

Thematic Investing In-Depth

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Climatic Consequences: An Update

Q2 2007

- **Physical Implications** — Drought is an issue, increasingly, in both Australia and New Zealand. The Australian government recently announced a plan to spend billions on water initiatives; desalination is increasingly important.
- **Regulatory Implications: U.S.** — A Supreme Court ruling confirmed the EPA's authority to regulate automobiles' emissions of GHGs; separately, RGGI and the new "Western Regional Climate Action Initiative" likely means that 38% of U.S. Gross State Product will be covered by restrictions on GHG emissions.
- **Regulatory Implications: Global** — In *Europe*, carbon markets are increasingly focused on the second "stricter" phase of the EU Emissions Trading Scheme that gets underway in 2008. *Australia* seeks to ban incandescent light bulbs. *China* will unveil a national climate change plan April 24; has set a target for 10-15% renewable energy by 2010; and the country's installed nuclear base is expected to grow five-fold by 2020.
- **Behavioral Implications** — Institutional investors managing \$4 trillion in assets recently called for a U.S. cap-and-trade system. With Kyoto (ex. U.S.) carbon trading potentially worth \$100 billion through 2012, a U.S. scheme would be both climate-friendly and lucrative. The U.S. electric-utility industry's chief trade group dropped its longstanding opposition to mandatory GHG emissions limits.
- **Who will benefit?** — We identify an additional 12 companies (across 6 industries and based in 8 countries) that seem well positioned to benefit from these trends.

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Figure 1. More Climatic Consequences Companies

Alstom	CO2 capture post-combustion	Motech Inds.	Solar cell manufacturer
Contact Energy	NZ hydro & geothermal power	Multiplex Group	Australian desalination
Fluor Corp	Gas turbine plant construction	Rhodia	Carbon emissions credits
L'Air Liquide	CO2 capture: Oxy combustion	Umicore	Solar grade silicon
Leighton Holdings	Australian desalination	United Group	Australian desalination
Makhteshim Agan	Crop protection chemicals	Verbund	Austrian hydroelectric

Source: Citigroup Investment Research

See Appendix A-1 for Analyst Certification and important disclosures.

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Contents

Climatic Consequences: An Update	3
The Regulatory Response	5
The U.S. Regulatory Response	5
The European Regulatory Response	8
Australia: Seeing the Light?	12
China: Multiple Agendas	14
The Physical Implications	16
Drought and Water Shortages	16
The Regulatory Implications	19
Power Generation in a Carbon-Regulated World	19
Natural Gas	24
Alternative Fuels and Renewable Energy	25
The Behavioral Implications	29
Consumer Behavior	29
Litigant Behavior	30
Investor Behavior	31
Corporate Behavior	33
Appendix A: Climatic Consequences Companies	36
Appendix B: Climatic Consequences Companies by Sector	37
Appendix C: Climatic Consequences Companies by Country	38
Appendix D: Climatic Consequences Companies Performance	39
Appendix A-1	40

Climatic Consequences: An Update

In our report “Climatic Consequences: Investment Implications of a Changing Climate” (published on January 19, 2007; order no. US01T004), we wrote that:

- For *investors*, the issue is *not whether* climate change is occurring. Today a variety of entities (governments, regulators, corporations, and individuals) *are reacting* to the perceived climate change threat, creating a number of *near-term* opportunities.

We discussed physical, regulatory, and behavioral implications of climate change issues, and we identified 74 companies (across 21 industries and based in 18 countries) that seemed well positioned to benefit from these trends.

As Figure 2 illustrates, in the few months since that report was published, there have been a number of developments with implications for this investment theme, including an important U.S. Supreme Court ruling, a significant expansion of regional greenhouse gas (GHG) initiatives at the state level, and greater clarity on the second “stricter” phase of the European Union Emissions Trading Scheme (EU-ETS) that gets underway in 2008.

Figure 2. Recent Climate Headlines

January 19	Massachusetts to Join Northeast U.S. Greenhouse Pact (<i>Reuters</i>)
January 19	A Coalition for Firm Limit on Emissions (<i>The New York Times</i>)
January 23	Bush Seeks Vast, Mandatory Increase in Alternative Fuels and Greater Vehicle Efficiency (<i>The New York Times</i>)
January 25	Australian Leader Unveils Water Reforms (<i>The Washington Post</i>)
February 2	A big UN report on climate change confirms that man is very likely responsible for some of it (<i>The Economist</i>)
February 20	Australia wants (incandescent) lights out by 2010 (<i>International Herald Tribune</i>)
February 26	5 Western govts agree to cooperate on greenhouse gases (<i>The Seattle Times</i>)
March 5	China's Wen Puts Emphasis on Green Growth (<i>Reuters</i>)
March 9	EU Leaders Agree to Cut Greenhouse Gases (<i>The Associated Press</i>)
March 9	U.S. OKs Early Site Permit for Nuclear Power Plant (<i>Reuters</i>)
March 10	TXU Announces Plans for 2 Coal Plants Designed to Be Cleaner-Burning (<i>The New York Times</i>)
March 12	[Irish] State may put tax on standard light bulbs (<i>The Irish Times</i>)
March 14	A [U.K.] Bill which makes reducing carbon emissions a legal duty (<i>The Independent</i>)
March 20	U.S. institutional investors sign pact urging Congress to enact 'green' legislation (<i>The Boston Globe</i>)
March 22	Big firms sign on to cut greenhouse emissions (<i>MarketWatch</i>)
March 27	[China's] COFCO Hopeful for Breakthrough in Cellulose Ethanol (<i>Reuters</i>)
March 27	EU Slashes Polish, Czech Emissions Plans (<i>Reuters</i>)
March 30	China to Unveil Climate Plan Next Month (<i>Reuters</i>)
April 2	Justices Rule Against White House on Emissions (<i>The New York Times</i>)

Source: Citigroup Investment Research

This report updates our January analysis, and examines the investment implications of recent developments. Figure 3 summarizes another 12 companies (across 6 industries and based in 8 countries) that also seemed well positioned to benefit from the themes we have identified.

Figure 3. More Climatic Consequences Companies

<p>Alstom ALSO.PA 2M – S. Smith</p>	<p>The French company has the number one position globally in emissions control systems (e.g., capturing nitrogen oxide, sulfur oxides). It recently announced a new process to capture carbon dioxide in power plant flue gas.</p>
<p>Contact Energy CEN.NZ IM – I. Graham</p>	<p>New Zealand's second largest electricity generator, with capacity split evenly between hydroelectric and geothermal. Droughts are a positive in the near term because they lift wholesale prices, but new generation capacity is focused on other renewable sources.</p>
<p>Fluor Corp FLR.N 1M – B. Chin</p>	<p>The U.S. engineering and construction company has extensive expertise in gas-fired power generation. Regulatory uncertainty about coal is likely to drive additional gas turbine orders in the U.S.</p>
<p>L'Air Liquide SA AIRP.PA 2L – A. Benson</p>	<p>A new opportunity for this French company is the use of oxygen in energy production, including the gasification of hydrocarbons to create syngas, which can be used to produce clean fuels.</p>
<p>Leighton Holdings LEI.AX 1H – A. Johnston</p>	<p>This large Australian engineering contractor is involved with building a desalination plant in eastern Australia. Reflecting drought conditions, the federal government plans to spend billions on water initiatives.</p>
<p>Makhteshim Agan Industries MAIN.TA 1H – A. Benson</p>	<p>The Israeli company is the world's largest <i>generic</i> crop protection chemicals company (offering fungicides, herbicides, and insecticides), and should benefit from a desire to boost crop yields amidst burgeoning biofuels demand.</p>
<p>Motech Industries 6244.TWO 1H – P. Liu</p>	<p>Based in Taiwan, the world's number six solar cell manufacturer should benefit from increasing demand for solar power in the West, as well as from China's goal of boosting renewables in energy consumption.</p>
<p>Multiplex Group MXG.AX 2H – P. Cashmore</p>	<p>This Australian construction company was part of the consortium that built the Perth desalination plant. Reflecting drought conditions, the federal government will spend billions on water initiatives.</p>
<p>Rhodia SA RHA.PA 2H – D. Mon</p>	<p>By eliminating nitrous oxide emissions in its two nylon production plants in Brazil and South Korea, this French company will likely generate 11 to 13 million tons of carbon credits per annum from 2007-12.</p>
<p>Umicore NV ACUMt.BR 1M – S. Jourdier</p>	<p>Amidst soaring demand for solar-grade silicon, this Belgian company is focused on the development of low-cost silicon. Longer term, germanium offers the potential for greatly improved solar efficiency.</p>
<p>United Group UGL.AX 2H – P. Graham</p>	<p>This Australian engineering services company is part of a consortium proposing on the development of a Sydney desalination plant. Reflecting drought conditions, the federal government plans to spend billions on water initiatives</p>
<p>Verbund AG VERB.VI 2M – D. Martin</p>	<p>The Austrian utility has been identified by Citigroup analysts as the best way to play expectations of rising carbon prices. With 85% of generation capacity in hydro, its electricity production is largely CO2-free.</p>

Source: Citigroup Investment Research

The Regulatory Response

The U.S. Regulatory Response

In “Climatic Consequences,” we wrote that:

- Arguably, from a business standpoint, a comprehensive federal response to climate change is preferable to the patchwork of state and local climate policies...However, although the U.S. seems to be slowly moving toward a federal policy, precisely when it will reach this tipping point is unclear.

As we outline below, in the few months since that report was published, there have been a number of developments that appear to move U.S. federal policy closer to a “tipping point” (including an important Supreme Court ruling, which is discussed in the section on litigant behavior), although that’s *not* to say that a national climate change policy is imminent. Even so, as we discuss in the section on behavioral responses to climate change issues, a number of companies and industry groups have, in recent months, acknowledged the seeming inevitability of mandatory national GHG emissions limits.

The National Level: Climate as an Election Issue

We noted in “Climatic Consequences” that “presumed candidates for both the Democratic and Republican presidential nominations — e.g., Clinton, Gore, and McCain — support mandatory GHG emission limits.” With the U.S. presidential elections just over eighteen months away, the leading candidates are now looking to distinguish themselves. As Figure 4 illustrates, most of the leading candidates for both the Democratic and Republican presidential nominations have outlined climate policies, suggesting that climate rhetoric will intensify as Election Day draws nearer (especially if Mr. Gore declares his candidacy).

Figure 4. Climate Policies of U.S. Presidential Candidates

Top four Democratic and Republican presidential candidates based on March 4 Gallup survey

Democratic	Declared?	Position	Related URL
Hillary Clinton	Yes	U.S. needs to “ultimately reduce emissions of carbon dioxide and other gases that contribute to climate change.”	http://clinton.senate.gov/issues/environment/
John Edwards	Yes	U.S. must “halt global warming by capping and reducing greenhouse gas pollution...”	http://johnedwards.com/about/issues/energy/new-energy-economy/
Al Gore	No	“Now is the time to act on global warming.”	http://www.algore.com/
Barack Obama	Yes	The U.S. “must act decisively and creatively to reduce the emission of greenhouse gases that contribute to climate change.”	http://www.barackobama.com/issues/energy/
Republican			
Newt Gingrich	No	Unclear.	
Rudolph Giuliani	Yes	Unclear.	
John McCain	Yes	“He has offered common sense approaches to limit carbon emissions by harnessing market forces...”	http://www.johnmccain.com/Informing/Issues/65bd0fbe-737b-4851-a7e7-d9a37cb278db.htm
Mitt Romney	Yes	No explicit climate policy, but believes in “developing alternative sources of energy like biodiesel, ethanol, nuclear, and coal gasification...” to achieve energy independence.	http://www.mittromney.com/Issue-Watch/Energy

Source: Citigroup Investment Research

The Regional and State Levels: A “Western RGGI”

As we pointed out in our January report, among the most far-reaching initiatives to curb GHG emissions at the state and regional levels is the “Regional Greenhouse Gas Initiative” (RGGI, pronounced “reggie”). Starting in 2009, this will be the first *mandatory* system for curbing carbon dioxide emissions from power plants in the U.S. RGGI’s original jurisdiction included Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont.

Subsequent to the creation of RGGI, the Maryland legislature approved a bill to accede to the agreement. And, in January, the governor of the Commonwealth of Massachusetts and the governor of Rhode Island both announced their states’ commitment to RGGI.

Five Western governors announced their own regional greenhouse gas reduction agreement.

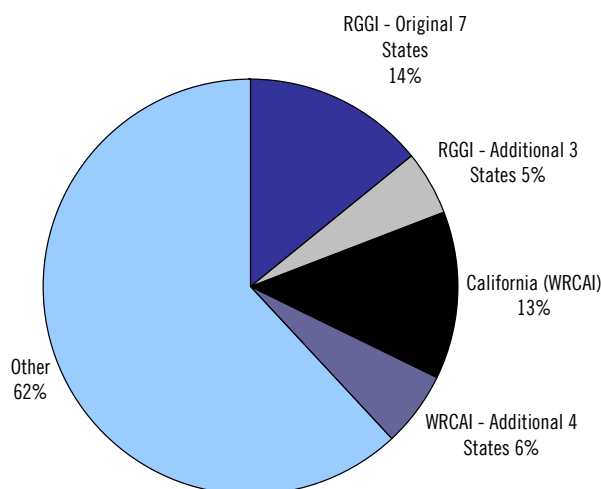
Then, in late February, five Western governors announced their own regional greenhouse gas reduction agreement. Specifically, the governors of Arizona, California, New Mexico, Oregon and Washington announced the formation of the “Western Regional Climate Action Initiative” to implement a joint strategy to reduce GHG emissions. Over the next few months, the participating states will develop a regional target for reducing GHGs; over the next year, the states will devise a market-based program, such as a cap and trade system, to reach that target.

38% of U.S. Gross State Product will have a scheme to curb GHG emissions.

