

The Economic Case for Climate Protection

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

—Sir Nicholas Stern¹

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 Clinton²

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

Solving the climate crisis is urgent. Perhaps more important, addressing it intelligently will unleash enormous economic opportunity. Mitigating greenhouse gas emissions will require a crash program to use energy more efficiently and to use renewable energy sources. Doing this will cut costs and drive competitiveness, spread the use of clean energy technologies that already are cost competitive and available, and deploy next-generation technologies in virtually every sector of the economy.

Capturing these opportunities will require investment, management attention, and determination. The fact that these resources are scarce goes a long way to explain why energy opportunities remain to be captured: without leadership and lacking a widespread recognition of the urgency, resources have been deployed elsewhere. Energy is typically 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. Until the issue is elevated to the level of CEO concern,

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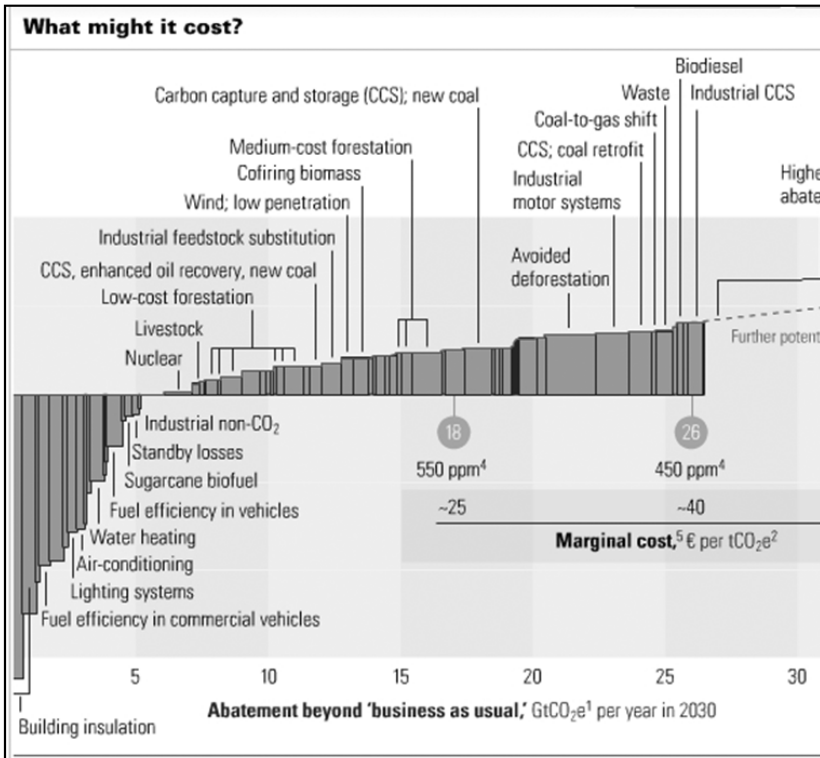


Figure 1. A Cost Curve for Greenhouse Gas Reduction

Source: Enkvist, Per-Anders, Naucler, Tomas, Rosander, Jerker, “A Cost Curve for Greenhouse Gas Reduction,” *The McKinsey Quarterly*, no. 1 (2007). © McKinsey & Co.

it will be hard to get action in corporations or governments. In addition, as described 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 has just not been worth surmounting—yet.

CAPTURING THE OPPORTUNITIES

The entrepreneurial opportunities in implementing a new energy economy will be unprecedented. Far from the crushing cost that some have called the price of climate protection, investments in using energy more productively and in unleashing the new energy economy will deliver impressive returns.

In the past, the United States led the world in the development of green technologies. Solar electric cells and wind turbines were first developed in America. Today, due to intelligent government policies, countries such as Japan, China, Germany and Denmark have taken the lead in solar and wind power. Renewables now create more new jobs in Germany than any other industry.³ Denmark aims to get 60 percent 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's largest car company, expects hybrid vehicles to rise from 6 percent of its U.S. vehicle sales in 2005 to 20 percent by 2012.⁴ 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.⁵

The McKinsey study profiled in Figure 1 is one of a growing number of studies that are finding that the challenge can be met with little or even negative cost. McKinsey 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 a cost less than the world spends on defense or insurance, and with around a third of the estimated impact of recent oil price rises.⁶ 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."⁷

Many companies and communities aren't waiting. DuPont, GE, Alcoa, Caterpillar, Pacific Gas & Electric (PG&E), and others, acting as members of the U.S. Climate Action Partnership, or USCAP,⁸ 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."⁹ PG&E, Exelon, Public Service of New Mexico, Nike, and Apple have all resigned from the U.S. Chamber of Commerce in disagreement with the Chamber's opposition to the Environmental Protection Agency limiting carbon emissions.¹⁰

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 had pledged that their cities would meet the goals set forth in the Kyoto Protocol or reduce their emissions of greenhouse gases by at least 7 percent by 2012. Some have already met even more aggressive targets or set goals ranging from a 20 percent reduction by Portland, Oregon, to a 42 percent reduction over the same time frame by Sebastopol, California.¹¹

