BASICS OF NATURAL CAPITALISM

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PRINCIPLES OF ECOLOGY

Networks: At all scales of nature, we find living systems nested within other living systems - networks within networks. Their boundaries are not boundaries of separation but boundaries of identity. All living systems communicate with each other and share resources across their boundaries.

Cycles: All living organisms feed on continual flows of matter and energy from their environment to stay alive, and all living organisms continually produce waste. However, a healthy and intact ecosystem generates very little waste as one species' waste is another's food. Thus, matter and energy cycle continually through the web of life.

Solar Energy: Solar energy, transformed into chemical energy by the photosynthesis of green plants, drives the ecological cycles.

Partnership: The exchanges of energy and resources in an ecosystem are sustained by pervasive cooperation. Life did not take over the planet by combat but by cooperation, partnership, and networking.

Diversity: Ecosystems achieve stability and resilience through the richness and complexity of their ecological webs. The greater their biodiversity, the more resilient ecosystems are.

Dynamic Balance: An ecosystem is a flexible, ever-fluctuating network. Its flexibility is a consequence of multiple feedback loops that keep the system in a state of dynamic balance. No single variable is maximized, and all variables fluctuate around their optimal values.

#1 Resource Productivity

Increasing resource productivity means getting more product out of each ton of natural material extracted. Just as the Business as Usual (BAU) system seeks to maximize labor efficiency, natural capitalism changes technology to create ways to stretch natural resources five, ten, even 100 times further than they do today. Resource efficiency saves money and increases profits.

Implementing Whole System Design: BAU has the idea that the greater the resources saved, the higher the cost. Thus, we pay more for recycled paper than paper made directly from trees. However, the concept of expanding returns - the more resources saved the lower the cost - governs natural whole-system design.

Energy Efficiency: Small changes can lead to big savings, such as that achieved by replacing incandescent bulbs with compact fluorescents. If everyone in America made this switch, the consumption of electricity would drop by 20%. Buying only Energy Star appliances and constructing buildings using the highest energy savings codes would save up to 30% of electricity used in this county.

Resource Efficiency: Reducing the use of wood fiber reduces the pressure to cut down forests. About half of the timber cut is used for paper and cardboard. Reducing packaging and increasing the recycled content of paper products make our use of trees more efficient. Construction uses the other half of the timber cut. Engineered wood products can reduce the wood needed in a stud wall for a typical tract house by more than 70% and still be stronger, more stable, and insulate twice as well. We have the current technology and capacity to supply the entire world's present wood fiber needs, if used efficiently, by an intensive tree farm about the size of Iowa.

Adopting Innovative Technologies: Within every economic sector, energy and resource efficient design has emerged. Metro Nashville now requires all new city buildings to be built using LEED standards. Similar ideas can be found in such industries as chemicals, semiconductors, general manufacturing, transportation, water and wastewater treatment, agriculture, forestry, and urban design. Whether through better design or through new technologies, reducing waste represents a vast business opportunity. The US economy is not even 10% as energy efficient as the laws of thermodynamics allow. Only about 1% of all the materials mobilized to serve Americans is still in use six months after sale. In every sector we can reduce the amount of resources that go into the production process, the steps required to run that process, and the amount of pollution generated and by-products discarded at the end. These all represent avoidable costs and hence profits to be won.

Barriers to Innovation:

- Investment decisions often are made by producers rather than consumers. Producers may choose to produce a less efficient product in order to reduce costs and increase profitability even though consumers, when educated, would choose a product that would reduce their costs over the long term. Energy efficient buildings and appliances are examples of this split-incentive.

- Most consumers do not have the information to evaluate the tradeoffs between capital costs and efficiency. Standards such as Energy Star attempt to provide reliable information on major appliances.

- Because building equipment is expected to last for more than 10 years, many tenants will move before they can get paid back in energy savings for the added expense of installing efficient equipment. Residential homeowners on average stay in the same house for eight years, and homeowners have no guarantee that the value of potential energy savings will add value to the resale price.

