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ENVIRONMENT 2010

ABSTRACT: The maturing U.S. environment industry continues to develop and encompasses vital national security issues such as sustainability, climate change, environmental degradation and biodiversity loss. There is a strong business case for a “green economy,” domestically and internationally. We analyzed key international regions and offer recommendations on how to develop U.S. policies to support our interests and to capitalize on emerging markets. Our forecast is for further development in an industry sector that is clearly growing, and that has broad strategic implications for the United States.

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PLACES VISITED

Domestic:

U.S. House Committee on Natural Resources, Washington, D.C.
U.S. Senate Committee on Environment and Public Works, Washington, D.C.
U.S. Green Building Council, Washington, D.C.
Chesapeake Bay Foundation, Annapolis, Maryland
Bechtel Corporation, San Francisco, California
The Nature Conservancy, San Francisco, California
Pacific Gas & Electric Company, San Francisco California
Sierra Club, San Francisco California
Chevron Energy Solutions, San Francisco, California
SF Environment, San Francisco's Department of the Environment, San Francisco, California
U.S. Export Assistance Center, U.S. Commercial Service, San Francisco, California
Lawrence Berkeley National Laboratory, Berkeley, California
Port of Oakland, Oakland, California
Farrallones Marine Sanctuary Association, San Francisco, California
San Francisco Bay Conservation and Development Commission, San Francisco, California
Farella Braun + Martel LLP, San Francisco, California
Draper Fisher Jurvetson, Menlo Park, California
Alexandria Sanitation Authority, Alexandria, Virginia
World Bank, Washington, D.C.
International Finance Corporation, Washington, D.C.

International:

Wildaid, Puerto Ayora, Galapagos Islands, Ecuador
Charles Darwin Research Station, Puerto Ayora, Galapagos Islands, Ecuador
World Wildlife Fund, Puerto Ayora, Galapagos Islands, Ecuador
Fabrio Valverde Recycling Center, Puerto Ayora, Galapagos Islands, Ecuador
Cerro Mesa Reserve, Santa Cruz, Galapagos Islands, Ecuador
Cuzco, Peru
Machu Picchu National Park, Peru
Puno, Peru
Floating Islands and Isla Taquile, Lake Titicaca, Peru
Lima, Peru
Meetings with World Wildlife Peru; Direccion General Forestal y de Fauna Silvestre; Instituto del Bien Commun; Initiative for Conservation in the Andean Amazon; Instituto Nacional de Desarrollo de los Pueblos Andinos, Amzonicos y Afro-Peruanos; Centro de Culturas Indigenas del Peru;
Confederacion de Nacionalidades; U.S. Agency for International Development
Lima; Sociedad Peruana de Derecho Ambiental; Centro de Conservacion, Investigacion y Manejo de Areas

INTRODUCTION

Is a multinational oil company like British Petroleum an environmental corporation? The recent oil platform disaster in the Gulf of Mexico not only highlights the challenges of examining the environment industry, but vividly portrays the wide-ranging implications of our dependence on finite natural resources, as well as the importance of addressing environmental problems, and their economic and political consequences. Environmental issues not only are drawn with increasing frequency from today's headlines, they are the subject of intense discussion in the White House, on Capital Hill, in international capitals, in corporate boardrooms, and at town hall meetings. The industry is wide-ranging, encompassing such vastly different enterprises as Chevron, Bechtel, the Sierra Club, and the World Bank. The breadth of issues associated with the industry is also expansive, including profit/loss and investment calculations, corporate social responsibility, and philanthropic giving. Together, they affect the health and welfare of the American people, our economy, and our relationships with other nations, and therefore the security of the United States.

This industry will continue to evolve as national policy matures, incentives increase, and other industries incorporate sound environmental practices. Within the U.S. and internationally, the focus on clean technologies, energy efficiency and pollution remediation will continue to provide excellent opportunities for economic growth. In addition, because environmental issues are inherently transnational, the U.S. has an opportunity to exert international leadership both by example and through collaboration.

THE STATE OF THE INDUSTRY

Defining the environment industry is a challenging task. Basic elements of the natural environment – air, water, soil – are critical to sustaining life. Yet they provide an elusive basis on which to define an industry that can be examined in a meaningful way, particularly with regard to competitiveness and sustainability. Traditional tools to help do so stubbornly exclude the growing environment industry. For example, the U.S. Government's North American Industry Classification System (NAICS) serves as the standard for use by federal statistical agencies in classifying business establishments for the collection, tabulation, presentation, and analysis of statistical data describing the U.S. economy, and for providing uniformity and comparability in the presentation of statistical data. NAICS is based on a production-oriented concept, meaning that it groups establishments into industries according to similarity in the processes used to produce goods or services.”¹ The environment industry, however, does not fit neatly within any one category of the NAICS. It includes firms involved in everything from renewable energy, to waste treatment, to resource management, to wildlife and habitat conservation, and from multinational corporations with global operations, to boutique nongovernmental organizations focusing on a single environmental issue. The industry ranges across a broad territory that is continuing to grow in economic and political impact.

The Organization for Economic Cooperation and Development (OECD), an international organization consisting of representatives from the U.S. and 29 other industrialized countries, defines the industry as “firms producing goods and services capable of measuring, preventing, limiting or correcting environmental damage such as the pollution of water, air, soil, as well as waste- and noise-related problems. They include clean technologies where pollution and raw material use is being minimized.”² Importantly, the OECD definition uses broad categories and includes so-called “clean technologies” despite their being emergent by nature and therefore difficult to track.

At this time, the best source of environment industry data is compiled by a private firm, Environmental Business International, Inc. (EBI), in its publication, the *Environmental Business Journal* (EBJ). Despite its limitations, especially regarding the timeliness of its data, we have relied on the EBJ as a primary source of industry data for this report. Another important source is the Commerce Department’s International Trade Association also, which provides data supported by insights into market conditions with a smaller time lag. EBJ data is recognized and used by numerous governmental agencies and trade organizations, and is the basis for market and industry analysis. The EBJ defines the environment industry as “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.” It assesses the industry as “representing total revenues of more than \$300 billion, generated by about 30,000 private sector companies and more than 80,000 public sector entities in the United States employing 1.6 million Americans.” Its most recent estimate of the global environmental market was that it was worth about \$750 billion in 2007.³ At this level, it is time for NAICS to recognize the environment industry.

PRIMARY INDUSTRY SEGMENTS

The fourteen segments devised by the Environmental Business Journal are grouped into three broad categories: services, equipment and resources. Examples include environmental testing, consulting and engineering; forms of waste management, and clean energy systems. One important area that is omitted from this classification system is the nongovernmental organization sector, which includes non-profit and advocacy organizations as varied as the World Resources Institute, The Nature Conservancy and the Union of Concerned Scientists. These organizations represent billions of dollars in research and grant funding, as well as charitable contributions, and they have a large impact on policy making and public opinion. Appendix A provides a full description of the recognized industry segments and the types of clients within each segment.

One segment of particular interest is water management, as it accounts for one third of the total environment industry activity. Around 85% of U.S. water delivery is in public-sector hands and only about 5% of municipal waste water treatment systems are privately owned.”⁴ As privatization of water services is expected to increase, this sector

will continue to grow. Resource recovery from post-industrial and post-consumer use and recycling is another important segment. According to the OECD, “The shift toward a circular economy (in which resources are reused and recycled and waste and pollution are minimized) along with state recycled content laws, general public pressure for recycling and increasing laws regarding manufacturer responsibility for packaging and waste from their used products, are creating many opportunities for resource recovery.”⁵ While this segment has been affected by the economic downturn since 2008, it has also resulted in a decrease in demand for some resources. For instance, the demand for recycled glass is easily met, with no increase predicted. The absence of effective recycling enforcement also affects this sector, despite the recycling laws that exist in many states. Within the segment, a shift is occurring, namely the increased use of polyethylene terephthalate (PET) plastics for water bottles and other products, and the decreased use of aluminum.