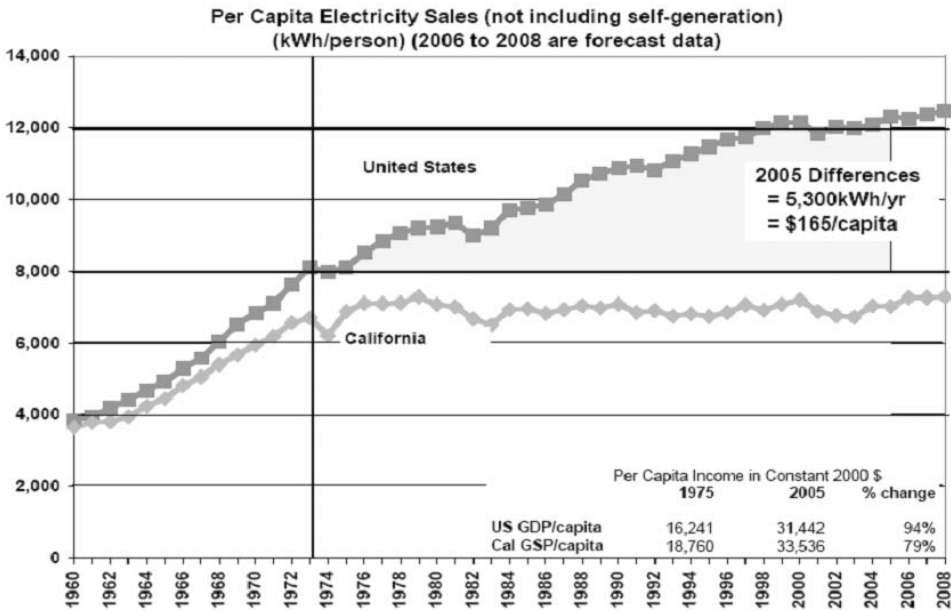


Figure 2. California versus U.S. Energy Demand

Source: Arthur Rosenfeld, California Energy Commission.

California, the world's sixth largest economy provides an example. Since 1974, Californians have held their energy consumption to zero growth while national per capita energy consumption grew 50 percent. The state's per-capita carbon emissions have dropped 30 percent since 1975. (See case narrative by Arthur Rosenfeld in this issue of *Innovations*.)

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.¹² In 2004, California ranked 12th in the nation in energy prices, but only 45th in energy costs per person.¹³

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 through savings. A city 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 encourage economic development in cities and states. They create new manufacturing companies, building retrofits, decentralized energy systems, farm income, etc., and spur the creation of a dynamic, transformative, clean energy economy that saves money, generates jobs, and confers economic opportunity.

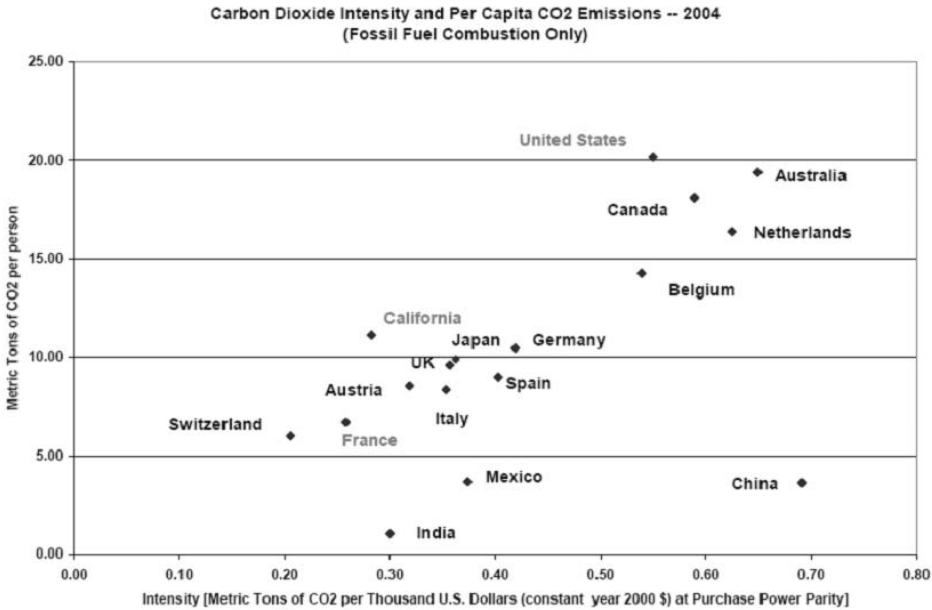


Figure 3. California and U.S. CO₂ Intensity

Source: Arthur Rosenfeld, California Energy Commission.

THE BUSINESS CASE FOR CLIMATE PROTECTION

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

Gains for the environment realized through increased efficiency are free—or better than free (see text boxes on following pages). And they exist throughout American businesses. Even where achieving the energy savings that will protect the climate costs money, it is one of the best investments a company can make. Johnson Diversey projects a 160 percent return on their investment in reducing their carbon footprint by saving energy.¹⁴

Given the many available examples of thoughtless waste, it should come as little surprise that American businesses use twice as much energy to produce a unit of GNP as do our competitors around the world.¹⁵ But then, all of the other nations in the world have signed the Kyoto Protocol, which obliges them to save energy in order to cut carbon emissions. They are innovating to do this, saving money in the process and enhancing their competitiveness.

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. Venture capitalist John Doerr recently stated that such green technology could match information technology and biotechnology as a significant money-making opportunity. He called

The Business Case for Climate Protection: Some 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 one billion people who now do not yet have access to electricity.¹ The World Bank estimates that an investment of up to \$40 billion annually will be needed worldwide to adapt to climate change. This may sound like a lot, but the investment will do more to create jobs and stimulate the economy than any other options. Investments in renewable energy create 10 times the number of jobs that a similar amount invested in conventional power stations would.² 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 2005 survey of 19 venture capitalists investing in 57 European clean tech firms showed average annual returns since 1999 of almost 87%.³
- 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 States⁴ 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.⁵ In contrast, current high oil prices represent one of the biggest transfers of wealth in history, redistributing 1% of world GDP each year. Oil consumers now pay \$5 billion more for oil every day than they did five years ago. In 2007, \$2 trillion will flow from customers to the oil companies and oil-producing nations.⁶
- 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

climate change “one of the most pressing global challenges” and said that the resulting demand for innovation would create the “mother of all markets.”¹⁶ One study estimated that investment in renewable energy projects could skyrocket to nearly \$50 billion by 2011, with double-digit annual growth rates.¹⁷ 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 authors to conclude that clean energy could provide almost a quarter of the world’s electricity by 2030. It reported that more than \$70bn was injected into wind and solar power and biofuels in 2006, 43 percent more than the preceding year. Sustainable energy accounts for only 2 percent of the world’s total, but 18 percent of all power plants under construction are in this sector.¹⁸

The European Union has established a goal of meeting 20 percent of its energy supply from renewable energy by 2020.¹⁹ Delivering the capacity to do this is

2050.⁷ 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, New York 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 a 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%.

