
The Economic Case for Climate Action



Presidential Climate Action Project

*National Climate Leadership:
The First 100 Days and Beyond*

This article is drawn from the lead chapter of the Presidential Climate Action Project Plan for Presidential action for the first 100 days in office for the next President of the United States
www.natcapsolutions.org/publications_files/PCAP/PCAP_EconomicCaseForClimateProtection_04xii07.pdf

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OVERVIEWⁱ

Business leader Ray Anderson asks: when you meet your Maker, what will you talk about?

Will you proudly discuss your rate of return? Or how you enhanced shareholder value?

What will your legacy be?

The way most companies do business, most communities operate, and most of us live will leave a legacy of an environmentally and financially impoverished planet.

We can, we must do better.

This paper will describe how U.S. Federal policy that does just that is also the best way to do business. It will set forth the evidence that there is a suite of policy measures to help the market solve the climate crisis not at a cost but as an investment in a far better future for all of the world's people. It will describe how this future is already emerging remarkably rapidly despite Federal policy that restricts it at every turn. Finally it sets forth the economic policies that the next President can implement in the first hundred days in office that can unleash the new energy economy and set the country on the course to prosperity, security and stewardship.ⁱⁱ

Introduction

Climate change represents a unique challenge for economics: it is the greatest and widest-ranging market failure ever seen – Sir Nicholas Sternⁱⁱⁱ

Creating the low-carbon economy will lead to the greatest economic boom in the U.S. since we mobilized for World War II – Former President Bill Clinton^{iv}

Sir Nicholas Stern and Bill Clinton both have it right. Global climate change has been our greatest market failure. Now it's our greatest market opportunity. Market mechanisms are enormously powerful tools to apply to such challenges as climate change.

The economy is a key issue in every presidential election, but in the 2008 campaign the climate crisis should force candidates to recognize that the health of economies and ecosystems are interdependent (see box).

Solving the climate crisis is urgent, but perhaps more importantly, doing it in a smart way will unleash enormous economic opportunity. Mitigating greenhouse gas emissions worldwide will require a crash program to use energy more efficiently, and to use renewable energy sources. Doing this can cut costs and drive competitiveness, spread the use of clean energy technologies that already are cost-competitive and available and develop next-generation technologies in virtually every sector of the economy.

Capturing these opportunities will all require investment, management attention, and determination. The fact that these resources are scarce goes a long way to explain why the opportunities remain to be captured: absent leadership and a widespread recognition of the urgency, resources have been deployed elsewhere. Energy has also been a relatively small part of most organization's budgets, so investing time and money in cutting energy use has been a relatively low priority for a typical manager. Unless the issue is elevated to the level of CEO concern, it has been hard to get action in corporations or governments. In addition, as described in detail below, there are myriad barriers to reducing energy use, even though doing so will save money quickly. Collectively these hurdles have created a hassle factor that for most executives, it's just been worth surmounting – yet.

But when the necessity of implementing a new energy economy is understood, the entrepreneurial opportunities will be unprecedented. Far from the crushing cost that some have called the price of climate protection, the investments in using energy more productively and in unleashing the new energy economy will deliver impressive returns. To give just a few examples:

- Researchers at Lawrence Berkeley National Laboratory estimate that an investment of more than \$300 billion will be needed worldwide over the next 20 years to provide low-carbon electric power and equipment to 1 billion people who now do not yet have access to electricity.^v The World Bank estimates that an investment of up to \$40 billion annually will be needed worldwide to adapt to climate change. Such investments will create 10 times the jobs that a similar amount invested in conventional power stations would.^{vi} Clean technology has become the fastest growing sector in venture capital and private equity investment, with a 2005 market valuation of \$50 billion. The amount of global energy sector investment into renewables reached 10%. A survey that year of 19 venture capitalists investing in 57 European clean tech firms showed average annual returns since 1999 of almost 87%.^{vii}
- New low-carbon fuels are needed to replace the 85 million barrels of petroleum the world consumes each day and the 385 million gallons of gasoline burned daily in the United States^{viii} and the much higher fuel consumption projected for the future. Production of biofuels grew globally by 95% between 2000 and 2005 and should account for 5% of transport fuels by 2020. By 2015 this should create more than 200,000 new U.S jobs in ethanol production alone.^{ix} In contrast, current high oil prices represent one of the biggest transfers of wealth in history, redistributing 1% of world GDP each year. American oil consumers now pay \$5 billion more for oil every day than they did 5 years ago. In 2007, \$2 trillion will flow from customers to the oil companies and oil-producing nations.^x
- According to the World Business Council on Sustainable Development, there were 700 million “light duty vehicles” worldwide in 2000. That number is expected to increase to 1.3 billion in 2030 and to more than 2 billion by 2050.^{xi} New applications of urban design, mass transit and vehicle efficiency are needed to prevent massive increases in transportation-related carbon emissions. Creating this infrastructure will revitalize aging downtowns and generate jobs.

- In December 2006, Mayor Michael Bloomberg announced a remarkable plan – PLANYC 2030 -- to create affordable and sustainable homes for nearly one million more New Yorkers, ensure that all residents live within a 10-minute walk of park, add public transit capacity for millions more commuters, upgrade energy infrastructure and achieve “the cleanest air of any big city in America” – all while reducing the city’s greenhouse gas emissions by 30%.

In the past, the United States led the world in the development of “green” technologies. Solar electric cells and wind turbines were first developed here. Today, due to progressive government policies, countries such as Japan, Germany and Denmark have taken the lead in solar and wind power. Renewables now create more new jobs in Germany than any other industry.^{xii} Denmark aims to get 60% of its energy from renewables by 2010. Japan was first-to-market with hybrid vehicles. Toyota, which this year surpassed General Motors as the world largest car company, expects hybrid vehicles to rise from 6% of its U.S. vehicle sales in 2005 to 20% by 2012.^{xiii} It is time again for the United States to become the world leader in developing the goods and services needed for low-carbon economic development worldwide.

The good news is that the transformation of the U.S. economy already is underway, and there is a strong business case for acting even more aggressively to protect the climate. Leading companies and communities are cutting their costs, creating jobs, increasing profits and strengthening shareholder value by doing just this.^{xiv}

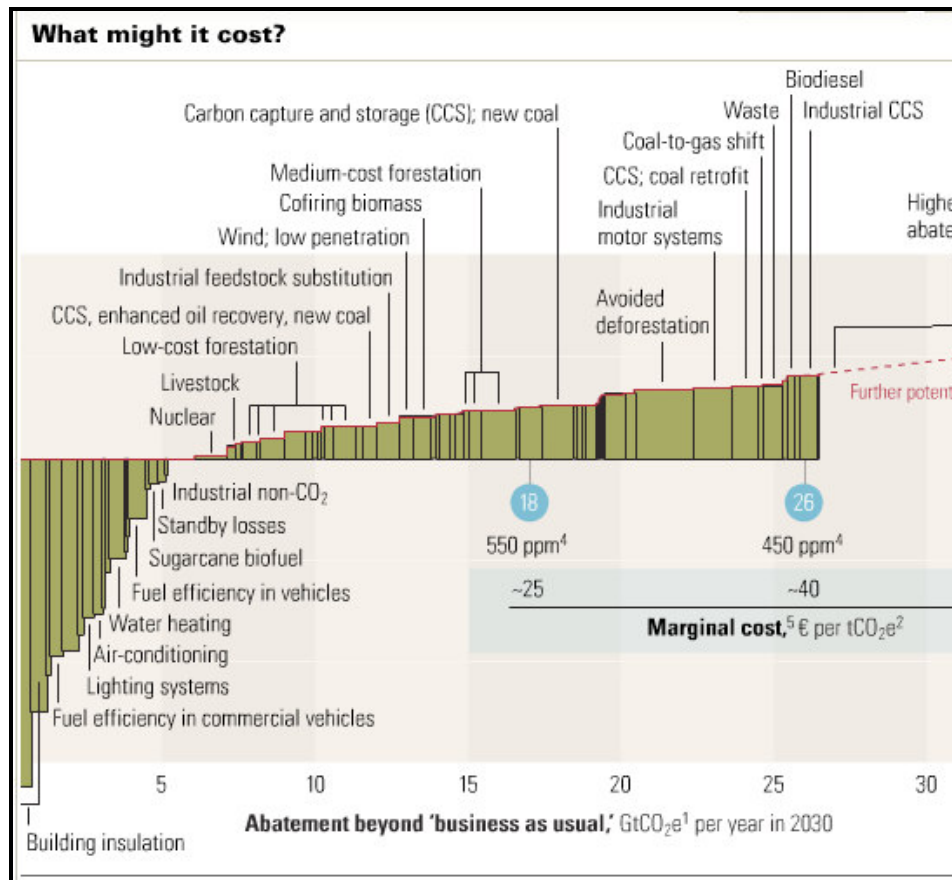


Figure 1 A Cost Curve For Greenhouse Gas Reduction^{xv}

The McKinsey study profiled in Figure 1 is one of a growing number of studies are finding that the challenge can be met at little or even negative cost. The McKinsey study found that greenhouse gas emissions could be stabilized at current levels and reduced on the scale that scientists say will be necessary to protect the climate at costs less than the world spends on defense or insurance and around a third of the estimated impact of recent oil price rises.^{xvi}

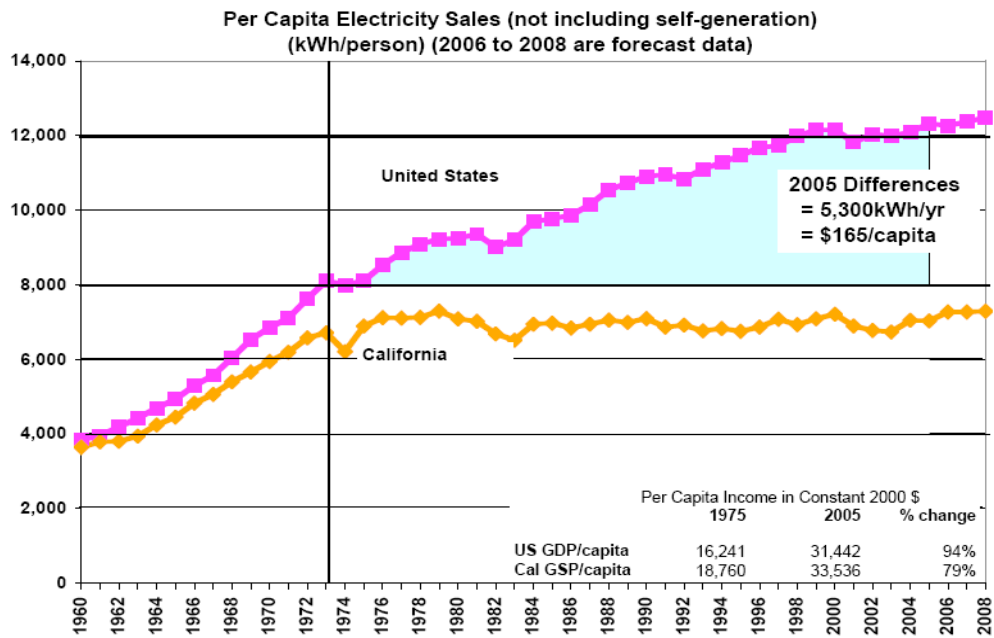
Although individual numbers can be questioned (the study uses historic nuclear costs, not the marginal costs of building new plants, and almost no one expects that carbon capture and sequestration of carbon emissions from new coal plants can be brought on without doubling the cost of coal, the shape of the graph is roughly right: most of the energy efficiency that by some estimates can cut energy use by at least half, comes on at a dramatic savings, and the measures needed to keep carbon emissions under 450 parts per million (the highest range that scientists believe the world can safely manage) are well within the range of acceptable investments.

“This is a hugely important message to policy makers everywhere, not least those in the United States Congress,” the New York Times editorialized in May 2007. “Many of them have been paralyzed by fears...that a full-scale attack on climate change could cripple the economy.”^{xvii}

Many corporations and communities are not waiting. DuPont, GE, Alcoa, Caterpillar, PG&E, Lehman Brothers and others, acting as members of the U.S. Climate Action Partnership, or USCAP,^{xviii} have called for national legislation to cap carbon emissions, stating, “In our view, the climate change challenge will create more economic opportunities than risks for the U.S. economy.”^{xix}

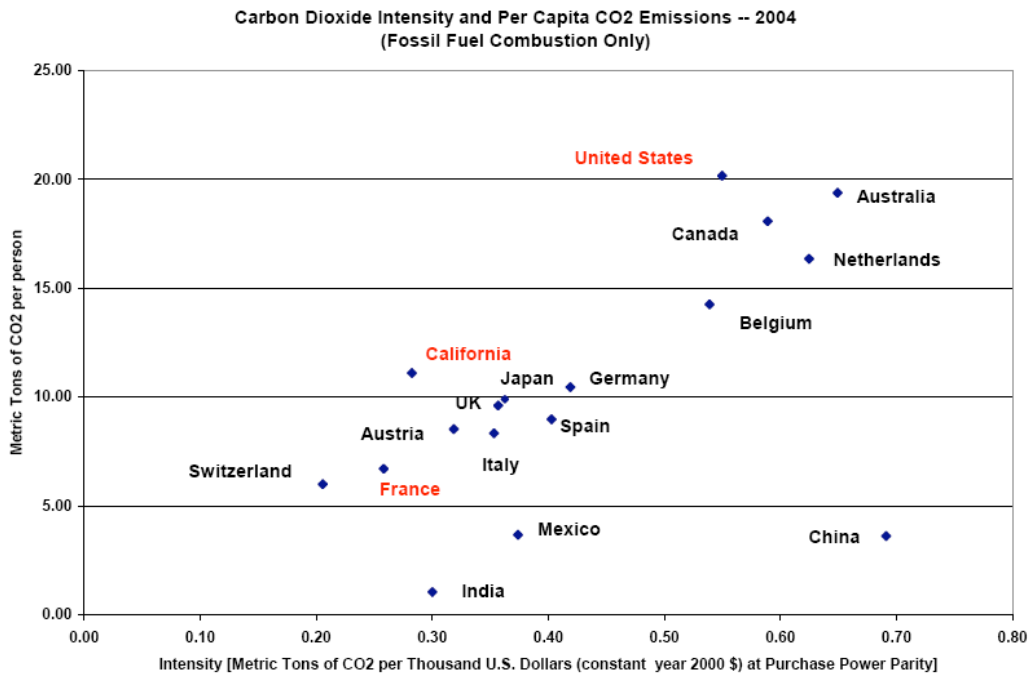
At the same time, farsighted leaders of cities, states, campuses and others are implementing climate protection efforts, cutting their costs, creating jobs and enhancing their economies by reducing their carbon footprint. As of October 2007 almost 750 American Mayors have pledged their cities to meet the goals set forth in the Kyoto Protocol or reduce their emissions of greenhouse gasses by at least 7% by 2012. Some have already met even more aggressive targets, ranging from a goal of 20% reduction by Portland to a goal of 42% reduction over the same time frame by Sebastopol, California.^{xx}

The world’s sixth largest economy – the State of California -- provides an example. Since 1974, Californians have held their energy consumption to zero growth while national per capita energy consumption grew 50% (figure 2). The state’s per capita carbon emissions have dropped 30% since 1975 (figure 3).



