

SUSTAINABILITY RESOURCE GUIDE 2011^{1,2}

In each deliberation, we must consider the impact of our decisions on the next seven generations.

- Great Law of the Haudenosaunee

In this age of sustainability, the negative consequences of irresponsible corporate behavior are clear. Several corporations have already changed their management models to deal with natural and social resource issues, and a growing body of empirical evidence suggests that companies can “do well by doing good.” Addressing social and environmental issues clearly contributes to the long-term value of the firm, thus meeting the needs of all stakeholders. There is increasing recognition of the potential for businesses to be strategic partners and agents for positive change to solve the world’s most pressing problems.

DEFINING SUSTAINABILITY

While the concept of sustainability has been known to and practiced by human kind since the dawn of civilization, it was not until 1987 that the concept gained the attention of the governments and other institutions when the United Nations’ World Commission on Environment and Development made it the focus of their work. Named after the former Prime Minister of Norway who served as the chair, the Brundtland Commission offered this definition of sustainable development:

Sustainable development seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future (p51).

The commission understood that sustainable development was not the destination but the means to achieve economic, social and environmental justice. Sustainable development, hence, is a “process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs (p25).”

In the business arena, the World Business Council for Sustainable Development (WBCSD) defined sustainability as:

...forms of progress that meet the needs of the present without compromising the ability of future generations to meet their needs.

¹ Prepared by professor Nagaraj Sivasubramaniam, PhD and Alexis Wheeler (MBA - Sustainability, 2009); updated Nov 2009 by Jessica Beckman and Erin Clymer, class of 2010. Contact sustainablemba@duq.edu for more information or to receive an electronic copy of this guide.

² The books and web sites included in this resource guide were chosen by the authors and should not be construed as endorsement by the Donahue Graduate School of Business, Duquesne University.

An example of how the definition can be translated into action is provided by the students of Duquesne University's MBA – Sustainability program. The 2009 class adopted the following vision of sustainable performance to guide their learning experiences. Their vision includes researching and developing business opportunities that are economically, environmentally, and socially beneficial.

- Economic success will depend on brand strength, community prosperity, and return on investment.
- Environmental responsibilities include resource conservation, recycling, reduction of supply chain impacts, collaboration with communities, the pursuit of energy efficiency and renewable energy sources on campus.
- Our social responsibility includes service learning, working with corporate sponsors on the business case for sustainability, respect for stakeholders, systems thinking, and an ethical approach to decision making.

In the following sections, we provide brief descriptions of different approaches to sustainability as well as regulatory and other frameworks that influence sustainability practices.

SUSTAINABILITY FRAMEWORKS

We have chosen to highlight four out of a dozen different tools and frameworks available to managers interested in sustainability. In addition to life-cycle analysis, ecological approaches and base of the pyramid strategy, we have also provided a brief description of green chemistry, a discipline that enables implementation of the other sustainability approaches. We have listed additional resources that can be consulted for more information on these approaches as well as several other frameworks.

Life Cycle Analysis (LCA)

Life cycle analysis (LCA) is a tool that allows companies to better understand and to evaluate the environmental impacts of products, activities and processes by following a product from raw material acquisition to consumer use and disposal. This provides the producer with a detailed picture of the product's life-cycle and its environmental impact. LCA can be utilized by stakeholder groups to measure if resources are being used wisely by benchmarking against the best. It is also a strategic tool that may help determine if a product or service fits the sustainable vision of a particular company or group.

The components of LCA include a life cycle inventory, life cycle impact assessment and life cycle improvement analysis. Life cycle inventory quantifies energy use, raw material requirements, emissions and waste production, and is especially useful for those groups interested in benchmarking, targeting means of resource reduction, developing new products and comparing alternative products. The life cycle impact assessment and improvement stages help evaluate environmental and health risks, and develop strategies to mitigate environmental impact by changing product design, raw material usage, industrial processes or waste management.