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1. “Sustainable, efficient electricity service for one billion people,” Fulkerson, Levine, Sinton and Gadgil, *Energy for Sustainable Development* 9, no. 2 (June 2005), pp. 26-34. The International Energy Agency estimates that 1.6 billion people worldwide now have no access to electric service.
 2. Daniel Kammen, “Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?” http://www.berkeley.edu/news/media/releases/2004/04/13_kamm.shtml; and Sanders, Robert, “Investment in Renewable Energy Better for Jobs as Well as Environment,” April 13 2004, http://www.berkeley.edu/news/media/releases/2004/04/13_kamm.shtml
 3. *In the Black*, Report by the Climate Group, August 2007, <http://theclimategroup.org/index.php/resources/>
 4. U.S. Energy Information Administration <http://www.eia.doe.gov/neic/quickfacts/quickoil.html>
 5. *In the Black*, Climate Group
 6. Mufson, Steven, “Oil Price Rise Causes Global Shift in Wealth,” *The Washington Post*, November 10 2007, <http://www.washingtonpost.com/wp-dyn/content/article/2007/11/09/AR2007110902573.html?hpid=topnews>. Americans use about 22 million barrels/day, times (say) \$130/bbl. This results in around \$3 billion per day spent. Based on the same usage rate, or about 7 to 8 billion barrels/year, at \$130, Americans are spending about \$1 trillion.
 7. See <http://www.wbcds.org/web/publications/mobility/overview.pdf>

expected to provide up to 2.8 million jobs and create up to 1.1 percent of the GDP. The E.U. energy commissioner, Andris Piebalgs, stated, “This shows that benefits of renewables in terms of security of supply and fighting climate change can go hand in hand with economic benefits.” Asia should do no less.

Vishal Shah, an investment analyst for Barclays Capital, has put it this way:

As global economies take action to mitigate climate change, we expect an era of fundamental reshaping of the global energy infrastructure to create a prominent role for the renewable energy sector. Renewable electricity represented 2.5 percent of worldwide electricity generation in 2008 and we believe it could represent more than 20 percent of worldwide electricity generation, as policies to promote renewable energy are implemented globally over the next 20 years. . . . Solar currently represents less

Interface Inc.

When Ray Anderson, CEO of the global carpet company, Interface Inc., looked critically at his carpet operations and sustainability, he concluded that “nothing about our business was sustainable.”¹ Anderson challenged himself, his employees, peers, and competitors to shift to sustainable operations. Innovating to cut waste and to redesign his products, Interface found that its commitment to sustainability enhanced every aspect of shareholder value. The savings accumulated from eco-efficiency measures paid for the entire sustainability commitment and enabled the company to remain profitable through economic downturns, gain market share, and become the dominant player in its industry.²

Anderson’s goals were:

- Take from the Earth only what can be rapidly renewed by the Earth naturally
- Take no oil from the ground for production and send nothing to landfill
- Create no harm to the biosphere, and
- Goal: “Mission Zero”—0 impact, 0 footprint

The company’s measured progress to date includes:

- Net GHG emissions are down 82% in absolute tonnage
- Sales increased by 2/3
- Profits have doubled
- Fossil fuel usage is down 60%; Water usage is down 75%
- Renewables and recycled materials are up 25%
- Renewable energy use is up 27%
- Interface diverted 74,000 tons of used carpet from landfills
- The company innovated the first certified carbon-neutral products, and
- Interface sold 85 million square yards of climate-neutral carpet since 2004

Interface is half way to its goal today. It anticipates meeting its goal of having zero impact and zero footprint in 2020. Ray Anderson, now chair of the company, reports that Interface’s sustainability quest has been the best thing he has ever done for the business.

Costs are down \$4.5 million per year. The program has elicited unprecedented customer loyalty that saw the company through the last economic downturn. The savings from eliminating waste paid for all of the costs for transformation of Interface.³

1. Anderson Ray, *Midcourse Correction*, Chelsea Green Press, 1999, ISBN-13: 978-0964595354.

2. Personal communication, Ray Anderson, Wingspread meeting, July 16 2008.

3. See http://www.ted.com/talks/ray_anderson_on_the_business_logic_of_sustainability.html.

than 0.5 percent of global electricity generation. However, as renewable electricity gains importance in the \$1 trillion global electricity market, we forecast solar photovoltaic shipments to rise at a compound annual growth rate of 50 percent for the next four years.²⁰

Renewable energy generation is being implemented across Asia. The government of India has announced plans to invest \$20 billion to build a solar market and an Indian solar photovoltaic industry.²¹ The plans include constructing 20 gigawatts (GW) of solar energy by 2020, with a total of 200 GW of solar generation by 2050. Currently, India has little solar generation, but by 2012 it expects to have 1 GW of solar power installed on the rooftops of public-sector buildings and in local solar manufacturing parks.

