OIL AND THE FUTURE:
Taking bearings in the greenhouse in a post Brent Spar world.

Paper for the Environment Northern Seas Conference "Sustainable Energy Production and Consumption" seminar

Dr. Jeremy K. Leggett
Director, Greenpeace International Solar Initiative
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A greenhouse-related environmental driving-force seems set to emerge in the capital markets in the years ahead. This will severely compound other already serious environment-related financial problems blighting the oil-industry's access-to- capital radar screen. The wise oil company is now, increasingly clearly, the company thinking about how to begin repositioning itself for the twenty-first century as a total- energy company.

THE CORE DILEMMA FOR THE INDUSTRY

Burning oil is the number one source of the number one anthropogenic greenhouse gas, carbon dioxide. In the late 1980s, the world woke up to the threat of an enhanced greenhouse effect. The Intergovernmental Panel on Climate Change was convened, and in 1990 duly delivered an authoritative and extremely gloomy prognosis [1]. Governments reacted, and had by June 1992 ~~negotiated the~~ Framework Convention on Climate Change, a treaty without teeth (which is to say greenhouse-gas emissions-reductions commitments) but with a tough objective inevitably requiring such teeth sooner or later (i.e. stabilization of atmospheric greenhouse-gas concentrations at levels which pose no threat of dangerous interference with climate, a goal requiring deep cuts in emissions).

Throughout that process, and in the continuing negotiations, the oil industry combined with coal and other fossil-fuel- related industries to try and stall governments' efforts to begin an international global-warming policy response commensurate with the threat. But this "carbon club" lobby, as it has become known (including organisations like the Global Climate Coalition and the Global Climate Council), failed to derail the negotiations. The Convention on Climate Change has now come into force - it is, in other words, an instrument of international law - and at the Berlin Climate Summit in April, governments negotiated a mandate to agree a protocol on emissions reductions by 1997.

In parallel, depressing evidence that global warming is a major threat continues to build up in the

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technical journals, and a synthesis for governments is due to appear in the IPCC's Second Assessment Report in December. Against this march of evidence and events, the arguments of the small but vocal community of scientific sceptics are beginning to look increasingly flimsy.

The insurance industry, for one, has clearly begun to recognise the danger signs. The first recommendations that investments be switched away from fossil fuels have begun to appear in financial-sector publications. Active discussion of the issue is proliferating in the financial sector, having spread to the banks and pension funds. At the same time, a suspicious recent catalogue of climatic extremes continues to build, edging global warming up the list of the publics' environmental concerns, where it has for a long term barely figured. Meanwhile, the Brent Spar episode points to the dangers of underestimating the publics' capacity for sudden involvement, where they are given a chance to act on issues which they are concerned about, or, in the global-warming case, could in the future become concerned about.

All this comes at a time when the oil industry faces the prospect of major liability payouts, public-relations disasters, and huge infrastructure-upgrade costs arising from routine operations, in particular as a result of the aging tanker fleet and the parlous state of the pipelines for delivering oil to market overland.

In the face of all this, in the years to come, oil companies wedded to the unsustainable status quo must raise many hundreds of billions in order to exploit the new frontier provinces, and deliver the oil therein to market.

Is it going to be possible?

THE GREENHOUSE-AWAKENING IN THE CAPITAL MARKETS

When governmental negotiators assembled in Berlin for the Climate Summit in March, they were joined for the first time in four years of talks by representatives from the financial sector. Business lobbyists had patrolled the corridors of the UN since day one of the climate talks, but until Berlin these lobbyists spoke only for the oil, coal, auto and chemical-industries. Climate negotiators, it seems, will now be seeing a different side of the business coin from the one on offer from the carbon club, as they have become known.