Selected Books, Websites and Journal Articles

Hendrickson, C.T., Lave, L.B., & Matthews, H.S. (2006). *Environmental Life Cycle Assessment of Goods and Services: An Input-Output Approach*. RFF Press.

SAIC (2006). *Life Cycle Assessment: Principles and Practice*. USEPA ebook (<http://www.epa.gov/NRMRL/lcaccess/pdfs/600r06060.pdf>)

Economic Input-Output LCA @ Carnegie Mellon University: <http://www.eiolca.net/>

EPA's LCA site: <http://www.epa.gov/nrmrl/lcaccess/>

LCA Calculator: <http://www.lcacalculator.com/>

The International Journal of Life Cycle Assessment:
<http://www.springerlink.com/content/112849/> (Subscription required)

Ecological Approaches

In 1989, Robert Frosch and Nicholas Gallopoulos published "Strategies for Manufacturing" in *Scientific American* calling for an industrial ecosystem in which the use of energies and materials is optimized, wastes and pollution are minimized, and there is an economically viable role for every product of a manufacturing process. This article set the foundation for the *industrial ecology* approach to sustainability. Inspired by their work which called for a renewed attention to design, several others offered variations of this approach; these include biomimicry by Janine Benyus in 1997, natural capitalism by Paul Hawken, Amory Lovins and Hunter Lovins in 2000, and cradle-to-cradle by William McDonough and Michael Braungart in 2002.

Paul Hawken and his colleagues proposed the natural capitalism framework as a counter to the traditional approach to managing businesses. Unlike the traditional economic system where financial, physical and human capital are deployed to convert natural capital into marketable products and services, their approach treats natural capital as an asset that is costly and scarce, and hence has to be leveraged to extract the most productivity. By increasing the productivity of resources by a factor of 10, imitating the biological systems to eliminate waste, renting products and services so they can be continuously updated thus avoiding the negative consequences of the throw-away culture, and restoring the health of our natural systems by reinvesting in them, organizations will be able to fully value all four forms of capital deployed in their operations. Several organizations have adopted this framework, the best known being *Interfaces*, the flooring manufacturer.

Cradle-to-cradle is another approach inspired by industrial ecology, and it adopts the idea that "waste equals food." In other words, the output from one process can be used as input for another process, thus eliminating the concept of waste. Products can be designed to provide nourishment for something new at the end of the product's life cycle. This model has been the guiding principle for William McDonough and Michael Braungart, the developers of this framework, as they work to make products and processes eco-effective and not just efficient. The objective of this methodology is to

design products with the method of disposal in mind; by categorizing all inputs as either technical or biological nutrients, designers can ensure that the complete process generates no waste. Producers then ensure that the technical nutrients are returned to industry and reused in the same process or manufactured into another product, and biological materials are returned to earth as they are deemed environmentally safe.

Several companies including Herman Miller and Nike have used this approach to maximize their eco-efficiency and, at the same time, achieve considerable cost savings. Companies strive for cradle-to-cradle certification of their products from McDonough Braungart Design Chemistry (MBDC), and publicize this certification to differentiate their products from their competition.

Selected Books, Websites and Journal Articles

Adams, W. (2009) *Green Development: Environment and Sustainability in a Developing World*. 3rd ed. Routledge.

Benyus, J.M. (2002). *Biomimicry: Innovation Inspired by Nature*. Harper Perennial.

Braungart, M. (2007). The Wisdom of the Cherry Tree. *International Commerce Review: ECR Journal*. 7(2). pp. 152.

Garner, A., & Keoleian, G.A. (1995). *Industrial Ecology: An Introduction*. National Pollution Prevention Center for Higher Education (ebook).

<http://www.umich.edu/~nppcpub/resources/compendia/INDEpdfs/INDEintro.pdf>

Hawken, P. (1993). *The Ecology of Commerce: A Declaration of Sustainability*. HarperCollins.

Hawken, P., Lovins, A., & Lovins, L.H. (2000). *Natural Capitalism: Creating the Next Industrial Revolution*. Back Bay Books.

