EXPLORING CORPORATE SOCIAL RESPONSIBILITY FOR CLIMATE CHANGE MITIGATION WITH THE STABILIZATION WEDGE ROLE-PLAYING EXERCISE IN AN MBA ETHICS CLASS

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Abstract

An emerging consensus agrees that anthropogenic global warming causes extreme weather patterns, resulting in flooding, droughts, fires, high insurance costs, threats to human health and the world’s food supply. The business community in the United States has been slow in adapting to this development.

The dual goal of this paper is to present the case for climate change as a genuine challenge and to explain the pedagogical methods the author uses to make students aware of the urgency of the problem and the opportunities created through the acceptance of socially responsible investments in alternative energy projects. The stabilization wedge game (developed at Princeton University) is a useful interdisciplinary exercise for exploring and developing, through teamwork, innovative solutions that are socially responsible and profitable at the same time.

KEY WORDS: Climate change, global warming, business ethics, socially responsible investing, corporate citizenship, corporate social responsibility (CSR), greenhouse gases, scientific consensus, stabilization wedge game, sustainable development, alternative energy, IPCC.

INTRODUCTION

Teaching is a voyage of discovery in search of the truth, learning with, and from, your students. In teaching a course in business ethics and corporate social responsibility, the challenge is to make the theory meaningful through the exploration of concrete cases that not only provide the students with examples of what to expect and avoid, but also engage them in critical thinking and problem solving. Strategies to engage the students are those that encourage learning through inquiry, reflection and collaboration. [Hammond, 2004] The range of possible cases is enormous, and covers everything from internal human resources issues, to white collar crime, environmental externalities, sustainable development [Cooperrider, 2008], regulatory compliance, dangerous or unhealthy products, and labor conditions in overseas factories. One can approach the course through a survey of many small cases, or build it around one large, challenging case that integrates all of the concerns, so that students come away with an in-depth understanding of a major topic, and an appreciation of the myriad ways they can address it. [Denbo, 2008]

Climate change is such a topic. It needs to be explored in depth because of a continuing disjuncture between growing public acceptance of the existence and seriousness of the problem it poses, and continued resistance by corporate officers and directors, particularly in the energy field, to accepting the implications of the problem for their own industries. Explaining its significance to the business community in order to get them to buy into becoming part of the solution, rather than remaining part of the problem,
thus becomes a matter of primary importance, and one that business educators in the United States need to address. While business educators increasingly are aware of the importance of the “triple bottom line” of “profits, planet and people” [Bisoux, 2008], the agenda of sustainability needs to be explicitly expanded to address the climate change problem in the curriculum.

Achieving this objective first entails ensuring that the students have a basic understanding of the underlying science, and how science can impact business opportunities, and challenges, in unexpected ways. This alone is an important goal, as it makes students aware that corporate social responsibility includes understanding the scientific method, and the importance of taking science seriously, and objectively in business planning.

Second, once the urgency of the challenge is understood, students should be motivated to take seriously how their own careers can make a difference in finding timely, affordable, and profitable solutions. Links to ethical corporate speech, sustainable development, ‘green’ technology and green businesses can be explored, and the carbon footprint of supply chain or construction decisions examined. Finally, through exploration of competing alternatives, students can learn how to begin to transform enormous, seemingly impossible problems into a myriad of possible solutions. This is a skill, once learned, that can be applied in many other situations.

At the end of the case study, students should emerge with an appreciation of how the fundamental theories of corporate ethics, whether grounded in duty to the shareholder alone as some would argue, or including obligations to a broader set of stakeholders, lead to the same conclusion: corporate self-interest and the interest of society are linked in finding a timely solution to the climate change challenge. [Heal, 2008, pp. 214, 222-223]

THE CLIMATE CRISIS

There is a widespread scientific consensus that climate change caused by anthropogenic global warming due primarily to reliance on coal, oil and other fossil fuels since the Industrial Revolution began in the 18th century is real [Ponting, 1993; McNeill, 2001, Oreskes 2004]. Many in the business community in the United States are reluctant to see the danger climate change presents to the world. Instead, they have supported climate change deniers and skeptics. The practice continues in the lobbying and sustainability reports of Exxon Mobil [Heal, 2008, pp. 213-214], the work of the Heartland Institute, and the writings of S. Fred Singer [Gelbspan, 2004; Revkin, 2008a & b; Robbins, 2008; Singer & Avery, 2008] and Pat Michaels [Pearce, 2007, at 16 & 205]. This has led to partisan and even religiously motivated attacks on legitimate science [Kaplan, 2004; Mooney, 2005; Rockwood, 2006; Gore, 2007]. The Bush administration promoted a national energy policy that emphasized fossil fuels, and minimized the risks of global warming [Broder, 2007; Broder & Barringer, 2007; N.Y.Times Editorial, 2008a; Revkin, 2008c; Barringer, 2008b].

