds must be removed from products in order to separate them for recycling. Eighty percent of Ni-Cds are enclosed in cordless tools and appliances, and most were not accessible before the mandate for removability was implemented. Following passage of the federal law, major retailers across the country were targeted to join the program, and retailers began asking for collection bins. Public agencies and recycling coordinators were also contacted.

Ni-Cd battery take-back is a hindrance to clean production

- Although some batteries are being diverted from landfills and incineration, capture rates are low. The recycling effort may in fact help perpetuate the production and use of a toxic product—cadmium is a highly toxic material.
- Rechargeable batteries have been marked as “green” products because of their reusability, with no attention given to their toxic nature.
- Other forms of power generation, such as manual or renewable electric, are not promoted instead. For example, BayGen has developed both a windup radio and windup flashlight—originally developed for use in Africa but now sold in fashionable stores in Europe.
- With intense research taking place on fuel cell and battery technologies for electric vehicles, Ni-Cds may be positioned as a green option because of the collection system in place.

A U.S. Town’s Resolution on Extended Producer Responsibility

In September 1998 the Town of Carrboro, North Carolina, passed a resolution asking the state’s General Assembly and the U.S. Congress to adopt legislation that shifts the burden of managing discarded products and packaging from local governments to the producers of those products. They are now requesting their representatives to sponsor such legislation.

The resolution was prompted by the fact that 7,500 tons of waste will be landfilled in the town this year at a cost to taxpayers of \$773,000. Because 70 percent of these wastes are manufactured products, the town believes “the success of waste prevention, reuse, recycling, and composting programs depends upon efforts by producers to take responsibility for minimizing waste and utilizing recovered resources.”

Mercury Take-Back Legislation

Mercury is a toxic metal widely found in products including toys, switches, medical devices, lights, apparel, and vaccines. When these products are discarded, they contribute about one third of the mercury emissions each year in the U.S. Supported by grassroots campaigns, all but one of the six New England states have proposed legislation to require labeling of mercury-containing products. Product labeling and take-back requirements are also included in the Mercury Action Plan agreed to by the New England governors and Eastern Canadian premiers. The Plan, adopted in June 1998, calls for the virtual elimination of mercury releases from man-made sources and establishes a five-year, 50 percent mercury reduction goal.

Vermont and Minnesota have already passed mercury labeling requirements and landfill bans. Vermont’s new law extends labeling requirements beyond Minnesota’s to include labeling of mercury-containing lamps and of cars that contain mercury switches. Additionally, Minnesota mandates certain mercury product take-back requirements. Legislation introduced recently in the U.S. Congress by Senator Patrick Leahy (D-VT) would require the establishment of manufacturer take-back programs for products when non-mercury substitutes are not available.

WHAT YOU CAN DO

- If you are involved in anti-incineration and anti-waste campaigns, determine what products are causing the main problem, approach the producers of these products, and ask them what their views are on EPR. (See sample questions above.) Ask them how their products are disposed of, if they are incinerated or landfilled, and how they intend to redesign their products to implement safe recycling and reuse.
- Enact local ordinances making producers responsible for product take-back and re-design. Contact the GrassRoots Recycling Network (see contact list)
- Use green procurement policies to support cleaner design by rewarding companies that close the material loop in their products.
- Join the campaign to defend European EPR initiatives, since this will have an important bearing on the future of EPR in the U.S. Join the clean computer campaign. For more information contact the International Campaign for Responsible Technology c/o Silicon Valley Toxics Coalition, 760 N. First Street, San Jose, CA 95112. Tel: (408) 287-6707; email svtc@igc.org, web site at www.svtc.org.
- Join the Clean Car Campaign. For more information contact the Ecology Center of Ann Arbor, tel: (734) 663 2400, email: charlesg@ecocenter.org or Environmental Defense Fund at tel (202) 287 3500 email: Kevin_Mills@edf.org.
- Replace your recycling campaigns with Extended Producer Responsibility initiatives. Ask yourself if your recycling programs are resulting in less per-capita consumption of resources and encouraging the use of less hazardous materials. Is your recycling program resulting in more reuse and less use or simply more recycling?

F FINANCING SUSTAINABILITY: ECOLOGICAL TAX REFORM

Extended Producer Responsibility is only one tool to move to clean production systems. EPR must be reinforced with ecological tax reform. The existing economic model, supported by the current tax and subsidies system, favors the use of resources and energy over people. Tax reform can increase the effectiveness of EPR by making resources more expensive and labor costs cheaper.

Reducing Labor Costs and Creating Jobs through Increased Pollution Charges

Ecological tax reform (ETR) shifts the tax burden away from “value-adding activities” such as labor and increases the tax burden of “value-depleting” activities, such as resource depletion. Most ETR programs aim to make the final tax income/revenue neutral. This means the savings employers would gain from paying less in employee benefits, such as social security contributions, would be balanced, for instance, by their increased taxes on energy use. ETR thereby provides an incentive to save money through environmentally sound actions—in this case by installing energy efficiency measures.