China is also investing heavily in solar and wind power, reportedly investing \$440 to \$660 billion²² in clean-energy industries over the next 10 years. Already one of the global leaders in wind power generation, with 100 billion yuan (\$14.6 billion) committed to wind power generation by 2010,²³ China plans to increase wind generation from 12,000 megawatts (MW) to 30,000 MW. Shi Lishan, deputy director of renewable energy at the National Energy Administration, said, "Wind power is 'vital' as it is the cheapest form of renewable energy."

Japan is investing to achieve a 20-fold expansion of installed solar energy by 2020,²⁴ while South Korea is devoting \$85 billion, or 2 percent of its GDP, to green industries and technologies over five years.²⁵ In contrast the U.S. is projected to invest only \$10 billion annually in a clean energy economy, assuming that the American Clean Energy and Security legislation now languishing in Congress actually passes. Only \$1.2 billion would be spent on research into low-carbon technologies.²⁶ Various observers believe that this is an opportunity for Asia to take the lead in creating a more sustainable energy future.²⁷

Energy supply is not the only aspect of a clean energy industry. China plans to produce half a million hybrid vehicles per year by 2011. Toyota projects 30,000 in Japan by 2012. In contrast, the Ford Motor Company estimates that it will have produced only 120,000 by 2020. Unless America acts, Asia will seize the center of the conversation in clean technologies.²⁸

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 have been outperforming the MSCI world index of stocks by 25 percent since 2005. Seventy-two percent of the companies on the list outperformed industry peers.²⁹

Even in the economic collapse, companies that make a commitment to behave more sustainably fared better than their peers in the same industry. From 2006 through 2007 companies on the Dow Jones Sustainability World Index performed 10 points above the S&P 500.³⁰

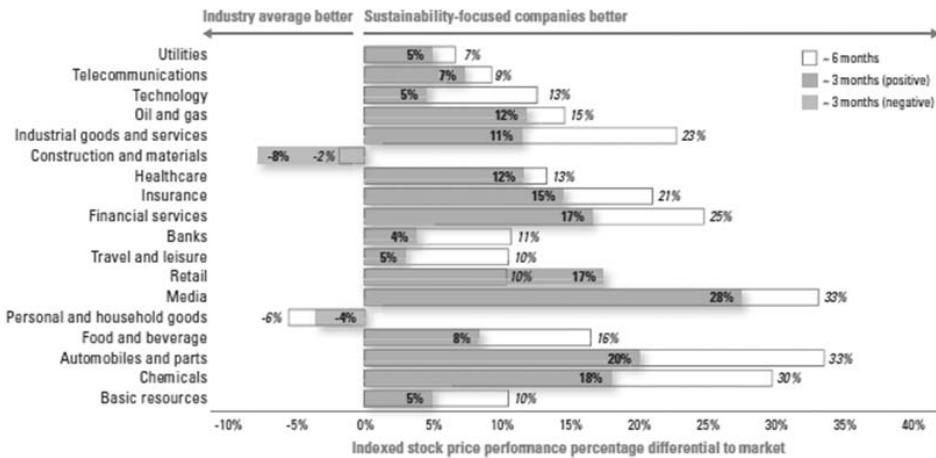


Figure 4. Performance of sustainability-focused companies.

Source: Mahler, Daniel, Jeremy Barker, Louis Besland, and Otto Schulz. “Green Winners,” online article for A.T. Kearney, 2009, http://www.atkearney.com/shared_res/pdf/Green_Winners.pdf.

In 2009, A.T. Kearney released the findings of their report, “Green Winners,” comparing the economic performance of companies with a commitment to sustainability to that of companies in the same industry without such a commitment. The report tracked the stock price performance of 99 firms on the Dow Jones Sustainability Index and the Goldman Sachs list of green companies over the six months prior to November 2008. In 16 out of the 18 industries evaluated, businesses deemed “sustainability focused” outperformed industry peers and were “well protected from value erosion.” In the study period of three months the differential between the companies with and without a commitment to sustainability was 10 percent and over six months the differential was 15 percent. “This performance differential,” the report stated, “translates to an average of \$650 million in market capitalization per company.”³¹

As shown below in Figure 2.13 from a 2009 study of European companies (the ATOS study) “there is a strong business case for environmental excellence. Companies with more mature sustainability programs enjoy higher profit.”³²

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” in recognition of this reality.³³

Shareholder value is enhanced when a company grows top-line sales, cuts its costs, manages its risks effectively, enhances labor productivity, drives innovation, better manages its supply chains, etc. These elements of what is now known as “the Integrated Bottom Line”³⁴ are all strengthened when companies save energy and reduce 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. Such programs enhance core business value through sector performance leadership and first-mover advantage, create greater access to capital, improve corporate governance, strengthen the ability to drive innovation, and improve government relations. They also help a company to retain competitive advantage, enhance its reputation and brand equity, increase its ability to capture market share, and differentiate its product. Finally, these 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, as enhance 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, companies who institute such programs will be in a leadership position because by taking early action to deal responsibly with GHGs, they cut their costs and got ahead of their competitors.

Cost Reduction: The Walmart Experience

As DuPont showed, using less fossil fuel 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.

Walmart 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, or forty bulbs per store) could save the company \$6 million a year. Said Chuck Kerby, the Walmart employee who did the math, "That, for me, was an 'I got it' moment."³⁵

In 2005, Lee Scott, then CEO of Walmart, committed the company to work with its more than 60,000 suppliers to deliver "affordable sustainability" to Walmart's 176 million customers in 14 countries. Walmart pledged:

- To be supplied 100 percent by renewable energy
- To create zero waste
- To sell products that sustain resources and the environment

Scott announced that Walmart was "helping thousands of suppliers, millions of associates, and tens of millions of customers make billions of individual decisions that sustain themselves, their communities and, in turn, the Earth."