With the two major candidates in the November, 2008 election in the United States supporting the global warming consensus, though differing on possible solutions [Sachs, 2007; Smith, 2008], the manufactured ‘gap’ between the view of scientists and public understanding [Gold and Helfand, 2007] has finally started to diminish. The release of the Stern Report in Britain [Stern, 2007] with its devastating analysis of the economic cost of failure to respond to global climate change, the cumulative effect of the many UN - IPCC reports, and the award of the Nobel Peace Prize, jointly to Al Gore and the IPCC [Bryne & Monastersky, 2007], have moved the public in the United States towards greater acceptance of the consensus viewpoint.

Some climate scientists and energy policy makers believe the challenge can be addressed through more efficient use of existing energy resources and alternative technologies. Amory Lovins [Kolbert, 2007], a long-time energy consultant, advocates such an approach.

Porritt and Speth each call for a renewal of capitalism to address the environmental challenge of the new century [Porritt, 2007; Speth, 2008]. James Lovelock urges primary reliance on nuclear power [Lovelock, 2006], and for the first time in decades American public utilities such as PP&L have begun seeking extensions of existing licenses and permits for new construction. Believing we may not be able to get away from reliance on coal soon enough, noted climate scientist Wallace Broecker proposes reliance on geological mineral sequestration as a solution [Broecker and Kunzig, 2008].

The diversity of possible solutions posed by scientists suggests a need to focus the attention of leaders and decision-makers in government and the business community. Both national and international
leadership is required. There is also a need for greater public education, so that any solution agreed to can be successfully implemented. One effort to promote this is the National Teach-In for Global Warming Solutions, which is organizing programs on college campuses across the United States for February of 2009, in an effort to get grass-roots understanding and support for a comprehensive solution. [Who We Are, 2008]


The Carbon Mitigation Initiative (CMI) is an early educational effort undertaken by Princeton’s Environmental Institute, Ford Motor Company and BP. The CMI combines promotion of cutting edge research and development with a variety of public education projects. The group has held an annual conference since 2002 and has promoted developing a variety of solutions to the climate crisis that are based on existing technology capable of being scaled-up to a commercial level in a reasonable time. “The most ambitious attempt to produce a simple global blueprint” [Pearce, 2007, p. 248] so far, the stabilization wedges approach developed by Robert H. Socolow and Stephen W. Pacala [Pacala and Socolow, 2004; Socolow, 2005; Socolow and Pacala, 2006], seeks to take the enormous challenge of climate change mitigation and break it down into components that can be implemented in a particular industry or energy sector.

Originally, Socolow and Pacala proposed that seven wedges out of a possible fifteen proposals could be implemented to avoid a doubling of atmospheric CO$_2$ or other greenhouse gas equivalents by 2050. In 2007 they raised it to eight wedges, and the deadline slipped to 2055, — “to avoid emitting 200 billion tons of carbon, or eight 25 billion ton ‘wedges,’ over the next 50 years,” as the teacher’s guide on their web site explains the change. [Hotinski, 2007] Pearce suggests [249] we need twelve or more wedges to actually begin reducing atmospheric CO$_2$ and avoid sliding into abrupt climate change. The current range of “wedges” at the Princeton “wedges game” site — http://www.princeton.edu/wedges/ — is found in Figure 1. Using this approach to break down the challenge into smaller, solvable problems opens the door for the business community to become engaged in active modeling and problem solving.
# FIGURE 1

