Survey of Energy & Climate Issues, Oct 2005

- The big growth of world energy use
  - Energy supply will be a pressing problem
  - The lead times for new supply are usually 8 to 30 years

- How much more oil and gas is there?
  - Information from USGS, DOE, and IEA

- More people, more money, more production, better housing, more travel--------use more energy

- Show world energy use by source and purpose during 1970 – 2030 (lots of growth)

- Estimates of oil and gas use to 2080
  - As constrained by estimates of total supply

- Carbon dioxide from oil and gas to 2080

- Liquid fuels are very important now for transport
  - How to get more (tar sands, biodiesel, shale oil, alcohol, gas-to-oil, etc.)
  - Will there be enough good substitutes?

- A section about climate changes

- Global warming, politics, and Kyoto

- Review of three energy books

- Ready Oct 20, 2005, (201 pages), Doc RJ0386 and RJ0387
  - Part 1
  - Part 2

Roy Jenne
Oct 2005

The National Center for Atmospheric Research (NCAR) is sponsored by the National Science Foundation.
Will Countries Meet Kyoto Promises for 2012?
(Promises to reduce or limit CO₂ emissions)

✗ No: 13 of 15 main Kyoto signers will not meet promises

✗ Expected CO₂ emission increases:

<table>
<thead>
<tr>
<th>Country</th>
<th>Increase 2000 - 2010</th>
<th>Increase 2000 - 2025</th>
<th>Kyoto Goal was 1990 - 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>13.3%</td>
<td>40.7%</td>
<td>-7.0%</td>
</tr>
<tr>
<td>Canada</td>
<td>18.1%</td>
<td>42.9%</td>
<td>-6.0%</td>
</tr>
<tr>
<td>UK</td>
<td>9.9%</td>
<td>25.1%</td>
<td>-12.5%</td>
</tr>
<tr>
<td>Germany</td>
<td>2.8%</td>
<td>17.0%</td>
<td>-21.0%</td>
</tr>
<tr>
<td>Japan</td>
<td>8.9%</td>
<td>19.2%</td>
<td>-6.0%</td>
</tr>
<tr>
<td>Russia</td>
<td>14.1%</td>
<td>39.2%</td>
<td>0%</td>
</tr>
</tbody>
</table>

NOTE: These are increases from year 2000.

✗ See next pages for similar numbers for other countries

Roy Jenne
Sep 15, 2005
Europe set to miss Kyoto targets ‘by a mile’

London European countries are nowhere near complying with the Kyoto Protocol on climate change, energy economists have warned.

Over the past two months, European Union (EU) states have been working on plans for emission allowances before the 2005 opening of a market for trading carbon dioxide emissions. But almost all the national targets for industrial emissions are above levels needed to meet the Kyoto Protocol, according to the Carbon Trust, a group that lobbies on climate-change issues for the British government. “Member states are going to miss their Kyoto targets by a mile,” says Michael Grubb, the trust’s director of policy and an energy economist at Imperial College London.

The analysis, published on 2 July, shows that 9 of 12 countries plan to increase emissions in the next three years. But under Kyoto, the EU should cut emissions by 8% from 1990 levels by 2012. If signatories miss domestic targets they must invest in overseas projects to comply with the protocol.

| 8 July 2004 |
| Nature Mag |

Europe will miss the Kyoto targets

· 9 of 12 countries plan to increase CO₂ emissions in the next three years.
EU Wrestles With Business Over Emissions

Europe Leads Charge
On Global Warming;
Devil Is in the Details

By GEOFF WINSTOCK
Staff Reporter of THE WALL STREET JOURNAL
BRUSSELS—As the European Union wages an international battle against the U.S. to save the Kyoto Protocol on global warming, it faces an equally tough internal struggle over how to meet its own commitments to cut greenhouse-gas emissions.

Countries within the 15-member bloc are proceeding in different directions, and the tension recently forced the European Commission, the EU's executive arm, to delay indefinitely a proposal for EU emissions caps and a Europe-wide emissions-trading system. The commission and environmentalists want the EU to set mandatory emissions limits even before details are ironed out on the 1997 Kyoto Protocol, which commits ratifying countries to reduce their net greenhouse-gas emissions to well under 1990 levels by 2112. The commission argues that, without limits, it will be impossible to start emissions trading, which is potentially the most efficient and simplest way of reducing the discharge of greenhouse gases. "We must lead by example," says Margot Walstrom, the EU's environment commissioner.

On the other side are companies that consume a lot of energy, and thus produce high levels of greenhouse gases—gases such as carbon dioxide that accumulate in the atmosphere and contribute to global warming. These companies fear high penalties under a program of emissions restrictions. They want more time to work out the cheapest solution to their pollution problems, and worry about their ability to compete with companies in countries that don't restrict emissions.

"What we are against is the exaggerated ecological leadership which ... the European Union wants to administer," says Joachim Hein, environmental adviser for the Federation of German Industries.

That internal debate is likely to intensify whatever the results of a meeting next week in Bonn, which is supposed to work out details of the Kyoto Protocol. At that meeting, the EU will try to persuade Japan and other rich countries to proceed with the Kyoto plan, despite the Bush administration's opposition to it. Japan has said it won't support the treaty without U.S. participation. To take force, the accord must be approved by 55 countries representing at least 55% of total emissions.

Already, most EU countries have raised energy taxes and slapped on tougher emissions regulations. As a whole, the EU registered a 4% drop in greenhouse-gas emissions between 1990 and 1999, compared with increases of 16% in the U.S. and 7.8% in Japan.

The EU has been helped over the past decade by a switch away from coal to cheaper, cleaner natural gas, which is readily available in Europe, and by the one-time but significant impact of the collapse of smokestack industries in eastern Germany.

