

Spring 2008 Industry Study

Final Report *Environment Industry*



The Industrial College of the Armed Forces
National Defense University
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Note: This assessment is printed on recycled paper produced by the women of the Association for the Protection of the Environment (APE), Moqattam Hill, Cairo, Egypt. This small, Egyptian-based non governmental organization, like the multi-billion dollar environmentally-focused corporations based in the U.S., believes that the future of the planet depends on man's ability to conserve energy and scarce resources for future generations and that mankind has the unique responsibility for insuring the survivability of the planet. In the heart of one of Cairo's poorest communities, APE is empowering Egyptian women and children to improve their lives through education and industry. (See Appendix C for additional information.)

Environment Industry Study

Abstract: The members of the 2008 Industrial College of the Armed Forces Environment Industry Study (EIS) evaluated a wide range of environmental issues that have implications for U.S national security in the complex, globalized economy. EIS determined that the growth in the World population and global industrialization, coupled with the tangible effects of climate change, has the potential to cause conflict in the future. This paper evaluates the current global environmental conditions and impacts, defines and assesses the current state and conditions of the industry, and most importantly, highlights several key issues that have the potential to impact the future. Research and development, to date, has been crucial to preventing environmental degradation and is still the biggest export the U.S and the European Union give to the developing nations. Yet, it is underfunded by the U.S government. Recycling is an under-used tool with vast potential to reduce waste going into landfills while also reducing the extraction of virgin raw materials in industrial production. Recycling programs need national emphasis and funding to jumpstart that potential. Education is needed to galvanize the collective energy of citizens and businesses in both developing and developed nations on the importance of strong environmental policies. The EIS team spoke with a myriad of government agencies in the U.S, Egypt and Tanzania about awareness, prevention and sustainment issues. We saw first hand how concerned Egyptians are about rising sea levels and the amount of fresh water flowing up the Nile River and how vulnerable poor nations such as Tanzania are to the pressures to improve their national productivity using environmentally insensitive strategies and technologies. Finally, amidst a healthy debate about whether the wide range of industries that mitigate environmental problems and sustain “green” business practices is actually an industry or a strategic enabler for other industries to protect the planet for future generations, the EIS team formed a greater appreciation for the complexity of environmental problems, the strategic value of environmental security and the need to aggressively seek global solutions to protect the planet.

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Local D.C. Area Visits:

U.S. Green Building Council, Washington D.C.
White House Council on Environmental Quality, Washington D.C.
British Petroleum Solar, Frederick, MD
Montgomery County Recycling Center, Solid Waste Transfer Station, Rockville, MD
House Committee on Natural Resources, Washington D.C.
Congressional Research Service, Washington D.C.
Alexandria Sanitation Authority Advance Wastewater Treatment Facility, Alexandria VA
International Finance Corporation, Washington D.C.

Domestic Travel:

US Army Corps of Engineers, Fort Lauderdale, FL
South Florida Water Management District, West Palm Beach, FL
Florida Atlantic University, Boca Raton, FL
Everglades National Park, Shark Valley, Miami, FL
Wetlandsbank Group, Deerfield Beech, FL
Port Everglades, Ft Lauderdale, FL
Royal Caribbean International & Celebrity Cruises, Miami, FL
Broward County Environmental Protection and Growth Management Department, Plantation, FL

International Travel:

U.S. Embassy and USAID, Cairo, Egypt
Association for the Protection of the Environment, Cairo, Egypt
Zabaleen Community, Moqataam Hills, Cairo, Egypt
American University, Cairo, Egypt
Egypt's International Economic Forum, Cairo, Egypt
Desert Development Center, Sadat City, Egypt
U.S. Embassy and USAID Tanzania briefs, Dar Es Salaam, Tanzania
World Wildlife Fund Tanzania, Dar Es Salaam, Tanzania
Vice President's of Tanzania's Office for the Environment, Dar Es Salaam, Tanzania
National Environment Management Council, Dar Es Salaam, Tanzania
Tanzanian Peoples Defense Force, Dar Es Salaam, Tanzania
The World Bank, Dar Es Salaam, Tanzania
University of Dar Es Salaam, Institute of Resource Assessment, Dar Es Salaam, Tanzania
Tanzania Natural Resource Forum, Arusha, Tanzania
Mweka Wildlife College, Arusha, Tanzania
College of African Wildlife Management, Moshi, Tanzania
African Wildlife Foundation, Maasai Steppe, Tanzania
Manyara Ranch, Manyara, Tanzania
Maasai Steppe Heartland Project, Arusha, Tanzania
Jane Goodall Institute: "Roots and Shoots," Dar Es Salaam, Tanzania

Introduction:

The environment industry seminar studied a comprehensive array of industries focused on protecting our planet for future generations. We also studied the positions of national and international advocacy groups, government and multilateral institutions on the environment. We learned that the environment is not an industry, per se, but rather, a part of ALL industries. It is the concept that government, business, civil society and individuals must take steps to ensure that rapid global population growth does not exhaust clean water supplies, clean living space, and deplete the planet of non-renewable energy sources.

We began by learning the research and futuristic views of Amory Lovins of the Rocky Mountain Institute. We visited state-of-the-art solid waste management plants that are dramatically reducing pressure on the nation's landfills and liquid waste management plants that are returning wastewater to our nation's waterways that is clean enough to drink. We learned of the increasing culture of industry to think "green" and to be green compliant. We learned of the increasing emphasis the Department of Defense is placing on environment protection and energy efficiency. We toured a cruise liner, noting the extreme efforts it takes to completely recycle onboard waste and the water treatment facilities it has onboard to purify water to a higher standard than required of municipalities in Alaska. We studied the efforts of Florida's state government to protect and restore the flow of the vast, but fragile Everglades. In Egypt, we studied the recycling of garbage by an entire community in one of the worlds most overpopulated and impoverished cities, and we studied efforts to irrigate barren desert next to the Nile River using minimally-treated waste water. In Tanzania we learned of the environmental concerns of poor tribesman farming coffee in the backdrop of the stately Mt. Kilimanjaro and studied the simple livelihoods of one of the tribes and peoples that contribute minimally to environmental degradation.

Along the way we developed an appreciation for the diverse scope of business opportunities that currently exist and will continue to grow in the environment sector. We also developed an appreciation for the "green" culture now growing among societies, businesses, and countries across the globe as the world focuses on the importance of protecting the environment for future generations. We also came to appreciate that the United States has a tremendous opportunity to exert leadership on international efforts to protect the environment that will increase our global diplomatic stature abroad while bringing together sometimes otherwise antagonistic countries and governments to solve commonly recognized world problems.

Environment Industry Defined:

The Environmental Protection Agency (EPA) defines the environment as "the sum of all external conditions affecting the life, development and survival of an organism."¹ However, to define the environment industry is much more complex. It is difficult to completely capture and categorize all aspects of the industry. The industry covers a variety of goods and services, such as clean-up equipment, water treatment facilities, waste removal and disposal, the development of renewable and non polluting energy sources, among others.² Many of these goods and services areas touch other industries. With such an eclectic mix of goods, services and industries, data collection and comparison is difficult.

In an attempt to define the Environment Industry so that data can be effectively compiled and compared, the Environmental Business International, Inc. (EBI), a privately held company

headquartered in California, developed the following definition: “All revenue generation associated with environmental protection, assessment, compliance with environmental regulations, pollution control, waste management, remediation of contaminated property and the provision and delivery of environmental resources.”³ This definition has become the commonly accepted definition in the U.S. It is the basis of comparison for all data in these market segments and has been adopted for use by the federal government. (See Appendix A for a list of Environmental Industry Segments according to EBI.) Accordingly, the Engineering News Record (ENR) includes America’s largest design, engineering, construction and consulting firms (such as CH2M Hill, Bechtel and Shaw) along with firms that it identifies as “All-Environment” in its listing of “America’s Top 200 Environmental Firms.”⁴

The Organization for Economic Cooperation and Development (OECD), an international organization of thirty nations, defines the industry as those “goods and services” that measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco systems. This includes cleaner technologies and products and services that reduce environmental risk and minimize pollution and resource use.”⁵ In addition to using a different industry definition than EBI, the OECD identifies broader environmental segment categories than EBI: pollution management, cleaner technologies and products, and resource management and environmentally preferable products.⁶

Whether or not the industry writ large should be defined as a “strategic industry” is subject to debate and interpretation. Certainly protecting the environment for future generations of Americans and for the global population is in our strategic interests. This includes the development of clean and renewable energy supplies, expanding the availability of potable water to satisfy the needs of the world’s expanding population, conservation and recycling of other non-renewable materials needed to support expanding national and global standards of living.