Source: Arthur Rosenfeld, California Energy Commission

Figure 2: California vs. U.S. Energy Demand



Source: Arthur Rosenfeld, California Energy Commission

Figure 3: California and U.S. CO₂ Intensity

By one estimate, the average family in California is paying about \$800 less for energy each year than it would have had the state not actively pursued energy efficiency.^{xxi} California's relatively mild climate is part of the reason the state's energy consumption is relatively low. But progressive policies and higher energy prices have played an important role. In 2004, California ranked 12th in the nation in energy prices, but only 45th in energy costs per person.^{xxii}

Communities and companies that are implementing climate protection programs are finding that smart, comprehensive approaches to climate planning make them more competitive and put hundreds of billions of dollars back into the economy from savings. A local government Commissioner from Portland, Oregon stated, "We've found that our climate change policies have been the best economic development strategy we've ever had. Not only are we saving billions of dollars on energy, we are also generating hundreds of new sustainable enterprises as a result."

Programs to ensure that buildings use less energy, and to encourage the use of efficient cars, appliances and machines generate immediate energy savings, but they also deliver economic development in cities and states. They create new manufacturing companies, building retrofits, new, decentralized energy systems, new farm income, etc. and spur the creation of a dynamic, transformative clean energy economy that saves money, generates jobs and confers economic opportunity.

This paper presents some of the opportunities now being captured by leading companies and communities.

The Business Case for Climate Protection

American businesses were among the earliest actors to undertake aggressive climate protection programs.

- DuPont pledged in 1999 to reduce its emissions of GHG 65% below its 1990 levels by 2010, and to get 10% of its energy and 25% of its feedstocks from renewables. It made this announcement in the name of increasing shareholder value and delivered on that promise, when, during the same period the value of DuPont stock increased 340% as the company had reduced global emission reductions 67% for a savings to date of \$3 billion.^{xxiii}
- ST Microelectronics pledged to become carbon neutral (zero net CO₂ emissions) by 2010 with a 40-fold increase in production. Figuring out how to do this drove the company's innovation, taking it from the number twelve microchip manufacturer in the world to the number six. ST gained market share, won awards and reckons it will save almost a billion dollars by the time it meets its goal.
- The business group, New Voice of Business, instrumental in getting both the million solar roofs bill and the California Climate Protection legislation (mandatory carbon caps) passed in California, testified that there are two kinds of businesses now: those from the last century and the businesses of the future. New Voice, stating that it represents the latter, called for strong government programs to drive a transition away from carbon fuels to renewable energy.^{xxiv}
- In December 2004, Chicago Climate Exchange began trading carbon in a country with no law that said companies had to. Inaugural members DuPont, ST, Baxter Health Care, the City of Chicago and 13 other businesses contracted to reduce their emissions by 1% a year. To the extent that they reduced even further, they created tradable Carbon Financial Instruments (CFI's), which they then sold to such members as World Resources Institute or Natural Capitalism, who wished to become carbon neutral, but lacked direct emissions to reduce (both organizations implemented energy efficiency measures and purchased wind credits, in addition). CCX now has over 330 members, companies, cities, states, counties, universities, NGOs and others, who have reduced their emissions a average of 9%. New members are required to reduce their emissions 2% a year.

- In 2006, the world's largest retailer, Wal-Mart, announced goals to reduce energy use at its stores 30% over three years, become carbon neutral, 100% powered by renewable energy, to double the fleet efficiency of its vehicle fleet, build hybrid-electric long-haul trucks, and sell millions of compact fluorescent light bulbs (CFLs). The company calculates that its campaign to selling 100 million CFLs in 2007 would save its customers as much as \$3 billion.^{xxv} Wal-Mart CEO Lee Scott observed that a corporate focus on reducing greenhouse gases as quickly as possible was just a good business strategy: "It will save money for our customers, make us a more efficient business, and help position us to compete effectively in a carbon-constrained world."^{xxvi}

These companies realize that cutting carbon emissions, and other GHGs is a "no regrets" strategy. Using energy more efficiently not only reduces carbon emissions, it saves money.

Businesses can also profit from using and investing in carbon free renewable energy, now the hottest investment target in the economy. The venture capitalist John Doerr recently stated that such green technology could match information technology and biotechnology as a significant money-making opportunity. He called climate change "one of the most pressing global challenges" and said that the resulting demand for innovation would create the "mother of all markets."^{xxvii} One study estimated that investment in renewable energy projects market could skyrocket to nearly \$50 billion by 2011, with double-digit annual growth rates.^{xxviii} In a separate report, the United Nations described, "A gold rush of new investment into renewable power over the past 18 months," which led the UN to conclude that clean energy could provide almost a quarter of the world's electricity by 2030. It reported that more than £35bn was injected into wind and solar power and biofuels in 2006, 43% more than the preceding year. Sustainable energy accounts for only 2% of the world's total but 18% of all power plants under construction are in this sector.^{xxix}

Enhancing the Integrated Bottom Line

Businesses that reduce their carbon emissions strengthen every aspect of shareholder value. The validity of this management approach is borne out by the recent report from Goldman Sachs, which found that companies that are leaders in environmental, social and good governance policies are outperforming the MSCI world index of stocks by 25% since 2005. Seventy two percent of the companies on the list outperformed industry peers.^{xxx}

Corporate managers are increasingly realizing that value returned to the owners, the real metric of success, derives from more than just attention to next quarter's profits – indeed the Financial Accounting Standards Board (FASB) has recently announced that it will revise its definition of "profit" away from this short-term fixation.^{xxxii}

Shareholder value is enhanced when a company grows top-line sales, cuts its costs, better manages its risks, enhances labor productivity, drives innovation, better manages its supply chains and stakeholders, etc. These constituents of what is now known as The Integrated Bottom Line^{xxxiii} are all enhanced by saving energy and reducing greenhouse gas emissions. Companies that implement climate protection programs enhance financial performance from energy and materials cost savings in industrial processes, facilities design and management, and fleet management. It enhances core business value through sector performance leadership and first-mover advantage, gains greater access to capital, improves corporate governance, and strengthens its ability to drive innovation, and improves government relations. Doing this helps a company retain competitive advantage, enhance its reputation and brand equity, increase its ability to capture market share and differentiate its product. Such programs increase a company's ability to attract and retain the best talent, increase employee productivity and health, improve communication, creativity, and morale in the workplace, and better stakeholder relations.

Regardless of how severe the impact of climate change proves to be, and regardless of how drastically and how soon GHG come to be regulated at the federal level, these companies will be in a leadership position because by taking early action to deal responsibly with it, they cut their costs and got ahead of their competitors.

Cost reduction

As DuPont found, using less fossil energy by using energy more efficiently saves money, because it costs less to implement the energy savings measures than it does to buy and burn the fuel. In 1999, the company estimated that every ton of carbon it displaced saved it \$6.

Wal-Mart realized that changing the incandescent bulbs in its ceiling fan displays throughout its 3,230 stores (10 models of ceiling fans on display, each with four bulbs. Forty bulbs per store, 3,230 stores) could save the company \$6 million a year. Said Chuck Kerby the Wal-Mart employee who did the math, "That, for me, was an 'I got it' moment." ^{xxxiii}

Risk management

Failing to reduce energy use and tolerating carbon emissions is a high-risk strategy for a business. Volatility of energy supply and increasing prices, overall volatility in the geopolitical and geostrategic environment, threats to business from extreme weather events, a growing risk of liability claims for failing to act and a host of other reasons make aggressive carbon reduction action simply good business.

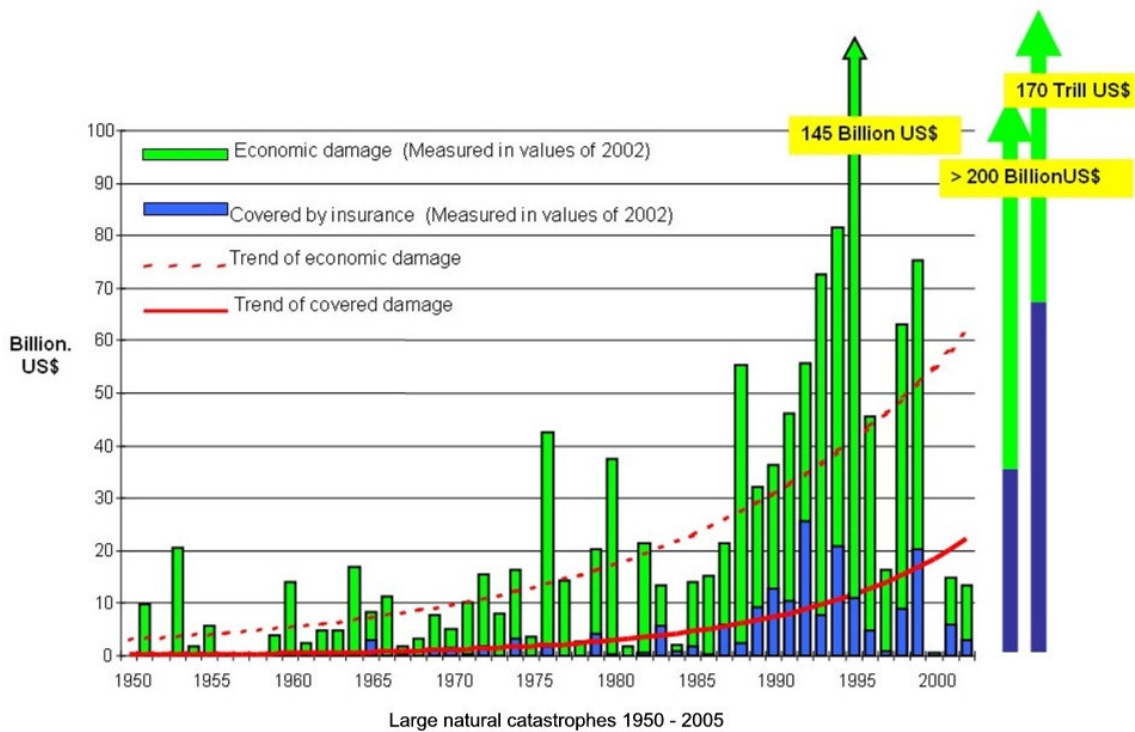


Figure: Evolution of economic costs, and insured costs of natural disasters worldwide^{xxxiv}

Corporate behavior that ignores such threats is coming to be seen as irresponsible. A 2003 Columbia Journal of Environmental Law article demonstrated the legal viability of lawsuits holding companies accountable for climate change. In July 2004, eight state attorneys general and New York City led the first-ever climate-change lawsuit against five of the nation's largest electric power generating companies to require them to reduce their CO2 emissions. Though the effects of such litigation on companies' market value and shareowner value remain to be seen, the first such suits have already been filed.^{xxxv} The Environmental Protection Bureau of the New York Attorney General's office has studied whether polluters can be sued along the lines of the successful tobacco litigation by states in the 1990s.^{xxxvi}

Climate change will have an impact on the value of investments and could cost U.S. public companies billions of dollars from decreased earnings due to cleanup costs and fines following the violation of environmental laws, increased operating costs due to changes in environmental regulations and higher management costs due to understated or undisclosed liabilities.

Conversely, an aggressive business posture to reduce greenhouse gas emissions is becoming a proxy for competent corporate governance. Climate protection programs can deliver better access to insurance, cost containment, legal compliance, ability to manage exposure to increased carbon regulations, reduced shareholder activism, and reduced risks of exposure to higher carbon prices.

The FTSE Index, the British equivalent of Dow Jones, states. “The impact of climate change is likely to have an increasing influence on the economic value of companies, both directly, and through new regulatory frameworks. Investors, governments and society in general expect companies to identify and reduce their climate change risks and impacts, and also to identify and develop related business opportunities.”^{xxxvii}

As described more fully below, the business and investment network CERES is working with institutional investors to require American companies to reveal the extent to which they may be liable for lawsuits and other risks than their European counterparts because of their emissions of climate changing gasses. The New York Times stated, "Dozens of US businesses in various climate-vulnerable sectors ... are still largely dismissing the issue or failing to articulate clear strategies to meet the challenge. Companies that disclose the amount of emissions of heat-trapping gases they produce and take steps to limit them cut their risks, including potential lawsuits from investors."^{xxxviii}

In 2006, the United Nations Environment Programme (UNEP), working with CERES, announced a new Climate Risk Disclosure Initiative to create a global standard for disclosing climate emissions.^{xxxix} UNEP is developing Principles of Responsible Investment to align the long-term goals of sustainable development with the obligations of institutional investors. CERES and UNEP are also establishing a new international forum for collaboration and information sharing by institutional investors on climate risk.

