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This report summarizes the main findings of a World Resources Institute research project. Additional information on the methodology, background sources, and results is available at <http://capmarkets.wri.org/>.

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EXECUTIVE SUMMARY The oil and gas industry will have to deal with two major environmental issues in the next decade—(i) the prospect of policies to combat climate change (“global warming”) and (ii) constrained access to oil and gas reserves. These issues have the potential to affect companies’ sales, operating costs, asset values, and shareholder value.

This report assesses the financial impact of these two issues for the following 16 companies: Amerada Hess (AHC), Apache (APA), BP (BP), Burlington Resources (BR), ChevronTexaco (CVX), Conoco-Phillips (COP), Eni (E), Enterprise Oil (ETP), ExxonMobil (XOM), Occidental Petroleum (OXY), Repsol YPF (REP), Royal Dutch/Shell Group (RD), Sunoco (SUN), TotalFinaElf (TOT), Unocal (UCL), and Valero Energy (VLO).

The major findings are as follows:

- Companies will have very different exposure to climate and access issues and their financial consequences by virtue of their unique asset bases. This differentiation is a source of competitive advantage and disadvantage within the industry.

- The corporate impact of these issues may be substantial, but it is not yet reflected in stock prices. Figure A reveals the possible implications for shareholder value. The lines reflect the range of outcomes for each company in light of uncertainty about the way that these issues will develop. The “most likely” outcome for each company is indicated by the squares.

- BR and SUN are least affected by these environmental issues. OXY, REP, and UCL—the most severely exposed to these issues—are likely to lose more than 6 percent in shareholder value.

- Few companies have disclosed the degree to which they are financially exposed to these issues, and no company has attempted to quantify the financial implications for its shareholders.

CLIMATE CHANGE

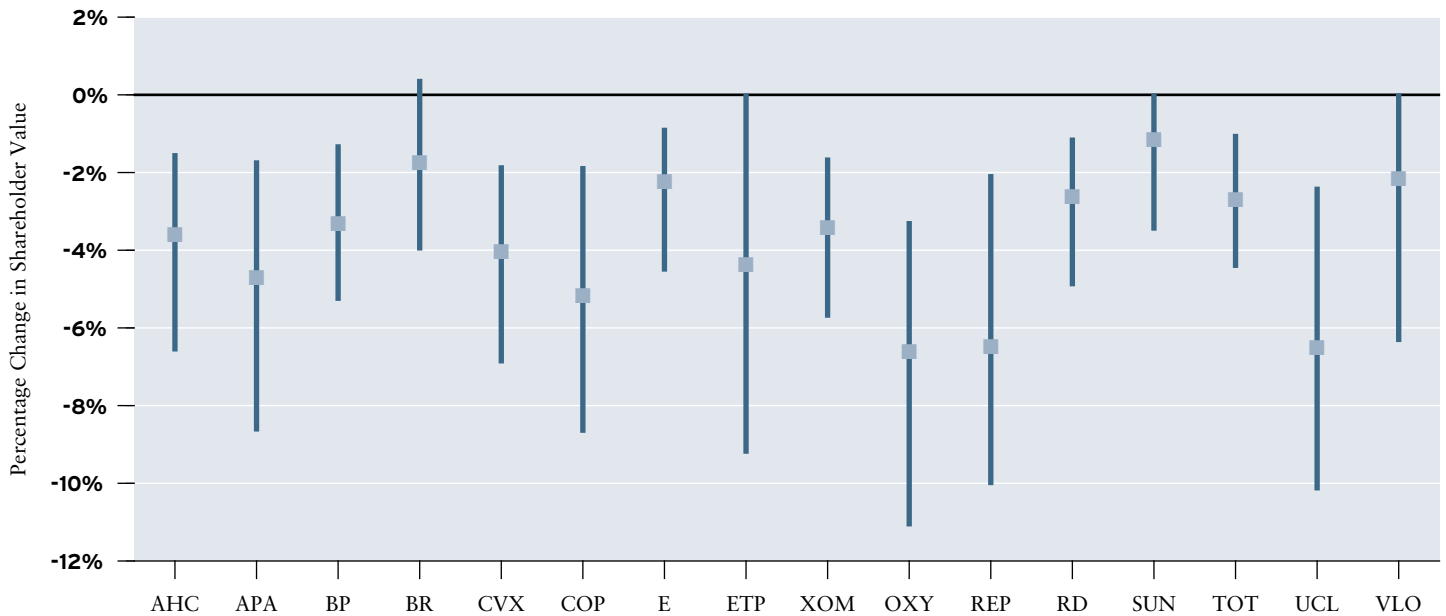
International concern is growing that rising greenhouse gas (GHG) emissions, derived mainly from combustion of fossil fuels, is causing the Earth’s climate to change. Over 180 countries have worked together in drafting the Kyoto Protocol, which commits developed countries to reduce GHG emissions to 5.2 percent below 1990 levels by 2010. The Protocol will likely go into force, but probably without the participation of the United States, and possibly without Australia. Even without these countries, the Protocol could have significant impacts on market demand and producer prices for crude oil, natural gas, and petroleum products.

- Across several different scenarios, ranging from no action to widespread adoption of the Protocol, future climate policies could create “most likely” financial impacts for companies, ranging from a 5 percent loss in shareholder value to a slight gain.

- One likely scenario is that Canada, Europe, Japan, and Russia will adopt the Kyoto Protocol, while the United States pursues its own measures to limit GHG emissions. Under this scenario, BR’s shareholder value could increase slightly. ETP, OXY, and REP could lose about 4 percent of shareholder value.

- Under some scenarios, two companies with significant natural gas assets—APA and BR—could face upside opportunities from a substitution trend toward natural gas.

FIGURE A: Financial Consequences of Climate Policies and Restricted Access to Reserves
(Range of possible outcomes and most likely impact)



■ Even without U.S. participation in the Protocol, U.S.-based companies could be affected by it. Changes in the global oil market, transmitted by price, will be felt throughout the industry. In addition, many U.S.-based companies have extensive assets abroad that could be impacted.

RESTRICTED ACCESS TO OIL AND GAS RESERVES

The industry also faces growing constraints in accessing oil and gas reserves, as increased efforts are made to protect pristine areas and preserve ecosystems. Community opposition puts production in a number of countries at growing risk, especially where population growth increases competition for land.

■ Past troubles encountered by Texaco (in Ecuador), Shell (in Nigeria), and other companies may be a precursor to future, more systematic difficulties. The debate over the Arctic National Wildlife Refuge foreshadows similar obstacles the industry could face around the world.

■ Companies' exposure to future resource accessibility pressures differs markedly. **APA, CVX, COP, TOT, REP, OXY,** and **UCL** have a larger than average share of their upstream reserves in areas identified as ecologically important by the environmental community and the United Nations. **BR, E, XOM,** and **RD** have relatively few reserves in environmentally sensitive areas, while none of **ETP's** reserves lie in these areas.

■ Future access policies could create "most likely" financial impacts for companies averaging a 2 percent loss in shareholder value across several different scenarios. Non-integrated producers were the most affected. **APA, OXY,** and **UCL** had a "most likely" loss of 3 percent in shareholder value.

■ One likely scenario is that communities living in or near environmentally sensitive areas will increase their opposition to oil and gas development, either through a political process or other means, such as protests and sabotage. Under this scenario, **ETP** was unaffected. **APA, OXY,** and **UCL** lost more than 3 percent of shareholder value.

1. Environment and Shareholder Value in the Oil and Gas Sector

The oil and gas industry has a significant environmental footprint.

Environmental issues have influenced profitability in the past.

Emerging environmental pressures may affect companies in new ways.

ENVIRONMENTAL ISSUES AND INDUSTRY PROFITABILITY

Environmental issues have long influenced corporate profitability in the oil and gas sector. The industry's products—crude oil and natural gas—are often extracted in ecologically sensitive areas, using processes that can generate large amounts of waste. Downstream refining and processing operations are energy- and chemical-intensive, and the final petroleum and gas products emit large volumes of air pollutants upon combustion. In addition, risks of accidents and spillage are high at every stage of oil and gas operations.

These factors create bottom-line financial pressures that are well known to analysts, including increased operating costs; penalties, fines, and settlements; and steady demands on capital budgets for pollution-abatement equipment. Sometimes these costs are highly visible as in the case of the *Exxon Valdez* oil spill, which cost Exxon over \$4.2 billion in clean-up, liabilities, and penalties.¹ Less visible, but more significant, expenditures by U.S. refineries for pollution abatement made up between 30 percent and 50 percent of their total capital expenditures between 1991 and 1995.² Industry-wide environmental expenditures—operating costs, compliance expenditures, penalties, and liabilities—amounted to \$8.5 billion in 1998, more than twice the net income of the top 200 oil and gas companies.³

The industry and analysts covering it have grown accustomed to traditional environmental risks, but new environmental trends may not follow the same patterns. Climate change, for example, is an issue that strikes at the industry's core products. Greenhouse gas (GHG) emissions can be cut only by reducing use of fossil fuels.

Other environmental issues may affect companies through new avenues. An increasing number of oil and gas companies find they are targets of boycotts and campaigns by environmental groups and the public. In 1995, for example, Shell became embroiled in a public relations battle with Greenpeace over plans to sink the inactive *Brent Spar* into the North Sea. In 2001, Europe's "Stop Esso" boycott campaign was a response to Exxon-Mobil's stance on global warming and opposition to the Kyoto Protocol. Public pressure is also manifest in growing demand for greener or more sustainable products. Some companies have started to respond by developing new fuels or investing in new businesses.

¹ Jonathan D. Jones, Christopher L. Jones, and Fred Phillips-Patrick, "Estimating the Costs of the Exxon Valdez Oil Spill," *Research in Law and Economics*, vol. 16 (1994), pp. 109–49.

² Energy Information Administration, *The Impact of Environmental Compliance Costs on U.S. Refining Profitability* (Washington, D.C.: EIA, October 1997).

³ American Petroleum Institute, *U.S. Petroleum Industry's Environmental Expenditures 1990–1998* (Washington, D.C.: API, 2000).

These new environmental pressures hold more uncertainties for companies than the old, familiar patterns of regulation and litigation. And they are likely to be an increasingly important determinant of the industry's financial performance.

TWO KEY ENVIRONMENTAL ISSUES

While the industry faces many environmental issues, consultation with company representatives and other industry experts identified two key issues:

- pending measures to mitigate climate change (“global warming”); and
- growing constraints on access to oil and gas reserves

CLIMATE CHANGE

The combustion of fossil fuels—the industry's main products—is the chief cause of increased atmospheric concentrations of GHGs, which are considered to be driving climate change. The Kyoto Protocol, shaped by over 180 nations, aims to reduce future GHG emissions in developed countries to 5.2 percent below their 1990 levels by 2010.⁴ Several companies have made well-publicized efforts to reduce GHG emissions from operations, but the industry's main vulnerability comes from the impact that policies could have on sales of gas and, particularly, oil (which emits more GHGs per unit of energy). Ninety percent of the GHG emissions associated with the industry result from final combustion of fuels by end-users.⁵

Within the industry, companies are positioned differently to respond to future climate policies, depending on (a) their oil-gas mix, (b) their position in the value chain, and (c) the location of their operations and sales. For the industry as a whole, the financial impact will be sensitive to the types of policies that might be implemented. Some policy options to reduce GHGs, in particular the “grandfathering” of tradable permits (explained in Section 2), could increase companies' shareholder value even as they limit output of carbon-intensive fuels.

ACCESS TO RESERVES

As conventional sources of oil and gas become exhausted, the search for new reserves often brings companies into regions that are remote, pristine, or close to existing communities. Intrusion into these new areas may result in vociferous environmental and social controversy. In developed countries, NIMBY (“not in my back yard”) attitudes can markedly restrict industrial development and impinge on the industry's plans for additional infrastructure. Opposition to oil development in the Arctic National Wildlife Refuge and offshore California are examples of this trend. Residents of developing countries are also becoming more vocal in their opposition to oil and gas projects through informal networks of community leaders, local nongovernmental organizations (NGOs), and international environmental or human rights organizations. Such opposition can raise operating costs, constrain production, or block access to reserves. Noteworthy examples include Occidental in Colombia and Shell in Nigeria.

Measures to mitigate climate change could significantly affect oil and gas sales.

Companies also face growing constraints in accessing oil and gas reserves.

⁴ United Nations, Framework Convention on Climate Change, “Report on the Conference of the Parties,” March 18, 1998. At <http://unfccc.int/resource/docs/cop3/07a01.pdf>.

⁵ American Petroleum Institute, *Global Emissions of Carbon Dioxide from Petroleum Sources* (Washington, D.C.: API, July 1991).