Current Industry Conditions:

At the heart of the environmental crisis facing the world today are two manifestations of the limitation of ecosystems. First, they are comprised of finite resources, which, unless properly managed, will be unable to sustain continued growth indefinitely. Second, they are limited in their capacity to absorb the wastes of production, resulting in contamination, which further limits resources, and, in the case of carbon, creates an atmosphere which increasingly retains heat resulting in global warming and climate change.

The environment industry is growing and the direction the industry takes in the future will be largely led by the U.S. and Western Europe. According to EBI, global environment market revenues reached more than six-hundred billion dollars in 2005. The U.S. accounts for two hundred forty-five billion dollars of this amount and leads the sector. In the U.S. alone, over 30,000 private sector companies and 80,000 public sector entities employ 1.4 million Americans.⁷ The industry as a whole is also growing at over five percent annually. (See Appendix B for environmental industry growth by segment.)

The environment industry is so diverse that it is difficult to characterize it as either mature or fledgling. Certain segments of the industry, such as waste management and water utilities, are well established while others, such as clean energy and resource recovery, are relatively new. EBI data confirm that the U.S. is the dominant force in the industry in terms of dollars spent, but it is not the fastest growing. In this competitive and rapidly-growing field, the U.S. government may need to assume a greater role in promoting the development of technology to address environmental issues. Such promotion may be in the form of additional research grants that are directed to industry and the development of a cost-effective means of producing products to scale. Corporate tax incentives or subsidies may also be needed to encourage industry to incur additional risk in the development and implementation of new technologies. If other nations surpass the U.S. in the development of alternative technologies such as wind, geo-thermal and solar power, Americans may find themselves trading dependence on foreign oil for dependence on foreign technology. (See Appendix C for environmental industry growth by region.)

The U.S. is uniquely positioned to contribute to environmental economics on a global scale. U.S. Gross Domestic Product (GDP) was over thirteen trillion dollars in 2006. As the largest single economy in the world by far, the U.S. must not only establish itself as a leader in addressing environmental issues but must also be viewed as a leader by the rest of the world. This leadership should include economic policies in the U.S. such as tax shifting or environmental tax reform that reward environmentally sound practices and serve as an example for other governments. Personal income taxes could actually be reduced while additional taxes are levied on people or companies engaged in environmentally destructive activities.⁸ According to Lester Brown, founder of Earth Policy Institute, tax incentives to reduce polluting activities would result in a net increase of jobs.⁹

The environment industry will face incredible challenges in the years ahead. Brown describes an “environmental bubble economy...where economic output is artificially inflated by overconsumption of the earth’s natural assets.”¹⁰ The growth in world population and the expansion of the world economy are not sustainable. As water and land shortages affect food supplies, the cost of grain and other commodities will continue to rise. Brown argues that steps must be taken immediately to address these problems and that these steps must include the stabilizing world population at 7.5 billion people. World populations may already be consuming beyond the earth’s ability to replenish resources. Decreased supply and increasing demand will have enormous economic impact and catastrophic consequences especially for the world’s poor. The U.S. and other nations must address this problem by promoting the stabilization of populations and the use of resource-efficient systems for water, agriculture, and energy. Environment and economics must be considered together since economic policies, including positive and negative incentives, offer the best opportunity to successfully address these challenges. In addition to the U.S., Western Europe is and will continue to be a major contributor.

Western Europe accounted for approximately twenty-nine percent of the global environment industry market in 2004, second only to the U.S. at thirty-seven percent according to the *Global 3000* report. The European Union (EU) has a strong environmental record and a mature environmental industry sector resulting in improving environmental conditions and an increasingly sustainable way of life. Western Europe spent approximately \$120 billion in mid-1990 in the environmental sector and the estimates from 2004 are approximately \$180 billion.¹¹ This is due to the strong environmental regulations for member countries. The EU supports legislation with significant financial backing to help member countries meet goals and regulations and is an outspoken advocate on environmental issues. Gaining consensus and consistency in policy can be challenging given their size and economic disparity

The EU has strong environmental sectors in water and wastewater treatment, air pollution prevention, and solid and hazardous waste disposal.¹² The hazardous waste sector is growing especially in new EU members from Eastern and Central Europe where industrial and military waste generated during the Cold War is the focus of clean-up and remediation efforts. The Kyoto Protocol in 1997 and the UN Environmental Program have emphasized the reduction of greenhouse gases and the Millennium Development Goals encouraged the development of the carbon trading system and the recognition that environmental sustainability is critical to global economics and social well-being. The EU is poised to take advantage of existing capacity in carbon sinks, reductions in carbon production and technologies which reduce carbon emissions. The cap and trade system for carbon is one of the latest efforts for sector growth.

The environmental market in developed EU countries is mature and serviced by well-established companies. The CEO of Inogen Environmental Alliance, Mr. Peter Pfenning, stated, “There is a more level playing field, with more players...we used to see Western European companies, and now we compete more with Czech and Polish companies, so we see a lot of competition and its impact on prices.”¹³ European environmental service companies who gained a foothold in the late 1970’s and early 1980’s also have done well. In many cases they have consolidated their market share and have developed the flexibility to adapt as environmental legislation matured. This allowed companies to expand relatively easily within Europe and the EU countries to both compete and increase their market share within specific sectors. Market consolidation within the established companies also occurred over time and as countries within the EU adopted similar environmental legislation and regulations to meet EU standards. However, as Pfenning states, there is growing competition and pressure on prices as new or developing EU countries attempt to break in to the market in the established EU countries. Combined, the United States and the EU comprise nearly seventy percent of the global market for environmental goods and services (ref. Appendix C).

Environment Challenges and Outlook:

Greenhouse gas emissions, pollution, water scarcity and security, biodiversity, clean energy alternatives, inefficient waste and recycling, and other environmental issues are threatening the survival and sustainable development of our global society. Climate change in particular is becoming one of the key global issues of our time and is now receiving substantial attention from policy makers, researchers and the public. Increased environmental awareness has led to polarized and divisive positions – especially in the U.S. -- over the extent and causes of climate change. Nonetheless, as the science of climate change becomes increasingly persuasive, the debate is clearly shifting from whether climate change is natural or manmade to how to address its effects. Climate change models are becoming more sophisticated and researchers are working to “nest” regional climate models into the larger global climate models to give clearer results on the overall phenomenon as well as in specific “micro cultures.”¹⁴ This will allow the industry to provide improved mitigation strategies for cities and regions. For example, Aspen, Colorado invested \$145,000 to develop climate predictions for their own town.¹⁵ At the other end of the spectrum, the State of California is investing four million dollars in their own regional climate model.¹⁶ These local and regional plans will allow local governments to begin detailed planning to mitigate the forecasted climate change.¹⁷

The state of the environment today presents a unique and unprecedented challenge that threatens to undermine the last few decades’ gains in economic growth and poverty alleviation. However, its impacts will not be evenly distributed. Underdeveloped nations, which have been least responsible for human contributions to climate change and are less able to cope with it, will

pay the heaviest price. The use of science and technology is one way to mitigate the effects of environmental devastation as developing countries expand industrial output. This can be accomplished through sequestering carbon dioxide (CO₂) and the increased use of solar energy and biofuels. Coal-fired electric plants are a major source of greenhouse gas emissions.¹⁸ Once the carbon is captured, there are few industrial uses for carbon dioxide. The oil industry has experience with this technology since it uses CO₂ to facilitate crude oil removal. The U.S. Department of Energy (DOE) planned to invest nearly one billion dollars to improve the technology available for other uses, but increasing costs led to project cancellation.¹⁹ Private utility companies have responded by proposing some fifty projects that will capture carbon dioxide emissions using readily available technology at a lower cost per megawatt.²⁰ This technology remains a work in progress.