Greenhouse-Gas Targets

The greenhouse-gas emissions record for the U.S., Japan and several E.U. countries

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>25.0%</td>
<td>22.2%</td>
<td>-1.9%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Ireland</td>
<td>23.0%</td>
<td>22.1%</td>
<td>-0.9%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Japan</td>
<td>21.0%</td>
<td>16.0%</td>
<td>-5.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>18.0%</td>
<td>16.1%</td>
<td>-1.9%</td>
<td>5.0%</td>
</tr>
<tr>
<td>Italy</td>
<td>18.0%</td>
<td>14.4%</td>
<td>-3.6%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Denmark</td>
<td>20.0%</td>
<td>16.0%</td>
<td>-4.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>E.U.</td>
<td>18.0%</td>
<td>14.0%</td>
<td>-4.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Britain</td>
<td>18.0%</td>
<td>12.5%</td>
<td>-5.5%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Germany</td>
<td>18.0%</td>
<td>15.3%</td>
<td>-2.7%</td>
<td>4.0%</td>
</tr>
</tbody>
</table>

Sources: European Commission, European Climate Network

*Under the Kyoto Protocol and E.U. burden sharing

But in order to comply with the Kyoto accord, the EU must cut emissions even further. Officials in Brussels believe the simplest way to do that is to set rigid caps on the amounts of greenhouse gases that specific industries can produce. Britain and Denmark have already started moving in that direction, albeit with different methods; Germany, Spain and Italy have all recently expressed doubts.

Denmark this year launched the world's first program for capping and trading the rights to greenhouse-gas emissions. Power companies are hit with a penalty tax for each ton of carbon dioxide emitted above a certain level that will decline in years to come. But they can discharge above the limit and avoid the penalty by buying emissions credits from other companies whose emissions are below the maximum. The problem, Danish power companies say, is that Denmark has too few places such as the U.S. that don't have caps and taxes. The commission now says it will make further consultations before submitting any bill.

Many companies would prefer a system of caps based on meeting pollution-efficiency targets, rather than a limit on the number of tons of emissions. Britain offered that option this year when it introduced a system of emissions-limits and trading. For instance, Blue Circle Group PLC, a cement maker that is one of Britain's biggest industrial producers of carbon dioxide, opted to cap the tons of gas it emits per ton of cement it makes, enabling the company to increase production as long as it meets its efficiency targets. Neil Jenkins, environment manager for Blue Circle, acknowledges that the risk in this flexible approach is that overall emissions may not actually fall—but he argues that is unlikely. "It would be very embarrassing to us and the government," he says.
Table 17. Quantified Emissions Reduction Targets Under the Kyoto Protocol by Country

<table>
<thead>
<tr>
<th>Country</th>
<th>Reduction Target (Percent)</th>
<th>Country</th>
<th>Reduction Target (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>+8.0</td>
<td>Liechtenstein</td>
<td>-8.0</td>
</tr>
<tr>
<td>Austria (R)</td>
<td>-13.0</td>
<td>Lithuania (R)</td>
<td>-8.0</td>
</tr>
<tr>
<td>Belgium (R)</td>
<td>-7.5</td>
<td>Luxembourg (R)</td>
<td>-23.0</td>
</tr>
<tr>
<td>Bulgaria (R)</td>
<td>-8.0</td>
<td>Monaco</td>
<td>-8.0</td>
</tr>
<tr>
<td>Canada (R)</td>
<td>-6.0</td>
<td>Netherlands (R)</td>
<td>-6.0</td>
</tr>
<tr>
<td>Croatia</td>
<td>-5.0</td>
<td>New Zealand (R)</td>
<td>0.0</td>
</tr>
<tr>
<td>Czech Republic (R)</td>
<td>-8.0</td>
<td>Norway (R)</td>
<td>+1.0</td>
</tr>
<tr>
<td>Denmark (R)</td>
<td>-21.0</td>
<td>Poland (R)</td>
<td>-6.0</td>
</tr>
<tr>
<td>Estonia (R)</td>
<td>-8.0</td>
<td>Portugal (R)</td>
<td>+27.0</td>
</tr>
<tr>
<td>European Community (R) 8</td>
<td>-8.0</td>
<td>Romania (R)</td>
<td>-8.0</td>
</tr>
<tr>
<td>Finland</td>
<td>0.0</td>
<td>Russia</td>
<td>0.0</td>
</tr>
<tr>
<td>France (R)</td>
<td>0.0</td>
<td>Slovakia (R)</td>
<td>-8.0</td>
</tr>
<tr>
<td>Germany (R)</td>
<td>-21.0</td>
<td>Slovenia (R)</td>
<td>-8.0</td>
</tr>
<tr>
<td>Greece (R)</td>
<td>+25.0</td>
<td>Spain (R)</td>
<td>+15.0</td>
</tr>
<tr>
<td>Hungary (R)</td>
<td>-6.0</td>
<td>Sweden (R)</td>
<td>+4.0</td>
</tr>
<tr>
<td>Iceland (R)</td>
<td>+10.0</td>
<td>Switzerland (R)</td>
<td>-8.0</td>
</tr>
<tr>
<td>Ireland (R)</td>
<td>+13.0</td>
<td>Ukraine</td>
<td>0.0</td>
</tr>
<tr>
<td>Italy (R)</td>
<td>-6.5</td>
<td>United Kingdom (R)</td>
<td>-12.5</td>
</tr>
<tr>
<td>Japan (R)</td>
<td>-6.0</td>
<td>United States</td>
<td>-7.0</td>
</tr>
<tr>
<td>Latvia (R)</td>
<td>-8.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(R) = Country has ratified, accepted, approved, or acceded to the Kyoto Protocol.

European Union member countries renegotiated their individual targets under the EU Shared Burden Agreement, which was agreed to in 1988 and reaffirmed in the ratification of the Kyoto Protocol in 2002.


Comments:

It is interesting that Spain gets to increase its greenhouse emissions by 15%, Sweden up 4%, Australia up by 8%, but Canada must decrease by 6%. One wonders why Canada agreed to this.

Actually, many countries are now well above their 1990 emissions, and will not be able to make their agreements to reduce carbon dioxide, etc.