Last year, a report by reinsurance giant Swiss Re concluded that "human intervention in the natural climatic system could accelerate global climatic change to such an extent that society may no longer be able to adapt quickly enough" [2]. This seems increasingly possible, and this gloomy view includes the insurance industry itself. The balance of probabilities is as follows. The Intergovernmental Panel on Climate Change (IPCC) has warned in three successive reports between 1990 and 1994 that greenhouse gases definitely trap heat in the Earth's atmosphere, that concentrations of such gases are definitely rising in the atmosphere, and that global warming is "certain" unless this is stopped [3]. The inherent complexities of the climate system, of course, allow no certainty about rates of warming, or of regional distribution. Estimates are required, and they must be based on calculations requiring use of the most powerful computers available. These estimates currently yield rates of global-average temperature-increase approaching 0.3 deg C per decade. There is no doubt that to hike the planetary thermostat that fast risks much, including ever more frequent and severe floods, drought-related wildfires, and possibly windstorms.

The worst case for insurers, if this comes to pass, is very bad indeed. Executives at the top of the industry, in Munich, Zurich, London, New York and Tokyo, have over the last few years aired the view that if the dice roll badly in the great greenhouse gamble, climate change could bankrupt the industry [4]. As few as two events might do this - a category five hurricane on New York, say, or a drought-related wildfire taking hold in an urban centre. Such events become more likely in a world where global warming is taking off. Neither is the worst-case limited to a small number of unkind rolls of the climatic dice: as a Swiss Re analyst has put it, the industry could end up trying to deal with "a machine-gun fire" of catastrophe.

In the wake of a global insurance crash, the knock-on problems in economies would be huge. The economic problems of small island states, where insurers have in many cases withdrawn cover or hiked rates to unaffordable levels, offer a partial microcosm. Without insurance, building programmes could not be commissioned, businesses could not start up; others would be forced to shut down as insurance expired and losses of whatever previously-insurable type mounted. Unemployment would ripple through the economy, starting spectacularly in the labour-intensive insurance industry itself.

And just as the insurance industry is threatened with unmanageable property-catastrophe losses, so the banks and pension funds face threats to debt and equity investments. These arise in two ways. The first involves direct damage from global warming: imagine for example the failure of the Thames Barrier under assault from a record storm surge, or the impacts of a supertyphoon on Tokyo, or a drought-related superwildfire on California. The second involves the indirect effects should governments procrastinate too long, and find themselves forced to rush through policy measures to fight ~~global~~ warming in a panic. As a former director of Chase Investment bank argued in the recent Delphi Report [5], the impact of climate change on equity holdings are potentially severe. Stated simply, it may seem like a good idea to invest today in a coal-fired power plant with a 30 year life cycle, or a highly-geared oil-exploration company anticipating returns in 15 years time - but only if you forget about what NASA, the Met Office, and other such institutions are warning about climate change in that kind of time frame, and what governments might relatively soon be forced to do, in consequence, ~~as the writing~~ becomes ever clearer on the greenhouse wall.

An awakening of the financial sector to these threats seems to be in progress in the banking sector, just as it is in the insurance sector. UNEP hosted a ground-breaking conference on banks and the environment in September 1994 in which much of the discussion focussed on climate change. For many of the senior bankers who attended, the occasion was their first serious encounter with the greenhouse threat-assessment exercise. Elsewhere, dialogue is under way in a growing number of fora. In November, for example, the City of London witnessed the strange spectacle of a seminar on climate change co-organised by Greenpeace and the British Bankers' Association. Bankers at the seminar on the eve of the Berlin Climate Summit, also organised by Greenpeace, offered the same grim assessments of global warming as the insurers, and spent an encouraging amount of time discussing the promotion of solutions. Attendees at the Berlin seminar represented many of Europe's major banks and insurers. The main point of the event came out clearly in the extensive press coverage. As the Financial Times reported, "the conference found Greenpeace joining forces with prominent members of the world's banking and insurance industries to demand international action on climate change."

The Berlin seminar was chaired by Rolf Gerling, chairman of Germany's Gerling insurance group. Gerling said it was no surprise that environmentalists and representatives of the financial community should agree on climate change. "The time is over when we should draw divisions between us. Now we should all march together." To back its words, Gerling Group is to publish the verbatim proceedings of the Berlin seminar in due course. According to its Chairman, the company was taking greater account of environmental factors in its insurance and investment policies and would try to set an example for the industry. As Lloyd's List put it in a long report on 4th April, "the debate between these new partners was friendly and conciliatory. The oil industry had better watch out."

