Chapter 11. Rebuilding the American Economy

*A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it does otherwise.*  
—Aldo Leopold (1949)

People today are basically still the same physically, emotionally, and psychologically as those who lived in Catal Hüyük in 6,000 BC, or those who first came to California 30,000 years ago. Yet now there are 6.7 billion people on Earth, and the environment is less rich and abundant than it was during either period. For as long as humankind has been on Earth, people have changed the planet. These changes have been both intentional and unintentional, but most have been damaging to the environment and have reduced the value of natural capital and nature’s services. The need for careful accounting has up to this time not been felt, as humankind has always found a new place that is rich with resources to start again. That option, however, has ended.

The new reality is clearly visible. One of the most striking aspects of photographs of Earth from space is the pattern and color of development. The cities and urban areas are gray and are spreading into the green areas with tentacles like a fungus or disease. It need not be that way, but many poor choices have been made and everyone has contributed to the changes that Earth has undergone. A look at each individual’s ecological footprint shows how large humankind’s impact has been. If everyone on Earth were to live as people do now in the United States, four, five, or even more planets would be needed. Clearly current lifeways are not sustainable.

The good news is that there have been enough successes to demonstrate that humankind can do much better. People can live well with very few adverse impacts and can restore damaged environments. To do this, the present “waste-based” economy must yield to a material-efficient economy based on sustainable management of renewable resources. Failure to do so will mean that humankind will not prosper and may not survive. True cost accounting will play a critical role in guiding this transition.

True cost accounting will help eliminate the free riders and the transfer of costs to the poor and to future generations. Many products will cost more when current subsidies are removed. As prices more closely reflect true costs, the demand for low-price, low-quality goods and services will fade away, and consumers will instead seek out high-quality, custom-tailored products that will last a very long time and maintain good value. In addition, new companies will emerge that can substitute services for goods, so that consumers do not have to own everything. Flexcar is a good example. Its members reduced their annual mileage driven by 40 percent. In 2007, the reduction in mileage reduced pollution emissions by 14 million pounds. Flexcar merged with Zipcar in 2007. Each Zipcar takes 15–20 personally owned vehicles off the road. After joining Zipcar, 90 percent of members have driven 5,500 miles or less each year, which adds up to more than 32 million gallons of crude oil (219 gallons of gas per person) saved.

The underlying basis of the American economy can be changed by reforming incentives and rewards and expectations with better accounting. Rather than being based on greed and fear, the market can be based on opportunity, equity, hope and satisfaction. Improving the quality of goods and services can help everyone to live better with less. Investments will be made for long-term growth in value instead of gambled on highly leveraged speculation. Just as the Slow Food movement is changing the production and consumption of food, the emerging Slow Money movement will change investment and management of money to favor community and sustainability. The Slow Money movement, with true cost accounting and transparency as a foundation, can reform and transform the American economy and the global marketplace.

The challenge will be to make the transition to true cost accounting and full transparency as smooth as possible and to start immediately, not 10 years from now. This will not be easy, because powerful corporations, a handful of very wealthy families, and politicians benefit from current market inequities. American consumers are also spoiled; many consider low prices a right. The politicians pander to citizens’ weaknesses, and promise that people do not have to save or stay within their budgets or environmental constraints. A transition to true prices, however, must be made, and bills must be paid.

Steps along the way include increasing awareness of the problems created by the current accounting of costs and the benefits of true cost accounting. Many people act unsustainably because they do not understand the impacts of their actions. Education is essential and has already begun through sustainability reporting. As these reports improve understanding, a political consensus will develop to embrace comprehensive true cost accounting.

As information from sustainability reports becomes more readily available, it will be channeled through schools and universities and will help drive the research and policy changes that are needed to transition to a system that embraces sustainable management based on renewable resources. It will also enable companies and organizations to better manage their activities and improve their long term profitability and stability. The benefits will include improved security and comfort as more sustainable products are made, more sustainable services are offered, and more sustainable homes, communities, cities, and organizations are created.
These reforms will also influence international policies and programs. Better accounting and charges for impacts will improve allocation of funding and provide new funding to restore and resettle the many damaged and degraded areas around the world. Improved understanding will also help in the initiation and support of policy reforms, particularly for rules and regulations to reduce the impacts of special interests on political decision making and government policy formulation. As the focus shifts from money and the quantity of goods to the quality of life and life satisfaction, people may rediscover the pleasures of living again.

The sections that follow discuss the following policy reforms and initiatives that will be necessary to successfully adopt true cost accounting methods:

- Accounting reform
- Sustainable management
- Education and research
- Developing industrial ecosystems
- Sustainable natural resources management
- Retrofitting and rebuilding homes and communities
- Policy reform

**Accounting Reform**

The most important step is to reform current U.S. accounting systems so that they include information about nature’s services and natural and social capital. Natural and managed ecosystems ultimately provide the requirements for life. Green plants give off the oxygen we breathe and the food and fiber we need to exist. Ecosystems play a role in absorbing, modifying, and disposing of our wastes. They also supply water, offer protection from floods, modify the climate to make it more comfortable, and stabilize the global energy and nutrient cycles. Yet for all of these benefits, the value of nature’s services is rarely calculated and considered in the daily lives of people. Farming, animal production, fisheries, and forestry practices have consistently been mining instead of harvesting potentially renewable resources. Use of almost all resources is unsustainable, and developed countries rely on inputs from nature and the exploitation of poor countries to maintain an illusion of wealth.