Insurance

In 2003 The Wall Street Journal reported, “With all the talk of potential shareholder lawsuits against industrial emitters of greenhouse gases, the second largest re-insurance firm, Swiss Re, has announced that it is considering denying coverage, starting with directors and officers liability policies, to companies it decides aren’t doing enough to reduce their output of greenhouse gases.”^{xl} The following years showed the prescience of this statement: insurance companies are already being battered by losses from the increase in the violence of storms. 2005 was the costliest year on record for weather related damage, costing insurers over \$65 billion, Claims from weather related disasters are now rising twice as fast as those from all other mishaps.^{xli}

In the Fortune Magazine article “Cloudy with a Chance of Chaos,”^{xlii} author Eugene Linden reported,

Already the pain of weather-related insurance risks is being felt by owners of highly vulnerable properties such as offshore oil platforms, for which some rates have risen 400% in one year. That may be an omen for many businesses. Three years ago John Dutton, dean emeritus of Penn State's College of Earth and Mineral Sciences, estimated that \$2.7 trillion of the \$10-trillion-a-year US economy is susceptible to weather-related loss of revenue, implying that an enormous number of companies have off-balance-sheet risks related to weather - even without the cataclysms a flickering climate might bring. In 2004, Swiss Reinsurance, a \$29 billion financial giant, sent a questionnaire to companies that had purchased its directors-and-officers coverage, inquiring about their corporate strategies for dealing with climate change regulations. D&O insurance, as it is called, insulates executives and board members from the costs of lawsuits resulting from their companies' actions; Swiss Re is a major player in D&O reinsurance.

What Swiss Re is after, says Christopher Walker, who heads its Greenhouse Gas Risk Solutions unit, is reassurance that customers will not make themselves vulnerable to global-warming-related lawsuits. He cites as an example Exxon Mobil: The oil giant, which accounts for roughly 1% of global carbon emissions, has lobbied aggressively against efforts to reduce greenhouse gases. If Swiss Re judges that a company is exposing

itself to lawsuits, says Walker, "we might then go to them and say, 'Since you don't think climate change is a problem, and you're betting your stockholders' assets on that, we're sure you won't mind if we exclude climate-related lawsuits and penalties from your D&O insurance.'" Swiss Re's customers may be put to the test soon in California, where Governor Arnold Schwarzenegger is pushing to restrict carbon emissions, says Walker. A customer that ignores the likelihood of such laws and, for instance, builds a coal-fired power plant that soon proves a terrible bet could face shareholder suits that Swiss Re might not want to insure against.

A single catastrophic event can cause insolvency or a precipitous drop in earnings, liquidation of assets to meet cash needs, or a downgrade in the market ratings used to evaluate the soundness of companies in the insurance industry.^{xliii} Weather-related insurance losses in the United States are growing 10 times faster than premiums, the population, or economic growth, and many smaller events have not yet been included in official totals.^{xliv} As the 2007 firestorms in Southern California showed, the convergence of climate change with rapid growth in population in some of the nation's most disaster-prone areas—and the accompanying real estate development and increasing real estate values—is leaving the nation exposed to higher insured losses. Hurricane losses are borne by private insurers and by two federal insurance programs established by Congress to provide coverage where voluntary markets do not exist: the National Flood Insurance Program (NFIP), which insures properties against flooding,^{xlv} and the Federal Crop Insurance Corporation (FCIC), which insures crops against drought or other weather disasters.^{xlvi} Increasingly, private companies are taking steps to limit their catastrophic risk exposure, transferring some of the risk to policyholders^{xlvii} and to the public sector. Federal insurers may see losses grow by many billions of dollars in coming decades.

Property owners are suffering price shocks, as well as reduced availability of coverage. Highly vulnerable properties such as offshore oil platforms have seen insurance rates rise 400 percent in one year.^{xlviii} Homeowner premiums have risen 20 to 40 percent in many areas, and 10- to 20-fold in isolated cases.^{xlix} Insurers have withdrawn coverage for hundreds of thousands of homeowners in Florida, Louisiana, Mississippi, New York, Massachusetts, Rhode Island, and South Carolina.¹

The exodus of private insurers from hurricane-prone areas is, in turn, creating enormous financial exposure for state-operated insurance pools—intended to be “insurers of last resort—that provide coverage for losses caused by weather-related events.^{li} Federal, state, and local governments also are compelled to address events for which there is no insurance at all by way of disaster preparedness and recovery operations. NFIP and FCIC data indicate the federal government already is more exposed to weather-related losses regardless of the cause. A General Accounting Office (GAO) study of weather-related losses between 1980 and 2005 notes that the number of NFIP policyholders has more than doubled since 1980, from 1.9 million policies to more than 4.6 million. Its exposure has quadrupled in the same period, nearing \$1 trillion in 2005, and program expansion increased FCIC’s exposure 26-fold to \$44 billion.^{lii}

In spite of the growing risks, climate change also offers substantial opportunities to the insurance industry. A 2006 CERES^{liii} report notes: “As the world’s largest industry . . . with core competencies in risk management and loss prevention, the insurance industry is uniquely positioned to further society’s understanding of climate change and advance forward-thinking solutions to minimize its impacts.”^{liiv} Indeed, a “vanguard of insurers” has begun to take concrete actions that generate profits while maintaining insurability and protecting their customers from extreme weather-related losses, in addition to reducing greenhouse gas emissions (see examples in Appendix A). Calling these examples an “encouraging start,” the CERES report calls for far greater efforts from insurance companies and regulators to get more of these creative programs into the public arena.

In April 2007, the chief research officer of Risk Management Solutions, an industry risk forecaster announced that climate change is already increasing “financial losses from extreme weather catastrophes.” A.M. Best, the historical voice of insurance, began a series in the August edition of Best’s Review on the risks, regulatory issues and economic impact of climate change.

In September 2007 the Washington Post reported, “Nervous investors have begun asking insurers to disclose their strategies for dealing with global warming. At a meeting of the National Association of Insurance Commissioners, Andrew Logan, insurance director of the as

investor coalition, representing \$4 trillion in market capital, warned that "insurance as we know it is threatened by a perfect storm of rising weather losses, rising global temperatures and more Americans living in harm's way." Ceres cites estimates that losses related to catastrophic weather have increased 15-fold in the U.S. property casualty industry in the past three decades."^{lv}

Access to capital

As investors evaluate corporations on the basis of their preparedness for the associated risks and opportunities of climate change they are increasingly recognizing that companies that do not adapt to a carbon-constrained world will be forced to compete with forward-thinking competitors ready to leverage new business models and capitalize on emerging markets in renewable energy and clean technologies. Large institutional investors are leading the way and have successfully waged shareholder campaigns urging companies to disclose climate risk and implement mitigation programs.^{lvi}

The Investor Network on Climate Risk,^{lvii} for example, includes more than 50 institutional investors that collectively manage more than \$3 trillion in assets. Another group of 28 leading institutional investors from the United States and Europe,^{lviii} who also manage over \$3 trillion in assets, announced a 10-point action plan in 2005 that calls on investors, leading financial institutions, businesses, and governments to address climate risk and seize investment opportunities. The plan calls on U.S. companies, Wall Street firms, and the Securities and Exchange Commission to intensify efforts to provide investors with comprehensive analysis and disclosure about the financial risks presented by climate change. The group also pledged to invest \$1 billion in prudent business opportunities emerging from the drive to reduce GHG emissions.

In October 2007 18 leading investors, including the \$250 billion California Public Employees Retirement System, filed a petition to the Securities and Exchange Commission (SEC) asking the SEC to require companies to assess and disclose "material" financial risks from climate change. Such risks would include financial impacts from emerging carbon-reducing regulations, extreme weather and other climate-related physical events, or growing global demand for low-carbon technologies and products.^{lix}

The petitioners included \$1.5 trillion of investor assets, including pension funds in California, Florida, New Jersey, New York, North Carolina and Rhode Island. The petition requests that the commission issue interpretive guidance clarifying that material climate-related information must be included in corporate disclosures under existing law. Dr Russell Read, the Chief Investment Officer of CalPERS stated, “CalPERS is interested in the sustainability of companies that may be threatened by climate change as well as those that can find new opportunities in a carbon-constrained market.... We want portfolio companies that are well positioned to avoid the financial risks associated with climate change and that can capitalize on new opportunities emerging from the regulation of greenhouse gases, including alternative energy technologies.”^{lx}

In the United States, the Sarbanes-Oxley Act^{lxi} makes it a criminal offense for the Board of Directors of a company to fail to disclose information, including such environmental liabilities as GHG emissions that could alter a reasonable investor’s view of the organization. In France, The Netherlands, Germany^{lxii} and Norway, companies are already required to publicly report their GHG emissions.

Even as early as 2005, such investor intervention and persuasion contributed to decisions by a number of large companies (Anadarko Petroleum, Apache, Chevron, Cinergy, DTE Energy, Duke Energy, First Energy, Ford Motor Company, General Electric, JP Morgan Chase, and Progress Energy) to make new commitments such as supporting mandatory limits on GHGs, voluntarily reducing their emissions, or disclosing climate risk information to investors.^{lxiii}

Since 2002, the British NGO, the Carbon Disclosure Project has surveyed the Financial Times 500, the largest companies in the world. Initially, perhaps 10 percent of the recipients bothered to answer. In 2005, 60 percent answered. In 2006 70 percent participated, and in 2007 77 percent answered the survey. Ford Motor Company produced a major report detailing its emissions. Why the change? The threat of Sarbanes Oxley liability clearly played a role. But perhaps more significantly, the Carbon Disclosure Project represents institutional investors with assets of over \$31.5 trillion, up more than \$10 trillion since 2006 and now representing almost a third of all global institutional investor assets.

In September 2007 the CDP released its fifth annual report. It found that the world's major companies are increasingly focused on climate change and that many see it as an opportunity for profit. The report noted, however, that US firms tend to view climate change as a risk to their bottom line. In the latest survey of a sample of members in the Financial Times 500 index, 77 percent of the Financial Times 500 (the 500 biggest companies on earth) responded, up from 72 percent a year earlier.

Nearly 80 percent of respondents around the world considered climate change a commercial risk, citing extreme weather events and tightening government regulations. Some 82 percent said they recognized commercial opportunities for existing or new products, such as investments in renewable energy. Overall, 76 percent said they had instituted targets and plans to reduce emissions, a jump from last year's 48 percent. Only 29 percent of US respondents had implemented greenhouse gas reduction programs with timelines and specific targets.

The banking industry is also reducing its carbon footprint. In 2006 HSBC won the Financial Times' First Sustainable Banking Awards as the first bank to become carbon neutral. It provided not only provided financing for renewable energy companies, it purchased renewable energy, to cover its operations.^{lxiv} In 2007 JP Morgan Chase and the Socially Responsible Investment advisors, Innovest, announced the creation of the JPMorgan Environmental Index – Carbon Beta (JENI-Carbon Beta), the first high-grade corporate bond index designed to address the risks of global warming by tracking carbon footprint of companies. "Taking into account environmental and social issues isn't just about good corporate citizenship, its becoming an essential part of risk management for investors,"^{lxv} In addition to reducing its own carbon emissions, the firm raised \$1.5 billion of equity for the wind power market in 2006, making investments in renewable energy totaling \$1 billion. The firm was also the lead sponsor of the C40 Large Cities Climate Summit in New York, in which mayors of the world's largest cities committed to move aggressively to reduce GHG emissions.^{lxvi} Citigroup Inc., Deutsche Bank AG, JPMorgan Chase & Co., UBS AG, and ABN Amro have committed \$1 billion to finance the energy savings measures in municipal buildings in such cities as New York, Chicago, Houston, Toronto, Mexico

City, London, Berlin, Tokyo, Rome; Delhi, India; Karachi, Pakistan; Seoul, Bangkok, Melbourne, Sao Paolo, and Johannesburg.^{lxvii}

In 2006, Goldman Sachs, the first Wall Street bank to issue an environmental policy, put \$1 billion into clean-energy investments. It has also pledged to purchase more products locally.^{lxviii} Credit Suisse followed by forming a renewable energy banking group that has done more than 40 deals, including the first capital markets financings in the biofuel, wind and solar power industries. Lehman Brothers "renewables vertical" combined its natural resources and power banking groups.^{lxix} Then in 2007, Citigroup committed \$50 billion to an Alternative Energy Task Force to provide financing for solar, wind, biomass, ethanol and other renewable industries.^{lxx} "Wall Street is waking up to climate change risks and opportunities," said Carbon Disclosure Project Chair James Cameron. "Considerably more of the world's largest corporations are getting a handle on what climate change means for their business and what they need to do to capture opportunities and mitigate risks. This all points to a continued elevation of climate change as a critical shareholder value issue for investors."^{lxxi}

In September 2007, Lehman Brothers published a climate change report that set forth its predictions of the likely future of climate change policies. Dr. John Llewellyn, Lehman Brothers' Senior Economic Policy Advisor, said "climate change policy will have to place the price mechanism at its core. In turn, investors and businesses that predict correctly the course of climate change policy should be able to anticipate the direction of asset prices."

Theodore Roosevelt IV, managing director and chairman of Lehman Brothers' Council on Climate Change, said, "We believe the U.S. Congress will enact legislation in the next few years, near term or by 2010, that will increase the cost of CO2 emissions. We look forward to working with our clients to develop the best strategies to address the economic changes that are likely to occur as a result of the new laws." Lehman Brothers believes the size of the carbon trading market will be \$100 billion by 2020.^{lxxii}

Managing Supply Chains

In a global marketplace the threat of more frequent and more violent storms is a threat to companies that depend on products shipped from around the world. In September 2007 Wal-Mart announced that it would begin to measure the amount of energy that it takes various suppliers to make and transport the products sold in its stores. Wal-Mart will work with suppliers of such products as DVDs, toothpaste, soap, milk, beer, vacuum cleaners, and soda to enable these suppliers to reduce their carbon footprint.^{lxxiii} As described above, Wal-Mart hired the Carbon Disclosure Project to survey factories in China that are manufacturing products for the company. "This is an opportunity to spur innovation and efficiency throughout our supply chain that will not only help protect the environment but save people money at the same time," said Wal-Mart's Chief Merchandising Officer John Fleming at a press conference at Merrill Lynch & Co.'s headquarters in New York. "We don't believe a person should have to choose between an environmentally friendly product and one they can afford to buy," he said. "We want our merchandise to be both affordable and sustainable."^{lxxiv}

Labor Productivity

A suite of energy efficiency measures that can be implemented in buildings have been shown to increase worker productivity by six to 16 percent.^{lxxv} Even if energy savings are not sufficient to attract scarce management attention, labor costs, which are typically 100 times as high as energy costs, should. Even a one percent increase in labor productivity will dwarf the energy savings, but it was the attention to better energy efficiency that produced the labor saving.^{lxxvi}

For example when Lockheed commissioned Building 157 in Sunnyvale, CA., the designers had to battle value-engineers who sought to delete the atrium around which they wrapped the building, calling it an expensive worker amenity. Declaring that the lighting feature was a "Literium" was structural, the designers preserved the daylighting features that enabled the building to use half the energy consumption of a comparable standard building. The extra \$2 million extra to achieve this (good green features, if implemented by an experienced team now add nothing extra and can actually reduce costs) paid back in four years. The features achieved a 75% reduction in lighting energy, saving \$500,000 a year worth of energy. Such metrics were predicted. What came as a surprise, however, was that the better lighting and the other green

features led to a drop in employee absenteeism of 15 percent, and a productivity increase of the same amount. This enabled the company to win a contract, the profits of which paid for the costs of the entire building.