## Stabilization Wedges – 15 Ways to Cut Carbon

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Sector</th>
<th>Description</th>
<th>1 wedge could come from...</th>
<th>Cost</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Efficiency – Transport</td>
<td></td>
<td>Increase automobile fuel efficiency (2 billion cars projected in 2050)</td>
<td>doubling the efficiency of all world’s cars from 30 to 60 mpg</td>
<td>$</td>
<td>Car size &amp; power</td>
</tr>
<tr>
<td>2. Conservation – Transport</td>
<td></td>
<td>Reduce miles traveled by passenger and/or freight vehicles</td>
<td>cutting miles traveled by all passenger vehicles in half</td>
<td>$</td>
<td>Increased public transport, urban design</td>
</tr>
<tr>
<td>3. Efficiency – Buildings</td>
<td></td>
<td>Increase insulation, furnace and lighting efficiency</td>
<td>using best available technology in all new and existing buildings</td>
<td>$</td>
<td>House size, consumer demand for appliances</td>
</tr>
<tr>
<td>4. Efficiency – Electricity</td>
<td></td>
<td>Increase efficiency of power generation</td>
<td>raising plant efficiency from 40% to 60%</td>
<td>$</td>
<td>Increased plant costs</td>
</tr>
<tr>
<td>5. CCS Electricity</td>
<td></td>
<td>CO₂ from fossil fuel power plants captured, then stored underground (700 large coal plants or 1400 natural gas plants)</td>
<td>injecting a volume of CO₂ every year equal to the volume of oil extracted</td>
<td>$§</td>
<td>Possibility of CO₂ leakage</td>
</tr>
<tr>
<td>6. CCS Hydrogen</td>
<td></td>
<td>Hydrogen fuel from fossil sources with CCS displaces hydrocarbon fuels</td>
<td>producing hydrogen at 10 times the current rate</td>
<td>$$$</td>
<td>New infrastructure needed, hydrogen safety issues</td>
</tr>
<tr>
<td>7. CCS Synfuels</td>
<td></td>
<td>Capture and store CO₂ emitted during synfuels production from coal</td>
<td>using CCS at 180 large synfuels plants</td>
<td>$§</td>
<td>Emissions still only break even with gasoline</td>
</tr>
<tr>
<td>8. Fuel Switching – Electricity</td>
<td></td>
<td>Replacing coal-burning electric plants with natural gas plants (1-400 1 GW coal plants)</td>
<td>using an amount of natural gas equal to that used for all purposes today</td>
<td>$</td>
<td>Natural gas availability</td>
</tr>
<tr>
<td>9. Nuclear Electricity</td>
<td></td>
<td>Displace coal-burning electric plants with nuclear plants (2 x current capacity)</td>
<td>~3 times the effort France put into expanding nuclear power in the 1980’s, sustained for 50 years</td>
<td>$§</td>
<td>Weapons proliferation, nuclear waste, local opposition</td>
</tr>
<tr>
<td>10. Wind Electricity</td>
<td></td>
<td>Wind displaces coal-based electricity (30 x current capacity)</td>
<td>using area equal to ~3% of U.S. land area for wind farms</td>
<td>$§</td>
<td>Not In My Back Yard (NIMBY)</td>
</tr>
<tr>
<td>11. Solar Electricity</td>
<td></td>
<td>Solar PV displaces coal-based electricity (700 x current capacity)</td>
<td>using the equivalent of a 100 x 200 km PV array</td>
<td>$$$</td>
<td>PV cell materials</td>
</tr>
<tr>
<td>12. Wind Hydrogen</td>
<td></td>
<td>Produce hydrogen with wind electricity</td>
<td>powering half the world’s cars predicted for 2050 with hydrogen</td>
<td>$$$</td>
<td>NIMBY, Hydrogen infrastructure, safety</td>
</tr>
<tr>
<td>13. Biofuels</td>
<td></td>
<td>Biomass fuels from plantations replace petroleum fuels</td>
<td>scaling up world ethanol production by a factor of 30</td>
<td>$§</td>
<td>Biodiversity, competing land use</td>
</tr>
<tr>
<td>14. Forest Storage</td>
<td></td>
<td>Carbon stored in new forests</td>
<td>halting deforestation in 50 years</td>
<td>$</td>
<td>Biodiversity, competing land use</td>
</tr>
<tr>
<td>15. Soil Storage</td>
<td></td>
<td>Farming techniques increase carbon retention or storage in soils</td>
<td>practicing carbon management on all the world’s agricultural soils</td>
<td>$</td>
<td>Reversed if land is deep-plowed later</td>
</tr>
</tbody>
</table>