Investments in solar energy technology are increasing. While uses of photo voltaic cells are gaining in popularity, it remains an expensive technology costing about two to four times the average cost for electricity.²¹ A number of firms are working to improve photo voltaic cell technology using lower quality silicon and ultra-thin silicon film deposited on the glass.²² The introduction of carbon-based regulations will have positive impacts on the economics of solar power. Biofuels, on the other hand, show promise but are controversial. The industry is focused on cellulosic feedstocks that consist of low-value products like wood chips, switch grass or municipal waste. Biofuels developed from marginal croplands and waste products are desirable because they would not increase food costs or negatively impact established ecosystems like mature forests that are currently acting as carbon sinks.²³ Science for biofuels must take into account the entire carbon cycle when selecting a biomass for conversion to fuel.

Regional Environmental Trends and Challenges:

South/Latin America. The major issue is balancing economic development with environmental issues. Brazil and Argentina are the environmental leaders in South America. Brazil's major challenge is deforestation of the Amazon rainforest due to illegal logging, cattle ranching, commercial agriculture and settlement/ subsistence farming. Since the Amazon accounts for thirty percent of all remaining tropical forest in the world, the challenge is immense.²⁴ Understandably, Brazil is a proactive player in the Kyoto Protocol's Clean Development Mechanism project development, accounting for approximately 23.6 percent of all registered projects that can generate carbon credits.²⁵ The development of renewable biofuel energy is increasing in Brazil, currently the World's largest consumer and producer of ethanol from sugar cane.²⁶ Brazilian ethanol production is projected to double current levels by 2030.²⁷

In Argentina, the major environmental challenges are pollution and the loss of agricultural lands due to soil erosion, increasing salinity, and deforestation. Access to safe drinking water is also an issue, with twenty-three percent of city dwellers and seventy-one percent of people living in rural areas lacking pure drinking water. Significant increases in industrial activity coupled, with a growing population and the uncontrolled dumping of pesticides, hydrocarbons, and heavy metals also contributes to pollution.²⁸ Environmental companies in the U.S. maintain a strong market position in South and Latin American and the prospective for future growth of the industry in this region is positive.

Europe. Environmental conditions in European Union countries are uneven, but generally good. The strongest environmental sectors are in water and wastewater treatment, air pollution prevention, and solid/ hazardous waste disposal.²⁹ Although EU countries have strong environmental records, challenges exist primarily in the area of enforcement of regulations for

the control and disposal of hazardous waste. The EU is poised to take advantage of existing capacity in carbon sinks, reductions in carbon production, and technologies that reduce carbon emissions. The cap and trade system for carbon represents a potential for growth in the environmental sector in EU countries. Newly admitted EU states such as Bulgaria, Hungary and Romania are still struggling to improve their environmental conditions. Non-EU countries typically have inconsistent environmental records. In many cases, these countries are still re-establishing basic environmental services such as solid waste removal and disposal as well as water and wastewater treatment. Environmental conditions are likely to improve as the economic vitality improves. It is difficult to impose stringent environmental legislation and regulations in countries where the economy and individuals are struggling financially.

Non-EU countries are not only aspiring to comply with EU environmental guidelines along the lines of air, water and solid/ hazardous waste but are also struggling to deal with large amounts of pollution that require significant remediation and clean-up. For instance, the straightforward pollution control of wastewater and industrial waste alone is striking. In Poland, the estimates are that twenty-five percent of all industrial discharge into surface waters is untreated and sixty-six percent of sewage that flows directly into the Baltic is untreated.³⁰ The need for remediation and clean-up of former Soviet bloc activities and bases of unchecked pollution from industrial and mining activities is acute. Many countries have established the basic legislation to begin the environmental groundwork such as encouraging pollution prevention, pollution precautions and the requirement for polluters to pay. According to the OECD, the weak financial markets and problems accessing credit for these eastern European countries makes the growing but still immature environmental industry sector risky for business and investors. The World Bank estimates that a \$97- 133 billion dollar investment will be required to bring the ten countries admitted in 2004 to EU standards.³¹

Russia and Central Asia. Countries in this region are faced with a daunting legacy of problems derived from nearly categorical neglect of environmental management in their previously planned economies.³² No other nation has so systematically poisoned its land, air, water and people over such a long period.³³ Eight locations in Russia and Central Asia that appear on the Blacksmith Institute's 2007 list of the "The World's Thirty Most Polluted Places," testifying to the ecological damage inflicted upon the region by the former Soviet Union.³⁴ The region's devastating environmental problems cover a wide range of conditions, including water and air pollution, radioactive contamination and deforestation. Astonishingly, seventy-five percent of Russia's surface water is polluted and air pollution in Russia is also severe. Seventy-five percent of the Russian population breathes air that is polluted beyond legal limits.³⁵ Air pollution and poor logging practices are resulting in the destruction of approximately five million acres of forest per year in Russia.³⁶ Given the array of severe environmental problems, this region represents a huge challenge and an enormously attractive future market for investors in environmental improvement.³⁷ However, the market is largely constrained by a lack of political will in Russia and financial resources in the five countries of Central Asia.

South and Southeast Asia. There are glaring environmental and ecosystem stresses across the region, including burgeoning populations, explosive urbanization, and inadequate infrastructure. These conditions have contributed to rapid environmental degradation, particularly in urban areas. Water pollution caused by untreated sewage, industrial effluents, and urban air pollution caused mainly by transportation in overcrowded cities are the major culprits. Carbon emissions from fossil fuels and cement production in India are significant, and only China's record was worse. The major markets in Southeast Asia (Indonesia, Malaysia, Philippines, Singapore, and Thailand), are small, roughly estimated at two to three billion dollars

annually (not including infrastructure costs). Some countries have promoted private sector investments in environmental infrastructure. Malaysia has taken the lead with an ambitious two billion dollars privatized sewerage scheme for the entire country.³⁸ India has made significant inroads in reducing the impact of poverty on its people, but it comes at the expense of the environment. India has the potential market for environmental goods that could range as high as 10 billion dollars annually in the next few years, to include pollution control technology, energy, water and waste management.³⁹

East Asia and the Pacific. The health of the environment and economic development are inextricably linked in the region, with massive industrialization, increased energy use, rapid urbanization, and unrelenting demand on natural resources all posing significant challenges. The most serious environmental issue in China is access to adequate usable water to sustain current population and industrial activity levels. Depending on the industry, China uses four to ten times more water per unit of production than the average in industrialized nations.⁴⁰ Nearly 500 million people in China lack access to safe drinking water.⁴¹ A staggering forty percent of China's water supply is polluted to the point where it is unusable for any purpose.⁴² Greenhouse gas emissions, such as CO₂, in the region are another major challenge. China overtook the U.S. in 2007 as the world's largest CO₂ emitter a full decade earlier than anticipated.⁴³ In terms of basic air pollution levels, there is no country worse than China, with sixteen of the World's twenty most polluted cities and there is even serious concern about the potential impact of Beijing's toxic air pollution on athletes during the 2008 Summer Olympics.⁴⁴ The severely degraded environment represents a long-term business opportunity. Although environmental markets in the region experienced an economic down cycle in the late 1990s and into the twenty-first century, the outlook today is much stronger. In order to "go green," China must also look to its energy sector for solutions and adopt efficiency improvements along the entire energy chain. Significant investment is also necessary to enable less reliance on coal and increased dependence on cleaner energy sources such as natural gas, nuclear energy and renewable energy sources.