Boeing implemented a lighting retrofit that cut lighting energy costs by 90 percent. This investment returned itself with a less than 2-year payback, but because the workers could see better, the error rate went down by 20 percent—very good news for everyone who flies around on airplanes. It also avoided rework, increased on-time delivery, and increased customer satisfaction.

In the United States alone, roughly 6 billion square feet of buildings are constructed each year.^{lxxvii} Buildings are the No. 1 cause of greenhouse gas emissions in the U.S. and must be made carbon-neutral as quickly as possible. This investment will cut healthcare costs and increase labor productivity. The current estimated decrease in productivity from “sick building syndrome,” around 2 percent nationwide, resulting in an annual cost to the United States of approximately \$60 billion.^{lxxviii} Better indoor air quality, a frequent result of more energy efficient building technology has been shown to improve worker productivity by 0.5 to 5 percent, with estimated savings of \$20 to \$200 billion.^{lxxix}

Disproportionate Risks and Potential Benefits for Small Business

Small businesses are the economic engine of the country, generating more than half of non-farm private gross domestic product. They represent 99.7 percent of all employer firms, employing nearly 60 million workers, about half of all private employees. For the past decade they have generated 60 to 80 percent of net new jobs each year.

A June 2006 article in *Business Week*^{lxxx} pointed out that the 25 million small businesses in the United States stand to be among the hardest-hit victims of climate change. According to the Institute for Business and Home Safety, at least one-fourth of the small businesses closed by natural disasters never reopen.^{lxxxi} It is also likely that small businesses will face increased government regulation if a mandatory program to reduce greenhouse gas emissions is implemented.

Small businesses consume half the electricity in the country, but only about a third have invested in energy efficiency. Less than half of the small business owners are aware that the EPA's Energy Star program can help them lower their energy usage. The Agency expends just \$1 million and two staff positions on its programs to get information to small businesses.^{lxxxii}

Natural Capitalism's Business Climate Protection Manual shows small businesses how they can benefit from programs to reduce carbon emissions. They can cut their own costs, and increase sales to others who are implementing emissions reduction programs. There is a rapidly growing demand by consumers for environmentally sustainable choices in every line of consumer item, including foods, clothing, and household and recreational items.^{lxxxiii} As *Business Week* noted, "reducing energy waste in U.S. homes, shops, offices, and other buildings must, of necessity, rely on tens of thousands of small concerns that design, make, sell, install, and service energy-efficient appliances, lighting products, heating, air-conditioning, and other equipment. Small businesses can also save as much as 20-30 percent on their own energy bills by making their own workplace more energy-efficient."^{lxxxiv}

Energy efficiency and renewable energy can enable small businesses to become energy self-sufficient. On 14 August 2003 a tree branch fell across a power line in Ohio, setting off a cascading failure that blacked out the Northeast for up to 30 hours. The Wall St Journal estimated the cost to the region at \$6 billion. Two thirds of business said that they lost at least a day of operation with a quarter losing more than \$50,000 an hour.

Harbec Plastics a small upstate New York injection molding company had recently completed a comprehensive energy efficiency program, including a lighting retrofit, and more efficient motors. The company had constructed a LEED certified green building to add to its existing facilities, and added renewable energy including a wind turbine and photovoltaics. The company had improved its energy efficiency by installing as a combined heat and power system to cut its soaring energy bill, which at 15¢ per kilowatt-hour was among the highest in the nation. The company was also tired of coping with the periodic power surges and outages to which it had been subjected.

Even before the blackout, Harbec had been pleased with its new energy efficiency, green building features and power supply. They cut costs and dramatically reduced temperatures on the shop floor, improving working conditions. When its systems enabled Harbec to continue operation all throughout the blackout the company was thrilled. Every year American businesses lose billions of dollars when blackouts, power surges and other interruptions force companies to shut down. Not having to shut down paid off the capital cost of Harbec's energy program. The company has since begun producing its own biodiesel, and bought fuel efficient vehicles.

Harbec worried especially about outages as they forced lost production time, wasted materials and made it unable to meet customers' needs, which risked sending its larger customers to suppliers overseas. President Bob Bechtold states, "I may be the only injection-molder in New York State who can go to his customers and talk about energy costs going down, in an industry where energy represents a significant portion of the cost of doing business. By reducing his energy costs, the leading reason that businesses are fleeing New York, Harbec has preserved jobs in an economic downturn, and created new business opportunities."^{lxxxv}

Similar opportunities exist in rural America. The Straus organic dairy outside of San Francisco powers its operation from the methane from the manure from its 270-cow dairy herd. Its utility, Pacific Gas and Electric allows the dairy to run its meter backwards, selling renewable energy to the grid, and significantly reducing the emissions of methane gas, an even more powerful green house gas than carbon dioxide. The methane digester, which cost the dairy \$280,000, is the fifth in the state, but 13 more are under construction, thanks in part to a state program that pays half the cost. The plant returns \$6,000 a month in saved energy costs, giving Straus a two-year payback. The digester will strip 80 to 99 percent of organic pollutants from the wastewater generated from the farm. Heat from the generator will warm thousands of gallons of water used to clean the milking parlor. The resulting wastewater fertilizes the fields.^{lxxxvi}

American workers would benefit from building a new energy economy, according to the Apollo Alliance, a coalition of labor unions, environmental organizations, social justice and faith-based

groups, businesses, and foundations. Industries improving the performance of the existing energy system, retrofitting buildings or installing new systems for energy efficiency, developing renewable energy sources, or building, improving, or maintaining transit systems will create large numbers of new high-wage jobs with good benefits, crossing a wide spectrum of industry sectors, from skilled craftsmen to designers and engineers, from public employees to laborers.^{lxxxvii}

"Renewable Energy and Energy Efficiency: Economic Drivers for the 21st Century," a 2007 report from the American Solar Energy Society, found that the renewable energy and energy efficiency industries currently generate about 8.5 million green collar jobs and almost \$1 trillion in revenue. The number could increase to 40 million jobs and \$4.5 trillion in revenues "with the appropriate public policy, including a renewable portfolio standard, renewable energy incentives, public education and research and development," the report found. As many as one in four workers could work in these fields by 2030. In the week that the report was released, General Electric Power Generation announced it would invest \$39 million and hire 500 workers for a renewable energy division expansion in upstate New York.^{lxxxviii}

The Community Case for Climate Protection

Business innovators are now being joined by thousands of large and small communities, counties, states, universities and communities of faith in cutting their emissions, and thus their energy bills.

Action at the State Level

With the Federal government abdicating responsibility on climate protection, states have taken up the challenge. The seven Northeastern states acted first, approving the Regional Greenhouse Gas Initiative, a mandatory regulatory scheme. Under Governor Bill Richardson, the state of New Mexico joined Chicago Climate Exchange, offsetting the carbon emissions of the State. Over 20 states have either passed or proposed legislation on CO2 emissions, or have developed carbon registries. In 2006 California became the first state to impose mandatory GHG emission limits, requiring a 25% cut by 2020 affecting companies from automakers to manufacturers. The state is the 12th largest carbon emitter in the world despite leading the nation in energy

efficiency standards.^{lxxxix} Arnold Schwarzenegger, Governor of California stated, “The debate is over. The science is in. The time to act is now. Global warming is a serious issue facing the world. We can protect our environment and leave California a better place without harming our economy.”^{xc}

Florida, one of the coastal states that could suffer from rising ocean levels as a result of global warming, has been hit hard by hurricanes, tornadoes, drought and wildfires. In his first State of the State address early in 2007, Republican Gov. Charlie Crist noted the extreme weather and skyrocketing insurance rates in his state. “I am persuaded that global climate change is one of the most important issues that we will face this century,” he told the Legislature. “Yet, we have done little to understand and address the root causes of this problem, or frankly, even acknowledge that the problem exists. No longer.”^{xcii}

In November, 2007, Illinois, Iowa, Kansas, Michigan, Minnesota and Wisconsin, a region, which if it were its own country would be the globe's fifth-biggest producer of greenhouse gas emissions trailing only the U.S., Russia, China and India, signed a joint agreement setting greenhouse gas reduction goals and allowing companies to buy and sell pollution credits to meet the targets. A separate agreement commits all states in the region to promote the use of renewable energy. The governors agreed that wind power, water and other renewable sources will eventually provide up to 30 percent of the region's electricity. The region could "become the Saudi Arabia of renewable energy," stated Wisconsin Governor Jim Doyle. Iowa Governor Chet Culver called the move "a great opportunity for our country to come together and put partisan politics aside, and become an international leader on this issue." ^{xciii}

With this pact, nearly half of Americans will now live in areas covered by climate protection agreements mandating carbon emissions limits.

Counties

King County, Washington, the county surrounding Seattle has undertaken to reduce its carbon footprint 80 percent below its current levels by 2050. Calling global warming the defining issue of the 21st Century, King County Executive Ron Sims committed to make County communities resilient to expected loss in drinking water supply, more frequent floods and other impacts of climate change. Sims stated, "Communities that thrive in this new century will be the ones that take action now in response to the growing body of scientific evidence about global warming and its cause. The best way to protect the people, economy and environment of the region is to take specific actions to reduce greenhouse gases and invest the money needed to adapt to less snow in the mountains and more frequent more damaging floods."^{xciii} Among many actions, the County implemented a broad scale citizens' education program, bought land throughout the County to serve as a "food-shed" in the event of global disruptions to food supply, encouraged public and private sector leaders to join the effort by setting their own climate stabilization goals, and joined Chicago Climate Exchange. Since then Miami-Dade and Sacramento Counties have also joined CCX.

On Earth Day, 2005, Alameda County, California, commissioned a 2.3 megawatt solar powerplant, spread on roofs located throughout the County. The local utility paid for half of it, and the array will save the County \$700,000 a year. Such use of distributed generation follows on the successful example of California's capital. In 1989, Sacramento, California shut down its 1,000-megawatt nuclear plant. Rather than invest in any conventional centralized fossil fuel plant, the local utility met its citizens' needs through energy efficiency and such renewable supply technologies as wind, solar, biofuels and distributed technologies like co-generation, fuel cells, etc. In 2000, an econometric study showed that the program had increased the regional economic health by over \$180 million, compared to just running the existing nuclear plant. The utility was able to hold rates level for a decade, retaining 2,000 jobs in factories that would have been lost under the 80% increase in rates that just operating the power plant would have caused. The program generated 880 new jobs, and enabled the utility to pay off all of its debt.

Cities

Cities are home to half of the world's population and consume 75 percent of the world's energy.^{xciv} Cities are even more aggressive in implementing climate mitigation programs. Although municipal budgets are strapped, over 730 cities have joined the call by Seattle Mayor Greg Nickels to commit their communities to aggressive climate protection campaigns.^{xcv} For example, Kansas City in the Show Me State published a website stating, "Cities that have taken action to reduce global warming pollution are saving millions of taxpayer dollars while boosting real estate values, attracting new jobs and businesses, and improving community livability. Investments in mass transit; commitment to clean, renewable energy; improved public health from cleaner air; and new partnerships with the private sector all result in greater economic prosperity for citizens. They also make a city a cleaner, safer and more desirable place to live."^{xcvi}

The benefits Kansas City identified from its climate protection plan included:

- Reduced energy costs to households, recognized by a certified rating system, increases property values. Reduced energy costs also strengthen one of Kansas City's calling cards—low cost of living.
- Reduced energy cost to businesses would have similar effect and lower the hurdle for our ongoing Economic Development efforts to bring new business to Kansas City.
- Reduced economic dependence on oil, natural gas and coal and reduced vulnerability to market fluctuations.
- Economic benefits from the production and use of regional renewable fuels.
- Lower maintenance costs of alternative technologies such as efficient fluorescent lights, compared with conventional products.
- Increased worker productivity from improved indoor air quality, and efficient lighting.
- Less traffic congestion and the associated inefficiencies of time delays plus lower costs for infrastructure maintenance.
- Job creation through development and deployment of new technologies.
- Increased success in attracting business to Kansas City's overall low cost of operation and our clean environment.^{xcvii}

Some cities are implementing and succeeding at even more aggressive programs. Salt Lake City's Mayor Rocky Anderson stated in a letter to the Seattle Mayor:

In Salt Lake City we have been working diligently since 2002 to meet the greenhouse gas emissions reduction goal set forth in the Kyoto Protocol. If every local and state government entity, every business, and every individual takes available, effective measures to significantly reduce greenhouse gas emissions, we can reverse the trend toward global warming. If we do not, the consequences will be devastating.