So, taking into account the RGGI scheme and the California Global Warming Solutions Act of 2006, as well as the Western Regional Climate Action Initiative, it seems likely that, by 2012, fifteen states, which currently account for 38% of U.S. Gross State Product, will have implemented a scheme of one variety or another to curb GHG emissions — see Figure 5.

Figure 5. Percentage of U.S. Gross State Product Likely Covered By GHG Emissions Schemes by 2012

Original RGGI: CT, DE, ME, NH, NJ, NY, VT; Additional RGGI: MD, MA, RI; Additional WRCAI: AZ, NM, OR, WA



Source: Citigroup Investment Research

Twenty-one of the 50 U.S. states have established “renewable portfolio standards.”

Note that these restrictions on GHG emissions are *in addition* to the renewable energy portfolio standards in place in many states. Thus far, twenty-one of the 50 U.S. states have established “renewable portfolio standards” concerning the share of renewable power used in electricity generation — see Figure 6. (Two other states — Illinois and Vermont — have renewable portfolio *goals*, which are voluntary, in contrast to renewable portfolio *standards*, which are generally enforced by a state regulatory agency.) The World Resources Institute estimates that about 40% of U.S. electricity generation is now covered by mandates for renewable power.

Figure 6. U.S. States' Renewable Portfolio Standards

State	Renewable Energy Portfolio Standard
Arizona	1.25% in 2006, rising to 15% by 2025
California	Increase 2% per year beginning in 2003 to reach 20% by 2010; goal of 33% by 2020
Colorado	3% by 2007; 6% by 2011; 10% by 2015
Connecticut	4% in 2004, rising to 10% by 2010
Delaware	1% by 2007, rising to 10% by 2019
Hawaii	7% in 2003 rising to 20% by 2020
Maine	Currently 30%, with a goal of increasing share by another 10% by 2017
Maryland	3.5% in 2006, rising to 7.5% by 2019
Massachusetts	1% new renewables in 2003, increasing to 4% in 2009
Minnesota	Xcel Energy: 15% by 2010, 30% by 2020. Other utilities: 12% by 2012, 25% by 2025
Montana	5% in 2008; 10% in 2010; 15% in 2015
Nevada	6% in 2005, rising to 20% by 2015
New Jersey	3.25% in 2005, rising to 22.5% by 2021
New Mexico	5% in 2006, rising to 10% in 2011
New York	19% in 2004 rising to 24% by 2013
Pennsylvania	5.7% in 2006, rising to 18.0% by 2020
Rhode Island	3% in 2007 rising to 16% by 2020
Texas	2,280 MW by 2007, increasing to 5,880 MW by 2015
Washington	3% by 2012, rising to 15% by 2020
Washington, D.C.	4% in 2007 rising to 11% by 2022
Wisconsin	10% by 2015

Source: North Carolina State University's Solar Center and Citigroup Investment Research

Note: Comparisons may not be proportional. For example, New York requires 24% renewable energy by 2013; large hydropower generation, which accounts for about 19% of power consumed in the state, can be classified as “renewable.” By contrast, California’s 20% standard by 2010 will not count large hydropower projects in place now.

The European Regulatory Response

As we outlined in our January report, the European Union (EU) countries have been at the forefront of climate change initiatives, with those initiatives falling under three broad headings:

- *Emissions trading* (to curb emissions from stationary sources). The European Union Emissions Trading Scheme (EU-ETS) consists of a first phase from 2005–07, and a second five-year phase coinciding with the Kyoto compliance period in 2008–12.
- *Agreements with the auto sector*. As per these agreements, reductions in carbon dioxide emissions of 15% from 2002 levels are to be achieved by 2008 by the European manufacturers, and reductions of 20% and 23% are to be achieved by 2009 by the Japanese and Korean manufacturers, respectively.
- *Renewable energy and alternative fuels programs*. The EU set a target to double the share of *renewable energy* (e.g., from wind and solar power) in its energy consumption from 6% in 1997 to 12% by 2010. With regard to the development of *alternative fuels*, the EU set a goal to achieve a 5.75% market share for biofuels in the overall EU transport fuel supply by 2010.

On March 9, following a two-day summit, EU leaders announced an extended set of climate goals, including:

- A cut in GHG emissions by at least 20% from 1990 levels by 2020.
- 20% of EU power to come from renewable energy sources by 2020.
- A 10% share of biofuels in overall transport fuel consumption by 2020.

While the EU proposals gained unanimous agreement, the way to achieve them is still undecided.

However, the European Commission pointed out¹ that, while these proposals “gained unanimous agreement, the way to achieve them is still undecided.” In other words, “with emissions reduction targets decided...the process of creating laws to achieve them [is] next on the list.”

The U.K. Climate Change Bill

Separately, on March 13, the U.K. government published a draft bill on climate change, claimed to be the first legal framework for a transition to a low-carbon economy to be introduced by a government. Although Citigroup analysts² observed that “we’ve heard most of this before,” they pointed out that what’s important is that “the aim of this bill is to enshrine long term emissions reduction targets in law, such that the current and future governments will be accountable to Parliament for the nation’s annual emissions performance.”

Specifically, the proposed targets to be put into statute are to reduce U.K. carbon dioxide emissions (against a 1990 baseline) by:

- 26-32% by 2020; and
- 60% by 2050.

¹ http://ec.europa.eu/news/environment/070309_1_en.htm

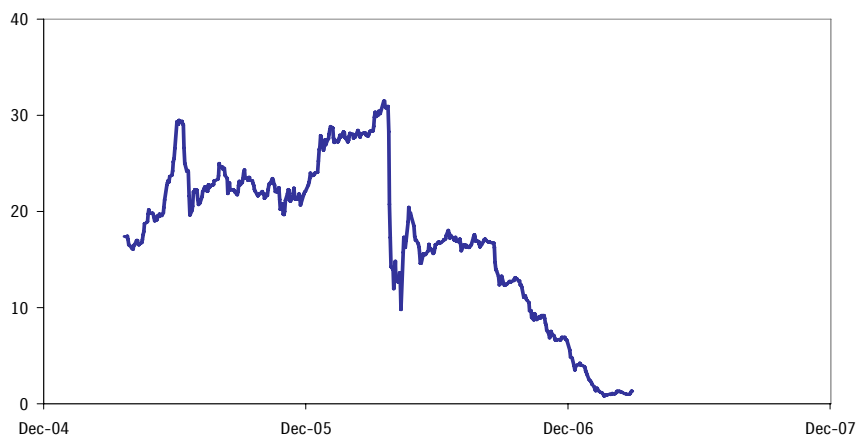
² See Meg Brown and Mike Tyrrell’s March 13, 2007, report, “UK Climate Change Bill: Bringing accountability to the targets.”

Reductions from Stationary Sources via Emissions Trading

In “Climatic Consequences,” we pointed out that in the first “learning” phase of the EU-ETS, emissions restrictions were not too onerous. In fact, it turned out that the EU allocation of carbon dioxide emissions allowances *exceeded* actual emissions, so that the surplus of permits in the market has caused the carbon price to fall to close to zero (see Figure 7).

Figure 7. European Climate Exchange Emissions Index: Dec-2007 Settlement

Price in euros of one EU allowance, equivalent to one metric tonne of carbon dioxide emissions



Source: European Climate Exchange

In Phase 1 of the EU-ETS, the vast majority of permits (95%) were given away for free. In the second, “stricter” phase, which runs from 2008 through 2012, carbon emissions restrictions will be tightened, and “just” 90% of permits will be given away for free. But with the start of the second phase less than a year away, a recent report³ by Citigroup Investment Research analyst Meg Brown pointed out that “full details regarding the structure of Phase 2 are not yet known.” A key reason:

- We do not yet know the result of the EU Commission’s review of all of the National Allocation Plans submitted. The most significant yet to be announced [is] Italy...which, in 2005, [was] in the Top 5 emitters in the scheme.

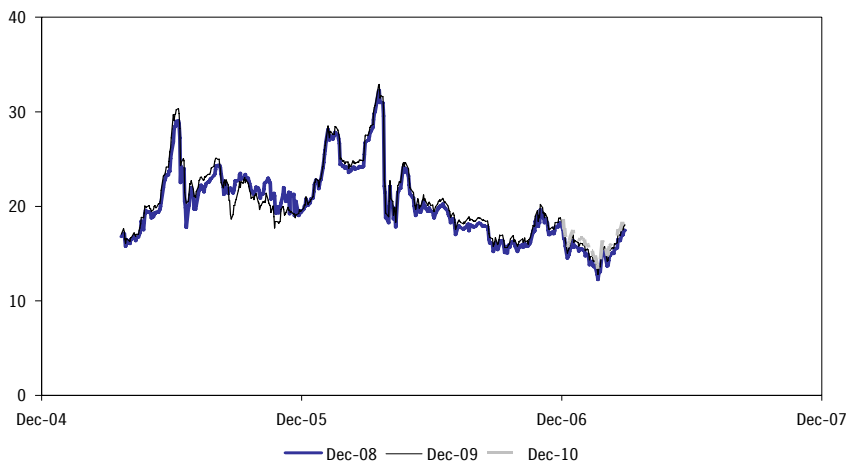
Citigroup sees carbon prices rising to €20 during Phase 2 of the EU-ETS.

Despite this lack of details, an analysis made the Citigroup analysts “confident that the surplus [of permits] situation in Phase 1 will not be repeated in Phase 2,” with the result that they “see [carbon] prices for Phase 1 remaining low (€0-1) for the remainder of the period, but rising to €20 during Phase 2.” Figure 8 shows the Phase 2 carbon price currently around €17.

³ See Meg Brown’s March 19, 2007, report, “Carbon Trading: The Sky’s the Limit.”

Figure 8. European Climate Exchange Emissions Index: Dec-2008 – Dec-2010 Settlements

Price in euros of one EU allowance, equivalent to one metric tonne of carbon dioxide emissions



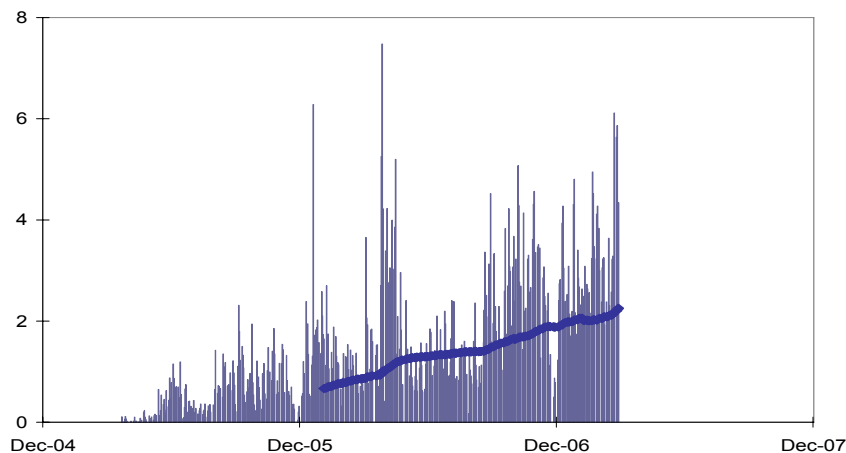
Source: European Climate Exchange

The volume of carbon futures traded on the European Climate Exchange more than doubled in the past twelve months.

Figure 9 illustrates that the volume of carbon futures traded on the European Climate Exchange more than doubled in the past twelve months, suggesting that carbon trading is now firmly established as “big business.”

Figure 9. European Climate Exchange Futures Volume

Millions of contracts with 200 day moving average



Source: European Climate Exchange

The Citigroup analysts then conducted a sensitivity analysis of European companies with exposure to carbon prices. That analysis revealed that **Verbund** of Austria is the best way to invest in expectations of rising carbon prices for the 2008-12 period, given that the utility’s large amount of hydro power generation (85% of generation capacity) means that its electricity production is largely carbon dioxide-free. Consequently, the utility should be able to reap windfall profits from the difference between the (“carbon-adjusted”) price it receives for its electricity, and the cost to generate that electricity.

Reductions from Mobile Sources

As we outlined in our January report, the European Commission negotiated a voluntary GHG reduction agreement with European, Japanese, and Korean automobile manufacturers. But we also noted that “it appears increasingly likely that these voluntary targets will be missed, raising the risk of mandated emissions reductions.”

In that regard, a recent Citigroup Investment Research report⁴ pointed out that:

The EU Commission proposed binding legislation to regulate CO2 performance of new cars sold in the EU.

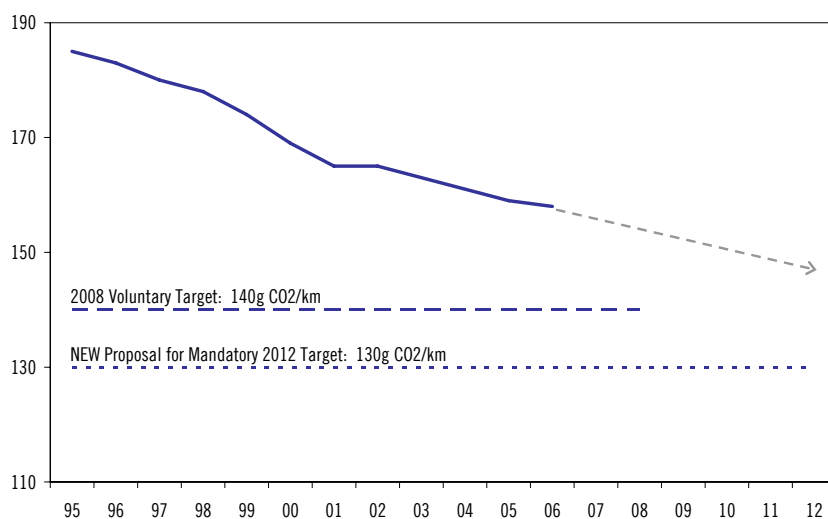
■ ...the EU Commission [proposed] *binding* legislation to regulate CO2 performance of new cars sold in the EU. The 130gCO2/km target for 2012 is less fierce than originally foreseen (120g/km) but represents a huge challenge, in our view, to an industry stuck at 158g CO2 /km and barely improving at present [italics added].

