

# Alternative Energy: Prospects for Policy, Finance and Technology

## AE4 – The Alternative Energy Conference

The fourth annual Goldman Sachs Alternative Energy Conference was held in New York City on May 20-21, 2009. The event was co-hosted by the Global Markets Institute, the Center for Environmental Markets and other divisions of Goldman Sachs. The conference offered panel discussions and keynote addresses on topics including: public policy, carbon pricing, wind operators, smart grid technologies, nuclear power creation, transportation innovations, solar power, and venture capitalist perspectives.

Three factors were identified as critical to the success of alternative energy development – policy support, financing and technology.

## Policy perspective – road to Copenhagen

Environmental policy changes are expected in the United States. Key energy and climate change legislation is being debated in Congress, although the timing of implementation remains unclear. Several developing countries are focusing on renewable energy sources. Our BRICs panel reviewed the policy direction in developing nations. Several are already focusing on renewable energy sources. Currently over 80% of China, India and Russia's power generation is from fossil fuels while Brazil is already a leader in renewables. The amount of energy generated from cleaner sources will continue to increase. Energy independence is another aim. The UN Climate Change Convention will take place December 7-18, 2009 in Copenhagen. The goal of the convention is updated international targets for greenhouse gas emissions reductions, replacing the Kyoto Protocols.

## Financing future development

Adequate and consistent financing is considered to be the most critical element in the development of alternative energy. Private financing is still available, although not to the same extent as prior to the financial crisis. In 2009, public financing is expected to top the levels of private financing due to worldwide stimulus funds directed towards renewable energy development.

## Innovative technologies

Technology for renewable energy must become cost competitive with fossil fuels. The technology continues to get better but for many, particularly solar, major cost reductions are still necessary. The creation of a smart grid in the United States, if implemented well, may reduce energy costs. There is also the potential for power generation from other renewable energy sources such as wind, ethanol and geothermal.

### Abby Joseph Cohen, CFA

(212) 902-4095 | abby.cohen@gs.com  
Goldman, Sachs & Co.

### Amy C. Semaya

(212) 902-7009 | amy.semaya@gs.com  
Goldman, Sachs & Co.

### Michael A. Moran, CFA

(212) 357-3512 | michael.moran@gs.com  
Goldman, Sachs & Co.

### Sandra Lawson

(212) 902-6821 | sandra.lawson@gs.com  
Goldman, Sachs & Co.

### Douglas B. Gilman

(212) 902-3132 | douglas.gilman@gs.com  
Goldman, Sachs & Co.

## Table of contents

---

<b>I. Introduction:</b> The Goldman Sachs Alternative Energy Conference	<b>3</b>
<b>II. US climate change policy</b>	<b>3</b>
<b>III. International perspective on renewable sources of energy</b>	<b>4</b>
China is expected to consume over 15% of world energy supply by 2010	6
India faces geographical challenges with energy supply	8
Russia lags in renewable energy programs	9
Brazil generates almost half of its energy from renewable sources	9
<b>IV. Financing of renewable energy technologies</b>	<b>10</b>
<b>V. The future of alternative energy sources</b>	<b>14</b>
Wind poised for growth in United States given sufficient transmission capacity	14
Solar power's expense is impeding widespread use	15
Ethanol development in the United States is likely to focus on cellulosic ethanol	17
Nuclear hampered by time horizon, cost and possible opposition to construction	17
The smart grid encompasses many concepts	19
Geothermal potential competes with water scarcity	19
<b>VI. Conclusions:</b> The future of alternative energy linked to policy, funding and technology	<b>20</b>
<b>Appendix I:</b> AE4 Conference Agenda	<b>21</b>
<b>Disclosures</b>	<b>23</b>
<b>Exhibits</b>	
<b>1. Primary energy consumption – the US versus China</b>	<b>5</b>
<b>2. Total primary energy consumption in the BRICs countries</b>	<b>5</b>
<b>3. Total primary energy consumption in the BRICs countries and the US per dollar of GDP</b>	<b>6</b>
<b>4. Total carbon dioxide emissions in the BRICs countries</b>	<b>7</b>
<b>5. Total primary coal consumption in the BRICs countries</b>	<b>7</b>
<b>6. Total hydroelectricity and other renewables in the BRICs countries</b>	<b>8</b>
<b>7. India's installed alternative energy capacity</b>	<b>9</b>
<b>8. Global new private investment in clean energy quarterly</b>	<b>10</b>
<b>9. Investor Network on Climate Risk controlled assets</b>	<b>11</b>
<b>10. Percentage of companies reporting total CO<sub>2</sub> emissions by industry</b>	<b>11</b>
<b>11. Performance of the New Energy Global Innovation Index (NEX)</b>	<b>12</b>
<b>12. Annual installed wind capacity level – 1999-2008</b>	<b>13</b>
<b>13. Countries with high annual increases of installed wind energy capacity</b>	<b>14</b>
<b>14. 2008 global installed wind energy</b>	<b>15</b>
<b>15. Crystalline silicon vs. thin-film</b>	<b>16</b>
<b>16. Price per kilowatt-hour of energy sources</b>	<b>17</b>
<b>17. Countries with a high level of electricity generated by nuclear energy</b>	<b>18</b>
<b>18. Global installed nuclear energy capacity</b>	<b>18</b>

## I. Introduction: The Goldman Sachs Alternative Energy Conference

---

The fourth annual Alternative Energy Conference (AE4) took place in New York on May 20-21, 2009. The conference was hosted with interdivisional cooperation by the Global Markets Institute, the Center for Environmental Markets and other groups across the firm. The conference included a wide range of topics including: carbon pricing and trading, wind operators, smart grid technologies, nuclear power creation in emerging nations, transportation innovations, solar power and venture capitalist perspectives. The main purpose of this report is to focus on the broader issues relating to the policy, financing and technology necessary for success in alternative energy development.

### **Strong policy is needed to encourage future alternative energy development**

Strong environmental policy is necessary to encourage development of alternative energy sources globally. Environmental policy changes are expected in the United States in the near future. The American Clean Energy and Security Act of 2009, which is being debated in Congress, would implement a US cap-and-trade program among other environmental policy changes. Changes are also expected in several of the larger developing countries. The governments of China and India have identified climate change as a concern and have encouraged the use of renewable energy sources through government sponsored programs. China, India and Brazil are not part of the Kyoto Protocol; therefore, the policies these countries implement are of great international interest as they provide information on the intentions of these fast-growing nations.

### **Financing is the most critical element in the development of alternative energy sources**

Financing is considered to be the most critical component in the development of alternative energy sources. Although it is expected that private investment levels will decline in 2009, the recent shift of venture capital investors towards clean tech will help the total private investment levels remain higher than in 2004. Public sector financing is expected to top the levels of private investment in 2009 due to the worldwide stimulus funds directed towards renewable energy development. Additionally, investors are looking for new ways to enhance their competitive advantage and have been shifting their interest towards environmentally conscious companies. These investors are likely to help continue to drive future funding from the private sector towards alternative energy.

### **Alternative energy sources must improve to become cost efficient with fossil fuels**

Alternative energy technologies must improve to the point where they are as cost effective as fossil fuels. Wind energy technology is now as cost efficient as fossil fuels in some markets. Technology continues to improve but for many technologies, particularly solar, major improvements are still necessary. Recent advancements in thin-film photovoltaics are encouraging because of the ability to create these solar cells in a cost effective way. Additionally, the creation of a smart grid in the United States may induce cost savings but only if it is implemented well. Recent advances in battery technology have made the use of electric cars more feasible in some markets. There is also energy generation potential for other renewable energy sources such as ethanol, solar thermal and geothermal.

## II. US climate change policy

---

The conference opened with a review of the US public policy response to climate change and the leadership role the United States intends to undertake in the global effort to create worldwide emissions standards. The US policy panelists included David Cavicce, chief of staff of the House Energy and Commerce Committee, Chris Miller, Senior Energy and Climate Staffer for Senate Majority Leader Harry Reid, Mary Frances Repko, Senior Energy and Climate Advisor for House Majority Leader Steny Hoyer and Karen Wayland, Senior Advisor for Speaker of the House Nancy Pelosi.

### **The American Clean Energy and Security Act of 2009**

The key climate change legislation currently under discussion, the American Clean Energy and Security Act of 2009 (ACES) authored and proposed by Representatives Henry Waxman and Edward Markey, would implement a cap-and-trade program as well as other environmental laws in the United States. Separately, the Senate Energy Committee has had discussions on whether to set a federal renewable electricity standard and other renewable energy and energy efficiency mandates and incentives. However, Senator Reid announced his intentions to wait until the debate on the Waxman/Markey bill is complete. On May 21, the Waxman/Markey bill, which is now over 1000 pages in length, passed its first hurdle when it was approved by the House Energy and Commerce Committee. The panelists all agreed that they expect bi-partisan support for a US cap-and-trade program, of some form, in both houses of Congress. When legislation will be implemented, however, is unclear.