A move must be made away from a mining economy to a harvesting economy. There also needs to be an accounting of the many relationships and activities that people value, but that are not currently priced. Human capital is the most valuable capital, because it can create value with little more than imagination, enthusiasm and determination. Health, satisfaction, community, and love are not currently counted, because they do not involve dollar transactions. Yet these factors make life worth living. Conventional economics cannot help, because the monetarists and Friedmannites calculate wealth without considering these factors. They see “the lowest price at any cost” as perfectly reasonable. They count war spending as a positive benefit, because the investment in war appears to boost the American economy. No need to count the fiscal cost of the war in Iraq in terms of lives lost, emotional and physical suffering, infrastructure damage in Iraq, harm caused to the environment, and loss of services that otherwise can have helped people in the United States, because funding was diverted to the war. No worries about the trillions of dollars in future costs. By the same token, the obesity epidemic is a positive benefit. Why? It leads to a $49 billion annual “investment” in fighting obesity and an additional $90 billion in health care costs each year. GDP rises, and, therefore, fat is good!

Although it is not always easy to calculate the environmental or social cost of a dollar of consumer spending, it can be done. Energy, resource, environmental, and social impacts and costs usually increase with the complexity and price of a product. A car, for example, includes a complex network of activities and resources, including mining and processing the materials to build a car, transporting the materials around the world, manufacturing and assembling specific parts, shipping the finished car, extracting the oil and refining the gasoline to operate the car, maintaining it, and eventually disposing of it. These environmental costs are matched by social costs related to car accidents, diseases from air pollution caused by auto emissions, and obesity from more time spent driving than exercising. True cost accounting will help manufacturers and consumers to better understand how every decision about spending money is either a dollar vote for sustainability or for environmental and social destruction. A new field of true cost accounting needs to be created, and certified public accountants need to be brought up to speed on its necessity and merits.

A company or personal balance sheet should address true costs. A company should detail true environmental and social costs and benefits in an annual report and, where feasible, on product labels. For a small firm a sustainability report might only be 4 or 5 pages (see Appendix B). For a large firm, a sustainability accounting report would include much more detail (Figure 11.1). However, many good reports are 30 pages or less with extensive supporting appendices. Take a look at some examples at the Global Report Initiative (GRI) database of reports (http://www.globalreporting.org) or try the Pacific Sustainability Index at (www.roberts.cmc.edu/psi/whatthescoresmean.asp).

As true cost accounting is implemented, it will change the value chain, which in turn will change company priorities and profit centers as businesses are reshaped and reorganized.
Sustainable Management

A wide range of industrial, commercial, and nonprofit organizations have already made tremendous strides toward sustainability reporting, and true costs will encourage the rest to follow suit or go out of business. Companies in the early stages of evolution will adapt or die. Sustainability reporting facilitates and improves management. The following are five stages in the evolution to sustainable management practices, as identified by Christopher Laszlo, a consultant on change management and strategic planning:

1. **Rejection:** Workers to be exploited; the environment as a “free good” and garbage dump
2. **Nonresponsiveness:** Minimize labor cost; eco-impleratives irrelevant or ignored
3. **Compliance:** To meet minimal labor and environmental law requirements
4. **Efficiency:** Increased attention to personnel development and satisfaction and eco-efficiency
5. **Strategic proactivity:** Product and process redesign for sustainability; worker-friendly practices; engagement with stakeholders and community

The transformation of the American economy will not be easy, and there cannot be a sudden change to true cost accounting for all. The support, the will, and the information are missing. A start can be made, however, by supporting the preparation of company documents for the GRI, thereby developing better environmental and social accounts. Stakeholders and NGOs can also begin to increase pressure for true cost accounting and full transparency. Companies that accept government contracts, financing, or subsidies can be required to prepare sustainability reports for the GRI.

Publicity, rewards, and support can also be given to companies that participate in the Dow Jones Sustainability Index, FTSE4Good, The Goldman Sachs Energy Environmental and Social Index, Corporate Social Responsibility rankings, Social Accountability 8000, the International Organization for Standardization Environmental Management Systems 14001, Ecomanagement and Audit Scheme, and other environmental and social standards.

As discussed in Chapter 9, sustainability reporting can be improved and facilitated with new software and middleware. Software for sustainability accounting is being developed, but no standard has yet emerged for this important task. Ideally the software will allow easy integration with existing business management software to provide data and reports that are useful for financial reporting, management, and policy purposes. For example, the software would translate the gallons of gasoline or diesel consumed into global warming gas emissions and costs, the cost of local nitrogen pollution remediation, and the water and air pollution generated in the supply and disposal chain. The software should also identify and calculate social costs and benefits.

Utilities, regulators, and research groups will also need to participate in sustainability reporting by developing city- or region-specific emission factors and cost data. Health and environmental departments can also help by offering impact evaluators that are comparable to, but more sophisticated than, ecofootprint calculators.

Texas has made a start by developing a simple set of...
calculators that are available for some types of impacts, and others should follow suit.