(Note, parenthetically, that, even prior to the recent U.S. Supreme Court ruling, it was reported⁵ that “all of the auto leaders [appearing before an Energy and Commerce subcommittee hearing in the U.S. House of Representatives] answered ‘yes’ when asked by [the Chairman] if they were willing to consider ‘a system which regulates the emissions of carbon dioxide from your vehicles.’”)

As Figure 10 illustrates, average carbon dioxide emissions of passenger cars in the European Union are currently 158 grams of carbon dioxide per kilometer, which is well above the voluntary target for 2008 of 140 grams. Moreover, to reach the proposed mandatory 2012 target (130 grams) would require a drop in emissions of 28 grams over the next five years, which would represent an unprecedented rate of reduction in automobiles’ emission of the GHG.

Figure 10. Average European CO2 Emissions versus Target

Grams of CO2 per kilometer



Source: European Commission, European Federation for Transport & Environment, and CIR Estimates

⁴ See John Lawson’s February 7, 2007, report, “CO2 Regulation begins to take shape.”

⁵ *Automakers Pledge Emissions Deal*, Time, March 15, 2007

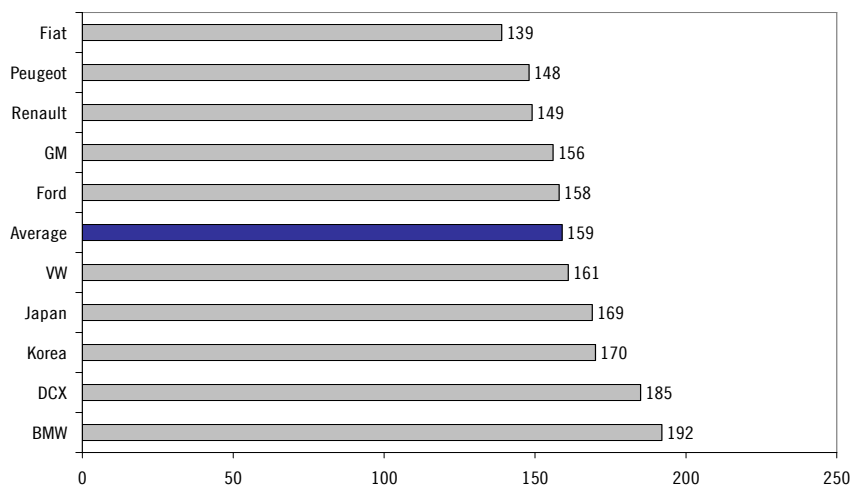
Even though the Citigroup analysts pointed out that “an impact study will start now, and proposals [will be submitted] thereafter to Governments and then [the] European Parliament (by O8E [at the] earliest),” they noted that, what’s next is:

- A gradual ‘investor education’ process for all in [the] financial markets, as the cost of preparing for [the] new requirements, and [the] competitive implications, is better documented and less conjectural. Even before legislation, look for substantial additional ‘powertrain efficiency’ development spending, and thereafter adjustments to lower forecast large/powerful vehicle sales.

As we pointed out in our January report, some European auto manufacturers — including *Peugeot* — seem better positioned to deal with these issues than others (see Figure 11).

Figure 11. Fleet Average CO2 Performance by Brand

Grams of CO2 per kilometer. Europe 2005



Source: European Federation for Transport & Environment

Australia: Seeing the Light?

In “Climatic Consequences” we wrote that “Australia, the world’s largest coal exporter, is another industrialized country [in addition to the U.S.] that has not acceded to the [Kyoto] Protocol.” Even so, a number of federal and state-based climate-friendly initiatives have been in place for some time. For example:

- At the federal level, the Mandatory Renewable Energy Target scheme has been in place since 2001. The measure requires retailers to source 9,500 gigawatt hours from renewable sources by 2010, representing approximately 2% of the national electricity market. The scheme also created tradable Renewable Energy Certificates (RECs). In our January report, we pointed out that *Energy Developments* is generating revenues from RECs by way of its landfill gas electricity generation facilities — given that, instead of venting methane, the GHG, into the atmosphere, it burns it — and Citigroup analysts highlighted favorable REC pricing trends in a recent report.⁶

⁶ See Paul Graham’s February 28, 2007, report, “Energy Developments: Positives building but needs to get closer on West Kimberley.”

A national carbon trading scheme looks increasingly likely for Australia, perhaps as soon as 2010.

Australia would effectively ban incandescent bulbs by imposing minimum energy performance standards on light bulbs.

The Irish government is considering plans for a new tax, or an outright ban, on traditional light bulbs.

- At the state level, the New South Wales Greenhouse Gas Abatement Scheme was established in 2003, and requires electricity retailers to reduce per capita GHG emissions to 95% of 1990 levels by 2007, and then maintain that level until 2021. In Queensland, the “13% Gas Scheme” requires electricity retailers to source 13% of their electricity from gas-fired generation.

Just as in the U.S., where there is also a patchwork of climate policies, Australia seems to be moving toward a coordinated federal approach. In that regard, Citigroup Investment Research analyst Elaine Prior recently wrote⁷ that “a national carbon trading scheme looks increasingly likely for Australia, perhaps as soon as 2010.”

More recently, the federal environment minister, Malcolm Turnbull, said in February that he would work with the states to replace incandescent light bulbs with more energy-efficient compact fluorescent bulbs by 2009 or 2010. Mr. Turnbull was quoted⁸ as saying that:

- The most effective and immediate way we can reduce greenhouse-gas emissions is by using energy more efficiently. Electric lighting is a vital part of our lives; globally it generates emissions equal to 70 percent of those from all the world's passenger vehicles.

Australia would effectively ban incandescent bulbs by imposing minimum energy performance standards on light bulbs. Mr. Turnbull cited International Energy Agency data that a worldwide switch to compact fluorescent lights could result in energy savings equivalent to five years of Australia's present electricity use by 2030. As for one possible motivation behind this proposal, the *International Herald Tribune* of February 20 pointed out that:

- Australia is going into a general election later this year, and opinion polls show that the environment is high on the list of voter concerns. The government's move on light bulbs is just the latest push in a concerted effort to seize the ecological initiative from the opposition Labor Party.

With regard to government fluorescent bulb initiatives, we pointed out in “Climatic Consequences” that *Philips Electronics*, the world's largest lighting manufacturer, has been lobbying state governments to highlight the advantages of a switchover from incandescent bulbs to energy-saving bulbs. Perhaps as a result of that campaign, some other countries also seem to be “seeing the light:”

- Chile's government commemorated World Energy Efficiency Day on March 5 by launching a new energy efficiency program. Part of the plan involves labeling products — including light bulbs — to indicate their energy efficiency. (As noted, the Australian scheme would go a step further, and would effectively ban incandescent bulbs by imposing minimum energy performance standards.)

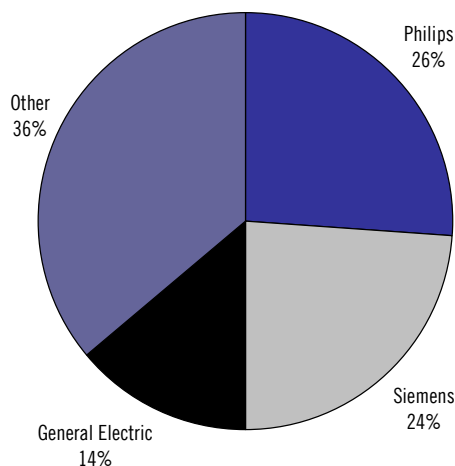
- *The Irish Times* of March 12, 2007 reported that the Irish government is considering plans for a new tax, or an outright ban, on traditional light bulbs to encourage people to switch to more environmentally-friendly low-energy bulbs. The newspaper said that a ban, or levy, on traditional light bulbs has the potential of saving over one million tonnes of Irish carbon dioxide emissions a year.

⁷ See Elaine Prior's March 9, 2007, report, “Carbon Trading for Australia.”

⁸ *International Herald Tribune*, February 20, 2007

Philips, along with two other “Climatic Consequences” companies — *Siemens* and *General Electric* — control almost two thirds of the global lighting industry (see Figure 12).

Figure 12. Global Lighting Industry Market Share



Source: Citigroup Investment Research estimates

Finally, note that fluorescent bulbs can be added to the list of solutions that are “climate friendly” but not necessarily “green” — the bulbs contain some mercury, and in Europe the price of each fluorescent lamp includes a premium to allow for its safe disposal.

China: Multiple Agendas

China will unveil its national climate change plan on April 24.

We pointed out in our January report that “developing countries, including major emitters such as China have no emissions limits under the current Kyoto agreement.” At a national level, China does not *yet* have any formal climate policy. However, it was recently reported⁹ that Gao Guangsheng, head of the Office of the National Coordination Committee for Climate Change, told the Renewable Energy Finance Forum in Beijing that China would unveil its national climate change plan on April 24. According to Mr. Gao, the plan will include concrete measures to cut carbon dioxide emissions.

Separately, we also noted in “Climatic Consequences” that “climate change initiatives are, in many regions of the world, part of a much broader agenda that covers a range of economic, political, and social issues.” In that regard, there have been some initiatives underway in China with “climate implications:”

- *Nuclear and hydroelectric power.* A recent Citigroup report¹⁰ noted that, driven by a rapidly-growing economy, “over the next four years power generation capacity is forecast to grow by 8.5% pa, with nuclear and hydro outperforming.” In particular, the report pointed out that “the Chinese authorities expect the installed base [of nuclear power generating equipment] in China to grow by 5x by 2020.”

⁹ *China to Unveil Climate Plan Next Month*, Reuters, March 30

¹⁰ See Simon J. Smith’s March 19, 2007, report, “Alstom — China: Opportunities and Risks.”

- *Pollution control.* The aforementioned Citigroup power generation report also pointed out that “the environmental control market [in China] is likely to be kick started by regulation.” In that regard, *Reuters* pointed out¹¹ that, in a recent report to the National People’s Congress, the National Development and Reform Commission said that energy-intensive companies that cause a lot of pollution should “retreat from the marketplace.” Obviously, any reduction in energy intensity should also lead to a reduction in China’s GHG emissions.
- *Renewable energy.* In the section on solar power below, we reference China’s 2006 Renewable Energy Law. As with other countries, energy efficiency and security of energy supply are key issues for China; in that regard, the Renewable Energy Law set a target for renewable energies to contribute 10-15% of the country’s total energy consumption by 2010, 18% by 2020, and 30% by 2050. The Chinese government is allocating significant amounts of money to promote solar and wind energy.

¹¹ *China's Wen Puts Emphasis on Green Growth*, Reuters, March 5, 2007

The Physical Implications

In February, the Intergovernmental Panel on Climate Change (IPCC) released its latest report¹² on the scientific basis for climate change. The panel was set up by the World Meteorological Organization and the United Nations Environment Program in 1988 to advise policy makers about climate change. It is comprised of independent climatology experts, and seeks to draw together a consensus of global scientific opinion. The panel's work triggered the negotiations towards, and subsequent ratification of, the Kyoto Protocol.

The most recent IPCC report on the state of the climate concluded that:

- Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750, and now far exceed pre-industrial values determined from ice cores spanning many thousands of years.
- The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land-use change, while those of methane and nitrous oxide are primarily due to agriculture.
- Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.
- At continental, regional, and ocean basin scales, numerous long-term changes in climate have been observed. These include changes in Arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather *including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones* [italics added].

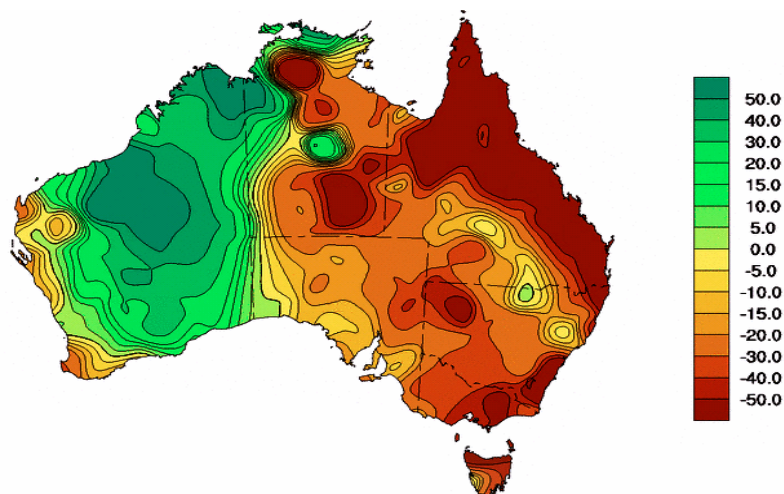
Drought and Water Shortages

In "Climatic Consequences," we discussed some implications of drought conditions in Australia. In a more recent report,¹³ Citigroup Investment Research analysts noted that while "climate change has dramatically influenced rainfall patterns across Australia...it hasn't brought ubiquitous dryness to the continent." Indeed, the analysts pointed out that, on account of the fact that "the distribution of rainfall has changed dramatically," the eastern side of Australia "has become progressively drier, while the western side has become progressively wetter" — see Figure 13.

¹² Climate Change 2007: The Physical Science Basis

¹³ See Australian Special Research February 7, 2007, report, "Turning on the Tap: Opportunities in Water."

Figure 13. Trend in Annual Total Rainfall in Australia (1970 – 2006)



Source: Australian Bureau of Meteorology

As a result:

The redistribution of rainfall from Australia’s most populated areas to the unpopulated parts of Western Australia due to climate change is having significant impacts.

- This redistribution of rainfall from Australia’s most populated areas to the unpopulated parts of Western Australia due to climate change is having significant impacts on both urban water supply and Australia’s agricultural industry.