- Replacement of equipment before failure is uncommon. Typically, a consumer waits for a major appliance to completely fail before replacing. As a result, the consumer purchases a replacement as quickly as possible to minimize inconvenience without comparing price and efficiency tradeoffs before making panic purchasing decisions.

- Demand response can be weakened by price signals that are incomplete and do not represent marginal costs. Residential consumers, who typically see only monthly electric bills based on average costs, have no incentive to reduce their use of air conditioning on peak days.

#2 Ecological Design

Just as a natural ecosystem recycles materials, natural capitalism shifts to "closed loop" production systems: recycling and remanufacturing. Zero waste is a goal that several countries have set for themselves. Using this strategy, companies can cut their long term materials requirements by more than 90% in most sectors. Natural capitalism seeks not merely to reduce waste but to eliminate its very concept.

As in natural systems, every manufacturing waste could be composted into natural nutrients or remanufactured into "technical nutrients" that are reused for further production. Elimination of harmful material by recycling them back into production eliminates the need to isolate them to prevent harm to natural systems. Xerox, for example, recycles its green line of photocopiers. German law makes many manufactures responsible for their products forever. Dupont gets much of its polyester industrial film back from customers after they use it and recycles it into new film.

#3 Solution-Based Business Models

The BAU economy focuses on the sale of goods: products are manufactured and buyers purchase them. Natural capitalism shifts the focus from ownership to flows of services which meet consumer needs - providing illumination, for example, rather than selling lightbulbs. In a BAU system, the buyer has the responsibility for disposing of goods, with most of it going to the landfill. In a solution-based business model, the producer maintains ownership of goods produced and takes back the product for remanufacturing or recycling. Moving to leasing models shifts consumerism to providing satisfaction with as little material throughput and waste as possible in the entire economic system. This new way of consuming defines well-being not in terms of what is owned but rather to satisfaction of services provided.

#4 Investment in Natural Capital

All industrial produces are created from resources extracted from nature. This flow of extracted resources is processed to eventually become the flow of purchased goods. Only a small fraction of extraction becomes production - less than 6% by weight when the entire industrial system is considered. The rest becomes manufacturing waste - the slag piles of consumerism. Ultimately, business must restore, sustain, and expand the planet's ecosystems so that natural systems can produce their vital services and biological resources even more abundantly.

If the flow of services from industrial systems is to be sustained or increased in the future for a growing population, the vital flow of services from living systems will have to be maintained or increased as well. Without reinvestment in natural capital, shortages of ecosystem services are likely to become the limiting factor to prosperity in the next century.

Distortions and Perversions or Why Aren't We There Yet?

Purchasing Decisions. Decisions to buy small items are typically based on their initial cost rather than their full life-cycle costs**.** Most companies buy the low price models without considering their energy use over time.

Crude Payback Calculations: Many use a crude payback estimate rather than more accurate measures to decide whether they can afford energy efficient equipment. A few years ago, the median simply payback many companies were demanding from energy efficiency was 1.9 years. That's equivalent to requiring an after-tax return of around 71% per year - about six times the marginal cost of capital.

Energy Fractions: Many pay too little attention to saving resources because they are often a small percentage of total costs. Energy costs run to about 2% in most industries.

1970s Retro: Many think they already "did" energy efficiency in the 1970s when the oil shock forced them to rethink old habits. But today we have far better energy saving technologies, and it is profitable to save even more energy.

Subsidies and Tax Laws: Corporations have distorted price signals through influencing legislation for corporate welfare subsidies. A recent example is the tax writeoff available to those who purchase SUVs. The nuclear industry has the Price Anderson Act (which limits utility liability in case of a nuclear accident), loan guarantees, and government programs to handle spent fuel.

Resources: Fritjof Capra: *The Hidden Connections* (2002); Peter Senge, *Society for Organizational Learning* (2000); Energy Information Administration: Annual Energy Outlook 2007; Amory Lovins, et. al., "A Road Map for Natural Capitalism," Harvard Business Review (5/99), "Power to Save: an Alternative path to Meet Electric Needs in Texas," Optimal Energy (2007);