DETERMINING FINANCIAL IMPACTS OF CLIMATE AND ACCESS ISSUES

This report estimates how the two main environmental issues will affect the shareholder value of a sample of 16 prominent oil and gas companies. The companies examined are Amerada Hess (AHC), Apache (APA), BP (BP), Burlington Resources (BR), Chevron-Texaco (CVX), ConocoPhillips (COP), Eni (E), Enterprise Oil (ETP), ExxonMobil (XOM), Occidental Petroleum (OXY), Repsol YPF (REP), Royal Dutch/Shell Group (RD), Sunoco (SUN), TotalFinaElf (TOT), Unocal (UCL), and Valero Energy (VLO). As of May 2002, these companies had a combined market capitalization of nearly \$1 trillion.

No two companies are alike with regard to environmental exposure.

Table 1 shows the composition of company value and the exposure of each company's reserves to environmentally sensitive areas. Combined, these factors give each company a different profile with regard to climate and access issues. As a result, these issues will affect companies differently in financial terms.

THE METHODOLOGY

To determine the financial impacts, we used a methodology previously developed by WRI.⁶ Details of the methodology are available at <http://capmarkets.wri.org/>.

The methodology used here has much in common with traditional shareholder valuation frameworks in that it is explicitly forward-looking and uses scenarios to frame future possibilities. The methodology traces a link between external environmental influences and fundamental business drivers, such as sales volumes or asset values, and expresses final impacts in terms of percentage changes in shareholder value. To account for the subjective nature of predicting the future, uncertainties are handled in a systematic and transparent way so that investors can come to different conclusions if they have different opinions about how future uncertainties may be resolved or wish to alter forecasts on the basis of new information.

Unlike some other approaches, we do not attempt to place a value on overall management positioning and statements with regard to the issues we are examining. We also do not attempt to value the reputational effects—positive or negative—that companies incur by responding differently to these environmental challenges, though we recognize that these may be important. Instead, the approach focuses on the core elements of shareholder value in these companies, such as reserves, acreage, and refining assets—the traditional foundations for company valuation in this sector. The goal is to predict how environmental issues could affect these major components of industry value.

We use Herold's Appraised Net Worth (ANW) estimates as our baseline for shareholder value.⁷ Herold applies a proprietary valuation methodology to the latest available information on companies to determine the value of separate segments of each company, as well as the company's overall net worth. Herold's ANW estimates are broadly comparable to market capitalization. For our sample of companies, Herold's ANW was on average 3.5 percent higher than recent market capitalization values. In some cases, however, Herold's ANW was as much as 30 percent higher or lower than recent market values.

STRUCTURE OF REPORT

The remainder of the report is structured as follows. Sections 2 and 3 look in detail at the way the methodology was applied to the climate change and access issues and provide issue-specific financial implications. Section 4 provides aggregate financial results. Section 5 concludes by reviewing the state of corporate disclosure on these issues.

⁶ Robert Repetto and Duncan Austin, *Pure Profit: The Financial Implications of Environmental Performance* (Washington, D.C.: World Resources Institute, 2000). At <http://capmarkets.wri.org/>.

⁷ Herold, *Herold Comparative Appraisal Reports* (Norwalk, Connecticut: John S. Herold Inc., 2001).

TABLE 1. Composition of Company Assets as of December 31, 2000, and Exposure of Reserves to Environmentally Sensitive Areas

Each company has a different profile, ensuring that companies will be differentially affected in financial terms by climate and access issues.

	Amerada Hess	Apache	BP	Burlington	Chevron Texaco	Conoco Phillips	ENI
Appraised Net Worth (\$ millions)	\$9,456	\$7,485	\$143,045	\$12,632	\$60,709	\$19,951	\$56,133
Total Value of Assets (\$ millions)	\$11,799	\$11,202	\$174,853	\$15,364	\$69,466	\$26,352	\$69,365

I. VALUE OF BUSINESS SEGMENT AS PERCENTAGE OF TOTAL ASSETS

Total Proven Reserves	65	83	52	86	57	64	37
Proven Oil Reserves	48	38	27	13	42	35	22
United States	11	22	12	9	10	7	2
Other Developed Countries	37	12	11	2	4	14	7
Rest of World		3	5	2	28	14	14
Proven Gas Reserves	17	45	25	74	15	29	15
United States	8	32	14	59	9	13	
Other Developed Countries	10	11	5	12	5	14	11
Rest of World		3	5	3	1	2	3
Acreage	5	6	5	8	3	5	3
Attributed to Oil ^a	2	3	3		2	4	1
Attributed to Gas ^a	3	3	2	8	1	1	1
Refining, Marketing, and Transport	18		18		16	21	9
Attributed to U.S. ^a	18		1		13	13	
Attributed to Other Developed ^a			8		3	7	9
Attributed to Rest of World ^a			8		1	1	
Other Assets ^b	13	11	25	6	24	10	51

II. PERCENTAGE OF TOTAL RESERVES IN ENVIRONMENTALLY SIGNIFICANT AREAS

Non-U.S. reserves in ecologically important areas (WWF Global 200)	15	31	24	2	29	33	7
Non-U.S. reserves in protected areas (IUCN I-IV)	2		4		5		2

^a Calculated by WRI from information in company annual reports.

^b Includes chemicals, utilities, renewables, coal, and other assets.

Source: Financial information comes from *Herold Comparative Appraisal Reports* (various dates, 2001). Exposure of reserves to environmentally sensitive areas calculated by WRI using information from IHS/Energy, International Exploration and Production Activity Database (Englewood, Colorado: IHS Energy Group, 2001); World Wildlife Fund, *The Global 200 Ecoregions* (Washington, D.C.: WWF, 1999); and WCMC, *United Nations List of National Parks and Protected Areas* (London: WCMC, 1993).

Enterprise	ExxonMobil	Occidental	Repsol	Royal Dutch/ Shell	Sunoco	Total FinaElf	Valero	Unocal
\$5,314	\$192,653	\$12,451	\$24,057	\$150,287	\$3,886	\$95,341	\$5,778	\$8,567
\$7,273	\$219,876	\$23,071	\$45,315	\$169,415	\$5,714	\$118,135	\$9,339	\$13,631
79	41	62	39	46		36		64
69	24	44	30	23		20		22
	8	33		4				8
69	8			6		7		2
	8	12	30	13		13		11
10	17	18	9	22		16		43
	10	18		4		1		20
10	8			14		8		3
			9	4		7		20
11	4	5	3	4		3		12
8	1	1	2	2		2		2
3	3	4	1	3		1		9
	20		28	21	53	14	89	
	3			5	53	1	82	
	7		17	12		11	7	
	10		11	4		2		
11	35	33	30	29	47	47	11	24
	11	22	27	26	n.a.	28	n.a.	45
	1	14		2	n.a.	1	n.a.	

2.

The Financial Implications of Climate Policies

SUMMARY

- The Kyoto Protocol will require developed countries to reduce their GHG emissions to 5.2 percent below their 1990 levels by 2012. The Bush Administration has ruled out U.S. participation, pushing instead a largely voluntary program to reduce national GHG emissions.
- With or without the United States, the Kyoto Protocol could fundamentally change global market demand for oil and natural gas. As a result, both oil demand and producer prices could fall.
- The prospects for natural gas are less clear. Incentives to reduce consumption of fossil fuels will create pressure to reduce natural gas use, but also will lead to substitution of carbon-intensive coal with natural gas in electricity markets.

The main findings are as follows:

- Across several different scenarios—ranging from adoption of the Kyoto Protocol to no action—climate policies could create “most likely” financial impacts for companies ranging from a 5 percent loss in shareholder value to a slight gain.
- BR’s shareholder value could increase slightly under the most probable scenario (Scenario C: Kyoto Protocol without the United States, but with some U.S. domestic action). REP, ETP, and OXY could lose about 4 percent of shareholder value.
- Natural gas companies could find significant upside opportunities from a substitution toward natural gas under some scenarios, leading to increases in shareholder value of up to 7 percent in one case.
- Even without U.S. participation in the Protocol, U.S.-based companies could be affected by impacts transmitted through the global oil price and by direct impacts on their assets held outside the United States.

THE CLIMATE CHANGE ISSUE

Climate change is the single most important environmental issue facing the oil and gas sector. Attempts to curtail GHG emissions—mainly carbon dioxide (CO₂)—could profoundly affect the industry. More than half of all GHG emissions in the United States are from oil and gas combustion.⁸ The industry also consumes large amounts of energy in its processes.

Rising GHG emissions are causing climate change.

Pressure for GHG reductions stems from the correlation between increased GHG concentrations and rising global temperatures observed over the last 150 years. The global average surface temperature increased by 0.6° C during the 20th Century, but some uncertainty persists about the causes and possible effects of this warming trend. However, the latest assessment by the U.N.-sanctioned Intergovernmental Panel on Climate Change (IPCC) finds that “most of the warming observed over the last 50 years is attributable to human activities.”⁹ The possible consequences include rising sea levels, changed weather patterns, and altered incidence and location of violent weather events such as hurricanes, monsoons, and droughts.

INTERNATIONAL DEVELOPMENTS

The Kyoto Protocol aims to reduce GHG emissions.

In the face of potential environmental damage, momentum for international action to constrain GHG emissions has been increasing, resulting in the drafting of the 1997 Kyoto Protocol and subsequent efforts to implement it. The Protocol sets out a complex international framework for achieving a first tranche of greenhouse gas reductions by 2012. Its key elements are GHG mitigation targets for developed countries (requiring average cuts in carbon emissions to 5.2 percent below 1990 levels); some (as yet unspecified) allowance for biological, and possibly physical, sequestration of carbon; and mechanisms for international trading of carbon emissions between countries.

Efforts to implement the Protocol were dealt a serious blow in March 2001 when President Bush ruled out ratification by the United States. This action has also called into question the participation of Australia. Canada, Europe, Japan, and Russia, however, appear to have resolved many of their remaining disputes about the structure of the Protocol at the Conference of the Parties in Marrakech in November 2001. Whether a sufficient number of countries will ratify the Protocol to bring it into force remains to be seen.

NATIONAL POLICIES

Some countries are already taking action to reduce GHGs.

Even as an international framework is debated, several countries are introducing their own policies and regulations to reduce domestic carbon emissions. The United Kingdom’s Climate Change Programme, announced in November 2000, has a goal of reducing the country’s overall greenhouse gas emissions to 23 percent below 1990 levels by 2010.¹⁰ The program includes a climate change levy—a flat rate levy on energy use by business—and the world’s first economy-wide GHG trading scheme. Bidding for permits under the trading scheme commenced in March 2002, with BP and Shell both participating.¹¹

⁸ Energy Information Administration, *U.S. Carbon Dioxide Emissions from Energy Sources, 2000 Flash Estimate* (Washington, D.C.: EIA, June 2001).

⁹ Intergovernmental Panel on Climate Change, “Climate Change 2001: The Scientific Basis—Summary for Policymakers: A Report of Working Group I of the Intergovernmental Panel on Climate Change” (Geneva, Switzerland: IPCC, 2001), p. 10.

¹⁰ Department for Environment, Transport and the Regions, “Climate Change: The UK Programme” (London: DETR, 2000).

¹¹ Department for Environment, Food and Rural Affairs, “Auction Success for UK Emissions Trading Scheme,” News Release (London: DEFRA, March 13, 2002).

Denmark has also instituted a national cap and trade system for GHGs from electricity generators. Several other countries, including France, Germany, Norway, and Sweden, have announced plans to develop trading systems to be implemented within the next 10 years. Moreover, the European Union (EU) is committed to developing a framework for an EU-wide emissions trading scheme to be implemented in 2005.¹²

Even in the United States, where near-term federal measures are unlikely, there is increasing action at the state level. California is considering a bill that would pave the way for regulations to tighten GHG emissions from passenger vehicles, and Massachusetts and New Hampshire have legislated to reduce CO₂ emissions from their power plants.

PRIVATE SECTOR INITIATIVES

Many companies are actively involved in developing corporate GHG accounting and reporting systems—a prerequisite for effective action on climate change and participation in emerging carbon markets. Several companies, including Shell, BP, Texaco, Suncor, and Petro-Canada, are participating in the Greenhouse Gas Protocol Initiative, which aims to create a uniform emissions reporting framework for corporations. The American Petroleum Industry (API) is leading a complementary effort to develop GHG-measurement algorithms for industry-specific processes.

BP and Shell have established internal carbon trading systems, in which facilities buy and sell carbon reductions to meet a corporation-wide target. Shell also has announced that it will explicitly attach shadow carbon prices to new investments, reflecting the likelihood that a carbon price might affect the future economics of its projects. In addition, BP, Shell, and other companies have made strategic investments in new noncarbon energy technologies, including wind, solar, and biomass.