Funding for this work would come from impact fees for advertising, perhaps 2 percent for beneficial products and 10 percent for damaging products. In 2007, advertising expenditures in the United States reached $149 billion. The faltering domestic automakers spent $7 billion, but found that advertising can not offset consumer demand for more sustainable vehicles. Television ads totaled $22 billion, cable television ads $18 billion, and Internet ads more than $11 billion. An impact fee for advertising averaging just 5 percent would generate more than $7 billion each year to invest in true cost accounting, education, research, and counter-programming.

Database developers, information source managers, and accountants must also be educated on the importance of this work and the need for readily accessible information. Although additional research on impacts and costs is needed, simply using existing information would be sufficient to improve cost accounting dramatically. Data mining can help make sustainability reporting faster, cheaper, more effective, and more fun. It can also make it easier to identify opportunities for saving, connecting with other firms who may be able to use waste flows as feedstocks, and reducing liability risk.

Developing the software for true cost accounting will take a concerted effort from developers, ecologists, psychologists, sociologists, medical professionals, accountants, managers, engineers, and environmental scientists. I would suggest a true cost accounting software contest, much like the recent, highly successful Defense Advanced Research Projects Agency robotic vehicle test. A well-publicized and administered $2 million prize brought incredibly fast innovation and progress through intense competition and real-world testing. Perhaps one of the world’s billionaires will step up to the plate to offer a comparable prize for sustainability software development.

True cost accounting will also change the desirability of career paths. As Table 11.1 shows, people respond to market pressures when choosing a career. In the past you can do very well by neglecting true costs—just ask the Walton family (owners of Wal-Mart). You can also do well in the short term by being blind to the issue of sustainability. Most business managers and accountants are, through no fault of their own.

And you can get very rich indeed by being as untransparent as possible. This made the Madoff and Stanford financial catastrophes possible. And equally opaque financial transactions based on voodoo economics have made billions for hedge fund managers, real estate, equity and derivatives brokers and advisors. An annual salary of several million dollars for a broker or hedge fund manager was not the exception but the rule, while an agricultural research scientist or forester with 11 years of training and 30 years of experience will typically earn only $60,000 per year. Consider who added more true value between the two.

<table>
<thead>
<tr>
<th>Table 11.1. Group Membership</th>
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<tr>
<td></td>
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<tr>
<td>United States Society for Ecological Economics</td>
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<tr>
<td>Ecological Society of America</td>
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<tr>
<td>Int’l Society for Sustainability Professionals</td>
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<tr>
<td>American Institute Certified Public Accountants</td>
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<td>American Institute of Certified True Cost Accountants</td>
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<tr>
<td>Hedge funds</td>
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Education and Research

More research on sustainability is urgently needed. Sadly, very little is known about the function and structure of many ecosystems and social systems, even in wealthier counties. Funding for basic research has been declining, and fieldwork has fallen out of favor. Fortunately, much of the research is not costly, requiring little more than time and expertise; but much, greater investment in basic science is essential. To speed up investment, it may be helpful to reach out to locally trained volunteers and university students as well as to specially trained para-botanists, -ecologists, -sociologists, and -accountants, asking them to undertake fieldwork under the supervision of experts. College, high school, and even middle school students can also provide meaningful support.

Long-term interdisciplinary research projects are critically important, yet remain very rare. The National Science Foundation’s Long-Term Ecological Research sites are, unfortunately, almost unique. They are woefully underfunded, with about $20 million each year spread over 26 sites. Each site can easily use $5 million to $10 million of base funding, and there should be hundreds of them to cover a wider range of ecosystems and to add agroecosystems and to add more urban/suburban ecosystems as well.

A much better understanding of ecosystem structure and function will be needed to develop sustainable management systems for farms, forests, rivers, and cities. A broad range of research is necessary (soils to microclimate, plants to fungi, termites to cattle), and all
should be related to past, current, and potential future use. The interaction between land management and the economics and policy drivers of land use must also be considered. The scale of research should extend from the microsite to the landscape as well as from the family to the community to the culture.

In addition to the basic sciences, research is needed across the full range of applied sciences, from agroecology to agroforestry, dairy to livestock, soils to climatology, and basic revegetation to ecological restoration. Research on innovations for more efficient irrigation and analyses of traditional irrigation systems will also be of value. Water harvesting is an important area for research and demonstration at several scales and will be crucial for sustainability in many regions.

Research on industrial ecology, biomimicry, renewable energy, and alternative building materials will also provide opportunities for engaging, enjoyable, and important work. Ideally the studies would be multidisciplinary and would involve a range of scientists, engineers, economists, anthropologists, psychologists, artists, designers, marketers, managers, and students who are working on common problems. Research on the successes and failures of existing sustainable management experiments is also needed. The benefits of restoration on biodiversity and ecosystem structure and function should be evaluated carefully. The importance of protecting cultural diversity to maintain biological diversity needs to be better understood as well.

Research on the adverse impacts of current management practices on human health is also important. This would include much more thorough evaluations of the health and mental health impacts of nutrition, exercise, air and water pollution, and exposure to mold, chemicals, and materials in the workplace and the community. Research on health impacts from environmental exposures is particularly important. Consideration of biomagnified environmental exposures in high-risk populations, such as subsistence fishermen, is also of the utmost importance. A registry should be started that includes a full blood analysis for chemicals for all new cancer patients.