Salt Lake set a goal to reduce GHG emissions by 3% per year for the next 10 years, to reduce emissions in city operations by 21% below its 2001 baseline, by 2012. Its long-term goal is to reduce emissions 70% by 2040. By 2007 the city had achieved a 31-percent reduction in carbon dioxide emissions in its municipal operations over the 2001 baseline, surpassing its goal to meet the Kyoto Protocol standard by 148%, and seven years early. To achieve this, the City reduced its vehicle fleet, purchased alternative fueled vehicles, aggressively encouraged alternative modes of transit, and offset the carbon emissions of City employees' air travel. Salt Lake required LEED silver for all new City buildings, purchased wind power, and implemented a comprehensive community education campaign. It increased recycling in the City by 85 percent, reduced water use by city residents 20 percent, replaced incandescent bulbs with compact fluorescent lamps, purchased open space, captured methane from land fills and the City's sewage operations, a year, and changed out all city traffic lights to LED's. These last three measures alone are saving the city \$248,000 a year in energy costs.^{xcviii}

St. Paul, Minnesota saved \$59 million in annual energy costs through measures such as energy retrofits in municipal buildings, recycling and waste reduction, and equipment and lighting upgrades. These actions reduced St. Paul's carbon emissions by 8% from 1988 levels by 2004. Toledo, Ohio saved \$710,208 in the first year after retrofitting 20 city buildings with energy efficient lighting and replacing old HVAC units with new, digitally-controlled boilers and chillers. These efforts cut electricity use by nearly 6 million kWh and eliminated 5,250 tons of CO₂.^{xcix}

San Francisco Mayor Gavin Newsome introduced the City's Climate Action Plan saying that the city can reduce the pollution that causes global warming by using currently available

technologies that also enhance economic development. It can promote energy efficiency, renewable energy, alternatives to automobile transportation, and recycling to help save money and create jobs that strengthen the local economy, and increase the livability of San Francisco's neighborhoods. To achieve this, the city has implemented renewable energy programs that promote power production from solar, wind, biomass, ocean wave, and bay tidal current sources. These will eliminate an estimated 550,000 tons of CO₂. The city fleet has more than 700 clean-air vehicles; one of the largest municipal alternative fuel vehicle fleets in the nation, and by the end of 2007 will run all municipal trucks on biodiesel. Its mass transit fleet has 57 percent zero-emission vehicles and a goal of a completely zero-emission fleet by 2020. Installing LED, traffic signals across the city will reduce electricity use by an estimated 7.7 million kilowatt/hours and save the city \$1.2 million per year. An expanded recycling program combined with methane capture at city-operated landfills to reduce emissions by about 300,000 tons of CO₂. The programs have already saved the City money and energy. For example: six megawatts of electricity were saved by retrofitting lighting systems in over 4,000 small businesses thanks to the Power Savers Program. The city's Peak Energy Program saved twelve megawatts by retrofitting residential and commercial buildings. Peak demand was reduced by 18 megawatts through successful programs operated by the SF Environment Department.^c

In 1974, the Municipal Utility in Osage, Iowa, faced the need to build a new power plant to meet growing demand. Its general manager, Wes Birdsall, realized that building the plant would increase everyone's rates. He also understood that what his customers wanted was not more raw kilowatt-hours, but the energy "services" of comfort in their homes: shaft-power in factories, illumination, cold beer and the other services that energy delivers. People buy energy, but what they really want is the service that the energy makes possible. If people can get the same or improved service more cheaply using energy more efficiently or from a different source, they will jump at it. By meeting customers' desires for energy services at lower cost, Birdsall began one of the most remarkable economic development stories in rural America.

The Osage energy efficiency program saved over a million dollars a year in this town of 3,800 people and generated over 100 new jobs. A report on the program found that, "Industries are expanding and choosing to remain in Osage because they can make money through employees

who are highly productive and through utility rates that are considerably lower than neighboring cities.”^{ci} Birdsall was able to reduce electric bills to half that of the state average and unemployment to half that of the national average, because with the lower rates new factories came to town. That increased demand and necessitated more efficiency. But in this way Birdsall held electric growth level until 1984. The program was profiled in the Wall Street Journal, and replicated by other utilities. According to a USDA study of Osage, “The local business people calculated that every \$1 spent on ordinary consumer goods in local stores generated \$1.90 of economic activity in the town’s economy. By comparison, petroleum products generated a multiplier of \$1.51; utility services, \$1.66; and energy efficiency, \$2.23. Moreover, the town was able to attract desirable industries because of the reduced energy operating costs resulting from efficiency measures put in place. Energy efficiency has a long and successful track record in Osage as a key economic development strategy.”^{cii}

A 2007 report by the Energy Trust of Oregon showed that per megawatt saved, economic output increases by over \$2 million, wages increase by over \$648,000, business income increases by over \$125,000, and 22 jobs are created.^{ciii}

Universities

The University of Colorado Student Union (UCSU) became the first student government in the nation to require that its student-run buildings become carbon neutral. In 2007, UCSU approved a \$500,000 Energy and Climate Revolving Fund (ECRF) to pay for energy efficiency and other measures to reduce greenhouse gas emissions. The Fund adds to the existing \$115,000-\$125,000 Energy Efficiency Fund (EEF), which has already prevented the release of 125 tons of emissions, and reduced energy costs by over \$30,000 per year.^{civ}

The University’s Chancellor, G.P “Bud” Peterson, became one of the first 100 university presidents to sign the American College and University Presidents Climate Commitment. Now signed by over 300 University Presidents, it commits the University to integrate sustainability into its curriculum, support American energy independence, and develop a campus plan to achieve carbon neutrality.^{cv} CU responded by developing a Blueprint for a Green Campus, laying out the University’s plan to achieve “zero climate impact” by 2025^{cvi}

Middlebury College in Vermont adopted a goal of carbon neutrality by 2016. The Dean of Environmental Affairs, Nan Jenks-Jay, states, "Students were telling us, 'You're not doing enough.'" Following the lead of CU, undergrads at dozens of schools are voting increases in activities fees to finance green initiatives. At St. Mary's College of Maryland, for example, 93 percent of students voted last spring for a \$25 annual increase in fees, which will raise approximately \$45,000 a year for the purchase of renewable energy.

Colleges are realizing that a commitment to climate protection enhances their recruiting efforts. "What message does a conventional campus send?" asks David Orr, Director of the Environmental Studies Program at Oberlin. "It sends the message that energy is cheap and plentiful." Orr sent a very different message by involving his students in the creation of the Adam Lewis Center for Environmental Studies. Powered entirely by photovoltaics, which deliver 30 percent more energy than the building consumes, the building treats its own wastewater in an Eco Machine, an artificial wetland that looks like a greenhouse, but costs less and works better. "You'd have no clue it's a wastewater system," says Orr. He credits the building with having helped to inspire hundreds of Oberlin students to choose professions in ecodesign, architecture and related fields. One such student, Sadhu Johnston, is now Director of Environment for the City of Chicago.^{cvi}

Communities of Faith

Hundreds of churches, synagogues, mosques and other houses of worship are reducing their energy bills and their carbon footprints as a sacred duty. Spearheaded by the Regeneration Project, such communities see their task as deepening the connection between ecology and faith. The Project's Interfaith Power and Light campaign, representing over 1,000 congregation members in eighteen states, encourages a religious response to global warming in congregations through promotion of renewable energy, energy efficiency, and conservation. IP&L showed *An Inconvenient Truth* to over half a million people of faith in 4,000 congregations in all 50 states.

The Michigan chapter of IPL helped St. Elizabeth's Catholic Church conduct an energy audit and implement the suggested changes. The Church invested \$150,000 in a new boiler, energy

efficient lighting and appliances, window insulation, and a solar thermal hot water heater. Their annual savings are \$20,000 a year, a 50% reduction in their annual energy budget.

Connecticut IPL organized green building projects or conservation upgrades for 22 organizations, including a kosher food store, 20 congregations and the association of non-profit building managers in the state. Their Lighten-Up CFL light bulb sale with 30 congregations sold approximately 3,400 bulbs. Currently, Connecticut IPL has 25 churches and synagogues, which have purchased clean energy, including nine that have conducted programs to encourage their congregants to become residential customers for clean energy. Two of the congregations have one or more congregants who have installed photovoltaics on their roofs. A third congregation is looking into this for their community's building. ^{civiii}

The Reverend Sally Bingham, Executive Director of the Regeneration Project states, "Global warming is one of the biggest threats facing humanity today. The very existence of life – life that religious people are called to protect – is jeopardized by our continued dependency on fossil fuels for energy. Every mainstream religion has a mandate to care for creation. We were given natural resources to sustain us, but we were also given the responsibility to act as good stewards and preserve life for future generations." ^{cix}

Equity Issues

Major changes in the economy – and even the introduction of significant new products – displace old technologies and the workers, businesses and communities that depend upon them. Personal computers replaced typewriters; vinyl records were replaced by tapes, which have been replaced by DVDs; horses were replaced by cars; wood was replaced with fossil fuels. Some households, business and communities will be less able to cope with the shift to a new energy economy – and some will be less able to cope with the effects of climate change. National policy must help.

"In developing climate policies, the incoming President has to be conscious of the need and clearly explain that the policies must be equitable," says Theodore Roosevelt IV, chairman of the Global Council on Climate Change at Lehman Brothers. "They should not impose an undue

burden on the poor to the advantage of the affluent. The American public needs to be convinced that climate policies are fair.”

The Advantages of Energy Efficiency

Every competent analysis has shown that efficiency costs far less than new supply. This conclusion was recently reaffirmed by a recent report by researchers from the U.S. Department of Energy, Oak Ridge National Laboratory, and Lawrence Berkeley National Laboratory. The study analyzed results from four recent engineering-economic studies of the potential for energy technologies to reduce greenhouse gas emissions, including a sector-by-sector assessment of specific technology opportunities and their costs, as estimated by the Five National Laboratories, the Tellus Institute, The National Academy of Sciences, and The Office of Technology Assessment.

It found that large carbon reductions are possible at marginal costs that are lower than the value of the energy saved. The report concluded that energy efficiency remains underused in every sector of the economy and is by far the cheapest option. New renewable supply, it found, has a net cost, but when combined with efficiency, can deliver climate protection at a profit. “In combination,” the study concluded, “Large carbon reductions are possible at incremental costs that are less than the value of the energy saved.” It called for an aggressive national commitment involving “some combination of targeted tax incentives, emissions trading, and non-price policies is needed to exploit these carbon reduction opportunities.”^{cx}

Good efficiency programs, to, say, retrofit light bulbs, cost about 1 - 2¢ per kilowatt hour (kWh) saved, while just running a coal plant costs 4 – 6 ¢. New wind, in good sites can cost as low as 3¢, is, on average, competitive with just the running cost of coal. Running an existing gas plant typically costs 5 – 6¢. The average price of electricity from the grid is at least 9¢ per kWh, and building a new nuclear plant can cost as much as 20¢. These numbers do not count the cost from coal or gas plants of emitting carbon, mercury, other air pollutants and threatening the climate.

Obviously, it is in everyone's interests to pursue efficiency first, but few utility programs achieve this outcome. Until recently, utilities have tended to pursue only as much efficiency as regulators require them to. Various states have experimented with regulations to encourage utilities to meet customers' needs in the cheapest way. Programs like Integrated Resource Planning, which require utilities to compare the cost of building new capacity with the cost of meeting customers' needs through energy efficiency, sought to level the playing field, but because utilities are fundamentally rewarded based on how much power they sell, they have continued to seek to build new power plants.^{cxix}

Only a few jurisdictions decoupled sales of electricity from utility profits, so utilities are no longer rewarded for selling more electricity nor penalized for selling less. Even better are states like Idaho that actively reward utilities for cutting their customers' bills through efficiency, by giving the utilities a share of the savings for their shareholders. When California implemented this plan (called the Batinovich plan, after the Public Utility Commissioner Robert Batinovich who first developed it) Pacific Gas and Electric, the country's biggest private utility, spent \$150 million in 1991 to help make its customers more efficient. It kept 15 percent of the resulting savings, boosting its 1990 profits by \$40-50 million. Doing this saved its customers nine times that much. The PUC found that between 1990 – 93 such efficiency measures saved customers a net present value of almost \$2 billion.^{cxix}

In the early 1990's there were a variety of experiments underway to help the market delivering utility customers better value. Eight states implemented programs to allow vendors to compete in an open auction for all ways to make or save electricity. Such auctions would typically ask who could make or save electricity at 1¢ per kilowatt-hour. The utilities would then sign contracts for the bids received. If they needed more capacity, they would then reopen bidding for efficiency or supply at 2¢ per kWh, then 3¢. At around 2 – 3¢ utilities would meet all of their required capacity, dramatically cheaper than building a new fossil fired plant.

Investor-owned utilities, when rewarded for cutting bills, sold efficiency ever faster and more skillfully despite falling electricity prices. In 1990, New England Electric System captured 90% of a small-commercial pilot retrofit market in two months. Pacific Gas and Electric Company

captured 25% of its entire new-commercial-construction market—150% of the year’s target—in three months, so it raised its 1991 target...and captured all of it in the first nine days of January.

Making an informed, effective, and efficient market in energy-saving devices and practices can fully substitute for a bare price signal, and indeed can influence energy-saving choices even more than can price alone. That is, people can save energy faster if they have extensive ability.

During 1990–96, utility programs that gave customers information and help enabled electric users in Seattle—which then had the cheapest electricity of any major U.S. city—to save electric load nearly 12 times as fast as citizens in Chicago, and electric energy more than 3,600 times as fast, even though Seattle electricity prices are about half of Chicago’s. Seattle City Light achieved measured savings achieved 313 gigawatt-hours per year or 38 average megawatts—3.2 percent of 1996 energy sales and average load. Seattle’s 1990–96 investments in demand-side management emphasized reducing energy use rather than peak-load.^{cxiii} By 1996, the nearly tenfold larger Chicago utility Commonwealth Edison saved 51 peak megawatts (0.27 percent of its 19-gigawatt peak load), or an 11.8-fold smaller fraction of load. ComEd had made essentially no effort to save electrical *energy*, and only achieved savings of 800 megawatt-hours per year, or 0.00088 percent of its sales^{cxiv}—a 3,640-fold smaller fraction than in Seattle. Big customers in Seattle in 1996 paid 1.9 times less and small customers paid 2.3–2.4 times less per kilowatt-hour than in Chicago.