Scott announced goals to reduce energy use at Walmart stores by 30 percent over three years to double the efficiency of its vehicle fleet, and to build hybrid-electric long-haul trucks.³⁶ Walmart, which if it were a country would be the 20th largest in the world, is not making such pronouncements out of the goodness of its heart. In the two years after Walmart began its sustainability program, savings were significant. Reducing unnecessary packaging by just five percent saved the company \$11 billion worldwide.³⁷

Walmart's challenge, like that of many retailers, is that it does not own or operate factories. "For instance," Lee Scott stated, "we were buying from a candy factory in Brazil that just did not have a good system in place for processing, recycling, and disposing waste. So our auditors sat down with the factory's management, explained that sustainability can be profitable, and made recommendations. These managers were skeptical, but they took on the challenge. The next time we visited the factory, we saw a new waste management program. And you know what? The factory managers proudly reported that their new program was generating \$6,500 per year in new profits."

In October 2008, Walmart, which would be China's sixth or seventh largest trading partner if it were a country, called its 1,000 largest Chinese suppliers to a meeting with representatives of the Chinese government, NGOs, and others. Walmart executives described the aggressive goals the company has established to build a more environmentally and socially responsible global supply chain.³⁸

Their criteria required that the top 200 factories from which Walmart's sources its materials achieve a 20 percent improvement in energy efficiency by 2012. The company stated that by that date it would source 95 percent of its production from the factories with the highest ratings in audits for environmental and social practices. It further revealed that Walmart China will design and open a new store prototype that uses 40 percent less energy.

To increase transparency and encourage sustainable development across its entire supply chain of 60,000 to 90,000 suppliers, Walmart asked the Carbon Disclosure Project (CDP) to survey suppliers in China to determine the carbon footprint³⁹ of factories, and to assess programs to reduce carbon emissions.⁴⁰ The CDP, which represents 315 global institutional investors with assets of \$55 trillion, receives annual corporate carbon footprint reports from almost 80 percent of the *Financial Times* 500, the largest companies in the world. Institutional investors use the CDP database to make investment decisions based a company's greenhouse gas emissions, emission-reduction goals, and strategies to combat climate change.⁴¹ Companies that do not responsibly manage their carbon footprint are deemed not worthy of investment.

Walmart was one of only two companies in the Dow Jones Industrial Average whose stock price rose in 2008—by 18 percent—and its sustainability efforts were credited in part with this performance.⁴² When he announced the sustainability initiative, Walmart CEO Lee Scott observed that a corporate focus on reducing greenhouse gases as quickly as possible was just a good business strategy, stating, "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."⁴³ In 2009, Reuters quoted the company's new CEO Mike Duke as saying that he wants to accelerate the sustainability efforts: "I am very serious about it. This is not optional. It's not something of the past. This is all about the future."⁴⁴

In July 2009, Walmart rolled the comprehensive environmental and social program out to its several thousand largest suppliers, asking them to complete an environmental scorecard relating to product packaging and waste reduction in

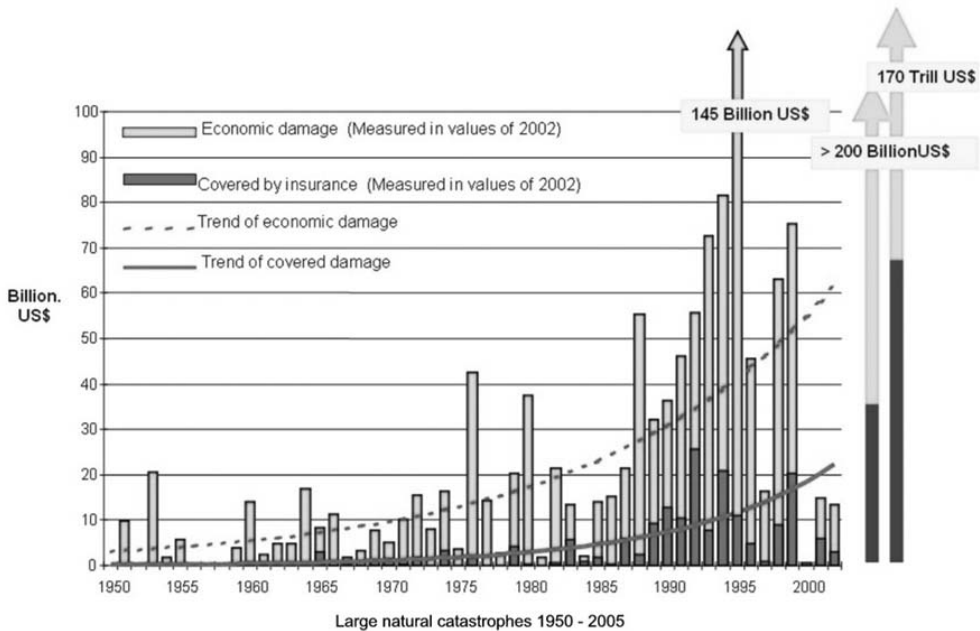


Figure 5. Evolution of economic costs, insured costs of natural disasters worldwide

Source: © 2003 GeoRisikoForschung, Müncheneruck.

order to improve product design and delivery.⁴⁵ The first two questions asked suppliers whether they had measured their carbon footprint, and whether they report it through the Carbon Disclosure Project.

Walmart is not the only company now requiring its supply chain to document more environmentally responsible practices. Hundreds of major European and American companies are establishing supplier codes of conduct and hiring third-party verifiers to audit their factories to ensure compliance with social and environmental standards. As such companies recognize that their survival depends on behaving in more sustainable ways, they are changing how the world does business.

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 reduction of carbon emissions simply good business (see Figure 5).