In the cultural and socioeconomic arena, the challenge is every bit as large. An approach similar to the National Science Foundation’s Long-Term Ecological Research sites can be developed to focus on the challenges now facing Cleveland, Baltimore, Detroit, the San Joaquin Valley, the colonias of southern Texas, Washington, D.C, and rural communities in many parts of the United States. Research agendas for long-term cultural research sites would include a wide range of problems that have proven intractable due to incomplete cost accounting and a lack of focus on sustainability. The issues analyzed can include: understanding the incentives and drivers that shape behavior, improving access to locally grown, more healthful food; exploring the causes and cures for obesity; and the relationships between crime, education, environment, and equality of opportunity. What steps can be taken to reduce infant mortality, improve educational quality and engagement, and satisfaction with work and life? Multidisciplinary investigations with careful interpretation of signals from incomplete cost accounting will be critical in advancing from treating the symptoms to addressing the causes. Benchmarking can also be helpful in improving quality of life (Figures 11.2 and 11.3). By looking closely at the best cities and the best countries, perhaps the symptoms and causes can be better distinguished and addressed. Nothing less than the best should be strived for.

![Figure 11.2. Obesity](image)

![Figure 11.3. Homicide Rate](image)
a globally competitive environment. Sadly, education remains a very weak point for the United States, and teaching to the test has not helped students develop real-world skills, such as problem solving. The United States ranked 29th out of 40 countries in the Programme for International Student Assessment, a triennial world-wide test of the scholastic performance of 15 year olds, the implementation of which is coordinated by the Organization for Economic Co-operation and Development (OECD). Several countries had three times as many students at the advanced level (Figure 11.4).

<table>
<thead>
<tr>
<th>Country</th>
<th>Percent</th>
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<td>Japan</td>
<td>36</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>32</td>
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<tr>
<td>Korea</td>
<td>30</td>
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<tr>
<td>Finland</td>
<td>28</td>
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<tr>
<td>Belgium</td>
<td>28</td>
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<tr>
<td>New Zealand</td>
<td>27</td>
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<tr>
<td>Liechtenstein</td>
<td>26</td>
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<tr>
<td>Australia</td>
<td>25</td>
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<tr>
<td>Canada</td>
<td>24</td>
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<tr>
<td>Macao</td>
<td>23</td>
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<tr>
<td>Switzerland</td>
<td>23</td>
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<td>Netherlands</td>
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<td>France</td>
<td>22</td>
</tr>
<tr>
<td>Germany</td>
<td>22</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>12</td>
</tr>
<tr>
<td>United States</td>
<td>12</td>
</tr>
<tr>
<td>Russia</td>
<td>12</td>
</tr>
<tr>
<td>Latvia</td>
<td>12</td>
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**Figure 11.4. Advanced Problem Solving Skills**

More than 50 percent of the U.S. students were at Level I or below. The United States was 24th out of 29 countries in math proficiency, and language skills have also fallen. In the International Adult Literacy Survey, Americans ages 56–65 ranked second out of 19 countries; ages 46–55 third; ages 36–45 fifth; and ages 26–35 eleventh. The United States graduates below the average number of science majors for the OECD per 100,000 workers ages 25–34, and only about half as many as Australia, Finland, France, Korea, and the United Kingdom. The competitive edge that the United States once had is rapidly slipping away.

To improve access to education and training for the underserved and low-income students, much more investment is needed in the form of grants and scholarships. Much of this funding should be tied to contributions to sustainability research and implementation. Loans simply do not suffice, and students cannot excel when they are working two or three jobs and going to school.

In many countries access to higher education is virtually free, with only 4 percent private cost in Denmark, Finland, Greece, and Norway, compared to 55 percent private cost in the United States. Continuing cost increases in education in the United States reinforce the growing divide between rich and poor. Students who graduate with high debt loads are forced to seek higher paying jobs rather than more meaningful and important jobs that would pay less.

Sustainability issues may provide the compelling topics that are needed to re-engage students in learning and in combining hands-on work in food production, energy management, and waste handling at every school and throughout the community. This re-engagement can cut the appalling drop out rates in American schools. Students drop out for a variety of reasons, but more than a third of students surveyed in 2000 considered school a place they do not want to go. With the growing emphasis on teaching to tests, this number has undoubtedly increased. One of my best students looked back on his years at a San Diego high school as being “just like prison.”

Sustainability as a comprehensive theme for learning across the curriculum can help re-engage the full student body, whether it is those headed to advanced degrees and a professional career or those who will start work in the trades. Many sustainability jobs will be green collar and will offer decent pay, meaning, and satisfaction. Student participation in school gardens and food preparation in cafeterias can help prepare boys and girls for rewarding careers. The Berkeley school food program in California, for example, should be replicated in every city in the United States. Many Berkeley students take an active role in the preparation of their lunch. Students plant seeds, raise crops, cook food, learn about sustainable ecosystems, and study nutrition as part of their classroom curriculum as they advance. The growing Slow Food movement can provide support and encouragement in this effort. Engagement and hope are the best tools to fight crime, violence, and hopelessness.