What this shows is that while economists would agree that in a free market energy prices should accurately signal to customers the full cost of using the resource, merely raising customers’ rates will not necessarily achieve the reductions in energy use that economic theory might suggest. Similarly, giving people information, incentives and opportunity to act can elicit significantly greater reductions of energy use and carbon emissions than purely price-based theory might suggest.

Combining Energy Efficiency and Renewable Energy

The most effective way to reduce greenhouse gas emissions is energy efficiency. But combining efficiency programs with renewable energy enables communities and companies to achieve truly large reductions. This combination is also key to unleashing the new energy economy of clean manufacturing and good jobs.^{cxv}

Over 43,000 firms in the US today are manufacturing and assembling renewable energy technologies. If the US used renewable energy to stop global warming, such firms would create over 850,000 new, high-tech manufacturing jobs. Because of California's early commitment to climate protection and to develop clean energy technologies, the State will receive nearly 95,600 new jobs and \$20.9 billion of investment to manufacture components to supply the growing national development of renewables.^{cxvi}

Toyota's Torrance, California, office complex, completed in 2003, combines energy-efficiency strategies such as roof color, photovoltaic solar electricity, an advanced building automation system, a utilities metering system, natural-gas-fired absorption chillers for the HVAC system, an Energy Star cool roof system and thermally insulated, double-paned glazing. The 600,000+ square foot campus exceeds California's stringent energy-efficiency requirements by 24 percent, but cost the same to build as a conventional office building.^{cxvii}

A recent article by utility regulator S. David Freeman, once Chair of the Tennessee Valley Authority, and Jim Harding of the Washington State Energy Office announced that the company Nanosolar is building a \$100 million manufacturing facility in the San Francisco Bay area to produce solar cells very cheaply. That, they say,

...would bring the cost to or below that of delivered electricity in a large fraction of the world." Backed by a powerful team of private investors, including Google's two founders and the insurance giant Swiss Re, Nanosolar announced plans to produce 215 megawatts of solar energy next year, and soon thereafter capable of producing 430 megawatts of cells annually.

What makes this particular news stand out? Cost, scale and financial strength.... Nanosolar is scaling up rapidly from pilot production to 430 megawatts, using a technology it equates to printing newspapers. ...No one builds that sort of industrial production facility in the Bay Area—with expensive labor, real estate and electricity costs—without confidence.

Thin solar films can be used in building materials, including roofing materials and glass, and built into mortgages, reducing their cost even further. Inexpensive solar electric cells are, fundamentally, a “disruptive technology,” even in Seattle, with below-average electric rates and many cloudy days. Much like cellular phones have changed the way people communicate, cheap solar cells change the way we produce and distribute electric energy. The race is on.

The announcements are good news for consumers worried about high energy prices and dependence on the Middle East, utility executives worried about the long-term viability of their next investment in central station power plants, transmission, or distribution, and for all of us who worry about climate change.... Meanwhile, the prospect of this technology creates a conundrum for the electric utility industry and Wall Street. Can—or should—any utility, or investor, count on the long-term viability of a coal, nuclear or gas investment? The answer is no.^{cxviii}

Renewable options are now the fastest growing form of energy supply around the world, and in many cases are cheaper than conventional supply. Solar thermal is outpacing all conventional energy supply technology around the world. Modern wind machines come second, delivering over 15 gigawatts (GW) of new capacity a year, or three times what nuclear power did at the peak of its popularity. In 2007, the U.S. will add 4,000 GW of new wind to its grid, more cheaply than just the running cost of existing coal or nuclear plants.^{cxix} The next fastest growing energy supply technology is solar electric, even at current prices.^{cxx}

The Governor of Pennsylvania recently announced the opening of a factory to make wind machines. Creating 1,000 new jobs over the next five years, it is the biggest economic development measure for Johnstown, PA, in recent memory. California announced that it would spend over \$8 billion installing solar in 2006. The State created a \$1.5 billion investment fund to help environmentally responsible companies that are developing cutting-edge clean energy technologies.

In 2006, researchers at the University of California proved that investing in renewable energy technologies results in 10 times the job creation of investments in fossil or nuclear technologies.^{cxxi} An analysis sponsored by the American Council on Renewable Energy found that in addition to eliminating the need for new coal or nuclear power plants over the next 20 years, renewable energy technologies could create \$700 billion of economic activity and 5 million high-quality jobs by 2025.^{cxxii} The Apollo Project, a coalition of environmental, business and labor organizations, contends that an investment of \$300 billion in Federal funding for low-carbon energy, infrastructure and urban development practices would add more than 3.3 million jobs to the economy, stimulate \$1.4 trillion in new GDP, save \$284 billion in net energy costs, and repay taxpayers in 10 years.^{cxxiii}

Regaining the Lead in the International Marketplace

The United States was once the international leader in the technologies that will meet the world's need for energy and products in ways that don't cause catastrophic climate change. Almost all of the solar electric and wind power technologies were invented in the U.S. But in the 1980's perverse Federal policies prohibiting investment in commercialization of renewables let the progress of these technologies lapse in the U.S. Europeans and Asians picked up the opportunity and now lead in manufacturing.

The European Commission has projected that meeting its targeted energy cuts and renewable energy increases that together would save 60 billion Euros, create millions of new jobs, increase European competitiveness, and reduce Europe's carbon emissions by a third.^{cxxiv} American businesses are already losing ground as their European competitors innovate to meet these goals. These renewables are the cheapest way to provide power to those around the world who don't

have it, because these technologies don't require fuel, or investments in large central generating plants, transmission lines and other conventional electric infrastructure.

As gasoline prices have climbed and public consciousness about greenhouse gas emissions has grown, it is the Japanese rather than U.S. automakers that were first to market with hybrid vehicle technology—just as in the 1970s the Japanese beat Detroit to the punch with compact cars that better served consumers seeking relief from high gas prices. Today, Australia, Japan, the European Union, Canada and China all have auto-efficiency standards higher than those in the U.S.

A confluence of rapidly developing factors is creating a worldwide opportunity for products, technologies, designs and practices that reduce greenhouse gas emissions. They include:

- Developments in various American states and internationally to place a price on carbon—whether through taxes or market mechanisms. Since the Kyoto Protocol came into force in February 2005, 141 nations have committed to limiting the amount of carbon that they emit. In November 2007 the Australian government fell, with the new government pledging to sign Kyoto, leaving the U.S. as the world's only major government to so-far refuse to ratify the treaty. As carbon is reflected in the price of energy and consumer products, low-carbon alternatives will become more competitive in the marketplace. Meanwhile, the growing international carbon market enables companies that make deeper reductions than required to sell their unused emissions capacity to companies unable to meet the limits. It is creating a de facto carbon currency. There are two ways to obtain a commodity/ currency: buy the credits or create them. Just as one can buy gold or mine it, one can create a carbon currency by reducing emissions. In such a market, companies will be invested in the new carbon currency, at best to forge wider margins on the rising costs of carbon fuels and at least to hedge their own exposure to the risks posed by the enactment of future legislation. Portfolio's (corporate, institutional and personal) of the future with carbon currency exposure can then be better positioned to mitigate the volatility of the new economy.

- The exploding demand for consumer products and energy technologies in rapidly developing nations such as China and India. Lester Brown of Earth Policy Institute points out that if China continues to grow at its current rate, and uses resources as efficiently as the U.S. (it is now four-fold less efficient) by 2030 it will want more oil than the world now lifts and likely can ever lift. It will also want more cotton, cars, concrete, and coal than the world now produces. And India is right behind. Both countries will be hard hit by climate change, with the melting of the Himalayan glaciers threatening water supplies throughout the region, the shifting of the monsoon patterns threatening agriculture, and the increased number and ferocity of cyclones already killing thousands of people each year. In 2007, China has passed the U.S. as the world's biggest emitter of carbon. In response, China has pledged to reduce energy intensity by 4 percent a year through the rest of the decade, and has set a target to reduce energy consumption for per unit GDP by 20 percent during the 2006-2010 period.^{cxxv} In 2007, the Chinese announced the creation of over a billion dollars of funds to encourage energy efficiency and renewables^{cxxvi}. The country is promoting biogas use, and investing in wind solar and other low carbon energy supplies. The world's first green billionaire now exists. He is a Chinese solar entrepreneur.
- The as-yet-unfulfilled aspirations of the billions of people in under-developed nations who need and deserve decent standards of living. An estimated 1.6 billion of the world's people lack convenient access to electricity. About the same number lack potable water. As the economies of these nations expand, pressures on the climate will become unmanageable without low-carbon technologies. At present, one-quarter of all development capital around the world is spent on carbon intensive power plants, whose electricity is unaffordable to the poorest, but whose economies are then taxed to pay for them. The only way that the half of the world's people who now live on less than \$2 a day can afford to develop is to leapfrog to world best practice in sustainable ways to meet their needs for energy services, water, sanitation, transportation, housing, etc. These technologies can deliver genuine development more reliably and affordably than can the carbon intensive practices of the last century. One of the best ways to ensure that the

world ramps its emissions down below the danger level at which we are now is to enable the whole world to unleash this new energy economy of efficiency and renewables.^{cxxvii}

- The growing world population. If present trends continue, the world population will grow from more than 6 billion today to more than 9 billion before mid-century.

Conclusion: Seizing the entrepreneurial imperative

Crafting a policy to enable America to prosper while meeting its needs for energy services with ample and affordable supplies is a challenging task. But it also offers unparalleled opportunities. Americans will balk at rules, taxes, mandates and bureaucracy. But they will rise to an entrepreneurial opportunity. “A well-designed climate policy framework will create huge opportunities for innovative companies to flourish as new markets are created and demand shifts to more efficient, more advanced and higher-value-added products and services,” according to a report from World Resources Institute.^{cxxviii} British economist Sir Nicholas Stern, in his 2006 study commissioned by the UK government on the economics of climate action, estimates that by mid-century, the global market for low-carbon technologies could deliver up to \$2.5 trillion a year in economic benefits. The stern report puts the 2010 value of the global environmental market at \$700 billion.^{cxxix}

There has never been a greater opportunity for America’s entrepreneurs to do well by doing good, and for communities to enhance energy security, improve quality of life, and enable their citizens to join the transition of the renewable energy future. This is the sort of challenge that Americans are good at. All they need is a supportive Federal policy environment.

The growing frequency of corporate commitments—even on the part of former climate-change skeptics —is an explicit message that companies and communities that are not quickly and boldly following suit will fall behind the curve as others demonstrate visionary leadership, responsible action, and the ability to capture public goodwill and patronage. This is one arena in which the business and advocacy communities are working together.^{cxxx}

Climate change presents an opportunity for the nation's businesses and communities to reinvent themselves for the 21st Century, reinvigorating America's economy and workforce, creating millions of new jobs on U.S. soil, and reasserting American leadership in knowledge, ingenuity and technological innovation. As researchers at the University of California-Berkeley concluded, "All states of the Union stand to gain in terms of net employment from the implementation of a portfolio of clean energy policies at the federal level."^{xxxix}

The challenge for policy is to design a comprehensive approach to climate planning that tackles building and car and appliance and machine efficiency and all of the other negative cost opportunities in ways that will makes us more competitive and puts 100's of billions of dollars back into the economy from savings. America can choose to invest in things that generate economic development in cities and states, bringing about more than savings. This approach will generate new manufacturing businesses, jobs retrofitting existing buildings, opportunities to build and manage the new decentralized energy system, the ability to revitalize farm income from biofuels, wind farms, etc. Traditional economists who use straight line projections to claim that acting to protect the climate will be costly should be challenged to show why unleashing the new energy economy will not, as President Clinton asserts, the greatest economic boom since World War II.

GUIDING PRINCIPLES FOR ACTION

NATURAL CAPITALISM

As we shift from the wasteful, polluting technologies of the first industrial revolution to the post-carbon age, the paradigm that drives industry will shift. Today's practice, which might be called *industrial capitalism*, has been financially profitable but only at the cost of liquidating such forms of wealth as natural and human capital. The natural resources, and more, the trillions of dollars worth of services that intact ecosystems give to our economy as part of our natural capital, and social and cultural systems, and more, the adaptive values that intact community gives to our society that are the basis of human capital have all been treated as having a value of zero.^{cxxxii} As the costs increasingly imposed on businesses from the loss of a stable climate show, the services that intact ecosystems provide to our economy have significant value.

Many businesses are shifting to a different approach to generating wealth and well-being. *Natural Capitalism* recognizes the critical interdependency between the production and four types of capital that an economy needs to function properly:

- human capital, in the form of labor and intelligence, culture, and organization
- financial capital, consisting of cash, investments, and monetary instruments
- manufactured capital, including infrastructure, machines, tools, and factories
- natural capital, made up of resources, living systems, and ecosystem services

Natural Capitalism is based on three principal strategies:

- *Buying time by radically using resources more effectively.* This slows resource depletion, lessens pollution, and provides increased employment with meaningful jobs. It can lower costs for business and society, halt the degradation of the biosphere, make it more profitable to employ people, and preserve vital living systems and social cohesion.
- Redesigning industrial processes and the delivery of products and services to do business as nature does, an approach known as *biomimicry*.^{cxxxiii} This approach enables a wide

array of materials to be produced with low energy flows, in processes that run on sunlight, with the constant reuse of materials and the elimination of toxicity.

- *Managing all institutions to be restorative of natural and human capital.* Such approaches enhance human well-being and enable the biosphere to produce more wealth from its intact communities and abundant ecosystem services and natural resources.

OPTIONS FOR PRESIDENTIAL ACTION

1: Instruct the Department of Energy identify and implement the market mechanisms that would unleash the creativity of companies, communities and individuals to reduce carbon emissions through energy efficiency

Robert J. Samuelson asserted in *Newsweek*: “It would be political suicide to do anything serious about [climate]....So shrewd politicians are learning to dance around the dilemma.”^{cxxxiv}

The statement reflects the fact that almost everyone *presumes* that protecting the climate will be costly. In Samuelson’s widely held view, saving a ton of carbon emissions would happen only under a roughly \$100 tax. Thus Samuelson continues, “Without a breakthrough in alternative energy—nuclear, solar, something—no one knows how to lower emissions adequately without crushing the world economy.” Congress “won’t impose pain on voters for no obvious gain to solve a hypothetical problem. And if the United States won’t, neither will anyone else.”