At the Berlin Climate Summit itself, the two biggest reinsurers in the world, Munich Re and Swiss Re, were represented throughout the two weeks of intergovernmental negotiations, the latter as part of the Swiss government's delegation. Also represented at various times were Lloyd's of London, the British Bankers' Association; and Norway's largest insurer, UNI Storebrand. The Assistant Director of the British Bankers Association, warned government delegates at the summit that "international banks are becoming convinced that the world faces serious changes to its climate, with equally serious economic consequences." As he told the press, "the banks are increasingly concerned at the economic consequences of climate change. It seems to me that [there is] a good case that we face significant and, perhaps, permanent changes in the UK and the world. It is also clear that climate change will have a dramatic impact on the work and lifestyles of our business and personal customers; it could bankrupt some of them and make some of them homeless and jobless."

A few weeks later, ~~the~~ report of the Lloyd's delegation to the summit was distributed at high levels in the insurance industry in London. It advocated full involvement of the insurance industry in the ongoing negotiations under the "Berlin Mandate" agreed at the climate summit. It also had some pointed comments to make about the antics of the carbon club at the negotiations: in particular the type of perspective offered by the main oil-and-coal lobby group, the Global Climate Coalition, and the way the International Chamber of Commerce had been led by oil industry representatives who had not considered or spoken for the ~~insurers and~~ bankers whose interests' the ICC was supposed to represent as well. "The obligation of managing risk, both for the benefit of their (insurers') customers and for their capital providers means that not to monitor scientific developments and to ignore the initiatives of the IPCC and most fundamentally not to have their voice heard and their interests not represented, except as purportedly expressed through the I.C.C. and the G.C.C. is a questionable exercise of their responsibilities." Looking into the future, the report concluded that "it is thus probable that the insurance industry is going to have to take some initiatives by itself, or along with the banking industry. The representatives of the church pension funds were taking the decision to exclude carbon club members from their investment portfolios, but they only have about $20,000,000,000 under management, and it is unlikely that this ripple in isolation will be felt. However the insurance industry has over a trillion dollars invested, and even a small shift could send a message which could be important and initiate a gathering in momentum."

Environmental groups, Newsweek commented, seemed to be correct in their belief that a major industry had defected to their side of the "great Greenhouse Debate" was an encouraging development. As Richard Keeling of Lloyd's told Newsweek, "it used to be just one or two business people getting concerned. But if you look around this conference, you'll see some serious people from some serious companies." But then, as Newsweek observed, "these days some serious money is at stake." Time magazine, reporting a similar gathering of insurers in New York, summarized the ultimate stakes in 1994: "the crucial role played by the $1.41 trillion insurance industry in the world economy could change the dynamic of the debate about global warming" [6].

Could this be correct? Can we really expect to see, in the closing years of the hydrocarbon century, the private financial institutions begin progressively to divert capital away from fossil fuels, towards solar energy and other greenhouse-friendly industries?

It is not as though the answer to this question involves merely greenhouse gases.

OTHER ENVIRONMENT-RELATED PROBLEMS FOR THE OIL INDUSTRY

Consider three further problems on the radar screen which hold the potential to add to the likelihood that the oil industry will suffer from a flight of capital in the years to come.

1. Emerging civil war with the gas industry, and the rise of solar energy markets.

The Oil and Gas Journal flagged an emerging division in the hydrocarbon world early in 1994. "Industry must avoid gas versus oil civil war," the title of an editorial exhorted. "The potential exists." It would all come to no good, the article raged, unless the gas industry stood side by side with the oil industry aginst the global-warming scare story. "In any civil war that oil and gas interests fight on government turf, the first casualties will be economic freedoms of individuals. The industry doesn't need that kind of blood on its hands." (Ed: Or any other kind of blood?)