As for the response to these trends, the report noted that:

- Australia has been slow to adjust to the longer term impact of climate change, with both State and Federal Governments only providing a notable lift in water industry capex during the past couple of years. However, the momentum is shifting quickly. *Late last month the Federal Government announced it would spend \$A11bn to improve water use efficiency and address over allocation in the Murray Darling Basin over ten years* [italics in original].

In this context, seawater desalination is an increasingly attractive option, and the Citigroup report highlighted a number of companies involved with desalination projects:

- **Leighton Holdings**, Australia’s largest diversified heavy engineering contractor. One of its subsidiary companies is part of the consortium that is building a major desalination plant in eastern Australia.
- **Multiplex Group**, a dominant player in the non-residential building industry. The company was part of the consortium that built the Perth desalination plant.
- **United Group**, a provider of maintenance, project management, and engineering services to a number of sectors is currently involved in fifteen water projects. The company is part of a consortium proposing on the development of a Sydney desalination plant.

Drought is also an issue in New Zealand, particularly in terms of hydroelectric power generation.

Not surprisingly, drought is also an issue in New Zealand, particularly in terms of hydroelectric power generation. In that regard, *Contact Energy* is New Zealand's second largest electricity retailer and generator, with its generation capacity split evenly between hydroelectric power and geothermal.

With regard to hydro, New Zealand has experienced multiple dry years this decade (most notably Autumn/Winter 2003 and Autumn/Winter 2006), and current water storage levels are again below average — storage levels fell from 138% of average in December 2006 to 93% in March 2007. Moreover, the National Oceanic and Atmospheric Administration recently forecast that a La Niña weather pattern may soon affect the Pacific Ocean, which increases the likelihood that droughts will occur across New Zealand's key hydro catchments region. In the near term, droughts would be a positive for Contact Energy, given that they would lift wholesale prices and profitability.

As New Zealand seeks to reduce its dependence on hydroelectric power because of the drought risk, policy makers are likely to encourage new generation capacity focused on other renewable sources. Contact Energy seems well positioned in that regard; indeed, a Citigroup Investment Research report¹⁴ pointed out that company management used a recent earnings announcement as a forum to announce ambitious expansion plans for the company's renewable energy generation — specifically 260MW of additional geothermal capacity, and 700MW of additional wind capacity.

¹⁴ See Ian Graham's February 23, 2007, report, "Contact Energy Ltd: More Power for the People (and the Share Price)."

The Regulatory Implications

Power Generation in a Carbon-Regulated World

We pointed out in our January report that, while carbon dioxide is not the most potent greenhouse gas with respect to trapping heat in the atmosphere, it does have the largest absolute impact, accounting for 77% of global GHGs. Approximately one third of global carbon dioxide emissions result from the burning of fossil fuels for electricity generation; not surprisingly, this sector is the focus of multiple regulatory initiatives.

Nuclear

While nuclear plants are completely carbon-free sources of electricity, we pointed out in “Climatic Consequences” that there are “serious obstacles to materially increasing the contribution of nuclear power to the global energy supply.” Some of those obstacles include high construction costs, fears about waste storage and terrorism, and unfavorable public opinion (a.k.a. “NIMBY”).

The U.S. Nuclear Regulatory Commission approved the first site in over 30 years.

Nevertheless, *Reuters* recently reported¹⁵ that “the U.S. Nuclear Regulatory Commission approved [March 8] the first site in over 30 years that could eventually house a new nuclear power plant.” As per the story:

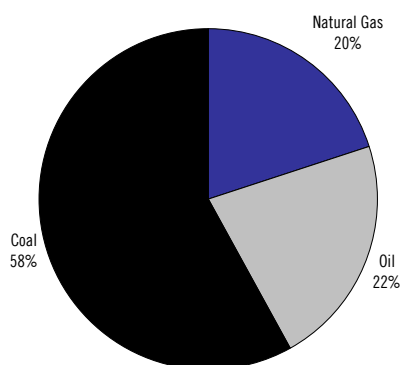
- **Exelon Corp.**, which sought the agency’s first-ever early site permit in September 2003, would have up to 20 years to seek a license from the NRC to build and operate a reactor at the company’s Clinton, Illinois, site, where it already has one nuclear reactor generating electricity.

It was also noted that the NRC is expected to make a decision in the next few weeks on **Entergy Corp’s** request for an early site permit for an additional reactor at its Grand Gulf site in Mississippi. We pointed out in our January report that Exelon operates the largest unregulated nuclear fleet in the U.S., and Entergy is the second-largest nuclear plant operator.

Coal

The relative abundance of coal (see Figure 14) means that it is likely to remain a primary fuel source for the foreseeable future.

Figure 14. Total World Reserves of Primary Energy Sources (in BTUs)



Source: BP Statistical Review of World Energy

¹⁵ *U.S. OKs Early Site Permit for Nuclear Power Plant*, Reuters, March 9, 2007

In “Climatic Consequences,” we noted that, from a technological perspective, there are several options for improving power plant fuel efficiency, including coal gasification, which involves the capture of carbon dioxide *before combustion*. We pointed out that **General Electric** and **Siemens** are both pursuing Integrated Gasification Combined Cycle (IGCC) technologies, with the GE strategy being to standardize the plant design in order to benefit from a learning curve and drive down costs.

Separately, we also highlighted **TXU Corp** (TXU.N - US\$63.76; 2H) in our January report because we suggested that being “grandfathered” might be its goal given that, at the time of publication, the utility was planning on rapidly building a large number of coal-fired power plants, ahead of possible U.S. federal restrictions on carbon dioxide emissions.

As has been widely reported, the TXU story has changed *dramatically* in the last few months. Specifically, on February 26, TXU announced it had accepted an offer to be taken private. As part of the deal, TXU said it would cancel eight of 11 of its proposed new coal plants, so that Citigroup Investment Research analyst Greg Gordon now assumes that TXU builds only three lignite plants (two at Oak Grove, and one at Sandow). Mr. Gordon hypothesized¹⁶ that TXU and its prospective buyers offered that concession (as well as some others) “in order to gain the blessings of key regulators and environmentalists.”

Parenthetically, Citigroup Investment Research analyst Brian Chin pointed out¹⁷ that these developments lead to potential upside in his earnings estimate for **Fluor**, the engineering and construction company:

- The TXU Oak Grove coal fired units are conservatively not in our EPS estimates or backlog estimates...If [these units are] approved, our estimates could still see 5-10% upside for 2008-09.

Pointing, in part, to the scrapped plans for eight new “dirty” coal-fired plants, *The New York Times* observed¹⁸ that “Texas faces a big hole in its electricity production, since the country’s second-most-populous state also happens to be one of the fastest growing.” However, on March 9, TXU announced that it had started the planning process for two IGCC plants to be located in Texas. Commenting on that announcement,¹⁹ the *Times* noted that:

- The planning for the two new clean-coal generators would potentially help fill the gap for a state where the population is expected to grow by 20 percent, to nearly 30 million people, over the next decade. But it also *may signal a shift in the thinking of utilities that depend on coal to generate energy to try to develop a challenging technology* that is accompanied by high construction costs [italics added].

¹⁶ See Greg Gordon’s February 26, 2007, report, “TXU: KKR Acquiring TXU for \$69.25/Share.”

¹⁷ See Brian Chin’s March 4, 2007, report, “Fluor: Q4 Backlog Exceeds Forecast; Conservative Guidance Means Upside.”

¹⁸ *With Coal Plans Cut Back, Texas Faces Energy Gap*, The New York Times, March 8, 2007

¹⁹ *TXU Announces Plans for 2 Coal Plants Designed to Be Cleaner-Burning*, The New York Times, March 10, 2007

Oxy-Combustion

Oxy-combustion involves using pure oxygen to combust the fuel, producing a carbon-dioxide-rich flue gas that can subsequently be captured at relatively low cost and sequestered. One of the key barriers to implementation of oxy-combustion is the cost of producing the oxygen. In contrast to coal gasification in which a partial mixture of oxygen (10%–70%) is required, oxy-combustion requires combustion in pure (i.e., 100%) oxygen.

L’Air Liquide stated that the main new growth driver that has emerged is the use of oxygen in energy opportunities.

In part reflecting increased interest in such technologies, Citigroup analysts pointed out²⁰ that *L’Air Liquide* stated at a recent conference that “the main new growth driver that has emerged is the use of oxygen in energy opportunities.” With regard to specific opportunities to use oxygen in energy, the Citigroup analysts noted that “this process starts with the gasification of hydrocarbons creating syngas. This is then further processed to produce clean fuels...” To address such opportunities, L’Air Liquide “plans to invest €1bn.”

Post-Combustion Capture

Another approach to carbon dioxide capture from coal-fired power plants involves capturing carbon dioxide *post-combustion* in flue gas. In that regard, it was recently reported²¹ that American Electric Power “is planning the largest demonstration yet of capturing carbon dioxide from a coal-fired power plant...” The project will utilize “a new process” developed by *Alstom*, which uses chilled ammonia to take a portion of the carbon dioxide from a power plant’s flue.

Alstom has the number one position globally in emissions control systems. Its environmental control systems division offers solutions to capture and transform compounds that have been identified as pollutants. The main compounds the division currently focuses on are nitrogen oxide, sulfur oxides, particulate matter and mercury/heavy metal emissions. Clearly, carbon dioxide emissions are, potentially, a huge market opportunity.

In contrast to coal gasification and oxy-combustion, post-combustion capture can be accomplished by retrofitting existing plants.

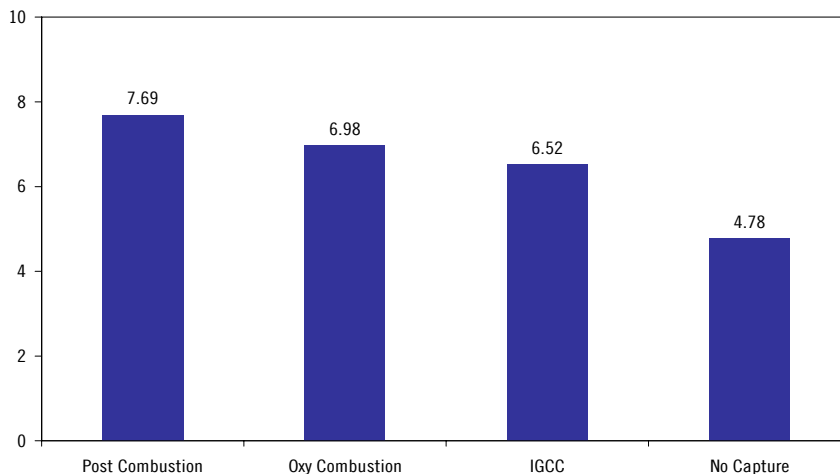
In contrast to coal gasification and oxy-combustion, which are not in widespread use, post-combustion capture can be accomplished by retrofitting existing plants. That said, it is a relatively expensive proposition; a recent MIT study²² compared the cost of electricity per kilowatt hour that would result from the various technologies — see Figure 15.

²⁰ See Andrew Benson’s March 8, 2007, report, “Conference Highlights: Ambitions to Accelerate Growth.”

²¹ *In a Test of Capturing Carbon Dioxide, Perhaps a Way to Temper Global Warming*, The New York Times, March 15, 2007

²² *The Future of Coal*, Massachusetts Institute of Technology, 2007

Figure 15. Cost of Electricity (Cents per Kilowatt Hour) of Carbon Capture Technologies



Source: *The Future of Coal*, Massachusetts Institute of Technology, 2007

Figure 16 shows the exposure of different companies to different carbon emissions reduction technologies; Figure 17 summarizes those technologies.

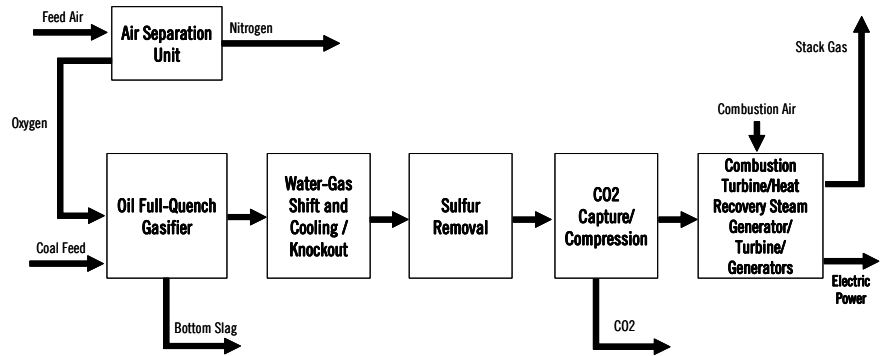
Figure 16. Exposure to Carbon Emissions Reduction Technologies

Coal Gasification	Oxy-Combustion	Post-Combustion Capture
General Electric	L’Air Liquide	Alstom
L’Air Liquide		
Siemens		