If the population of a country goes up, and the economy goes up a lot, and people travel more, then it is especially hard to reduce the emissions of carbon dioxide.
Table A9. World Carbon Dioxide Emissions by Region, Reference Case, 1990-2025
(Million Metric Tons Carbon Dioxide)

<table>
<thead>
<tr>
<th>Region/Country</th>
<th>History</th>
<th>Projections</th>
<th>Average Annual Percent Change, 2001-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrialized Countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North America</td>
<td>5,769</td>
<td>6,731</td>
<td>6,613</td>
</tr>
<tr>
<td>United Statesa</td>
<td>4,989</td>
<td>5,787</td>
<td>5,692</td>
</tr>
<tr>
<td>Canada</td>
<td>473</td>
<td>581</td>
<td>569</td>
</tr>
<tr>
<td>Mexico</td>
<td>308</td>
<td>364</td>
<td>352</td>
</tr>
<tr>
<td>Western Europe</td>
<td>3,412</td>
<td>3,442</td>
<td>3,465</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>600</td>
<td>553</td>
<td>563</td>
</tr>
<tr>
<td>France</td>
<td>374</td>
<td>401</td>
<td>396</td>
</tr>
<tr>
<td>Germany</td>
<td>995</td>
<td>828</td>
<td>819</td>
</tr>
<tr>
<td>Italy</td>
<td>415</td>
<td>443</td>
<td>445</td>
</tr>
<tr>
<td>Netherlands</td>
<td>211</td>
<td>228</td>
<td>248</td>
</tr>
<tr>
<td>Other Western Europe</td>
<td>816</td>
<td>989</td>
<td>994</td>
</tr>
<tr>
<td>Industrialized Asia</td>
<td>1,280</td>
<td>1,526</td>
<td>1,556</td>
</tr>
<tr>
<td>Japan</td>
<td>987</td>
<td>1,138</td>
<td>1,158</td>
</tr>
<tr>
<td>Australia/New Zealand</td>
<td>294</td>
<td>387</td>
<td>398</td>
</tr>
<tr>
<td>Total Industrialized</td>
<td>10,462</td>
<td>11,699</td>
<td>11,634</td>
</tr>
<tr>
<td>EE/FSU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Former Soviet Union</td>
<td>3,798</td>
<td>2,338</td>
<td>2,399</td>
</tr>
<tr>
<td>Russia</td>
<td>2,405</td>
<td>1,570</td>
<td>1,614</td>
</tr>
<tr>
<td>Other FSU</td>
<td>1,393</td>
<td>767</td>
<td>785</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>1,104</td>
<td>756</td>
<td>748</td>
</tr>
<tr>
<td>Total EE/FSU</td>
<td>4,902</td>
<td>3,094</td>
<td>3,148</td>
</tr>
<tr>
<td>Developing Countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developing Asia</td>
<td>3,994</td>
<td>5,709</td>
<td>6,012</td>
</tr>
<tr>
<td>China</td>
<td>2,262</td>
<td>2,861</td>
<td>3,050</td>
</tr>
<tr>
<td>India</td>
<td>561</td>
<td>914</td>
<td>917</td>
</tr>
<tr>
<td>South Korea</td>
<td>234</td>
<td>425</td>
<td>443</td>
</tr>
<tr>
<td>Other Asia</td>
<td>937</td>
<td>1,509</td>
<td>1,602</td>
</tr>
<tr>
<td>Middle East</td>
<td>846</td>
<td>1,262</td>
<td>1,299</td>
</tr>
<tr>
<td>Turkey</td>
<td>129</td>
<td>184</td>
<td>184</td>
</tr>
<tr>
<td>Other Middle East</td>
<td>717</td>
<td>1,078</td>
<td>1,115</td>
</tr>
<tr>
<td>Africa</td>
<td>656</td>
<td>811</td>
<td>843</td>
</tr>
<tr>
<td>Central and South America</td>
<td>703</td>
<td>961</td>
<td>964</td>
</tr>
<tr>
<td>Brazil</td>
<td>250</td>
<td>343</td>
<td>347</td>
</tr>
<tr>
<td>Other Central/South America</td>
<td>453</td>
<td>618</td>
<td>617</td>
</tr>
<tr>
<td>Total Developing</td>
<td>6,200</td>
<td>8,744</td>
<td>9,118</td>
</tr>
<tr>
<td>Total World</td>
<td>21,563</td>
<td>23,536</td>
<td>23,899</td>
</tr>
</tbody>
</table>

*Includes the 50 States and the District of Columbia.

Notes: EE/FSU = Eastern Europe/Former Soviet Union. The U.S. numbers include carbon dioxide emissions attributable to renewable energy sources.

Rift over successor to Kyoto is as wide as ever

A United Nations seminar in Bonn, Germany, last week failed to end the transatlantic impasse over climate change, especially once the Kyoto Protocol has expired in 2012.

The treaty, which came into force in February, requires industrialized countries to reduce their emissions of greenhouse gases. The European Union has called for a follow-up commitment that would require emissions to be cut by 15–30% relative to 1990 levels by 2020.

This goal is hardly achievable without the cooperation of the United States, which withdrew from the protocol in 2001 and is the world's largest producer of greenhouse gases. But the United States made no sign last week of going back on its brusque rejection of mandatory targets for reducing emissions.

One positive sign was a move led by several less-industrialized countries, including China and Papua New Guinea, towards more actively tackling climate change, says Karla Schoeters, director of the Climate Action Network, a European umbrella agency working on climate and energy issues.

#

26 May 2005

Hazy prospects: the future of agreements on greenhouse-gas emissions is clouded in doubt.

1. Note: The promises from the first Kyoto will not be met. It promised a 5% reduction from 1990.

2. Europe wants the next one to give a 15 to 30% reduction vs 1990, all this done by 2020. (Only 15 years away).
Kyoto — the sequel

Better knowledge of the carbon cycle could provide a basis for future climate-change agreements.

The Kyoto Protocol has only just come into force, but its 2012 expiration date already looms large on the horizon. A successor agreement faces some formidable political obstacles. But negotiators should put these to one side for now and ask themselves this: what kind of agreement is best justified by our current knowledge of climate science?

Negotiations on Kyoto II are due to begin at the eleventh meeting of the parties to the United Nations Framework Convention on Climate Change in Montreal in November. Climate science, and the tools that researchers can use to detect global change, have advanced significantly since 1997, when the Kyoto Protocol was negotiated.

These improvements must be considered when laying the basis for what comes after 2012.

One important advance has been the study of global carbon cycles — the large-scale carbon fluxes between the biosphere, the atmosphere and the oceans. Siberia, for example, is likely to undergo significant changes in vegetation, wildfire frequency and permafrost abundance, which all have a substantial impact on global carbon transfers (see page 732). Similar changes are being observed in other terrestrial ecosystems, including tropical rainforests and deserts.

Meanwhile, better satellite sensors, in combination with other remote-sensing techniques, provide ever more accurate data about biomass changes on the ground. The Siberian work has demonstrated that it is possible, in principle, to reliably determine carbon flux to and from Earth’s main carbon reservoirs.