Africa. Africa faces enormous environmental issues, particularly the need to provide access to adequate clean water and sewer systems in urban areas and electricity everywhere.⁴⁵ Lack of resources to address environmental issues is a fundamental challenge, as most populations in much of Africa are impoverished, and rely heavily on international aid.⁴⁶ Additionally, most automobiles are old, and very few countries have converted to unleaded fuel. Use of diesel is common, which is of particular environmental concern.⁴⁷ Moreover, heating and cooking are done largely with wood, coal, paraffin, crop residues and refuse, which all emit particularly toxic fumes. There are, however, a number of opportunities for creative environmentally conscious firms in nearly all African countries due to World Bank, International Monetary Fund and other multilateral and bilateral funding sources. For instance, in 2006 the New Partnership for Africa's Development (NEPAD) developed a successful initiative to provide 9,000 solar systems to families in Zimbabwe. The Global Environmental Facility provided \$7 million and the Zimbabwean Government \$400,000 to install the systems which provided power to light 3-6 rooms and a black and white TV per house. Although the five-hundred to one-thousand dollar cost is still beyond the means of most African families without a project subsidy, NEPAD continues to seek out innovative funding schemes.⁴⁸ Such projects are undertaken on a project-by-project basis and few environmental engineering firms have set up permanent offices in any African nation other than South Africa. Moreover, American companies have been reluctant to develop the personal contacts and business relations necessary to penetrate the various African national markets.⁴⁹

Middle East and North Africa. The Middle East and North African countries are particularly vulnerable to water scarcity and water security issues. Competition for water within the region and across its borders is projected to increase, carrying the risk of conflict.⁵⁰ Other environmental challenges include land and coastal degradation and desertification, urban and industrial pollution. Many of the region's irrigation systems are under considerable strain due to salinity, water logging or overexploitation of groundwater. Groundwater, including non-renewable fossil water, is of primary importance in most countries of the region. In addition, arable land is extremely limited, making agriculture highly vulnerable to climate change.

Environment Industry Outlook and Opportunities:

While the industry as a whole continues to experience strong growth,⁵¹ it is important to recognize that the magnitude of our current global environmental business market is much more a reflection of initial commitments that have been made, than on the totality of commitments that need to be made. In 2004 the U.S. share of 240.8 million dollars represented 38.3 percent of the overall global market. There are significant segments of our global landmass such as the regions of Russia, Central Asia and China that have been subjected to a severe degree of long-term environmental abuse and that are in dire need of long overdue environmental remediation. Other vast areas of the developing world, such as the majority of countries in Africa, are pursuing economic growth in a non-environmentally sustainable manner in an effort to alleviate widespread poverty. Despite the sizable environmental challenges that our global population is confronted with and the continued degradation of life sustaining resources such as water and air, there are positive global trends that cause cautious optimism for the future of Earth's ecosystems.

Environmental Law. The growing interest in environmental law reflects society's awareness and concerns about the environment. As our global society is placing increased pressure on the environment, the law is being asked to define and clarify a balance between natural resources, patterns of consumption, and the effects of human life on the environment.

Four basic principles of protection provide the framework for environmental law:

- Prevention is a measure taken to preclude irreversible situations from occurring and to “make the risk ‘as small as practically possible’ in order to allow necessary activities to proceed while protecting the environment;”⁵²
- Precaution advocates a “science-based approach to regulation” when there exists both a threat to the environment and a “lack of full certainty” as to the “cost effective measures to prevent environmental degradation;”⁵³
- The “polluter pays” principle stipulates that all environmental costs are paid for by the producer instead of the community as a whole;⁵⁴ and
- Environmental justice aims to “fairly allocate and regulate scarce resources to ensure that the benefits of environmental resources, the costs associated with protecting them, and any degradation that occurs are equitably shared by all members of society.”⁵⁵

The expansion of global environmental law and related enforcement activity will serve to increase the instances in which short-term business decisions consider the long-term economic externalities associated with environmental degradation. Many countries now quantify environmental degradation as a percentage of their GDP. As an example, Russia and the five Central Asian republics estimate that the degraded environmental conditions in that region costs their economies between 10% - 12% of annual GDP⁵⁶ or \$25-\$30 billion.⁵⁷ In June 2006, China's State Environmental Protection Administration (SEPA) concluded that environmental

degradation and pollution costs the Chinese economy the equivalent of 10% of GDP annually.⁵⁸ The trend towards accounting for the economic costs associated with environmental impacts will support the proliferation of sustainable development oriented endeavors on a global basis.

Environmental Education. Multiple nation-wide polls show that Americans rank global warming as their number one environmental concern and, depending on the poll, fifty percent to eighty percent believe that it is already taking place with the majority believing that human activity is the primary cause.⁵⁹ The number of Americans citing pollution and environmental problems as the top global threat has increased by fourteen percent from 2002 to 2007 making the environment the fastest growing concern as a global threat.⁶⁰ According to the Yale Center for Environmental Law & Policy, environmental issues are the most rapidly growing concern amongst Americans.⁶¹ The generally positive trend within the U.S. in terms of environmental awareness has resulted from increased coverage of environmental-oriented issues within elementary and secondary schools curriculums. From a global perspective, the proliferation of non-governmental organizations (NGOs) engaged in environmental education and knowledge amongst the World's youth as well as an increase in related formal education opportunities will lead to more sensitivity in the protection of our life-sustaining shared ecosystems.

Recognition that Economic Disconnectedness is Both a Global Security and Environmental Problem. As economic globalization continues to provide for enhanced prosperity for a large segment of our world population, emerging economies in heavily populated nations such as China and India will place an increasing demand upon our environment. Regions such as “the Caribbean Rim, Africa, the Balkans, the Caucasus, Central Asia, the Middle East and Southwest Asia and much of Southeast Asia”⁶² that are currently disconnected from the global economy will continue to become less stable as the quality of life of these regions' inhabitants continues to decline in relation to those regions reaping the economic benefits of globalization. The citizens within these disconnected countries will remain disproportionately dependent upon the environment for their livelihood, an environment that is being increasingly sacrificed by developing nations in pursuit of greater economic growth. As these forces play out over time, collaborative engagement between the world powers will be essential to ensure that the ecosystems of our world are not irreparably damaged as the world's focus upon economic growth continues to intensify. The increasing recognition by the OECD community of the interrelationship among economic disconnectedness, poverty and environmental degradation, can be expected to result in collaborative interaction among nations that mitigate the degree of impact that would otherwise be realized. Technological advancements such as the increasing cost effectiveness of solar power will also serve as “enablers” in terms of affording low income countries the opportunity to develop economically in an environmentally sound manner without being confronted with substantial infrastructure related investment.

Globalization Mandates Multilateral Collaboration. As the world's sole superpower, the U.S. is uniquely positioned to contribute to environmental economics on a global scale. As previously mentioned, the \$13.1 trillion U.S. economy was three times bigger than that of second place Japan (\$4.3 trillion) and over four times bigger than that of third place Germany (\$2.9 trillion) or fourth place China (\$2.7 trillion)⁶³ and only slightly less than that of the European Union (\$14.5 trillion).⁶⁴ As the world's largest economy, the U.S. has a responsibility to establish itself as both the actual and perceived world leader on the environment. There are a number of shared concerns and environmental initiatives with world-wide economic implications. As international bodies and individual countries explore alternative energy sources as well as carbon trading and sustainability programs and policies, the ultimate decision to implement proposed solutions will be based on economic viability as much as projected

environmental benefits. The environmental area represents a strategic opportunity for the U.S. to engage multilaterally with members of the global community in confronting problems of shared interest. Given that the U.S. percentage of global GDP will decrease during the upcoming decades as the global shift in economic power and influence continues its transition from North America to Asia, the U.S. should view a position of global environmental leadership as a prime strategic objective that will build international goodwill while America is still the world's sole superpower.

