Market Transformation and Guiding Principles of Sustainability

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ABSTRACT

Scientific analysis suggests that in order to stabilize the climate, we need to meet our electricity end-use needs at 10-20% of the current levels (Stern, et al., 2007; IPCC, 2007). We assert that the types of fundamental, sweeping, institutional, market transformation required to accomplish this will be guided by three fundamental principles: elegant efficiency, biomimicry, and restoring natural and cultural heritage.[1]

1. Elegant efficiency—not freezing in the dark, but affordable, stylish, comfortable, and convenient options that allow end users to enjoy well being, while using resources wisely;
2. Biomimicry—designing goods and services the way nature does—local, recyclable, non-toxic, closed-loop, conducted at ambient temperature and pressure, and keeping whole systems in mind. Implementing biomimicry involves creating markets for technologies and designing approaches that are as different from those of the last century as an LED is from a kerosene lamp;
3. Restoring natural and cultural heritage—it is no longer enough to "do no harm." To be effective, energy efficiency markets must also be respectful and restorative of cultural and natural heritage.

The purpose of this paper is to illustrate how transformation currently taking place at the institutional level, in the European Union (EU), in global corporations such as Wal-Mart and Home Depot, in the financial and investment sectors through such indices as the Dow Jones Sustainability Index, the Domini Index and the Equator Principles are often guided by these principles. We will also discuss how the energy efficiency community, especially utilities, can provide greater outreach to diverse market segments through valuing cultural heritage.

Successful market transformation will embody these simple, easily-understood principles, which can be applied effectively in diverse situations and circumstances.

Introduction

Scientific consensus now concedes that climate change is real, it is human caused, and that available solutions will require significant market transformation in how societies use energy (Stern, et al, 2007; IPCC, 2007). As documented in the IPCC and Stern Reports, responding to the challenges of climate change will require meeting end-use needs for energy services with 20% or less of the current carbon intensity. This paper proposes that the types of fundamental market transformation in the energy sector required to achieve this increased level of efficiency

[1] These three principles are derived from the four principles of Natural Capitalism (Hawken, Lovins and Lovins, 1999) and have been refined over the last ten years in private conversations between Paul Sheldon and Hunter Lovins, in collaboration with the students of Presidio School of Management (http://www.presidiomba.org).

will be based on three fundamental principals: elegant efficiency, biomimicry, and restoration of natural and cultural heritage.

Market Transformation

"The Quest for sustainable development is the supreme challenge facing humanity today" (Taylor, 2002).

Market transformation differs from incremental change in degree and scope. Thus a transformed energy market will be as different from what we know today, as an iPod is from a wax-cylinder phonograph.[2] This transformation, which is already underway, is driven by the need to improve energy efficiency by a factor of ten or more, in order to prevent runaway climate change.[3]

Transforming the markets that produce and use energy depends on making fundamental, sweeping, and institutional changes as described in the sections below.

Fundamental

By "fundamental," we're referring here to the type of basic change in lifestyle represented by the difference between single passenger automobiles leading to interstate highways and suburban sprawl, as distinct from mass transit enabling more local, walking-oriented villages and neighborhoods; and the distinction between mono-crop, petrochemical-pesticide-based agriculture and locally grown, organic, perennial farming and permaculture; or the differences between sanitary landfills, and "zero waste" management in which there is no place to throw things that we call "away." Though food and waste disposal are often not considered as energy-intensive, more efficient practices in these areas can save significant amounts of energy, both in transportation and in reduced use of energy-intensive pesticides and fertilizers.

Sweeping

The kinds of sweeping market transformation we're pointing to are akin to the sweeping change that took place in health care following the development of the germ theory of disease.

> Pasteur fought to convince surgeons that germs existed and carried diseases, and dirty instruments and hands spread germs and therefore disease. Pasteur's pasteurization process, kills germs and prevents the spread of disease. … He solved the mysteries of rabies, anthrax, chicken cholera, and silkworm diseases, and contributed to the development of the first vaccines. (Bellis, 2008).