### **85% of the carbon credits will initially be distributed to regulated industries for free**

The main goal of ACES is to reduce US carbon emissions by over 80% below 2005 levels by 2050. One way the bill plans to achieve this goal is by issuing carbon credits to regulated industries. At the start of the program, 85% of the emissions permits will be distributed for free and the remaining 15% will be auctioned; the auctioned percentage will increase over time. President Obama initially stated he would prefer a 100% auction of these permits. However, the panelists all agreed that the shift to free credits was not a surprise and has been accepted as politically necessary given the desire to shield consumers from the additional cost at this time. Additionally, regulated entities will be allowed to purchase offsets to meet their required emissions reductions levels. These offsets could account for up to 2 billion tons of emissions reductions each year.

### **A US cap-and-trade program is more likely than a carbon tax**

The panelists agreed that a carbon tax is less likely to be implemented for two reasons. First, constituents will likely oppose any new tax given current economic duress. Second, a cap-and-trade program would be more consistent with international standards. Nancy Kontou, *Chef de Cabinet* to European Commission Environmental Commissioner Stavros Dimas and a speaker at the conference, added that the EU would like to see an OECD-wide program in place by 2020. She opined that the EU may consider amending its current plan to achieve an international standard by potentially adopting price ceilings and floors as well as allowing companies to use offsets, all of which the current EU plan does not allow.

### **The United States will take a leadership position in Copenhagen, as noted by our panelists and DOE Secretary Chu**

The US congressional staffers at our conference agreed that the United States will take a leadership position at the UN Climate Change Convention in Copenhagen this December, consistent with recent remarks by the US Energy Department (DOE) Secretary Steven Chu, whether or not ACES has been passed by that time. The panelists believe that the United States has made, and will continue to make, progress before the Copenhagen meetings that will show the Obama administration's strong desire to implement significant legislative changes. Nonetheless, it would be preferable to have legislation passed in advance of the conference.

## **III. International perspective on renewable sources of energy**

---

### **Cap-and-trade programs are being debated globally**

In Europe, a cap-and-trade program has been in place since 2005. Due to the diversity of the 27 EU member states, the program had to be formulated so every member country could participate regardless of the country's primary energy supply source. Australia has announced updated climate legislation including a revised Carbon Pollution Reduction Scheme with the goal of reducing emissions 25% below 2000 levels by 2020. There have also been recent discussions in Canada and Mexico regarding whether to implement a national cap-and-trade program.

The Alternative Energy in the BRICs panel addressed the developing world's response to climate change. The panel was comprised of Thomas Heller from Stanford University, Trevor Houser from the Peterson Institute for International Economics, Michael Levi from

the Council on Foreign Relations and David Pumphrey from the Center for Strategic and International Studies.

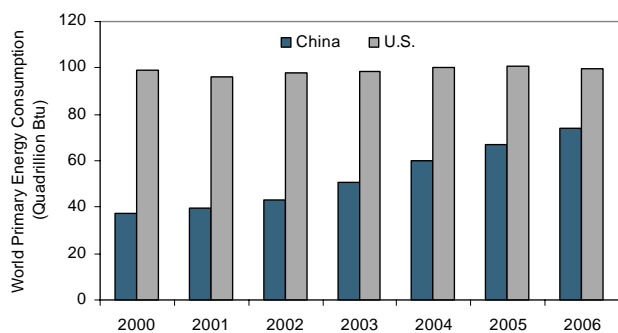
**The United States will likely not wait for firm commitments from China and India to implement new domestic environmental policy**

In the developing world, some fast-growing countries are large greenhouse gas emitters. However, the consensus among the panelists was that the United States will not wait for firm commitments from China and India to implement domestic policy changes. Although Congress would prefer that China implement energy standards, some members believe that developing countries may need to be treated differently. It has been intimated that changes to US policy are a prerequisite to formal changes in China and India. Although neither developing country has formally committed to adopting international standards, both China and India have been working to reduce the emissions of greenhouse gases. In early June 2009, DOE Secretary Chu publicly stated that he believed the United States should commit to emissions cuts even if China was unwilling to agree to the same standards. The panelists agreed that even if the United States adopts new climate change legislation, that will not guarantee that China and India would follow suit. The governments of China and India understand the need for renewable energies from a development perspective. However, China and India's first priority is to get electricity to all regions of the country to ensure adequate development.

**Growth in BRICs energy usage**

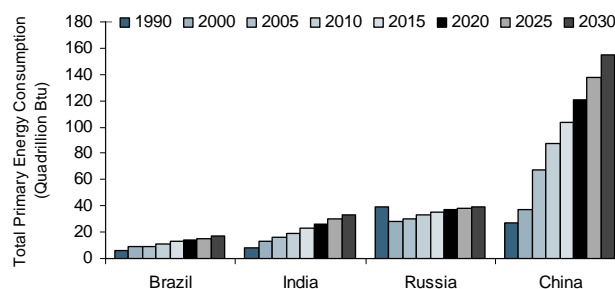
Currently, more than 80% of China, India and Russia's energy generation is from fossil fuels. China's energy consumption has been increasing rapidly. In 2000, China consumed about one-third of the total energy that the United States consumed. In 2006, China's energy consumption was already about two-thirds of the total US energy consumption level. However, China and India's 2006 energy consumption per capita (56.2 and 15.9 million BTUs respectively) was far below the per capita level of the United States (334.6 million BTU) and lower than the world average (72.4 million BTU). Nevertheless, China's total energy consumption level is expected to continue to increase, ultimately exceeding that of the United States by 2020 (see Exhibits 1 and 2). China is not seeing the same improvement in energy intensity that is observed in the United States and the other BRIC countries (see Exhibit 3).

**Exhibit 1: Primary energy consumption – the US versus China**



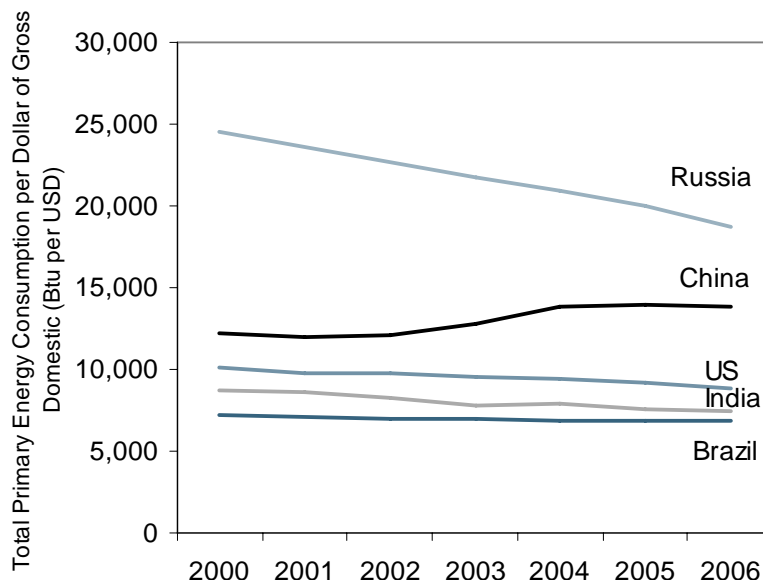
Source: US Department of Energy, Energy Information Administration.

**Exhibit 2: Total primary energy consumption in the BRICs countries**



Source: US Department of Energy, Energy Information Administration.

**Exhibit 3: Total primary energy consumption in the BRICs countries and the United States per Dollar of GDP**



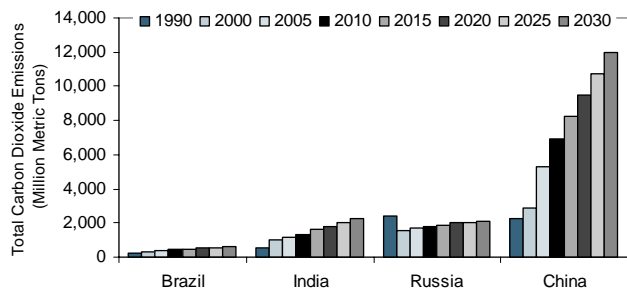
Source: US Department of Energy, Energy Information Administration.

**China is expected to consume over 15% of world energy supply by 2010**

**China is now the world's largest CO<sub>2</sub> emitter**

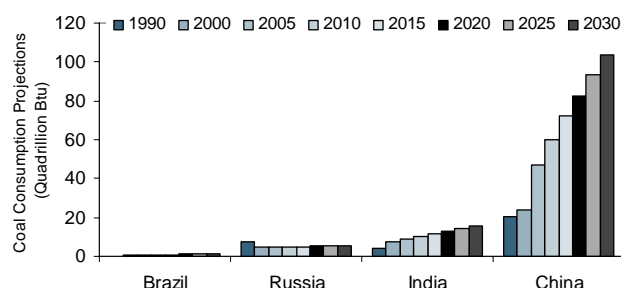
China has become the world's largest emitter of carbon dioxide (CO<sub>2</sub>) and some other greenhouse gases, and is expected to consume over 15% of the world's energy by 2010. China's main source of energy is coal and it is currently the largest producer and consumer of coal in the world. **There are now more coal power plants in China than in the United States, the United Kingdom and India combined.** China is currently building two large coal-fired power plants a week. Moreover, China's usage is projected to account for approximately 46% of the world's coal demand by 2030 according to the Pew Center on Global Climate Change and the Asia Society. Coal power presents a serious environmental and health threat to China resulting in costly damages annually. The burning of coal produces a variety of air pollutants including sulfur dioxide, nitrogen oxides, particulate matter, mercury, and water pollution. Exhibits 4 and 5 show the total CO<sub>2</sub> emissions and the total coal consumption in the BRICs.