For more information, go to the Carbon Mitigation Initiative website at [http://www.princeton.edu/~cmi](http://www.princeton.edu/~cmi)
DEVELOPMENTS IN 2007, 2008 AND BEYOND

In the United States, during the last two years, several legal and political developments impacting on climate change challenge have occurred. The Supreme Court has ruled that the Environmental Protection Agency (EPA) can and should regulate CO\textsubscript{2} as a pollutant under the existing language of the Clean Air Act [Massachusetts v. EPA, No. 05-120, April 2, 2007, 127 S.Ct. 1438]. Justice John Paul Stevens, writing for a 5-4 court majority, held that Massachusetts had legal standing to sue “because it was faced with the concrete injury of inundation of its coastal lands, U.S. automobile emissions were contributing meaningfully to that threat, and reduction of those emissions would at least slow global warming.” On the merits of the case, he concluded that the EPA had both “the authority and duty to regulate carbon dioxide emissions... if those emissions may endanger public health or welfare” and could not decline to do this for “policy reasons unrelated to” this threat [Doremus, 2008].

Doremus notes that the current Supreme Court’s environmental jurisprudence is “full of umpires whose view of the strike zone seems to depend on who is at bat,” and doubts that they would have ruled as they did in this case “unless five Justices were persuaded by the strong scientific evidence and gathering political consensus that global warming is a serious problem requiring immediate attention” [2008, p. 12]. While the current EPA Administrator, Stephen L. Johnson, resists implementing the Supreme Court’s directive, the States that brought that suit have filed a new lawsuit on the anniversary of the Court’s decision, calling upon the Courts to order the EPA to publish “within 60 days its analysis that found” emissions from automobiles “endanger humans as well as contribute to climate change” [Barringer, 2008a].

The average age of the Supreme Court’s members suggests the Court, and thus its views, may change in the near future. The new administration is likely to appoint Justices and lower court judges that will support EPA authority to regulate CO\textsubscript{2} and the business community will need to adapt to this.

According to a study by a Stanford University scientist, Mark Jacobson, the direct health risk of CO\textsubscript{2} for human mortality is, “for each increase of one degree Celsius caused by carbon dioxide, the resulting air pollution would lead annually to about a thousand additional deaths and many more cases of respiratory illness and asthma in the United States... Worldwide, upward of 20,000 air-pollution-related deaths per year per degree Celsius may be due to this greenhouse gas” [Bergeron, 2008]. Jacobson’s study has been accepted by Geophysical Research Letters and lends support to the wisdom of the Supreme Court’s ruling. The new administration’s EPA is likely to rethink its resistance to regulating CO\textsubscript{2}, or granting California the waiver it requests.

Internationally, the United States will begin to move towards greater cooperation with the European Union and others in addressing climate change planning beyond the Kyoto Protocol. This is already reflected in the United States representative’s acceptance of compromise language at the 2007 United Nations Climate Change Convention in Bali, Indonesia, when the 187 nations present agreed to initiate a two year process of negotiations to address climate change [Eilperin, 2007; Friedman, 2007]. This essentially punts the repositioning of America’s international response to climate change to the next administration.

The Developing Business Response

Global business has begun to adapt to the carbon emissions trading system under Kyoto and to recognize the need to follow through on Bali. Cooperation between business and governments is essential. Is continued reliance on fossil fuels unavoidable, or could subsidies for alternative energy and carbon taxes lead to serious reductions in the use of fossil fuels, and thus reduce greenhouse gases? The choices facing the international community have been described by the CEO of Royal Dutch Shell, Jeroen van der Veer, as between a nationalistic approach to the problem, which he calls “Scramble,” and a more cooperative approach, which he calls “Blueprints”. The process may “start slowly,” but could be successful over time [Mouawad, 2008].

The support of Ford and BP for the CMI at Princeton, and GE’s Eco-Imagination program, show that the American business community is starting to recognize that it is only a matter of time before it must make significant and potentially costly adjustments to alleviate the consequences of climate change. It is simply in the best interest of business to act as responsible corporate citizens in rising to the climate challenge. [White, 1985; Heal, 2008]
Some American companies are already taking steps to identify and respond to their climate change risk through annual reports to Ceres, “Investors and Environmentalists for Sustainable Prosperity.” Many of these reports are available at: http://www.ceres.org/. Ceres describes itself as “a national network of investors, environmental organizations and other public interest groups working with companies and investors to address sustainability challenges such as global climate change”. Ceres has been active in pursuing this goal since 1989. Its mission is “to assist in creating a world in which business and capital markets promote the well being of society and the protection of the earth’s biological systems and resources... by bringing investors, environmental groups and other stakeholders together to encourage companies and capital markets to incorporate environmental and social challenges into their day-to-day decision-making”.