GHG reductions are being traded even outside of formal programs in the United Kingdom and Denmark. Since 1996, at least 55 million tons of GHG emissions have been traded in more than 65 trades.¹³ Several brokerages have established businesses in this area, and markets are being established to handle anticipated large volumes of GHG credits. In late 2000, Australia set up the first official futures exchange in GHG trades. The exchange expects an annual transaction volume of \$5 billion. The Chicago Climate Exchange, with support from BP and Suncor, has been established as the first U.S. marketplace for trading GHG emissions.

BROAD IMPLICATIONS FOR THE INDUSTRY

If countries adopt the Kyoto Protocol or implement other policies to reduce GHGs the oil and gas industry could face significant new pressures. These include

- the introduction of tradable permit systems or new “carbon taxes”;
- a consequent fall in market demand for oil relative to business as usual;
- a relative increase in demand for (less carbon-intensive) natural gas;
- incentives to reduce process energy use and process emissions (such as gas flaring);
- opportunities for physical sequestration of carbon in depleted oil and gas fields; and
- new market opportunities for cleaner, alternative fuels, and renewable energy technologies.

¹² The European Commission, “Green Paper on greenhouse gas emissions trading within the European Union,” COM (2000)87 (European Union, 2000).

¹³ Richard Rosenzweig et al., “The Emerging International Greenhouse Gas Market” (Arlington, Virginia: Pew Center on Climate Change, March 2002).

Some oil and gas companies are taking steps to limit GHG emissions.

GHG trading is already taking place.

Climate protection presents new challenges and opportunities for the industry.

Markets for GHG emissions trading are increasingly likely.

One of the more likely policy options is the widespread establishment of trading programs for carbon and other GHG permits. Such programs would set a national or regional cap on overall GHG—or carbon—emissions and would allow emitters to buy and sell emissions permits as needed. Over time, companies able to make reductions most cheaply would end up with excess permits, which could be sold to those less able to make reductions. Such a system would give companies a direct financial incentive to reduce emissions and ensure overall reductions at the lowest aggregate cost.

Pricing and allocation of GHG permits remains uncertain.

Speculation has been rife about the future price of carbon permits under such a market. Model estimates of the market clearing price required to meet the Kyoto targets in 2012 range from low single digits to more than \$300 per metric ton of carbon equivalent.¹⁴ Prices established in early, voluntary trades are firmly at the low end of the range and have yet to top \$36 per ton of carbon equivalent.¹⁵ Early low prices may still be consistent with higher prices by 2012 if GHG reductions become increasingly difficult to achieve.

The impact of new GHG permit markets on oil and gas company profitability will be very sensitive to the way in which permits are initially allocated. One option is to require companies to pay for permits through an auction system, thereby increasing their operating costs. According to one study, an auctioned permit system could lead to a drop of 5 percent in shareholder equity for the upstream oil and gas sector in the United States.¹⁶

Another proposal is to “grandfather” permits to oil and gas companies and others responsible for introducing carbon into the economy. Under grandfathering, new permits to emit carbon or to pass on carbon embodied in fuels would be given free of charge to companies on the basis of historic sales. Considering the likely value of carbon permits, grandfathering would constitute a significant allocation of valuable resources to eligible companies. For example, a grandfathered permit at a \$50-per-ton carbon price implies an additional value of \$6 per barrel of oil. Consequently, if permits are given in this way to U.S. upstream oil and gas companies to cover all of their “carbon output,” the same study finds that shareholder equity in that sector could increase by up to 22 percent, even as oil and gas companies reduce their sales.¹⁷

POSSIBLE SCENARIOS

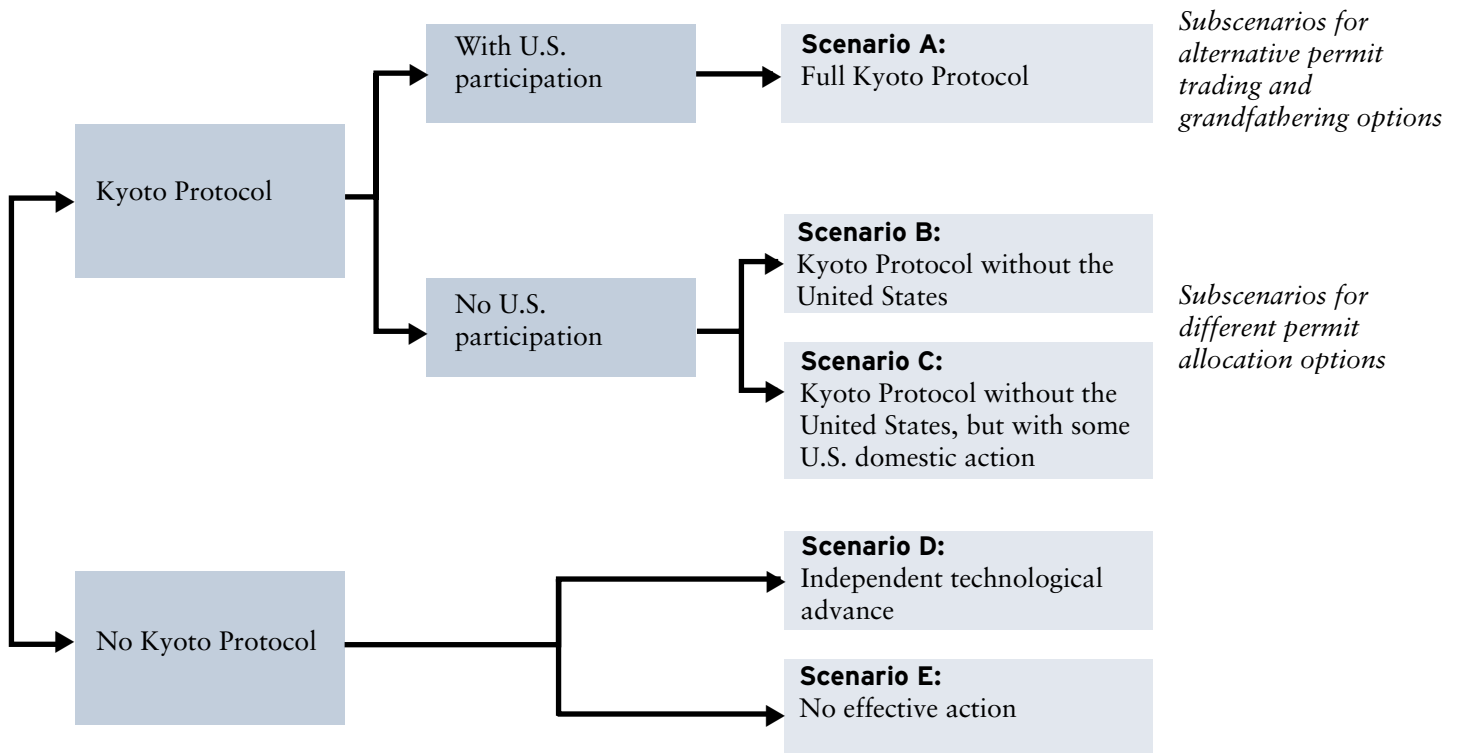
There is a wide spectrum of possible climate-related futures, ranging from near-term implementation of the Kyoto Protocol to continued international stalemate that prevents meaningful action to reduce GHG emissions. Figure 1 illustrates the relationships among some of these admittedly complex developments, while Table 2 provides details on the scenarios used here. The probabilities assigned to each scenario were informed by a limited poll of company representatives and other industry experts. Final judgments, however, were made by the authors. Readers can explore sensitivity to these probabilities at the WRI website.

¹⁴ John Weyant and Jennifer Hill, “The Costs of the Kyoto Protocol: A Multi-Model Evaluation,” *Energy Journal*, Special Edition (1999): pp. vii–xliv.

¹⁵ Rosenzweig et al., 2002.

¹⁶ Lans A. Bovenberg and Lawrence Goulder, “Neutralizing the Adverse Industry Impact of CO₂ Abatement Policies: What Does It Cost,” C. Carraro and G.E. Metcalf, eds., *Behavioral and Distributional Impacts of Environmental Policy* (Chicago: University of Chicago Press, 2001).

¹⁷ Bovenberg and Goulder, 2001.

FIGURE 1. Scenarios for Future Pressures to Reduce GHG Emissions**HOW ARE COMPANIES EXPOSED TO PENDING CLIMATE INITIATIVES?**

A company's relative exposure to potential climate policies will depend mainly on

- the oil and gas mix of its production, proven reserves, and acreage;
- the relative focus on upstream or downstream activities; and
- the regional spread of its operations.

OIL-GAS MIX

With more carbon per unit of energy, oil assets will be more affected by climate regulations than natural gas assets. Table 1 (on pages 8–9) shows the share of asset value made up by proven oil and gas reserves for each company. Enterprise stands out as having a greater share of its asset base in oil (69 percent) than in gas assets (10 percent). Amerada Hess, ChevronTexaco, Occidental, and Repsol are also more “oil-heavy” than the average. In contrast, for Apache, Unocal, and especially Burlington, the value of natural gas reserves exceeds the value of oil reserves.

POSITION ALONG VALUE CHAIN

The sensitivity of margins and profitability to GHG constraints may be slightly different along the value chain, with pure upstream companies affected slightly more than pure refining companies by GHG policies.¹⁸ In addition, depending on how tradable permit systems are set up and potential permits grandfathered, upstream and downstream assets could be very differently affected. Within the sample group, six companies are non-integrated producers and two are non-integrated refiners.

Oil-heavy companies are more exposed than gas-heavy companies.

Upstream and downstream operations may fare differently.

¹⁸ Bovenberg and Goulder, 2001.

TABLE 2. Scenarios for Future Pressures to Reduce GHG Emissions

Scenario	Description	Assigned Probability
A. Full Kyoto Protocol	The United States reverses its position and adopts the Kyoto Protocol, along with all other developed nations. Impetus for change in U.S. stance may reflect several possibilities: a reaction to a “surprise” climate event, a response to compelling new scientific evidence, or a part of a broader effort of international engagement by the United States, perhaps to bolster support for the war on terrorism.	10%
B. Kyoto Protocol without the United States	The Kyoto Protocol goes into force without U.S. participation, effectively putting in place a Kyoto framework for all other developed countries. No significant emissions reduction occurs in the United States; voluntary programs prove ineffective.	30%
C. Kyoto Protocol without the United States, but with some U.S. domestic action	As in Scenario B, the United States does not participate in Kyoto Protocol, but a series of effective domestic policies leads to some reduction in GHG emissions. U.S. reductions are less than would have been achieved under Kyoto Protocol.	40%
D. Independent Technological Advance	Kyoto Protocol fails to move forward. However, technological advance, either independent or prompted by targeted policies, reduces demand for oil and leads to some emissions reductions.	10%
E. No Effective Action	Continued international stalemate prevents adoption of Kyoto Protocol, and there are no major technological breakthroughs. This scenario implies no change in a company’s near-term financial performance.	10%

Note: In Scenarios A, B, and C, we explore different options for the allocation of carbon permits. In addition, in Scenario A, we examine the impact of different degrees of international trading of permits.

Multinational companies will be sensitive to decisions in many countries.

GEOGRAPHIC DISTRIBUTION OF RESERVES AND OPERATIONS

Regional location of reserves and operations will also be a factor, particularly for downstream petroleum refining and for gas markets. Different approaches by U.S. and European policymakers, for example, could lead to significant differences in refinery profitability in these two regions. The same is true for upstream gas producers, given limitations on transport of natural gas. Regional policy differences are less important for oil, which effectively trades on a global market.

Within the sample group, some companies are relatively concentrated in geographical terms (e.g., Burlington, Sunoco, and Valero in the United States; Enterprise in Northern Europe; and Repsol in Argentina). In contrast, large integrated companies have their assets dispersed widely.

THE FINANCIAL IMPACTS OF PENDING CLIMATE RISKS

The following is a brief overview of the methodology used in this report. A detailed description is available on the WRI website.¹⁹

The methodology evaluates changes in the value of core business segments.

The methodology compares baseline estimates of shareholder value with new estimates of shareholder value under each of the five climate scenarios in Table 2. Baseline estimates of shareholder value were taken from Herold's ANW estimates, made in 2001.²⁰ The business segments evaluated were (a) proven developed reserves, (b) undeveloped reserves and acreage, and (c) refining (and other downstream) operations.

