

Clean Technology

A Smart Investment for the United States

Climate change is one of the most serious economic and environmental threats facing the world today. Carbon dioxide emissions from the combustion of fossil fuels are the biggest source of global warming emissions—about 57 percent of total annual emissions worldwide¹ and 81 percent of total annual U.S. emissions. To help avoid the worst consequences of climate change, we need a rapid global transition to clean energy that dramatically reduces this carbon overload.

As a major economic power, the United States has an important role to play in driving this transition, by both reducing its own carbon emissions and helping developing countries reduce theirs. Investing in clean energy technologies—technologies that increase energy efficiency and generate energy from low-carbon sources—and supporting their global deployment can create major economic opportunities for American businesses. It will also improve global security and public health, and spur sustainable development worldwide.

A Smart Business Strategy

Investing in energy efficiency and renewable energy, both at home and abroad, makes smart business sense for the United States because it will create new jobs in a wide range of rapidly growing industries, foster innovation, and give us a competitive edge in the global market. This message was echoed in a recent letter to President Obama and members of Congress from more than 80 U.S. companies, urging our nation's leaders to move quickly to enact comprehensive climate and energy legislation.²

Clean technology is already a very successful industry, with global revenues totaling \$900 billion in 2007³ and venture capital investments totaling \$8.5 billion in 2008.⁴ American companies like Solyndra and Nanosolar (which manufacture thin-film solar cells) and A123 Systems (which manufactures advanced batteries) are among the top businesses attracting venture capital today. The clean technology industry has been less affected by the current economic downturn than many other areas of the economy, and industry experts expect it to more than double in value by 2020. This has made it an

attractive investment choice for many countries seeking to direct economic stimulus funds to job creation.

The United States has always been an engine of innovation and entrepreneurship but we cannot take success for granted in the intensely competitive global market. For example, Chinese businesses are rapidly expanding their manufacture and export of components such as wind turbines and solar cells as a result of that country's aggressive energy efficiency and renewable energy policies (with goals of reducing its energy consumption per unit of gross domestic product 20 percent from 2005 levels by 2010 and generating 15 percent of its electricity from renewable resources by 2020). The United States must make the right policy and investment choices *now* if it is to reap the long-term economic benefits of being an industry leader.

A Cost-Effective Global Warming Solution

There is overwhelming consensus among climate scientists that, to avoid some of the worst impacts of climate change, global average temperatures must not increase any more than 2 degrees Celsius (°C), or 3.6° Fahrenheit, above pre-

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industrial levels; many scientists believe that this limit should be set even lower—to 1.5°C—to avoid dangerous impacts. This will require global emissions reductions of at least 50 percent, and U.S. emissions reductions of at least 80 percent, by 2050. Deep emissions reductions will also be necessary in developing countries; this goal cannot be achieved without cooperation on clean technology with developed countries.

A number of independent studies conclude that we can dramatically reduce global heat-trapping emissions at a minimal cost, with clean technologies playing a major role.^{5,6,7,8} One of the easiest and most cost-effective



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ways to quickly reduce emissions is to increase energy efficiency—for example, by improving home heating and cooling systems, installing building insulation, improving industrial processes, and raising the fuel efficiency of vehicles. Increasing the use of renewable electricity—from wind, sunlight, biomass, and geothermal sources—and providing low-emission transportation choices are also solutions that are already affordable and whose costs will decline further as they are more widely implemented. We also need to invest in research and development of the next generation of clean technologies to bring down the costs of future emissions reductions.

According to the International Energy Agency (IEA),⁹ it will take an additional investment (beyond what is currently projected) of \$10 trillion in the energy sector between 2010 and 2030 to lower emissions enough to keep global temperature increase below 2°C.¹⁰ These upfront investment costs are significant but affordable—equivalent to just 1.1 percent of global GDP in 2030—and will likely be outweighed by future savings. Between 2010 and 2030, cumulative energy savings in the industrial, transportation, and buildings sectors alone (due to increased energy efficiency and renewable energy development) will total \$8.6 trillion.

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Additionally, there will be significant savings due to both reduced public health costs (resulting from a transition to less polluting forms of energy) and the avoided costs of unchecked climate change.

Delaying action is costly: The IEA estimates that for every year we delay, the costs of acting will increase by \$500 billion. And if we wait even 10 years, it could foreclose the option of meeting the 2°C target, according to



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Roughly 85,000 people were employed in the wind industry in 2009. In general, renewable energy projects can create more jobs per kilowatt-hour than coal and natural gas power plants.

an analysis by global consulting firm McKinsey & Company.¹¹ This would likely impose immense social, environmental and economic costs on all countries, especially the poorest and most vulnerable ones. Some of the most significant costs would be those due to the impacts of sea-level rise, more severe storms, altered weather patterns, droughts, heat waves, and the loss of water resources and vital ecosystems.