[2] http://memory.loc.gov/ammem/edhtml/edcyldr.html

[3] To stabilize CO2 between 445 and 490 ppm (resulting in an estimated maximum rise in global temperature of 2-to-2.4°C above the pre-industrial average) CO2 emissions would need to peak before 2015, with 50 to 85% reductions on 2000 levels by 2050. (IPCC, 2007)

Institutional

To impact climate change in a significant way, it's not enough to rely on personal, individual, early-adopter innovations and choices like home-built systems and washing out plastic bags. What will be needed in the coming decades is fundamental, sweeping change at the institutional level, such as is occurring in some utilities, in the European Union (EU), what may be occurring in global corporations such as Wal-Mart and Home Depot, in financial institutions such as Dow Jones, Domini, and the banks that have adopted the Equator Principles, and in some "conservative" religious congregations such as the Southern Baptist Convention and the Vatican.

Institutional transformation in utilities. While baseload supply is still fundamental, continuing improvements in efficiency are transforming some utilities. If customers can provide the same end-use services using half, or one fifth, or even a tenth of the energy provided in 1990, then during this period of market transformation, utilities will have to transform their business models. A customer, who needs 80% less energy because of efficiency improvements, can afford to pay four times as much for that energy without increasing their net bill. Thus a few utilities, like California's Pacific Gas & Electric, are beginning to realize that investments in efficiency improvements, with commensurate rate adjustments, can pay for the transition to more sustainable sources of supply (such as Adobe Systems' new office tower in San Jose – see story at http://www.sfbayenergy.org/html/modules/news/article.php?storyid=114). Incentive programs for improved lighting technologies are beginning to be copied for technologies like battery chargers, power supplies, and even cable TV set top boxes. "Deemed" and "calculated" savings programs are being used to incentivize the purchase of the most efficient technologies; and various websites (such as Europe's www.topten.info) are beginning to provide consumers and institutional purchasers with specific information about the most efficient brands in many categories of products. Such innovations can lead utilities and consumers in the market transformation towards ever-increasing efficiency. Radically increased efficiency will, in turn, dramatically reduce the need for baseload sources of supply, perhaps even making the goals of 20-30% renewable sources sufficient to meet all needs (see next section on elegant efficiency).

Institutional transformation in governments. Innovative market transformation programs must involve both standards, such as the federal Energy Independence and Security Act of 2007[4] and California's lighting bill, AB 1109, both of which mandate dramatic improvements in lighting efficiency; and also incentive programs such as EPA's ENERGY STAR program.[5]

Similar institutional change is embodied in the movement by cities, deciding to meet Kyoto protocols on their own, known as the "Mayor's Climate Initiative." "In May of 2007, Tulsa Mayor Kathy Taylor became the 500th Mayor to sign on"[6] According to the Seattle Mayors Climate Protection Center, "The work ahead will be to sustain Seattle's gains, build on the momentum, and redouble efforts to reduce climate pollution in Seattle, not only by 7 percent by 2012, but by 80 percent by 2050." And a recent study shows the City of Seattle on target to meet that goal.[7]

[4] http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_bills&docid=f:h6enr.txt.pdf
[5] http://www.energystar.gov/
[6] http://usmayors.org/climateprotection/agreement.htm
[7] http://www.seattle.gov/news/detail.asp?ID=7868&dept=40

In 1996, Germany issued the Waste Avoidance, Recycling, and Disposal Act stating that "Responsibility for a product must not end with its manufacturing." The recycling system--the "Green Dot"--program has been one of the most successful recycling initiatives in the world. (Murti 2005). And Iceland has declared its intention to run the whole country's energy systems off of geothermal and hydrogen. (Motovalli, 2008)

Institutional transformation in corporations. In global corporations such as Wal-Mart and Home Depot, institutional shifts may be signaled by their corporate sustainability statements, or such statements may be just "greenwashing." Wal-Mart, for example, has declared:

> Climate change is an urgent threat not only to our business but also to our customers, communities, and the life support systems that sustain our world… Through deep investments and efficiency innovations in our stores and trucking fleet, we plan to reduce our overall greenhouse gas emissions by 20 percent over the next eight years. We will also design a store that will use 30% less energy and produce 30% fewer greenhouse gas emissions than our 2005 design within the next 3 years. (Wal-Mart, 2008)

When Wal-Mart declares an institutional shift, it produces results like selling 100 million CFLs in one year (Wal-Mart, 2008), but light bulbs are not enough. The next few years will reveal whether or not lofty statements and their accompanying implementation programs are leading to measurable market transformation.