The climate scenarios were modeled by changing variables for future quantity sold and producer price of oil and gas. Although oil and gas prices are volatile, and therefore hard to predict, the assumption made here was that policy-induced changes would represent additional price movements not reflected in conventional forecasts. Companies faced different market demand for their product, mainly decreases, particularly for oil, but also increases in demand for natural gas under certain scenarios. Operating costs increased slightly, reflecting the higher cost of energy.

Our analysis allowed for different regional impacts in three major regions: (1) the United States, (2) other developed countries, and (3) developing countries—the most important blocs to emerge with regard to the Kyoto Protocol. Under different scenarios, varying degrees of international permit trading were assumed to take place.

We also explored different possibilities for grandfathering carbon permits to upstream producers, which could enhance shareholder value. Permit prices varied across scenarios. Policies were assumed to be introduced in 2004 and phased in gradually to 2010 to meet appropriate targets. The analysis extended out to 2015, though outlying years contributed significantly less due to discounting.

The results were sensitive to assumptions made about movements in natural gas markets, for which estimates of climate policy-induced impacts vary widely. Consequently, for many scenarios, we averaged the effects of large and small changes in natural gas markets.

In focusing our attention on quantifying the changes in value of companies' core assets, we ignore several other channels through which climate pressures might affect shareholder value. We do not analyze the beneficial impact of companies' incremental activities, such as investing in renewable energy sources and reducing operational emissions. We ignore the potential impacts on companies' reputations—positive or negative—that may result from companies' different public handling of the climate issue. Nor do we attempt to measure the degree to which companies are exposing themselves, as some have suggested, to longer-term product liabilities similar to those recently faced by the tobacco industry. Finally, we do not explicitly consider climate-related policies or pressures that may emerge after the 2008–2012 window of the Kyoto Protocol targets and timetables. Though the discount rate reduces the relevance of longer-term pressures for today's shareholder value determinations, the industry may well face greater pressure for change than it does now.

Though harder to quantify, other studies have explored the financial impacts associated with these factors.²¹ Interested investors can weigh these other factors alongside the quantitative impacts on the major components of company value estimated here. (*See Box 1 on pages 23–24 for a discussion on these issues.*)

¹⁹ At <http://capmarkets.wri.org/>.

²⁰ Herold, *Herold Comparative Appraisal Reports* (Norwalk, Connecticut: John S. Herold, Inc., 2001).

²¹ See, for example, Coalition for Environmentally Responsible Companies, *Value at Risk: Climate Change and the Future of Governance* (Boston, Massachusetts: CERES, 2002); Mark Mansley, *Risking Shareholder Value? ExxonMobil and Climate Change* (London: Claros Consulting, 2002).

SCENARIO A: FULL KYOTO PROTOCOL

(Assigned Probability: 10 percent)

Though given a relatively low probability of occurring, the Kyoto Protocol has been extensively analyzed by economists and provides a useful starting point for examining impacts on shareholder value. Under this scenario, we explored four sub-scenarios:

- A1: Permit trading between developed nations; no grandfathering
- A2: Permit trading between developed nations; permits grandfathered to upstream producers
- A3: Global permit trading; no grandfathering
- A4: Global permit trading; permits grandfathered to upstream producers

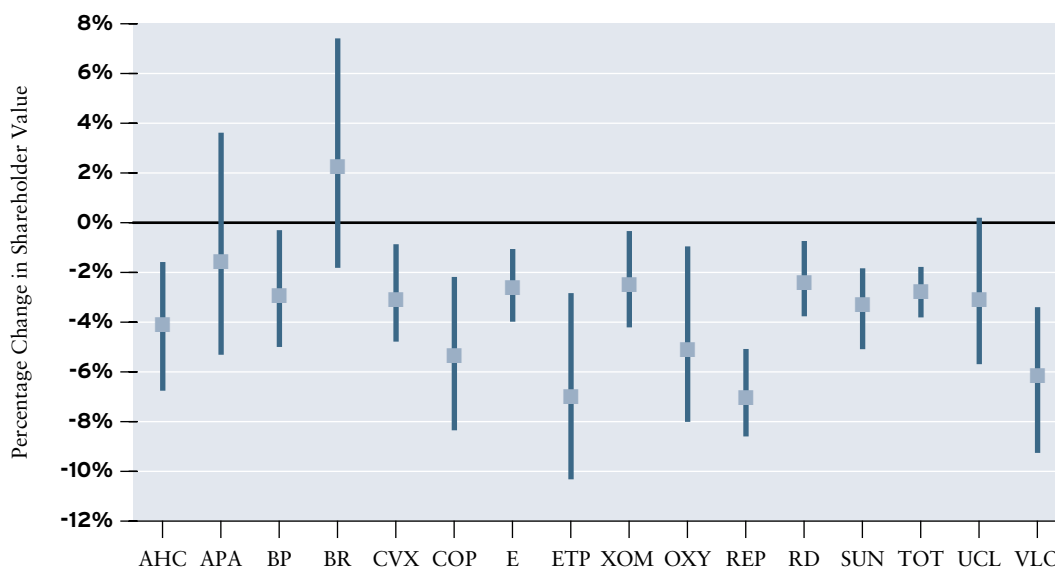
Figure 2 summarizes the results of Scenario A, with lines indicating the range of financial impacts under the different sub-scenarios and squares representing the average financial impact where the four sub-scenarios are given equal weight.

Companies are differently affected by policy scenarios. The Protocol could increase Burlington’s shareholder value by 2 percent, while lowering the shareholder value of Enterprise, Repsol, and Valero by more than 6 percent. Two natural gas-heavy companies—Apache and Burlington—could see shareholder value increase significantly under some scenarios due to a transition away from coal in electricity markets. The average impact across all companies is a loss in shareholder value of about 4 percent.

In the grandfathering scenarios, permits were grandfathered at a price that rose to \$50 in 2010 for trading among developed countries only, and to \$25 in 2010 under global trading. We assumed grandfathering favors companies with upstream sales in developed countries and is of lesser benefit for companies whose activities are primarily upstream in developing countries or in the refining sector. Alternative allocations of permits (e.g., to refiners) would change these impacts.

FIGURE 2. Scenario A: Financial Impacts of the Full Kyoto Protocol

(Range of possible outcomes and most likely impact)



SCENARIO B: KYOTO PROTOCOL WITHOUT THE UNITED STATES

(Assigned Probability: 30 percent)

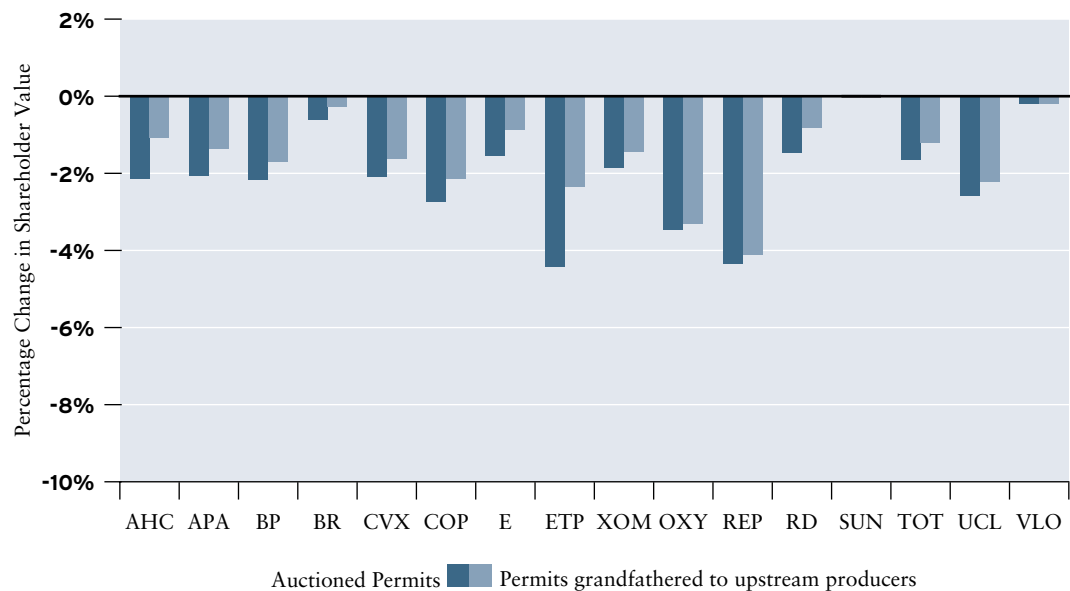
This scenario seems increasingly probable in view of recent developments. The main implications of U.S. withdrawal would be a substantial reduction in permit price for participating countries, who would be able to acquire the large number of Russian and Eastern European permits that would otherwise have been sold to the United States. Consequently, non-U.S. developed nations could meet their targets at lower cost and with less real domestic change. In addition, there would be less need to support emissions reduction efforts in developing countries.

In this scenario, U.S. natural gas and petroleum product markets would be unaffected. The world oil market would be constrained by a factor reflecting the efforts of other developed countries to reduce their emissions, and this would affect upstream oil producers worldwide. We also explored the possibilities of grandfathering permits, though upstream sales into the U.S. market were ineligible, as a result of U.S. nonparticipation.

Overall, the financial impacts of this scenario are milder than in Scenario A, with an average loss in shareholder value of about 2 percent. (See Figure 3.) The most affected companies are oil-heavy companies with significant production and sales outside the United States, notably Enterprise, Occidental, and Repsol. The upside opportunities for natural gas producers in Scenario A disappear, both because U.S. nonparticipation greatly reduces global market changes (reducing substitution opportunities) and because the greatest opportunities for natural gas were in the U.S. market.

United States oil producers are not entirely insulated, as reduced demand from other developed nations lowers the global producer price. Also, grandfathering permits—priced at \$15 in 2010—on the basis of historic sales in non-U.S. developed countries affects companies differently. Though Enterprise and Repsol perform comparably if permits are auctioned, Enterprise would benefit from grandfathered permits on this basis much more than Repsol would.

FIGURE 3. Scenario B: Financial Impacts of the Kyoto Protocol without the United States



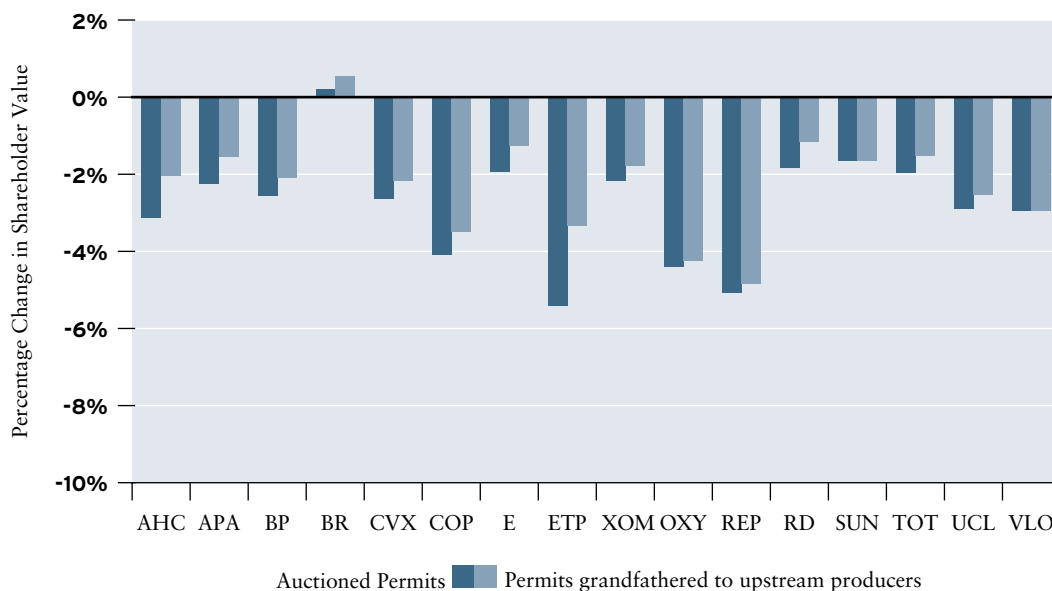
SCENARIO C: KYOTO PROTOCOL WITHOUT THE UNITED STATES, BUT WITH SOME U.S. DOMESTIC ACTION

(Assigned Probability: 40 percent)

Scenario C is similar to Scenario B, except that domestic programs in the United States lead to some reductions in GHG emissions from the baseline, though less than what would have been the case under participation in the Protocol. We assume that market changes in oil and gas would be one-third of those experienced by the United States in Scenario A under trading between developed countries. These are achieved through a patchwork of efficiency incentives and technology-supporting measures and not through the establishment of any formal trading program. Hence, sellers in the United States cannot be the beneficiaries of grandfathered permits. Impacts in the crude oil market are again transmitted through the single market and are felt globally.