Samuelson, like many, believes that climate protection is costly because the best-known economic computer models say it is. Few people realize, however, that those models find carbon abatement to be costly *because that’s what they assume*. This assumption masquerading as a fact has been so widely repeated as the input and hence the output of supposedly authoritative models that it’s often deemed infallible.

Climate policy has been held hostage to a tacit presumption that if saving a lot more energy were possible at an affordable price, it would already have been implemented. That’s like not picking up a \$100 bill from the sidewalk because if it were real, someone would previously have picked it up; or like an entrepreneur who abandons a good business idea because if it were sound, it would have been done earlier.

All economists know that real markets are far from theoretical perfection. But most climate/economy models assume that almost all profitable energy savings must already have been bought—as if a perfect market did exist. On this basis, the modelers suppose, buying

significantly bigger savings will be worthwhile only at higher energy prices. They then use big computer models to calculate how high an energy tax is needed (based on historic elasticities), how much that will depress the economy, and hence what the “cost” of protecting the climate must be.

Those models have driven policy for the past two decades. Ever more elaborate models continue to be built on the same old assumption—that saving energy isn’t profitable at present prices and hence will require higher prices that will burden firms and the national economy.

This is contradicted by an enormous body of overlooked empiricism. In addition, *other* economic models derive the opposite answer from different assumptions, including government-sponsored studies^{cxxxv} and worldwide business practice, shows that the technological breakthroughs Samuelson seeks have already happened. The earth’s climate can be protected *not at a cost but at a profit*^{cxxxvi}—just as many industries are already turning the costs of environmental compliance into the profits from pollution prevention.^{cxxxvii} The Department of Energy should:

- Catalogue best practices of companies and communities that are profitably reducing emissions;
- Show that high energy prices are not the only way to ensure rapid adoption of energy-efficient practices;
- Clarify how least-cost climate solutions can foster vibrant competitiveness and employment; and
- Demonstrate that the climate issue represents a largely unexploited and under-recognized
- Work with the large institutional investors and others to organize pools of public and private capital to implement efficiency programs. The investors would expect a competitive rate of return in exchange for providing capital, but could share the savings over time as many green architects/builders do. This mechanism would create competition for conservation projects, whereby the “worst offenders” would become the best investments.

2: Instruct the Department of Energy to comprehensively identify and implement programs to clear the barriers that inhibit individuals, communities and companies from implementing cost effective measures to reduce greenhouse gas emissions.

The Report, *Climate Making Sense and Making Money*, commissioned in 1996 by the President’s Council on Sustainable Development, described how eight categories of barriers that are retarding wide implementation of climate protection.^{cxxxviii} This is tacitly conceded whenever market economists, as a senior government official recently wrote, “are not persuaded that just because an act seems to make good economic sense it will happen.” Many economically rational things don’t happen—precisely because of real-world obstacles and complexities that aren’t reflected in the perfect-market economic models relied upon for the conventional conclusion that saving much energy will require much higher energy prices.^{cxxxix} In fact, those barriers block economically optimal investment in efficient use of energy in at least eight main ways:

- **Capital Misallocation** – most executives believe that because energy costs are a small part of overall costs it is not worth management time to reduce them. About four-fifths of firms don’t assess potential energy savings using discounted-cashflow criteria, as sound business practice dictates; instead, they require a simple payback whose median is 1.9 years.^{cxl} At (say) a 36% total marginal tax rate, a 1.9-year payback means a 71% real aftertax rate of return, or around six times the marginal cost of capital. Many supposedly sophisticated firms count lifecycle cost only for big items and make routine “small” purchases based on first cost alone. Power plant investments typically attract cheap 40 year money, while most citizens must pay credit card interest rates to weatherize their homes or install renewable energy
- **Organizational Failures** – Infectious repetitious keeps many wasteful practices alive. Tight timelines prevent energy efficient design, or installation of renewable supply. Few facilities actually measure the energy performance of their buildings or equipment, instead relying on assumptions. Departments frequently do not cooperate, and energy savings costs are in different budgets than capital expenditures. In many government agencies, any energy savings will reduce next year’s budgets. Institutional and personal

rewards for savings are rare. Corporate turnover tends to eliminate institutional memory and energy savings champions. Risk-taking is rarely rewarded, so it is easier to remain mediocre, especially if the organization is doing well as it is.

- Regulatory failure – All but a handful of states and nations reward regulated utilities for selling more energy^{cxli} and penalize them for cutting customer bills, so shareholders and energy users have opposite goals—with predictable results. Obsolete codes competitively discourage innovators from using comprehensively efficient practices. Subsidies and other incentives to conventional supply technologies, to car-based transport and to conventional agriculture all encourage carbon intensive behavior. Tax asymmetries further distort energy choices. For example, energy purchases are deductible business expenses, but investments to save energy get capitalized.
- Lack of adequate information – few citizens know where to get more energy efficient devices, how to optimize their energy use, how to shop for it, how to get it properly installed, or who would stand behind it. Few understand such losses as phantom loads, or even what energy use is really costing them. “Hassle factors” and transaction costs prevent efficient microdecisions in day-to-day life.
- Risks to manufacturers and distributors – Industry lacks information too—about what customers really want and whether they’ll put their money where their mouths are. Manufacturers often hesitate to take the risk of developing and making new energy-saving products, because of limited confidence that customers will buy them in the face of all the obstacles listed here. Often the more efficient equipment is not available when and where it may be desired, leading companies and consumers to settle for less.
- Perverse incentives – Most buildings are designed by architects rewarded with a share of the mechanical systems they spec, and no incentive to spend extra time to produce a truly efficient structure. Split incentives between landlords and tenants, between builders and buyers, and many other actors keep a great deal of worthwhile efficiency from being implemented. Appraisers rarely credit efficient buildings for their actual energy savings, so efficiency’s value isn’t capitalized. Most leasing brokers base pro forma financials on average assumed operating costs, not actual ones. Few buildings have efficiency labels. Few renters have access to past energy bills.

- False or absent price signals – Fossil fuels do not bear the full cost that they impose on society, either in carbon emissions or air pollution. The U.S. still subsidizes energy supply by billions of dollars each year, mostly for the least competitive options and essentially all for supply. Significant costless reductions in carbon emissions are available just by removing subsidies. Few firms track energy costs as a line item for which profit centers are accountable. Firms in rented space often have energy bills prorated rather than submetered. Most billing systems give no end-use information that let customers link costs to specific devices. Many firms, especially chains and franchises, never even see their energy bills, which are sent directly to a remote accounting department for payment. Some large firms still assume that utility bills are a fixed cost not worth examining.
- Incomplete markets and property rights – There is no market in saved energy: “negawatts” aren’t yet a fungible commodity subject to competitive bidding, arbitrage, secondary markets, derivatives, and all the other mechanisms that make efficient markets in copper, wheat, and soybeans. There is no ability to go bounty-hunting for wasted energy, trade negawatt futures and options (or bid them in a spot market against megawatts), or bid them fairly against expansions of energy supply. You can seldom sell reduced demand or reduced uncertainty of demand; yet both are valuable resources that deserve markets. Property rights in most forms of depletion-and-pollution avoidance are incomplete or absent and hence cannot be traded.

Compare the “actually existing market” above with the requirements of a theoretical free market: perfect information about the future, perfectly accurate and complete price signals, perfect competition, no monopoly or monopsony (sole buyer), no unemployment or underemployment of any resource, no unmarketed resources, no transaction costs, no subsidies, no barriers to market entry or exit, and so forth. It’s a different universe. Identifying and systematically eliminating such barriers to the efficient functioning of the market would enable the climate to be protected without an economically burdensome regulatory regime.

In the absence of programs to clear barriers, there will need to be mechanisms to enable the companies of the new energy economy to build defensible moats around their businesses.

Warren Buffet makes no secret of investing in companies with such “defendable moats” and “pricing power,” or in economist’s terms, those companies that can create and maintain economic rents. This approach seeks imperfect markets because in perfect markets economic rents are minimized or eliminated. It is a firm’s job to maximize its own rent, while it is the market’s “job” to eliminate those rents. However, in the real world, dollars expressly flow into those businesses where profitability can be maintained over a long horizon, where monopoly or monopsony exists, where information is imperfect, where bargaining power is inherently unfair, or where price signals are unclear. Federal policy can either seek to reinforce such behavior, or clear these barriers.

3: Instruct the Federal Energy Regulatory Commission to implement a national version of the California Batinovich Plan to enable electric utilities to be rewarded with a share of what they save their customers by cutting their bills through implementing energy efficiency

In California in the late 1980’s, the Public Utility Commission under Commissioner Robert Batinovich shifted its regulations to reward utilities with a portion of the savings they created for their customers by implementing efficiency. The program worked spectacularly. California utilities realized that their highest rates of return would come from enabling their customers to become more efficient. Within a few years, no utility in California projected the need to build any more power plants, and all projected that they would meet all future demand growth through renewable generation.

Unfortunately free market advocates overturned this program. It is beyond the scope of this paper to review all of the mistakes that were made in that program, but it is important for advocates to realize that it was the overturning of the Batinovich Plan that caused the crisis in California electricity prices. The so called “deregulation” was actually a re-regulation with policies that allowed many of the actors to so “game” the system to be the furthest thing from a real market imaginable.

4: Reinstate Department of Energy Programs to enable all citizens to gain access to the information that they need to implement cost effective energy efficiency and renewable energy initiatives.

Markets only work if the actors within them have access to information and the opportunity to act on that information. It is important to have prices that properly signal actors, but if the actors lack information and opportunity, they will not respond to price signals alone.

Under the Carter Administration, the Department of Energy implemented a variety of programs to ensure that effective information programs existed at the Federal level, as well as at the state and local levels. These programs should be restored.

5: Create an Energy Security and Climate Stabilization Board to advise the Administration and Congress on how Federal policy and market mechanisms can help the U.S. business sector better respond to the opportunities of climate action, including Federal procurement.

On January 16, 1942, President Franklin Roosevelt established by executive order a War Production Board “for the purpose of assuring the most effective prosecution of war procurement and production” during the American engagement in World War II.^{cxlii} During its three-year existence the board supervised the production of \$185 billion worth of weapons and supplies.

Today, a growing number of military leaders recognize that climate change poses a threat to national security. While President Roosevelt’s War Production Board was controversial, it provides a precedent in which presidential leadership mobilized U.S. industry around an urgent national security objective.

The next President can call for a voluntary public-private partnership between the Federal government and U.S. industry to marshal America’s scientific and industrial expertise to meet global market demand for low-carbon technologies and products. The President could create an Energy Security and Climate Stabilization Board of CEOs to recommend market-mechanisms,

subsidy reforms, regulatory reforms, trade policies and other measures to assist U.S. industry in responding to the market opportunities presented by global climate action.

6: Reduce public and private exposure to mounting insurance losses and governmental disaster recovery expenses by creating innovative insurance instruments that encourage people not to build in vulnerable sites, fosters loss-mitigation approaches and that reduce the causes of climate change, thereby minimizing the prospects of weather-related disasters.

As the nation's largest economic sector and one that reaches virtually every consumer and business in the country, the insurance industry can play an enormous role in the development and promotion of climate-change mitigation and adaptation strategies. Because of the predicted impacts of climate change, property/casualty and health insurers, as well as insurance programs funded with public dollars, have much to gain from climate stabilization and adaptation programs. The President can:

1. Encourage state-regulated insurers to conduct customer education programs on cost-effective measures they can take in homes and businesses to reduce greenhouse gas emissions.

2. Encourage insurers to provide rate incentives for building practices that reduce losses related to climate change.^{cxliii}

3. Through the Institute for Business and Home Safety, conduct research that further substantiates the ability of low-carbon technologies and designs to reduce property/casualty losses.

4. Direct the Secretary of Homeland Security to analyze the potential long-term implications of climate change for the National Flood Insurance Program, and the Secretary of Agriculture to conduct a similar analysis for the Federal Crop Insurance Corporation. Direct that these analyses

use assessments from the Climate Change Science Program and the Intergovernmental Panel on Climate Change as the basis for anticipating future liabilities.

Key components of this analysis can include:

- Estimates of future exposure levels
- Implications for rates, the Federal budget and the availability of insurance
- Mitigation options that each program might use to reduce its exposure to losses^{cxliv}

5. Request that the National Association of Insurance Commissioners and other key stakeholder organizations develop recommendations on the following:

- Public-private partnerships to spread risk and to foster cooperation in data collection and enhanced actuarial analysis^{cxlv}
- Innovative insurance products that will reduce climate risks and preserve insurability for homeowners through advanced building codes, the “fortified building” concept, and tools to mitigate potential losses^{cxlvi}
- Incentives for local zoning and planning officials to integrate climate change and risk-reduction considerations into land-use planning^{cxlvii}
- Integrating energy efficiency and renewable energy strategies with risk management^{cxlviii}
- Facilitating risk-prevention strategies as an intrinsic part of disaster planning and recovery, including attention to the siting of reconstruction to avoid hazard areas; restoration of wetlands, watersheds and other natural features that mitigate flood damages; the use of climate-friendly, energy-efficient and disaster-resistant design and construction of buildings; and the design of energy infrastructure to combines greenhouse gas reductions with reduced vulnerability to disruption from future extreme weather events^{cxlix}

7: Create incentives for fossil energy industries to transition their production and labor force into technologies, resources, products and services that help the nation mitigate or adapt to global warming.

Public policies and market mechanisms that reduce greenhouse gas emissions will cause adjustments, and possible dislocations, for industries that produce, service or supply fossil energy. Owners, stockholders, workers and host communities all should be assured that they will be helped through the transition to a low-carbon economy.

- Use revenues from selling or auctioning cap-and-trade permits, from carbon taxes, or from other sources generated by national carbon policy to provide worker retraining, community development grants, and technical and financial assistance for traditional industries to move into new products that will be competitive in a post-carbon economy.