There is growing recognition that clean energy sources including solar, wind, geothermal, hydroelectric, biomass and other forms of alternative energy have environmental benefits that make them substantially more desirable than fossil fuels. The use of fossil fuels has negative externalities in terms of human health, infrastructure decay, declines in forests and fisheries, and ultimately, the costs associated with climate change. Public interest is driving the need for research and development of cleaner, more affordable, renewable sources of energy.⁶ Continued increases in energy prices, and environmental laws and policies are expected to heighten demand for clean energy solutions. The Environment Business Journal projected that the clean energy segment would grow by approximately 12% between 2008 and 2010 – the largest area of predicted growth. The factors behind this include an increased demand for clean energy, rising product performance and reliability, and advancing technology. However, history gives rise to some amount of caution, as the 1970’s saw advances made in solar power that quickly came and went. Increased interest in clean energy also stems from subsidies and tax credits. If these are discontinued, it is not clear whether the push to clean energy will continue as quickly.

THE ROLE OF GOVERNMENT AND ITS OBJECTIVES FOR THE INDUSTRY

Water management, recycling and clean energy environmental sectors all illustrate the key role that government plays in the environment industry. The size, diversity and technological nature of the industry result in a complex, multijurisdictional governance structure. Numerous agencies and organizations are involved in environmental matters at the federal, state, and local levels. The complexity of the actors and legislation governing oversight and enforcement poses real challenges to this industry. Traditionally, environmental matters include monitoring and improving air, water, and soil quality, as well as the protection of wildlife species and habitats. The current trend is to take a broader, more expansive view of environmental matters to include any matter that may directly affect humans in the form of health, wealth, food, and quality of life. Because of the far-reaching nature and complexity of environmental issues, over the years, many existing organizations have been assigned or developed specific responsibilities. As a result, there are numerous government organizations that

address some aspect of important environmental issues. These organizations include: the White House Council on Environmental Quality, the Environmental Protection Agency, other federal Agencies, and state and local governments.

The role of government has developed and intensified over the years at both the federal and local levels. The federal government has created numerous Congressional committees as well as executive agencies that have some responsibility for areas being addressed by environmental legislation. Thus, any piece of environmental legislation provides for oversight by multiple congressional committees and subcommittees. The executive branch has tasked numerous agencies with responsibility to produce regulations regarding enforcement and management. As these federal regulations flow down to the local level each state must enforce those regulations and provide for additional state regulation, as necessary. On a local level, state government similarly has created legislative committees and executive agencies with environmental duties and responsibilities. As a result, it often takes years for any new laws or even changes to existing law to be implemented and the enforced. One final factor that adds to the complexity is the growing recognition that protecting the environment is an international issue. Although some environmental issues are able to be addressed by the country internally, many will require the cooperation of many other nations, each with its own interests and ways of government.

The White House Council of Environmental Quality (CEQ), a division of the Executive Office of the President is tasked with crafting a broader environmental vision for the nation. CEQ must balance changing environmental conditions with advances in technology and leadership priorities. An example is the Executive Order signed by President Obama that requires federal agencies to reduce energy use, set greenhouse gas emissions reduction targets and improve overall sustainability. The council coordinates federal environmental efforts and works closely with agencies and other federal organizations in the development of environmental and energy policies and initiatives.⁷

The Environmental Protection Agency (EPA) moves environmental policy from theory to reality. The agency is tasked with implementing federal laws designed to promote public health by protecting the nation's air, water and soil from harmful pollution.⁸ To do this, EPA provides systemic monitoring, standard-setting, and enforcement activities, administering numerous pieces of legislation including the Clean Air Act, the Clean Water Act, the Safe Drinking Water Act, the Marine Protection, Research and Sanctuaries Act, the Endangered Species Act, the Occupational Safety and Health Act, the Oil Pollution Act, the Energy Policy Act, the Atomic Energy Act, and the Shore Protection Act. Typically, the regulations promulgated as a result of these acts set national standards that states must enforce through their own enforcement mechanisms. The EPA is also tasked with supporting state and local government research and anti-pollution activities.⁹ Nearly half of the EPA budget goes toward grants to states, non-profits, and educational institutions and cover a wide range from scientific study to local cleanups.¹⁰

In addition to EPA, there are more than 23 federal agencies that have some direct form of environmental responsibility.¹¹ These agencies have responsibilities varying from management of specific environmental areas, such as the National Parks by the Department of the Interior, to implementing regulations supporting federal law. Particularly illustrative of the complexity of the management and regulation of environmental laws is the Commerce Department whose mission is primarily to enhance business interests and advance the development and use of science and technology.¹²

The states' role is to implement and enforce federal as well as state mandates. Each state has a large number of state agencies that play an important role in developing, implementing, and ultimately enforcing federal and state legislation. California has taken a leading role in assisting the development of renewable energy technologies, such as solar energy, by providing incentives for solar power installations among customers of California utility companies, and has set aggressive greenhouse gas emissions goals. We also learned that the State of Maryland is especially representative of how environmental laws are being carried out at the state level with both the top two elected officials in the state, the Governor and the Attorney General, having stated that protection of the environment is a top priority.¹³

U.S. ENVIRONMENTAL LAW AND INTERNATIONAL COMMITMENTS AFFECTING THE INDUSTRY

The United States has historically shown leadership in environmental legislation, from early efforts to conserve forests and regulate pollution dating back to the late nineteenth century. These efforts continued through the early twentieth century and culminated with the legislative “zenith” of contemporary U.S. environmental legislation that occurred in the 1970s. This phenomenon is a direct reflection of public outcry and the resulting political will generated by the environmental movement. Some of the most significant of these laws in terms of cost, complexity, and coverage include: the Clean Air Act (CAA), the National Environmental Policy Act (NEPA), the Clean Water Act (CWA), the Endangered Species Act (ESA), the Toxic Substances Control Act (TSCA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This legislation is described in further detail in Appendix D. In the succeeding decades, federal environmental law expansion has waxed and waned, based on the agenda of the presidential administration.¹⁴

Environmental issues are subject to the jurisdiction of numerous congressional committees and subcommittees and as Congress is generally reluctant to limit the scope of its oversight authority, interaction with the federal agencies involved in these issues is complicated. The political nature of the legislative branch further adds to the level of complexity with regard to protecting the environment, especially when these issues have an economic impact. This is readily apparent when examining President Obama's efforts to combat global climate change. Specifically, according to one analyst, “it was the lack of legislative progress here in the U.S. that helped to ensure that no binding climate treaty would be reached at the international climate summit in Copenhagen, Denmark in

December 2009.”¹⁵ Furthermore, recent discussions with congressional staffers on key environmental committees in the House and Senate revealed the existence of an extremely partisan and disparate legislative climate when it comes to environmental legislation. This obviously does not bode well for future environmental legislation.

While the U.S. has arguably made strides in the protection of the domestic commons, transboundary environmental issues and globalization highlight the interconnected nature of the global commons. Like the U.S., other countries and the international community at large have a long history of environmental conservation. According to an official of the United Nations Environment Program, environmental treaties extend back to the early 20th century, but “it was not until the 1960s that concern about environmental pollution and the depletion of natural resources led to the kind of binding multi-lateral agreements (MEAs) that we know today.”¹⁶ The international “high water mark” occurred in the 1990s, and was directly linked to the 1992 United Nations Conference on Environment and Development, also known as the “Earth Summit,” held in Rio de Janeiro. The conference, which included all but six members of the United Nations, is considered “a landmark in the history of environmental law, confirming the global character of environmental protection and its integration with development.”¹⁷ A slowdown in international collaboration following the enthusiasm of the 1990s can be linked to the fragmentation of environmental policy making. “Multilateral agreements have exploded in number to 220, by one UNEP [United Nations Environmental Program] count. Individual conferences of parties and scattered secretariats have often pursued separate agendas as if isolated from each other – or in competition.”¹⁸ In short, the international environmental agreement regime is suffering from something akin to combat fatigue.