In a few years’ time, a comprehensive, global carbon accounting system, incorporating natural carbon fluxes between the ground, the oceans and the atmosphere, as well as anthropogenic emissions, could be in place. Global carbon accounting, if it can be shown to work, would greatly reduce uncertainty about changes in atmospheric greenhouse-gas levels. And our understanding of climate sensitivity — the response of the climate to changing greenhouse-gas levels — is slowly improving (see, for example, J. M. Murphy et al. Nature 430, 768–772; 2004).

All this could strengthen the case for a Kyoto II agreement that would incorporate a target for the parameter of central importance in determining the course of climate change: the concentration of greenhouse gases in the atmosphere. A new agreement could have such a target at its core, advocates suggest. Such a deal would also include emissions targets, but would be flexible enough to allow changes in these secondary targets as more evidence comes to light, or if natural carbon cycles don’t behave as expected.

At their summit meeting in March, European Union (EU) leaders announced a goal of keeping global temperature rise below 2°C over pre-industrial levels. As temperatures have already increased by around 0.7°C, this would limit future warming to 1.3°C. The EU has also tentatively suggested that a 15–30% cut in greenhouse-gas emissions should be sought by 2020.

But targets based on temperature or on emission ceilings still suffer credibility problems. With climate sensitivity still under debate, any given temperature target is necessarily associated with a broad range of possible emissions levels. Likewise, any emission target corresponds to a very wide range of temperature-change scenarios.

Focusing on greenhouse-gas concentrations could help policymakers steer clear of this uncertainty trap. An interim goal of, say, 400 parts per million of carbon dioxide by 2030 might attract widespread political support. Given advances in global carbon accounting, it would also be more manageable and backed by more solid science than the other options. Such a target would have to be supported by goals for greenhouse-gas emissions, but these could be open to some modification in response to real-world observations and advances in scientific knowledge.

The Intergovernmental Panel on Climate Change (IPCC) — the scientific branch of the convention — is already compiling the latest advances in the science of climate change for its next assessment report, due in 2007. The challenge is to incorporate this knowledge into a viable, fair and effective new agreement.

“Kyoto II agreement could incorporate a target for the concentration of greenhouse gases in the atmosphere.”

Given the trenchantly negative approach of the current US administration (which will itself expire in 2008), it falls to the EU and developing countries to ensure that the Montreal meeting makes progress towards drafting a new agreement. Their negotiators, backed by the IPCC’s findings and the climate-research community, must be decisive in translating the available scientific knowledge into a workable framework for the treaty that will succeed Kyoto.
In 2003 the UK Planned for Huge Cuts in CO₂ by 2050

◆ In Feb 2003, the UK promised to reduce carbon dioxide emissions by 60% by year 2050.
  • This is a huge cut and an amazing promise.
  • See the story about this plan (2 pages ahead).

◆ This plan was written by a group of people who believed it was possible to make these enormous cuts in CO₂ by using more renewable energy and increasing the energy efficiency. They would stop using coal and nuclear.
  • Other people in the UK did not believe that the plan was realistic (I agree).
  • Other countries have similar groups of “experts” who would write a similar plan for energy and CO₂. Help.

◆ The US president advised the UK to keep the nuclear option open because it would probably be needed.

◆ Now (Aug 2005) the experience and opinion in the UK seems to be moving toward the idea: “We must use nuclear.”

◆ Most of the countries will not achieve their promises for carbon release in 2012.

◆ Let us hope that better energy and CO₂ plans will gradually emerge.

◆ Senior advisors in the UK speak for nuclear (next page).

Roy Jenne
Sep 7, 2005
The threat of global warming and high fossil fuel prices have inspired talk of a revival of nuclear power, but skeptics say it is a poor investment and a worse security risk.

Is the Friendly Atom Poised for a Comeback?

"Nuclear power faces stagnation and decline." So warned a group of scientists in a sweeping review published 2 years ago by the Massachusetts Institute of Technology (MIT) in Cambridge. Led by chemist John Deutch and physicist Ernest Moniz, both of MIT, the study concluded that nuclear power was in trouble and deserved a helping hand from government. Despite high construction costs, the authors argued that the United States should triple the number of nuclear power plants by midcentury because they can deliver electricity without emitting greenhouse gases such as CO₂.

Although a few Asian countries never got off the nuclear bandwagon, new ones are now climbing aboard to meet rapidly growing electricity demand. India, with the most reactors under construction in the world, is planning a unique system that relies mainly on thorium rather than uranium fuel (see p. 1174). Japan continues work on fast neutron reactors that can "breed" plutonium (see p. 1177). And China announced in April that it will more than quadruple its nuclear electric capacity by 2020, buying among other designs a new "pebble bed" reactor that shuts down if it overheats. Nuclear advocates in the West also hope that advanced reactor designs can help overcome the lingering memories of Three Mile Island and Chernobyl (see p. 1172).

I entreat my friends in the movement to drop their wrong-headed opposition [to it]." A few others, such as Greenpeace co-founder Patrick Moore, have made similar statements. But environmental advocacy groups are not following.

"It is difficult to see how we can reduce our dependence on fossil fuels without the help of nuclear power." —ROBERT MAY, PRESIDENT OF THE ROYAL SOCIETY, U.K.

UK: Need for nuclear

David King, science adviser to the U.K. government, has spoken publicly about the need to keep nuclear power as a clean energy option. Britain, the world's most visible campaigner for action on global warming, faces a common dilemma, as King explained to the Independent newspaper in May. He described a looming "gap" in clean energy production. About 27% of U.K. electricity now comes from nuclear power, he noted, but without a "new build," only one reactor unit (Sizewell B) will still be running in 2025, producing an estimated 4% of the needed electricity. King said he was "not a great fan of nuclear" but was willing to consider it because "the climate change issue is so important."

A recent U.K. government forecast lends weight to King's analysis: Solar panels, windmills, and wave-driven generators cannot pick up the slack anytime soon. An electricity strategy issued in May by the U.K. Council of Science and Technology, which reports to King, notes that "the existing policy to reduce CO₂ will not be sufficient ... since the nuclear stations are likely to be replaced by carbon-based technology (e.g., gas) in the short term."