McDonough, W., & Braungart, M. (2002). *Cradle to Cradle: Remaking the Way We Make Things*. North Point Press.

McDonough, W. (2008). Time for a New Strategy. *Parameters*. 38(3). pp. 109.

Erkman, S. (1997). Industrial Ecology: an historical view. *Journal of Cleaner Production*, 5(1-2), pp. 1-10.

Frosch, R.A., & Gallopoulos, N.E. (1989). Strategies for manufacturing. *Scientific American*, 261(3), pp. 94-102.

Lovins, A., Lovins, L.H., & Hawken, P. (1999). A roadmap for natural capitalism. *Harvard Business Review*, May-June, pp. 145-158.

Lovins, A.B., L.H. Lovins, and P. Hawken. (2007). A Road Map for Natural Capitalism. *Harvard Business Review*. 85(7). pp. 172-83.

McDonough, W., & Braungart, M. (2003). Towards a sustaining architecture for the 21st super century: the promise of cradle-to-cradle design. *Industry and Environment*, 26 (2-3), pp. 13-16.

Journal of Industrial Ecology: <http://www.blackwellpublishing.com/journal.asp?ref=1088-1980&site=1>

Information on Biomimicry: <http://www.biomimicryinstitute.org/>

International Society of Industrial Ecology: <http://www.is4ie.org/>

Natural Capitalism Official Site: <http://www.natcap.org/>

Natural Capital Institute: <http://www.naturalcapital.org/>

McDonough-Braungart Design Chemistry: <http://www.mbdc.com/index.htm>

William McDonough's site: http://www.mcdonough.com/cradle_to_cradle.htm

Green Chemistry

The above ecological frameworks require a redesign of both materials and processes involved in the manufacture and delivery of the industry's products. A key enabler is the discipline of *Green Chemistry* which calls for the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. This philosophy complements the other sustainability approaches by eliminating pollution at the source by designing chemicals that are less harmful to human health and the environment, and by reusing or recycling chemicals. Tangible benefits of green chemistry include improved efficiency, safer products, improved effectiveness of product, elimination of costly end-of-pipe treatment of chemicals, reduced waste, energy, and resource usage, and improved competitiveness of product. One example of a successful green chemistry implementation is the reformulation of SC Johnson's *Windex* product, launched in 2001 as a company-wide effort to incorporate greener components into their products. SC Johnson was able to improve the cleaning power of *Windex* by 30% and increase market share while eliminating 1.8 million pounds of volatile organic compounds.

Selected Books, Websites and Journal Articles

Anastas, P., & Warner, J. (1998). *Green Chemistry: Theory and Practice*. Oxford University Press.

Kirchhoff, M.M. (2005). Promoting sustainability through green chemistry. *Resources, Conservation and Recycling*, 44(3), pp. 237-243.

American Chemical Society Green Chemistry Institute:

http://portal.acs.org/portal/acs/corg/content?nfpb=true&_pageLabel=PP_TRANSITIONMAIN&node_id=830&use_sec=false&sec_url_var=region1

U.S. EPA's Green Chemistry Portal: <http://www.epa.gov/greenchemistry/>

REACH – the European community regulation on chemicals and their safe use:

http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm

SC Johnson: www.scjohnson.com/environment/

Bottom-of-the-Pyramid (BOP)

The bottom of the pyramid (BOP) represents the poorest as well as the largest socio-economic group in the world. There are approximately four billion people who live on less than two dollars per day, and the majority of these people live in developing countries. To become a sustainable society, the needs of these people have to be taken into account: improving their living conditions to better their health and access to education, creating opportunities for economic development, and serving their needs profitably. This calls for radically different business models that may require businesses to take on new roles in the targeted communities. Successful examples of BOP innovations include microfinancing by Grameen Bank in Bangladesh and Accion International operating in four continents, and Unilever's personal hygiene products in India.