**Developing Industrial Ecosystems**

Every year more than 80 tons of nonrenewable natural resources are devoted to maintaining the material
wealth of each American and European. This amounts to more than 400 pounds of nonrenewable natural resources used each day. The more resources used, the greater the emissions, effluents, and wastes. The environmental impacts of a waste-based U.S. society have been increasing year on year, but it does not have to be that way. A radical reduction of material use in “advanced countries” is both essential and possible.

Moving from waste to efficiency with true cost accounting will enable the United States to dematerialize its society by a factor of four times or more. Today, Western-style wealth is generated for less than 20 percent of the world’s citizens through the consumption of more than 80 percent of the natural resources disturbed and harvested globally, and with the accompanying exploitation and destruction of communities and people. Rich nations will have to reinvent themselves to generate wealth with only 25 percent (or a Factor of 4 times less than current use) or 10 percent (Factor 10) of their present consumption. The U.S. Business Council for Sustainable Development has gone further and suggested Factor 20 as an even better goal for sustainability, which would reduce material use 95 percent for a given service. This may seem impossible, but many examples show that it can be done. Compare, for example, a record player of the 1940s with an iPod shuffle of today. Less material is used to manufacture the iPod (less than 1 percent of the amount of nonrenewable natural resources), yet it offers improved performance and much greater efficiency. Value and productivity can be dramatically increased with improved information, knowledge, and technology, not by increasing mass or energy use.

True cost accounting will also improve dramatically the recovery of goods and products and the materials they are made of. The Netherlands’ car recovery program dismantles cars at the end of life instead of flattening and grinding them (the American way). The program now captures 90 percent of cars. The material recovery rate is excellent, and the dismantling fee at the time of purchase has dropped from 70 euros to 40 euros, as experience has improved the process. The European Union recovery goal for auto recycling was met 10 years ahead of schedule.

The development and adoption of industrial ecosystems is a tremendous and exciting challenge now facing industry and engineers around the world in efforts to decrease the use of nonrenewable natural resources and improve material recovery. Industrial ecosystems can be designed to fit into the landscape without harming the environment or human health and to minimize the use of renewable and, more particularly, nonrenewable resources. The basic approach is to consider the industrial, manufacturing, and disposal/recycling process as a closed system, much like a natural living ecosystem. Materials, energy, water, and other resources are used, reused, and eventually recycled with minimal leakage into the environment or movement into landfills. Ultimately, these industrial ecosystems will be fully integrated with regional agriculture, forestry, river management, urban design and management, and natural reserve planning and restoration.

The rapid growth of the Internet and global connectivity has made the integration of businesses much more practical. Users and waste generators can link up in local, regional, national, and global industrial ecology networks. Individual companies, like organisms in an ecosystem, can work for their own survival and prosperity as well as for the benefit of the environment. A movement toward industrial ecologies would also benefit from the increasing sophistication of accounting for environmental and health costs. As the “polluter pays” principle is more widely adopted, the incentives for participating in industrial ecology networks become much greater. In fact, if true cost accounting were done, the industrial ecology approach would be universally adopted. Kalundborg, Denmark, was an early adopter of this approach (Figure 11.5).

Figure 11.5. Industrial Ecology at Kalundborg
The Statoil Refinery removes sulfur from its natural gas to reduce air pollution and sells the sulfur to the Kemira Company sulfuric acid plant. The Asnaes Power Plant sells gypsum to the Gyproc plasterboard factory. The hot water from the power plant heats water for a fish farm, the fly ash left over from burning coal at the power plant goes to a cement manufacturing plant, and the hot water from the cement plant goes to the municipality for district heating and hot water.

Financial incentives work and will be essential in encouraging the widespread adoption of industrial ecology in manufacturing and waste management. Pollution has been subsidized and encouraged for far too long. If people are provided with more complete information, they will make better decisions and all will benefit. True cost accounting, transparency, green technology and a local focus can help reinvigorate manufacturing in America. The goal should be to increase manufacturing from 10% to 20% of GDP in the U.S. Germany has maintained this level of manufacturing, and it should be possible here as well.

**Sustainable Natural Resources Management**

The most important first step in implementing sustainable natural resources management is openly acknowledging that agriculture, ranching, forestry, and fishing are usually unsustainable as currently practiced. They are profitable only if the true costs are not counted. The future for renewable resources management can be bright and assured if true cost accounting is adopted and if steps are taken to improve sustainability in production, processing, distribution, and waste recycling. With a concerted effort, this first step can begin by developing a workable set of sustainability indicators for production, processing, distribution, and waste recycling with published charts of trends over time and best practices worldwide. These will help achieve the longer term goal of doubling or tripling income to farmers, fishermen and women, and forest managers.

Natural resources management will also demand a better understanding of the policies and incentives that have led to the current predicament of billions of dollars of subsidies propping up failed resource management practices. This can start with outreach to economists, ecologists, and environmental and social scientists to better understand the multifarious effects of direct and indirect subsidies not only at home, but also around the world. The Environmental Working Group’s efforts to publicize single, double, and triple subsidy dipping in agriculture are to be commended. Imagine what the United States will be able to do if it starts spending $20 billion a year on researching, demonstrating, and implementing new crops, products, and production systems instead of squandering money on farm subsidies. It is time to stop chasing the lowest food price at any cost and seeking the best products and improved health and taste. Food prices will increase on the market shelf, but the overall cost of food will be reduced and the quality and taste will improve dramatically.