Some of the most significant of these MEAs in terms of overall relevance to the environment and the fact they crosscut the areas of law, economics and politics include: the Convention on International Trade on Endangered Species of Wild Fauna and Flora (CITES), the Montreal Protocol on Substances that Deplete the Ozone Layer and the Vienna Convention for Protection of the Ozone Layer, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, the Convention on Biological Diversity (CBD) and the UN Convention on Climate Change (UNFCCC) and the Kyoto Protocol (see Appendix E).

The current legislative structure has essentially served to address the issues resulting from the industrial age. The burning rivers and smoke filled skies of the 1960’s and 1970’s have been addressed. However, the realization is that much remains to be done. Complex issues such as pollution prevention, climate change, and resource depletion will require further international cooperation. Existing organizations such as the Global Environment Facility (GEF) can help further that endeavor. The GEF includes 181 member countries and works with organizations such as the United Nations Environment Programme and the World Bank.¹⁹ The Copenhagen conference on climate change demonstrated growing recognition of the need for more international cooperation. Unfortunately, “the 193-nation meeting proved to be fairly meaningless. Instead of a treaty mandating greenhouse gas limits, which climate watchdogs have been working

towards for years, the meeting produced only a non-binding accord with no firm limits on emissions.”²⁰ Although the United States is already a member of each of these organizations, it may be time to take a more active role as a partner nation in the international community to continue to improve all aspects of the environment.

ENVIRONMENTAL EDUCATION AND AWARENESS

A more active role for the United States depends in many respects on environmental awareness and education among its people. This year, we celebrated the fortieth anniversary of Earth Day, the landmark event inaugurated to promote environmental awareness and education around the world. With increased attention on climate change and global warming, many believe that environmental education is critical to understanding the issues, increasing environment-friendly behavior, and influencing decisions to improve, enhance, and in many cases, restore our environment to a condition better than our generation found it.

National surveys have shown that U.S. students’ awareness of environmental science and their attitudes towards the environment are at the basic proficiency level. According to a 2009 world-wide poll, Americans rank 34th out of 57 countries surveyed in environmental science and geosciences and is consistently rated below the Organization for Economic Cooperation and Development averages in almost all categories.²¹ In a poll conducted by the Yale Center of Environmental Law and Policy's Environmental Attitudes and Behavior Project, 83 percent of Americans say global warming is a serious problem and environmental threats such as toxic soil, water security, deforestation, air pollution and the extinction of wildlife are growing concerns.²² More significantly was a survey of 1,000 adults nationwide that showed 63 percent of Americans agree that the United States "is in as much danger from environmental hazards, such as air pollution and global warming, as it is from terrorists."²³

Even though there is a positive trend within the U.S. towards environmental awareness, more work needs to be done. Recently, both the U.S. government and non-profit organizations have taken steps to increase environmental literacy. In 2007, Congress amended education legislation to include the No Child Left Inside Act (NCLI), providing funding to train teachers, provide innovative technology addressing environmentalism, and supports outdoor recreation and sound nutrition.²⁴ President Barack H. Obama’s fiscal year 2011 (FY2011) budget includes (for the first time ever) funding for environmental and sustainability education. New programs have been proposed at the National Science Foundation (NSF), Department of Energy (DOE), Department of Education (ED), and Department of the Interior (DOI) involving scholarships, fellowships and a 21st century Youth Conservation Corps Initiative.

These are all positive signs that the U.S. Government is interested in environmental education and schools will finally receive funding in FY2011 to educate children on the impacts of greenhouse gases, water pollution, and how to recycle. One of several programs in the budget is the Education Department's program "Effective

Teaching and Learning for A Well-Rounded Education." President Obama's budget proposal includes 265 million dollars for this program, an increase of 17% from last year, and would develop and expand innovative practices to improve the curriculum in the arts, foreign languages, civics and government, history, geography, environmental literacy, and economic and financial literacy.²⁵ The over 50 million members of the NCLI coalition, as well as groups like the National Wildlife Federation, who are longstanding advocates for improved environmental education, believe the President's proposed budget is an exceptional opportunity to improve student achievement through environmental learning, and prepare students for the new clean energy economy.²⁶

In addition to the above programs, the President's proposed budget includes one billion dollars for "Effective Teaching and Learning for a Complete Education" program.²⁷ This program is designed to improve college readiness within the fields of Science, Technology, Engineering, and Mathematics (STEM). The STEM program received 300 million dollars, an increase of 66%, to expand the Federal investment in improved teaching and learning of STEM disciplines, especially in high-need schools and school systems, and prepare the next generation of scientists and engineers.²⁸ During a visit to the Lawrence Berkeley National Laboratory in California, a professor said that our nation is losing the edge with STEM and innovation and schools need to recruit and nurture talent to develop environmental leaders in the STEM fields.

In the private sector, there are a wide range of environmental awareness campaigns and organizations that promote environmental awareness through the use of the internet, within communities, and in schools. The Pew Charitable Trusts has become a leader in supporting programs in the educational systems across America and recommends policy solutions to help leaders establish better standards and accountability.²⁹ Another organization that was established is the National Council for Science and the Environment (NCSE), which supports several environmental research, assessments and educational programs at 284 universities, 84 professional societies, and 50 national and regional environmental groups.

Even though the majority of Americans are not environmentally literate, they are aware of the importance for increased environmental education. The goal of environmental education should focus on increasing environmental literacy and awareness of the population where there is an improved understanding of environmental issues and increase environment-friendly behavior. National surveys have repeatedly shown that citizen's support environmental education both within the school curriculum and for the public yet at the same time the surveys show below average levels of basic environmental knowledge. To address the nation's need for environmentally literate citizens, we need the government and the private sector to work together to both strengthen our formal education system and creating a lifelong understanding of the importance of environment issues.

LOOKING AHEAD: THE ENVIRONMENT INDUSTRY'S FUTURE

According to a study by the Rand Corporation, “The environmental industry now displays the characteristics of a maturing industry, such as decelerating growth, heightened competition, growing sophistication among its client base, greater emphasis on marketing, consolidation of market share in larger players.”³⁰ An important transition is taking place away from regulatory-based demand for products and services to broader market demand. Rand notes, “Most companies are aware that the regulatory era is grinding to a halt. Virtually all know that customers demand much more than they used to. Few disagree that industry cannot last in its current form. The environmental industry must not merely exploit its current position until the traditional demand is gone, but take advantage of client relationships to transition towards more sustainable operations on their behalf.”³¹

The growth of the industry – from less than \$20 billion in 1970 to \$302 billion in 2007 (the most recent year for which statistics are available) reflects broad recognition that it is a “valuable and vital part of the economy, responsible for almost 3% of GNP and employment of 1.6million people in the United States.”³² Though it has fluctuated over the years, revenue growth in the U.S. environment industry has largely remained between 1% and 5% (hitting 7% in 2007) and is predicted to remain in this range (see Appendix C). The *Environmental Business Journal* projects strong growth in power, resource recovery, water treatment services. Clean energy systems alone are projected to grow by 12% between 2008 and the end of this year.