**Exhibit 4: Total carbon dioxide emissions in the BRICs countries**



Source: US Department of Energy, Energy Information Administration.

**Exhibit 5: Total primary coal consumption in the BRICs countries**



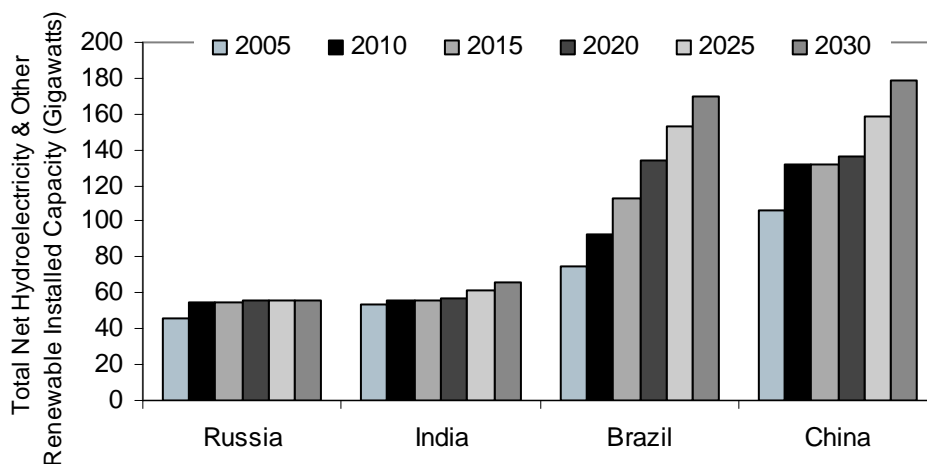
Source: US Department of Energy, Energy Information Administration.

**China invests in renewable energy to reduce its reliance on foreign energy sources and to enhance growth prospects**

According to the panelists who discussed Alternative Energy in the BRICs, China is becoming more concerned about the effects of global warming including extreme weather events and the reputational risks the country faces as the world’s largest CO<sub>2</sub> emitter. In addition to coal, China currently relies on foreign oil imports to help meet its development needs and is consequently subject to the fluctuating price of oil. Alternative energy development in China is driven, in part, by the desire for energy independence and an awareness of reputational concerns. Currently, China generates about 17% of its electricity and 7% of its total energy from renewable sources. China’s National Renewable Energy Law, implemented to promote development and utilization of renewable energy, set targets to produce 20% of the country’s electricity and 16% of the country’s energy from renewable sources by 2020.

**China’s primary source of alternative energy is hydropower**, generated from large dams and micro-turbines. China’s current hydropower capacity is the largest in the world at about 145,000 MW, which is projected to double by 2030. Historically, China has been criticized for its handling of the social issues relating to the creation of the country’s large dam systems, particularly the Three Gorges Project which forced the relocation of many people. The current projections show China increasing power capacity generated from hydropower to the equivalent of a new Three Gorges Project every two years. Exhibit 6 displays China’s total installed hydroelectric and other renewable energy capacity.

**Exhibit 6: Total hydroelectricity and other renewable installed capacity in the BRICs countries**



Source: US Department of Energy, Energy Information Administration.

**China is the world’s largest producer of photovoltaic cells and is likely to become a world leader in electric car development**

The Chinese government has incentivized investment in wind power through feed-in tariffs which helped to double capacity in 2008 to 12,210 MW. In solar power, China has become the world’s largest producer of photovoltaic cells, accounting for 35% of the world market. Similarly, China is likely to become a world leader in electric car development. Chinese policy makers have adopted a plan to help establish it as a leader in hybrid and all-electric vehicles in the next three years. The research and development needed to create a cost-effective and reliable battery is being financed by the Chinese government. The Chinese government can provide capital cheaply relative other lending facilities.

**India faces geographical challenges with energy supply**

India also faces many energy demand challenges. As the BRICs panelists stated, the primary goal of the Indian government is to continue economic development. However, India is a geographically diverse country which makes it difficult to provide reliable power at affordable prices to all regions. As of 2005, 16% of the country’s rural villages had not yet been electrified and many of the villages with electricity report the power supply is erratic and unreliable. According to the UN, India’s population is expected to grow by over 1% per annum until 2020 which will increase energy demand. **Presently, India produces approximately 50% of its total power generation from coal but, unlike China, India has only about 7% of the world’s coal reserves.** Due to the lack of the natural resource, India has been importing coal from countries such as Indonesia.

**India has started to invest in alternative energy but providing reliable power to all regions is still the country’s first priority**

India has recognized the need to invest in alternative sources of energy for several reasons including (1) the ability to generate power in remote locations, (2) to reduce dependence on foreign countries, and (3) to address environmental concerns. India’s 11<sup>th</sup> Five Year Plan (2007-2012) outlines the need for nonconventional sources of energy such as wind, small hydro, biomass and solar and plans to increase power generation from these alternative sources to 183,000 MW by 2032. Exhibit 7 outlines the alternative energy sources already installed in India.

**Exhibit 7: India's installed alternative energy capacity**

Energy Source	Installed Capacity
	2002-2007
Hydro power	33,642 MW
Nuclear	3,900 MW
Wind*	9,645 MW

\*Wind capacity level as of 2008.

Source: India's Ministry of Power – the 10<sup>th</sup> Five Year Plan and Global Wind Energy Council.

Studies show there is significant potential for solar power generation especially in India's rural areas but the cost associated with generating solar power is the major factor inhibiting growth. The Indian government has taken steps to reduce the user's cost of solar energy systems by investing in research and development, subsidizing solar systems, providing loans to manufacturers and reducing duties on imports for raw materials needed to produce the panels. India has only about 2 MW of solar power capacity today but the government hopes with additional subsidies the amount of power generated from this renewable source will increase to 50,000 MW by 2012.

**Russia currently does not utilize its renewable energy sources**

**Russia lags in renewable energy programs**

Russia is a key energy producer and a major energy exporter. The BRICs panelists stated that most of the larger developing countries have ambitious renewable energy programs except for Russia. **Russia's large fossil fuel resources discourage alternative energy development and energy efficiency.** As of 2001, only 3.5% of the country's energy supply was from renewable sources, the majority of which was produced by hydropower. In 2003, about 10 million Russians had still not been connected to the electricity grid. They were dependent on power from stand-alone fuel powered generation systems which have been reported to operate for only a few hours each day. Alternative sources of energy could help supply these off-grid regions with a reliable energy supply. **Studies have shown Russia has enormous wind, hydro, geothermal, biomass and solar energy resources.** Ironically, Russia was the first country in the world to start to construct a utility-sized wind turbine and had one of the best-developed technologies for solar photovoltaic cell due to the Soviet space program. However, recent policy has been focused on fossil fuels.

**Brazil has the most highly developed renewable energy program in the developing world**

**Brazil generates almost half of its energy from renewable sources**

Brazil is distinguished by its highly developed renewable energy program. Brazil's sugarcane ethanol market has proven to successfully complement gasoline as a transportation fuel source. Fully 90% of Brazil's cars are now flex-fuel capable; that is, they can run on a combination of ethanol and gasoline. The country also has been a successful exporter of ethanol to both China and Japan.

**Deforestation is a major issue, worsening the carbon footprint of Brazil**

The increased use of ethanol is not without its problems. As the market for ethanol in Brazil grew, and as the government continued to provide subsidies to encourage growth, farmers started to use more land to grow sugarcane, contributing to the deforestation of the Amazon. Although the use of ethanol reduces CO<sub>2</sub> emissions because it is a cleaner burning fuel, the deforestation of the Amazon reduces the number of trees available to absorb excess CO<sub>2</sub> in the atmosphere. Additionally, Brazilian farmers typically burn their sugarcane crops in order to harvest the stalks and roots which contain the sugar used for ethanol production. The use of fire results in additional CO<sub>2</sub> emissions.

Recent initiatives have been put in place to make ethanol creation more environmentally friendly. Among the main goals of Brazil’s National Plan on Climate Change is to reduce the amount of deforestation of the Amazon and to phase out the use of fire for clearing and cutting sugarcane. As Philippe Reichstul the CEO of Brenco, stated on the Brazilian Ethanol panel, new technologies are now available for harvesting sugarcane in a less environmentally damaging way.