Companies that collaborate with Ceres by sending annual reports on their activities also indicate the steps they are taking to mitigate the impact of those activities on climate change. This might affect future liability exposure for negligence in causing climate related harm. Ceres has initiated a project, the Investor Network on Climate Risk, to emphasize that climate change is a business risk that must be addressed. Ceres has petitioned the Securities and Exchange Commission (SEC) to make climate risk disclosure a requirement in corporate financial reports, under the Management Discussion and Analysis (MD&A) section, citing Rule S-K, Item 303 of the Securities Act of 1933. This would “require publicly traded companies” to disclose “known” risks that are “reasonably likely to have material effects” on their financial position [Ceres, 2008]. Climate science suggests that those risks are likely to be considerable. Owning property on the Gulf Coast, or being responsible for insuring it against hurricanes and rising sea levels, are just two examples.

Ceres’ efforts have generated opposition from free market climate skeptics, who have formed their own organization to oppose “Socially Responsible Investing” under the rubric of the “Free Enterprise Action Fund,” http://wwwfreeenterpriseactionfund.com/advocacy.html. One American corporation seeking to get ahead of the curve in responding to climate change is General Electric. GE’s “Eco-Imagination” initiative is a major theme of its 2007 Annual Report (available at: www.ge.com). GE faced a challenge from the Free Enterprise Action Fund at its 2008 annual meeting. Shareholder Proposal No. 6 – Global Warming Report,” called on GE to report on what science it relies on in formulating GE’s climate policy and to provide “estimates of costs and benefits to GE of its climate policy”.

A sign that the views of skeptics are losing ground in the business community is the decision of T. Boone Pickens to build “a $10 billion wind farm in the Texas panhandle” and promote the use of wind power to replace natural gas in the generation of electricity. The Pickens Plan was widely advertised on television during the 2008 presidential elections in the United States www.pickensplan.com/index.php.

Security, Sustainability and Global Cooperation

The impact of climate change on the environment, business, society and government in the near and medium term should not be underestimated. Some argue that society is only beginning to develop an understanding of the real costs in terms of property damage, loss of homes and coastal infrastructure, species extinction, health threats, increasing food costs and shortages [BBC, 2008] and the need for changes in product mixes, manufacturing methods, and energy sourcing that the climate change challenge presents. Others say that climate change poses serious national security risks caused by dislocation of populations and competition for scarce resources [Busby, 2007; Kriz, 2007; Heffernan, 2008; Bagley, 2008]. The melting of the arctic ice cap may lead to conflicts between Russia, the U.S. and other nations.

A global humanitarian crisis may be avoided through the development and transfer of green technology in all countries. Such a solution would require collaboration between business and governments in the implementation of the Bali roadmap. A thought-out transfer of green technology to developing nations (e.g. India and China) would also be required [Bingaman, 2007; Furman et. al., 2007; Hansen, 2007; Hecht, 2008; Kim & Jones, 2008]. See Figures 2 and 3 below. For this approach to receive support in the United States, business would have to take on a pro-active leadership role and abandon the skepticism and partisan polemics of the past decade.
CORPORATE SOCIAL RESPONSIBILITY AND THE STABILIZATION WEDGE GAME

Business education traditionally addresses corporate social responsibility from a variety of perspectives: (1) financial benefit to the firm and shareholders by attracting socially responsible investors, minimizing regulation, improving brand image, and improving returns through an image of corporate social responsibility; (2) avoidance of “sin stocks” (deontological motives) by concerned investors; (3) activist investors seeking to “reward good behavior and to provide an incentive for firms with lagging social performance to improve”; and (4) consumers and investors who “use their power” for self-expression [Chatterji, Levine and Toffel, 2008; Heal, 2008]. It is the author’s view that the climate change case can be used effectively to discuss corporate social responsibility from each of these perspectives.

It is also the author’s view that business education has a critical role to play in educating tomorrow’s business leaders to recognize their ethical obligation to address climate change simply because it is a task that has to be performed. Understanding the potential of alternative energy, conservation and other methods to reduce reliance on fossil fuels (refer to Figure 1) will assist firms in being socially responsible and enhancing the bottom line.