Pressure to implement ETR has come initially from countries with some of the highest income tax rates in Europe (and high unemployment).

Example: Union Support for ETR in Germany

A 1994 a German study prepared by the influential German Economic Research Institute and commissioned by Greenpeace showed that a unilateral Ecological Tax Reform program that raised energy prices by 7% per year for 15 years and recycled the revenues to industry and households would not damage competitiveness. It would pool the tax receipts taken from consumers through their utility bills and return it all by mailing “eco-bonus” checks, worth a flat amount per person, to every home in the country. Poorer households, which spend less than average on energy (though more as a percentage of their incomes), would gain from the system. Rich households would lose—though very slightly compared with their incomes.

Similarly, industry would get its money back in the form of across-the-board payroll tax cuts, which would stimulate job creation. Total energy use would fall by the year 2010 to 14 percent below what it would be without tax reform. In addition, 600,000 jobs would be generated within 10 years.

Under this plan, industries that use the most energy and the least labor, such as chemical manufacturers, steelmakers, and coal companies—which were responsible for 46 percent of value added in private industry in 1988, but only 42 percent of employment—

would see their costs rise. Cleaner, more labor-intensive industries—from education to telecommunications to retail—representing 50 percent of output and 54 percent of employment, would save money and probably expand. The automobile industry, with 4 percent of output and employment, would break even.

The proposal is popular with many industry and labor groups. Even the head of BMW has endorsed the idea because he believes that energy taxes will encourage consumers to invest a little extra in more energy-efficient cars. The German metal workers union, IG-Metall, the largest union in Europe, has also voiced strong support. With employment already falling steadily in the German iron and steel industries, it is clear that the status quo offers little security for union members in this sector. Payroll tax cuts and an accelerated transition to a sustainable, more labor-intensive steel recycling industry would do them more good. It would create more jobs, and longer lasting ones.

The results of the Germany ETR study were in line with others produced in the Netherlands, Belgium, Austria, and France. The European Commission funded a six-country study that showed that, unless economic and environmental policies were integrated through an ETR program, either the economy or the environment would suffer.

The task of reducing greenhouse gases should be a job creator. It has been calculated that half a million jobs could be created if Europe immediately implemented ecological tax reform. The EU Commissioner for the Environment sees this as the only effective way of meeting the Kyoto agreement to reduce Europe's greenhouse gas emissions by 8% by 2010. This would involve taxing energy products and directly linking the benefits to job creation.

By contrast, when President Clinton proposed an energy tax in 1993, its costs were clear to those who would pay but not directly clear to those who would benefit. Political support for the tax was therefore weak. Major manufacturers and energy producers launched a multimillion-dollar lobbying campaign against the tax—the largest such effort ever mounted to stop a bill in U.S. history—and won.

Removing Tax Breaks to Polluting Industries

States supposedly give tax incentives to industry to create jobs. However, analyses by groups like the Louisiana Coalition for Tax Justice have shown that these tax breaks offer no net benefit to the community.

Thus far in the 1990s, Louisiana has wiped off the books \$3.1 billion in property taxes alone. In the past 10 years the state canceled:

- \$213 million in industrial property taxes owed by Exxon Corporation—in return for the creation of 305 jobs;
- \$140 million in taxes owed by Shell Oil affiliates—in return for 167 jobs;
- \$103 million in taxes owed by International Paper—in return for 172 jobs;
- \$96 million in taxes owed by Dow Chemical Company—in return for 9 jobs.

The list could go on. In return Louisiana has the highest releases of toxic substances in the U.S. and among the highest income disparity between rich and poor. Louisiana industrial users also have the lowest energy costs in the country, while Louisiana residential electricity consumers have among the highest. An elimination of these tax breaks would allow the state to better fund schools and invest in environmentally friendly technologies such as solar power.

Removing Subsidies to Polluting Industries

The U.S. is funding unsustainability. Not only is the government subsidizing environmental degradation, but average citizens must make up for the lost revenue by paying higher taxes or suffering under the burden of increased national debt. Every year, these polluting tax subsidies cost U.S. taxpayers \$4 billion.

For example each year billions of dollars benefit the mining industry through depletion allowance costs. Depletion allowance is based on the idea that as minerals are extracted, the mine's value decreases. Mining companies can deduct up to 22 percent of total income. The subsidy encourages wanton mining regardless of the true economic value of the resource.