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 shareholder value remain to be seen, the first such suits have already been filed.⁴⁶ 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.⁴⁷

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 the 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."⁴⁸

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 more 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 U.S. 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."⁴⁹

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.⁵⁰ 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 reinsurance 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.”⁵¹ 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. The year 2005 was the costliest 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.⁵²

In the *Fortune* magazine article “Cloudy with a Chance of Chaos,”⁵³ 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 percent 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 U.S. 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 reinsurance 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 percent 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.⁵⁴ 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.⁵⁵ 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,⁵⁶ and the Federal Crop Insurance Corporation (FCIC), which insures crops against drought or other weather disasters.⁵⁷ Increasingly, private companies are taking steps to limit their catastrophic risk exposure, transferring some of the risk to policyholders⁵⁸ 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.⁵⁹ Homeowner premiums have risen 20 to 40 percent in many areas, and 10- to 20-fold in isolated cases.⁶⁰ Insurers have withdrawn coverage for hundreds of thousands of homeowners in Florida, Louisiana, Mississippi, New York, Massachusetts, Rhode Island, and South Carolina.⁶¹

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.⁶² 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.⁶³

In spite of the growing risks, climate change also offers substantial opportunities to the insurance industry. A 2006 CERES⁶⁴ 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 cli-

mate change and advance forward-thinking solutions to minimize its impacts.”⁶⁵ 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 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.”⁶⁶

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.⁶⁷

The Investor Network on Climate Risk,⁶⁸ 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,⁶⁹ 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.⁶⁹ The plan calls on U.S. companies, Wall Street firms, and the Securities and Exchange Commission (SEC) 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 the SEC, asking it to require

companies to assess and disclose “material” financial risks from climate change. Such risks would include the financial impact of emerging carbon-reducing regulations, extreme weather and other climate-related physical events, or growing global demand for low-carbon technologies and products.⁷⁰

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, then 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.”⁷¹

In the United States, the Sarbanes-Oxley Act⁷² 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,⁷³ 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.⁷⁴

Since 2002, a British NGO, the Carbon Disclosure Project (CDP) has surveyed the *Financial Times* 500. 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 U.S. 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 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 U.S. 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 Award as the first bank to become carbon neutral. It not only provided financing for renewable energy companies, it purchased renewable energy to cover its operations.⁷⁵ 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 the 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."⁷⁶ 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.⁷⁷ Citigroup Inc., Deutsche Bank AG, JPMorgan Chase, UBS AG, and ABN Amro have committed \$1 billion to finance the energy savings measures in municipal buildings in 16 cities: New York, Chicago, Houston, Toronto, Mexico City, London, Berlin, Tokyo, Rome, New Delhi, Karachi, Seoul, Bangkok, Melbourne, São Paulo, and Johannesburg.⁷⁸

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.⁷⁹ 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 (now famously defunct, for unrelated reasons) combined its natural resources and power banking groups into "renewables vertical."⁸⁰ 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.⁸¹ "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."⁸²

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 at the time, 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."⁸³

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, Walmart 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. Walmart 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.⁸⁴ As described above, Walmart 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 Walmart'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."⁸⁵

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.⁸⁶ 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.⁸⁷

For example, when Lockheed commissioned Building 157 in Sunnyvale, California, 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, 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 to achieve this (good green features, if implemented by an experienced team, now add nothing extra and can actually reduce costs), was paid back in four years. The features achieved a 75 percent reduction in lighting energy, saving \$500,000 a year in energy costs. 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 an increase in productivity of the same amount. This enabled the company to win a contract, the profits of which paid for the cost 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 two-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, improved on-time delivery, and increased customer satisfaction.

In the United States alone, roughly six billion square feet of buildings are constructed each year.⁸⁸ 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, result in an annual cost to the United States of approximately \$60 billion.⁸⁹ Better indoor air quality, a frequent result of more energy-efficient building technology, has been shown to improve worker productivity by 0.5 percent to 5 percent, with estimated savings of \$20 billion to \$200 billion.⁹⁰

Disproportionate Risks and Potential Benefits for Small Business

Small businesses are the economic engine of the country, generating more than half of nonfarm 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 percent to 80 percent of net new jobs each year.

A June 2006 article in *Business Week*⁹¹ 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.⁹² 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 EPA expends just \$1 million and two staff positions on its programs to get information to small businesses.⁹³

A number of programs show small businesses how to achieve the same sorts of savings that big companies like Walmart are enjoying. Natural Capitalism offers a web-based learning tool, Solutions at the Speed of Business, that shows small companies 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.⁹⁴ There is rapidly growing consumer demand by consumers for environmentally sustainable choices in every line of consumer item, including foods, clothing, household, and recreational items.⁹⁵ 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.”⁹⁶

Energy efficiency and renewable energy can enable small businesses to become energy self-sufficient. On August 14, 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 Street Journal* estimated the cost to the region at \$6 billion. Two-thirds of businesses surveyed 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 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. Company 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.⁹⁷

Similar opportunities exist in rural America. The Straus organic dairy outside of San Francisco powers its operation from the methane from the manure produced by 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 greenhouse 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 percent 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.⁹⁸

American workers would benefit from building a new energy economy, according to the Apollo Alliance,⁹⁹ 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.¹⁰⁰

“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.¹⁰¹

THE COMMUNITY CASE FOR CLIMATE PROTECTION IN THE U.S.

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.