For example, provide:

- A “conversion tax credit” for retrofitting carmakers’ existing facilities to produce vehicles with advanced fuel-saving technologies or their components, tied to energy and greenhouse gas emissions metrics.^{cl}
- Federal loan guarantees to help U.S. automakers and suppliers retool to make advanced vehicles.^{cli}
- Federal loan guarantees to help airlines buy efficient new airplanes and scrap inefficient ones.^{clii}
- Technical assistance, including assistance with technology “roadmapping” (see below) to help carbon-intensive industries move into the new markets being created by climate policy.
- Tax advantaged lending through “Carbon Reduction Bonds.”

- Offer “Golden Carrot” awards for federal procurement of high-efficiency, low-carbon vehicles and products. This could take the form of advance purchase commitments by the federal government for vehicles and products that meet prescribed energy efficiency and carbon performance standards. The federal government could aggregate similar purchase commitments from States and others to sweeten the pot. Alternatively, offer a \$1 billion “Platinum Carrot” award to the first company that produces a super-efficient vehicle.^{cliii}

8: Create zero-carbon roadmaps for the nation’s most energy- and pollution-intensive industries.

The U.S. Department of Energy has worked in the past with the nation’s most pollution- and energy-intensive industry to develop technology “roadmaps”—documents that project each industry’s path to the future and the technologies needed to go there. Among other things, the roadmaps helped guide research and development investments by the department’s national laboratories and the private sector. They provided “customer driven” guidance to Congress and the Administration about highest research priorities for these key industries.

Industry roadmaps currently listed on DOE’s website are between three and 13 years old.^{cliv}

While some deal specifically with carbon dioxide emissions, many do not, in part because CO₂ has not been a criteria pollutant under the Clean Air Act, has not been regulated by the government and therefore has not been high priority for industry.

- The President can direct DOE to work with industry organizations to update the roadmaps to achieve significant reductions in greenhouse gas emissions, starting with the most carbon-intensive industry sectors—including oil and gas, electric power, auto, chemical, industrial equipment, mining and metals, coal, food products, forest products and air transport.
- The President can further direct that DOE undertake roadmapping exercises with industries most likely to suffer economic losses due to national carbon policies. The

purpose of these roadmaps would be to assist disadvantaged industries in transitioning to carbon-friendly products and services that, when possible, build upon their skills and imbedded investments in physical plant.

- The President can direct the U.S. Department of Commerce, Environmental Protection Agency, and Small Business Administration to support and promote corporate use of a 14-point "Climate Change Governance Checklist" used by Ceres to assess company action on climate risk in five areas: board oversight, management performance, public disclosure, greenhouse gas emissions accounting and strategic planning.

9: Direct the Environmental Protection Agency to develop an Energy Star Business program that recognizes businesses that meet sustainability and climate-protection criteria.

As noted above, a number of nongovernmental organizations and government agencies work with private companies on voluntary commitments to reduce greenhouse gas emissions. Several other organizations, domestic and international, regularly recognize companies that have made strong commitments to “green” and sustainable products and operations.

The standards and goals facilitated by these efforts, however, are not uniform, and there is no single program that combines high standards with highly visible and prestigious recognition.

Under this action item, the President would direct EPA to create an “Energy Star Business” program that, using lessons learned from its other Energy Star programs, develops criteria for the Federal government to recognize corporate efforts to mitigate or adapt to climate change.

Unlike its other Energy Star programs, however, the Energy Star Business program would offer several levels of recognition—for example, one star for companies that meet minimum requirements and up to five stars for companies that meet exceptional levels of performance. This approach, modeled on the LEED standard for buildings, would include a set of requirements for Energy Star designation, plus a variety of voluntary measures that would earn companies

higher levels of recognition. EPA would work with relevant Federal agencies, including the Small Business Administration and the Department of Commerce, and with stakeholder organizations such as the U.S. Chamber of Commerce, the National Association of Manufacturers and Businesses for Social Responsibility, to develop the rating system. Rating categories could include the following:

- Commercial buildings that attain LEED ratings through the use of advanced energy efficiency and renewable energy designs and technologies, and other measures that increase the buildings' sustainability;
- Percent of fleet vehicles utilizing non-petroleum fuels and meeting prescribed levels of vehicle efficiency;
- Production and/or use of recycled and recyclable products;
- Water and other resource conservation;
- Use of qualified environmental management programs;
- Efforts to educate consumers about climate change and the goods and services that help mitigate it;
- Internal climate change mitigation and adaptation strategies, including a limited use of carbon offsets;
- Participation in utility green power programs and/or green tag purchases to offset energy use;
- High scoring on the Ceres 14-point management actions mentioned in Action Item 5 above.

10: Add carbon mitigation and adaptation activities to the loan guarantee and technical assistance program offered by the U.S. Small Business Administration.

- The President can direct the U.S. Small Business Administration to focus its loan-guarantee programs for small, veteran-owned and women-owned businesses on activities that manufacture, install, maintain or use technologies that reduce greenhouse gas emissions.

Senators. John Kerry (D-Mass.) and Olympia Snowe (R-Maine) have accused federal agencies yesterday of doing too little to encourage the nation's 25 million small businesses to reduce their energy consumption claiming that the speed and scope of the Bush administration's voluntary efforts to curb global warming are insufficient. The Energy Policy Act of 2005 called for a government-wide program to improve energy efficiency in small businesses, modeled after the EPA's Energy Star program, which certifies energy-efficient consumer products. The Energy Star Small Business Program Web site was to be an online clearinghouse accessible through SBA's portal to provide content provided by the Energy and Commerce departments.

Kerry others proposed the "Extend the Energy Efficiency Incentives Act," which would increase a tax deduction for energy-efficient buildings from \$1.80 to \$2.25 per square foot, among other things.^{clv}

- The President can direct the U.S. Small Business Administration to equip its Small Business Development Centers, its Service Corps of Retired Executives (SCORE), and its other technical assistance programs to help small and medium-sized companies respond to market opportunities related to climate stabilization and adaptation, and to understand their own opportunities to reduce greenhouse gases in their buildings, operations and products.

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- ⁱ This paper draws extensively on the *Climate Protection Manual for Cities* (<http://www.climatemanual.org/Cities/Chapter1/index.htm>) see, especially “Climate Change: Why Act Now.” Grateful acknowledgement to peer reviewers Lyle Casriel, Bill Becker, Michael Northrup, Ray Anderson, and the staff of Natural Capitalism Solutions.
- ⁱⁱ Comprehensive policies to implement climate protection agency by agency throughout the Federal government are set forth in the detailed chapters of the Presidential Climate Action Project Action Plan, <http://www.climateactionproject.com/>
- ⁱⁱⁱ ‘The Stern Review’ on economics of climate change, www.hm-treasury.gov.uk/media/4/3/Executive_Summary.pdf October 2006 - Sir Nicholas Stern, once the Chief Economist and Senior Vice-President of the World Bank (2000 to 2003) released a report commissioned by the UK government, stating that that inaction on climate change will result in a depressed economy worse the Great Depression of the 1930s, with financial cost higher than the Depression combined with the two world wars. In human terms, the report concluded that the resulting drought and flooding will displace 200 million people from their homes creating the largest refugee migration in history. Up to 40% of world’s known species are likely to go extinct. To avert this tragedy, the report states, the world will need to spend 1% of global GDP each year to mitigate climate change, equal to the worldwide advertising budget. Failure to mitigate the crisis, the report stated, would commit the world to spend up to 20% of world GDP each year to deal with the consequences.
- ^{iv} Stated in a speech to the U.S. Conference of Mayors' Climate Protection Summit, 2 Nov 2007, Reuters
- ^v “Sustainable, efficient electricity service for one billion people,” Fulkerson, Levine, Sinton and Gadgil, Energy for Sustainable Development Volume IX No. 2, June 2005, p. 26-34. The International Energy Agency estimates that 1.6 billion people worldwide now have no access to electric service.
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- ^{vii} “In the Black” A report by the Climate Group, August 2007, theclimategroup.org/index.php/resources/
- ^{viii} U.S. Energy Information Administration at <http://www.eia.doe.gov/neic/quickfacts/quickoil.html>
- ^{ix} “In the Black” Climate Group
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- ^{xi} www.wbcd.org/web/publications/mobility/overview.pdf
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- ^{xvi} Ibid.
- ^{xvii} “The Warming Challenge”, *New York Times*, May 5, 2007
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- ^{xix} www.us-cap.org/climate-report.pdf. The report, issued in January 2007 was, in part, an effort to relieve corporations of having to navigate the disparate regional and state-level carbon-reduction regimes now proliferating in the United States.
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- ^{xxiii} Gary Pfeiffer, Dupont CFO, 340% increase in share value paralleling 60% reduction in environmental footprint personal communication at speech he gave at a Conference Board conference 2005.
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- ^{xxxii} From the article “Sustainable Executives”, <http://www.natcapsolutions.org/resources.htm#ART>
- ^{xxxiii} Fishman, Charles, “How Many Lightbulbs Does it Take to Change the World? One. And You're Looking At It.” *Fast Company Magazine*, Issue 108 | Sept 2006, Pg 74
http://www.fastcompany.com/magazine/108/open_lightbulbs.html
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- ^{xxxv} Friends of the Earth, in conjunction with Greenpeace and several western cities, filed one of the first climate change lawsuits in 2004. The suit charges two U.S. government agencies with failing to comply with National Environmental Policy Act (NEPA) requirements to assess the environmental impact of projects they financed over the past decade. The states of Connecticut, Massachusetts, and Maine have also filed a climate change lawsuit against another U.S. government bureau, the Environmental Protection Agency, for failing to regulate carbon dioxide emissions under the Clean Air Act.
- ^{xxxvi} Press Statement of Peter Lehner, chief of Environmental Protection Bureau, New York State Attorney General's Office, Re: Corporate Governance and Climate Change: Making the Connection, August 1, 2006.
http://www.ceres.org/news/news_item.php?nid=57.
- ^{xxxvii} http://www.ftse.com/Indices/FTSE4Good_Index_Series/Downloads/FTSE4Good_Climate_Change_Consultation_Aug_06.pdf
- ^{xxxviii} March 22, 2006 <http://www.planetark.com/dailynewsstory.cfm/newsid/35747/story.htm>
- ^{xxxix} CERES website, <http://www.ceres.org/pub/>, August 1, 2006.
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http://www.ceres.org/pub/docs/Ceres_insure_climatechange_120105.pdf
- ^{xli v} NFIP provides insurance for flood damage to homeowners and commercial property owners in more than 20,000 communities. Homeowners with mortgages from federally regulated lenders on property in communities identified as being in high flood risk areas are required to purchase flood insurance on their dwellings. Optional, lower cost flood insurance is also available under the NFIP for properties in areas of lower flood risk. NFIP offers coverage for both the property and its contents, which may be purchased separately. GAO, pp. 7-8.
- ^{xli vi} Congress established the NFIP in 1968, partly to provide an alternative to disaster assistance for flood damage. Participating communities are required to adopt and enforce floodplain management regulations, thereby reducing the risks of flooding and the costs of repairing flood damage. FEMA, within the Department of Homeland Security, is responsible for, among other things, oversight and management of the NFIP. Under the program, the federal government assumes the liability for covered losses and sets rates and coverage limitations.
- Congress established the FCIC in 1938 to temper the economic impact of the Great Depression and the weather effects of the dust bowl. In 1980, the Congress expanded the program to provide an alternative to disaster assistance for farmers that suffer financial losses when crops are damaged by droughts, floods, or other natural disasters.

^{xlvii} Insurance companies can transfer risk to policyholders by increasing premiums and deductibles, by setting lower coverage limits for policies, and by passing along the mandatory participation costs of state-sponsored insurance plans (GAO, *Climate Change*, p. 33).

^{xlviii} Estimate by John Dutton, dean emeritus of Penn State's College of Earth and Mineral Sciences, in Eugene Linden, "Cloudy with a Chance of Chaos," *Fortune Magazine*, January 17, 2006, http://money.cnn.com/2006/01/17/news/economy/climate_fortune/index.htm.

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^{lxi} Francis X. Lyons, a former US EPA regional administrator now with Gardner, Carton & Douglas LLP, "Sarbanes-Oxley and the Changing Face of Environmental Liability Disclosure Obligations," *Trends*, Volume 35 No. 2, Nov/Dec 2003. Available from. www.gcd.com/db30/cgi-bin/pubs/Sarbanes2.pdf.

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penalized for selling less. This also eliminates the incentive to game the forecast (lowball sales forecasts so you can sell more), and does not make utilities' profits depend on things they cannot control such as weather.

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http://www.ceres.org/pub/docs/Ceres_insure_climatechange_120105.pdf

^{cxlvi} Ibid.

^{cxlvii} In New Zealand in 2004, for example, the Insurance Australia Group (IAG) worked in partnership with local government planners to determine the most appropriate flood planning levels for the future. IAG provided modeling results showing changes in extreme rainfall, which the local government used to determine likely changes in future flood levels. This was then incorporated into their flood mitigation program in planning for higher levee banks. "From Risk to Opportunity," p. 16.

^{cxlviii} Ceres cites the DOE's list of nearly 80 technologies and practices that can lower GHG emissions while reducing the direct risk of property damage from mechanical equipment breakdown, professional liability, builders' risk, business interruption, and occupational health and safety. Ibid., p. 17.

^{cxlix} Ibid. p. 18.

^{cl} Energy Futures Coalition. http://energyfuturecoalition.org/new_vehicles.cfm

^{cli} Amory B. Lovins, E. Kyle Datta, Odd-Even Bustnes, Jonathan G. Koomey, and Nathan J. Glasgow, *Winning the Oil Endgame*, p. xi.

^{clii} Ibid., pp. 154-156.

^{cliii} Ibid., p. 182.

^{cliv} See http://usms.nist.gov/roadmaps/browse_author.cfm?AuthorID=9 for a list of roadmaps

^{clv} Burnham, Michael, "ENERGY POLICY: Kerry, Snowe slam agencies for work on small businesses, Environment and Energy Daily, Friday, March 9, 2007