UK: Goals to reduce CO₂

And even the United Kingdom, which has championed the international effort to curb CO₂ emissions, is failing to meet its self-imposed CO₂ reduction goals. Physicist David Wallace, vice president of the Royal Society in London, warned in May that "our emissions are clearly going in the wrong direction," and that U.K. government forecasts of achievable CO₂ reductions have been "frankly unrealistic." Royal Society president Robert May has written that "it is difficult to see how we can reduce our dependence on fossil fuels without the help of nuclear power."
Britain to Cut CO₂ Without Relying on Nuclear Power

CAMBRIDGE, U.K.—Britain and the United States may be marching side by side to war in Iraq, but their energy policies could not be more different. Prime Minister Tony Blair’s government announced this week that it wants to up the ante on reducing carbon emissions over the next half-century, without building any new nuclear power stations. Lauded by environmentalists as “a crucial landmark,” the Energy White Paper is nonetheless taking heavy flak from energy experts.

In what seems the death blow to nuclear energy in this country, the white paper outlines a plan to reduce levels of carbon dioxide in the atmosphere by increasing funding and incentives for companies to invest in renewable energy sources, such as wind, wave, and tidal power. “Climate change is a clear and present danger,” says Trade and Industry Secretary Patricia Hewitt. “The government is serious about cutting carbon emissions, but we know this cannot be achieved without a fundamental review of the way we produce and consume energy.”

Over the next 50 years, the U.K. aims to cut its carbon dioxide output by 60% from today’s levels, substantially more than is required by the Kyoto Protocol. It intends to do so by setting tougher standards for energy efficiency and by boosting renewable energy from its current 3% of total energy capacity to 10% by 2010 and 20% by 2020. If achieved, this ramping up of renewables will offset the decline of nuclear power as the country’s 33 nuclear reactors—which now produce 26% of Britain’s energy—reach the end of their working lives over the next 30 years.

Prior to publication of the white paper, several scientific bodies, including the Royal Society and the Institute of Physics, as well as the government’s own chief scientific adviser, David King, all warned the government against abandoning nuclear power entirely. And the government has not shut the door: If renewables do not fill the gap, new nuclear stations could be built.

Energy experts consulted by Science were generally skeptical of the government’s plans. “To try to reduce carbon dioxide by 60% is a fantastic thing to do. But I don’t think it is remotely achievable,” says Ian Fells, an energy consultant and professor of energy conversion at the University of Newcastle upon Tyne. And electrical engineer Mike Laughton of London’s Queen Mary College believes that a 20% share of renewable energy is wishful thinking: “It is totally aspirational and not realistic at all.”

The government has put several measures in place to achieve its 20% ambition. There is $95 million in new money for renewable projects, raising spending on renewable energy to $550 million over 4 years. Further tax breaks will endow the renewables industry with an estimated $1.6 billion a year by 2010. In addition, planning regulations will be loosened to speed approval of onshore and offshore wind farms.

Although critics of the white paper concede that renewable energy needs to be pushed, they argue that a mix of nuclear and renewables is more realistic. Wind is a notoriously unreliable power supply, they say, so nuclear energy or conventional gas-fired power stations are still needed as a backup. “A wind policy is not an emission-free policy in total,” says Laughton. “[The white paper] will be taken to pieces gradually and sorted out.”

—DANIEL BACHTOLD
Feb 2003

• Britain aims to reduce carbon dioxide emissions by 60% by 2050 from today’s levels.
• They plan for a decline in nuclear energy (now 26%) as the 33 nuclear plans are retired over the next 30 years.
• Several science bodies and key government scientists advised against abandoning nuclear power. This was before the plan was printed.
• The Energy White Paper is taking heavy flak from energy experts.
• One engineer believes that a 20% share of renewable energy is wishful thinking.
• **MY COMMENTS:** Credible energy plans must be based on real numbers, and a good analysis of energy possibilities, costs, and tradeoffs. Present day planning often does not do a good job of this. Why is this?

*Story from Science Mag*

28 Feb 2003 p1291

Rog Neair
Electricity

The power to change

This is more like reality than what I have seen before.

Large bits of Britain’s power-generation capacity will disappear over the next decade. That will test the government’s commitment to markets.

Unlike most other industrialised nations, Britain has long had the good fortune to be self-sufficient in energy. Partly because of that it has, for the past decade, pursued an unusually free-market approach towards electricity generation. Over the next ten years, however, the government’s commitment to that policy will be tested. Oil and gas production from the North Sea is running down, meaning that Britain will rely increasingly on imports. That will coincide with big changes in the electricity market, as many of Britain’s coal and nuclear power plants (which between them produce over half of the nation’s electricity) begin to go off-line.

For nuclear power, the problem is age. Atom-splitting provides a fifth of Britain’s electricity, but most of the reactors are decades old and near the end of their operational lives. Ten years from now, nuclear’s share of generation is expected to fall to 11%; by 2020 it will be just 7%.

For coal, greenery is responsible. Tough new environmental rules, especially a European directive requiring coal stations to fit expensive chimney-scrubbing equipment, will make it harder for coal to pay its way. Plants that don’t comply with the new rules will have to shut by 2012. Malcolm Grimston of the Royal Institute of International Affairs (RIIA) thinks that half Britain’s coal capacity is threatened.

The government has not been entirely hands-off during these years of plenty. Its flagship policy has been subsidies for renewable energy—mostly wind power—justified on environmental grounds. Supporters point out that renewables can make a contribution to energy security as well as reducing carbon emissions. Ministers want renewables to generate a tenth of Britain’s electricity requirements by 2010.

But, says Gareth Davies, a researcher at Oxera, a consultancy, that seems a vain hope. And although renewables don’t require fuel and are, in that sense, the most secure of all energy supplies, they are intermittent—especially windmills, which are useless on a still day. This makes them unsuitable to replace the reliable “base-load” provided by coal and nuclear plants.

Complaints about the cost are growing, too. The National Audit Office, an independent watchdog, predicts that subsidies to renewables will cost £1 billion ($1.8 billion) a year by 2010. A recent report from the Public Accounts Committee reckons that another £1.5 billion will be needed if the national grid is to reach out-of-the-way wind farms, and complains that none of the subsidies are scrutinised by Parliament. And while the public likes the idea of renewables, it is less keen on the reality, with fierce planning battles springing up over several proposed wind farms.