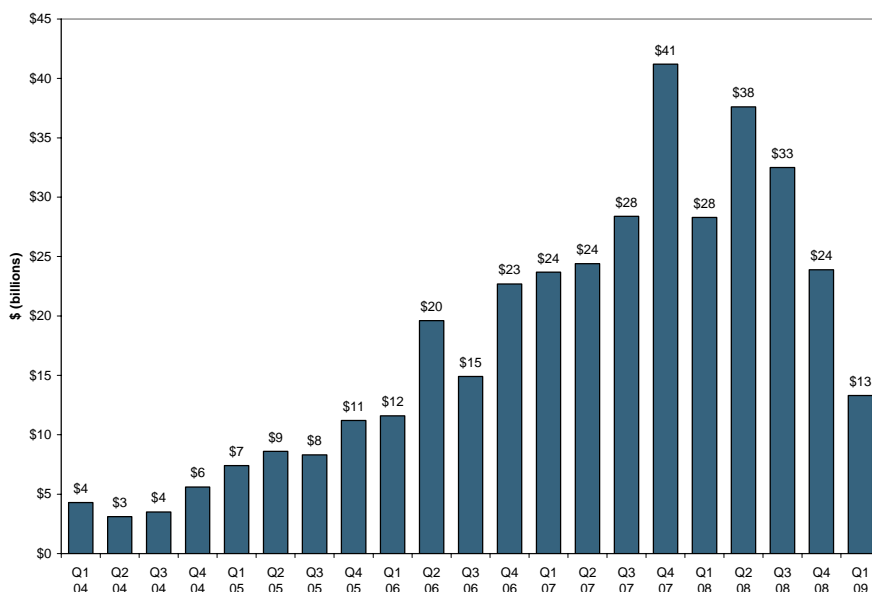
Brazil’s Ten Year Energy Plan (2007-2016) includes plans to produce more power from other renewable sources such as 35,460 MW of new capacity from hydropower. Nevertheless, Brazil’s oil production has risen steadily in recent years and is expected by the US Department of Energy’s Energy Information Administration (EIA) to be a net oil exporter this year.

## IV. Financing of renewable energy technologies

### Venture capital has recently shifted towards clean tech

As many of the panelists stated, financing is a critical element in the development of alternative sources of energy. Traditionally, venture capital investors focused their investments in information technology and life sciences. **In 2008, clean tech became the largest venture capital investment category in North America**, and computer software was second. In the first quarter of 2009, the level of private investment in clean energy dropped substantially to \$13.3 billion. However, this is viewed as a temporary disruption of a long-term upward trend evident since 2005. Exhibit 8 portrays the private investment in clean tech since 2004.

**Exhibit 8: Global new private investment in clean energy quarterly**  
Recent decline likely to be an aberration

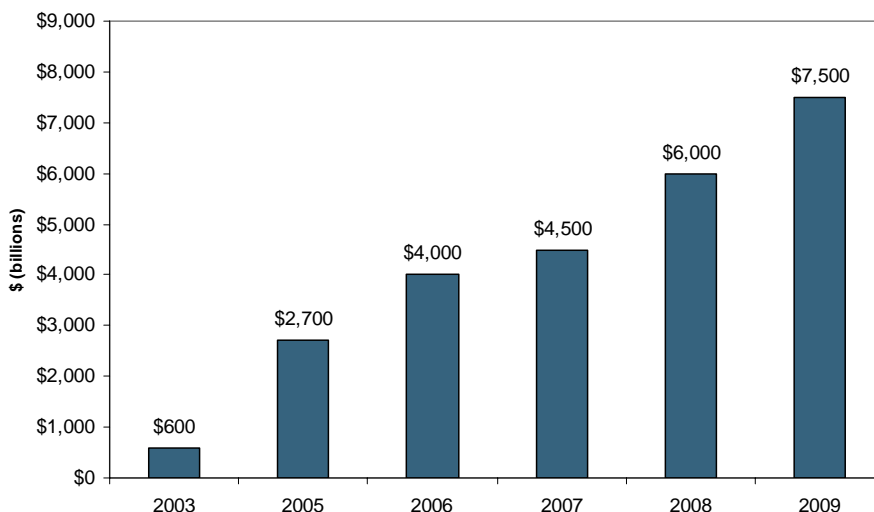


Source: New Energy Finance.

### Investments in public equities are shifting towards green awareness

There has been a shift in investor perspective towards environmentally conscious companies. The Investor Network on Climate Risk (INCR), an organization of institutional investors and financial institutions focused on the financial risks and investment opportunities associated with climate change, now has over \$7 trillion in total assets controlled by participants. Exhibit 9 depicts the level of INCR assets since 2003.

**Exhibit 9: Investor Network on Climate Risk controlled assets**

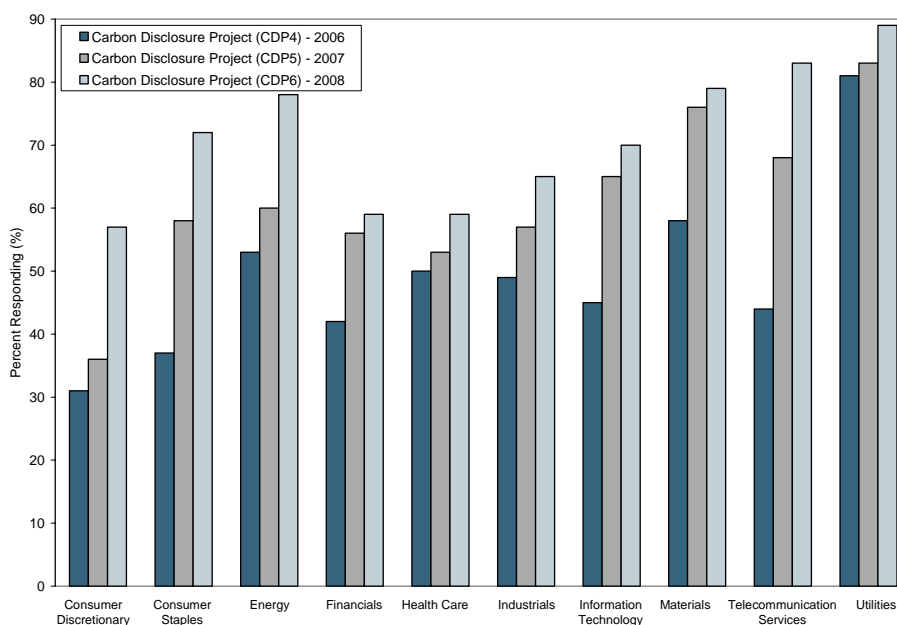


Source: Investor Network on Climate Risk.

**Utility companies have the highest CO<sub>2</sub> disclosure levels**

Each year more public companies are voluntarily disclosing their level of CO<sub>2</sub> emissions. Corporate managements are aware that investors are increasingly concerned with environmental issues and companies are responding by making it easier for their investors to evaluate their environmental performance. The percentage of companies reporting CO<sub>2</sub> emissions by industry is depicted in Exhibit 10.

**Exhibit 10: Percentage of companies reporting total CO<sub>2</sub> emissions by industry**

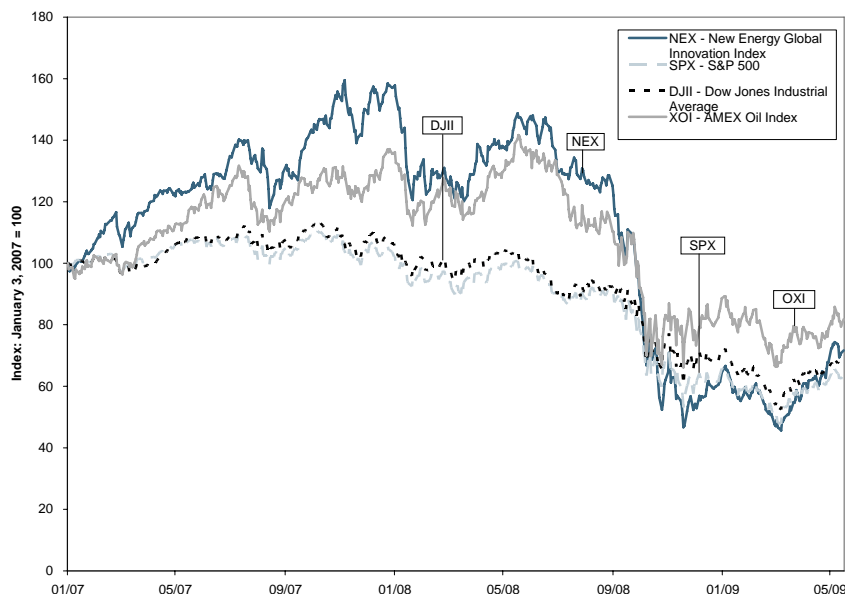


Source: Carbon Disclosure Project.

**Shares of “green” producers benefit from investor attention**

Given the focus, many clean energy companies have been performing well when compared to major indices. During the last bull market, clean energy companies outperformed. However, clean energy companies have not performed as well during the current recession and sharp bear market. Some of this underperformance was attributable to general investor preference to reduce exposure to riskier and less established companies during the recent financial crisis. We expect clean energy companies to outperform again in the future due to their growth potential and investor attention (see Exhibit 11).

**Exhibit 11: Performance of the New Energy Global Innovation Index (NEX)**



Source: Bloomberg, Factset, New Energy Finance and the Goldman Sachs Global Markets Institute.

International cooperation to some extent is already occurring with regard to the production and use of alternative fuel sources. For example, Michael Granoff, Head of Oil Independence Policies at Better Place and a panelist on the Transportation panel, cited that several countries were vital to the development and implementation of the electric car in Israel. Specifically, Better Place, a US company, provides services for the use of electric vehicles in Israel. The cars used in the program are created in Europe and the batteries are produced in Japan.