U.S. Government Goals and Role in Influencing the Environmental Agenda:

As American society (societies around the world for that matter) have become increasingly concerned about local, national and international environmental degradation, the various levels of the U.S. government have been asked to define and arbitrate a balance between the development and exploitation of natural resources and patterns of consumption in light of the reality that mankind, particularly in the developed world, runs the risk of causing permanent damage to the planet. Only government, through the combination of the carrots of research and development funds and tax incentives on the one hand and the sticks of regulation and enforcement on the other has the tools to adequately protect the environment. "Environmental governance" is essential because environmental threats represent public or collective good problems and cannot be resolved through purely private action.⁶⁵

Historically, environmental protection was regarded as a reserved power of the states since the Constitution does not explicitly delegate such a power to the federal government.⁶⁶ However, in the 1960s this viewpoint changed and the Congress has increasingly derived power to formulate and implement environmental policy "from several provisions of the Constitution, especially the commerce clause (Art I, sec 8), the spending clause (Art I, sec 8), the treaty clause (Art. II, sec 2), and the U.S. public lands clause (Art. IV, sec 3)."⁶⁷ The federal government generally has three approaches to implement U.S. environmental policies across the states: cooperation, whereby the federal government stimulates state and local action based on federal standards that are then implemented by state and local governments, usually with federal grant incentives and with state and local administrative discretion;⁶⁸ conjoint programs, whereby the federal government establishes precise standards that must be implemented by state and local governments through an approved plan; and national in which the federal government issues mandates which are often enforced at the state and local level with limited discretion.⁶⁹ These methods have variable success rates. Uneven results from various federal programs arise from differences in state wealth, the variety of industries located within a particular state, and the political leaning of the state and local government. The reality is that current U.S. environmental policy has taken a centralized approach to environmental regulation which has led to a continuous debate on the appropriate role that the federal government and states should play, respectively, in the development and enforcement of environmental policy.

From industry's perspective, it is often useful to have the federal government establish a national standard in areas that affect commerce among many or all states, such as the automobile and cruise industries. There are also areas ripe for potential federal oversight with clear national benefit, such as reducing the depletion and energy needed to develop natural resources through recycling. But not all federal government actions have led to improved environmental protection standards. Recently on behalf of the auto industry, the EPA refused to allow California to adopt stronger fuel emission standards than federal law.⁷⁰ The rationale was that this would defacto establish emission standards for new car sales for all states. On the other hand, the cruise industry would prefer a tough national standard governing waste disposal from cruise ships to

avoid the patchwork standards that they confront at different ports of call, both inside U.S. territorial waters and abroad.⁷¹ The profitability of the recycling industry is currently determined by varying local regulations. The National Recycling Coalition claims that \$9.3 billion in recyclable materials are not recovered each year. Since participation rates in recycling programs are directly related to the ease of participation as well as local government carrots and sticks, (ref essay on recycling), the establishment of a national recycling standard would force all communities across the country to better collect these lost resources.

Many environmental issues are global in nature and require a coordinated international effort to resolve. As such, the U.S. government should seize the opportunity to lead efforts in establishing basic frameworks for environmental protection. International cooperation on environmental protection efforts, especially among otherwise antagonist states, could lead to confidence building and cooperation in the resolution of other more contentious matters. Unfortunately, American influence on environmental matters has waned in recent years, largely as a result of our refusal to assume a leadership role in ratifying and advancing the Kyoto Protocol and other international treaties. While Kyoto has become the whipping boy of America's failure to lead on environmental matters, our failure to ratify the 1982 UN Convention on the Law of the Sea also cost us diplomatic leverage in subsequent efforts to advance our interests on environmental protection matters. Ironically, despite not being party to the Convention, in 1999 we used it to defend our import ban on shrimping and shrimp products that were harvested in a way that endangered sea turtles.⁷²

In addition to a greater commitment to negotiate, ratify and act on international agreements, the U.S. should demonstrate leadership through more active encouragement of the use of voluntary standards established by the International Standards Organization (ISO). U.S. leadership through active engagement with the ISO to further develop and refine worldwide standards offers another avenue for the U.S. to increase its standing and influence among foreign audiences. For instance, the ISO developed the ISO 14000 series as a tool to assist business organizations to meet the myriad of regulatory obligations most countries impose. The ISO 14000 standards allow business organizations to integrate environmental compliance requirements with overall operating requirements. U.S. government leadership in the realm of voluntary standards should focus on creating a regulatory environment that encourages the application of the ISO standard as a means of further increasing the efficacy of government regulations.

Essays on Pertinent Environment Industry Issues:

“Environmental Research and Development Funding”

Research and development (R&D) holds the key to industry success in the design and production of the technologies that will better protect and preserve our planet for future generations. For America to maintain its narrow technological edge in the environment field, the more R&D funds, the better. Federal and private funding for Environmental R&D increased in 2008 in the areas of climate change and renewable energy sources. Congress increased energy R&D spending by 23 percent to \$1.9 billion, primarily in the areas of carbon sequestration, biomass, solar energy, energy conservation, and fossil fuels.⁷³ Funding demonstrated Congress's desire to focus energy R&D efforts on the development of climate friendly energy sources and improving fuel efficiencies. Environmental R&D rose four percent to \$2.1 billion, primarily benefiting the climate change research of the U.S. Geological Survey (USGS), the National

Aeronautics and Space Administration (NASA), and the National Oceanic and Atmospheric Administration.⁷⁴ The private sector in 2007 invested \$3 billion worldwide for research in “clean technology” such as solar energy. Most of the \$2.5 billion in private R&D investment (a 43% increase from 2006) in R&D occurred in the U.S. There is a direct correlation between the global increase in green technology R&D and increased regulatory interest in reducing green house gas emissions.⁷⁵

Solar Energy. One principle cause of climate change is the green house gasses emitted from energy generation. Both governments and private investors are working to develop energy sources with reduced green house gas emissions. According to the United Nations Environmental Program (UNEP), investments in sustainable energy increased fifty percent from 2004-2006 reaching 70.9 billion dollars. Private investment in sustainable energy in 2006 reached \$8.6 billion dollars.⁷⁶ Over one third of U.S. investments -- nearly \$700 million dollars – go to solar energy, making this the most popular of the “green technologies”.⁷⁷

Uses of photo voltaic cells are gaining in popularity, especially for micro power generation. However, photovoltaic cells are still an expensive technology costing about 23 to 32 cents per kilowatt hour (kwh).⁷⁸ The average cost for electricity is about 5.8 to 16.7 cents (kwh).⁷⁹ A number of firms are working to improve photo voltaic cell technology possibly through the use of lower quality silicon and other ultra thin silicon film deposited on the glass.⁸⁰ The introduction of regulations to reduce carbon based emissions would have a positive impact on the economics of solar power.

Biofuels. Researchers are working to develop a biologically based fuel to convert cellulosic biomass into fermentable sugars, essential to the production of ethanol. The industry is focused on cellulosic feed stocks that consist of low value products like wood chips, switch grass or municipal waste. The DOE and USDA this fiscal year announced that they would invest \$18.4 million in the development of biomass feed stocks.⁸¹ Likewise, DOE has invested \$385 million to construct six cellulosic ethanol plants. From 2007-2010, government and private capital investments of \$1.2 billion dollars will construct several refineries that will generate 130 million gallons of cellulosic ethanol.⁸²

In the development of this technology, care must be taken to ensure that we are approaching the research from a holistic viewpoint to prevent unintended consequences. For instance, clearing forests to grow biomass can actually increase rather than reduce greenhouse emissions by as much as 17 to 420 times, depending on the type of forest cleared.⁸³ Better is to use biofuels developed from marginal croplands and waste products that are currently acting as carbon sinks.⁸⁴ The point is to consider the entire carbon cycle when selecting a biomass for conversion to fuel. Obviously it would be detrimental to harvest forests for conversion to fuel and then grow a feed stock like switch grass in its place, since this would result in carbon debt as the CO₂ removed by the forest would be greater than the gains of the biomass feed stock.