The introduction of reduction efforts in the United States increases the average adverse impact felt by the sample companies to approximately 2.5 percent. (See Figure 4.) Compared to Scenario B, the companies that are most affected are the U.S.-based refiners Sunoco and Valero. For other companies, adverse impacts in oil and petroleum business lines are offset by positive opportunities for natural gas. Hence, Burlington benefits from substitution towards natural gas and should see shareholder value increase marginally. In contrast, Amerada Hess, whose U.S. assets are more oil-based than gas-based, suffers a greater loss of value than in Scenario B.

FIGURE 4. Scenario C: Financial Impacts of the Kyoto Protocol without the United States but with some U.S. domestic action



SCENARIO D: INDEPENDENT TECHNOLOGICAL ADVANCE

(Assigned Probability: 10 percent)

To model a technology-driven climate future that might affect the oil and gas industry we used as a general proxy a scenario where rapid technological advance in automobile fuel efficiency was achieved, either through independent development or through directed policy incentives. Improving automobile technology could be an effective way to reduce carbon emissions. For example, an estimated 34 percent of all U.S. CO₂ emissions will come from petroleum consumption in the transport sector by 2020.²²

We assessed the impact for companies of two Energy Information Administration (EIA) projections for moderate and aggressive penetration of new low-emissions vehicles in developed country markets.²³ Penetration of new vehicles was assumed to weaken demand for refined oil products, and thus for crude oil. However, we took into account the fact that while refiners may suffer from reduced demand for gasoline and diesel they may perhaps benefit from new demands for hydrogen or other fuels, such as methanol. Figure 5 shows the average impacts from these two projections.

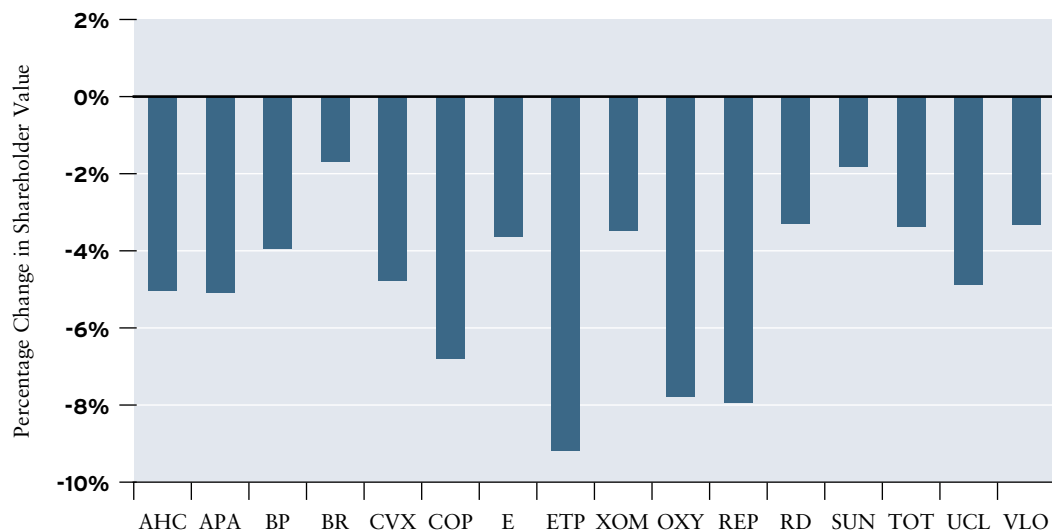
As this scenario is neutral with regard to natural gas markets, the company impacts are proportionate to the oil interests of the companies, falling harder on upstream producers than on downstream refiners who could switch to higher valued new fuels.

SCENARIO E: NO EFFECTIVE ACTION

(Assigned Probability: 10 percent)

In this scenario, efforts to reduce GHG emissions either nationally or internationally do not succeed, and no sufficient technological advances occur to greatly change market conditions for oil and gas. Company shareholder value is unchanged.

FIGURE 5. Scenario D: Financial Impacts of Independent Technological Advance



²² Energy Information Administration, *Annual Energy Outlook* (Washington, D.C.: EIA, 2000).

²³ Energy Information Administration, 2000.

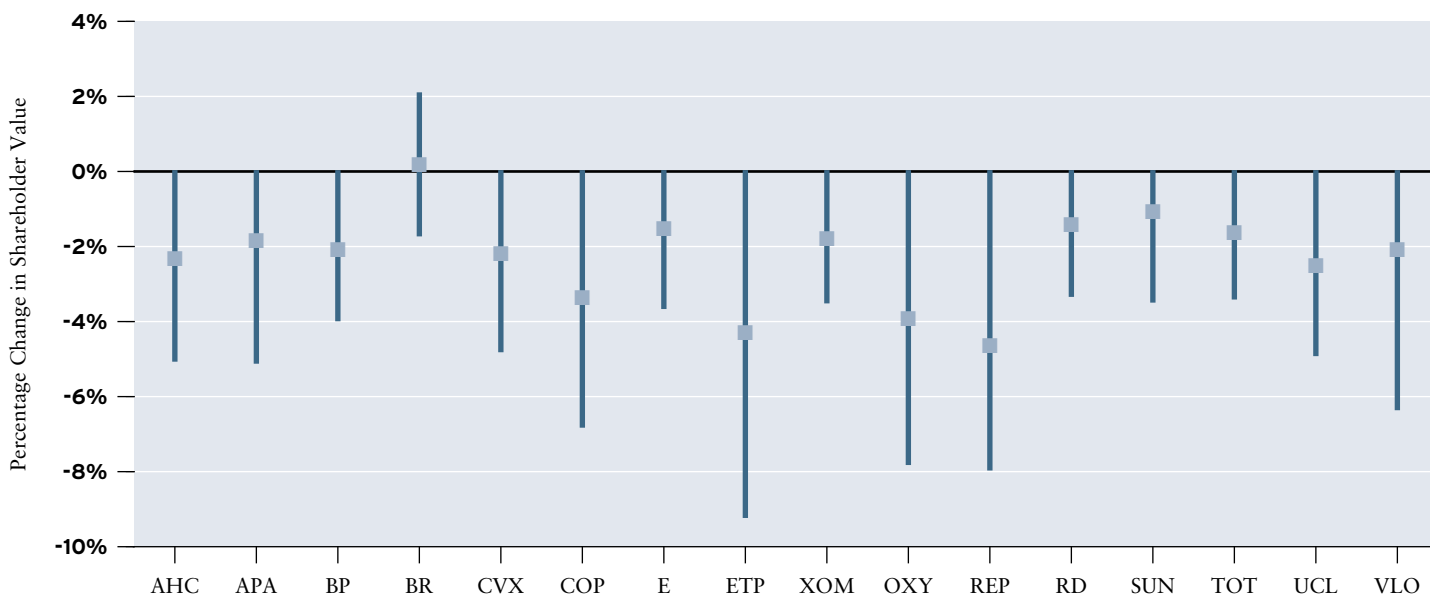
AGGREGATE FINANCIAL IMPACTS OF CLIMATE SCENARIOS

The impacts under different scenarios were weighted according to probabilities recorded in Table 2. Figure 6 shows the full range of outcomes possible for each company, as well as the weighted average figure representing the “most likely” outcome.

Even with considerable uncertainty about the form and timing of potential climate policies, companies are differently exposed on this issue. “Most likely” impacts range from a small gain in shareholder value to a loss of about 4 percent. Burlington could see shareholder value increase, while ConocoPhillips, Enterprise, Occidental, Repsol, and Valero face significant downside risks from some (lower probability) scenarios.

FIGURE 6. Financial Impacts of Prospective Climate Mitigation Policies

(Range of possible outcomes and most likely impact)



BOX 1. BP, Shell, and ExxonMobil: Which Company Does Best On Climate And Does It Matter Financially?

BP, Shell, and ExxonMobil have staked out very different positions with respect to climate change. Although other companies have also been active on this issue, the positions of the three largest oil and gas companies have come to represent extremes of opinion within the industry. Do these positions matter financially?

COMPANY RESPONSES TO CLIMATE CHANGE

The three companies' stances on climate change differ in both style and substance.

BP AND SHELL

In addition to publicly supporting national and international initiatives to mitigate greenhouse gas (GHG) emissions, both BP and Shell have made explicit changes in their businesses to begin to address climate challenges.

- Both companies have committed to reduce operational emissions by 10 percent from 1990 levels, with BP meeting this commitment in March 2002.
- Both companies have instituted internal GHG trading programs to reduce operational emissions and to learn about emissions trading markets.
- Both companies have made significant commitments to develop renewables. BP is now one of the world's largest solar electric companies, while Shell has invested \$500 million to develop a separate new renewables business.
- Both companies are among the leaders in the industry in terms of reporting corporate GHG emissions.
- Shell has instituted a formal process of incorporating "shadow" carbon prices into investment decisions.

EXXONMOBIL

In contrast, ExxonMobil has been a vocal opponent of climate policies, particularly the Kyoto Protocol, and has made few discernible changes in its business to respond to the issue. It continues to question publicly the science of climate change and has not made any visible effort to broaden its energy mix or reduce operational emissions.

DOES THIS MATTER FINANCIALLY?

Are these companies' policies on climate change reflected in their balance sheets?

BP, Shell, and ExxonMobil perform comparably in our study. Our analysis finds little difference in the financial exposure of BP, Shell, and ExxonMobil on the climate issue. As explained in the text, our methodology is a fundamental analysis of the risks to these companies' primary business segments. Table 1 on page 8–9 reveals that the overall composition of these three companies is similar. That is why they perform comparably in this study.

BP's and Shell's investments in renewables are relatively small-scale. Our analysis ignores alternative energy investments. However, while BP's and Shell's commitments to renewables makes both of them major players in the renewable energy markets, their commitments still constitute mere fractions of their respective asset bases. In 1999, BP Solar made up less than 0.1 percent of the overall worth of BP. Shell's \$100 million per year commitment to renewables since 1997 constitutes less than 1 percent of its overall capital expenditure over that period—most of it directed toward oil and gas infrastructure.

Although these business lines may grow quickly under certain climate policies, and although they represent important learning opportunities, they are still an almost insignificant component of these companies' asset bases from the perspective of fundamental analysis.

Reductions in operational emissions may lead to some future cost savings. The industry's primary financial exposure from climate policies will be through impacts on demand for its products, not through constraints on process emissions. However, operational emissions reductions may yield future cost savings. By March 2002, BP had eliminated 10 million tons of carbon emissions that might otherwise be exposed to a carbon tax or permit system. The financial benefit to BP of those emissions reductions will depend on the future price for carbon and the share of its operational emissions that occur in countries that are likely to adopt climate policies.

For example, if a carbon price of \$5 per ton had been applied to half of BP's operations in 2001, BP would have avoided approximately \$25 million in costs—equivalent to a 0.1 percent increase in gross profits for that year. Under a \$50 per ton price for carbon, the comparable savings would be \$250 million, or a 1 percent increase in gross profits. BP's competitors would not have similar savings. In addition, BP claims to have made these emissions reductions at no cost. If so, these process changes have been a costless way to reduce regulatory risk.

Company positioning may have created financially significant management expertise or corporate liability. Although company actions may not show up in fundamental analysis, investors may view the difference in companies' positioning as either (a) creating value in the form of management expertise and preparedness or (b) reducing value by creating reputational risks and exposure to future liabilities. Investors evaluating companies typically weigh such factors—though they are hard to quantify—alongside quantitative analysis.

In this regard, investors may value BP and Shell's management changes and investments in renewables as an indication that management understands a critical issue facing the industry and consider it a sign of corporate preparedness to respond to possible policy changes. More generally, finding a cost-neutral way of reducing exposure to future regulations, as BP has done, could be interpreted as a sign of management quality.

In contrast, investors may consider that ExxonMobil's positioning exposes the company to reputational risks and future liabilities. The company's prominent opposition to climate policies has prompted a strong reaction from the environmental community and led to targeted campaigns. In "Campaign ExxonMobil", the company faces an orchestrated shareholder campaign seeking to change its response to climate change. In Europe, where ExxonMobil sells about a quarter of its petroleum products, the "Stop Esso" campaign has called for a boycott against the company's products. It is too soon to say how damaging such campaigns may be but, at a minimum, they pose a risk not borne by others within the industry.

In conclusion, while company actions do not show up on today's balance sheet, they may influence future financial performance within the industry. Whether investors attach importance to steps taken by BP and Shell depends on the respective weight given to quantitative and qualitative measures of company performance. Traditionally, analysts have had to consider both types of measure in making investment decisions. Also relevant is the expected pace of regulatory and market change arising from climate concerns. If change is slow, inaction by companies may not be penalized. If change is fast, some companies may be caught flat-footed.