The more intriguing and exciting work for agricultural and biological engineers, farmers, foresters, and fishermen is the development and refinement of locally adapted agro-industrial ecosystems. Developing agro-industrial ecosystems that mimic natural ecosystems, are fully recycling with closed resource loops and no wastes, and based on renewable energy is one of the great challenges for the twenty-first century. The challenge may include: using bio-mimicry to develop eco-composite materials for cars, planes, and buildings; biofuel production from algae or wastes; solar applications from simple integral solar water heaters to preheat water to sophisticated concentrating solar collectors to make process steam; streamside buffers to capture fertilizer and chemicals; and very diverse agro-forestry and mixed cropping systems that minimize pest problems and are self-fertilizing. One of the key challenges is improving the energy input–output ratio for the food system from the current 10 to 1 to levels approximating some traditional agricultural systems (e.g., 1 to 30). Twenty billion dollars of funding for research on sustainable management for agro-industrial ecosystems and nature’s services can lead to rapid improvements in energy returns.

Recalculating costs and benefits can also lead to new natural resource management policies. In Costa Rica, forest owners are compensated annually for the nature’s services that their forests provide. Although the payments are modest, they are invaluable to landholders and help keep ecosystems functioning well. As Daily and Ellison (2002) note, Costa Rica’s Forest Law 7575 “was set up to compensate thousands of property owners for ‘environmental services’ provided each year by forests they maintain or reestablish on their land. The services include carbon sequestration, watershed protection, and biological diversity resources.” A carbon sequestration fee would add even greater impetus to the straw bale building movement.

Many opportunities exist, such as pollution fees and cap-and-trade programs, to foster sustainability and to encourage true cost accounting, efficiency, health, life satisfaction, and the sustainable management of resources. These efforts must be carefully monitored to avoid fraud, folly, and unintended consequences.

**Retrofitting and Rebuilding Homes and Communities**

The development of energy-efficient homes has progressed more rapidly and much further than comparable work on energy-efficient and healthful subdivisions and communities. It is relatively easy and cost effective to build a Factor 10 home, although current perverse incentives keep it from happening. True cost accounting would ensure that all new buildings would optimize the energy efficiency of the building shell and would use solar- and climate-responsive design.
Daylighting design for interior lighting would be standard. Building buyers would receive an owner’s manual describing the operation of the building’s energy, water, and waste management systems. Building materials would come from local sources (wood, straw bale, plaster, stone, concrete, recycled metals) and finishes would be nontoxic. Compost heating is an excellent, traditional method of heating greenhouses and has been tested for home and water heating. Although output is low, compost is a clean fuel, is locally available, and after use is a valuable soil amendment.

Planning, design, and construction at the subdivision or neighborhood scale can offer additional energy savings, environmental impact reduction, improved health, and increased satisfaction. These environmental savings extend beyond space heating and cooling to water supply, transportation, waste management, activity, health, and food supply that are not as easily addressed at the house scale. The goal should always be to close resource loops, as was first suggested in 1943 by Sir Albert Howard, a pioneer in the early organic food movement.

The neighborhood and community scale offer several advantages for designers, planners, and engineers. Microclimates can be manipulated to improve summer cooling and to reduce the need for winter heating. Wood, green waste, or compost for heating can be collected locally as by-products of orchards or edible landscape operations that are managed by subcontractors or utility companies.

Wind, microhydro, or photovoltaics can be used to meet primary electrical demand, which can be kept to less than 10 percent of current demand through skilled design. A larger scale of development planning will reduce the per unit cost of bigger and more advanced systems, such as district total energy systems (which can also provide super-efficient freezer storage space and laundry facilities), fuel cells, wind energy, or solar pond facilities. Neighborhood energy systems can be interlinked for resilience and backup. Utility employees would help operate and maintain energy systems (control system checks, monitoring, seasonal orientation, night ventilation, battery testing, etc.)

Water heating would be done with solar, primarily integral systems and with some thermosiphon and drain-back models in temperate and warm climates. Evacuated tube systems can provide solar hot water even in cold climates. Backup water heating can be done with natural gas, methane, or other renewable fuels.

Food production should be an integrated and important function of a neighborhood. Some homeowners would choose to maintain their own gardens. America’s home gardeners currently produce about $7 billion worth of vegetables each year, and this can be dramatically increased in response to true cost adjustments. Other homeowners would hire landscape service companies to produce food instead of just lawn clippings, leaves, and branches.

Homeowners associations can also increase the value of their landscaping services, as Village Homes in Davis, California, did. Fresh fruit from the community trees was a highlight of summer. The kitchen gardens of many areas of the world show what can be done. These gardens, rarely operated as a primary occupation, provide a very high percentage of vitamins and minerals and often a substantial portion of calories and cash income as well. Residential developments can establish farm areas for intensive production of basic commodities and biofuels. Landscaping for the neighborhood can be chosen for food, fodder, and biofuels, just as it currently is in the highly evolved garden/forest systems in many other parts of the world.