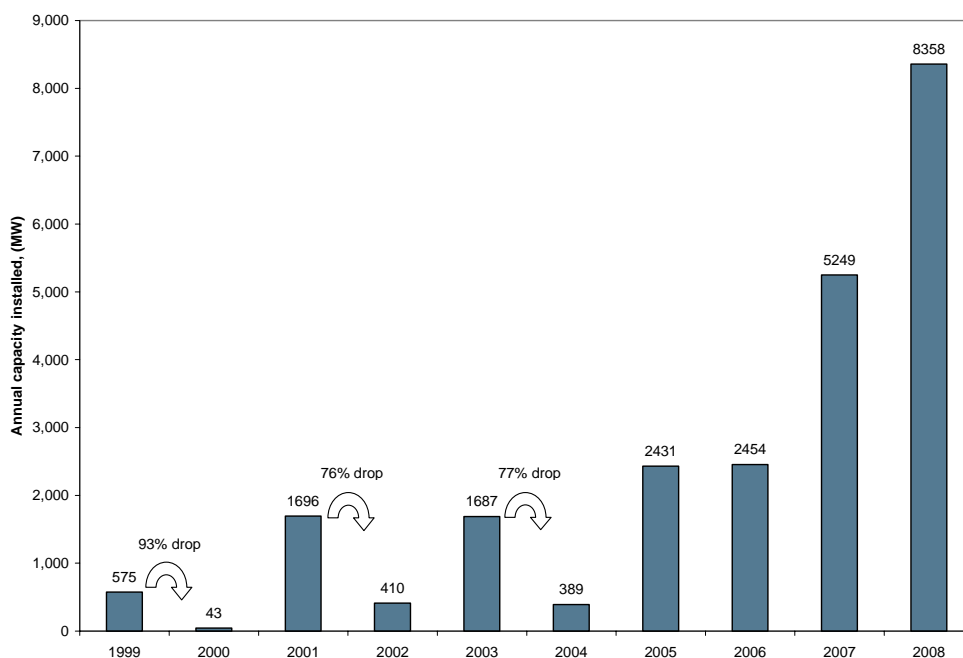
**Increased government funding and tax incentives are likely to help drive future advancements in alternative energy**

Development of alternative sources of energy is expected to increase due to the heightened investor interest and the large amounts of money the public sector is expected to invest through worldwide stimulus packages. Researchers at the United Nations Environment Program and New Energy Finance believe that the global stimulus funds directed for renewable energy investments will help to compensate for the decreased private sector funding. US public investments in alternative energy include over \$13 billion that has been allocated to modernize the electricity grid and improve transmission power to ensure wind and solar panel farms can be connected to the grid. An additional \$20 billion in tax incentives has been allocated over 10 years towards the development of renewable power sources (wind, solar, hydro) and about \$20 billion has been directed to increase energy efficiency of federal buildings and public housing. The DOE loan guarantee program was provided with an additional \$6 billion to underwrite up to \$60 billion in new loan guarantees for projects to be commenced by September 30, 2011. It is widely expected that the DOE will start distributing loans in a timelier manner than in the past.

**The PTC and other tax credits may help jumpstart US alternative energy development**

The American Recovery and Reinvestment Act included a two year extension to the Production Tax Credit (PTC) for wind until the end of 2012. History shows that investment tax credits of all forms are the most effective when they have durations that match the length of the relevant investment cycle. The PTC for hydro, geothermal, municipal solid waste and bioenergy was extended though the end of 2013. The legislation also extended the Investment Tax Credit (ITC) of 30% for solar and allows other eligible technologies to receive the ITC instead of the PTC. A new program was also implemented which would provide renewable energy developers the option of obtaining a cash grant of up to 30% of the value of the project from the US Treasury in lieu of the PTC. To accelerate development, developers are only eligible for the Treasury grant if the project is set to begin in either 2009 or 2010. In the past, the PTC has been allowed to expire or was only extended for one year at a time. The uncertainty of the PTC has been detrimental to wind energy production in the United States. History has shown that when the PTC expires, the amount of wind energy investment and level of wind energy installation declines (see Exhibit 12). Long-term adoption of these technologies will ultimately depend on their cost effectiveness, perhaps including the costs associated with carbon.

**Exhibit 12: Annual installed wind capacity level – 1999-2008**  
 Slower growth in the years the PTC lapsed – 1999, 2001 and 2003



Source: American Wind Energy Association.

## V. The future of alternative energy sources

### The United States is the leader in installed global wind energy capacity

### Wind poised for growth in United States given sufficient transmission capacity

Global wind energy power generation topped 120,000 MW at the end of 2008. The United States has the largest installed wind capacity with 25,300 MW. Germany has the second highest level of installed capacity with 22,903 MW followed by Spain (16,754 MW), China (12,210 MW) and India (9,645 MW). Exhibit 13 portrays the countries with the highest 2007 annual installed wind energy growth rate; some of these are from low bases.

**Exhibit 13: Countries with high annual increases of installed wind energy capacity**

Country	2007 Annual Growth Rate
China	106.6%
Australia	58.5%
United States	49.6%
Italy	37.1%
United Kingdom	34.7%
Portugal	33.1%
Norway	31.3%
Sweden	30.0%
Finland	30.0%

Source: Global Wind Energy Council.

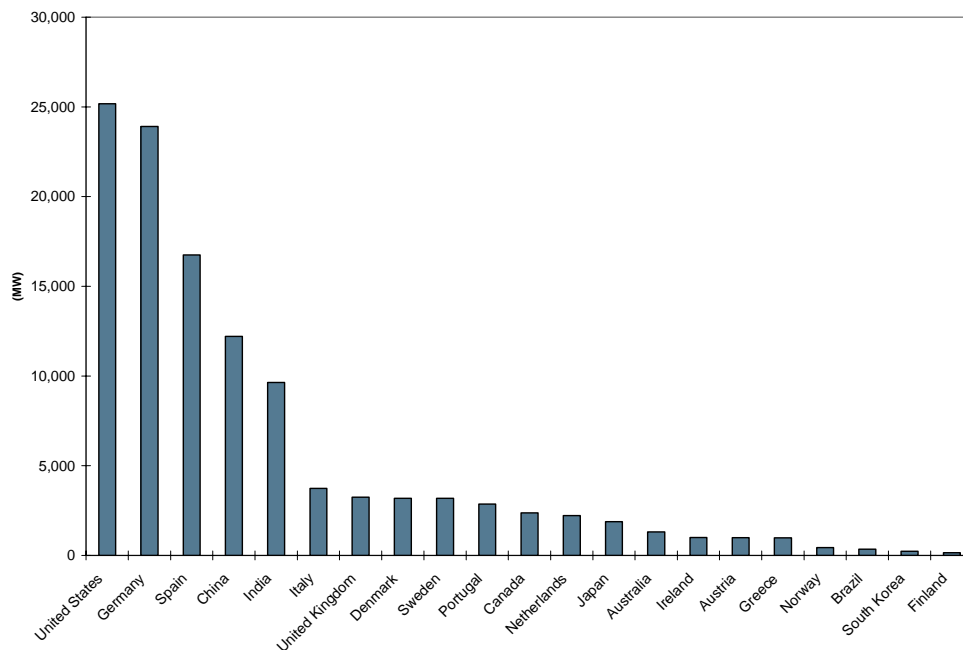
In the United States, Texas continues to lead all other states in wind power capacity. In 2008, Texas installed 2,671 MW of new capacity, more new capacity than any country in the world (excluding the rest of the United States) except China. Iowa now ranks second in the United States with 2,791 MW of cumulative installed capacity and California is third with 2,517 MW. The 1.5 MW wind turbine continues to be the most popular model, over half of the turbines installed in the United States in 2008 were of this capacity. Steve Fludder, Vice President of Ecomagination at GE and a keynote speaker at the conference, discussed plans to increase the capacity of the company's flagship turbine to 2.5 MW in the future. There were also discussions of a possible 10 MW turbine for offshore facilities.

### There is still a large amount of untapped wind energy potential in the United States

The panelists expect US wind energy production to continue to increase given the large potential for new wind power farms in areas with high wind resources that have not been fully developed. For example, North Dakota has the highest wind energy potential of any state in the United States with 1,210 kWhs of potential power. In theory, if sufficient transmission capacity existed, North Dakota has enough wind energy potential to generate power for more than a fourth of the US population. Wind power generation has become cost effective in many markets as the technology has improved. The extension of the PTC also serves to enhance the advancement of other alternative energy sources. The 2008 global installed wind energy levels are depicted in Exhibit 14.

**Exhibit 14: 2008 global installed wind energy**

Global wind capacity now totals 120,800 MW



Source: Global Wind Energy Council.