Research by the U.S. Department of Commerce presents more leading indicators in the same vein. Commerce evaluates foreign markets for environmental products and services as nearly twice as large as the U.S. market and projects that \$40 billion will likely be invested in clean technologies annually by 2020. The largest portion of growth in the industry by 2030 will come from non-OECD countries.³³ Joel Makower, in “The State of Green Business 2010,” predicts that other gains will be made in the areas of clean energy patents, energy efficiency, green information technology, green office space, paper use and recycling, and water intensity.³⁴ He also projects continued growth in patents for so-called “clean technology,” which reached an historic level in 2009. He expects that 2010 will see a growth in initial public offerings for clean technology companies; several firms have already announced their intention to go public this year.”³⁵

Venture capitalists agree with government and private analysis of the health of the environment industry. A number of venture capital firms are focusing on clean technologies and planning on an expected market shift away from carbon-based fuels toward renewables. We heard repeatedly from scientists and representatives of private firms that there must be a link to public policy to help drive and shape the way ahead, in order to provide predictability for investors and help emergent technologies and startup businesses cross the “Valley of Death” between innovation and market scalability. To underscore the breadth of opportunities in the environmental industry, one venture capital firm is looking to invest in projects involving solar, smart grid, wind, lighting, synthetic biology, storage and water.³⁶ In these and other sectors of the industry, U.S. venture

capital plays a vital investment role. This critical support for entrepreneurialism is relatively advanced in the U.S. and provides the industry with a significant competitive advantage beyond government funding for innovation.

U.S. economic stimulus legislation in 2009 also boosted the industry by allocating \$63 billion for investment in the fields of renewables and energy efficiency, as well as \$18 billion for investment in environmental infrastructure. Other commitments to reduce greenhouse gas emissions (by 10% by 2012 and 25% by 2025) are intended to spur activity in these fields. The Obama administration hopes to create 5 million jobs in the sector by investing \$150 billion over the next ten years.

Further, the environment – and specifically the issue of climate change – has become the new catalyst for assistance to developing countries, as climate change becomes the new “commons.” The United Nations reports that China, India, Brazil and Indonesia now emit more than half of mankind’s greenhouse gas. India and China have indicated to the UN energy group that they will reduce gases. China said they will “by 2020, reduce gases 40-45% below business as usual against 2005 figures for energy versus economic output”.³⁷ India offers to slow down emissions growth 20-25%.³⁸ To assist developing nations, the current UN plan calls for a three-year, \$10 billion per year package of cash donations to help them build sea walls, water systems, wind farms and other projects in a warmer world.³⁹ China, on the other hand, estimates it needs over \$300 billion each year.⁴⁰ This represents an enormous market opportunity.

We learned in the Galapagos Islands that a future vision of sustainability is critical. Even though this unique area of environmental heritage recognized around the world enjoys strong protections, they are insufficient in the face of globalization, migration and development. The transition to further sustainability in the U.S. will require similar leadership and investment. As the environment industry continues to mature, we expect that government roles, responsibilities, and structure, at both the federal and state level will change, providing new legislative or regulatory signals for businesses and investors as well as enforcement officials. We also expect additional international integration and cooperation on environmental issues, as the focus on climate change and other transnational issues intensifies. In the meantime, U.S. as well as international markets present growth opportunities for the industry that will contribute materially to the security and to the economic health of the United States.

REGIONAL ANALYSES: IMPLICATIONS FOR U.S. POLICY MAKERS AND THE INDUSTRY

Latin America and the Caribbean

The countries of Latin America and the Caribbean (LAC) host an extensive and diverse environmental profile which presents significant current and developing environmental challenges and opportunities for environmental business development. LAC countries contain exploitable natural resources, sustainable development

opportunities and a consumer base that is beginning to embrace the “green movement”⁴¹ Taken together these factors combine to provide a robust climate for the development of environmental markets and opportunities for firms engaged in a wide range of environmental and conservation activities.

In addition to the national and regional challenges associated with the conservation and sustainable utilization of natural resources, LAC countries are experiencing significant early economic impacts caused by global climate change. The potential economic impact of widely-accepted degradation projections has resulted in a regional effort to develop methodologies to assess and strengthen, “capacities for participatory environmental governance through the collaboration of government and non-government stakeholders.”⁴² Mitigation and adaptation technologies focusing on probable environmental impacts produced by global climate change present a significant potential market for environmental technologies, both in terms of services and goods. LAC ecosystems and associated eco-regions represent some of the most diverse in the world. The services these regions provide are important nationally, regionally and globally and national as well as international recognition of the value these systems provide is a regional priority.

RECOMMENDATION: The prioritization and identification of ecological services throughout LAC countries is creating opportunities for market expansion and development by U.S. environmental firms. The U.S. should seize these opportunities. Negotiating the competitive, regulatory and policy pitfalls will be critical to obtain access to these markets.

Western Europe

Western Europe contains both developed and developing environmental sectors and represents about 25% of the world environmental market, second only in size to the United States.⁴³ Members of the European Union (EU), in particular, have some of the highest environment standards in the world. While the diversity of countries and levels of development in this region present an environmentally rich opportunity, they also complicate environmental reform. TTDdeveloped nations see the need for environmental reform, while developing countries see environmental degradation as an unfortunate consequence of economic growth. This situation has resulted in more complex and specialized environmental issues for developed regions, and a focus on industrial pollution in more developing sectors.⁴⁴

The strength of the region’s environmental movement can be attributed to the strong role of government, the growing environmental market and public awareness. For example, as a direct result of significant threats to 42% of mammals, 15% of birds and 52% of freshwater fish, European nations have committed to protect biodiversity at more than 26,000 sites across the EU.⁴⁵ The European Green Belt Initiative goes beyond biodiversity and promotes trans-boundary cooperation. Ecolabels that identify products and services rigorously tested against high environmental and performance standards represent a growing initiative that characterizes the EU’s market strategy with its growing

public awareness. These labels identify products and services that meet high environmental standards from raw material extraction through to production, distribution and disposal.

RECOMMENDATION: In order to capitalize on the European market, the U.S. will have to, “establish mergers, joint ventures or alliances with well established European companies, engage in technology transfer of cost-effective air, water or solid waste techniques, and develop novel service approaches to homogeneous markets.”⁴⁶ Paramount to such efforts will be an understanding of both the environmental legislation of the individual country and that of the EU.⁴⁷

Russia and Eastern Europe

Severe environmental degradation exists throughout the countries of Eastern Europe and the Former Soviet Union (FSU). This region, populated with large steel and chemical industries using poor quality coal with limited treatment of solid waste, face grave pollution problems.⁴⁸ Largely, these environmental problems are the legacy of the antiquated Soviet Union and Eastern European policies that promoted heavy industries and discouraged conservation.

A key player in addressing environmental issues is the Organization for Economic Co-operation and Development (OECD) which, along with the international community and the United States continue to promote and elevate environmental requirements, awareness and recognition for better environmental enforcement. Specifically, the Europe, Caucasus and Central Asia (EECCA) provide an organization to further develop and execute their respective national and in many cases multi-national environmental policies of the member countries.⁴⁹ Of note, most EECCA countries are continuing to experience sizeable economic growth. Partnerships through the EECCA consortium, individual efforts, bilateral and multilateral agreements between countries along with private sector engagement have all contributed to the growing environment market. Increasing percentages of EECCA countries’ GDP are being committed to environmental efforts. Noticeable advancement in the environment market in EECCA countries include compliance assurance, water supply and sanitation, water resource management, and public awareness.

RECOMMENDATION: The United States Agency for International Development (USAID) and Department of State (DOS) continue to provide environmental assistance combating central deficiencies in air and water quality to create a healthier region.⁵⁰ These efforts have shown progress, in conjunction with OECD and the EECCA, supporting central and eastern Europe’s environmental initiatives through grants, funding and education. In order to further affect government efforts and public attitudes, the United States should continue its strong partnership with the international community’s and EECCA environmental efforts through Support for Eastern European Democracy (SEED) program, OECD participation, and bilateral agreements developed between nations.