The design of neighborhoods and communities to a large extent determines transportation requirements and preferences. The City of Davis and the Village Homes development emphasize pedestrian and bicycle circulation over that of autos. Copenhagen, Denmark, Freiburg, Germany, and many other European cities show that a city can be a bicycle- and pedestrian-oriented place, more for humans than for cars (Figure 11.6). This type of design focus can also help fight the obesity epidemic. This will take investment and careful design to undo the mistakes made in the last 50 years. And these must be well linked to bus systems, rail lines and other mass transit options running on sustainable energy sources.

Figure 11.6. Bicycles and Mass Transit have much lower true costs and encourage healthful activity

Rebuilding and retrofitting homes and neighborhoods across America are critical. No more funding for heating oil subsidies should be provided. Money should instead be provided for basic energy upgrades, to establish a Conservation Corps to help those unable to do the retrofitting themselves, or for long-term energy retrofit loans.

Redesign must also provide windows and porches in homes and buildings that effectively put more eyes on the...
The most important policy reform will to reduce and eliminate direct and indirect subsidies. If existing subsidies are allowed to continue, at the very least sustainable management should be expected in return. The $60 billion each year in subsidies for homeowners in the form of mortgage interest deductions does little good and in-effect punishes the poor who cannot afford to buy a home. A mortgage interest tax credit should only be available for homes with zero net energy use. The billions now lost in interest tax credits can be invested in retrofitting American homes and buildings.

True cost accounting is critically needed, but equally important is a renewed commitment to pay as you go conservatism. Current incomplete accounting methods are unsustainable and have bankrupted government at the local, state and federal level. Instead of increasing fees and taxes to meet costs, financial and environmental costs are passed on to future generations.

The failure to maintain the transportation infrastructure offers a perfect example of current unsustainable practices, but it is simply one of many failures. The American Society for Civil Engineers estimates that the current backlog of highway and bridge repairs in the United States totals $461 billion, and for all infrastructure the need exceeds $1.6 trillion, which translates into more than $5,000 per person.

Americans have not paid the level of fees or taxes needed to meet these needs, and politicians have almost unanimously agreed to support unsustainable practices. They not only panders to corporations, but also to taxpayers and voters. The mantra of the neocorporative movement, No new taxes!, has directly led to catastrophes such as the tragic Minnesota bridge collapse in 2007.

California has done no better by repealing car registration fees that once provided millions of much-needed dollars for highway repairs. And it is no better at the local level, where cities such as San Diego have spent hundreds of millions on sports teams, while neglecting a backlog of infrastructure repairs that total in the hundreds of millions of dollars. Paying for maintenance and repairs cannot be avoided forever—things wear down and break and people can die as a result.

Products and services must be paid for in current income. This will be painful, but it is essential. Fees for environmental and social impacts can replace many taxes as well as offer direct incentives for better choices. Policy changes are important and essential. America must rethink the meaning of democracy to encourage people to once again participate in local, state, and national politics. Making policy meetings more accessible and providing on-line response forums and surveys will be critical to removing the well-ingrained feeling that “my opinion doesn’t matter” as well as to offsetting the balance of power in most public decision making where a company or organization with a very

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Policy Reform

The changes that are necessary to successfully adopt true cost accounting methods will require political action and cooperation from a wide range of stakeholders. Nongovernmental organizations (NGOs) will play a key role in developing these new approaches, but government at the local, state, and federal level will also need to participate. A shift in political power from large corporations back to the people and local communities will take a concerted effort. As Adam Smith noted in the eighteenth century, “Civil government, so far as it is instituted for the security of property, is in reality instituted for the defense of the rich against the poor, or of those who have some property against those who have none at all.” Those who have benefited from subsidies will not readily give up their advantages or profits. But growing unrest from the increasingly stressed middle and lower classes can provide the energy for reform.

Water systems can include rainwater harvesting, home or neighborhood cisterns, and recycling. While current water consumption in the United States is about 150 gallons per person per day, the Minimum Cost Housing Group and others have demonstrated that use can probably be cut to 10 gallons per day. The neighborhood scale is most appropriate for water systems, allowing investment in more elaborate rainwater harvesting, storage, and treatment facilities. A utility specialist can oversee and manage home water systems to ensure that they are cleaned and treated regularly.

The most effective management of wastes is source control, and this should be an integral part of a sustainable community. Waste streams must be minimized and kept clean of hazardous materials so they can be biologically recycled. This would require a dramatic shift in marketing, but a very small change in lifestyle. Household food wastes would be locally composted. In many areas, human waste would be treated in ecologically engineered aquatic systems or composting toilets.

Integrating cost-effective home and neighborhood energy systems will provide many economic and environmental benefits compared to the systems used today. The development of neighborhoods that are more sustainable is not only possible, but also economically sound and essential for the future security and prosperity of the United States. These energy systems would also offer many benefits as well as increased security for people during or after a natural disaster or terrorist attack.

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Rebuilding the American Economy

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Strong profit or power motive confronts a public where everyone is affected.

Creating a stronger democracy with a better-educated electorate is critical. Programs that provide opportunities for citizens to meet with legislators are critical. They can include help with transportation, child care, and company release time to enable citizens to travel to the state or national capital to meet with the people who are supposed to represent them, not just major corporations through their well-paid lobbyists.

**Hope with Trepidation**

I am very encouraged by the dramatic and rapid interest in true cost accounting research, discussion, and application. External costs are getting increasing attention. Sustainability reporting has grown exponentially. Many companies get it. European and some Asian governments have begun to adopt policies that support sustainability. The United States and many developing countries, however, lag far behind.