Selected Books, Websites and Journal Articles

Brugmann, J. and C.K. Prahalad. (2007). Cocreating Business's new Social Compact. *Harvard Business Review*. 85(2). pp 80-90.

Hart, S.L. (2005). *Capitalism at the Crossroads: The Unlimited Business Opportunities in Solving the World's Most Difficult Problems*. Wharton School Publishing.

Hart, S. L. (2003). Sustainable Value Framework. *Academy of Management Executive*. 17(2).

Prahalad, C.K. (2004). *The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits*. Wharton School Publishing.

Sachs, J.D. (2006). *The End of Poverty: Economic Possibilities for Our Time*. Penguin Press.

Simanis, E., & Hart, S.L. (2008). *The Base of the Pyramid Protocol: Toward Next Generation BoP Strategy*. 2nd Edition, Center for Sustainable Enterprise, Cornell University (ebook):
http://www.johnson.cornell.edu/sge/docs/BoP_Protocol_2nd_ed.pdf

Simanis, E., and S. Hart. (2009). Innovation from the Inside Out. *MIT Sloan Management Review*. 50(4).

Yunus, M. (1999). *Banker to the Poor: Micro-Lending and the Battle against World Poverty*. PublicAffairs.

Karnani, A. (2007). The Mirage of Marketing to the Bottom of the Pyramid: How the private sector can help alleviate poverty. *California Management Review*, 49 (4), pp. 90-111.

Seelos, C., & Mair, J. (2005). Social entrepreneurship: Creating new business models to serve the poor. *Business Horizons*, 48, pp. 241-246.

Accion International – a leading global microfinancing institution: <http://www.accion.org/>

Founding Network of Social Entrepreneurs: <http://www.ashoka.org/>

Grameen Bank & Professor Muhammad Yunus: <http://www.grameen-info.org/>

Kiva – a microfinance facilitator: <http://www.kiva.org/about/microfinance/>

Microfinance Portal: <http://www.microfinancegateway.org/>

Example of BOP Innovation: <http://www.wbcsd.org/web/projects/water/sanitation.pdf>

MEASURING AND REPORTING SUSTAINABILITY INITIATIVES

Next, we provide a brief description of the most widely used standard for reporting sustainability initiatives as well as links to non-financial reporting initiatives including Triple-Bottom Line (TBL), ISO 26000 and responsible investing.

[Global Reporting Initiative \(GRI\)](#)

The Global Reporting Initiative (GRI) is a large, multi-stakeholder network of experts worldwide who have developed a framework for reporting on economic, environmental, and social performance within an organization. GRI's goal is to make sustainability reporting as routine and comparable as financial reporting for all organizations. Via published Sustainability Reporting Guidelines GRI published the third version, called G3, in 2006. The GRI framework standardizes formats to produce reports that can be compared across firms and over time that are useful for tracking sustainability performance and benchmarking against best practices. The GRI is independent, but works in cooperation with the United Nations Global Compact, which encourages organizations to have sustainable and socially responsible policies and report on the implementation of these policies. The GRI also collaborates with the United Nations Environment Programme (UNEP) and the International Standards Organization (ISO).

Selected Websites and Journal Articles

GRI Home Page: <http://www.globalreporting.org/>

Hedberg, C., & von Malmberg, F. (2003). The Global Reporting Initiative and corporate sustainability reporting in Swedish companies. *Corporate Social Responsibility and Environmental Management*. 10(3), pp. 153-164.

Willis, A. (2003). The role of the Global Reporting Initiative's sustainability reporting guidelines in the social screening of investments. *Journal of Business Ethics*. 43(3), pp. 233-237.

[Triple Bottom Line](#)

The Triple Bottom Line (TBL) approach was first described by John Elkington in his 1998 book *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*, and popularized by Andrew Savitz in his 2006 book *The Triple Bottom Line Approach*. TBL suggests that companies will do well to pay attention to economic, environmental and social successes rather than economic performance alone.