States

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 the 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 percent cut by 2020, affecting a wide range of companies including automakers and other manufacturers. The state is the 12th largest carbon emitter in the world, despite leading the nation in energy-efficiency standards. In 2007, Arnold Schwarzenegger, the Republican 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.”¹⁰²

The governor is right. A 2008 study by the University of California found that California's programs to reduce energy dependence and increase energy productivity three decades ago directed a greater percentage of its consumption to in-state, employment-intensive goods and services, whose supply chains largely reside within the state. This created a strong "multiplier" effect of job creation, generating 1.5 million FTE jobs with a total payroll of over \$45 billion, saving California consumers over \$56 billion in energy costs. Going forward, achieving 100 percent of the greenhouse gas emission reduction targets mandated by AB 32, the legislation that Schwartzenegger championed to reduce carbon emissions 80 percent by 2050, would increase the Gross State Product by \$76 billion, increase real household incomes by \$48 million, and create as many as 403,000 new efficiency and climate action jobs.¹⁰³

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 governor Charlie Crist, remarking on the extreme weather and skyrocketing insurance rates in his state, said, "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 acknowledged that the problem exists. No longer."¹⁰⁴ Governor Crist commissioned a Republican task force to study what it would cost the state to implement measures to cut greenhouse gas emissions. Under even the most optimistic projections of climate change, much of Florida will be vulnerable both to flooding and to extreme weather events of increased frequency and intensity. The governor was surprised to find that implementing aggressive measures to reduce Florida's carbon footprint would add \$28 billion to the state economy between now and 2025.

In November 2007, Illinois, Iowa, Kansas, Michigan, Minnesota, and Wisconsin—a region that, 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."¹⁰⁵

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 the supply of drinking water, 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."¹⁰⁶ 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 the food supply, encouraged public and private sector leaders to join the effort by setting their own climate stabilization goals, and joined the Chicago Climate Exchange (CCX). Miami-Dade and Sacramento counties have also joined CCX.

On Earth Day, 2005, Alameda county California commissioned a 2.3-megawatt solar power plant, 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 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 cogeneration, 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 percent increase in rates that 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.¹⁰⁷ 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.¹⁰⁸ 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.”¹⁰⁹

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

- Reduced energy costs to households, recognized by a certified rating system, and increased 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 a similar effect and lower the hurdle for 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 the development and deployment of new technologies.
- Increased success in attracting business to Kansas City’s overall low cost of operation and clean environment.¹¹⁰

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 percent per year for the next 10 years and to reduce emissions in city operations by 21 percent from its 2001 baseline by 2012. Its long-term goal is to reduce emissions 70 percent 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 percent, and did so 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 sewage operations, and changed out all city traffic lights to LEDs. These last three measures alone are saving the city \$248,000 a year in energy costs.¹¹¹

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 percent 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 CO₂.¹¹²

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. The Plan can promote energy efficiency, renewable energy, alternatives to automobile transportation, and recycling, which will 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 all municipal trucks will run 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, will 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 12 megawatts by retrofitting residential and commercial buildings. Peak demand was reduced by 18 megawatts through successful programs operated by the city's Environment Department.¹¹³

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 energy "services"—shaft-power in factories, illumination and comfort in homes, cold beer, and so much more. 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.”¹¹⁴ 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.”¹¹⁵

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.¹¹⁶

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.¹¹⁷

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.¹¹⁸ The university responded by developing a “Blueprint for a Green Campus,” laying out the university’s plan to achieve “zero climate impact” by 2025.¹¹⁹

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 the University of Colorado, undergrads at dozens of schools are voting for increases 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.¹²⁰

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 (IPL) campaign, representing over 1,000 congregation members in 18 states, encourages a religious response to global warming in congregations through promotion of renewable energy, energy efficiency, and conservation. IPL showed Al Gore’s film *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 percent 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 lightbulb sale involving 30 congregations sold approximately 3,400 bulbs. Currently, Connecticut IPL has 25 churches and synagogues, that 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.¹²¹

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 sus-

tain us, but we were also given the responsibility to act as good stewards and preserve life for future generations.”¹²²

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.

ADVANTAGES OF ENERGY EFFICIENCY

Competent analyses have shown consistently 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, stating, “Some combination of targeted tax incentives, emissions trading, and non-price policies is needed to exploit these carbon reduction opportunities.”¹²³

Good efficiency programs, such as retrofitting light-bulbs, cost about 1-2¢ per kilowatt hour (kWh) saved, much less than the 4-6¢ it costs to generate a kWh in a coal plant. Building wind turbines in good sites can cost as low as 3¢, 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 requires 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.¹²⁴

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 Public Utilities Commission found that between 1990 and 1993, such efficiency measures saved customers a net present value of almost \$2 billion.¹²⁵

In the early 1990 a variety of experiments were underway to help the market deliver 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 which was 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 percent of a small-commercial pilot retrofit market in two months. Pacific Gas and Electric Company captured 25 percent of its entire new commercial construction market—150 percent 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 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 of 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.¹²⁶ By 1996, the near-

ly 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 sales¹²⁷—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 k-Wh 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.¹²⁸

Over 43,000 firms in the U.S. today are manufacturing and assembling renewable energy technologies. If the U.S. 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.¹²⁹

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.¹³⁰

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.¹³¹

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.¹³² The next fastest growing energy supply technology is solar electric, even at current prices.¹³³

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, Pennsylvania, in recent memory. California announced that it would spend over \$8 million 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.