3.

The Financial Implications of Restricted Access to Reserves

SUMMARY

- As traditional oil producing regions mature and yield progressively less oil, the industry is increasingly choosing to explore and produce in new areas where environmental and social controversies may be significant.
- New information technologies and emerging networks between NGOs ensure that companies' activities become more transparent to their principal markets and shareholders.
- In environmentally and socially sensitive areas, access to reserves can be denied, restricted, or kept in limbo. Where access is permitted, opposition from local communities can constrain production operations, making them more costly. One prominent example is the case of Shell in Nigeria, where production has at times been cut to 40 percent of capacity and lower due to opposition and sabotage from local communities.

The main findings are as follows:

- Companies' exposure to future resource accessibility pressures differs markedly. **APA**, **CVX**, **COP**, **OXY**, **TOT**, **REP**, and **UCL** have a larger than average share of their upstream reserves in areas identified as ecologically important by the environmental community and the United Nations. **BR**, **E**, **ETP**, **XOM**, and **RD** have relatively few reserves in environmentally sensitive areas.
- Across several different scenarios, future access policies could create "most likely" financial impacts for companies averaging a 2 percent loss in shareholder value. Not surprisingly, the upstream companies are the most affected, with **APA**, **OXY**, and **UCL** having a "most likely" loss in shareholder value of about 3 percent.
- In the most probable scenario (Scenario B: Local Opposition to Oil and Gas Development), **ETP** remains unaffected. **APA** and **OXY** lose more than 3 percent of total shareholder value, while **UCL** loses over 5 percent.

The search for new reserves is impeded by environmental and social concerns.

THE ACCESS ISSUE

As traditional oil-producing regions mature and yield progressively less oil, the industry is increasingly exploring and producing in new areas, where environmental and social controversies may be significant. This is true of exploration and production in both the developed world (e.g., the Arctic National Wildlife Refuge), and the developing world (e.g., Occidental and U'wa community opposition in Colombia). These obstacles will become even more relevant in the future, as companies seek new reserves. By 2007, more than 80 percent of new oil development will take place in the humid tropics, where most of the world's biodiversity is concentrated.²⁴

While pressures are specific to regions, they generally reflect one or two core concerns: a desire to maintain the integrity and biodiversity of pristine areas and ecosystems, even if they are remote; and a more parochial instinct to protect one's immediate environment and the livelihoods and established economic interests that depend on it. Some examples of issues related to access to reserves include restricted access to formally protected areas, threats to property values, existing economic interests (e.g., fishing or tourism), and indigenous community opposition. These issues are relevant not only for the exploration and development of new fields, but also for accompanying transportation infrastructure such as pipelines.

Access to many U.S. reserves has already been restricted or is in question.

THE UNITED STATES

The United States has only a few remaining oil and gas frontiers: areas of Alaska, including the Arctic National Wildlife Refuge; the deepwater Gulf of Mexico; off the western Florida coast; and offshore California's Outer Continental Shelf. Additional resources, including up to half of the remaining untapped natural gas resource base, lie under federally owned lands, mainly in the Rockies. Questions exist about industry access to many of these areas. Prohibition of drilling off the California and Florida coasts has rendered many long-held leases worthless. In the Arctic National Wildlife Refuge and in the Rockies, the industry faces persistent opposition from groups interested in preventing development in pristine areas. In addition, access to some of these regions is prevented by formal protection status.

Access constraints also exist in Europe.

EUROPE

In Europe, access to the Wadden Zee inlet off the coast of Holland is subject to similar obstacles, and public concern for environmental protection has effectively put the area "off-limits." In addition to informal pressures, an important regulatory force in the EU is the Habitats Directive, established in 1992 to provide a network of protected areas, called Natura 2000, across EU member countries. The United Kingdom has introduced the Habitats Directive into the offshore oil and gas licensing system, which is likely to increase pressures to ban some exploration or subject the industry to more stringent conditions in sensitive areas.

Access in developing countries is at risk from both international and local opposition.

THE DEVELOPING WORLD

Upstream operations are increasingly focused on regions in developing countries. The share of proven oil reserves of companies reporting to EIA's Financial Reporting System that are located in developing countries increased from 16 percent in 1990 to 27 percent in 1999.²⁵ Production in Africa increased 15 percent for oil and 48 percent for natural gas between 1990 and 2000; in Latin America it increased 27 percent and 36 percent, respectively.²⁶

²⁴ Amy Rosenfeld, Debra Gordon, and Marianne Guérin-McManus, *Reinventing the Well* (Washington, D.C.: Conservation International, 1997).

²⁵ U.S. Department of Energy, Financial Reporting System Public Data, Table S5241.xls, "Exploration, Development, and Production Statistics."

²⁶ BP, *Statistical Review of World Energy* (London, 2001).

Operations in developing countries have been exposed to a number of different costs and pressures, including project delays, sabotage of equipment and pipelines, loss of access to reserves or partnerships, and negative publicity that has incited consumer opposition in developed countries. Occidental's withdrawal from Colombia has been attributed in part to opposition from both the indigenous community and international NGOs, though the company maintains that the decision was based purely on economic considerations.

In 1999, oil companies operating in Nigeria announced that losses from disruptions caused by these incidents exceeded \$1 billion.²⁷ Shell's Nigerian operations were able to produce at only 25 percent of capacity in 1999 and 40 percent in 2000.²⁸ Social pressures have had repercussions for other companies as well, as protest movements have been organized against Chevron and other corporations producing in the region.

Financial implications include increased operating costs, constrained production, and loss of access.

FINANCIAL IMPLICATIONS

The ability to secure access to reserves is being made more difficult by accompanying environmental and social concerns and the ease with which controversial activities can be communicated to distant consumers and shareholders. These risks may affect companies in various ways. Access to reserves can be denied, restricted, and held in limbo because of biodiversity and NIMBY issues. Where access is permitted, opposition from local communities can limit production and raise costs. The cost of developing new fields may increase if community-focused projects become an indispensable part of the development price, or if pressure builds to meet more stringent environmental standards than those set by governments. Indirect costs include future loss of partnerships and damaged relations with foreign governments, as well as negative publicity that results in consumer reaction in developed countries.

POSSIBLE SCENARIOS

How these issues play out will depend on region-specific developments and trends in customer and investor preferences. Environmental preferences often compete with other concerns. For example, general momentum to protect ecosystems and biodiversity is at odds with meeting increasing demand. Desire for plentiful energy may lead consumers to care less about disruption of far-off ecosystems. Alternatively, recent world events may renew energy security concerns that trump preferences to prohibit drilling in protected areas or near heavily populated coastlines. Other factors may be relevant as well. New technologies may permit more vigorous insistence on stringent environmental protection or could earn the industry access to pristine areas through the promise of reduced intrusion.

To help frame future possibilities, we consulted with industry representatives and experts to define and assign probabilities to the scenarios described in Table 3. As with climate scenarios, final judgments on probabilities were made by the authors. Readers can explore sensitivity to weightings on the WRI website.

HOW ARE COMPANIES EXPOSED TO POTENTIAL ACCESS CONSTRAINTS?

Access constraints will be site- and company-specific. Nonetheless, an overview of company exposure emerges from comparing the location of reserves to the location of ecosystems at risk documented by global maps.

²⁷ Energy Information Administration, *Performance Profiles of Major Energy Producers 1999* (Washington, D.C.: Office of Energy Markets and End Use, 2001).

²⁸ Shell, "How Do We Stand? People, Planet and Profits," *Shell Report 2000* (The Netherlands: Shell, 2001).

TABLE 3. Scenarios for Future Pressures to Restrict Access to Reserves

Scenario	Description	Assigned Probability
A. Global Support for Conservation	International biodiversity initiatives, such as the Convention on Biodiversity, gain global support, resulting in formal efforts to protect biodiversity worldwide. In developed countries, widespread preference to protect biodiversity and endangered ecosystems restricts access to more regions within their own borders. Desire to protect ecologically valuable and diverse areas extends into developing regions where more and more reserves are formally placed off-limits.	20%
B. Local Opposition to Oil and Gas Development	Consumer preferences and environmental concerns restrict access in developed countries. In this scenario, access to protected areas in the United States, Europe, and other developed countries is limited. Increasing exposure of indigenous groups and local communities to international NGOs and media increases ability of developing regions to deter or hinder oil and gas projects they see as harmful to their livelihoods. Protests, sabotage, or other disruptions increase costs and constrain production in developing regions.	60%
C. Weak Environmental Sentiment	National security and global oil supply concerns suppress environmental and biodiversity issues, and access to most areas is granted under current terms. This scenario implies no change in a company’s near-term financial performance.	20%

Mapping company reserves against sensitive areas reveals the extent of company exposure.

MAPPING ANALYSIS

To conduct this assessment, Geographic Information System (GIS) data were obtained for company fields and contract areas around the world and for several global maps of environmentally important areas. Information on company interests comes from IHS Energy Group’s database of fields and reserves, which does not include interests in the United States. The global maps of environmentally sensitive areas are from the World Wildlife Fund, which brings together several other smaller mapping efforts such as WRI’s mapping of reefs at risk and frontier forests.²⁹ The map of protected areas is produced by the World Conservation Monitoring Centre (WCMC), an extension of the United Nation’s Environment Programme.³⁰ These maps can be viewed at the WRI website.

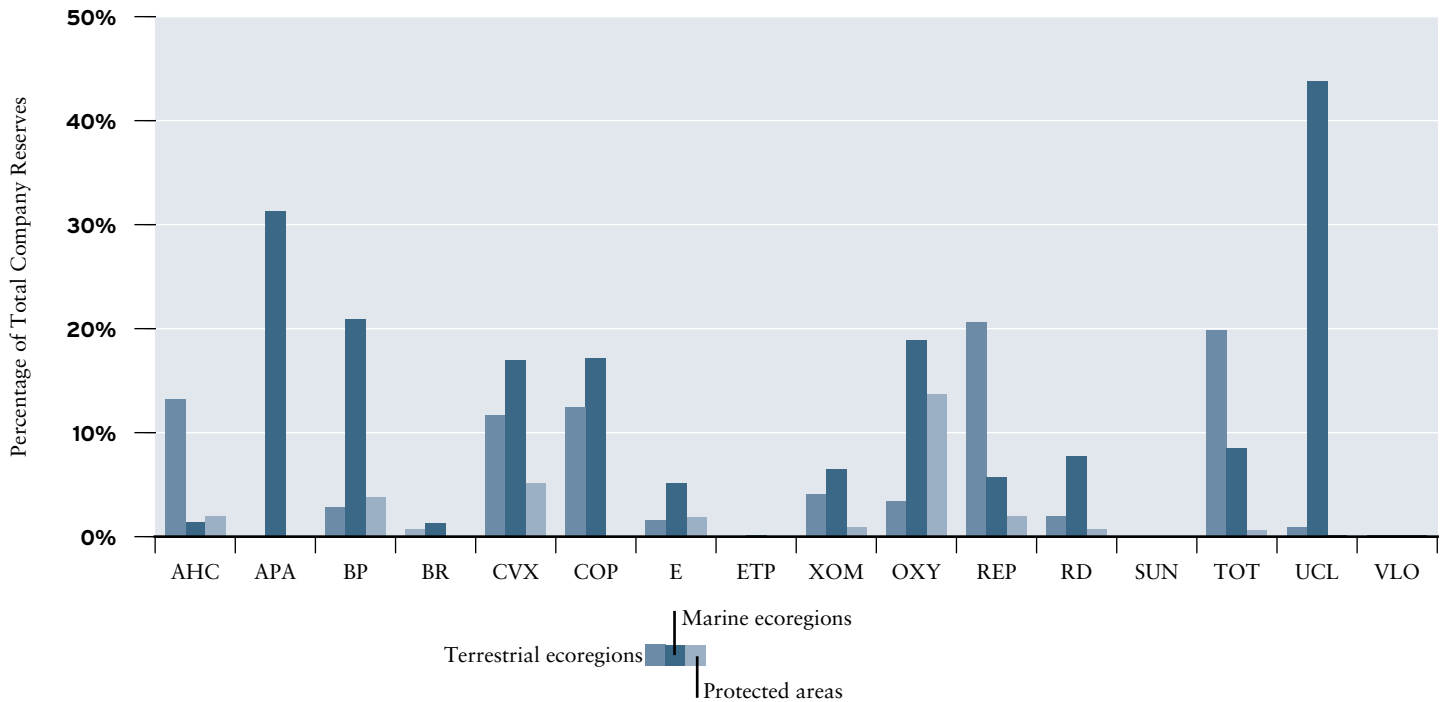
Company exposures vary.