The Home Depot has similarly declared, "We're dedicated to making communities a better place for generations to come … At the Home Depot, we realize how vitally important it is to conserve our environment." Their declaration includes commitments to responsible manufacturing, packaging, labeling, recycling and using energy, water, and other natural resources wisely. (The Home Depot, 2008)

Institutional transformation in financial organizations. Dow Jones Sustainability Index, the Domini Index and the Equator Principles each represent innovative, institutional shifts in the way financial performance is measured, moving from old-fashioned "bottom line" portfolio assessments, to "integrated bottom line" and "true cost pricing." (Ferguson, 2007). For example, according to their website, the Equator Principles are: "A financial industry benchmark for determining, assessing and managing social & environmental risk in project financing" including such topics as social and environmental assessments, action and management plans, grievance plans, independent review containing full disclosure, and continuous monitoring and reporting. The Principles offer a social and environmental cost analysis to a company's financing (www.equator-principles.com).

Institutional transformation in faith communities. And there are a few indications emerging that the decades-old chasm between "pro-life" and "pro-choice" constituencies may find some confluence around the health of the natural environment upon which our lives depend. In a March 9, 2008 New York Times account of a meeting of the Southern Baptist Convention, titled *Southern Baptists Back a Shift on Climate Change* the 25-year-old son of the Convention's past president, James Merritt was quoted, describing an "epiphany": "I learned that God reveals

himself through Scripture and in general through his creation, and when we destroy God's creation, it's similar to ripping pages from the Bible," Mr. Merritt said (Banerjee, 2008)

And in a March 10, 2008 Reuters report, Vatican spokesman Archbishop Gianfranco Girotti, who is number two in the Vatican "Apostolic Penitentiary," which deals with matters of conscience, listed "ecological" offences as among the "New Forms of Social Sin." Phillip Pullella's Reuters article goes on to point out that:

> In recent months, Pope Benedict has made several strong appeals for the protection of the environment, saying issues such as climate change had become gravely important for the entire human race. Under Benedict and his predecessor John Paul, the Vatican has become progressively "green." It has installed photovoltaic cells on buildings to produce electricity and hosted a scientific conference to discuss the ramifications of global warming and climate change, widely blamed on human use of fossil fuels.[8] (Pullella, 2008) See also http://www.azstarnet.com/dailystar/199458

Principles

Though diverse in its implementation, market transformation is taking place according to three basic principles, as detailed below: elegant efficiency, biomimicry – doing business with nature in mind – and restoration of natural and cultural heritage.

Principle # 1: Elegant Efficiency

Factor Ten—providing the same or improved levels of end-use services using 10% of the resources we now use—is not only possible, but cost effective, now (Schmidt-Bleek, et al., 1997). Most notably, this means providing energy and transportation services with 10% of the greenhouse gas emissions. So this means providing the same lumen output as a 20th-century 100-Watt light bulb, with 10 Watts; getting the transportation equivalent of 200 miles per gallon; washing, flushing, hydrating, and irrigating our yards and farms with 10% of the water and energy now used; and so on, throughout our economies and lifestyles.

"Elegant Efficiency" does not include negative self-sacrifice, which doesn't lead to broad, sweeping, institutional transformation – turning down thermostats, dimming lights, and generally "doing without," won't bring about the type of fundamental market transformation needed to completely reshape the energy sector. For example, in the early days of water efficiency, many jurisdictions mandated the use of flow restricting showerheads. In the authors' opinion, such "mister" showerhead are one of the examples of "freezing in the dark"—doing without, instead of providing elegant efficiency. Anyone who has shivered in the shower under a fine mist knows that these misnamed "showerheads" actually belong in the produce department of the local supermarket. More recently, "pulse" type showerheads have provided the same level of efficiency, but with a pulsed flow that more elegantly and comfortably provides the services of a traditional showerhead, while using much less water and energy.