Later that year, at the climate negotiations the gas industry joined up with the renewables industry to provide a counter voice to the carbon club. "The Business Council for a Sustainable Energy Future," the new organisation's mission statement reads, "is comprised of environmentally responsible companies that support the objectives of the Framework Convention on Climate Change, including the long term goal of stabilizing the concentration of greenhouse gases in the the atmosphere." In other words: *deep cuts in emissions*. "The Business Council believes that delay in taking actions to mitigate global warming is irresponsible, and that the opportunity cost of delay is substantial." Over twenty companies and organisations have joined the new business council and they include energy efficiency and renewable organisations like the the Solar Energy Industries Association, and the United States Export Council for Renewable Energy, the American Wind Energy Association, Energy Conversion Devises Inc, Kenetech, and the North American Insulation Manufacturers Association. Gas companies are also mixed in among the names, including Enron, the world's largest gas company.

The week after the Berlin Summit finished, in San Antonio, Texas, over six hundred people attending the US Solar Energy Industries Association annual trade fair heard an Executive Vice President of Enron talk about global warming and the solar energy markets. The global consensus after the Berlin Summit, Bob Kelly said, was that something had to be done about the burning of fossil fuels. "We're wracking up a great big clean air deficit." Sometime, our children were going to have to pay a carbon pollution cost, he said. "That could be be a great big number. It could be bigger than the budget deficit." Kelly, despite being an oilman, saw the greenhouse threat not just as an environmental problem, but as a market driver. It was inevitable that global warming would one day force solar into energy markets, he argued. "We see a great big market out there, and we are going for it."

Enron intends to build 100 megawatt photovoltaic power stations generating electricity at $5.5 cents a kilowatt hour, hence competitive with fossil fuels. Enron are actively pursuing plans to build such plants in Nevada, China and India. They have formed a partnership with Amoco, owners of Solarex, the biggest American solar-cell manufacturer. If they build just one of their 100 megawatt plants, they would be halving the cost of solar cells, and doubling world production. Moreover, they are intent on building not just one, but many: they were intent on breaking solar-photovoltaic energy-technology out of its current price trap.

Consider the potential here. As a former Director of Strategic Planning at Texas Instruments puts it, "if we could cut the price of PV by three times, to 6 cents per kilowatt hour, then nobody would use anything else for electricity in the sunbelt, ever." The scope for solar PV, in other words, if the price trap can be broken, is exactly analogous to the xerox machine: the first one of those had cost $30,000. Shell's Head of Renewable Energy Supply and Marketing, Roger Booth, told an International Solar Energy Society conference in 1994 that covering just 0.4 percent of the land area of the globe with 15 percent efficient solar cells would supply the equivalent of all the world's current primary energy. Desert areas, for example, amount to 10 percent of total land area. Just a few percent of the Sahara, covered with pv, could provide all Europe's electricity, in principle. "All the world's energy could be achieved by solar many thousands of times ~~over,~~" Shell's man emphasised. Once such a solar revolution was underway, there could be little doubt that it would proliferate to the transport sector, and ultimately lead to mass-production of zero-emission and very-low-emission cars: solar cars, battery cars, hydrogen cars, and hybrids of various kinds.

2. Liability and the parlous state of the tanker fleet.

Shell's former chief J. van Engelshoven summarized the bottom line or his industry in 1990. "No matter how desirable it is to reach a zero accident ~~goal,~~ we will never get there. Even if we operate on the basis that every accident is preventable, accidents will, unfortunately, still happen." And when they do, the skirmishes with environmentalists in this particular theatre of the carbon war will resume. Peering into the crystal ball, where might they lead?

Environmentally-unconstrained oil advocates, after all, want another century of tankers delivering oil to global markets. There is far more oil waiting below ground to be delivered to market than has yet been delivered. What is ideally needed, in such a world view, is for the public not to become too concerned about periodic oilspills. After all, so the argument goes, there is a certain hypocrisy in that concern: if the public want their cars - oil's principal market - they should be prepared to live with the odd oiled seabird. Accidents such as the ExxonValdez spill, as one Exxon official historically and rather unwisely put it at the time, are "the price of civilization." But sadly for the oil industry, the public does not seem too keen to make this connection. The media coverage following the Exxon Valdez spill ran and ran. Amid TV images of dying otters, came pictures of Americans tearing up their Exxon charge cards. The PR damage from that spill turned out to be long-term. And what happened on Capitol Hill in the wake of the Valdez disaster was even worse. The Oil Pollution Act swept through Congress in 1990 on a wave of public pressure. Among other measures, this new legislation posed the owners of the next Exxon Valdez - should their accident happen in US waters - with the dreadful prospect of unlimited liability. The oil industry reacted to the Act with horror. But even with a former oilman in the White House, the new legislation stuck.