Ironically the more toxic the mineral, the higher the subsidy. Mercury, zinc, uranium, cadmium, and asbestos are among the minerals that receive the

highest percentage depletion allowance, while less toxic substances have lower rates. In many instances, this tax break creates absurd contradictions in government policy. Nearly nine percent of U.S. preschoolers, 2.7 million, have lead poisoning. Federal agencies spend nearly two hundred million taxpayer dollars each year to prevent lead poisoning, test young children, and research solutions. At the same time, the mining of lead is subsidized with a 22 percent depletion allowance. Eliminating the percentage depletion allowance for mining operations would save \$1.5 billion over five years, according to the Congressional Joint Committee on Taxation.

If there are to be tax breaks for materials, they should be for recycled materials and bio-based ones, not extraction of scarce raw materials.

Why Changes Don't Happen

It is politics and not sound policy that best explains the remarkable resilience of outmoded resource regimes in the U.S. Between 1993 and mid-1996, oil and gas companies gave \$10.3 million to protect special tax breaks worth roughly \$4 billion over the same period. Lumber lobbies donated \$2.3 million in an effort to keep the subsidized timber coming. Mining firms handed out \$2.9 million to members of Congress to fend off royalty charges on public hardrock minerals, something they have succeeded in doing since 1872. Ranching interests contributed, too, in order to keep federal grazing fees low as they have been since 1906.

WHAT YOU CAN DO

Find out where your tax dollars are going.

Removing tax breaks and subsidies to polluting industries is essential to move our production and consumption to sustainability. Citizens can find out where their tax money is going through a variety of means.

Community groups can demand detailed disclosure of forgone revenues and direct payments by governments as well as projected public benefits. Some states already have passed laws requiring the disclosure of this information and keep excellent records of the subsidies that state agencies grant. A few states even have "tax expenditure budgets" that track the amount of tax dollars that have been forgone through targeted tax abatements. Other states and localities are less vigilant. Sometimes the best way to start a campaign is

by demanding that states do a better job monitoring business incentives.

The extent of corporate disclosure required by state and local governments varies. Right-to-know laws were originally passed so that the public could monitor toxic releases. Where subsidy policies are concerned, some states and cities have passed laws that extend right to know to other types of information, including compliance with job creation targets. Much more is needed for corporate disclosure, however. A true model for a subsidy right-to-know system does not as yet exist in any state or locality.

Few cities and states actually know the real cost of what they are giving away or what they are getting in return. The National Association of State Development Agencies found that few states conduct rigorous evaluations of incentives. Similarly, a survey conducted by the University of Illinois at Chicago discovered that no cities use this kind of analysis to determine the amount of subsidy to be given.

Evaluate what your tax dollars achieve.

Citizens need to measure if our taxes are being spent on sustainable industries. Community groups can demand these analyses. These evaluations can be more cost effective than simply requiring subsidized companies to estimate how many jobs they think they will create or retain. They could audit the actual number and wages of jobs created, the impact on revenues, the secondary industry effects, and the impact on state and local service provision. The analysis could audit the ecological footprint of industries, the life cycle impacts of products, and the contribution the industry or company is making to sustainability.

Some states are setting goals that companies receiving financial incentives must meet:

- Minnesota has led the way in developing benchmarks to assess its progress toward making "small cities, rural, and urban areas economically viable."
- In Connecticut, peace activists, unions, and local legislators recently helped to pass state legislation that ties the receipt of state financial incentives to defense diversification. The legislation requires every Connecticut firm that receives assistance from the state and more than one million dollars per year in defense contracts to

establish an alternative-use committee to identify new commercial products and determine retraining needs.

Demand clean production strategies that are tied to subsidies.

Integrating clean production criteria and strategies to state goals is now essential. Recouping tax breaks and subsidies to polluting industries would allow financing for renewable solar energy pilot projects to stimulate the market and bring down the price of solar cells. It could help farmers make the transition from intensive agriculture to organic. It could also subsidize public transportation and increase the frequency of service to areas poorly serviced by buses and trains.

Example: Using good subsidies

The Netherlands has developed cleaner production incentives to the fullest. Its tax breaks apply specifically to purchases of 400 or so technologies officially listed as cutting-edge, from devices for recycling concrete to machines that generate ozone for use as a chlorine-free bleaching agent in paper making. When these become commonplace, they get bumped off the list by newer entries, thus creating a steady incentive to prod industry to develop cleaner production. In another path-breaking step, the Dutch government now grants complete tax exemption for mutual funds that invest in green projects such as wind farms and pollution prevention research and development.

Demand government procurement of cleaner products.

Stimulating the market for cleaner products is most effectively done by major buyers. For example, President Clinton signed an Executive Order in 1993 requiring federal agencies to purchase only computers and printers that meet Energy Star requirements.