The Middle East and North Africa

The most pressing environmental concerns in the Middle East and North Africa today are dwindling water resources and desertification. These threats are significant and, according to the United Nations Arab Human Development Report, the security of the region and its people face growing challenges from environmental stresses.⁵¹ Because of rapid population growth, often referred to as the “youth bulge,” the need for potable water, arable land, and energy for industrial development, is critical. Declining water resources for agriculture and human consumption present a tremendous challenge to Arab nations. According to the World Bank, the region is the world’s richest in oil and gas reserves, but one of the poorest in renewable water resources.⁵² In the Kingdom of Bahrain, for example, desalination plants are compensating for the lack of natural freshwater resources, and providing much of the drinking water.⁵³ Water scarcity, stressed groundwater systems and water pollution pose a major threat to human security according to the Arab Human Development Report.

For many countries in the Middle East and North Africa resource degradation and desertification is also a paramount concern. Desert has swallowed up over two-thirds of the total land area. Soil erosion and pollution are also reducing arable land, as rural populations increasingly migrate to cities in search of jobs. Unsustainable agricultural practices, wood removed for fuel, overgrazing, wind and floods have all contributed to desertification. The World Bank estimates the loss in agricultural productivity due to land degradation stands at about \$1.15 billion a year.⁵⁴ There is a significant need for strategic planning, environmental services, and ecological innovation in support of international efforts to reclaim arable land and stop desert encroachment.

RECOMMENDATION: The stability of the region depends on a healthy environment that can sustain the rapidly growing population. In countries where the U.S. has a military presence preserving and protecting the environmental infrastructure and resources will be crucial to reconstruction and winning the peace.⁵⁵ If the U.S. can assist in reducing or avoiding regional conflict over dwindling water resources and actively encourage efforts to halt desertification, it can play a significant role in creating stability in the region.

Sub-Saharan Africa

The environmental issues facing Africa are many and diverse, reflecting the wide range of climates, landscapes and types of government represented in this massive region. Serious environmental issues in Africa include air and water pollution, scarcity of water, inefficient use of natural resources, deforestation, loss of soil and soil fertility, and the dramatic decline in biodiversity and marine resources. These problems are exacerbated by the rapid population growth on the continent. With severe climatic variations throughout the continent, there have been extreme events such as flooding and drought. Rainfall records show that the average rainfall in Africa has decreased since the late 1960’s.⁵⁶ Seeking refuge from armed conflicts, populations have often settled in fragile ecosystem areas. The impacts from this have resulted in land degradation and

desertification, loss of natural habitat, changes in distribution of biodiversity, increased soil erosion and silting of rivers, dams, and coastal ecosystems.⁵⁷

In a social and political environment where fewer than 20 nations have democratic governments, dictatorships still flourish, and armed conflicts continue in several countries, approaches to environmental issues vary widely across the continent. One bright spot is the African Union (AU) initiative “to integrate Africa into a globalizing world through responsive and responsible leadership.”⁵⁸

RECOMMENDATION: The U.S. has a role to play, especially with regard to support for environment in this region. Some proposed areas of engagement include: increasing tax-related incentives for U.S. firms doing business in Africa; encouraging African governments to reduce corporate and capital gains taxes; and for carbon offsets: promulgating U.S. law to create incentives for investment in offset programs that would benefit Africa. The countries of Africa must also take responsibility, working individually and together to provide security for their people, particularly by enacting laws and educating the population on the benefits of improving the environment.

East and West Asia

The eight countries of East Asia, the nineteen of West Asia, and the United States are inextricably linked with all nations in the global fight to stem and reverse the increasingly calamitous effects of pollution and climate change.⁵⁹ Together, we must forge solutions that efficiently and effectively reverse these alarming trends. East and West Asia – including China – are particularly susceptible to environmental challenges, driven by burgeoning economic growth, mushrooming urban population density, and primary reliance on coal-based energy sources. Specifically, both East and West Asia have “experienced increasingly severe dust storms, which are believed to be caused by over-farming, over-grazing, and increasing use of irrigation. Plumes of dust from north China, mixed with toxic air pollution, now are a major public health concern in China, Korea, and Japan. Some of these aerosols even reach the United States.”⁶⁰ In Western Asia, three-fourths of the land is already desert.⁶¹ While parts of Asia are blessed with the benefits of significant oil, they are cursed with water pollution coming from spills, broken pipelines, and dumping, as every year “1.2 million barrels of oil are dumped into the Persian Gulf.”⁶²

Two nations serve as telling examples for the breadth and depth of environmental challenges facing this large region. In East Asia, China is the dominant force and recent decades of dramatic economic growth have resulted in this nation becoming the largest generator of greenhouse gases and environmental crises in water and air pollution. Due to its size and influence, China also has the opportunity to provide leadership by developing a true enterprise strategy that adopts sustainable policies to protect the environment as it pursues aggressive economic growth. In West Asia, Iran faces challenges to its water security and habitat. It is literally drying out, with ninety percent of wetlands having disappeared after two years of extreme drought at the turn of this century. Iran has an opportunity to reverse decades of environmental degradation and

pollution exacerbated by globalization and hardened by corrupt and inefficient governance.

RECOMMENDATION: Environmental hazards in East and West Asia affect areas well beyond this region and have the potential to destabilize individual nations and increase world tension. The U.S. should collaborate with countries in these two regions to develop environmentally progressive policies that focus on limiting greenhouse gas emissions in a manner that does not unduly hamper economic growth, and to spur investment and deployment of technologies in support of this effort.

Southeastern, Southern and Central Asia

Human activities in the pursuit of economic development have caused vast pressures on the environment, contributing to enormous challenges in this region. Specifically, air pollution, ecological degradation and resource depletion, lack of access to clean water and sanitation, toxic and hazardous agro-industrial waste generation and disposal are the major vulnerabilities. Recent changes in the hydro-meteorological processes of major river basins and the degradation and inundation of the region's coastal areas indicate that Southeast Asia will not be "safe" for long. Indonesia, Malaysia, the Philippines, Thailand, and Vietnam are all experiencing changing patterns of floods, coastal storm surges, and erosion. Water pollution has emerged as one of the more critical forms of environmental degradation. India and Pakistan have seen almost two-thirds of their surface water resources and a growing number of their groundwater reserves contaminated by organic toxic, biological and inorganic pollutants. In the Central region, the semi-arid and arid climate will likely experience further climate changes, exacerbating issues related to water and disasters, coastal development, agriculture and food security. Environmental policies are neither effective nor efficient in motivating significant environmental improvements, and policy instruments still present serious shortcomings.

The rapid growth of the global environmental market is evident in Asia. Environmental technology exports are an important part of this trend as ecological concerns grow along with economic development. Because Asia has successfully embraced the increased globalization of markets and international trade, leading to both foreign investment and rapid economic development, this region presents unparalleled opportunities for U.S. companies. As a developing region, Asia's GDP is dependent on the condition of the environment. Regional climate changes will especially affect the low-income populations of urban, highland, and coastal-island regions. In addition, good governance is central to improving the effective delivery of urban environmental services, management of natural resources and protection of critical ecosystems in Asia.

RECOMMENDATION: In addition to the tremendous market opportunities offered in this region, the United States should invest in fostering global goodwill by providing environmental solutions to the people of Asia. Specifically, the U.S. can use its technological prowess to find more economical solutions to secure clean water supplies and improve waste water treatment plants, bolstering development, public health, and

environmental protection. The transfer of scientific and technological advancements would allow Asian countries without similar capabilities to take advantage of new approaches toward environmental sustainability.