The International Organization for Standardization (ISO) has launched the development of an international standard for social responsibility. ISO 26000 will be published in 2010, and unlike ISO 9001 and ISO 14001, will not be a certification standard.

Selected Books, Websites and Journal Articles

Bell, S., & Morse, S. (2008). *Sustainability Indicators: Measuring the Immeasurable*. Earthscan.

Elkington, J. (2004). Enter the Triple Bottom Line. *The Triple Bottom Line: Does it All Add Up?*. Sterling: EarthScan. pp. 1-17.

Elkington, J. (1998). *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*. New Society Publishers.

Gazdar, K. (2007). *Reporting Nonfinancials*. Wiley.

Savitz, A. (2006). *The Triple Bottom Line Approach: How Today's Best-Run Companies are Achieving Economic, Social, and Environmental Success - And How You Can Too*. Jossey-Bass.

Brown, D., Dillard, J., & Marshall, R.S. (2006) Triple Bottom Line: A business metaphor for a social construct Working Paper, Portland State University, School of Business Administration. <http://www.recercat.net/bitstream/2072/2223/1/UABDT06-2.pdf>

Russo, M. (2008). The Triple Bottom Line: Sustainability's Accountants. *Environmental Management: Readings and Cases*. Sage Publishing. pp. 49-62.

Elkington, J. (1994) Towards the sustainable corporation: Win-win-win business strategies for sustainable development. *California Management Review*, 36 (2), pp. 90-100.

Deloitte Touche Tohmatsu – Sustainability Reporting Scorecard
<http://www.deloitte.com/dtt/research/0,1015,sid%253D1084%2526cid%253D4065,00.html>

ISO 26000: <http://www.iso.org/sr>

Responsible Investing

Several new advocacy groups have formed adopting a market-based strategy to effect change in corporate practices. By aligning with the interests of the stockholders, these groups have sought to act as partners interested in meeting investor needs while being environmentally and socially responsible. An extension to the United Nations Global Compact is the Principles for Responsible Investment which seeks to promote social responsibility by aligning shareholder interests with the interests of other stakeholders. Examples include:

<http://www.ceres.org/> - Network of investors, environmentalists and public interest groups working with companies to address sustainability challenges such as global climate change.

<http://www.incr.com/> - a \$7 trillion network of investors that promotes better understanding of the financial risks and opportunities posed by climate change.

<http://www.iehn.org/> - the Investor Environmental Health Network (IEHN) is a collaborative partnership of investment managers, advised by nongovernmental organizations, concerned about the financial and public health risks associated with corporate toxic chemicals policies.

<http://www.unpri.org/> - Principles for Responsible Investment is an investor initiative in partnership with UNEP Finance Initiative and the United Nations Global Compact.

GLOBAL CLIMATE CHANGE: MEASUREMENT & MITIGATION STRATEGIES

In this section, we provide an overview of the causes of global climate change, methods for inventorying greenhouse gas emissions, and the strategies for mitigating the emission of CO₂ and other greenhouse gases.

The Science behind Global Warming

While there is no agreement on the scope and extent of the consequences of global climate change, scientific consensus on causes of global warming has emerged. The Intergovernmental Panel on Climate Change (IPCC), in its fourth report released in 2007, confirmed that the observed change in the earth's temperature is caused primarily by increased levels of CO₂ since the start of industrial revolution, and particularly over the past fifty years. The rapid increase in CO₂ levels in the last century is now attributed to human activity. The rise in average temperature is predicted to have far-reaching effects on the planet's climate patterns as well as all living things.

Greenhouse gases like CO₂ trap heat from escaping our atmosphere; we need these to be present so the earth is warmer than if these were not present; however, increased levels of greenhouse gases create two problems:

- they trap heat thereby leading to increased warming, and
- contribute to the feedback effects where increased warming of the earth leads to three distinct feedback effects:
 - the melting of the ice-cap at the poles – the exposed (dark) earth and/or the blue oceans absorb heat rather than reflect them back leading to more warming causing the circular effect of increased melting and more warming,
 - increased warming leads to more evaporation of water from the bodies of water; water vapor is a powerful greenhouse gas which leads to increased warming which creates the circular effect of more evaporation and so on; and
 - increased warming could lead to the release of methane from the tundra – methane is a much more powerful greenhouse gas than CO₂.