[8] See also http://www.azstarnet.com/dailystar/199458

Although much has changed since 1999, Dan York noted in his 1999 study for the Energy Center of Wisconsin:

> Energy efficiency is a low priority for consumers. Low energy prices remain the biggest barrier toward higher energy efficiency resulting from market outcomes. Because energy efficiency is such a low priority, the success of market transformation depends on selling consumers on the things they value in a product or service, such as superior performance, quality, and convenience. (York, 1999, p. 3).

Affordable. Energy efficiency is already cost-effective. For example, the table below shows relative life cycle costs for CFLs vs. incandescent light bulbs. Solid state lighting is projected to offer even greater lighting efficacy. According to the U.S. Department of Energy, "No other lighting technology offers the Department and our nation so much potential to save energy and enhance the quality of our building environments." (http://www.netl.doe.gov/ssl/)

Table 1. Total Costs: CFL's vs. Incandescent Light Bulbs

	Fluorescent	**Incandescent**
Energy Input (Watts)	15	60
Light Output (lumens)	810	830
Useful Life (hours)	10,000	1,500
# of Bulbs for 10,000 hours	1	6.7
Bulb Costs	1 @ $2.00 = $2.00	6.7 @ $0.32 = $2.14
Electricity Used (kWh)	150	600
Electricity Cost (@$0.085 per kWh)	$12.75	$51.00
TOTAL COST	$14.75	$53.14
Cost saving from using a CFL: $38.39		

Source: http://www.cleanenergydurham.org/RESOURCESlightbulbs.html

As strongly as early adopters may feel about the propriety and importance of energy efficient choices, the most dramatic market transformations will be seen when the price clearly justifies the decision by traditional bottom line analysis.

> …any improvement in productivity, through occupant comfort, lighting, temperature, and increased natural ventilation, etc. will have a major impact on the bottom line. (Davis Langdon, 2007, p. 6).

On a larger scale, major corporations are moving towards cost-effective energy efficiency measures at a great rate. As reported by Daniel Esty and Andrew Winston in *Green to Gold,* for an investment of $20 million in greenhouse gas reduction, BP saved $650 million in the first few years, and more than $1.5 billion by 2006. "Nobody had dared imagine such an absurdly high return on investment. As Lord Browne, former CEO of BP has said, 'We set out to do good….and we ended up doing well.'" (Esty, 2006)

Stylish. For too long, "energy efficient" has been synonymous with "weird," "kooky," or "clunky"—so much so that the California Energy Commission maintains a website to dispel "myths" about energy efficiency (http://www.consumerenergycenter.org/myths/index.html).

Though European communities have been somewhat more forgiving, steel solar panel frames and large black rectangles on the tops of buildings have raised protests from historic preservation and architectural design committees throughout the United States; and use of pigtail-like CFLs have not reached many constituencies yet, with minimal adoption rates among segments of the population not yet inclined toward energy efficiency. For example, Wal-Mart's "Live Better Index" shows that the highest adoption rates for CFLs are still in progressive-minded states like California, New Hampshire, and Connecticut (http://www.walmartfacts.com/articles/5383.aspx).

When energy efficiency choices get made based on style, such that consumers are selecting the most energy efficient option by coincidence, and their choice is made because it's "cool" or because "it looks good," then the sea change will occur without further justification. (York, 1999, p. 3).

Comfortable. Until energy efficiency becomes as comfortable and convenient as flipping a light switch, enjoying in-floor heating as you step out of bed, wearing shoes that fit, turning on a faucet, or grabbing a cold beer from the fridge, it's unlikely that "mainstream" consumers and institutions will choose anything other than the most convenient and least expensive options.

> People don't want raw kilowatt-hours or lumps of coal or barrels of sticky black goo," Lovins says. "They want hot showers, cold beer, comfort, mobility, illumination. It's like when you go to the hardware store looking for a drill. What you really want is not a drill but a hole. And why do you want the hole?" Asking such questions, Lovins says, is the first step in good design. (Ward, 2007)

Convenient. Though not yet cost-competitive, checking off a box on a utility bill for "green power" is convenient; as is public transit that runs on time and drops you off where you need to be. As noted by Conservation Law Foundation's Carrie Russell, "A comprehensive, convenient and affordable transit system is one of our best strategies for addressing climate change."