An alternative is to replace old nuclear plants with new ones. The nuclear lobby is busily pointing out that nuclear power is well-understood, carbon-free, and would contribute to security of supply (uranium can be bought from stable, friendly countries such as Australia and Canada). New reactor designs, says the industry, are cheaper, cleaner, and easier to build. The European Emissions Trading Scheme, which puts a price on carbon, is raising the cost of nuclear’s fossil-based competitors.

But historically, atomic energy has had a vast appetite for public money, and its economics are still tricky. Although they are cheap to run, nuclear plants are expensive to build (see chart). Investors are wary of an industry with big, front-loaded capital costs that are repaid over several decades. In Finland, currently building one of the new generation reactors, long-term contracts between power users and suppliers help mitigate these problems. Without some form of government intervention...
The Theology of Global Warming

By James Schlesinger

Almost unnoticed, the theology of global warming has in recent weeks suffered a number of setbacks.

If only we would repent and sin no more, mankind’s actions could end the threat of further global warming. By implication, the cost, which is never fully examined, is bearable. So far the evidence is not convincing. It is notable that 13 of the 15 older members of the European Union have failed to achieve their quotas under the Kyoto accord—despite the relatively slow growth of the European economies.

July 05

The drumbeat on global warming was intended to reach a crescendo during the run-up to the summit at Gleneagles. Prime Minister Blair has been a leader in the global warming crusade. (Whether his stance reflects simple conviction or the need to propitiate his party’s Left after Iraq is unknown.) In the event, for believers Gleneagles turned out to be a major disappointment.

On the eve of the summit, the Economic Committee of the House of Lords released a report sharply at variance with the prevailing European orthodoxy. Some key points were reported in the Guardian, a London newspaper not hostile to that orthodoxy:

- The science of climate change leaves “considerable uncertainty” about the future.
- There are concerns about the objectivity of the international panel of scientists that has led research into climate change.
- The Kyoto agreement to limit carbon emissions will make little difference and is likely to fail.
- The U.K.’s energy and climate policy contains “dubious assumptions” about renewable energy and energy efficiency.

Most notably, the Committee itself concluded that there are concerns about the objectivity of the IPCC [Intergovernmental Panel on Climate Change] process and about the IPCC’s crucial emissions scenario exercise.

Their lordships’ conclusions were probably not welcomed at No. 10.

13 of 15 European countries will not meet Kyoto promises.

- The U.K. wanted a drumbeat about Global warming.
- The House of Lords (UK) released a different report

Key points from it were in a major London Newspaper

This was really a surprise to me. Wow!

Ray James
COMMENT

Does Oil Have a Future?

Even the industry has its doubts

BY CLIVE CROOK

The energy bill that emerged from Congress this past summer could be the last of its kind. Certainly it ought to be. Missing the point at such an inordinate expense of effort, words, and dollars is plain bad government.

At only a little under 2,000 pages, the new legislation is exhausting but, surprisingly, by no means exhaustive. Somewhere in the vast spaces of the Energy Policy Act, you might think, room could have been found for actions that actually addressed the two main energy-policy challenges of the next decade: global warming and the national-security implications of dependence on imported oil. But no, the authors of this purportedly comprehensive law mostly chose to concentrate on other issues. Severely pressed for time (remember, they had been working on this for years), they had urgent battles to win on subsidies and tax breaks for their respective energy-producing constituencies.

None of this is new, admittedly. Energy bills have been that way for as long as anybody can remember. So why are things likely to be different when the next energy bill gets written? Because, for the first time, economics and politics are starting to align.

Economics starts with the price of oil. When this sits at around $50 a barrel or higher—and, more important, is expected to stay there—ambitious efforts to conserve the stuff look attractive. Businesses and consumers economize. Firms invest in oil-saving technologies, including new fuels. Oil producers respond as well, adding to refining capacity (the chief bottleneck of late), spending more on exploration, and, as the frontier of profitable extraction advances, bringing previously marginal sources on-stream. In the past demand and supply have both responded to higher prices even more powerfully than expected.

This raises the question whether future increases in price will merely be curbed, or whether the price might even drop sharply again—say, to $20 a barrel or less. In such a strange nonmarket this is always possible. At the moment, oil traders are contemplating the potentially awesome appetites of China and India, and betting against it.

The prospect of expensive oil for the foreseeable future, and the risk that the price will go far higher yet, have put the industrial economies, including the United States, in the mood to save oil.

What is interesting is that thanks to shifting politics, this is no longer regarded as bad news. Moderating America's thirst for oil
is widely seen nowadays as a good thing, regardless of price. Security is one reason. Dependence on imported oil exposes America to political risk in the most turbulent part of the world. Whatever one’s views about the war in Iraq—or about 9/11, for that matter—oil dependence is part of what lies behind those events, and the connection is widely understood. Geopolitical types, including some from the right, increasingly want to pursue energy efficiency, and oil efficiency in particular, as a matter of national security.

These voices are now oddly in harmony with those of environmentalists, mostly on the left, who are calling for drastic measures to curb emissions of greenhouse gases. The science of global warming is nothing like as settled as the environmental movement’s spokesmen and media followers would have people believe: projections of future warming are still uncertain, and exactly what one ought to do about greenhouse-gas emissions, even if those uncertainties go away, would be hard to say. Nonetheless, a political alliance of greens and geostategists has formed, and continues to grow, around the idea that America must use less oil.

It is telling that many oil and other old-energy companies are already working on this assumption, and trying to spread their risks. They are big investors in clean or renewable fuels such as wind, solar, hydrogen, and biomass. Anticipating a new carbon-constrained economy, they are also throwing money at research on “sequestration”: ways to remove carbon from the air and store it underground. Nuclear power, assisted by heavy subsidies, is making a comeback. This transformation of the energy business would be less of a gamble for the firms concerned if they could be sure that a year from now the world will not be seeing another oil glut. And that is why some big energy companies are leading rather than resisting calls for a new policy—a coherent, stable blend of taxes, public spending, and regulation—to lessen America’s demand for oil.