Figure 7 shows the percentage of each company’s oil and gas reserves that falls within the boundaries of WWF Global 200 terrestrial or marine ecoregions or within protected areas. There are differences in both overall company exposure and exposure to different types of areas. Two companies, Apache and Unocal, stand out as having 30 percent or more of their reserves lying in Global 200 marine ecoregions. TotalFinaElf, and Repsol have the greatest exposure to Global 200 terrestrial ecoregions. Occidental has a much larger share of its reserves in protected areas than any other company. In contrast, relatively few of the reserves of Burlington, Eni, ExxonMobil, and Shell lie in environmentally sensitive areas. Of companies with upstream assets, Enterprise alone has no reserves in ecologically important or protected areas. Two companies—Sunoco and Valero—have no reserves and are therefore not exposed to access pressures.

Higher exposure of a company’s reserves to areas deemed environmentally significant may not in itself imply greater financial exposure. Companies with high exposure may be operating to higher environmental standards that minimize or dispel risk within these areas. Alternatively, companies with low exposure to environmentally sensitive areas may nonetheless be susceptible to environmental risks in other regions through poor performance or processes, which could create liabilities or other adverse effects. However, the analysis is a first-level assessment of potential risk, indicating which companies might be more exposed to increased pressure to maintain pristine and biodiverse areas based on assessments conducted by environmental experts.

²⁹ World Wildlife Fund, *The Global 200 Ecoregions* (Washington, D.C.: WWF, 1999).

³⁰ World Conservation Monitoring Centre, 1993. *United Nations List of National Parks and Protected Areas* (London: WCMC, 1993).

FIGURE 7. Company Reserves in Ecologically Important and Protected Areas

Source: IHS Energy Group 2001, World Wildlife Fund 2001, World Conservation Monitoring Centre 2000

Mapping assessments are driving environmental standards in other extractive industries.

Mapping assessments are proving relevant for practices in other extractive industries. Spurred by market campaigns led by Greenpeace and Rainforest Action Network, a host of wood product companies have implemented new policies to avoid purchasing wood from the world's frontier forests. To date, at least 75 companies have implemented these commitments, including Home Depot (the single largest global wood consumer), IKEA (the largest global furniture manufacturer), major homebuilders in the United States, and leading German publishing houses.

THE FINANCIAL IMPACTS OF EMERGING ACCESS RISKS

The following is a brief overview of the methodology used in this analysis. A detailed description is available on the WRI website.³¹

The basis of the methodology was to compare baseline estimates of shareholder value for reserves and acreage with new estimates of shareholder value under each of the access scenarios listed in Table 3. Baseline estimates of the value of reserves and acreage were derived from Herold's ANW estimates, made in 2001.³²

Under different scenarios, access pressures were reflected by different combinations of increased production costs, reduced production capacity and reserves being placed "off-limits." Specific assumptions are described below. Reserves were treated differently depending on whether production had commenced or not. We assumed that fields that were already producing would be more resilient to access pressures than fields that had not yet commenced production. Offsetting that, we treated the latter fields as acreage and the former as higher-valued proven reserves.

³¹ At <http://capmarkets.wri.org/>.

³² Herold, *Herold Comparative Appraisal Reports* (Norwalk, Connecticut: John S. Herold, Inc., 2001).

SCENARIO A: GLOBAL SUPPORT FOR CONSERVATION

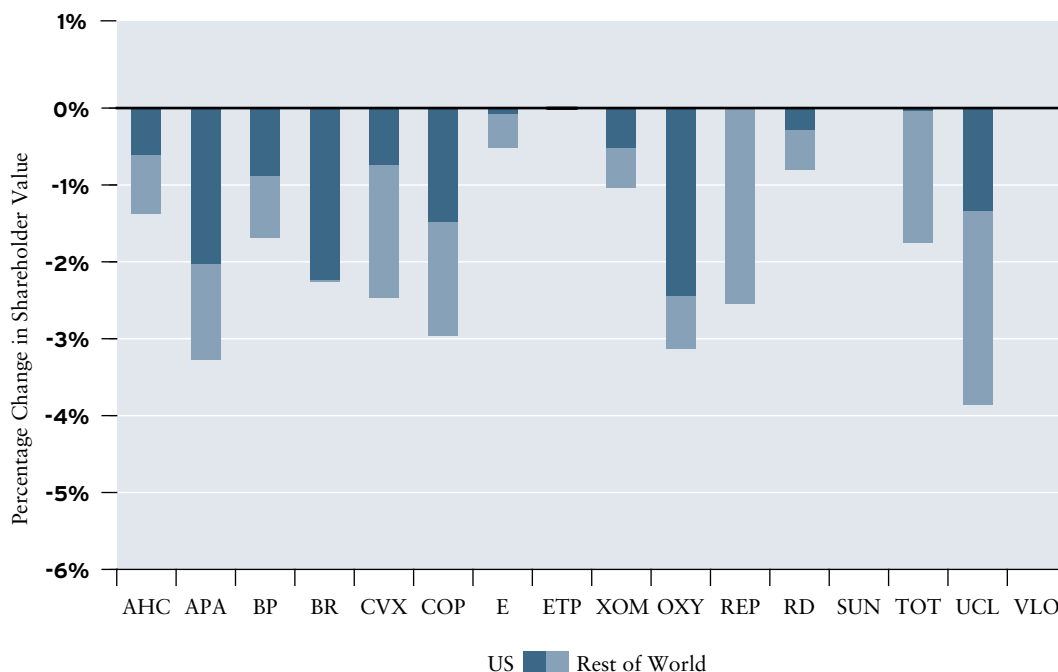
(Assigned Probability: 20 percent)

Scenario A, representing increased global support for conservation and the protection of biodiversity, examines a case where a small percentage of worldwide reserves in ecologically important areas will become “off-limits” from formal intervention by international, state, and regulatory agencies or by a formal commitment from companies not to explore and produce in sensitive areas. The value of these off-limits reserves is deducted from a company’s asset base and total appraised net worth.

For countries outside of the United States, it was assumed that between 15 percent and 30 percent of reserves lying in ecologically important areas, and between 30 percent and 45 percent of reserves lying in protected areas, were put off-limits. Though these percentages appear high, they are applied to relatively small fractions of companies’ overall reserve base. On average, the non-U.S. reserves placed off-limits were about 5 percent of total reserve holdings.

Due to a lack of field-specific data, reserves in the United States were treated differently for this analysis. We made a conservative assumption that 2.5 percent of U.S. reserves and acreage would be placed off-limits (i.e., approximately half the level seen in other countries). This reflects potential constraints in Alaska, the Rockies, and in offshore California and Florida. We recognize that companies are invested by different degrees in sensitive regions in the United States, yet without having standardized reserve data for the United States, we apply the exposure uniformly across companies. There is a need for further research of company exposure to U.S. access issues. The results of this scenario are sensitive to this assumption, both because reserves in the United States make up a large share of overall reserves and because U.S. reserves are highly valued. Apache, Burlington, Occidental, ConocoPhillips, and Unocal are the most sensitive to changes in the percentage of U.S. reserves placed off-limits.

FIGURE 8. Scenario A: Financial Impacts of Global Support for Conservation



Notes: SUN and VLO do not have upstream operations and are not exposed to reserve access issues. ETP is an upstream operator that does not have reserves in sensitive areas.

For reserves outside of the United States, the greatest impacts were felt by Repsol and Unocal, both of which could see a potential loss of nearly 3 percent. Assuming that a share of U.S. reserves would also be placed off-limits impacts Apache, Burlington, and Occidental the most. Overall, four companies would lose about 3 percent of total company shareholder value: Apache, ConocoPhillips, Occidental, and Unocal. Eni and Enterprise would remain virtually unaffected by the scenario, losing less than 1 percent of their shareholder value. Figure 8 shows the results from Scenario A.

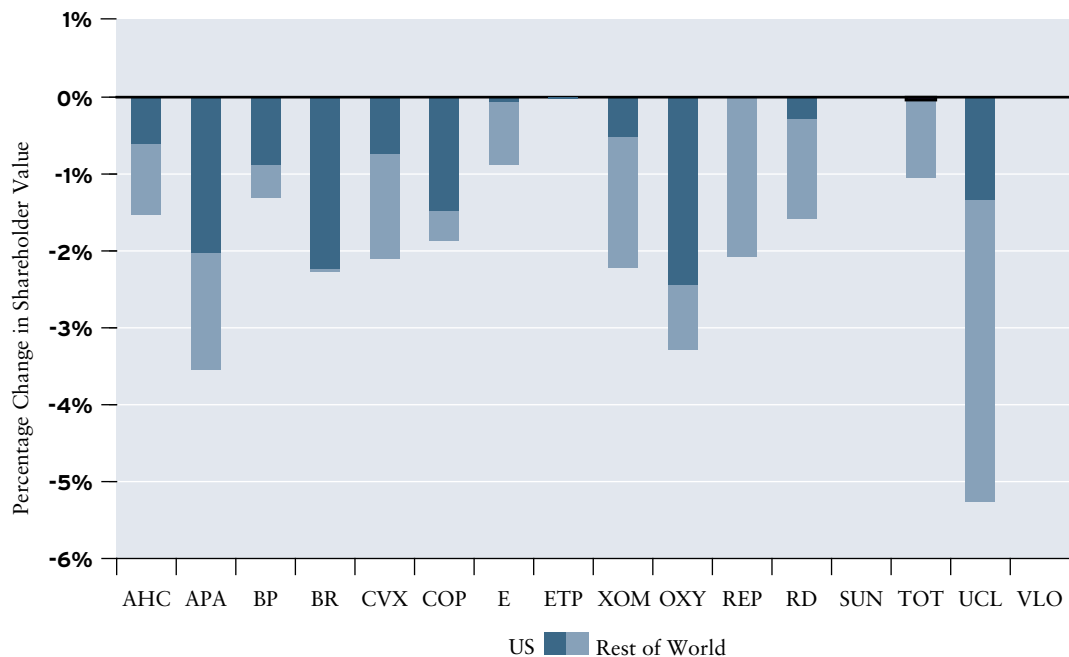
SCENARIO B: LOCAL OPPOSITION TO OIL AND GAS DEVELOPMENT
(Assigned Probability: 60 percent)

In Scenario B, we assumed that informal pressures such as NIMBY in the industrial world and community opposition in the developing world continue to create complications and restrictions on companies’ access to reserves.

In the industrial world, as a result of NIMBY concerns, a small percentage of reserves in environmentally sensitive and protected areas became off-limits in Australia, Canada, France, Germany, the Netherlands, Norway, and the United Kingdom. Again, the United States was treated slightly differently by reducing the U.S. value of proven reserves and acreage by 2.5 percent (as in Scenario A).

In Scenario B, we also assumed that community opposition in some developing countries would raise extraction costs by 15 percent by 2006 and reduce overall production by 15 percent a year for the life of the reserve. This scenario was applied to reserves in Bolivia, Chad, Cameroon, Colombia, Ecuador, Equatorial Guinea, Indonesia, Nigeria, and Papua–New Guinea. We chose these countries based on comments from the Scenarios Workshop that we held in London with industry representatives and on research on past

FIGURE 9. Scenario B: Financial Impacts of Local Opposition to Oil and Gas Development



Notes: SUN and VLO do not have upstream operations and are not exposed to reserve access issues. ETP is an upstream operator that does not have reserves in sensitive areas.

and current areas of community opposition.³³ The scenario is partly informed by Shell’s experience in Nigeria, where production has been constrained by 40 percent.

For reserves outside of the United States, Unocal is most affected, facing a loss of 4 percent of shareholder value. Assuming that some U.S. reserves would be placed off-limits is most financially significant for Apache, Burlington, and Occidental. Combined, the financial losses to individual companies are varied. Apache, Occidental, and Unocal lose more than 3 percent of total shareholder value. Eni and Enterprise remain virtually unaffected, losing less than 1 percent of shareholder value. The results from this scenario are shown in Figure 9.

SCENARIO C: WEAK ENVIRONMENTAL SENTIMENT
(Assigned Probability: 20 percent)

National security and global oil supply concerns suppress environmental and biodiversity issues, and access to most areas is granted under current terms. Scenario C, reflecting a decrease in effects from access issues in the future, does not involve any changes in the current appraised net worth of our companies.