There is considerable evidence to indicate that the first feedback effect is in play; over 200,000 square miles of the arctic ice-cap have permanently melted and the rate of melting seems to be increasing as would be predicted by the feedback effect. There is also evidence that the moisture in the upper strata of our atmosphere is at its highest levels in the last 100 years. The third feedback effect may yet occur if the earth continues to warm.

Selected Books and Websites

USA Today's compendium of Climate Change Books:

<http://www.usatoday.com/weather/climate/wclibooks.htm>

Andrew Revkin's Blog @ New York Times on Climate Change and Sustainability:

<http://dotearth.blogs.nytimes.com/>

Basic Information on Global Warming from National Oceanic & Atmospheric Administration:

<http://www.ncdc.noaa.gov/oa/climate/globalwarming.html>

Intergovernmental Panel on Climate Change: <http://www.ipcc.ch/>

Real Climate – Climate Science from Climate Scientists: <http://www.realclimate.org/>

U.N. Environment Programme – Climate Change Web site:

<http://www.unep.org/Themes/climatechange/>

U.N. Framework Conventions on Climate Change: <http://unfccc.int/>

U.S. EPA – Climate Change Web site: <http://www.epa.gov/climatechange/>

Inventorying Greenhouse Gas Emissions

Several approaches have been proposed to measure the emissions of CO₂ and other greenhouse gases (GHG) so that such levels can be benchmarked, monitored and controlled. Accurate and reliable measurement of GHG inventory is also critical for evaluating a company's risk position arising from regulatory changes relative to GHG emissions. Recognizing this need, the Greenhouse Gas Protocol was developed by the World Resources Institute and the World Business Council for Sustainable Development. The GHG Protocol has become the most widely used international accounting tool for government and business leaders to understand, quantify, and manage greenhouse gas emissions. Third party verification/auditing of GHG inventory is enabled by the adoption of GHG Protocol which provides the accounting framework for dealing with different GHG standards and programs in the world.

Selected Websites

GHG Inventory

Greenhouse Gas Protocol Initiative (described above): <http://www.ghgprotocol.org/>

U.S. EPA – Greenhouse Gas Emissions:

<http://www.epa.gov/climatechange/emissions/index.html>

Carbon Footprint & Other Smaller Scale Initiatives

Clean Air – Cool Planet – Carbon Calculators: <http://www.cleanair-coolplanet.org/>

Nature Conservancy – Personal Carbon Footprint calculator:

<http://www.nature.org/initiatives/climatechange/calculator/>

Personal Carbon Footprint Calculator: <http://www.carbonfootprint.com/calculator.aspx>

Carbon Mitigation

The strategies proposed to reduce GHG emissions range from conservation and efficiency initiatives to switching from fossil fuels to renewable sources of energy. Provided is a brief overview of the institutional framework that influences policies and strategies at the country-level and the mechanisms available for reducing GHG emissions using voluntary and/or mandatory systems.

The objective of the Kyoto Protocol, adopted in 1997 and effective since 2005, is to stabilize greenhouse gas concentrations in the atmosphere. Under this agreement, industrialized countries will reduce their collective emissions of greenhouse gases by 5.2% from the year 1990. Over 180 countries have ratified the agreement, and the participating developed countries have committed to the reduction targets and have implemented the systems necessary to achieve the reduction targets. Acknowledging the fear that compliance with the reduction targets will be expensive for many developed countries, the agreement allows the participating countries to buy carbon credits from the world market. Investment flows from the sale of these carbon credits are expected to finance the reduction of emissions in developing countries. The investment flows are targeted at supporting clean development mechanisms and joint implementation projects in less developed countries to help aid in their reduction of GHG.