ESSAYS ON MAJOR ISSUES

North America: Environmental Crisis or Market Opportunity?

The United States, Canada and Mexico, in varying degrees, are experiencing many of the environmental concerns found around the globe. Water pollution and scarcity, air pollution and greenhouse gases, endangered species and threats to biodiversity, ocean and coastal water pollution, deforestation and soil erosion all plague some part of these three North American nations. Experts at the Lawrence Berkeley National Laboratory are adamant that we face extreme climate changes – hurricanes, downpours, snowstorms, flooding, droughts and heat waves – if we do not act soon.⁶³

Across North America, the facts about water use and abuse seem to confirm the belief of a prominent California venture capital firm: “Water is the next big crisis.”⁶⁴ Agricultural irrigation accounts for 70% of the fresh water used by humans.⁶⁵ The largest underground water supply on the planet, the Ogallala Aquifer, sits beneath the Midwestern U.S. and allowed that region to become the breadbasket we know today. But, in a classic case of tragedy of the commons, overuse by private interests has depleted about 60 percent of the Ogallala.⁶⁶ As water is withdrawn faster than nature can replenish it, the entire middle-section of the U.S. inches closer to environmental and economic disaster every day. On top of our wasteful ways, North Americans have a sorry history of polluting precious freshwater resources. Approximately one-third of Canadians are not served by waste-treatment plants, and the Canadian government reports 40 percent of the nation’s rural water wells may be contaminated by fecal bacteria and nitrates.⁶⁷ Wastewater from Mexico City that flows north and is used for irrigation in the state of Hidalgo has been linked to congenital birth defects and high levels of gastrointestinal diseases.⁶⁸

The situation with the air we breathe is no less dire. According to the Lawrence Berkeley National Laboratory, carbon dioxide levels in the atmosphere have gone up 20% in the past 50 years.⁶⁹ Mexico City, with a population of 15 million, is the poster-child of air pollution in North America. One government study in the late 1980s determined that nearly 5 million tons of contaminants were emitted annually into the atmosphere, a tenfold increase over the previous decade. Carbons and hydrocarbons from the region's more than 3 million vehicles account for approximately 80% of these contaminants, with another 15%, primarily of sulfur and nitrogen, coming from industrial plants. As a result, Mexico City residents had astonishingly high levels of lead and cadmium in their blood.⁷⁰

Biodiversity is the proverbial canary in the coal mine. Concerning ourselves with biodiversity is important precisely because we do not yet understand the significance and interactions of the planet’s species and ecosystems – “protection of biodiversity can be

viewed as an insurance policy against future catastrophes.”⁷¹ Sadly, global biodiversity is declining at an ever-increasing rate.⁷² Atlantic fisheries are fished-out, modern fishing methods trap and kill unintended species (including mammals), and river damming projects decimate salmon populations.⁷³ In North America, 39% of freshwater fish are at risk, up from 20% only a few decades ago.”⁷⁴ Land development and habitat fragmentation have adversely affected both large predators and the species on which they depend. As a result, we have created a biodiversity crisis with cascading effects, affecting individual species, the ecosystems in which they live, and the economics of the three North American nations experiencing these problems.⁷⁵

Naturalists and environmentalist have long preached the need to be better stewards of the planet. But which will work better to address climate change: market-based solutions or government-imposed policies and regulations? The answer is “both.” PG&E, a major California utility company, believes achieving greenhouse gas reductions will require both market-based (cap & trade and greenhouse gas taxes) and non-market based command and control measures.⁷⁶

Government intervention can force changes in the marketplace; in the U.S., the current environmental markets derive from enactment of the Clean Air Act (1963) and Clean Water Act (1977), both since updated over time. Experience suggests market-based emission controls work. The 1990 modifications to the Clean Air Act introduced a cap-and-trade system to address acid rain. Over time, sulfur-dioxide emissions were cut almost in half, at a much lower cost than predicted.⁷⁷ In 2006, regulators approved the Environmental Defense Fund’s proposal to end commercial overfishing of red snapper in the Gulf of Mexico. The program made fisheries more sustainable while increasing per-boat revenues by 80 percent.⁷⁸

To extend this model to the much larger issue of climate change, venture capital experts suggest “we need a price on carbon to build a market around it.”⁷⁹ What we need are market incentives for reducing greenhouse gas emissions, and cap and trade is a reasonable way to create those incentives.⁸⁰ But what are the economic effects of government mandates? Nobel laureate Paul Krugman states, “We’ll hear cries that climate change policies will destroy jobs and growth. The truth, however, is that cutting greenhouse gas emissions is affordable as well as essential. Serious studies say that we can achieve sharp reductions in emissions with only a small impact on the economy’s growth.”⁸¹

The Environmental Defense Fund states, “If we can make environmental protection profitable, people will invent all kinds of ways to make it happen. That’s the power of market solutions.”⁸² Indeed, some experts believe we already have the “scientific, technical, and industrial know-how to solve the carbon and climate problem for the next half-century”⁸³ but lack the political will and economic incentives to make it happen. Scientists are frustrated: “It’s time to have an adult conversation about climate change—scientists agree climate change is happening and have moved on to finding solutions.”⁸⁴

Fortunately, the U.S. has the right “ecosystem” to spur innovation – the American mind-set allows for trial and error within a risk-taking culture that encourages entrepreneurship.⁸⁵ Experts believe the trillion dollar shift from carbon fuel to renewable energy will create massive market value.⁸⁶ But science, technology and engineering need to be combined with economics and policy to bring ideas to scale.⁸⁷ Typically, universities partner with government labs and commercial enterprises to conduct research and bring green ideas to market. At the Lawrence Berkeley National Laboratory, technology transfer is a key function, with the aim of sharing technology with society to solve environmental problems and contribute to regional and national economic development.⁸⁸

According to Chevron Energy Solutions, renewable energy sources “are not yet economic without incentives but energy efficiency is economic now.”⁸⁹ Reducing energy demand through efficiency and government policy is the most important thing we can do to slow climate change. In the U.S., we need to retrofit existing buildings to gain efficiency; European buildings are more efficient than U.S. buildings, and Japanese buildings are even more efficient than European buildings. But economics are important too.⁹⁰ Scientists at the Lawrence Berkeley National Laboratory say that, when crafting energy efficiency initiatives, the ideal payback term is three years or less; businesses balk at longer payback periods. Energy efficiency efforts must be designed so they don’t decrease worker efficiency, or else the financial gains are wiped out.⁹¹

The green market is drawing the attention of big players like Wal-Mart, Home Depot, Clorox, and Procter and Gamble.⁹² In fact, large corporations create a competitive edge by marketing their partnerships with environmental non-profits to “go green.” Wal-Mart exerts extraordinary influence over suppliers. The Environmental Defense Fund proclaimed, “one company influences 100,000 suppliers,” after helping the world’s largest retailer improve energy efficiency, cut waste, and launch a sustainability index to assess the environmental performance of Wal-Mart’s suppliers.⁹³ In 1990, McDonald’s collaborated with the Environmental Defense Fund to “do away with foam-plastic sandwich boxes and eliminate 150,000 tons of packaging waste over ten years. Others in the restaurant industry quickly followed suit.”⁹⁴ Clorox approached the Sierra Club about certifying its “Green Works” line of environmentally-friendly products. After independent testing, the Sierra Club granted Clorox permission to use the Sierra Club logo on Green Works products. Green Works is now an industry leader in the entire product segment.⁹⁵ Bechtel, a giant in the engineering, construction, and project management industry, designs energy efficiency into their projects, convincing customers of life cycle savings even if up-front costs are higher. After receiving client feedback that the sustainability aspect of project proposals is what put them above the competition, Bechtel now quantifies the value of sustainability in project proposals.⁹⁶

Environmental challenges in North America may be caused by, or contributors to, climate change; but one thing is clear: the climate is changing and all nations are affected. A combination of government actions and market-based solutions must be pursued to slow the impending crisis.