Sequestering Carbon Dioxide. The capture and sequestering of green house gasses is a technology that is under development. The major constituent of green house gas is carbon dioxide and a principle point source of carbon dioxide is emissions from coal fired electric plants.⁸⁵ Carbon capturing technology has been demonstrated in small scale projects with varying results. To improve upon this technology, DOE originally planned to invest \$950 million dollars in a public private venture to construct a state-of-the-art coal powered electric plant called “FuturGen.” This plant will convert coal to hydrogen fuel to generate electricity and capture and store the carbon dioxide emissions in a sandstone deposit. Unfortunately, the plant technology

was not ready for large scale production and required additional smaller scale trials.⁸⁶ The goal was to remove the carbon from the fuel prior to combustion, a process that is theoretically more efficient, but still unproven.⁸⁷ Ultimately, cost overruns of \$1.8 billion dollars resulted in the cancellation of the project.⁸⁸ However, as the R&D train has moved along, 50 additional private utility project proposals have been made to capture carbon dioxide emissions using readily available technology and would result in a twenty-seven percent cost savings per megawatt more than the “FuturGen” plant would have achieved.⁸⁹

Once carbon is captured there are few industrial uses for CO₂. One idea industry is pursuing is injecting carbon dioxide into the ground. Oil companies have experience with this technology as they use the gas to facilitate crude oil removal. Similarly, utility companies are moving in the same direction. In Australia, scientists have prepared a natural gas reservoir for the injection of 100,000 tons of carbon dioxide. The reservoir will then be sealed and observed to note any adverse impacts.⁹⁰ This technology remains a work in progress as our society struggles to determine an eco friendly way to handle the principle bi-product of our existence.

By CDR John Kleim

“Economic and Environmental Potential of the Recycling Industry”

According to a December 2006 GAO study, each U.S. resident generates on average, 1,600 pounds of waste per year, or 4.4 pounds per day.⁹¹ This is an increase of sixty-three percent from the 2.7 pounds per person per day generated in 1960, reflecting the steady increase in the American standard of living and consumption patterns. In conjunction with the sixty-seven percent increase in the U.S. population during the same period, Americans now generate close to 500 billion lbs of municipal solid waste per year, well over double the 180 billion lbs generated in 1960.⁹² The growth in electronic waste, which now totals five to seven million tons each year, is of particular interest.⁹³ The EPA reports that E-waste is growing 2 to 3 times faster than any other waste stream.⁹⁴ With increased politicization of environmental matters and a lack of desire by community residents to open new landfills, particularly in expanding urban areas, there is new interest in recycling. Add to this a generalized and growing belief that government and individuals should be doing much more to decrease CO₂ emissions to help combat global warming; there will be increased pressure for municipalities to continue to increase recycling opportunities as one method of mitigation.

This situation has created new markets for the reclamation of as much trash as possible. In particular, materials such as aluminum, steel, paper, glass, and plastic provide a double environmental benefit in that they have a market value for resale and significantly reduce the amount of raw strategic resources needed to create them from scratch. Recycling also provides a means to get raw materials such as aluminum and steel which reduced the need for more expensive virgin material. For example, creating aluminum from recycled material uses 95% less energy than using virgin material and using recycled plastic for bottles saves 16 barrels of oil per ton.⁹⁵ As the market for products from recycled materials grows, it has the potential to spur a new wave of growth for the relatively flat reclamation industry. The past five years of industrial stagnancy (29-32 percent national participation in recycling programs) does not reflect the potential for real market growth if political and industrial goals and strategies can be aligned.⁹⁶

The reclamation and recycling industry generates \$236 billion in yearly revenues.⁹⁷ In 2006, the National Recycling Coalition (NRC) reported that only 32.5 percent of discarded

material was recycled and another 12.5% was burned in waste-to-energy facilities.⁹⁸ That means fifty-five percent of recyclable materials went into landfills despite their value on the open market. Corrugated cardboard currently sells for \$131/ton, office paper for \$198/ton, steel for \$418/ton, glass for \$342/ton, plastic from \$.18 to \$.36/pound and aluminum \$.89/pound.⁹⁹ The NRC estimates that less than fifty percent of discarded cardboard, aluminum, glass and plastic were recycled in 2006, translating to \$9.385 billion in lost revenues from reclamation, making recycling not only an altruistic endeavor but an economic opportunity, not to mention the opportunity and land use costs of transporting those materials to landfills.¹⁰⁰ This potential to generate revenues by selling reclaimed material, the opportunity to buy less virgin material, and reducing oil imports for plastic manufacture and other materials is a compelling reason to grow the materials reclamation part of the waste management industry.

The NRC estimates that if cities across the country maximized their ability to recover raw materials, the U.S. could cut carbon emissions by 5 percent.¹⁰¹ The federal government should seriously consider adopting national standards to force states to do more for energy reduction and environmental protection. The biggest predictor of industry success in any given recycling market is the commitment of the local government. Making programs available and mandatory, with easily enforceable statutes would increase the currently stagnant recycling rates dramatically. In 2007, fewer than fifty percent of U.S. households were served by curbside recycling programs with great regional variance: Northeast 84%, West 76%, Midwest 61%, South 30%.¹⁰² From industry's side, making participation as simple as possible is the biggest driver of success. Individual households with curbside collection fare much better than apartment complexes which do not facilitate collections on individual floors. One bin collections that do not require the separation of materials (glass for a glass bin, paper for a paper bin, for example) result in increased compliance rates in communities that have adapted this practice.

The average value of recovered materials from computer equipment is a meager \$1.50 to \$2.00.¹⁰³ This, coupled with the fact that the handling, dismantling, and recycling cost outweigh the profit, requires disposal fees to cover costs. The narrow profit margin does not have much potential for near term growth. Economy of scale stemming from the overall size of the industry and available infrastructure increases will yield some efficiency, but competition will keep profits from growing. The companies that are able to differentiate themselves with services will realize the biggest gain.

Because the benefits of recycling are clear, the federal government should seriously consider increasing national standards and targets in the same way that it sets targets and regulates vehicle emissions. Recycling aluminum, steel, plastics, glasses and papers is more energy efficient than producing new materials. Recycling and reusing solid waste by burning it in power generating facilities also positively contributes to the electrical grid. All recycling and reuse programs reduce landfill. Additionally, Government Accountability Office interviews indicate that environmental stakeholders are convinced that a nationwide public education campaign in conjunction with a limited number of federal mandates and targets and locally developed programs would increase local participation dramatically.¹⁰⁴

By Col Victoria Reed, Mr. Robert Kerr and CDR Eric Hendrickson

“Environmental Education”

All Americans over forty remember the powerful impact of the public service announcement portraying an elderly Native American chief shedding a tear as he witnessed the

littering of our lands. Similarly, the federal government's anti-smoking campaign has contributed to educating and influencing American views and behavior to the benefit of our nation's public health. Our government's next challenge is to develop the environmental awareness messages that will result in the corporate and private behavioral changes needed to protect and preserve the nation's and world's heritage for future generations.

The number of Americans citing pollution and environmental problems as the top global threat has increased drastically since 2002, far more than the growth of any other perceived threat.¹⁰⁵ According to the Yale Center for Environmental Law & Policy, environmental issues are the most rapidly growing concern amongst Americans, two out of three Americans feel that global warming is a problem and the environment is getting worse, but only one in three is familiar with the concepts of Sustainability.¹⁰⁶ This disparity reflects the urgency for improved Environmental Education (EE) and public knowledge of environmental issues.

For the average American, environmental concern appears to be emotional and instinctive as opposed to fact based. A study by The National Environmental Education & Training Foundation (NEETF) found that about eighty percent of Americans are heavily influenced by incorrect or outdated environmental myths and just twelve percent could pass a basic quiz on awareness of energy topics.¹⁰⁷ There is a general gut feeling that things are bad without a full understanding of the cause and effect relationships on what to do about it. This emotional rush to try to make the environment better has led to a public demand for corn based ethanol despite the fact that it has proven not to be very efficient or sustainable. The desire to make positive changes to ameliorate the environment is a good thing, but lack of understanding of the issues and the proclivity to react on emotions, has turned the environmentally-friendly, green movement into an altruistic event. The reality is that the vast majority of people are often much more inspired by monetary incentives. The National Recycling Coalition states that over \$9.3 billion of recyclable material is not recovered each year.¹⁰⁸ The incentives to recover so much money in materials should not be an altruistic endeavor. As issues of the environment and climate change come into the public debate, leaders and public alike will be called upon to understand increasingly complex issues, assess risks and make decisions regarding the environment, global warming, and the energy needs of our nation. This increases the demand for a public that is genuinely aware and literate.