The Kyoto Protocol is a “cap and trade” system; each participating country is assigned a reduction target. Countries that go beyond the set targets can trade their emission rights to another country or entity that has not been able to meet their required reduction. An example of a successful GHG emission reduction system is the European Union Emission Trading system (EU ETS). The EU ETS is a mandatory system similar to the Kyoto Protocol “cap and trade”. The Chicago Climate Exchange (CCX) is an example of a voluntary system. Companies voluntarily participate in the CCX and commit to GHG

reduction targets, with the ability to buy or sell emission credits depending upon their ability to meet the set targets. The worldwide emissions trading value exceeded \$60 billion last year, with over 90% accounted for by EU ETS.

An alternative to the “cap and trade” system is the auction system. The Regional Greenhouse Gas Initiative (RGGI) is a collaboration of ten Northeastern and Mid-Atlantic States. In this system, a collective GHG reduction target is set and individual states can auction available GHG allowances. These allowances can then be traded like any other financial instrument, giving the holder the right to emit the purchased GHG amount in excess of their set target.

Unlike the above two systems which target the producer-side of GHG emissions, the carbon tax system targets the consumer side by including the full cost of GHG emissions in the product or service price. The tax is on the carbon content of energy sources, thereby crucial price signals are conveyed to consumers through the tax on the carbon content of utilized energy sources in production. This initiative is expected to spur carbon-reducing investment and low-carbon behavior by consumers. A smaller market for carbon credits (or offsets) has emerged for individuals and institutions to purchase carbon credits to mitigate GHG emissions caused by activities such as corporate air travel and individual transportation, and electricity needs. An individual may buy a carbon offset to mitigate the GHG emissions created by personal travel. In general, offset providers work to invest in more expensive, carbon-free energy sources such as wind and solar to ensure that an equivalent amount of new GHG emissions is prevented.

Selected Books & Websites

Bayon, R., Hawn, A., & Hamilton, K. (2007). *Voluntary Carbon Markets*. Earthscan.

Hoffman, A.J. (2007). *Carbon Strategies: How Leading Companies Are Reducing Their Climate Change Footprint*. University of Michigan Press.

Houser, T., Bradley, R., Childs, B., Werksman, J., Heilmayr, R. (2008). *Leveling the Carbon Playing Field: International Competition and US Climate Policy Design*. Peterson Institute.

Labatt, S., & White, R.R. (2007). *Carbon Finance: The Financial Implications of Climate Change*. Wiley Finance.

CantorCo2E – Provider of financial and transactional services to global environmental and energy markets: <http://www.cantorco2e.com/>

Carbon Finance – A portal for all things Carbon: <http://www.carbonfinance.org/>

Carbon Markets & Investors Association, the trade association of service providers to the global carbon markets: <http://www.cmia.net/>

Comparison of Carbon Offset Providers:

http://www.ecobusinesslinks.com/carbon_offset_wind_credits_carbon_reduction.htm

Chicago Climate Exchange: <http://www.chicagoclimatex.com/>

The ENDS Guide to Carbon Offsets: <http://www.endscarbonoffsets.com/>

European Union – Emissions Trading System:
http://ec.europa.eu/environment/climat/emission/index_en.htm

Kyoto Protocol – Official site: http://unfccc.int/kyoto_protocol/items/2830.php

Point Carbon – provides news and other information related to carbon markets:
<http://www.pointcarbon.com/>

Regional Greenhouse Gas Initiative (RGGI): <http://www.rggi.org/home>

Sustainability – General Resources

Selected Books, Articles & Websites

Blackburn, W. (2007). *The Sustainability Handbook*. Environmental Law Institute.

Brundtland, G.H. (ed.). (1987). *Our Common Future: The World Commission on Environment and Development*. Oxford University Press.

Daly, H.E. (1997). *Beyond Growth: The Economics of Sustainable Development*. Beacon Press.