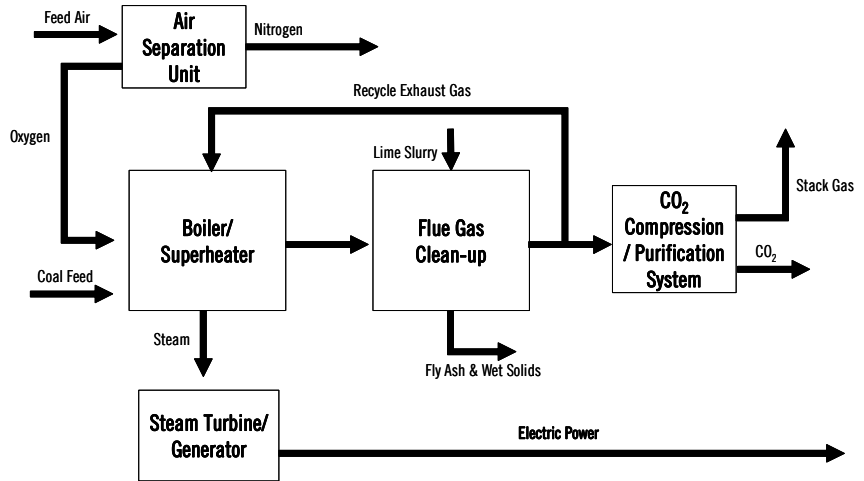
Source: Citigroup Investment Research

Figure 17. Carbon Emission Reduction Technologies

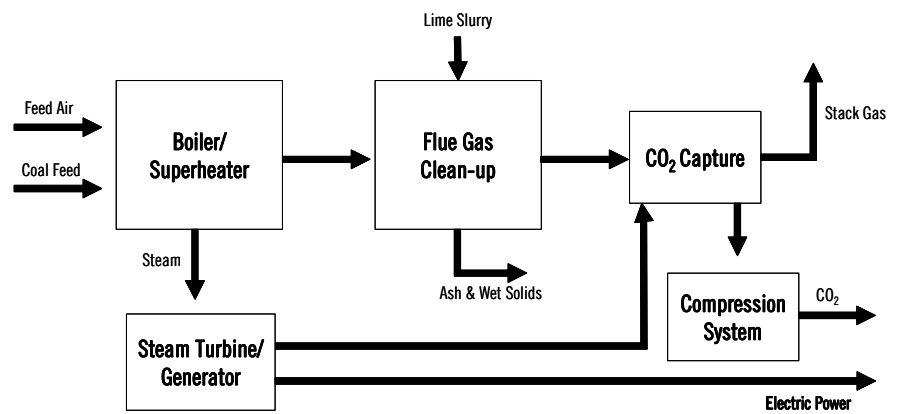
Integrated Gasification Combined Cycle (IGCC)



Oxy-Combustion



Post-Combustion Capture



Source: *The Future of Coal*, Massachusetts Institute of Technology, 2007

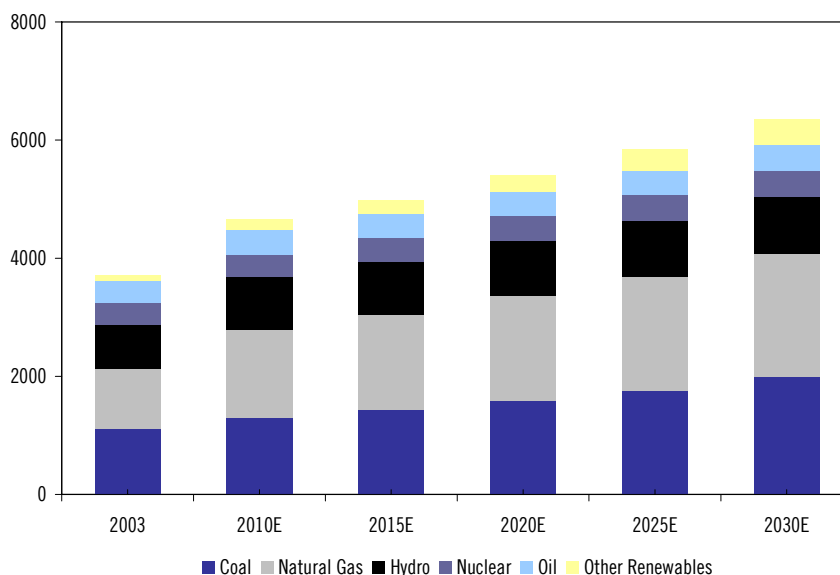
Natural Gas

At the same time that total electricity generating capacity grows 71%, the use of natural gas is expected to increase 106%.

In “Climatic Consequences” we wrote that “carbon emissions per unit of electricity are about half as large from natural-gas-power plants as from coal plants, suggesting that the attractiveness of natural gas as a fuel source should increase as restrictions on GHG emissions are tightened.” In part reflecting those factors, it is forecast that the use of natural gas in world electricity generation will increase 106% by 2030, at the same time that total electricity generating capacity grows 71% — see Figure 18.

Figure 18. World Electricity Generating Capacity by Fuel Type

Gigawatts



Source: Energy Information Administration International Energy Outlook 2006

In his recent upgrade²³ of *Fluor*, Citigroup Investment Research analyst Brian Chin wrote that:

- Politically difficult coal generation expansion and long development time for nuclear...could ultimately renew interest in gas fired generation. We are already seeing the first hints of this; a November 2006 trip to General Electric with Citigroup analyst Jeff Sprague...noted investors asking questions about how many gas fired combined cycle turbines were still in inventory — a sign that investors are starting to gain renewed interest in gas fired generation. Fluor has extensive expertise in gas fired generation from the last merchant power cycle — more so than other E&C peers. Fluor’s potential benefit from interest in gas-fired generation matches our recent commentary that gas-fired generation has the highest degree of cyclical upside of any major fossil fuel fired generation type.

Similarly, in a report²⁴ summarizing company presentations at a recent conference, the aforementioned Mr. Sprague noted that *General Electric* was:

²³ See Brian Chin’s March 4, 2007, report, “Fluor: Q4 Backlog Exceeds Forecast; Conservative Guidance Means Upside.”

²⁴ See Jeff Sprague’s March 7, 2007, report, “EE/MI - Day 2 Conference Highlights.”

Regulatory uncertainty about coal and nuclear is likely to drive additional gas turbine orders.

- ...very bullish on power demand. They have never seen such uniform strength across geographies and products. Gas turbine pricing power is improving, and is in excess of cost driven margin improvement. Regulatory uncertainty about coal and nuclear [is] likely to drive additional gas turbine orders.

Note that GE's gas turbine share is about 46%, compared to number two **Siemens** at about 28%; Fluor's focus is on the construction of power plants that use gas turbines.

Alternative Fuels and Renewable Energy

Alternative fuels and renewable energy sources are increasingly feasible options in the automotive and power generation sectors, respectively.

Biofuels

In "Climatic Consequences" we wrote that:

- ...the U.S. Energy Act of 2005 was the first official U.S. commitment to expand the usage of alternative fuels, such as bioethanol (produced from sugar crops such as corn and sugarcane). The Act requires refiners to ensure that gasoline sold in the U.S. contains a specified volume of biofuels, with a minimum of 4.0 billion gallons in 2006, increasing to 7.5 billion gallons by 2012.

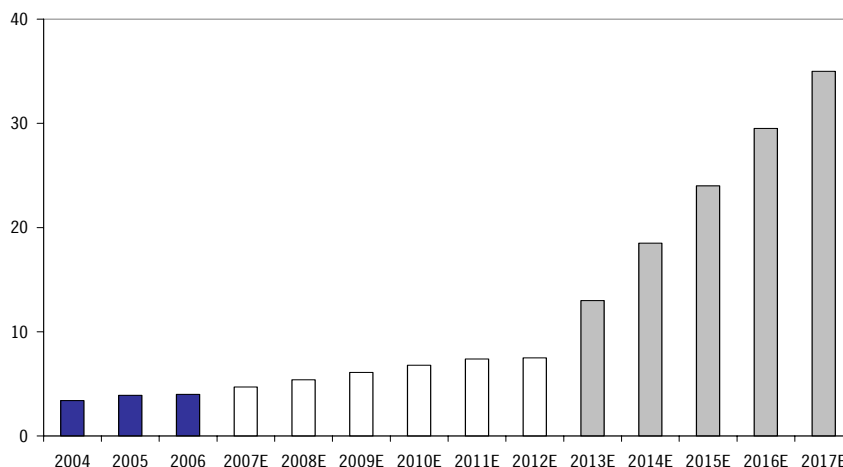
Looking to extend that target, in his January 23 State of the Union address, President Bush said that:

- ...we must increase the supply of alternative fuels, by setting a mandatory fuels standard to require 35 billion gallons of renewable and alternative fuels in 2017 — and that is nearly five times the current target.

Figure 19 illustrates the growth in biofuels required to meet those goals.

Figure 19. Billions of Gallons of Biofuels in U.S. Gasoline

Required by U.S. Energy Act of 2005 (through 2012) and targeted by President Bush (through 2017)



Source: Renewable Fuels Association and Citigroup Investment Research

We also pointed out in our January report that:

- ... there is a lot more to a corn plant than just the kernel, including leaves and stems. In that regard, in contrast to “normal” ethanol, whose original raw materials are starches, the starting raw material of “cellulosic” ethanol is cellulose, which forms the primary structural component of green plants. The key challenge in making cellulosic ethanol, however, is the identification of enzymes that facilitate the efficient transformation of cellulose into ethanol. (Note that corn ethanol can only ever be a fuel additive; there’s just not enough corn to replace motor fuels. Cellulosic technology offers a way for ethanol to become a major source of motor fuel.)

It appears that some companies are making progress with cellulosic technology. In a recent report,²⁵ Citigroup Investment Research analyst David Driscoll wrote that, following an earnings release, *Archer Daniels Midland* commented on:

Cellulosic ethanol is real and commercialization in some form could come as soon as two years from now.

- ...cellulosic ethanol, noting that the opportunity is real and that commercialization in some form could come *as soon as two years from now*. There are still numerous hurdles to large scale commercialization of cellulosic ethanol using a broad variety of inputs, including developing economically viable processing and building the infrastructure of the supply chain. Some more breakthrough technology, especially for certain kinds of input materials, is probably still five to seven years away. However, despite these obstacles, the company asserted that production of cellulosic ethanol using by-products of current inputs the company already uses — such as from corn — is a more close-in prospect, *perhaps coming on-line in about two years* [italics added].

In a subsequent note,²⁶ Mr. Driscoll reiterated the positive outlook:

- Cellulosic ethanol is right around the corner as several firms are already developing cellulosic ethanol at pilot plants, with the *first commercialized production expected to come on line as early as 2009* [italics added].

China’s state-owned grain trader, COFCO, is hopeful it will achieve a breakthrough by 2008 in the production of cellulose-based ethanol.

Similarly, *Reuters* reported²⁷ that “China’s state-owned grain trader, COFCO, is hopeful it will achieve a breakthrough by 2008 in the production of cellulose-based ethanol, the next generation biofuel derived from agricultural waste.”

Separately, the *Wall Street Journal* recently pointed out²⁸ that:

- With much attention focused on the race to ramp up production of ethanol in the U.S., Archer-Daniels-Midland Co. is pushing into a different and growing alternative-fuel market abroad: soy-and-palm-based biodiesel in Brazil and Indonesia.

The *Journal* reported that ADM is planning to open a biodiesel plant in Indonesia this year, and a wholly owned biodiesel plant in Brazil before July. World-wide, the company projects a fourfold rise in biodiesel production over the next five years.

²⁵ See David Driscoll’s February 1, 2007, report, “Archer Daniels Midland: Oppty. Ahead; ST: Corn Costs Set to Fall, LT: Cellulosic Ethanol.”

²⁶ See David Driscoll’s March 5, 2007, report, “Ethanol Ind. Leaders Indicate Cellulosic Production in Near Future.”

²⁷ *COFCO Hopeful for Breakthrough in Cellulose Ethanol*, Reuters, March 27, 2007

²⁸ *ADM Seeks Global Options With Biodiesel Markets*, The Wall Street Journal, February 15, 2007

As we observed in our prior report, burgeoning demand for biofuels has positive repercussions for a range of sectors, including agricultural supply companies:

- Citigroup Investment Research analyst P.J. Juvekar recently upgraded²⁹ **Monsanto** (MON.N - US\$55.62; 1M), the agricultural biotechnology company, based on his research that suggested a recovery in Latin American agriculture due, in part, to “additional acres driven by biofuels.” Recall that Monsanto produces seed with traits that enhance crop yields.
- A recent Citigroup Investment Research report³⁰ pointed out that “structurally high grain prices seem set to be a medium-term consequence of the global efforts to increase biofuels output. This in turn will help focus farmers’ attention on boosting yields and *crop chemicals will play a role in this production growth* [italics added].” Based on these forecasts, **Makhteshim Agan** seems well positioned, given that the company is the world’s largest *generic* crop protection chemicals company, offering fungicides, herbicides, and insecticides.

Renewable Energy: Solar

We pointed out in “Climatic Consequences” that the following players comprise the solar equipment value chain:

- A *silicon manufacturer* refines silicon to various quality grades.
- The silicon manufacturer supplies ingots or wafers to the *solar cell manufacturer*.
- The cell manufacturer can take the cells and assemble panels, or it can sell cells to *systems integrators*.
- Integrators typically have their own *distribution channels* (e.g., retailers), or they can sell panels directly to customers, who might use them to form giant arrays.

Subsequent to the publication of that report, Citigroup Investment Research launched coverage³¹ of **Motech Industries**, the world’s number six solar cell manufacturer (see Figure 20).

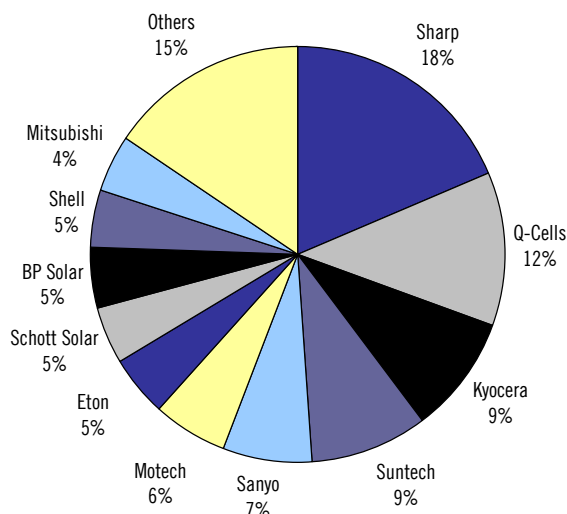
²⁹ See P.J. Juvekar’s March 5, 2007, report, “Monsanto: Upgrading On Latin America Ag Recovery.”