For companies like Exxon and Shell, the problem posed by the Oil Pollution Act - bad though it is in their frame of reference - is not as bad as it could have been, at least in the short term. More than 80 percent of the world's oil tankers are today chartered by the oil companies from independent tanker owners. There are over 1,000 such owners, most of whom run relatively small companies operating one or two tankers. Shell, Exxon, BP, Chevron, Mobil and Texaco own only around 12 per cent of the global tanker fleet, and in the aftermath of the Oil Pollution Act they are busy running down their fleets. Shell had more than 60 tankers in the mid 1980s, but plans to be down to about 30 by 1995. The oil companies, in other words, are busy offloading the responsibility for shipping their oil onto others. That they are allowed to do this is at once a fortunate and unfortunate state of affairs for the oil companies: fortunate because it means the multi-billion dollar bills for future spills are less likely to fall on them, but on shipowners (most of whom would be unable to pay in any case); unfortunate because the shipowners are less likely to maintain their ships to the standards oil companies might, and hence increase the prospect of un-imageworthy disasters harmful to oil's long-term prospects of capitalizing on a second century of oil profligacy.

An additional and immensely worrying consideration for the oil-company planner, in the longer term, is that as tankers grow older they are more likely to be wrecked. The boom years for tanker building were in the mid 1970s, before the second oil shock. What this means is that the fleet is aging fast. In the early 1980s some two thirds of tankers were less than 10 years old. Today two thirds are more than 10 years old. Nearly half the tankers afloat today are more than 15 years old, and the statistics show that over 80 percent of marine insurance losses involve ships over 15 years old. For the oil industry, this has to be very bad news. Publics are becoming environmentally sensitised. An oiled seabird means more to a TV viewer these days than one poor dying bird. The image triggers recurrent concerns about the water the viewer drinks, the food he or she eats, and - increasingly - the air he or she breathes. All this means that politicians are prone to be ever more reactive when a breeze of public concern blows across their desks. Suppose policymakers in other countries started to emulate the US Oil Pollution Act? Suppose - horror of horrors - governments began to question the right of oil companies to offload the responsibility for transporting their product onto shipowners?

One answer, of course, would be to build new tankers. But here the oil industry is caught in the vice of its own profit motive. The problem is that there is overcapacity of some 20 percent in the tanker market. Minimal improvements in energy efficiency achieved in the wake of the 1979 oil shock, cutting projected demand for oil, were responsible for this. The glut allowed the oil companies to strike very hard bargains with the tanker owners during the 1980s. In consequence, times became tough in the oil-shipping business. Few tanker owners can afford the $125 million it requires to build a new tanker. Indeed, the competitive nature of the shipping market forces tanker owners to cut corners with existing ships. Captains are under pressure to use the most direct routes to market, even if that involves passage through dangerous straits or close to sensitive coasts. Because most of the fleet is registered under "flags of convenience," whereby countries like Liberia and Panama certify the seaworthiness of both tanker and crew, crews are selected from those nations where mariners are more likely to accept low wages. Needless to say, the accident statistics are higher for flag-of-convenience ships than for those registered in industrialized countries.

But are new tankers being built? The answer at present is no. Even for the oil companies, shedding jobs and retrenching everywhere as they are, $125 million is a non-trivial cost for a line item. And so, as the fleet ages, largely unreplaced, the cycle of risk intensifies, and the prospect of abating it recedes.

The oil companies know they have a problem. They inspect the aging tankers before they charter them. BP's inspection record, detailed in a memo leaked to Greenpeace during the Braer episode, was instructive. Of more than 3,000 tankers inspected, nearly a third were blacklisted by the company. "Many of the ships now over 15 years old," the memo read, "have not been maintained to the standards we would employ on our own ships."