During the last four years, the author has taught the climate change case in four required MBA ethics classes and two undergraduate law classes at a medium-sized public university in Pennsylvania. The author used the climate change stabilization wedge project first in 2006 as a discussion and essay assignment in connection with the assigned reading of Kolbert [2006, pp.131-147]. During three subsequent classes the exercise provided the core of a four to six week unit, integrated with an introductory unit on theories of business ethics and social responsibility and a smaller unit on corporate speech under the Supreme Court’s First Amendment jurisprudence.

THE GAME

The stabilization wedge game is described in a downloadable document at the Princeton University web site. It has been widely used in academic and educational settings, including the World Resources Institute [2004], the Climate Conference in Melbourne, Australia [2005], Los Alamos National Lab [2005], the Montreal Climate Leaders Summit [2005], the Department of Energy National Youth Science Camp [2006], the American Association for the Advancement of Science (AAAS) Annual Meeting in San Francisco, California [2007] and the Association for Public Policy Analysis and Management (APPAM) Fall 2007 Conference in Washington, D.C The CMI encourages use of the game in professional, academic and educational settings. The CMI has not done a study of how the game has been used. In a communication with the author, the site coordinator has indicated that CMI is currently working with two groups engaged in high school teacher training impacting hundreds of teachers [Hotinski, 2008]. The Keystone Group has developed the “Climate Status Investigations” (CSI) curriculum. For details refer to http://www.keystonecurriculum.org/. For details on the National Energy Education Development Project (NEED), refer to http://www.need.org/.

The co-directors of the Carbon Mitigation Initiative (CMI), Robert Socolow and Stephen Pacala, created the concept of “stabilization wedges” to reflect a series of fifteen (or more, as technology advances) 25-billion-ton “wedges” of CO$_2$ or equivalents that need to be cut from predicted levels of carbon emissions in the next half century to avoid passing the dangerous threshold of a doubling of atmospheric CO$_2$ since the industrial revolution. The resources of the game include an overview of the carbon and climate problem, illustrative charts and links to more detailed scientific papers and documentation for each suggested “wedge”. The game makes use of a chart showing a triangle: the current upward “path” of carbon emissions towards a doubling of CO$_2$ by 2055, while a “flat path” of keeping CO$_2$ constant through mid-century can be built by adopting eight of the possible “wedges”. Each wedge generates a portion of the necessary reduction of additional atmospheric CO$_2$. The object of the game is to let teams brainstorm and negotiate on how to achieve this goal. Links are provided to the U.S. Department of Energy (DOE) Energy Efficiency and Renewable Energy division, at http://www.eere.energy.gov/, the UN’s IPCC and other resources.

One purpose of the game is to “convey the scale of the effort” required to solve the climate problem. Through participation in the game, students, businessmen and others will gain a greater understanding of the scope of the problem and the challenges of implementing possible solutions. In the game, rough cost estimates are used. In Figure 1, one, two and three dollar signs indicate relative cost for different wedges.
Introducing the Wedge Game

The climate change case and the wedge exercise can be made part of a business ethics course through a series of steps. The initial assignment requires participants to identify in the annual report of a corporation or on its web site, the corporation’s formal code of ethics, statement of sustainable development and corporate social responsibility. Although the format is not uniform, many corporations include in their annual reports or on their websites such statements. Some companies address conflicts of interest and human resource issues. Many companies, particularly in the energy, transportation and manufacturing sectors, have clear statements regarding climate change, a commitment to reduce the corporate carbon footprint, or steps being taken to foster sustainable development. In addition, shareholder activists on both sides of the issue are increasing their efforts to put resolutions on the annual proxy statement addressing climate change concerns.

Next, during a class session, various approaches to corporate ethics and social responsibility are introduced. These include Adam Smith and Milton Friedman (emphasizing the invisible hand and duty to the investor) and stakeholder theory that takes into account corporate externalities and duty to the broader community [Heal, 2008]. Through student oral presentations, supported by PowerPoint presentations, during another class session, a wide range of ideas and information on "sustainable development" or "carbon footprint" are developed and discussed. In their presentations, students in the author’s classes have used extensive video material on corporate social responsibility they discovered on the websites of Citi Group and GE.