The majority of Americans are not environmentally literate, but they are conscious of the need for increased environmental education. According to NEETF's report on Environmental Literacy in America, ninety-five percent of the public supports EE in our schools, and wants continued EE throughout their adult lives. Over eighty-five percent agree that the government should support these EE programs, and eighty percent believe private companies should train employees in businesses that impact the environment.¹⁰⁹ The NEETF actually distinguishes between environmental awareness (EA) and environmental literacy (EL). About fifty to seventy percent of Americans are EA – basically familiar with major issues surrounding air & water pollution, energy efficiency, solid waste, habitat loss, climate change, primarily from the popular media, but with little understanding of deeper causes or issues. Unfortunately, there is not a high correlation between EA and “environmentally-friendly” behavior. The main EA advantage is its contribution to support government action in environmental policy and management.¹¹⁰

Environmental Literacy (EL) is the highest level of environmental knowledge and usually requires formal education in the field with practical lab or field work. Only about 1 % to 2% of Americans can be classified as EL.¹¹¹ It is unrealistic to set a national goal of widespread EL, considering NEETF's definition. However, the country cannot expect to meet the challenges of

the future with a population that is only at a knowledge level of EA. The goal of EE should be to focus on increasing the size and knowledge base of the EA population to a point where there is an improved understanding of issues and increase in environment-friendly behavior.

Primary Education: If the nation is serious about building a suitable foundation of environmental knowledge, the issue must first be addressed at the primary school level. There are a myriad of NGOs whose primary focus is the advancement of environmental awareness and many have taken innovative approaches at reaching children. But to achieve a coherent and comprehensive plan for a long-term national EE effort, a reliable level of federal funding must be available each year. Unfortunately, the No Child Left Behind's (NCLB) focus on results of mandatory competency testing forced many schools to curtail EE programs. Several lawmakers have introduced the "No Child Left Inside Act" (NCLI) which amends NCLB to provide funding to train teachers and support outdoor EE programs. The legislation proposes reestablishing the Office of Environmental Education back in the Department of Education. New Mexico has proposed unique funding of such activities. They have proposed a 1% sin tax on new televisions and video games to fund outdoor EE programs. They estimate that such a tax would raise four million dollars a year for New Mexico alone.¹¹² This could be a model for a national approach to stabilize the long-term funding of EE Programs.

Higher Education: Formal training for an EL level of knowledge is being provided by an increasing number of colleges and universities, and this number will only continue to grow. As big business leads the way, sustainable practices will become a model for MBA programs to further promote sustainable, environmentally-friendly behavior. Unlike primary elementary education, advanced degrees in related topics will expand based on market demands. Organizations such as the Environmental Careers Organization and the Environmental Leadership Program offer development, internships, and job-placement services for anyone wanting to enter the "Green Collar" workforce.

Consumer Education: Consumer education is another area that needs to be addressed to affect pro-environmental behavior. Americans have been very responsive in the switch to compact florescent light bulbs (CFLs). They are aware that the seventy-five percent energy savings allows homeowners to quickly recover the extra cost of the bulbs. However, only a small fraction of them are aware that each CFL bulb contains up to 5 milligrams of mercury. Unaware of the risks of mercury, many consumers unwittingly throw CFL bulbs into landfills where the mercury can be released as vapor or leach into ground water. Current labeling is insufficient to warn consumers of the risks or to describe the proper means of disposal. As another example, one U.S. General Accountability Office report estimates that one-hundred million computers, monitors and televisions are becoming obsolete each year and that the number is increasing.¹¹³ The primary problem is that toxic substances such as lead, lithium, and cadmium have adverse health effects if improperly disposed of. The improper disposal of these products is often done out of ignorance. Education and proper incentives could have a positive impact on increasing environmental awareness and encouraging pro-environmental behavior.

By CDR Eric Hendrickson

“Sustainability: Justifying Sustainability Efforts Today Yield Significant Benefits Tomorrow”

Making sense of “sustainability,” as various stakeholders define it, and incorporating it as a source of long-term business value, is a critical challenge for the next generation of business

and business leaders. Balancing an economic equation (cost, efficiencies, profit) with the needs of the environment is no small task. Businesses and business leaders must, in a risk management framework, address two complex questions: will today's cutting-edge environmental measures be seen as "green-washing" in five years, and how do you account for sustainability projects that have no immediate payoff, but will yield significant benefits decades from now?

Sustainability and Sustainable Development are not new concepts. Rather, they are the latest expression of a long-standing ethic involving peoples' relationships with the environment and the current generation's responsibilities to future generations. Sustainability, as it relates to the potential longevity of vital human ecological support systems can be defined as the ability of world economies, societies, and the environment to thrive in a harmonious state, indefinitely. Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.¹¹⁴ Sustainable development is generally thought to have three distinct, yet intertwined components: environment, society, and economy. Thus, sustainability can be considered as a paradigm for thinking about a future in which environmental sustainability, societal sustainability, and economic sustainability considerations are balanced in the pursuit of development and improved quality of life. In support of this, the "Millennium Development Goals," an eight-goal action plan that 189 UN member states have agreed to achieve by 2015, recognize that environmental sustainability is part of global economics and social well-being.¹¹⁵ Unfortunately, exploitation of natural resources (often by the powerful few), have caused alarming changes in our natural world in recent decades, often harming the most vulnerable people in the world who depend on natural resources for their livelihood.

This begs the question of whether we are walking the talk. Sustainability challenges are indeed massive as impacts are global in scope. Consider the world we live in. The World Resources Institute, an independent, nonprofit environmental think tank, estimates that four billion of the globe's six billion people live on less than four dollars per day. According to the United Nations' Millennium Ecosystem Assessment, "Over the last fifty years, human activity has altered ecosystems at a faster rate and on a larger scale than at any time in human history. Researchers report that there is compelling evidence that human activity is accelerating climate change. CO₂ has increased by thirty percent in the industrial era and is now higher than at any time in at least the past 160,000 years (or even the past twenty million years). As a result, mean global temperature is also a record high. Moreover, the energy demand of developing countries will increase forty-five percent by 2020, which will further increase carbon-dioxide based warming unless more sustainable forms of energy can be developed."¹¹⁶

Dr. William E. Rees, with the University of British Columbia, School of Community and Regional Planning, offered a multi-faceted approach to this eco-economic sustainability problem. "Future global development planning must include explicit policies to: lower human populations everywhere; reduce material consumption in the high-income countries through more efficient technologies; encourage the adoption of simpler, less materially intensive lifestyles in the high-income countries; and provide the developing world with the best available technologies to limit the impacts of essential growth."¹¹⁷ Dr. Rees also addressed the fallacy of his recommendations. "At present, and unfortunately for sustainability and the long-term human prospect, discussion of the first objective is suppressed (one is likely to be labeled racist since most population growth is occurring among "non-white" populations); most politicians (particularly in North America) dismiss the second and third objectives as politically naïve or unfeasible ("...the American life-style is not up for negotiation"); and prevailing market morality and the rise of intellectual

property rights prohibit the forth. It seems that the human evolutionary path does not yet converge with sustainability.”¹¹⁸

As a result, promising areas of connection between the environment and other policy areas are going unrealized. This difficulty in moving forward with environmental improvements has been traced, in part, to an inability to identify the most pressing environmental problems, quantify the burdens imposed, measure policy progress, and assure funds from both private and public sectors are worthy of the investments.¹¹⁹ These limitations mean that pollution control and natural resource management issues have been systematically under-funded and lag behind other global challenges.

What is the role of industry? The answer seems obvious, but those who have tried know that it is no simple task. Sustainability must be incorporated into an organization's core business strategy. A steady focus on sustainable production and consumption can produce the greatest impact and enable an acceptable standard of living for both current and future generations. And it is starting to happen. Corporate sustainability leaders are enacting smart decisions, such as reducing the consumption of natural resources and using purchasing power to drive supplier performance. Companies are beginning to endorse a “code of conduct” approach, insisting that business partners share their dedication to environmental initiatives.