In the face of this kind of exposure, the companies set up expert groups to study oilspill clean-up technologies. They beef up oilspill response capabilities. They generally try to look as concerned and responsible as possible. But they cannot escape the inevitable. And meanwhile, the threat not just of public-relations disasters, but of multi-billion- dollar, hyper-liability payouts, is increasing all the time.

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3. The problem of environmental positioning in the post Brent Spar World

For years, Shell UK had run a successful PR campaign in the United Kingdom called the "Better Britain" campaign. This consisted of an annual set of awards for conservation schemes. Shell was effectively exhorting the British population to act with environmental responsibility, including in the matter of dealing with garbage. So what did the company plan to do, in May 1995, with the thousands of tonnes of steel and concrete, plus over 100 tonnes of toxic waste - including oily sludge, arsenic, cadmum, PCBs, and lead - that was the disused Brent Spar platform? It planned to dump the lot in the sea.

What are the lessons, given the benefit of hindsight? They are many, and substantial. Business-school textbook chapters will be written on the Brent Spar episode for years to come. Let me offer just two. The first and biggest lesson is that industry in general, and the oil industry in particular, encountered a clear turning point in environmental politics on 20th June 1995. Though the risk to life in the incident was nothing compared to Chernobyl, or Bhopal, this was just as seminal a political episode. The world's heavyweight papers seemed to be in broad accord on this. "People no longer accept that the men from the ministry, let alone the multinational, know best," the Financial Times concluded in an editorial which captured the general vein. "They are inclined to trust the man from Greenpeace instead. This is the battlefield in which companies and governments must be prepared to engage." The financial editor of the UK's Guardian newspaper saw it even more grandly. "There are those, including some whose business it is to advise Britain's biggest companies, who regard this issue as a defining moment in the transition from shareholder capitalism to what might be called sustainable capitalism."

The second lesson involves the built-in propensity the oil industry seems to have to underestimate its environmental liabilities. The Brent Spar episode now means that 50 similar installations in the North Sea will have to be decommissioned on land now, at a cost of around 1.5 billion over the next ten years. If smaller structures - ordinary drilling rigs, rather than oil-storage platforms - have to be decommissioned in the same way, the total cost will rise to 7.5 billion or more. That now seems inevitable. Within ten days of Shell's defeat, eleven European governments agreed at a meeting of the Ospar Commission that there should be a moratorium on all dumping of oil structures at sea. The UK and Norway were the only states to oppose this measure, and the Commission decides its measures by majority, not consensus. In the greater scheme of things, it might be argued, a few billion dollars extra over ten years is still no big deal for big oil. But the critical question that oil companies must ask themselves is whether or not this propensity to underestimate environmental liability extends to other areas of the oil industry's operations. To the aging fleet of creaking oil tankers? To the tens of thousands of kilometres of leaking oil pipelines? Even, as the Delphi Report suggested, to the wilful stoking, via carbon-club disinformation and solar-market suffocation, of the greenhouse threat?

These are questions which it will not be possible for the industry to dodge for much longer. The Economist was quick to offer its take on the main lessons of the Brent Spar episode, and it put the themes of transparency and ethics high on the list in its editorialising. "Tomorrow's successful company can no longer afford to be a faceless institution that does nothing more than sell the right product at the right price. It will have to present itself more as if it were a person, as an intelligent actor, of upright character, that brings explicit moral judgements to bear on its dealings with its own employees and with the wider world." Shell Germany, at least, seemed to have been quick on the uptake in this respect. "We are going to change," it announced in full-page newspaper advertisements. "It is not enough for a decision to conform to laws and international rules - acceptance by society is needed too."

Apply that to global warming. Society's concern about the enhanced greenhouse effect has yet to assume the proportions of the concern which makes its citizens question the dumping of garbage, or oil platforms, in the sea. But that cannot last. Even as the Brent Spar story unfolded, terrible floods revisited the US Midwest, over a million hectares of Canada's tinder-dry boreal forest was ablaze at one point, and a deadly heatwave across northern India saw temperatures in Delhi average 117 deg Fahrenheit. *Average*. "More extremes found in weather, pointing to greenhouse gas effect," a 23rd May headline in the New York Times announced. Researchers at the US National Climatic Data Center had found that the climate in America had indeed become more extreme in the last 15 years, and had calculated a 90 to 95 percent chance that this was due to the enhanced greenhouse effect.