Barry Commoner says we are losing a major opportunity by not pressuring federal and local governments to pursue such things as electric vehicles, organic food caterers, and renewable energy. Indeed, the growth of the high-tech computer industry was accelerated by government purchasing. It was the U.S. military establishment during the 1950s that accelerated the development of the integrated circuit computer to prepare for rapid nuclear response in time of war. Because the U.S. had no large-scale facilities for producing comput-

er chips, the Pentagon offered private entrepreneurs large, lucrative contracts, enabling them to set up the required production facilities. In a few years, a computer chip that originally cost \$50 came down in price to \$2.50.

Twenty-five years later, during the Carter administration, an effort was made to resurrect this practice for the development of photovoltaic cells. It was estimated that if demand increased through government purchasing, the price of a silicon cell could be reduced from \$20 per peak watt to \$2-3 within a year, to \$1 in three years, and to 50 cents in five years. At this price, photovoltaic cells were expected to be competitive with electric utilities in many parts of the country. A bill for the purchase of nearly half a billion dollars' worth of photovoltaic cells for federal installations was passed, but was never realized because the bill was vetoed by President Carter.

G REDUCING CONSUMPTION—SELLING THE SERVICE, NOT THE PRODUCT

Advocates must encourage consumers to adopt a different attitude toward buying products, if we are to support the move toward clean production. The first questions to ask when looking at a product are: What is the need this material good is supposed to satisfy? What is the function I am buying?

Some companies have realized they can supply consumers' needs with less material and energy use by focusing on the service sold. This provides an incentive for designing more environmentally friendly products that are more easily recycled. The idea behind this concept is that consumers may not need to own a product if they have the benefit of the service it provides.

Example: Interface, Inc.: covering your floor, not selling carpets

In 1994 Interface, Inc., a leading maker of commercial carpet and interior furnishings, began changing its \$1 billion company to become "the first name in commercial and industrial ecology worldwide." Instead of selling wall-to-wall carpets, the company has developed carpet tiles which are modular and can easily be replaced one by one when worn out (focusing changes on areas with highest traffic). The company contracts

with purchasers to keep their floors covered with high-quality carpet by replacing tiles when necessary. The company retains ownership of its carpet tile, making itself solely responsible for its maintenance, repair, and ultimate recycling. By assuming full life cycle responsibility, the company assures the recycling loop will be closed as well as maximizing the potential to reuse natural resources and avoid landfill.

The company has now developed a fully compostable carpet made of natural and degradable fibers that it hopes to put into large-scale production. The company has currently saved over \$20 million from the leasing policy and cleaner technology improvements within the manufacturing plant.

A similar system could be used for lawn or garden maintenance. Rather than sell artificial fertilizers and chemical pesticides, a company could market “healthy lawns.” This then enables the use of integrated pest management, companion planting, integration of clover into the definition of “lawn,” and manual weeding to obtain the same result using cleaner production.

Bike sharing schemes in Amsterdam have been revived, solving the problem of stolen bikes. Citizens now buy a fifty-cent “smart card” which is needed to log in to a meter where the bike is locked. The card records the person’s address and social security number, which is then deleted when the bike is returned to another drop-off point in the city when the person logs out.

Similarly, car sharing schemes have surfaced in many cities from Amsterdam to Portland, Oregon, to Montreal, Canada. In these places, members of a club register and provide 24 hours notice when a car is needed. They pick up the key from a locked box in a designated parking lot, use the car, and return it, paying a fee that is much less than traditional car rental. The benefit of car-sharing clubs is that newer, fuel-efficient cars are used more intensively—and members

have no repair bills. People also can use cars to fit their exact needs at a specific point in time (e.g., a van for moving household articles).

The potential of sharing schemes will depend on the ability to market these services as better than individual ownership. Yet material acquisition is marketed as being linked to happiness. Adolescents from poor households buy designer shoes and clothes to show they can afford them. Ownership of fuel-inefficient four-wheel-drive vehicles in urban centers has escalated.

A poll done by the Center for a New American Dream in November 1998 surveyed the attitudes of Americans about the holiday season. They found the majority of people were stressed by advertising pressure to fulfill children’s expectations of expensive toys and by general assumptions about constantly buying and consuming during the holiday season. Most claimed they were pressured to spend more than they could afford, bought presents for the sake of giving gifts, and had no time to rest and enjoy the holiday season.

Until we also acknowledge the needs that advertisers are so adept at targeting, can we really understand how to market a saner, less material-intensive, and sustainable future for all?

H Conclusion

The challenge is for all of us—consumers, environmental activists, government, industry, labor—to think together about how to live responsibly on this Earth. The above guide lists some tools by which we can do this in ways that sustain and even increase our own well-being. It calls for creativity, energy, and organization but it is truly worth it. Implementing Clean Production is an empowering and positive journey. This handbook is only a beginning.

We would be happy to receive news of your clean production campaigns and achievements. We can then include them in future updates of this guide. Please contact Beverley Thorpe with information about your activities. Contact information is on the front page.