Sustainability: The Business of Being Environmentally Sound

The American people demand more environmentally friendly products and services. A 1989 survey by the Michael Peters Group surprisingly found that 89% of all Americans were concerned about the environmental impact of the products they bought, and 78% were willing to spend 5% more for them if they were environmentally friendly.⁹⁷ Subsequent surveys continue to bear this out. These surveys clearly show that there is a market for green. However, to date, it is difficult to demonstrate that consumer behavior reflects the results of these surveys.

Acknowledging some of the market obstacles to the implementation of green technology, government is providing incentives to consumers and businesses in an attempt to improve clean technology viability. For instance, “the \$787-billion federal stimulus package (in 2009) included \$79-billion for renewable energy,”⁹⁸ and the federal government provided tax incentives in 2009 to encourage the development of the green technology market.⁹⁹ State and local governments also provide various incentives in order to encourage increased investment in and improve the economic viability of clean technology. This significant investment by government is a critical mechanism to aid in the maturation of green markets.

Recognizing the market opportunities of clean technology, venture capital companies are making significant investments in clean technology. In 1995, venture capitalists in the United States invested approximately \$80 million into 36 clean technology projects. By 2009 this increased to \$4.1 billion spread over 277 projects.¹⁰⁰ This growth of venture capital investment in clean technology is expected to continue. Sixty three percent of global venture capitalists intend to increase their investments in clean technology.¹⁰¹ Based on these data, it is clear that private sources of revenue believe that clean technology is worth increased investment.

Although there is currently significant public and private investment in clean technology, which appears to have permanently established itself as a major market driver for the future, there is risk. Makower wonders if the “ever-growing green activity in the business world represents a true transformation ... or is it merely nibbling at the edges of the problems?”¹⁰² Is there a green bubble? Unlikely. A study sponsored by Siemens in 2009 finds that sustainability is “no longer seen as a niche activity in corporate America.” Instead, there has been “a substantial growth in sustainability activity ... with a shift in focus from internal operations and public relations to a core part of business performance.”¹⁰³ American companies are beginning to see sustainability as being profitable. “More than three quarters of corporate executives expect sustainability efforts to retain and attract customers and to drop costs of doing business,”¹⁰⁴ while over 60% believe “sustainability will serve the financial performance of the company.”¹⁰⁵ Businesses expect tangible gains from investing in sustainability.

As noted above in the discussion of North American environmental issues, one of the leaders in corporate sustainability is Wal-Mart. In October 2005, Wal-Mart set three core sustainability goals: “to be supplied 100 percent by renewable energy; to create zero

waste; and to sell products that sustain our resources and the environment.”¹⁰⁶ Wal-Mart is actively pursuing these goals through renewable energy and energy efficiency projects, as well as reduce – reuse – recycle programs and high performance buildings.¹⁰⁷ Wal-Mart is also using its considerable leverage to improve the sustainability of its supply chain. It has also developed an index that it will use to evaluate the sustainability of its suppliers and educate its customers. Even treehugger.com praises this effort as being one of the “biggest motivators to make truly 'green' products ever.”¹⁰⁸

General Electric (GE) has also made sustainability a core part of its business. Its citizenship framework consists of three supporting pillars: “make money, make it ethically, and make a difference.”¹⁰⁹ GE has reduced CO2 emissions by over one million metric tons per year, equivalent to over two million people traveling from New York to San Francisco by airplane. GE has also reduced its energy usage by 4,420,000 MMBTUs, equivalent to the electricity required to power San Francisco for 212 days.¹¹⁰ GE’s belief “that improving environmental impact is good for business”¹¹¹ led to the “ecomagination” line of products ranging from polymer bottles to hybrid locomotives. In 2008, this product line generated over \$17 billion of revenue.¹¹² These, along with myriad other efforts, resulted in GE being named the world’s most sustainable large corporation at the World Economic Forum.¹¹³

Many other companies have embraced increased sustainability. General Motors, in addition to improving vehicle fleet efficiencies (in part in response to legislated standards), reduced energy and water usage by 22% and CO2 emissions by 21% from 2005 to 2008. GM has fifty five facilities that are landfill-free.¹¹⁴ Dow Chemical “reduced its emissions by 28% while increasing its production volume 37% from 1994 to 2004.”¹¹⁵ DuPont “saved \$3 billion reducing its greenhouse gas emissions 80%.”¹¹⁶ Sustainability is increasingly a part of the fabric of American business.

American businesses appear to increasingly understand the economic benefits of environmental protection and sustainability. Consumers demand more and more green products and services. Government incentives are increasing in priority. Private investment is increasing to service growing green markets. More importantly, American industry is making sustainability a priority in its operations, and is realizing positive economic benefits. Combined, these efforts are critical to ensuring the continued competitiveness of U.S. industry and to ensuring the future security and prosperity of the American people.

CONCLUSION

Today, it is clear that preserving our natural resources for future generations and strengthening environmental protections are critical to the continued security and prosperity of the American people. Our government has provided significant funding and other incentives to begin to address environmental issues, particularly those that have an impact on public health, but it must do more. Private venture capital has increased significantly over the past decade in order to attempt to meet identified market demand

for environmentally-friendly products and services. We expect this interest to continue to expand, and the interplay between regulations and our entrepreneurial system to be a source of economic strength.

The overwhelming consensus among government officials, business people, academics and representatives of international and nongovernmental organizations is that climate change is occurring and will materially affect our national interests, including power, sovereignty and wealth. The United States should seize the opportunity to exert international leadership by promoting sound environmental practices by example and by encouraging collaboration. We must focus domestically on developing environmentally progressive policies and technologies, and internationally on crafting and negotiating progressive environmental protection mechanisms.

The attention devoted to developing the technologies and attitudes required for a green, sustainable economy, is important, but it is not yet sufficient. Enhanced environmental literacy will result in better understanding of the causes and impacts of developments like climate change. It will also broaden awareness of the need to change behaviors that can mitigate climate change effects. The environment industry creates opportunities for the U.S. to invest in education focusing on science, technology, engineering and mathematics. This in turn will help ensure that we maintain our capacity to innovate, an historic strength of the U.S. and a critical component of our transition to an economy focused on sustainability.

Protecting our global environment is a strategic imperative and critical to our national security. Coupling our nation's preeminent leadership with our environment industry is key. Simply put, failure to follow this strategy exposes us to heightened risk from depleted global resources and increased world tensions. U.S. businesses must remain competitive in order to survive in a green world. If not, both our economy and way of life are threatened. However, as many businesses are proving by focusing on sustainability, it is not only possible to survive while improving environmental performance, it can be profitable. This ability to increase profitability while reducing environmental harm is one of the most critical factors to ensuring American businesses remain competitive, our economy remains strong, and our resources are preserved.