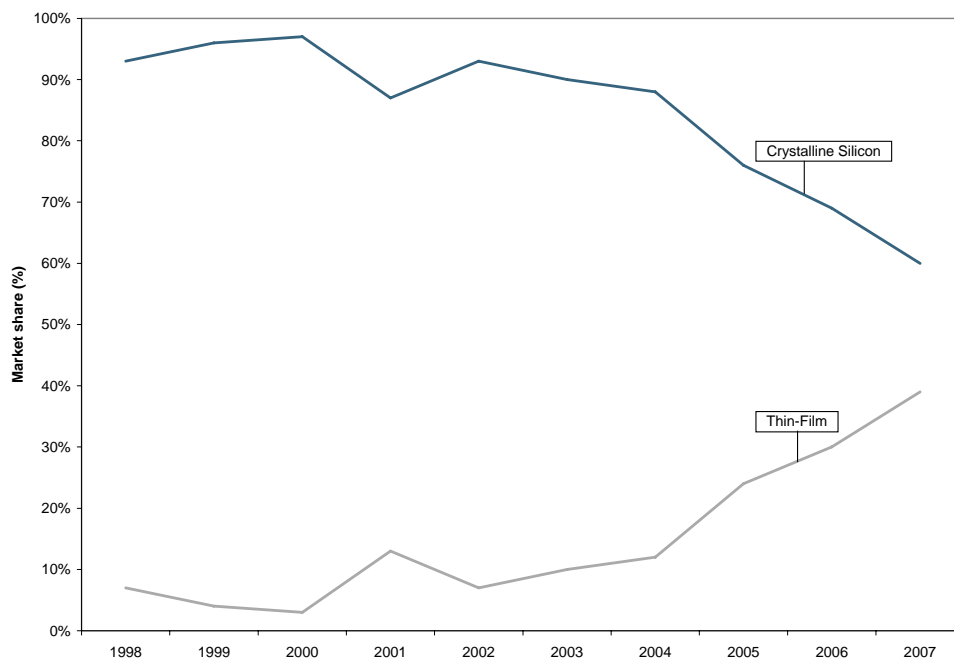
**The United States ranks fourth in the world for cumulative installed solar power**

**Solar power’s expense is impeding widespread use**

The United States only ranks fourth in the world for cumulative installed solar power with 9,183 MW, after Germany, Spain, and Japan. This is striking for two reasons: (1) the relatively large size of the continental United States compared to the size of the three countries with higher installed capacity, and (2) according to the EIA, the United States has high levels of concentrated solar power potential in many regions of the country, particularly the southwest. Additionally, solar energy is the most expensive form of energy which impedes widespread use.

**New thin-film technology may lead the future of photovoltaic solar panels**

Solar power is primarily generated in two ways, either through thermal energy generation, converting the solar energy into heat, or through photovoltaic energy generation, converting the solar energy into electricity. The Next Generation Solar Power panel focused on the new technology in thin-film photovoltaics, specifically cadmium telluride (CdTe) and copper indium gallium selenide (CIGS) cells. The panelists discussed how these new thin-film products can be manufactured more efficiently than the traditional silicon-based panels. Additionally, studies by the DOE’s National Renewable Energy Laboratory (NREL) showed CIGS cells can now reach efficiency of 19.9%. However, CIGS are still not as efficient as crystalline silicon solar cells which have been shown to reach efficiency levels of over 40%. More companies are moving toward the development of thin-film as the technology improves (see Exhibit 15).

**Exhibit 15: Crystalline silicon vs. thin-film**

Source: US Department of Energy, Energy Information Administration.

James Robo, the President and Chief Operating Officer of FPL Group and a keynote speaker at the conference, stated that FPL Group plans to continue to increase their investment in solar technology. FPL Group, the largest US renewable provider and a major investor in wind technology, believes that solar technology can be as successful for them as wind has been in the past. Due to FPL Group's investment in solar power, Florida is now has the second-largest installed solar power capacity in the country behind California.

**Solar power is still too expensive**

The major inhibiting factor for solar power usage today is the cost. Until the technology improves, solar power will lag behind the more developed renewable sources of energy, such as wind. More significantly, fossil fuels will continue to dominate the market until the cost of alternative energies, including solar power, decline dramatically. Joseph Laia, the Chief Executive Office at Miasolé and a panelist on the Next Generation Solar Technologies panel, summarized what the main goal of solar power developers should be today. He stated that the goal should not be to compete on price with more developed solar power companies but to compete on price with coal. Additionally, the fact that large amounts of capital have already been invested in the current infrastructure slows the shift to new technologies.

Exhibit 16 provides an approximation of the range of cost of fossil fuels relative to renewable sources of energy in the United States.

**Exhibit 16: Price per kilowatt-hour of energy sources**

Energy Source	Cost per Kilowatt-hour (kWh) range
Coal	2-6 cents per kWh
Nuclear	2-5 cents per kWh
Wind	3-6 cents per kWh
Natural gas	5.5-9 cents per kWh
Biomass	5-10 cents per kWh
Geothermal	5-10 cents per kWh
Solar	12-35 cents per kWh (most expensive)

Source: US Department of Energy, Energy Information Administration, World Nuclear Association, IEA, Oregon.gov, WSJ article - "The New Math of Alternative Energy", 2007.

### **Ethanol development in the United States is likely to focus on cellulosic ethanol**

The United States has focused its ethanol development on corn. Corn-based ethanol is not as efficient as other forms of ethanol, such as sugarcane ethanol. Additionally, there were unintentional consequences due to the use of corn to produce ethanol, such as the 10-15% increase in food prices between April 2007 and April 2008 due to corn usage for fuel. The United States is now moving away from producing corn-based ethanol. In 2009, corn-based ethanol factories have been filing for bankruptcy protection.

**Future US ethanol development will likely focus on cellulosic ethanol**

Researchers expect future ethanol development to be focused primarily on cellulosic ethanol in addition to starch based ethanol. Cellulosic ethanol has a greater energy potential because the process consumes the entire plant. However, cellulosic biomass is difficult and more costly to produce than the feedstock for starch-based ethanol. The US demand is high for renewable transportation fuels such as ethanol because the transportation sector accounts for about a third of US carbon dioxide emissions. In an attempt to increase US development of biofuels, Secretary Chu of the DOE recently announced an investment of about \$800 million from the Recovery Act to accelerate advanced biofuel research and to provide additional funding for large biorefinery demonstration projects.

### **Nuclear hampered by time horizon, cost and possible opposition to construction**

**France generates more power from nuclear energy than any other country**

Nuclear power provided about 14% of the world's electricity in 2007. France generates 76.8% of its electricity from nuclear power, a higher percentage than in any other country. Due to the country's large production of nuclear power energy, France is the world's largest net exporter of electricity. The United States has the highest level of installed nuclear power capacity with over 100,000 MW, but generates only about 19% of electricity from this source. Interestingly, Vermont generates almost 75% of the state's electricity from nuclear power. Exhibit 17 lists the countries with the highest level of electricity generated by nuclear power.

**Exhibit 17: Countries with a high level of electricity generated by nuclear power**

Country	Electricity Generated by Nuclear Power (%)
France	76.8%
Lithuania	64.4%
Slovakia	54.3%
Belgium	54.0%
Ukraine	48.1%
Sweden	46.1%
Armenia	43.5%
Slovenia	41.6%
Switzerland	40.0%
South Korea	35.3%

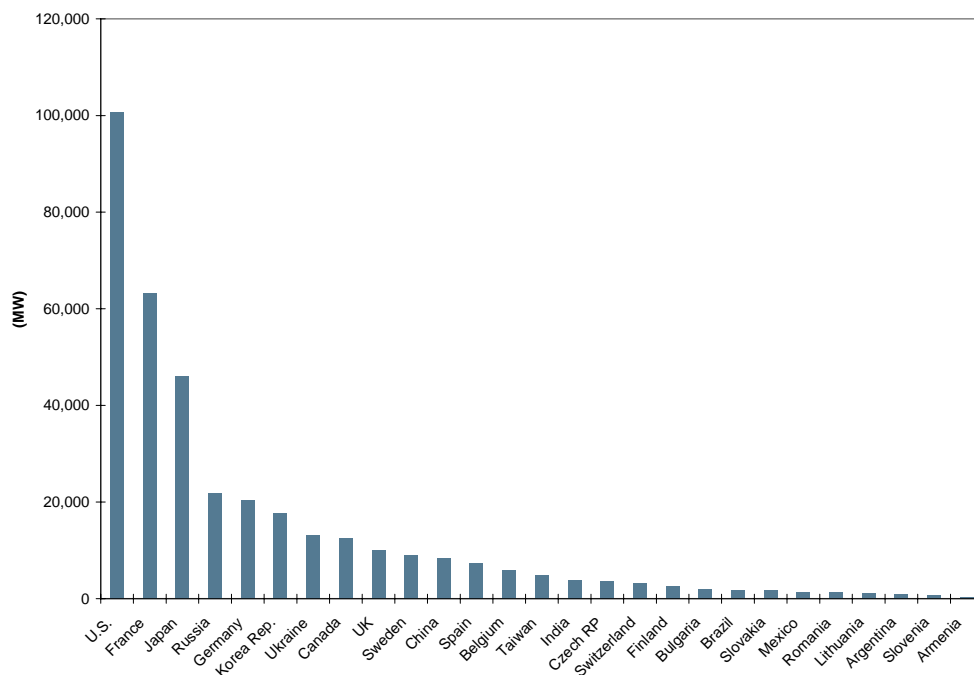
Source: Nuclear Energy Institute.

**There are three factors that hamper nuclear power creation: time, cost and community opposition**

As the panelists on the Nuclear 2010 panel stated, a long time horizon is necessary for nuclear power production due to the lengthy planning, approval and construction processes. Cost is also considered a key factor inhibiting future growth. Additionally, opposition may arise in communities where new nuclear power plants may be built.