Many other examples of convenience are emerging in local communities, such as the return of curbside recycling pick-up, readily available 100% post-consumer recycled paper, centrally-located farmer's markets, and so forth.

Principle #2: Biomimicry

> Biomimicry is the conscious copying of examples and mechanisms from natural organisms and ecologies. It is a form of applied case-based reasoning, treating nature itself as a database of solutions that already work. Proponents argue that all natural life forms minimize and ecological niches remove failures.
> (http://en.wikipedia.org/wiki/Biomimicry, 2005)

Janine Benyus' *Biomimcry* and its subsequent spin-offs revolutionized the relationship between design and nature. As described by L. Hunter Lovins, "Nature shops locally, recycles, and uses non-toxic materials, in closed-loop systems." (Lovins, 2007)

Biomimicry has led to many budding innovations. Many emerging innovations contain some but not all of the elements of biomimicry, for example:

- **Velcro (or touch-fasteners):** Velcro®--those strips of plastic that stick so tightly to each other--was invented by a Swiss innovator, named George de Mestral. The story goes that he was walking his dog one day on vacation in Colorado and when he came home noticed how cockleburs were sticking to his pants and his dog's coat. He examined the cockleburs under a microscope and noticed the hook-like structure on the burs. This led George to the invention of the well known Velcro, an object that many people us every day.
- **Swimwear:** At the 2000 Olympics in Sydney, 28 out of 33 gold medalists wore Speedo's Fastskin allovers. These suits improve swimmer's speed by as much as 7.5%, by reducing the drag in the water, as compared to the old-fashioned human flesh. The design is based on the feature of sharks' skin, that uses tiny V-shaped ridges (called "dermal denticles") to reduce turbulence around their body and therefore the drag in the water (Gíslason, 2003).

Local. A transformed energy market will count local sources as one of its most prominent features. The vulnerability of large, over-centralized systems, with long supply lines to shortages and terrorist disruption has been well documented for more than 25 years (Lovins, 1982). Using energy sources and building materials from a local area, such as solar or geothermal, dirt/adobe, local/sustainable wood/log construction, regionally-obtained rock construction, "living roof" construction with local flora provides both energy savings and a revived sense of place. "When a company decides to create a workplace where employees can develop an appreciation for local natural beauty, it has given itself the opportunity to rethink everything under the sun" (Schor, 2002 p.22). Eating local foods will save transportation costs, and locally-grown organic food can also save the costs of both transportation and petrochemicals. Further market transformation towards local resources will include manufacturing from regionally-available, renewable resources, using local labor and renewable energy.

> The fact that a global company can achieve positive local effects is a very critical issue for us. In our minds, all sustainability is local. On one level, that suggests a rich engagement with one's place, an attitude toward design that draws information and inspiration from the nearby living world. But it can also mean that one develops an appreciation for the distant effects of local actions, and the local effects of distant actions (McDonough, 2002, Extravagant Gesture…in Schor, 2002, pp. 25-26).

Recyclable. The importance of recycling to market transformation has become such a staple basis for energy efficiency as to require no further comment here. With only one earth, there is no "away" to throw "disposable" items. Nature doesn't do it that way—everything exuded from a system becomes food for another process. Market transformation towards a sustainable energy economy will, as a matter of necessity, include recycled and recyclable materials as a taken-for-granted prerequisite.

> Simple process innovations can make recycling an even more attractive option. Green Bay Packaging Company in Green Bay, Wisconsin – a state that banned all paper from its landfills in 1995 – improved its manufacturing processes enough by 1992 to be able to eliminate all the effluent discharge that had been a waste

product from making all-recycled containerboard. (Hawken, Lovins & Lovins, 1999)

Non-toxic. In many instances, nature is not only the model, but the answer. Using the local flora and fauna in decision making often provides a win/win for all involved.