"It is not enough for a decision to conform to laws and international rules - acceptance by society is needed too." The key question is this. When concern about global warming reaches levels to match concern about environmental issues of the kind that drove the politics of Brent Spar, as it surely must, and when the march of the long-suppressed solar markets reaches the point where people realize that the concept of solar/battery/hydrogen/hybrid cars could well become reality, will the oil industry have society's acceptance for its core business any longer?

CONCLUSIONS

Fault lines have begun to appear in the idea that the oil industry can add a second century to the oil era. In particular, major elements of the gas, insurance, and banking industries have essentially allied themselves with the environmentalists' camp on global warming. Other environmental problems - tanker and pipeline spills in particular - begin to suggest the oil-industry will experience severe capitalization problems in the decade to come, just as Brent Spar shows that oil transnationals more powerful than most governments can now no longer ride roughshod over publics.

Daniel Yergin described the situation perfectly in closing his epic history of the hydrocarbon age, "The Prize". "With the fate of the planet itself seeming to be in question, the hydrocarbon civilization that oil built could be shaken to its foundations. ....It will be remarkable if we reach the end of the century without the preeminence of oil being tested again by political, technical, economic, or environmental crises - perhaps foreseen, perhaps coming by surprise."

Place your bets on environmental, and foreseen.

During the late 1980s and early 1990s, Shell introduced into its corporate culture a process known as Scenario Planning, in which strategists would conduct elaborate crystal-ball- gazing exercises, and managers throughout the group would be trained by means of them to try and sense the shape of the future, and the best course to pick therein for Shell's business interests. Scenario Planning, according to the founder of the process, was needed to guard against "the parochialism of the internally constructed version of reality." As a former Shell Head of Strategic Planning put it, "it is extremely difficult for managers to break out of their world view while operating within it. When they are committed to a certain way of framing an issue, it is difficult to see solutions that lie outside this framework."

Shell has recently conducted a poignant demonstration, in the full glare of world publicity, of the veracity of those sentiments. In the course of the company's painfull post mortem, senior managers are now no doubt in the process of arguing that the writing on the Brent-Spar wall was too hard to read. That may be true. But in the greenhouse, in the post- Brent Spar world, the writing on the wall is actually becoming much easier to read.

NOTES

[1] "Climate Change: The IPCC Scientific Assessment," Intergovernmental Panel on Climate Change, Report to IPCC from Working Group 1, edited by J. T. Houghton, G. J. Jenkins and J. J. Ephrams, WMO-UNEP, Cambridge University Press, 1990).

[2] "Global warming: element of risk," Swiss Re special report, 1994.

[3] Intergovernmental Panel on Climate Change, 1992 IPCC Supplement, Scientific Assessment of Climate Change, Final Report, Guangzhou, China, January 1992; 1994 IPCC Radiative Forcing report.

[4] J. K. Leggett, "Climate change and the insurance industry: solidarity among the risk community?" Greenpeace International Special Publication, February 1993; for accounts showing the evolving story of the insurance industry's awakening to the threat see also "Climate change and the future security of the reinsurance market: recent developments and upcoming issues for the industry," Journal of Reinsurance, v. 1, no. 2, p. 73-95, winter 1993; "Climate change," a report presented to the 26th Annual Meeting of the Reinsurance Association of America, Ritz-Carlton, Laguna Niguel, California, 29 April 1994; "Climate change and the financial sector," Journal of the Society of Fellows, Chartered Insurance Institute, January 1995; "Climate Change and Financial Institutions: Taking Bearings in the greenhouse," in Proceedings of a March 1995 seminar in Berlin, "Climate Change and the Financial Institutions," Gerling Verlag, Special Publication, in press.

[5] M. Mansley, "The long-term financial risks of climate change to the carbon-fuel industry," Delphi International, November 1994.

[6] "Burned by warming," Time Magazine, 14 March 1994.