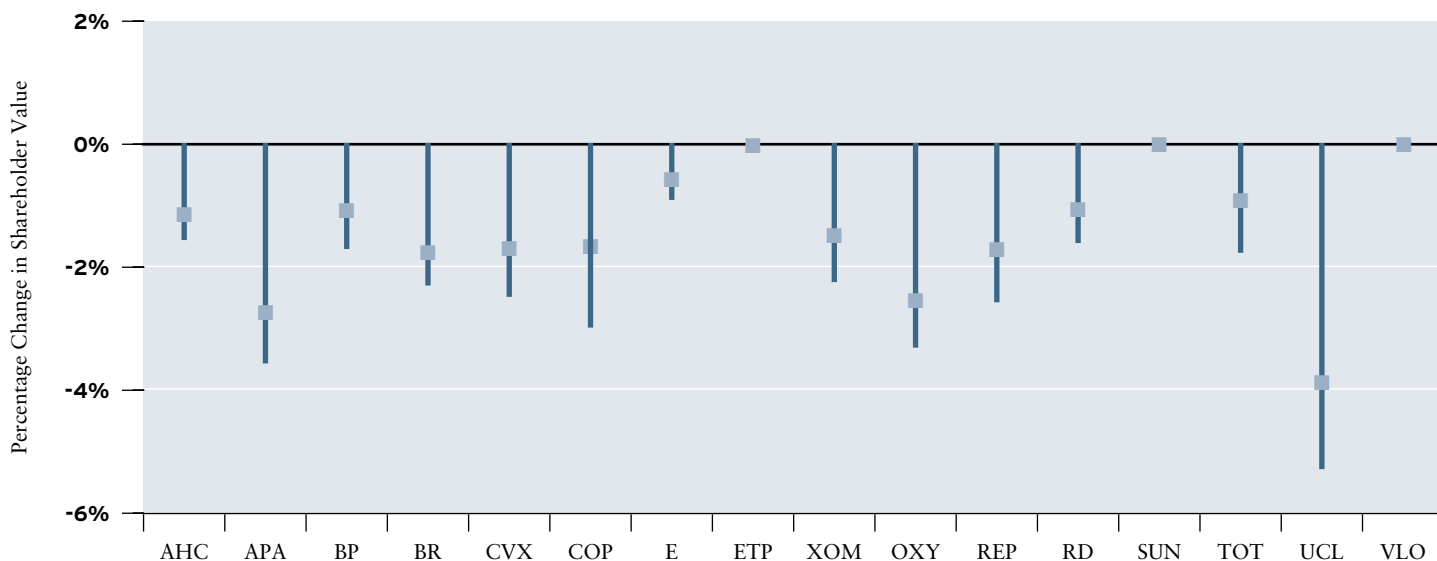
AGGREGATE FINANCIAL IMPACTS OF ACCESS SCENARIOS

The different scenarios were given different probabilities, as indicated in Table 3. The weighted impact of restricted access using those probabilities is indicated in Figure 10. The smaller, non-integrated upstream companies are among the most affected. Apache, Occidental, and Unocal most likely lose about 3 percent of shareholder value. The exception is Enterprise, an upstream operator without exposure to financial losses from access issues.

These results highlight the advantages of geographical diversification of reserves in insulating companies against risks of losing access to reserves in environmentally sensitive areas. Companies heavily invested in sensitive areas are at higher risk from emerging opposition to industry presence.

FIGURE 10. Financial Impacts of Restricted Access

(Range of possible outcomes and most likely impact)



³³ The countries were chosen on the basis of historical evidence of conflict between local people and international oil companies. This evidence was accumulated through a workshop of oil industry professionals, an extensive literature review, conversations with peers in the NGO community, and regular reviews of updates from grassroots organizations such as Oil Watch.

4.

Aggregate Results and Conclusions

The financial implications of prospective climate policies and limited access to reserves were combined to obtain an overall assessment of the impact of these pending environmental pressures for companies. Developments on climate and access issues were assumed to be independent. Accordingly, the ranges of values in Sections 2 and 3 can be combined to assess each company's overall range of outcomes. We also combined the "most likely" outcomes, as determined by probabilities given to the different scenarios.

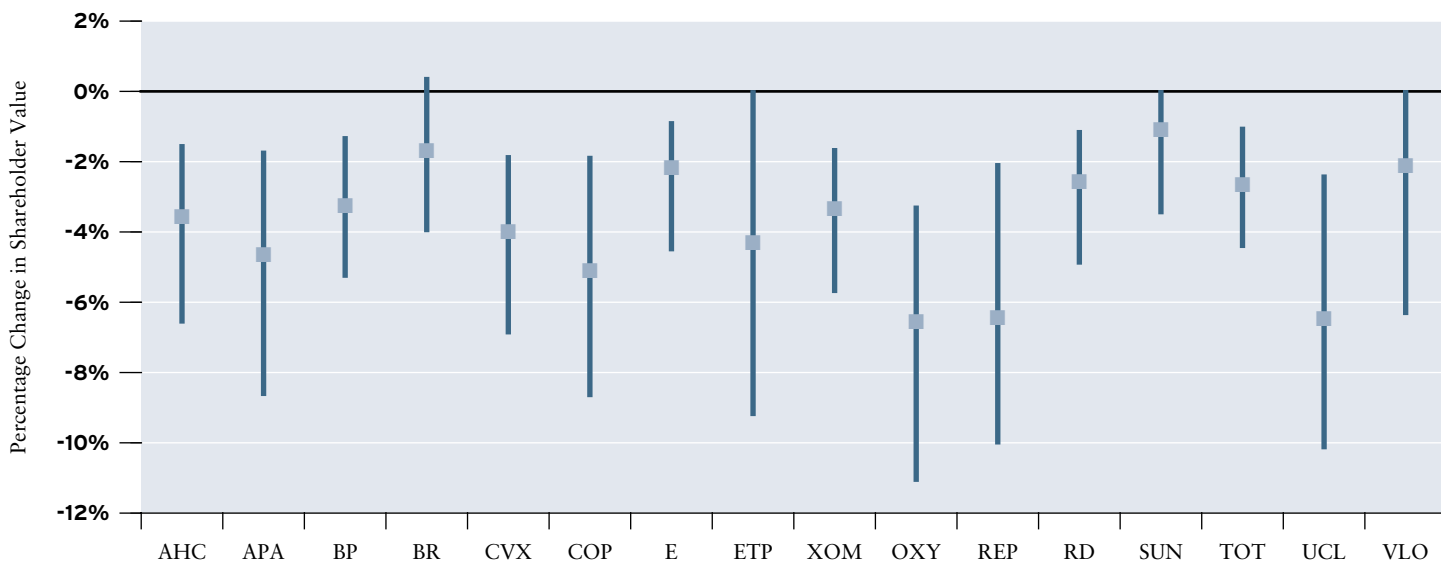
Financial losses range from 1 percent to 6 percent of shareholder value.

The results of this approach are illustrated in Figure 11. The squares indicate the "most likely" outcome, while the lines represent the 90th percentile spread of possible outcomes (i.e., outcomes with less than a 5 percent probability were not included).

The main conclusions are as follows:

- The average financial impact across all companies is a loss of about 4 percent in shareholder value. Consequently, investors need to recognize that climate and access issues will be important determinants of future profitability for the industry.
- There is a wide range in "most likely" financial impacts from these two issues, ranging from a loss in shareholder value of 1 percent for Sunoco to potential losses of more than 6 percent for Occidental, Repsol, and Unocal. Positioning with regard to environmental issues will be an important source of competitive advantage and disadvantage within the industry.
- Exploring the tails of the distribution reveals that Burlington has a small chance of seeing shareholder value increase, while Apache, ConocoPhillips, Enterprise, Occidental, Repsol, and Unocal face losses in shareholder value of more than 8 percent under certain unfavorable scenarios.
- The major integrated companies are protected by their size and diversity. Expected losses for BP, ChevronTexaco, Eni, ExxonMobil, Shell, and TotalFinaElf all fall between 2 percent and 4 percent.

FIGURE 11. Combined Financial Impact of Climate Policies and Restricted Access to Reserves
(Range of possible outcomes and most likely impact)



■ Non-integrated producers and refiners tend to find themselves in more extreme positions. Sunoco and Valero (benefiting from likely U.S. non-participation in the Kyoto Protocol and not exposed to access issues) and Burlington (benefiting from upside opportunities for natural gas) face the least adverse expected impacts. In contrast, Occidental and Unocal (both oil-heavy and with a greater than average share of reserves lying in sensitive areas) are among the worst performers.

■ Finally, the uncertainty of future developments is more important for some companies than others. The 90th percentile distribution represents 9 percent of Enterprise’s shareholder value but only 3 percent of Sunoco’s. Consequently, Enterprise’s investors should watch these developments more closely than Sunoco’s might need to.

5.

Corporate Disclosure of Environmental Risks

Only three companies identify climate change in their annual reports as a prospective influence on financial performance.

No company attempts to quantify financial impacts of prospective climate change policies.

Investors' ability to determine the future exposure of companies to these issues depends heavily on the amount of relevant information disclosed by companies.

DO COMPANIES DISCLOSE EXPOSURE TO THE CLIMATE ISSUE?

Of the companies examined here, only 3—BP, Conoco and Phillips³⁴—made any reference in their latest 10-Ks (or 20-F equivalent) to climate change as an issue that may affect future operations. Three other companies—Enterprise, ExxonMobil, and TotalFinaElf—refer to the issue in their annual reports, but do not elaborate on any possible implications for their business. The remaining 11 companies do not mention climate change in the principal materials prepared for investors.

Outside of financial reports, eight companies mention climate change as an issue in an environment, health, and safety report or on their website. However, the extent of reporting varies considerably. Occidental raises the issue as a theory and addresses it by reporting energy-efficiency improvements. Shell discusses its climate change commitments in detail in its *People, Planet, and Profits* report. Of all the companies, only seven—BP, Conoco, Enterprise, ExxonMobil, Royal Dutch/Shell Group, TotalFinaElf, and Unocal—report their operational GHG emissions.

None of the sample companies attempt to quantify the possible financial implications of climate change and policy responses. BP, Conoco, and Phillips come closest. In their separate reports last year, Conoco and Phillips both state that expenditures under the Kyoto Protocol are hard to predict but “could be substantial.”³⁵ In contrast, BP notes that the Kyoto Protocol could lead to “some” reduction in the use of fossil fuels; however, “the impact of the Kyoto agreements on global energy (and fossil fuel) demand is expected to be small.”³⁶ Though better than others, even these disclosures fall short of quantitative estimates of financial impacts that investors would find useful.

³⁴ Conoco and Phillips filed separately for the year 2001.

³⁵ Conoco, *2001 Form 10-K* (Houston: Conoco, 2002) p. 34; Phillips, *2001 Annual Report* (Bartlesville, Oklahoma: Phillips, 2002) p. 50.

³⁶ BP, *2001 Annual Report on Form 20-F* (London: BP, 2002) p. 58.

Only one company reports that specific access issues constitute explicit business risks.

DO COMPANIES DISCLOSE EXPOSURE TO ACCESS ISSUES?

Reporting of access issues is more difficult to monitor, mainly due to the piecemeal nature and the variety of ways financial consequences may be felt (e.g., lawsuits, asset losses, increased operating costs). Most companies report political risks inherent in overseas operations, particularly in developing regions of the world, yet describe community investments as corporate stewardship rather than as a risk-mitigation policy.

Furthermore, in regions that are highly dependent on natural resources for survival, the link between social unrest and environmental quality is rarely made. Only Repsol specifically links environmental and social policies in sensitive areas with the goal of preventing disruptions and losses in oil and gas operations.³⁷ Despite the fact that access issues have always been at the heart of the upstream oil and gas business, their financial significance goes largely unmentioned in annual reports.

The assumption that environmental issues will impact companies equally is likely wrong.

In addition, companies generally play down environmental risks by stating that they will not be affected differently from other companies in the industry. As seen earlier, though, companies in the industry do *not* have comparable assets. Rather, they have different asset mixes which ensure different financial exposure. This analysis, and past experience within the industry, shows that environmental measures affect companies differently.

WHAT CAN INVESTORS DO?

Financial analysts who follow the oil and gas industry routinely estimate the financial implications of environment-related capital expenditures, and may mark down the whole sector in light of widespread environmental risks. It is much less likely that investors are aware of the company-specific financial consequences of the pressures reviewed here, despite the fact that these new pressures may soon impact corporate balance sheets. Investors should begin asking companies about their exposure to climate, access, and other regulatory issues, as well as the financial consequences of these issues and the company's planned response. In addition to information obtained from companies, investors should initiate their own assessments of the financial implications of these major pending environmental issues.

³⁷ Repsol YPF, 2001 Annual Report (Madrid: Repsol YPF, 2002) p. 34.

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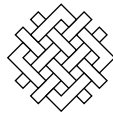
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