³⁰ See Andrew Benson’s March 13, 2007, report, “Makhteshim Agan Industries Ltd: Recovery but Without the Dividend?”

³¹ See Patty Liu’s January 30, 2007, report, “Motech Industries — Initiate at Buy: A Play on the Greening of America.”

Figure 20. Solar Cell Capacity

2007 estimates



Source: Citigroup Investment Research estimates

Taiwan-based Motech should benefit from China's 2006 Renewable Energy Law.

In addition to benefiting from growing demand for solar power in Europe and the U.S., (driven, in part, by climate concerns), Taiwan-based Motech should also benefit from China's 2006 Renewable Energy Law, which set a target for renewable energies to contribute 10-15% of the country's total energy consumption by 2010 (450MW from solar), 18% by 2020 (2000 MW from solar), and 30% by 2050.

Germanium is three times as efficient as silicon as a semiconductor, but it is also ten times as expensive.

A recent Citigroup basic materials conference³² also highlighted the potential opportunity for *Umicore* in the photovoltaics market. Umicore, a Belgian company, operates in four divisions, all with roots in metallic chemistry. Among the most important metals for Umicore is germanium — the company has the global number one position in the recycling and processing of the metal.

At the Citigroup conference, it was pointed out that "germanium is three times as efficient as silicon as a semiconductor, but it is also ten times as expensive" Umicore already manufactures germanium substrates for space photovoltaics (i.e., used on satellites) and, while the development of concentrator photovoltaics for *terrestrial* applications using germanium substrates is progressing, this remains a longer-term opportunity for the company.

More near term, Umicore is focused on reducing the costs of producing solar-grade silicon. As we noted in "Climatic Consequences," reflecting burgeoning demand for solar power, "silicon costs have tripled in the past three years," so that any break-through technology in the manufacture of "cheap" solar-grade silicon would likely be a material positive for Umicore.

³² See Andrew Benson's March 8, 2007, report, "Conference Highlights."

The Behavioral Implications

In “Climatic Consequences,” we discussed the impact of climate change issues on the behavior of four distinct groups:

1. consumers;
2. litigants;
3. investors; and
4. corporations.

Consumer Behavior

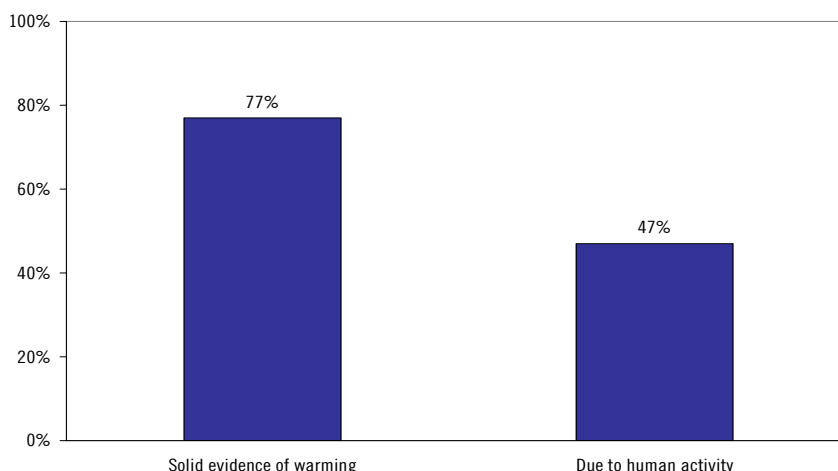
In our January report we pointed out that surveys of public opinion revealed that there is “no evidence of alarm over global warming” in the U.S., which is currently the world’s largest emitter of GHGs.

More recent surveys shed light on Americans’ attitudes:

- Although the vast majority of Americans (77%) believe there is “solid evidence that the earth is warming,” less than half (47%) of those respondents think that warming is “due to human activity”³³ — see Figure 21.

Figure 21. . “Is there solid evidence that the average temperature on earth has been getting warmer?” “Mostly because of human activity?”

Nationwide survey of 1,708 U.S. adults from January 10-15



Source: Pew Research Center

Americans do not regard “global warming” as a “top priority” issue. “Global warming” recently ranked fourth-lowest of 23 items listed.

- More significantly, the majority of Americans do *not* regard “global warming” as a “top priority” issue. In Pew Research’s annual list of policy priorities for the president and Congress, “global warming” recently ranked fourth-lowest of 23 items listed. Similarly, a recent Gallup poll³⁴ revealed that worries about “the ‘greenhouse effect’ or global warming” ranked third-lowest on a list of ten environmental issues.

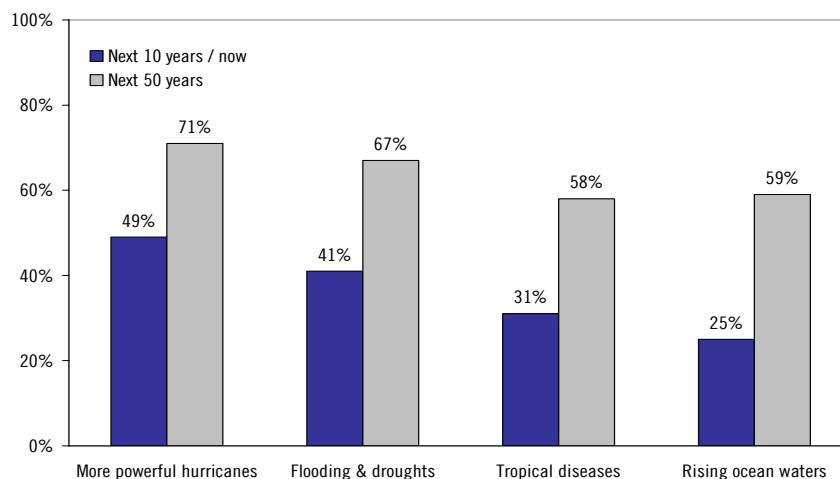
³³ *Global Warming: A Divide on Cause and Solutions*, Pew Research, January 24, 2007

³⁴ *Did Hollywood’s Glare Heat Up Public Concern About Global Warming?* The Gallup Poll, March 21, 2007

The reason for this lack of concern, it would appear, is that most Americans believe *it will be a decade or more before serious physical manifestations of climate change become apparent*³⁵ — see Figure 22.

Figure 22. “When do you think the earth would see these effects of global warming?”

Nationwide survey of 1,018 U.S. adult from February 22-25



Source: The Gallup Poll

The implication here is that, if certain physical manifestations of climate change were to occur *in the near future* — e.g., an increase in the frequency of intense hurricanes — then climate change would likely move up the American public’s list of policy priorities.

Litigant Behavior

We noted in “Climatic Consequences” that a trial date early in 2007 was expected for a lawsuit³⁶ filed by the Alliance of Automobile Manufacturers against the California Air Resources Board (CARB) and its efforts to reduce GHG emissions from passenger vehicles in California. We also pointed out that the U.S. Supreme Court was set to rule sometime in 2007 on the federal regulation of GHG emissions.

In January, a federal judge stayed the trial of the auto industry’s lawsuit against the CARB. Judge Anthony Ishii decided to wait for the Supreme Court’s decision in *Massachusetts et al. v. the Environmental Protection Agency (EPA)* before holding a lengthy and costly trial on the auto industry’s lawsuit.

On April 2 the Supreme Court ruled that the EPA *does* have the authority to regulate GHGs from automobile emissions.

With regard to the EPA case, on April 2 the Supreme Court ruled that the EPA *does* have the authority to regulate GHGs from automobile emissions. In addition to the implications for the CARB lawsuit, that ruling also has implications for another stayed case (referenced in “Climatic Consequences”) pertaining to the EPA’s ability to regulate GHGs from power plants.

It would seem that the Supreme Court ruling will have two key repercussions:

³⁵ *To Americans, the Risks of Global Warming Are Not Imminent*, The Gallup Poll, March 12, 2007

³⁶ In the case of *Central Valley Chrysler-Jeep, Inc., et al v. Catherine E. Witherspoon*

- *At some point, there will be a federal approach to the regulation of all GHGs, not just those from automobile emissions.* As the *New York Times* observed,³⁷ “the ruling does not force the environmental agency to regulate auto emissions, but it would almost certainly face further legal action if it failed to do so.” Furthermore, the *Wall Street Journal* noted³⁸ that while “the Supreme Court decision concerns regulation only of those global-warming emissions from cars and trucks...its effect is likely to be far broader. It ruled that carbon dioxide...falls under the legal definition of pollutants that the federal government has authority to regulate. That decision is likely to boost pressure on the government to limit carbon-dioxide emissions *from a variety of sources* [italics added].”
- *A federal approach is going to take time to develop.* In a separate analysis of the ruling, another *Wall Street Journal* article³⁹ pointed out that “the slow pace of the nation’s regulatory machinery, the potential for congressional or legal challenges to future regulations, and the lead time industry would need to comply with them effectively ensure that no significant changes in regulating emissions will take effect during the remainder of Mr. Bush’s time in office.”

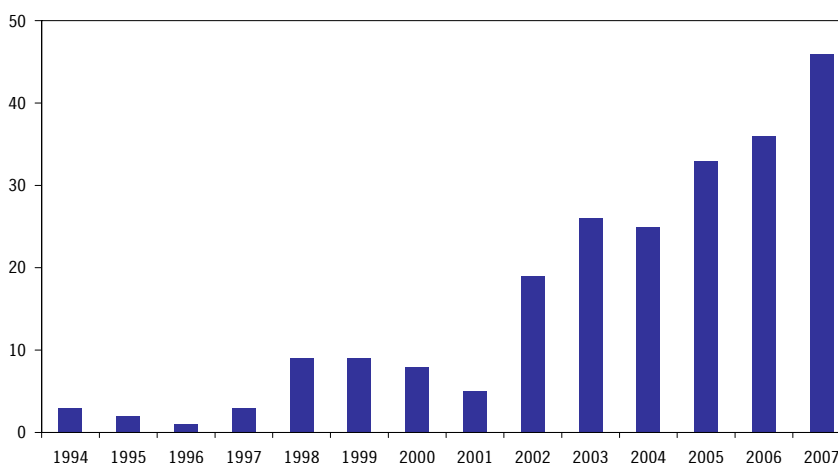
Investor Behavior

In our January report, we pointed out that “investor reaction to climate change issues has taken a number of forms, which might be classified as either relatively ‘passive’ (e.g., requests for corporate GHG disclosures, shareholder resolutions) or, alternatively, more ‘active’ (e.g., socially responsible investment, or flows into ‘clean technology’ venture capital funds).”

- *Shareholder Resolutions.* Figure 23 illustrates that a record number of climate change resolutions have been filed by shareholders thus far in 2007.

A record number of climate change resolutions have been filed by shareholders thus far in 2007.

Figure 23. U.S. Shareholder Resolutions on Climate Change



Source: Institutional Shareholder Services

³⁷ *Justices Say E.P.A. Has Power to Act on Harmful Gases*, The New York Times, April 3, 2007

³⁸ *Industries Show Uncertainty Over Ruling’s Impact*, The Wall Street Journal, April 3, 2007

³⁹ *Court Rulings Could Hit Utilities, Auto Makers*, The Wall Street Journal, April 3, 2007

- **Lobbying.** Dozens of institutional investors managing \$4 trillion in assets recently (March 19) called on U.S. lawmakers to enact federal legislation to curb the pollution causing global climate change.⁴⁰ The group, *Investors and Business for U.S. Climate Action*, proposed, amongst other things, a reduction in GHG emissions by 60-90% from 1990 levels by 2050. To achieve that goal, the group said the national policy should include *mandatory market-based solutions, such as a cap-and-trade system*, that establish an economy-wide carbon price.

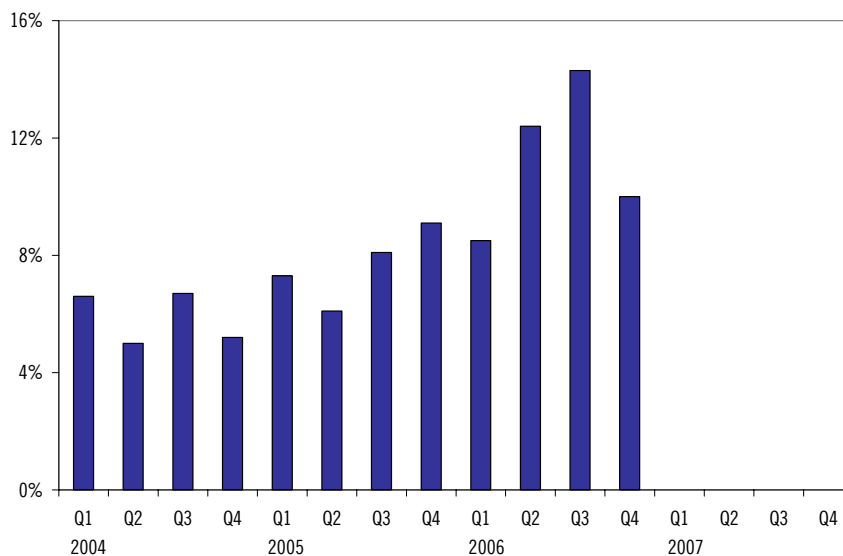
In addition to their environmental concerns, some financial firms may have other motivations in encouraging the development of a carbon market.

In addition to their environmental concerns, some of these financial firms may have other motivations in encouraging the development of a carbon market — in the aforementioned report on carbon trading, Citigroup analysts wrote that “through the first compliance period of the Kyoto Protocol [which the U.S. is not participating in], we have forecast demand for carbon credits representing...almost 5 billion tons of CO₂. At approximately €15 per tonne, the total value of this demand will be €75 billion” (i.e., close to \$100 billion). Obviously, the adoption of a cap-and-trade system by the U.S. would only increase the carbon trading opportunities for some financial firms.

North American venture capital investment into clean technology rose 78% in 2006.