During the discussion of these reports, the question of the credibility of the firms’ stated goals as compared to their actual behavior could be raised. For example, would automobile manufacturers be in better shape today had they addressed fuel efficiency and zero-emissions automobiles pro-actively a decade ago. Students could be asked whether, based on their findings, they would consider working for the company or invest in the company they had researched.

A key point of this discussion should be the distinction between “sustainable development” in terms of higher standards of living and an improved quality of life for the world’s poor versus a mindless pursuit of “growth” at any price. Some say that it is possible and essential to promote development in an environmentally responsible manner without necessarily promoting growth. Sustainable development is at the heart of global economic planning for nations as well as corporations [Blackburn, 2007; Salzman and Thompson, 2007]. Addressing climate change in a timely manner is a crucial component of sustainable development.

To provide participants with an overview of the game, the PowerPoint slides from the Princeton CMI website should be reviewed (http://www.princeton.edu/wedges/). Printed game boards and a range of color-coded wedges (refer to Figure 1) or, alternatively, a right triangle divided into eight blank wedges (of the same size) are distributed. The class is divided into teams of three to five students. Team members are challenged to acquire ‘expertise’ in several technologies, perhaps based on prior work experience, background or interest. The goal is that each team has expertise in all fifteen options under review. A recorder in each team documents the discussions and assists in preparing a final team report. The exercise can comprise one or more sessions. Library research or visits to area wind farms and power plants could also be incorporated.

After distributing the wedge game and establishing teams, the author recommends that the teams meet for half an hour to get acquainted, discuss team logistics and develop a plan of action. This is followed by a discussion of previously assigned readings on climate change. Texts by Kolbert [2006] or Pearce [2007] are recommended. Documentaries available on DVD or over the Internet can be used to provide an overview. Some examples are: “Global Warming: The Signs and the Science,” narrated by Alain Morissette [South Carolina Public Television, 2005], “Scientific American Frontiers: Hot Planet – Cold Comfort,” narrated by Alan Alda [PBS Home Video, 2005] and Al Gore, “An Inconvenient Truth: A Global Warning” [Paramount, 2006]. Short video clips are also available on the web sites of The M.I.T. Technology Review: http://www.technologyreview.com/index.aspx or on BBC. Guest speakers from the university science and political science faculty and experts from area industries would add to the proceedings by introducing new ideas and experiences. Running the exercise over three or four weeks will give students the opportunity to develop an in-depth appreciation and understanding of the available options.

Each team is expected to analyze the assigned company or sector through the stabilization triangle, develop a plan of action and report (document) how the plan will be implemented. This report should
include pros and cons and economic, political and technical considerations. Invited corporate representatives, environmental activists and local government officials could be used as reality checks and assist in the evaluations of the proposals made by the student teams. At the conclusion of each presentation and discussion, students might be asked to vote for their 'wedge combination' preference.

CONCLUSION

Although no empirical evidence has been collected at this time, anecdotal data indicates that through the participation in the Stabilization Wedge Role-Playing Exercise, students become aware of the urgency of dealing with climate change. They also have gained an appreciation of the opportunities created through the acceptance of socially responsible investments in alternative energy projects. The stabilization wedge game facilitates exploring and developing, through teamwork, innovative solutions that are socially responsible and profitable at the same time. Climate change may be the most significant global challenge of our time. Ignored, it threatens to defeat all other objectives [Speth, 2008]. Meeting the challenge climate poses has the potential of addressing many other challenges as well: water and food shortages, threats to species extinction, displacement of people by rising seas and the spread of tropical diseases. Although the challenge is complex, it must be addressed now.

FIGURE 2, FIGURE 3

15 WAYS TO MAKE A WEDGE

An overall carbon strategy for the next half a century produces seven wedges' worth of emissions reductions. Here are 15 technologies from which those seven can be chosen (taking care to avoid double-counting). Each of these measures, when phased in over 50 years, prevents the release of 25 billion tons of carbon. Leaving one wedge blank symbolizes that this list is by no means exhaustive.

Notes:
1. World fleet size in 2050 could well be two billion cars. Assume they average 10,000 miles a year.
2. Assumed efficiency for these two billion cars is 25 mpg.
3. World coal-fired power plant capacity. Assume they produce 1300 TWh.
4. Assume wind power is produced and used locally.
5. Assume half of carbon originally in the coal is captured.
ENDNOTES

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