Closed-loop. One of the most prominent examples of a "closed-loop system is Oberlin College's Adam Joseph Lewis Center for Environmental Studies. Besides recycling everyday products such as paper, aluminum, glass, and plastic, Oberlin took it one step further to reduce the amount of sewage waste they were producing. Incorporated into their building schematics is Dr. John Todd's "Living Machine." The Living Machine is an ecologically engineered system that combines elements of conventional wastewater technology with the purification processes of wetland ecosystems to treat and recycle the building's wastewater. The system is designed to remove organic wastes, nutrients, and pathogens, including both "grey" and "black" water. Water cleaned by the Living Machine is reused in the building's toilets and landscape effectively creating a "zero-waste" building. Aside from being an ideal model for a closed-loop system, the Living Machine serves as a valuable research laboratory and educational tool for students and faculty, conserves water, and reduces costs and energy otherwise spent on sewage/sewer disposal. This clean, simple approach efficiently transforms high-strength industrial wastewater and sewage into water clean enough to be recycled for reuse, and is aesthetically pleasing with plants shining in full bloom (Oberlin College, 2007).

Principle #3: Restoration

Business and industry have done such egregious damage to the natural systems upon which our lives depend, that it is no longer sufficient to, as Hippocrates said, "do no harm." To achieve the types of fundamental market transformation required to address energy challenges, businesses and communities must include restoration of natural and cultural heritage as part of the measurement of success.

For example, with funding from the San Francisco, Dept. of Energy, the California Energy Commission, the California Public Utilities Commission, and others, the San Francisco Community Power Program has been operating since 2001. The program is designed to focus on underserved neighborhoods by "helping small businesses and low-income families lower their expenses and reduce their ecological footprint." Since its inception, besides helping to close the century-old Hunters Point Power Plant, the single largest stationary source of air pollution in San Francisco, the organization has helped the Bay Area save almost 10 megawatts of electricity since 2001, and has won numerous awards both on the local and National level. (http://www.sfpower.org).

As another example of restoration, Western Area Power Administration (WAPA) has been working with the Intertribal Council on Utility Policy (COUP), a coalition of Great Plains tribes, since 1995 to generate new jobs through extensive wind energy projects. COUP uses WAPA's transmission lines that traditionally carried hydroelectric power to now carry energy created by the wind. COUP has also installed solar and wind systems at tribal schools and participates in energy audits, weatherization projects, and natural building programs to create a less toxic and energy independent ideal that works closer in–line with their traditional heritage and lifestyle (http://www.solartoday.org/2008/may_june08/sacred_winds.htm).

Ford Motor Company has committed to a $2 billion restoration of it's historic, ground-preserving, Rouge River plant, in Dearborn, MI. Though it is also notable as a lone, isolated example among many less-balanced facilities, Rouge River's restoration may stand again as a symbol of commitment to architectural harmony with natural systems. As described by William McDonough and Michael Braungart.

> By the beginning of the twenty-first century, the Rouge River plant was a brownfield, a sprawling wasteland of dilapidated buildings, leaky pipes, and old equipment. …Rather than walk away from a worn-out industrial landscape and a community that had supported it for nearly a century, Ford chose to transform the Rouge River site into a healthy, productive, life-supporting place… As his great-grandson William Clay Ford says, "this is not environmental philanthropy; it is sound business…" (McDonough, The Extravagant Gesture… in Schor, 2002, p. 24)

Implications for the Market Transformation Community

The energy efficiency community can learn from, and take action based on these principles, in ways that support and take advantage of these trends. Utilities and their regulators, in particular, can continue to incentivize and promote the most efficient technologies and strategies, featuring elegant, stylish, affordable, comfortable, nature-compatible, and culturally-appropriate ways outlined in this paper.

Conclusion

The business opportunities and lifestyle benefits of market transformations resulting from elegant efficiency, biomimicry, and restoration of natural and cultural heritage can be accompanied by net savings, improved qualify of life, and more sustainable communities. Light bulbs are a good start, to be followed by increased use of green building practices, and efficiency programs for such technologies as solid state lighting, battery chargers, power supplies, and set top boxes. Local planning regulations can also promote these principles by incorporating them into the basic approach to all topics. The transformation is already underway. All we have to do is keep on, keeping on.

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