Global Security Benefits

Clean, renewable forms of energy are available in most parts of the world and could readily be harnessed to power our economies; here in the United States, renewable energy combined with efficiency could reduce—or even eliminate—our dependence on oil¹² and liquefied natural gas imports. Increased global reliance on a diversified, homegrown energy portfolio can free up military resources and taxpayer dollars now devoted to safeguarding long-distance fuel supplies, and can help ratchet down political tensions related to maintaining energy security. It also helps reduce the risks of unchecked climate change, which has the potential to create global instability and security threats such as those triggered by food shortages or mass migrations.¹³

A global move away from fossil fuels will help moderate price spikes, which are economically disruptive and impose a disproportionate burden on poor families by driving up the costs of necessities. It can also help advance economic development in poorer countries and reduce inequities that foster discontent and even violence.

Public Health Benefits

Moving away from an energy system based on fossil fuels would significantly reduce the public health risks associated with their use. In addition to producing heat-trapping emissions, burning fossil fuels in power plants and vehicles produces many harmful pollutants including carbon monoxide, nitrogen oxides, sulfur oxides, hydrocarbons, particulates, and heavy metals. These pollutants can cause or aggravate a wide range of health problems including asthma and other respiratory and cardiopulmonary ailments. Our dependence on coal has particularly dangerous health impacts. Coal combustion is the leading U.S. source of airborne mercury, a potent neurotoxin that can contaminate waterways and cause developmental delays in children. And coal miners are exposed to high levels of lung-damaging pollution and are at serious risk of injury and even death.

The public health benefits of switching to cleaner energy are likely to be even more significant in developing countries, where high levels of air and water pollution and lax environmental or worker safety protections endanger residents and impose significant economic costs. For example, according to a joint report by the World Bank and Chinese experts, outdoor air and water pollution costs China's economy around \$100 billion a year (or about 5.8 percent of the country's GDP), primarily due to increased public health costs.¹⁴ And indoor air pollution—from burning wood, coal, and dung for cooking and heating—causes pneumonia, chronic respiratory disease, and lung cancer that leads to 1.5 million deaths worldwide each year, according to the World Health Organization.¹⁵ Children and women are particularly vulnerable to the effects of indoor air

pollution. Replacing dirty sources of energy with cleaner alternatives, such as modern stoves fueled by solar energy or biogas, would greatly improve public health and reduce pollution-related health costs.

A Driver for Low-Carbon Development

Globally, 1.4 billion people live in abject poverty,¹⁶ 1.5 billion people do not have access to electricity, and 3 billion people depend on directly burning very polluting fuels (coal, biomass, and dung) for their household energy needs. Most of these people live in developing countries, where the immediate economic priority must be raising living standards and increasing access to necessities like clean, reliable sources of energy. We should help these countries transition to sustainable low-carbon development pathways, even as we do the same at home, so that they can increase their economic well-being without exacerbating global warming.

Because much of the energy infrastructure in developing countries is yet to be built (a McKinsey & Company analysis projects that 80 percent of India's 2030 infrastructure is yet to be built),¹⁷ it is possible for them to leapfrog the polluting technologies that currently dominate in developed countries and choose cleaner technologies instead. While there are many low-cost and even positive-return opportunities—such as ramping up energy efficiency—developing countries will need both finance and technology assistance to access the full range of clean technology options and avoid locking in long-lived dirty technologies. The United States is in an excellent position to support this effort, consistent with our role as clean energy innovators and building on our existing energy and development projects overseas.¹⁸

A Catalyst for Global Climate Progress

Action by the United States alone will not be sufficient to solve the climate crisis, but our efforts are necessary and will have a significant influence on the actions of other countries. This was evident at the international climate



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Air pollution generated by power plants and vehicles increases the risk of respiratory illnesses such as allergies and asthma, and other lung diseases. Children and the elderly are particularly vulnerable to these health impacts.

talks in Copenhagen in December 2009, where the United States helped secure the Copenhagen Accord in cooperation with other major emitters like China and India. In spite of its major shortcomings (the chief one being that it does not have provisions to ensure that the emissions reductions pledged by countries will meet a science-based target),¹⁹ the Accord does provide a framework for emissions reduction and finance commitments from countries, with a transparent reporting process for delivering on these pledges.