Financial incentives are the most powerful force for changing behavior, and only by applying true cost accounting to the market can a rapid transition to sustainable management be encouraged. Rules and regulations that favor unsustainable practice need to be amended to favor sustainable practices instead. Although progress has been more rapid than I imagined possible, there is still a long way to go.

Some materials are not sustainable by definition. One example is the extraction of minerals and fossil fuels. Although these regenerate in geologic time, they do not regenerate in human time scales. The extraction of all "finite" minerals and fossil fuels should carry depletion charges, not depletion credits. Full costing of the environmental impact of mines and processing would drive up costs and would encourage efficiency, recycling, reuse, and substitution with renewable materials.

Many resources are theoretically renewable, including fish, forests, farms, groundwater, and many types of energy. Most are currently overharvested, misused, and mined rather than sustainably harvested. Many resource management problems are related to overall ignorance and the fact that many of these theoretically renewable resources are "open access" and not owned by anyone. The open ocean fisheries are a good example. New methods will have to be developed to add true costs to the accounting of these resources and to provide ownership/ supervision/stewardship.

A preoccupation with the short term (for companies, the next quarter; for politicians, the next election) has led to ruinous policies. True cost accounting will encourage greater consideration of the long term, but reform of election policies and government budgeting and accounting are also needed. The corner can be turned with concerted effort, after a history of neglecting basic life support systems.

The growing recognition among businesses and organizations around the world of the importance of sustainable management has also been encouraging. Sustainability champions such as Ray Anderson at Interface, Yvon Chouinard at Patagonia, and many others are taking steps to make their products, services, facilities, and companies more sustainable. Mid-level and senior managers in multinational corporations have taken courageous steps to bring the benefits of triple-bottom-line thinking to their companies. Often these sustainability advocates are well rewarded for encouraging changes that improve the value proposition and reduce costs and liability.

Progress in sustainability management in the corporate world has been eclipsed by rapid growth in the activity and impact of NGOs around the world. As environmentalist Paul Hawkens suggests, NGOs may be the immune system of the planet. They are growing in strength to offset the infection of consumption, pollution, and exploitation.

People can join together to make changes happen. A group can provide the support an individual needs to take the steps he or she wants to take, to encourage others to take steps, and to support change throughout the community and the world. And these groups should meet and work with other groups with related interests to explore the complex interactions in the economy and opportunities that may exist for working together. The computer systems specialists for example, could invite the ecologists working on sustainability to their annual meeting to explore the opportunities for data mining. What goals are held in common? How can group efforts be parlayed into stronger, and more effective action for change?

The challenge is not to accept a policy of "shiver in the dark" or "sweat in the heat," as the threatened and defensive dinosaur brained fossil fuel industries have suggested in the past. The challenges are to increase efficiency and effectiveness and to improve health, life satisfaction, and communities using fewer resources and causing limited impacts. There are enough good examples to show that the challenges can be met! Reducing resource use and improving efficiency by a factor of 4 is very easy for most applications. Factor 10 is well within reach for many critical issues, including building construction and operation. And Factor 20 will be surprisingly easy once the United States begins to devote resources to this essential work.

**It Is Up to You**

The challenge of implementing full cost accounting, full transparency and sustainable management is up to you! First and foremost, vote for sustainability with every purchase you make and with every purchase you decide you do not need to make. Invest in sustainability with changes to your home, career, and investment decisions. Insist, gently but firmly, that your local schools, colleges,
and universities teach and demonstrate sustainable practices and adopt sustainability reporting. Request that your local libraries buy the core magazines listed in Appendix D. Help your school and city libraries offer books and resources on sustainable living that students, homeowners, and business people will need. Encourage your local schools to follow the courageous example of the Berkeley school food program in California.

Ask the companies that you buy from to improve their accounting practices, reporting, and management. Request that they add more information to their products, perhaps starting with global warming impact or, in the case of a car, the amount of carbon dioxide emission (Figure 11.7). Encourage companies to prepare a sustainability report every year using the Global Reporting Initiative format. Also encourage them to develop an environmental management system ISO14000 and to seek certification for their product’s sustainability, based on both local and international standards (Figure 11.8). Petition your local, state, and national government to favor true cost accounting for sustainable practices.

Tell your elected officials that you insist on policies and programs that will:

* Protect future generations
* Make the market as complete as possible – carefully count and report true costs
* Make the market as transparent as possible
* Help the consumer understand true costs
* Make the market as free as possible
* Reward beneficial actions
* Make harmful actions costly and illegal
* Make the polluter pay, not the victim or taxpayer
* Be conservative in assessing risk
* Remove perverse incentives for waste (take away subsidies)
* Criminalize the worst environmental and social crimes
* Support school and community sustainability programs
* Live within your means
* Enjoy friends, family, and community
* Respect, study, enjoy and embrace the natural world

And tell them you want these now!

Working with the Carbon Trust

![8.9 tons CO2](image)

Figure 11.7. Better Labeling is Essential, Carbon Cost for a New Car

![Global Labels](image)

Figure 11.8. Global Labels must provide True Cost Accounting to Level the Playing Field