- **Venture Capital Flows.** According to Cleantech Venture Network, a group that tracks capital flows into clean technology companies, North American investment in this space rose 78% in 2006 — see Figure 24.

Figure 24. North American Venture Capital in Clean Technology as a Percentage of Total Capital Invested



Source: Cleantech Venture Monitor

⁴⁰ Accessible at http://www.ceres.org/Call_to_Action

Corporate Behavior

In “Climatic Consequences” we pointed out that, from a corporate perspective, climate-friendly policies have a number of advantages, including the fact that they may “yield a ‘first-mover’ advantage to a company that voluntarily adopts climate-friendly policies ahead of competitors that are forced to do so by regulators.”

In that regard, the *Wall Street Journal* recently reported⁴¹ that:

- ... the Edison Electric Institute, the electric-utility industry’s chief trade group, announced last week that it is dropping its longstanding opposition to mandatory [GHG] emission limits. The corporate change is a concession to political reality. Even if they would prefer not to have an emissions limit, industries targeted by regulators *are angling to shape whatever they get slapped with to minimize their portion of the bill* [italics added].

The *Journal* article also noted that “Exxon Mobil Corp., which has long opposed emission constraints, now is talking about how such rules should be structured.”

Similarly, in late January, a group of businesses (including Climatic Consequences companies *FPL Group* and *General Electric*) and environmental organizations formed the *United States Climate Action Partnership* (USCAP). As per its website,⁴² USCAP calls “on the federal government to quickly enact strong national legislation to *require* significant reductions of greenhouse gas emissions [italics added].”

Note that, in calling for national legislation, USCAP goes a step further than other initiatives, such as the U.S. Environmental Protection Agency (EPA) *Climate Leaders Program*. That program — in which both FPL Group and General Electric also participate — is an industry-government partnership, whereby organizations *voluntarily* set corporate-wide GHG reduction goals, and inventory their emissions to measure progress.

In March, the EPA announced⁴³ that “the agency recognized 12 corporations for announcing new reduction goals;” Figure 25 summarizes the GHG targets of some of the biggest public corporations referred to in the announcement.

Figure 25. Corporate Greenhouse Gas Reduction Targets — Some Examples

	Absolute targets
Anheuser-Busch	Reduce total U.S. GHG emissions by 5% from 2005 to 2010
Boise Cascade	Reduce total U.S. GHG emissions by 10% from 2004 to 2014
General Motors	Reduce total North American GHG emissions by 40% from 2000 to 2010
IBM	Reduce total global GHG emissions by 7% from 2005 to 2012

Source: Citigroup Investment Research

⁴¹ *Climate Change’s Cold Economics*, The Wall Street Journal, February 15, 2007

⁴² Accessible at <http://www.us-cap.org/>

⁴³ *EPA Lauds Corporate Partners for Cutting Greenhouse Gas Emissions - Climate Leaders Program Continues to Attract New Members*, March 22, 2007

Looking further out, the *Global Roundtable on Climate Change* recently endorsed⁴⁴ “a bold post-Kyoto framework” to tackle climate change. Specifically, more than 90 international companies and organizations (including Allianz, Bayer, and Volvo) called on governments “to set scientifically informed targets for greenhouse gases and carbon dioxide (CO₂) emissions.”

Carbon Markets

In “Climatic Consequences” we differentiated between distinct sets of companies involved with the carbon markets:

- *Carbon buyers* are purchasing GHG emissions offsets because they face emissions restrictions, or because they voluntarily desire to be “carbon neutral.”
- “*Carbon sellers*” are using growing demand for emissions offsets to generate incremental revenues.
- “*Carbon facilitators*” assist with carbon abatement initiatives e.g., by preparing environmental statements.
- *Carbon traders* are developing products and services that facilitate the burgeoning market in carbon trading.

“Carbon Sellers”

Rhodia is a broad-based, commodity-oriented company, which is organized around eight business units, the largest of which is nylon. While the waste gas stream from the nylon production process previously went through a treatment process to recover nitrogen oxides (NO_x), *nitrous oxide* (the *highly potent* GHG, with 300 times the heat-trapping impact of carbon dioxide) was released with other gases into the atmosphere.

Rhodia’s emissions reduction initiative is one of the biggest Kyoto projects worldwide.

Given an incentive, Rhodia will now capture the nitrous oxide, and burn it, thus producing carbon dioxide (the *much less potent* GHG), water and nitrogen, which will all be released into the atmosphere. Specifically, by eliminating nitrous oxide emissions in its two plants in Brazil and South Korea (neither of which are Annex 1 countries), Rhodia generates carbon credits, in the form of Kyoto Certified Emission Reductions (CERs). (Rhodia’s emissions reduction initiative is one of the biggest Kyoto projects worldwide.) These emissions reductions will likely generate 11 to 13 million tons of carbon credits per annum from 2007-12.

“Carbon Facilitators”

In our January report, we highlighted some companies that facilitate carbon abatement initiatives, including *Noble Group*, which has a division called *Noble Carbon Credits*. That division focuses on sourcing carbon credits from overseas emissions reduction projects, and transacting Kyoto Certified Emission Reductions (CERs).

⁴⁴ *The Path to Climate Sustainability: A Joint Statement by the Global Roundtable on Climate Change*, February 20, 2007

Noble Group controlled 18% of CERs approved under the Kyoto Protocol in 2006.

So, for example, Noble might buy CERs that arise from a company's Clean Development Mechanism project in India, and use those carbon credits to help a European company meet its emissions requirements. In a recent report,⁴⁵ Citigroup analysts pointed out that "Noble controlled 18% of [CERs] approved under the Kyoto Protocol in 2006."

Carbon Trading

In "Climatic Consequences" we pointed out that *Chicago Mercantile Exchange* (CME) offers futures contracts for ethanol, which act as a means of price discovery in a highly volatile, rapidly growing market. We speculated that:

- Going forward, there could be additional opportunities for a futures exchange such as the CME to develop innovative products and risk management tools for companies impacted by climate-motivated regulations; the cost of adding such products would be minimal to the exchanges.

CME launched trading of hurricane futures and options contracts on March 12.

In that regard, the CME launched trading of hurricane futures and options contracts on March 12, ahead of this year's Atlantic storm season, which begins June 1. The contracts cover five regions of the U.S.: the Gulf Coast, Florida, the Southern Atlantic Coast, the Northern Atlantic Coast and the Eastern U.S. As we noted in our January report, while there is still debate in the scientific community about whether the frequency of intense hurricanes has increased, the U.S. property insurance industry has changed its models to account for multiple severe hurricanes in the midst of an active multiyear hurricane cycle.

⁴⁵ See Peter Williamson's February 28, 2007, report, "Noble Group: Buy — Metamorphosis."

Appendix A: Climatic Consequences Companies

Acciona (ANA.MC - €172.60; Not Rated)	Honda (7267.T - ¥4,150; 1M)
Ace Limited (ACE.N - US\$57.34; 1H)	Iberdrola (IBE.MC - €37.00; 2M)
Aguas de Barcelona (AGS.MC - €27.18; 2M)	IJM Plantations (IJM.KL - RM1.76; 1L)
Allegheny Technologies (ATI.N - US\$110.18; 1H)	IOI Corp (IOIB.KL - RM22.30; 1L)
Alstom (ALSO.PA - €99.64; 2M)	Itron (ITRI.OQ - US\$65.24; Not Rated)
American Intl Group (AIG.N - US\$67.77; 2H)	Johnson Controls (JCI.N - US\$96.25; 1M)
Arch Capital Group (ACGL.O - US\$68.20; 1H)	KL Kepong (KLKK.KL - RM11.90; 1L)
Archer Daniels Midland (ADM.N - US\$37.31; 1H)	L'Air Liquide SA (AIRP.PA - €183.78; 2L)
Bajaj Hindusthan (BJHN.BO - Rs205.05; 1M)	Leighton Holdings (LEI.AX - A\$34.68; 1H)
Balrampur Chini (BACH.BO - Rs69.00; 1M)	Magna International (MGA.N - US\$74.57; 1M)
BG Group PLC (BG.L - £7.33; 2M)	Makhteshim Agan Industries (MAIN.TA - NIS26.44; 1H)
BorgWarner (BWA.N - US\$76.03; 1M)	Monsanto (MON.N - US\$55.62; 1M)
Brasil Ecodiesel SA (ECOD3.SA - R\$9.31; 1S)	Motech Industries (6244.TWO - NT\$432.00; 1H)
Bunge Limited (BG.N - US\$82.16; 2M)	Multiplex Group (MXG.AX - A\$4.49; 2H)
Centrica PLC (CNA.L - £3.93; 2M)	Neste Oil Corporation ((NES1V.HE - €25.42; 1M)
Chesapeake Energy Corp (CHK.N - US\$32.19; 1H)	Noble Group (NOBG.SI - S\$1.50; 1H)
Chicago Merc. Exchange (CME.N - US\$548.25; 2H)	Ormat (ORA.N - US\$41.48; 2H)
Compagnie de St Gobain (SGOB.PA - €74.22; 1M)	Peugeot SA (PEUP.PA - €53.55; 1H)
Conergy AG (CGYG.DE - €52.88; 1H)	Philips Electronics (PHG.AS - €28.55; 1M)
Constellation Energy (CEG.N - US\$87.81; 1M)	Potash Corp of Sask (POT.N - US\$164.74; 1M)
Contact Energy (CEN.NZ - NZ\$9.25; 1M)	Q-Cells (QCEG.DE - €48.00; 1M)
Cosan SA (CSAN3.SA - R\$37.50; 1S)	Rhodia SA (RHA.PA - €2.86; 2H)
CropEnergies (CE2G.DE - €7.15; 2H)	RPS Group PLC (RPS.L - £3.42; 2L)
Deere (DE.N - US\$106.72; 1M)	RWE AG (RWEG.DE - €80.82; 1M)
DSM NV (DSMN.AS - €33.91; 2M)	Schneider Electric (SCHN.PA - €97.42; 2M)
DuPont (DD.N - US\$49.82; 1M)	Sharp (6753.T - ¥2,270; 2H)
Ebro Puleva (EVA.MC - €17.66; 1M)	Shaw Group (SGR.N - US\$30.61; 2S)
Electricité de France (EDF.PA - €63.20; 1M)	Siemens AG (SIEGn.DE - €79.97; 1M)
Emerson (EMR.N - US\$42.86; 1M)	SIG PLC (SHI.L - £12.99; 2M)
ENCE (ENC.MC - €50.15; 2M)	SolarWorld (SWVG.DE - €59.20; 2H)
Energy Developments (ENE.AX - A\$4.68; 2H)	Southwestern Energy Co (SWN.N - US\$41.67; 1H)
Entergy Corp (ETR.N - US\$108.60; 1M)	SunPower Corp (SPWR.O - US\$47.21; Not Rated)
Esco Technologies (ESE.N - US\$45.03; Not Rated)	Suntech Power (STP.N - US\$34.86; Not Rated)
Evergreen Solar (ESLR.O - US\$10.31; Not Rated)	Swiss Reinsurance (RUKN.VX - SFr114.60; 1M)
Exelon Corp (EXC.N - US\$71.18; 1M)	Syngenta AG (SYNN.VX - SFr237.70; 2L)
Fluor Corp (FLR.N - US\$91.42; 1M)	Terra Industries (TRA.N - US\$17.63; 1H)
Fortum Oyj (FUM1V.HE - €22.02; 1M)	Toyota Motor (7203.T - ¥7,420; 1M)
FPL Group (FPL.N - US\$62.54; 2M)	TXU Corp (TXU.N - US\$63.76; 2H)
Gamesa (GAM.MC - €27.87; 1M)	Umicore NV (ACUMt.BR - €138.00; 1M)
Gaz de France (GAZ.PA - €35.74; 1M)	United Group (UGL.AX - A\$13.60; 2H)
Gazprom RTS (GAZP.RTS - US\$10.22; 1L)	Verbund AG (VERB.VI - €33.78; 2M)
General Electric (GE.N - US\$35.28; 1L)	Vestas Wind System (VWS.CO - Dkr316.50; 2H)
GFI Group (GFIG.O - US\$68.14; 1H)	XTO Energy Inc (XTO.N - US\$55.33; 1H)

Source: Citigroup Investment Research

Appendix B: Climatic Consequences Companies by Sector

Sector	Company Name	Sector	Company Name
Consumer Discretionary	BorgWarner	Industrials (cont'd)	Itron
	Honda		Leighton Holdings
	Johnson Controls		Motech Industries
	Magna International		Multiplex Group
	Peugeot SA		Philips Electronics
Toyota Motor	Q-Cells		
Consumer Staples	Archer Daniels Midland		RPS Group PLC
	Bajaj Hindusthan		Schneider Electric
	Balrampur Chini		Sharp
	Bunge Limited		Shaw Group
	Cosan SA		Siemens AG
	Ebro Puleva		SIG PLC
	IJM Plantations		SolarWorld
	IOI Corp		SunPower Corp
	KL Kepong		Suntech Power
	Noble Group	United Group	
Energy	BG Group PLC	Vestas Wind System	
	Brasil Ecodiesel SA	Materials	Allegheny Technologies
	Chesapeake Energy Corp		DSM NV
	CropEnergies		DuPont
	Energy Developments		Ence
	Gazprom RTS		L'Air Liquide SA
	Neste Oil Corporation		Makhteshim Agan Industries
	Ormat		Monsanto
	Southwestern Energy Co		Potash Corp of Sask
	XTO Energy Inc		Rhodia SA
Financials	Ace Limited		Syngenta AG
	American Intl Group	Terra Industries	
	Arch Capital Group	Umicore NV	
	Chicago Mercantile Exchange	Utilities	Aguas de Barcelona
	GFI Group		Centrica PLC
	Swiss Reinsurance		Constellation Energy
Industrials	Acciona		Contact Energy
	Alstom		Electricité de France
	Compagnie de St Gobain		Entergy Corp
	Conergy AG	Exelon Corp	
	Deere	Fortum Oyj	
	Emerson	FPL Group	
	Esco Technologies	Gaz de France	
	Evergreen Solar	Iberdrola	
	Fluor Corp	RWE AG	
	Gamesa	TXU Corp	
General Electric	Verbund AG		