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Clean technology has been an area of progress in the international negotiations because it presents win-win opportunities for all countries. There is already broad agreement over an institutional framework for technology cooperation, called the “Technology Mechanism.” The United States’ proposal for establishing a global network of technology centers to help build capacity, diffuse technologies, and share know-how has been well-received. In addition, clean technology will be

eligible for a portion of funding that developed countries put on the table at Copenhagen, which includes \$30 billion committed over three years (from 2010 to 2012), as well a fund of \$100 billion per year to be mobilized by 2020.²⁰

The United States can contribute significantly to further advancing global cooperation on clean technology. Working within the United Nations Framework Convention on Climate Change (UNFCCC) negotiations, the United States can help finalize an agreement on implementing clean technology deployment. In addition, it can help ensure that discussions in other relevant international forums, such as the Major Economies Forum on Energy and Climate (MEF)²¹ and the Group of Twenty (G20),²² play an important complementary role to the UN process. The MEF has already begun to lay the groundwork for implementing “technology action plans” to ramp up critical clean technologies. The G20 countries have the opportunity to forge greater agreement on scaling up funding for climate-related purposes like clean technology.

All these efforts together can help catalyze cooperative global climate action, bolster the effectiveness of any U.S. climate legislation, and ensure that our long-standing investments in economic development in poor countries are not undone by the effects of unchecked climate change.



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Developed countries can play a major role in helping developing countries shift to cleaner energy sources. This solar array in Rwanda, which will provide electricity for a nearby hospital, is funded by the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) as part of its effort to improve HIV/AIDS treatment services. Technical expertise was provided by the United States Agency for International Development (USAID).

Securing the Benefits of Clean Technology

To help drive a shift toward a clean energy economy, we need policies that will put a price on carbon, direct long-term investments toward clean technologies, and reward innovators and entrepreneurs who develop and deploy these technologies. U.S. policies that will help advance clean technology globally include:

- A carbon cap that limits U.S. emissions and requires polluters to pay for their emissions, with a significant portion of revenues allocated to domestic clean energy and energy efficiency programs and at least one percent of revenues allocated to funding clean technology in developing countries
- Incentives for ramping up the domestic clean energy industry
- including renewable electricity standards, energy efficiency standards, tax credits, loan guarantees, worker training programs, and research and development programs
- Development assistance channeled through the United States Agency for International Development, Department of Energy, the World Bank, United Nations, and other agencies
- Joint agreements with other countries to collaborate on clean technology research²³
- Incentives for public-private partnerships, joint ventures, and private sector investments to develop and deploy clean technologies globally
- Intellectual property rights agreements that reward innovation but do not hinder rapid deployment of critical clean technologies

We also need international agreements to facilitate progress on global clean technology deployment, with a priority on ensuring that sufficient funding is available for developing countries to adopt clean technology. A study by Project Catalyst estimates that developed countries would need to contribute \$76 billion to \$111 billion per year between 2010 and 2020 to help finance clean energy development in developing countries.²⁴ Based on its economic standing and contribution to global emissions,²⁵ a fair share for the United States would be approximately one-fifth of this total, or \$15 billion to \$22 billion per year. Additionally, there must be transparency and effectiveness in the delivery and use of clean technology funding. Finally, a formal decision implementing a Technology Mechanism under the UNFCCC can and should be made at the next annual climate meeting in Mexico at the end of 2010.

Supporting low-carbon growth in developing countries can help them increase their economic well-being without exacerbating global warming.

By adopting strong policies to promote clean technology, the United States can become a leader in producing and using these technologies at home and selling them worldwide. Investing in clean technology will deliver tremendous economic dividends—in the form of energy savings, new jobs, new growth industries, and new opportunities for innovation—as well as help tackle climate change. To maximize these benefits, we must get started today.



The Union of Concerned Scientists is the leading science-based nonprofit working for a healthy environment and a safer world.

This summary was prepared by Rachel Cleetus for the Union of Concerned Scientists' Clean Technology Initiative. A fully referenced version is available online at www.ucsusa.org/cleantech.



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ENDNOTES

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- 10 This pathway would lead to a long-term stabilization of the concentration of heat-trapping gases in the atmosphere at 450 parts per million of carbon dioxide equivalent (CO₂-eq). Many scientists now believe that a 450 ppm CO₂-eq pathway is inadequate and we need to restrict emissions much more to give us a fighting change of avoiding the worst consequences of climate change. See Hansen, J., M. Sato, P. Kharecha, D. Beerling, R. Berner, V. Masson-Delmotte, M. Pagani, M. Raymo, D.L. Royer, and J.C. Zachos. 2008. Target atmospheric CO₂: Where should humanity aim? *Open Atmospheric Science Journal* 2:217–231, doi:10.2174/1874282300802010217.
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- 20 The funds will go toward helping developing countries deploy clean technology, reduce emissions from tropical deforestation, and adapt to the unavoidable effects of climate change.
- 21 The MEF is a group of 17 major developed and developing economies focused on advancing clean energy and climate solutions. See <http://www.majoreconomiesforum.org>.
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