France continues to develop its nuclear power and has two new nuclear reactors currently under construction each with over 1,600 MW of capacity. Although, the last reactor completed in France was in 1999. In contrast, the most recent nuclear power plant completed in the United States was in 1996 with 1,121 MW of capacity. The construction of this power plant was initiated prior to the Three Mile Island incident in 1979. Exhibit 18 depicts the global installed nuclear capacity in 2008.

**Exhibit 18: Global installed nuclear energy capacity, 2008**



Source: Nuclear Energy Institute.

## The smart grid encompasses many concepts

The Smart Grid Technology panelists stated that the development of a smart grid is necessary for the advancement of renewable technologies. The term smart grid encompasses many different concepts. One of the principal problems relating to the smart grid is connecting new sources of energy to the main power grid. As Susan Tomasky, the President of Transmission at American Electric Power and a panelist on the Smart Grid Technology panel stated, the supply side solutions to integrate the US power grid are fragmented. In the United States, individual states have their own guidelines and costs vary.

### The use of smart meters may help to reduce energy consumption

Another possible smart grid advancement mentioned by many of the panelists is the potential for smart meters, or Advanced Metering Infrastructure (AMI), which would allow utility end users the ability to monitor and reduce their consumption level. Dan Reicher, Director of Climate Change and Energy Initiatives at Google.org and a keynote speaker, announced the launch of the Google PowerMeter at the conference. Google PowerMeter receives information on usage levels directly from the utility company and allows users to monitor their levels on their home computers. Google is currently working with a variety of utility companies testing the software on a larger scale. James Robo also discussed a recent initiative, Energy Smart Miami, along with Cisco, GE and Silver Spring Networks to provide one million customers in the Miami area smart meters with money funded by the stimulus package. Many of the panelists expect cost savings for customers with the creation of a smart grid only if it is implemented well.

## Geothermal potential competes with water scarcity

### Hot rocks!

Geothermal is another potential global source of renewable energy. In 2006, researchers at MIT declared geothermal energy a renewable energy source that was relatively unused in the United States despite the fact that it can provide electric power and heat at a level that can have a major effect on domestic energy production while incurring minimal environmental impact. Researchers believe the number of countries that produce geothermal energy could more than double to as many as 46 countries in 2010 from 21 countries in 2000. As of August 2008, seven US states were producing power through geothermal electric power generation, Alaska, California, Hawaii, Idaho, Nevada, New Mexico and Utah with capacity rated at 2958 MW, and there are another seven states with geothermal energy generation in production.

### The need for water may inhibit future growth in geothermal power

As Dan Reicher stated, enhanced geothermal systems (EGS), the process of injecting cold water on to hot, dry rock below the earth's surface, could vastly increase the ability to generate and expand the production of geothermal power. An enormous obstacle for this type of energy production is the need for water. As we have stated in our previously published work on climate change, we expect water to become an increasingly scarce resource. Consequently, renewable sources of energy that rely on water may not be viable or cost effective.

## VI. Conclusions: The future of alternative energy linked to policy, funding and technology

---

### **Strong global policy is necessary to ensure emissions reductions**

**The future for alternative energy development remains robust.** International policy makers are working to set guidelines to encourage the reduction of greenhouse gas emissions. Strong global policy could help to ensure the reduction of greenhouse gas emissions. Several large developing countries are focusing on generating power from renewable energy sources. The governments of China and India have identified climate change as a concern and have encouraged the use of renewable energy sources through government sponsored programs. Three of the BRICs countries (Brazil, India and China) are not signatories to the Kyoto Protocols, and the policies these countries implement are of great international interest.

### **Public sector funding will help drive innovation**

Public financing of new technology will drive future innovation and catalyze adequate funding. Private investment is still available due to the shift of private investors towards the clean tech space since 2005, although not to the same extent as in 2008. Additionally, investors in public markets have been shifting their interest towards environmentally conscious companies.

### **The cost of alternative energy options must decline**

Finally, the technology is improving. To hasten the adoption of these new technologies globally, the cost must decline to the point where it is as cost efficient as fossil fuels. This can be seen in some markets with wind energy. The creation of a smart grid may help to reduce the cost of using renewable energy. Advancements in alternative sources of renewable energy, such as ethanol and geothermal power, may also help to increase the percentage of energy created from alternative energy sources worldwide. In the meantime, public R&D funding and tax incentives would help drive innovation.

### **Policy changes are expected globally prior to the Copenhagen convention this December**

Countries around the world are working to adjust their domestic climate change policies before the Copenhagen convention in December 2009. These new policies would help to formulate new international emissions reduction standards. We will be closely watching the progression of the American Clean Energy and Security Act of 2009 through Congress. It is likely that this legislation and other actions by the Obama Administration will help to position the United States as a leader at the convention this December.

## Appendix I: AE4 Conference Agenda

**Goldman Sachs**  
AE4: Fourth Annual Alternative Energy Conference



May 20-21, 2009  
Sheraton New York Hotel and Towers  
New York, NY  
<http://www.gs.com/events/aec2009>

### Wednesday, May 20, 2009

- 7:15 a.m. **Registration (2<sup>nd</sup> Floor - Metropolitan Ballroom Foyer)**
- 7:45 a.m. **Welcome** - Abby Joseph Cohen, CFA, Senior Investment Strategist and President, Global Markets Institute, Goldman Sachs (Metropolitan Ballroom East)
- 8:00 a.m. **Keynote Breakfast - Public Policy: The view from Washington on climate change and energy (Metropolitan Ballroom East)**  
Moderators Ken Connolly, Goldman Sachs Executive Office Division, Government  
Todd Maian, Goldman Sachs Executive Office Division, Government  
David Cavicke, Chief of Staff, House Energy and Commerce Committee  
Chris Miller, Senior Energy and Climate Staffer, Senator Majority Leader Harry Reid  
Mary Frances Repko, Senior Energy and Climate Advisor, House Majority Leader Hoyer  
Karen Wayland, Senior Advisor, Speaker Nancy Pelosi
- 9:30 a.m. **Keynote Speaker - Google.org: Dan Reicher, Director of Climate Change and Energy Initiatives (Metropolitan Ballroom East)**
- 10:00 a.m. **Carbon Pricing / Trading Panel (Metropolitan Ballroom West)**  
Moderators Tracy Wolstencroft, Global Head, Center for Environmental Markets Group, Goldman Sachs  
Tim Kingston, Goldman Sachs Investment Banking, Natural Resources Group  
Gary Gero California Climate Action Registry (CCAR) - President  
Nancy Kontou Chief de Cabinet, EU Environment Commissioner Stavros Dimas  
Raymond J. Kopp Resources for the Future (RFF) - Director of Climate Policy Program  
Gerrit Nicholas Goldman Sachs - Head of North American Environmental Commodities Sales
- 11:15 a.m. **Wind Operating Panel - Escaping the Boom and Bust Cycle (Metropolitan Ballroom West)**  
Moderators Brian Bolster, Goldman Sachs Investment Banking, Natural Resources Group  
Jason Channell, Goldman Sachs Equity Research, Renewable Energy Analyst  
Acciona Group Peter Duprey, Chief Executive Officer, Acciona Energy North America Corporation  
AES Corp. Marty Crotty, President of AES Wind Generation  
EDP Renovaveis Rui Teixeira, Chief Financial Officer  
Iberdrola Renovables US Ralph Currey, President and Chief Executive Officer  
NextEra Energy Michael O'Sullivan, Senior Vice President NextEra Energy (formerly known as FPL Energy)
- 12:15 p.m. Break
- 12:30 p.m. **Keynote Lunch (Metropolitan Ballroom East)**  
Introduction Gary Cohn, President and Chief Operating Officer, Goldman Sachs  
Exelon Corporation John W. Rowe, Chairman and Chief Executive Officer
- 1:15 p.m. **Utility Scale Solar Generation Panel - Navigating the Value Chain (Metropolitan Ballroom West)**  
Moderators Mariano Alarco, Goldman Sachs Equity Research, Renewable Energy Analyst  
Brian Bolster, Goldman Sachs Investment Banking, Natural Resources Group  
NextEra Energy Michael O'Sullivan, Senior Vice President NextEra Energy (formerly known as FPL Energy)  
Stirling Energy Systems (SES) Ian Simington, Chief Executive Officer  
SunEdison LLC Carlos Domenech, Chief Financial Officer
- 2:30 p.m. Break
- 2:45 p.m. **Smart Grid Technology: The Promise and Peril of the Grid: Can You Get There From Here? (Metropolitan Ballroom West)**  
Moderator Michael Lapidés, Goldman Sachs Equity Research, Electric Utilities and IPPs Analyst  
Radford Small, Goldman Sachs Investment Banking, Natural Resources Group  
American Electric Power Susan Tomasky, President of Transmission  
GridPoint, Inc. Karl Lewis, Chief Strategy Officer  
Landis + Gyr Cameron O'Reilly, Chief Executive Officer  
Northeast Utilities David R. McHale, EVP and CFO  
Silver Spring Networks Scott Lang, Chairman, Chief Executive Officer and President
- 4:00 p.m. **Nuclear 2010: Value Creation from Existing Plants and the Potential Nuclear Renaissance (Metropolitan Ballroom West)**  
Moderators John Gilbertson, Goldman Sachs Investment Banking, Natural Resources Group  
Michael Lapidés, Goldman Sachs Equity Research, Electric Utilities and IPPs Analyst  
EDF Development Inc. Joel Dogue, Vice President, Nuclear  
Entergy Nuclear (Enexus Energy) Rick Smith, President and Chief Operating Officer  
Nuclear Innovation North America (NINA), an Affiliate of NRG Energy, Inc. Steve Winn, President and Chief Executive Officer  
Progress Energy Inc. Garry Miller, General Manager, Nuclear Plant Development  
USEC Inc. John Welch, President and Chief Executive Officer