Devising such a policy will be the challenge for the next energy bill, which is needed soon. Is it simply a matter of America’s deciding to follow Europe’s lead—to accept the Kyoto treaty on greenhouse-gas emissions and mandate abrupt cuts in oil consumption? With luck, no. That is a bad model. Europe’s commitment to the Kyoto process is shallow. Most countries are likely to miss their Kyoto targets, and the few that reach them will do so because of changes (such as Britain’s switch from coal to natural gas in power generation) that predate Kyoto and were made for other reasons altogether.

Kyoto is not a good plan for the United States or for any other country. Europe’s superior virtue on the issue is mostly affectation. The fact is, attitudes are converging, and policies are likely to follow. Speaking at the Aspen Ideas Festival in July (an event co-sponsored by The Atlantic), Bill Clinton said that the greatest threat facing mankind this century is not nuclear, biological, or chemical terrorism but global warming. He was warmly applauded, and—right or wrong—this is no longer a distinctively European point of view. Responding intelligently to the danger, such as it is, calls not for crushing, top-down controls, as Europe is finding out, but for a more pragmatic blend of private innovation and supportive public policy.

However, the right policies are not in place. Subsidies to encourage oil production, the mainstay of the energy bill, would be wrong even if oil were cheap and industry margins thin. Work on new fuels is worthier of support (but not ethanol, another big energy-bill beneficiary, which isn’t very clean). Best and cheapest of all is oil conservation, including the use of hybrid vehicles and other technologies. Supporting such efforts with subsidies, however, is complicated and—given the ingenuity of those seeking subsidy—often wasteful.

There is a simpler way. Burning petroleum imposes costs (insecurity, carbon) on society at large. It is a perfect case of externality—and the best remedy, whatever the price of oil may be, is a tax that pushes those costs back to the consumer. It would raise some badly needed revenue at the same time. That is correct: a gas tax. Its time is coming.
Kyoto? Mamma Mia! Oct 7 2005

By Antonio Martino

ROME—The devastating hurricanes that hit the United States recently offered “eco-doomsayers”—who like to blame human activities, preferably of the industrial kind, for all sorts of natural disasters—yet another chance to lash out at the Bush administration. America's “failure” to ratify the Kyoto Protocol—regularly held responsible for extreme weather conditions around the globe—was quickly found guilty of the destruction brought about by Katrina and Rita. As usual, the eco-doomsayers care very little for the small fact that their sweeping accusations have absolutely no basis in modern science.

First of all, it is not true that President George W. Bush is alone in opposing the Kyoto agreements that his predecessor Bill Clinton signed. In fact, when Kyoto was submitted to the U.S. Senate for ratification on July 27, 1999, the result was 95 nays and zero yeas. Not a single senator, not even from the most liberal fringe, voted in favor of Kyoto. (The ratification of international treaties requires the support of at least two-thirds of the Senate.)

Mr. Bush’s position, in other words, is not simply the product of a supposedly archconservative president who arrogantly imposes his radical views on a nation held hostage by religious zealots—as a rather popular myth here in Europe would have it. It is instead a view shared widely on both sides of the aisle in Congress and supported by the vast majority of the American public.

Second, there is no scientifically sound link between rising global temperatures and an increase in the frequency and intensity of hurricanes. Nor are the events of the recent weeks unprecedented: As Max Mayfield, Director of the National Hurricane Center, pointed out, a comparable series of hurricanes of similar intensity has already been observed in 1915.

Third, and most important, while a scientific consensus about the true nature of climate change is still lacking, we know for certain that the impact of Kyoto on the average global temperature will be negligible at best. The U.N.'s Intergovernmental Panel on Climate Change forecasts that without the ratification of Kyoto, the average global temperature will rise about one degree Celsius by 2050. The same panel predicts that after the implementation of Kyoto, the temperature will still rise 0.94 degrees. In other words, the benefits from Kyoto amount to about 0.06 degrees in half a century. Remarkably, this is even the most optimistic estimate. S. Fred Singer—the climatologist who developed the method for measuring the ozone layer—reckons that it may be as small as 0.02 degrees. This is a difference so minuscule that our available instruments wouldn’t even be able to notice it!

Moreover, the U.S. is not the only country that did not ratify the Kyoto Protocol. Both China and India, major and growing producers of so-called “greenhouse-gas emissions,” are not required to abide by its terms. The EU countries, including my own, ratified Kyoto. That the EU would still insist on implementing the protocol must be seen as an institutional form of collective self-flagellation. Kyoto will severely penalize the European economy without bringing any real progress toward the noble aims proclaimed by the EU. As Carlo Stagnaro, environmental director at the Istituto Bruno Leoni, Italy’s free-market think tank, observes, the Earth’s atmosphere cannot tell European carbon dioxide emissions from the rest of the world’s.

What’s more, the limitations imposed by Kyoto will make our current energy problems worse. The relative slowing of oil prices after the steep rise of the last weeks must not deceive us—the world’s energy demand is bound to grow in lockstep with the breathtaking economic growth of China and India.

Those countries, such as Italy, that for decades steered clear of building new power plants and gave up on nuclear power—the cleanest, safest and cheapest energy source available today—will need to face up to a harsh reality: Compliance with the Kyoto Protocol will punish even the existing energy-producing capacity by capping emissions. The cost of energy in Italy, already higher than the European average, will increase to that in the U.S., will go up even more. Given the country’s lack of competitiveness, that can only be described as a self-inflicted wound.

Perhaps the problems of our times are manufactured, after all. But rather than being caused by those “necons” in Washington, they stem from the noble intentions of environmentalists so bent on “saving nature” that in the process they wage an unrelenting war against mankind and its endeavors.

Mr. Martino is Italy’s defense minister.
Politics and Pressure on Global Warming

Bush Faces Heat Over Global Warming
As Political Pressure Grows From Key Allies, Administration Could Be Forced to Act

June 20, 2005

Points of View
A sampling of editorial comment from around the nation and world

Earth to George: I'm hot

June 18, 2005

Schwarzenegger: Calif. will reduce greenhouse gases
Governor's plan at odds with White House policy
By Terence Chua June 2, 2005

Mayors sign green treaty
By Justin M. Norton
Associated Press
SAN FRANCISCO — Mayors from around the world on Sunday signed an international treaty calling for increased use of public transportation and drastic cuts to the amount of trash sent to landfills.