Sustainability is more than being “green.” It is more than the environmental impact of a company and its employees. Sustainability will require a commitment to make basic changes in social, economic and political activity. Sustainable development marries two important themes: environmental protection does not preclude economic development and economic development must be ecologically viable now and in the long run. It is essential not only for the protection of our earth's resources, but also for the development of the world's economies and communities. Understanding the interdependency of all three elements (environment, social, and economic) and addressing each is critical.

By Mr Travis Stewart

Conclusion:

The environment industry, writ large, will continue to grow as American and societies around the world increasingly realize that our planet is vulnerable. The global population will continue to increase, most notably in developing countries that currently consume a relatively small amount of the world's natural resources and non-renewable energy supplies, per capita. The peoples and governments of these countries will continue to strive to provide the clean water and energy needed to lift these societies into the modern world. The combination of increased environmental concern and continued development pressure offer tremendous opportunities for American business and for American political leadership. On the one hand we have the potential to export the sophisticated and often expensive technologies (i.e., solid and liquid waste management as two examples) that are working in our developed economy. On the other hand, U.S. industry has the potential to modify sophisticated technologies to both protect the environment and to assist developing aspirations of the Third World.

While American industry continues to develop solutions to U.S. based environmental challenges, American diplomacy has exciting opportunities to use American knowhow and leadership to leverage increased international cooperation on solving global environmental challenges in ways that increase America's international stature and influence. For instance, the confidence building that results from U.S. leadership to stem or reverse the effects of climate change, that facilitates international development using renewable and non polluting power

supplies, that promotes solutions to cross border water disputes and that protects the world's biodiversity will pay benefits in U.S. led efforts to resolve non environmental disputes.

As America's influential columnist and best selling author Tom Friedman predicts: "the future is green." Friedman believes that being "green" is "geostrategic, geoeconomic, capitalistic and patriotic, and that it can form the basis for a "new unifying political movement (national and international) for the 21st century," the second "American Century."¹²⁰ The 2008 environment industry seminar agrees wholeheartedly with this assessment.



Appendix A:¹²¹

Exhibit 1-6 Environmental Industry Segments

Segment	Description	Examples of Clients
Environmental Services		
Environmental Testing & Analytical Services	Provide testing of "environmental samples" (soil, water, air and some biological tissues)	Regulated industries, Gov't, Environmental consultants Hazardous waste and remediation contractors
Wastewater Treatment Works	Collection and treatment of residential, commercial and industrial wastewaters. These facilities are commonly know as POTWs or publicly owned treatment works.	Municipalities, Commercial Establishments & All industries
Solid Waste Management	Collection, processing and disposal of solid waste	Municipalities & All industries
Hazardous Waste Management	Manage on-going hazardous waste streams, medical waste, nuclear waste handling	Chemical companies Petroleum companies Government agencies
Remediation/Industrial Services	Physical cleanup of contaminated sites, buildings and environmental cleaning of operating facilities	Government agencies Property owners Industry
Environmental Consulting & Engineering (C&E)	Engineering, consulting, design, assessment, permitting, project management, O&M, monitoring, etc.	Industry, Government Municipalities Waste Mgmt. companies, POTWs
Environmental Equipment		
Water Equipment & Chemicals	Provide equipment, supplies and maintenance in the delivery and treatment of water and wastewater.	Municipalities & All industries
Instruments & Information Systems	Produce instrumentation for the analysis of environmental samples. Includes info systems and software.	Analytical services, Gov't Regulated companies
Air Pollution Control Equipment	Produce equipment and tech. to control air pollution. Includes vehicle controls.	Utilities, Waste-to-energy Industries, Auto industry
Waste Management Equipment	Equipment for handling, storing or transporting solid, liquid or haz. waste. Includes recycling and remediation eqmmt.	Municipalities Generating industries Solid waste companies
Process & Prevention Technology	Equipment and technology for in-process (rather than end-of-pipe) pollution prevention and waste treatment and recovery	All industries
Environmental Resources		
Water Utilities	Selling water to end users	Consumers, Municipalities & All industries
Resource Recovery	Selling materials recovered and converted from industrial by-products or post-consumer waste	Municipalities Generating industries Solid waste companies
Clean Energy Systems & Power	Selling power and systems in solar, wind, geothermal, small scale hydro, energy efficiency and DSM	Utilities All industries and consumers

Source: Environmental Business International Inc. (San Diego, Calif.)

Appendix B:

Environmental Industry Growth by Segment¹²²

Industry Segment	2003	2004	% Growth
Analytical Services	4.4	4.6	3.7
Water	83	87.8	5.7
Solid Waste	124.2	128.2	3.2
Haz Waste Mgt	21	21.3	1.7
Remediation Svcs	36.3	39.1	7.8
Envnt Consulting Engr	33.8	35.4	4.6
Water/ Wastewater Chem	46.7	51.3	9.9
Air Pollution	39	40.2	3.0
Waste Mgt Equip	32.1	33	2.8
IT Support Systems	7.2	7.5	3.9
Process/ Protection Tech	3.4	3.5	1.9
Water Utilities	91.9	96.7	5.3
Resource Recovery	39.1	43.1	10.0
Clean Energy/ Power	34	37	9.1
	596.1B	628.6B	5.5%

EBI Data Package 2006¹²³

The U.S. Environmental Industry 1970-2010

Revenue & Growth (\$ Billions)

ENVIRONMENTAL INDUSTRY SEGMENT	1970	1980	70-80		80-90		90-00		00-10	
			Growth	1990	Growth	2000	Growth	2010	Growth	
Services										
Analytical Services	0.1	0.3	300%	2.1	523%	1.8	-14%	1.8	4%	
Wastewater Treatment Works	2.7	8.4	213%	18.4	119%	28.7	56%	40.4	41%	
Solid Waste Management	3.2	10.6	236%	26.1	145%	39.4	51%	54.4	38%	
Hazardous Waste Management	0.1	0.6	370%	6.7	942%	8.1	21%	8.7	8%	
Remediation/Industrial Services	0.3	1.6	401%	9.9	534%	10.1	3%	10.2	1%	
Consulting & Engineering	0.1	1.3	1492%	12.5	856%	17.4	39%	27.8	60%	
Equipment										
Water Equipment and Chemicals	1.7	6.9	306%	13.4	93%	19.8	48%	26.7	34%	
Instruments & Information Systems	0.1	0.4	265%	2.0	404%	3.8	88%	5.9	58%	
Air Pollution Control Equipment	0.4	4.5	1122%	11.1	144%	19.0	72%	14.3	-25%	
Waste Management Equipment	1.9	4.5	134%	8.7	92%	10.0	15%	11.2	12%	
Process & Prevention Technology	0.0	0.1	259%	0.4	418%	1.2	183%	1.9	67%	
Resources										
Water Utilities	3.3	9.3	181%	19.8	112%	29.9	51%	41.1	37%	
Resource Recovery	2.3	6.1	161%	13.1	114%	16.0	22%	23.5	47%	
Clean Energy Systems & Power	0.7	4.1	467%	6.5	58%	13.4	106%	40.1	199%	
TOTALS:	17	59	247%	151	156%	219	45%	308	41%	

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Appendix C:

Environmental Industry Growth by Region¹²⁴

Region or Country	2003	2004	% Growth
United States	228.7	240.8	5.3
Europe	172.4	180	4.4
Japan	96.1	98.8	2.8
Rest of Asia	33.6	38	13.1
Mexico	4.1	4.4	9.1
Rest of Latin America	11	12.1	10.3
Canada	16	16.5	2.9
Australia/ New Zealand	9.6	10.1	5.3
Central/ Eastern Europe	11.8	13	9.7
Middle East	8.3	9.4	13.6
Africa	4.6	5.5	19.4
	596B	628.5B	5.5%



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