Diamond, J. (2004). *Collapse: How Societies Choose to Fail or Succeed*. Viking.

Edwards, A.R. (2005). *The Sustainability Revolution: Portrait of a Paradigm Shift*. New Society Publishers.

Epstein, M.J. (2008). *Making Sustainability Work: Best Practices in Managing and Measuring Corporate Social, Environmental and Economic Impacts*. Berrett-Koehler Publishers.

Esty, D.C., & Winston, A.S. (2006). *Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage*. Yale University Press.

Esty, D.C. (2007). Is China Turning Green? *Fortune* 155.8

Esty, D. and M. Porter. (2005). National Environmental Performance: An Empirical Analysis of Policy Results and Determinants." *Environment and Development Economics*. 10.4. pp. 391.

Esty, D. (2007). Green is Beautiful; Helping the Planet Doesn't have to Hurt Your Bottom Line. Environmentally Responsible IT can Improve Efficiency and Generate New Revenue Streams. *CIO*. 20.6.

Jones, V. and A. Conrad. (2008). *The Green-Collar Economy: How One Solution can Fix our Two Biggest Problems*. HarperOne.

Korten, D. (2006). *The Great Turning from Empire to Earth Community*. Kumarian Press.

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Laszlo, C. (2003). *The Sustainable Company: How to Create Lasting Value Through Social And Environmental Performance*. Island Press.

Laszlo, C. (2008). *Sustainable Value: How the World's Leading Companies are Doing Well by Doing Good*. Greenleaf Publishing.

Makower, J. (2009). Strategies for the Green Economy. *CMA Management*. 82(9).

Makower, J., & Pike, C. (2008). *Strategies for the Green Economy: Opportunities and Challenges in the New World of Business*. McGraw-Hill.

Porter, M. and N. Siggelkow. (2008). Contextuality within Activity Systems and Sustainability of Competitive Advantage. *Academy of Management Perspectives*. 22(2). pp. 34-56.

Porter, M., and F.L. Reinhardt. (2007). A Strategic Approach to Climate. *Harvard Business Review*. 85(10).

Senge, P.M., Laur, J., Schley, S., & Smith, B. (2006). *Learning for Sustainability*. Society for Organizational Learning.

Senge, P.M., Smith, B., Schley, S., Laur, J. & Kruschwitz, N. (2008). *The Necessary Revolution: How Individuals and Organizations are working together to create a Sustainable World*. U.S. Green Building Council.

Steffen, A. (2006). *Worldchanging: A User's Guide to the 21st Century*. Harry N. Abrams Publishers.

Yunus, M. (2008). *Creating a World without Poverty: Social Business and the Future of Capitalism*. PublicAffairs.

Orsato, R. (2006). Competitive environmental strategies: When does it pay to be green? *California Management Review*, 48 (2), pp. 127-143.

Senge, P.M., Lichtenstein, B.B., Kaeufer, K., Bradbury, H., & Carroll, J.S. (2007). Collaborating for systemic change, *Sloan Management Review*, Winter, pp. 44-53.

American Public Media – Coverage of Sustainability Issues:

<http://sustainability.publicradio.org/consumed/>

Business for Social Responsibility: <http://www.bsr.org/>

GreenBiz.com – A portal for sustainability news: <http://www.greenbiz.com/>

Rocky Mountain Institute: <http://www.rmi.org/>

U.S. Army Sustainability: <http://www.sustainability.army.mil/>

U.S. Army Corps of Engineers – Sustainable Design & Development:

<https://eko.usace.army.mil/fa/sdd/>

U.S. EPA Energy Star Program: <http://www.energystar.gov/>

U.S. Green Building Council & LEED Certification: <http://www.usgbc.org/>

U.S. National Renewable Energy Laboratory: <http://www.nrel.gov/>

World Business Council for Sustainable Development: <http://www.wbcsd.org/>

The World Resources Institute: <http://www.wri.org/>