APPENDIX A

Exhibit 2-1 Environmental Industry Segments

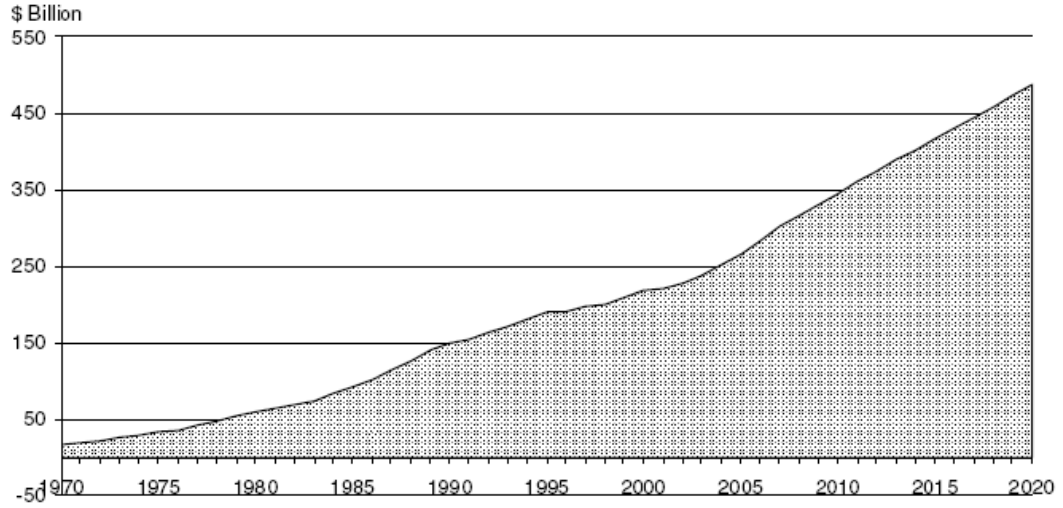
Segment	Description	Examples of Clients
Environmental Services		
Environmental Testing & Analytical Services	Provide testing of "environmental samples" (soil, water, air and some biological tissues)	Regulated industries, Gov't, Environmental consultants Hazardous waste and remediation contractors
Wastewater 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 eqmnt.	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

U.S. Environment Industry Revenue

Exhibit 2-10 Historical and Projected Size of U.S. Environmental Industry



Source: Environmental Business Journal



APPENDIX C

Exhibit 2-15 Projected Growth in the U.S. Environmental Industry, 2007-2012

ENVIRONMENTAL INDUSTRY SEGMENT	08-10 Avg . Ann.Growth	Revenue & Growth (\$ Billions)					
		2007	2008	2009	2010	2011	2012
SERVICES							
Analytical Services	1.4%	1.89	1.95	2.02	2.09	2.17	2.25
Wastewater Treatment Works	4.4%	39.06	40.78	42.57	44.40	46.28	48.22
Solid Waste Management	4.0%	53.20	55.33	57.54	60.90	64.40	68.03
Hazardous Waste Management	1.6%	9.08	9.18	9.28	9.39	9.40	9.39
Remediation/Industrial Services	4.0%	12.18	12.66	13.17	13.81	14.42	14.98
Consulting & Engineering	5.0%	25.61	27.12	28.36	29.65	30.95	32.28
EQUIPMENT							
Water Equipment and Chemicals	5.2%	27.29	28.71	30.20	31.77	33.39	35.04
Instruments & Information Systems	4.6%	5.49	5.86	6.18	6.46	6.89	7.33
Air Pollution Control Equipment	-0.8%	18.31	17.97	17.65	17.34	16.95	16.48
Waste Management Equipment	2.1%	11.00	11.23	11.47	12.01	12.56	13.01
Process & Prevention Technology	7.0%	1.80	1.93	2.06	2.20	2.35	2.51
RESOURCES							
Water Utilities	3.6%	37.89	39.25	40.67	42.33	43.98	45.61
Resource Recovery	6.6%	31.23	32.04	34.16	36.21	38.02	39.92
Clean Energy Systems & Power	12.0%	28.30	31.70	35.50	40.70	46.59	52.85
TOTAL INDUSTRY:	4.8%	302.3	315.7	330.8	349.3	368.3	387.9
AVERAGE GROWTH RATE:	1.4%	7.2%	4.4%	4.8%	5.6%	5.5%	5.3%

Source: Environmental Business Journal.

APPENDIX D

Summary of Key U.S. Environmental Legislation

Clean Air Act (CAA): The CAA was first enacted in 1963 and is the comprehensive Federal law that regulates air emissions from area, stationary, and mobile sources. This law and amendments authorize the U.S. Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health. The Act was amended in 1990 to address acid rain, ground-level ozone, stratospheric ozone depletion, and air toxics. There was a significant development regarding the CAA in 2007. Specifically, the United States Supreme Court ruled the EPA has the authority under the CAA to regulate carbon dioxide and other greenhouse emissions.¹¹⁷

National Environmental Policy Act (NEPA): NEPA was enacted in 1969 and requires “all federal agencies to integrate environmental values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions.”¹¹⁸ This is accomplished through a three step process which includes an assessment to determine the applicability of NEPA to the proposed action, the accomplishment of an environmental assessment, and if required, the accomplishment of a detailed environmental impact statement.

Clean Water Act (CWA): The CWA was enacted in 1972 and established the basic structure for regulating discharges of pollutants into the waters of the United States. It allows the EPA to set water quality standards for all contaminants in surface waters. The Act makes it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit is obtained under its provisions. It also empowers the EPA with the authority to implement pollution control programs including the setting of industrial wastewater standards.

Endangered Species Act (ESA): The ESA was enacted in 1973 and provides for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The law requires federal agencies to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or negatively impact their habitat. The law also prohibits the "taking" of any listed species of endangered fish or wildlife. It also prohibits the import, export, interstate, and foreign commerce of listed species.¹¹⁹

Toxic Substances Control Act (TSCA): The TSCA was enacted in 1976 to give the EPA the ability to track industrial chemicals currently produced or imported into the United States. The EPA can ban the manufacture and importation of chemicals that pose what it deems to be an unreasonable risk. Also, the EPA tracks thousands of new industrial chemicals developed annually with either unknown or dangerous characteristics. The EPA can control these chemicals as necessary to protect human health and the environment.¹²⁰

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): CERCLA (commonly referred to as Superfund) was enacted in 1980 and created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. \$1.6 billion was collected and the tax went into a trust fund for cleaning up abandoned or uncontrolled hazardous waste sites.¹²¹



ICAF

APPENDIX E

Summary of Selected International Environmental Agreements

Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES): CITES entered into force in 1975 and is widely recognized as one of the world's most comprehensive conservation agreements. CITES is intended to ensure the international trade in specimens of wild animals and plants does not threaten their survival. CITES currently protects over 30,000 species of animals and plants, whether they are traded as live specimens, fur coats or dried herbs,¹²² and currently has 175 parties, including the U.S.

Vienna Convention for Protection of the Ozone Layer: This treaty entered into force in 1988. "The ultimate objective of the Convention is to protect human health and the environment against adverse effects resulting from human activities which modify or likely to modify the ozone layer."¹²³ The United States has signed and ratified the Vienna Convention. The Convention's Montreal Protocol controls the production and consumption of the most commercially and environmentally significant ozone-depleting substances.¹²⁴ This includes chlorofluorocarbons commonly used as propellants and refrigerants. The Montreal Protocol has been ratified by 196 countries including the U.S.

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal: The Basel Convention entered into force in 1992. It is the most comprehensive global environmental agreement on hazardous and other wastes. The Basel Convention aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes.¹²⁵ The Basel Convention has 172 parties. While the U.S. has signed, it has not yet ratified the Basel Convention.

Convention on Biological Diversity (CBD): The CBD entered into force in 1993 and was inspired by the world community's growing commitment to sustainable development. The CBD entered into force on December 29, 1993. It has three main objectives. These include the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.¹²⁶ The agreement currently has 193 parties and has been ratified/accepted by 168 nations. The U.S. has signed the CBD but has not ratified the agreement.

United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol: The UNFCCC entered into force in 1994 and sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It "recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases."¹²⁷ The Kyoto Protocol sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. These reductions amount to an average of five percent against 1990 levels over the five-year period 2008-2012.¹²⁸ The U.S. is a party to the UNFCCC. The Kyoto Protocol has 190 parties and has been

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