Source: Citigroup Investment Research

Appendix C: Climatic Consequences Companies by Country

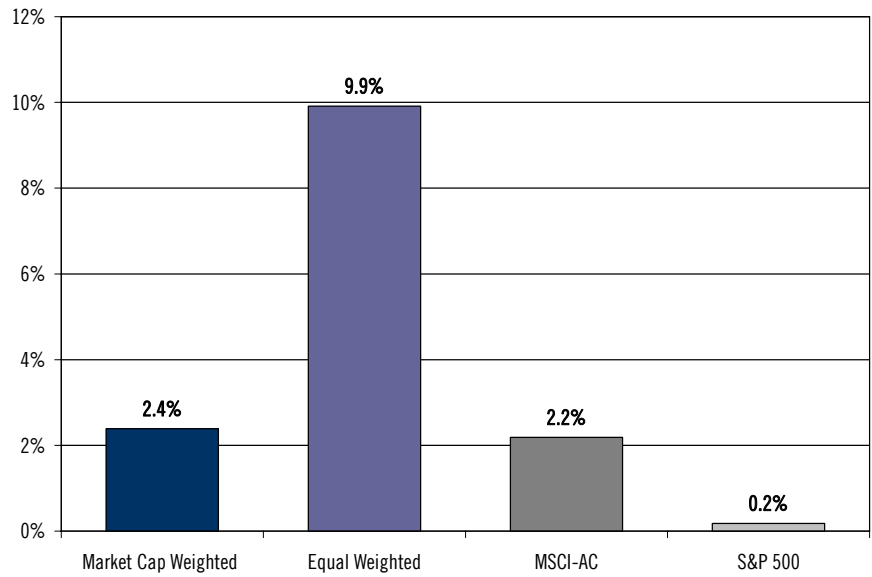
Country	Company Name
AUSTRALIA	Energy Developments
	Leighton Holdings
	Multiplex Group
	United Group
AUSTRIA	Verbund AG
BELGIUM	Umicore NV
BRAZIL	Brasil Ecodiesel SA
	Cosan SA
CANADA	Magna International
	Potash Corp of Sask
CHINA	Suntech Power
DENMARK	Vestas Wind System
FINLAND	Fortum Oyj
	Neste Oil Corporation
FRANCE	Alstom
	Compagnie de St Gobain
	Electricité de France
	Gaz de France
	L'Air Liquide SA
	Peugeot SA
	Rhodia SA
	Schneider Electric
GERMANY	Conergy AG
	CropEnergies
	Q-Cells
	RWE AG
	Siemens AG
	SolarWorld
HONG KONG	Noble Group
INDIA	Bajaj Hindusthan
	Balrampur Chini
ISRAEL	Makhteshim Agan Industries
JAPAN	Honda
	Sharp
	Toyota Motor
MALAYSIA	IJM Plantations
	IOI Corp
	KL Kepong
NETHERLANDS	DSM NV
	Philips Electronics
NEW ZEALAND	Contact Energy
RUSSIA	Gazprom RTS
SPAIN	Acciona
	Aguas de Barcelona
	Ebro Puleva
	Ence
	Gamesa
	Iberdrola

Country	Company Name
SWITZERLAND	Swiss Reinsurance
	Syngenta AG
TAIWAN	Motech Industries
UNITED KINGDOM	BG Group PLC
	Centrica PLC
	RPS Group PLC
	SIG PLC
UNITED STATES	Ace Limited
	Allegheny Technologies
	American Intl Group
	Arch Capital Group
	Archer Daniels Midland
	BorgWarner
	Bunge Limited
	Chesapeake Energy Corp
	Chicago Mercantile Exchange
	Constellation Energy
	Deere
	DuPont
	Emerson
	Energy Corp
	Esco Technologies
	Evergreen Solar
	Exelon Corp
	Fluor Corp
	FPL Group
	General Electric
GFI Group	
Itron	
Johnson Controls	
Monsanto	
Ormat	
Shaw Group	
Southwestern Energy Co	
SunPower Corp	
Terra Industries	
TXU Corp	
XTO Energy Inc	

Source: Citigroup Investment Research

Appendix D: Climatic Consequences Companies Performance

Figure 26. Climatic Consequences Companies' Stock Price Performance: 12/31/06 – 3/31/07



Source: Citigroup Investment Research

US014956

Appendix A-1

Analyst Certification

We, Edward M. Kerschner, CFA and Michael Geraghty, research analysts and the authors of this report, hereby certify that all of the views expressed in this research report accurately reflect our personal views about any and all of the subject issuer(s) or securities. We also certify that no part of our compensation was, is, or will be directly or indirectly related to the specific recommendation(s) or view(s) in this report.

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Citigroup Global Markets is acting as advisor to Bayer AG in the sale of its diagnostics division to Siemens AG

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Citigroup Global Markets Inc. currently has, or had within the past 12 months, the following company(ies) as investment banking client(s): ACE Limited, Allegheny Technologies Inc., American International Group, Archer Daniels Midland, Bajaj Hindusthan, Brasil Ecodiesel S.A., Centrica, Chesapeake Energy Corporation, Chicago Mercantile Exchange Holdings Inc, Constellation Energy, Contact Energy Ltd, Deere & Company, DuPont, Ebro Puleva, EDF, Emerson, Entergy Corporation, Exelon Corp., Fluor, Fortum, FPL Group, Gaz de France, Gazprom, General Electric, GFI Group Inc, Honda Motor, IBERDROLA, IOI, Johnson Controls Inc., Leighton Holdings Ltd, Makhteshim, Monsanto, Neste Oil, Noble Group, Ormat Technologies Inc, PSA Peugeot Citroën, Q-Cells, Saint Gobain, Schneider Electric, Sharp, Siemens, Swiss Re, Terra Industries Inc, Toyota Motor, TXU Corporation, Verbund AG and XTO Energy.

Citigroup Global Markets Inc. currently has, or had within the past 12 months, the following company(ies) as clients, and the services provided were non-investment-banking, securities-related: ACE Limited, Aguas de Barcelona, Air Liquide, Allegheny Technologies Inc., Alstom, American International Group, Archer Daniels Midland, Bajaj Hindusthan, Balrampur Chini Mills, BG Group, BorgWarner, Inc., Brasil Ecodiesel S.A., Bunge Limited, Centrica, Chesapeake Energy Corporation, Chicago Mercantile Exchange Holdings Inc, Constellation Energy, Contact Energy Ltd, Deere & Company, DSM, DuPont, Ebro Puleva, EDF, Emerson, Entergy Corporation, Exelon Corp., Fluor, Fortum, FPL Group, Gaz de France, Gazprom, General Electric, GFI Group Inc, Honda Motor, IBERDROLA, IOI, Johnson Controls Inc., KL Kepong, Leighton Holdings Ltd, Magna International Inc, Makhteshim, Monsanto, Neste Oil, Noble Group, Ormat Technologies Inc, Philips, Potash Corp of Saskatchewan Inc, PSA Peugeot Citroën, Q-Cells, Rhodia, Saint Gobain, Schneider Electric, Sharp, Siemens, Swiss Re, Syngenta, Terra Industries Inc, Toyota Motor, TXU Corporation, Umicore, Verbund AG and XTO Energy.

Climatic Consequences: An Update

4 April 2007

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Data current as of 31 March 2007

	Buy	Hold	Sell
Citigroup Investment Research Global Fundamental Coverage (3215)	45%	40%	15%
<i>% of companies in each rating category that are investment banking clients</i>	45%	42%	32%
Auto Manufacturers -- Europe (11)	18%	55%	27%
<i>% of companies in each rating category that are investment banking clients</i>	100%	83%	67%
Auto Manufacturers -- Japan (12)	58%	33%	8%
<i>% of companies in each rating category that are investment banking clients</i>	57%	50%	0%
Auto Manufacturers -- North America (10)	40%	30%	30%
<i>% of companies in each rating category that are investment banking clients</i>	50%	67%	0%
Building Products -- Europe (14)	64%	36%	0%
<i>% of companies in each rating category that are investment banking clients</i>	56%	20%	0%
Chemicals -- Europe (22)	27%	50%	23%
<i>% of companies in each rating category that are investment banking clients</i>	83%	36%	80%
Chemicals: Major -- North America (13)	31%	54%	15%
<i>% of companies in each rating category that are investment banking clients</i>	75%	86%	0%
Chemicals: Specialty -- Europe (1)	100%	0%	0%
<i>% of companies in each rating category that are investment banking clients</i>	0%	0%	0%
Commodity Agriculture -- North America (5)	80%	20%	0%
<i>% of companies in each rating category that are investment banking clients</i>	25%	0%	0%
Consumer Electronics -- Japan (7)	29%	57%	14%
<i>% of companies in each rating category that are investment banking clients</i>	100%	50%	100%
Diversified Commercial Services -- Europe (10)	40%	60%	0%
<i>% of companies in each rating category that are investment banking clients</i>	0%	0%	0%
Electric Utilities -- Australia/New Zealand (1)	0%	100%	0%
<i>% of companies in each rating category that are investment banking clients</i>	0%	100%	0%
Electric Utilities -- North America (30)	23%	73%	3%
<i>% of companies in each rating category that are investment banking clients</i>	100%	86%	100%
Emerging Europe/Middle East/Africa (130)	45%	33%	22%
<i>% of companies in each rating category that are investment banking clients</i>	43%	42%	28%
Emerging Growth -- Australia/New Zealand (30)	13%	67%	20%
<i>% of companies in each rating category that are investment banking clients</i>	25%	5%	0%
Energy Merchants -- North America (7)	29%	71%	0%
<i>% of companies in each rating category that are investment banking clients</i>	50%	60%	0%
Engineering -- Europe (32)	28%	66%	6%
<i>% of companies in each rating category that are investment banking clients</i>	33%	48%	50%
Engineering/Construction -- Australia/New Zealand (3)	33%	67%	0%
<i>% of companies in each rating category that are investment banking clients</i>	100%	0%	0%
Engineering/Construction -- North America (4)	50%	50%	0%

Climatic Consequences: An Update

4 April 2007

<i>% of companies in each rating category that are investment banking clients</i>	0%	0%	0%
Exploration & Production -- North America (16)	38%	56%	6%
<i>% of companies in each rating category that are investment banking clients</i>	67%	44%	0%
Food Manufacturers -- Europe (15)	47%	40%	13%
<i>% of companies in each rating category that are investment banking clients</i>	43%	67%	0%
Food Manufacturers -- North America (11)	55%	45%	0%
<i>% of companies in each rating category that are investment banking clients</i>	83%	60%	0%
Hong Kong -- Asia Pacific (99)	58%	13%	29%
<i>% of companies in each rating category that are investment banking clients</i>	42%	38%	38%
India -- Asia Pacific (130)	58%	14%	28%
<i>% of companies in each rating category that are investment banking clients</i>	42%	50%	42%
Insurance--Property & Casualty -- North America (26)	42%	46%	12%
<i>% of companies in each rating category that are investment banking clients</i>	82%	92%	67%
Insurance--Reinsurers -- Europe (4)	25%	75%	0%
<i>% of companies in each rating category that are investment banking clients</i>	100%	0%	0%
Latin America (111)	44%	32%	23%
<i>% of companies in each rating category that are investment banking clients</i>	57%	42%	46%
Machinery -- North America (10)	60%	10%	30%
<i>% of companies in each rating category that are investment banking clients</i>	83%	100%	33%
Malaysia -- Asia Pacific (40)	68%	5%	28%
<i>% of companies in each rating category that are investment banking clients</i>	22%	0%	18%
Metals & Mining -- North America (8)	75%	25%	0%
<i>% of companies in each rating category that are investment banking clients</i>	83%	50%	0%
Multi-industry -- Europe (1)	100%	0%	0%
<i>% of companies in each rating category that are investment banking clients</i>	100%	0%	0%
Multi-industry -- North America (14)	29%	64%	7%
<i>% of companies in each rating category that are investment banking clients</i>	100%	56%	100%
Oil Companies--International -- Europe (11)	45%	45%	9%
<i>% of companies in each rating category that are investment banking clients</i>	80%	60%	100%
Paper & Forest Products -- Europe (8)	25%	50%	25%
<i>% of companies in each rating category that are investment banking clients</i>	100%	25%	0%
Real Estate Investment Trusts -- Australia/New Zealand (22)	23%	64%	14%
<i>% of companies in each rating category that are investment banking clients</i>	80%	29%	33%
Refiners -- Europe (4)	50%	50%	0%
<i>% of companies in each rating category that are investment banking clients</i>	100%	50%	0%
Renewable Energies -- Europe (8)	75%	25%	0%
<i>% of companies in each rating category that are investment banking clients</i>	17%	50%	0%
Specialty Finance -- North America (19)	42%	58%	0%
<i>% of companies in each rating category that are investment banking clients</i>	88%	45%	0%
Taiwan -- Asia Pacific (91)	66%	20%	14%
<i>% of companies in each rating category that are investment banking clients</i>	17%	6%	23%
Utilities -- Australia/New Zealand (12)	50%	25%	25%
<i>% of companies in each rating category that are investment banking clients</i>	67%	0%	33%
Utilities -- Europe (31)	35%	52%	13%
<i>% of companies in each rating category that are investment banking clients</i>	55%	56%	25%
Utilities--Gas Distribution -- Europe (1)	100%	0%	0%
<i>% of companies in each rating category that are investment banking clients</i>	100%	0%	0%

Guide to Fundamental Research Investment Ratings:

Citigroup Investment Research's stock recommendations include a risk rating and an investment rating.

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Medium to High Risk -- Mid Triple B through High Double B

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4 April 2007

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