**Goldman Sachs**  
**AE4: Fourth Annual Alternative Energy Conference**



May 20-21, 2009  
 Sheraton New York Hotel and Towers  
 New York, NY  
<http://www.gs.com/events/aec2009>

**Thursday, May 21, 2009**

- 7:15 a.m. **Registration (2<sup>nd</sup> Floor - Metropolitan Ballroom Foyer)**
- 7:45 a.m. **Welcome - Tracy Wolstencroft, Global Head, Center for Environmental Markets and the Environmental Markets Group, Goldman Sachs (Metropolitan Ballroom East)**
- 8:00 a.m. **Keynote Breakfast (Metropolitan Ballroom East)**
- |                        |   |
|------------------------|---|
| Introduction           | Tim Kingston, Goldman Sachs Investment Banking, Natural Resources Group |
| <b>FPL Group, Inc.</b> | James Robo, President and Chief Operating Officer                       |
- 8:45 a.m. **Next Generation Solar Technologies (Metropolitan Ballroom West)**
- |              |  |
|--------------|--|
| Moderators   | Jason Channell, Goldman Sachs Equity Research, Renewable Energy Analyst<br>Alex Hernandez, Goldman Sachs Investment Banking, Natural Resources Group |
| Abound Solar | Pascal Noronha, Chief Executive Officer  |
| eSolar       | Merrick Kerr, Chief Financial Officer  |
| Miasolé      | Joseph Laia, Chief Executive Officer   |
| NorSun       | Jon Hindar, Chief Executive Officer  |
- 10:00 a.m. **Break**
- 10:15 a.m. **Brazilian Ethanol Panel (Metropolitan Ballroom West)**
- |                                    |   |
|------------------------------------|---|
| Moderator                          | Arjun Murti, Goldman Sachs Equity Research, Oil: Integrated Analyst |
| Petroleo Brasileiro SA (Petrobras) | José Sergio Gabrielli de Azevedo, Chief Executive Officer           |
| Brenco                             | Philippe Reichstul, Chief Executive Officer                         |
| ETH Bioenergia SA                  | Jose Carlos Grubisich, Chief Executive Officer                      |
- 11:15 a.m. **Transportation Panel: Assessing the Role of Infrastructure in Enabling the Electric Car (Metropolitan Ballroom West)**
- |                 |  |
|-----------------|--|
| Moderators      | Jeff Adams, Goldman Sachs Investment Banking, TMT Group<br>Patrick Archambault, Goldman Sachs Equity Research, Airlines, Autos & Autoparts Analyst |
| Better Place    | Michael Granoff, Head of Oil Independence Policies   |
| Ener1, Inc.     | Charles Gassenheimer, Chairman and Chief Executive Officer   |
| GridPoint, Inc. | John Clark, Head of Development of Electric Vehicle Management Solutions   |
- 12:15 p.m. **Break**
- 12:30 p.m. **Keynote Lunch (Metropolitan Ballroom East)**
- |                             |  |
|-----------------------------|--|
| Introduction                | Brian Bolster, Goldman Sachs Investment Banking, Natural Resources Group |
| <b>General Electric Co.</b> | Steve Fludder, Vice President of Ecomagination                           |
- 1:00 p.m. **Wind Manufacturing/Equipment - Opening the Bottlenecks, and Balancing Returns and Grid Parity (Metropolitan Ballroom West)**
- |                                    |   |
|------------------------------------|---|
| Clipper Windpower plc              | Doug Pertz, President and Chief Executive Officer |
| Hansen Transmissions International | Alex De Ryck, Chief Financial Officer             |
- 1:45 p.m. **The Venture Capital Perspective (Metropolitan Ballroom West)**
- |                                  |   |
|----------------------------------|---|
| Moderator                        | Jeff Adams, Goldman Sachs Investment Banking, TMT Group |
| Kleiner Perkins Caufield & Byers | Ben Kortlang, Partner                                   |
| Mohr Davidow Ventures            | Erik Straser, Partner                                   |
| Technology Partners              | Ira Ehrenpreis, General Partner                         |
- 2:45 p.m. **Break**
- 3:00 p.m. **Alternative Energy in the BRICs: What Do They Have, What Can They Have, and What Are Their Policies for the Future? (Metropolitan Ballroom West)**
- |                  |  |
|------------------|--|
| Moderator        | Sandra Lawson, Goldman Sachs Global Markets Institute  |
| Thomas C. Heller | Lewis Talbot and Nadine Hearn Shelton Professor of International Legal Studies & Senior Fellow, Stanford Freeman Spogli Institute for International Studies, Stanford University |
| Trevor Houser    | Visiting Fellow, Peterson Institute for International Economics & Partner, Rhodium Group   |
| Michael Levi     | David Rubenstein Senior Fellow for Energy and the Environment and Director, Program on Energy Security and Climate Change, Council on Foreign Relations                          |
| David Pumphrey   | Deputy Director & Senior Fellow, Center for Strategic and International Studies (CSIS)   |
- 4:00 p.m. **Closing Remarks - Brian Bolster, Goldman Sachs Investment Banking, Natural Resources Group  
 Jason Channell, Goldman Sachs Equity Research, Renewable Energy Analyst**

## Disclosures

This report has been prepared by the Global Markets Institute, the public policy research unit of the Global Investment Research Division of The Goldman Sachs Group, Inc. ("Goldman Sachs"). As public policy research, this report, while in preparation, may have been discussed with or reviewed by persons outside of the Global Investment Research Division, both within and outside Goldman Sachs, and all or a portion of this report may have been written by policy experts not employed by Goldman Sachs.

While this report may discuss implications of legislative, regulatory and economic policy developments for industry sectors, it does not attempt to distinguish among the prospects or performance of, or provide analysis of, individual companies and does not recommend any individual security or an investment in any individual company and should not be relied upon in making investment decisions with respect to individual companies or securities.

### Distributing entities

This research is disseminated in Australia by Goldman Sachs JBWere Pty Ltd (ABN 21 006 797 897) on behalf of Goldman Sachs; in Canada by Goldman Sachs Canada Inc. regarding Canadian equities and by Goldman Sachs & Co. (all other research); in Germany by Goldman Sachs & Co. oHG; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs JBWere (NZ) Limited on behalf of Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman, Sachs & Co. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom and European Union.

**European Union:** Goldman Sachs International, authorised and regulated by the Financial Services Authority, has approved this research in connection with its distribution in the European Union and United Kingdom; Goldman, Sachs & Co. oHG, regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht, may also be distributing research in Germany.

### General disclosures in addition to specific disclosures required by certain jurisdictions

Goldman Sachs conducts a global full-service, integrated investment banking, investment management and brokerage business. It has investment banking and other business relationships with governments and companies around the world, and publishes equity, fixed income, commodities and economic research about, and with implications for, those governments and companies that may be inconsistent with the views expressed in this report. In addition, its trading and investment businesses and asset management operations may take positions and make decisions without regard to the views expressed in this report.

Copyright 2009 The Goldman Sachs Group, Inc.

**No part of this material may be (i) copied, photocopied or duplicated in any form by any means or (ii) redistributed without the prior written consent of The Goldman Sachs Group, Inc.**



Global Markets  
Institute

#### President

Abby Joseph Cohen, CFA +1-212-902-4095 (US)

#### Chair

Esta E. Stecher +1-212-902-3490 (US)

Robert D. Hormats +1-212-902-5347 (US)

Sandra Lawson +1-212-902-6821 (US)

Michael A. Moran, CFA +1-212-357-3512 (US)

Douglas B. Gilman +1-212-902-3132 (US)

Amy C. Semaya +1-212-902-7009 (US)

#### Recent Publications

Pension review 2009

June 4, 2009

Effective Regulation Part III: Helping Restore  
Transparency

June 4, 2009

Bankruptcies could add to PBGC's deficit as plans  
terminate

May 15, 2009

Learn More, Earn More: Getting Ahead in America

April 22, 2009

Effective Regulation Part I: Avoiding Another  
Meltdown

March 31, 2009

Effective Regulation Part II: Local Rules, Global  
Markets

March 31, 2009

#### Recent Events

AE4: Goldman Sachs Fourth Annual Alternative  
Energy Conference

New York / May 20-21, 2009

Top Five Risks: Critical Perspectives on the Global  
Economy

London / June 4, 2008

Goldman Sachs Research personnel may be contacted by electronic mail  
through the Internet at [firstname.lastname@gs.com](mailto:firstname.lastname@gs.com)  
Goldman Sachs Global Investment Research



**Mixed Sources**

Product group from well-managed  
forests and other controlled sources  
[www.fsc.org](http://www.fsc.org) Cert no. SW-COC-001941  
© 1996 Forest Stewardship Council