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 eco-

conomic activity and five million high-quality jobs by 2025.¹³⁴ 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.¹³⁵

REGAINING THE LEAD IN THE INTERNATIONAL MARKETPLACE

The United States was once the international leader in technologies to 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 1980s 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 would save 60 billion Euros, create millions of new jobs, increase European competitiveness, and reduce Europe's carbon emissions by a third.¹³⁶ 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 become volatile 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, so far, to 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. Portfolios (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 the 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 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 per unit GDP by 20 percent during the 2006-2010 period.¹³⁷ In 2007, the Chinese announced the creation of over a billion dollars of funds to encourage energy efficiency and renewables.¹³⁸ 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 underdeveloped 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.¹³⁹

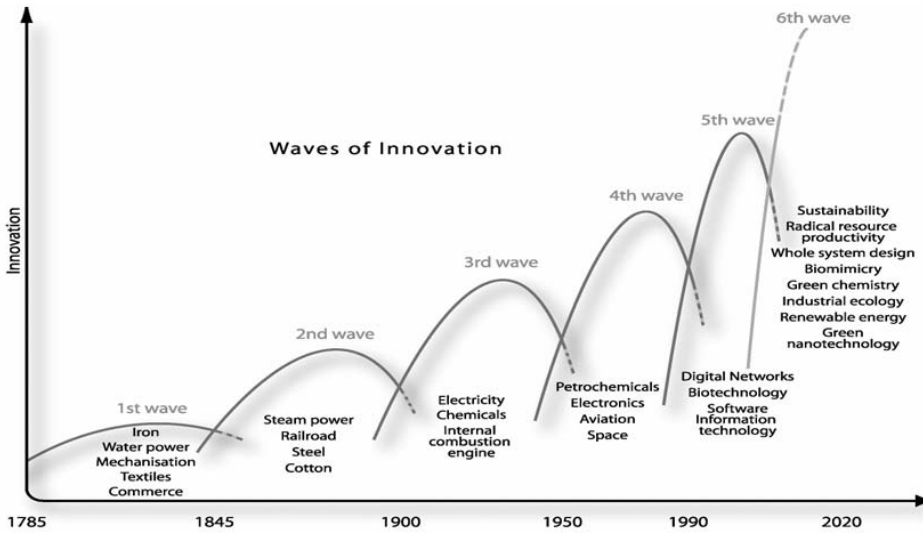


Figure 6. Waves of Innovation

Source: Technological “long waves” were long-ago described by Russian economist Nikolai Kondratiev. The version of long waves represented in this figure appeared first in *The Economist*. The image is courtesy of The Natural Edge Project, Australia, <http://www.naturaledgeproject.net/>, 30 October 2006.

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

Business success in a time of technological transformation demands innovation. Since the Industrial Revolution, there have been at least six waves of innovation, each shifting the technologies underpinning economic prosperity. In the late 1700s, textiles, iron mongering, water power, and mechanization enabled modern commerce to develop.

The second wave saw the introduction of steam power, trains, and steel. In both of these waves, Britain led the innovation and rose to world prominence because of it, ruling both the waves and the global economy.

In the 1900s, oil, electricity, chemicals and cars began to dominate, enabling the production of cars and appliances. America led in this innovation, and by the middle of the century was the dominant world power, continuing to innovate with petrochemicals and the space race, along with electronics. The most recent wave of innovation saw the introduction of computers and the rise of the digital or information age.

Which country will lead the next wave—the transition, described in this paper, to renewable, low-carbon energy? As the Industrial Revolution plays out and economies move beyond iPods, industries and countries will suffer dislocations unless they drive innovation, implementing the array of sustainable technologies

that will make up the next wave of innovation.¹⁴⁰ *New York Times* editorialist Tom Friedman warns that America is losing the race to lead this innovation. In the last two years, he points out, Applied Materials, a U.S.-based company, has built 14 solar panel manufacturing facilities around the world, now earning Applied \$1.3 billion a year. None are in America. Friedman writes,

The reason that all these other countries are building solar-panel industries today is because most of their governments have put in place the three prerequisites for growing a renewable energy industry: 1) any business or homeowner can generate solar energy; 2) if they decide to do so, the power utility has to connect them to the grid; and 3) the utility has to buy the power for a predictable period at a price that is a no-brainer good deal for the family or business putting the solar panels on their rooftop.

Regulatory, price and connectivity certainty, that is what Germany put in place, and that explains why Germany now generates almost half the solar power in the world today and, as a by-product, is making itself the world-center for solar research, engineering, manufacturing and installation. With more than 50,000 new jobs, the renewable energy industry in Germany is now second only to its auto industry. One thing that has never existed in America—with our fragmented, stop-start solar subsidies—is certainty of price, connectivity and regulation on a national basis.

That is why, although consumer demand for solar power has incrementally increased here, it has not been enough for anyone to have Applied Materials—the world’s biggest solar equipment manufacturer—build them a new factory in America yet. So, right now, our federal and state subsidies for installing solar systems are largely paying for the cost of importing solar panels made in China, by Chinese workers, using hi-tech manufacturing equipment invented in America.

Have a nice day.¹⁴¹

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 the World Resources Institute.¹⁴² British economist Sir Nicholas Stern, in his 2006 study commissioned by the U.K. government on the economics of climate action, estimates that by mid-century, the global market for low-carbon technolo-

gies 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.¹⁴³

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 to a 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.¹⁴⁴

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."¹⁴⁵

The challenge for policy is to design a comprehensive approach to climate planning that ensures that America will capture all of the opportunities to make our building, and car, and appliances and machines as efficient as possible, transform our sunset industries from using dirty technologies from the last century, and capture the opportunities to lead the innovation into renewable energy in ways that will make us more competitive, puts 100's of billions of dollars back into the economy from savings, and put Americans back to work. America can choose to invest in the approaches that generate economic development in cities and states, generate new manufacturing businesses, and create jobs retrofitting existing buildings. We can seize the opportunities to build and manage the new decentralized energy system, revitalize farm income with the production of biofuels and wind farms. Or we can allow our Asian and European competitors to become the new industrial leaders.

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, deliver the greatest economic boom since World War II.

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- tion in history. Up to 40 percent of world's known species are likely to go extinct. To avert this tragedy, the report states, the world will need to spend 1 percent 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 percent of world GDP each year to deal with the consequences.
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