June 6, 2005
Bush Faces Heat Over Global Warming

As Political Pressure Grows From Key Allies, Administration Could Be Forced to Act

President Bush is facing new pressure from key allies—both abroad and in his own Republican Party—for tougher action on global warming. While the White House remains opposed to new regulations, the shifting politics of the issue could force Mr. Bush to move further this summer on curbing greenhouse gases.

In the latest sign of change, Senate Energy Chairman Pete V. Domenici is indicating support for legislation mandating limits on carbon emissions. That raises the prospect that Congress this year could pass global-warming regulations for the first time. And it comes as European leaders prepare to lobby President Bush next month to pledge stronger action against so-called greenhouse gases at the annual summit of the Group of Eight leading nations.

Mr. Domenici’s chief of staff, Alex Flint, says the New Mexico Republican has become “convinced” by leading scientists in the U.S. that the damages caused by climate change are real “and we need to do something about it.” As a result, Mr. Flint says, “there is a very real possibility” that Mr. Domenici will cosponsor this week a measure with his fellow New Mexican, Jeff Bingaman, the top Democrat on the Energy Committee, that would set up a system requiring annual limits on emissions, and forcing companies exceeding those caps to buy “permits” allowing the emissions. The Senate is expected to debate global warming this week as part of deliberations on an energy bill moving through Congress.

Mr. Domenici’s interest in the Bingaman approach reflects the search for middle ground in the climate-change debate, even as the Bush administration and many business groups in the U.S. continue to question the most dire predictions about global warming.

The group that came up with the proposal behind Sen. Bingaman’s bill is the National Commission on Energy Policy. The foundation-funded organization has members from both political parties and from industry as well as labor and environmental groups. Among the commission’s corporate members are former executives of Ford Motor Co. and oil producer ConocoPhillips, as well as John Rowe, chairman and chief executive of utility Exelon Corp.

The commission’s recommendations are less severe than those in the international Kyoto Protocol treaty, which the U.S. has rejected. They’re also less stringent than a bill the Senate debated this week in the Senate proposed by Joseph Lieberman, D. (Conn.), and John McCain, R. (Ariz.). The Kyoto treaty would have required the U.S. to cut global-warming emissions 7% below 1990 levels by 2012. The McCain-Lieberman bill also would require the U.S. to cut emissions, though less sharply: to 2000 levels by 2010.

By contrast, the commission’s proposal introduced by Sen. Bingaman wouldn’t require an absolute cut in U.S. emissions. It would, like the Bush administration’s preferred approach, slow the growth in emissions as the economy expands. Unlike the Bush approach, though, the Bingaman proposal would make that slow growth mandatory. Under the plan, the Department of Energy would issue companies allocations or permits for certain levels of emissions annually. Each year after 2009, the supply of permits, measured against U.S. economic output, would shrink by 2.5% requiring companies to reduce their emissions or to buy more permits from the government.

Additional permits could be bought from other companies or at government auctions, says Bob Simon, Sen. Bingaman’s chief of staff. Revenue from the sale of allocations would go into the “Climate Change Trust Fund,” run by the Treasury Department. The money would be used for incentives for new technologies that reduce emissions, including cleaner coal-burning power plants and processes that can make ethanol from farm wastes. The money also would be used to encourage production of more fuel-efficient cars.

According to a study issued by the Energy Department’s Energy Information Administration, the Bingaman approach would “not materially affect average economic growth rates” in the U.S. through 2025.

The Bingaman bill is drawing criticism from many industry officials—who say it’s still too stringent—and some environmental groups—who say it doesn’t go far enough. But an imprimatur from Mr. Domenici could swing enough Republicans toward supporting some climate-change regulation to win passage in the Senate. That would set up a showdown with the House, which has repeatedly rejected climate-change regulation, and has passed its own version of the energy bill without such a provision.

There’s room, however, for compromise. House leaders say they will fight hard for an environmental-liability waiver for oil companies that make the gasoline additive, methyl tertiary butyl ether. The Senate so far has rejected that. Some aides say an energy bill containing both measures could emerge from a House-Senate conference committee.

Then it would be up to President Bush to decide whether such a proposal might lead him to veto an energy bill he has long sought. Administration officials are concerned about growing political support for some regulation, and Vice Presi-
**Curbing Greenhouse Gases**

The projected effect of proposals to limit carbon dioxide and other industrial emissions believed to cause global warming. At right, U.S. greenhouse-gas emissions, actual and projected.

*President Bush proposes reductions roughly similar to Bingaman plan through 2012, but the Bush plan would be mainly voluntary.

Source: National Commission on Energy Policy

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**U.S., Europe Clash Over Global Environment Fund**

**By Michael M. Phillips**

WASHINGTON—A fight between the U.S. and major European and developing countries is threatening to derail a multibillion-dollar fund created to help poor nations preserve rain forests, stem global warming and address other world-wide environmental concerns.

The row has slowed—and perhaps stalled—negotiations over a new round of funding for the Global Environment Facility, which helps poor countries comply with international environmental treaties.

European and developing-world governments are talking among themselves about the possibility of pursuing the program without American participation if the Bush administration continues to demand that countries receiving aid meet new economic, political and environmental conditions.

Progress in the talks "is very slow because there are no negotiations," said Dick Cheney met with Mr. Domenici Friday morning to discuss the issue. James Connaughton, chairman of the White House Council on Environmental Quality, declined to say whether Mr. Bush would veto an energy bill containing the Bingaman measure. He criticized the proposal, saying it "goes right to the heart of our competitiveness" by forcing all sectors of the economy to achieve efficiencies equally. The administration also contends that the Bingaman approach would drive up energy prices—a charge that could become a political weapon with voters smarting over gasoline prices now hovering above $2 a gallon.

Mr. Bush also will face pressure from British Prime Minister Tony Blair and other foreign leaders, who will attempt to jump-start negotiations over global warming at the G-8 summit in Scotland starting July 6.

Mr. Blair and other leaders hope to create a framework on greenhouse-gas emissions among the major energy-consuming economies. Many of the leaders say global warming is a more serious and imminent threat than the U.S. recognizes; they also can score political points back home by bashing the U.S. position.

To counter that pressure, the Bush administration is attempting to recast its message on climate change by emphasizing that it, too, favors some regulatory solutions but wants to tailor them to the economic sectors that need them.
Two sides:
1. The US should sign Kyoto
2. The US should not sign it.

The Fight of the Decade

At the inauguration of the United Nations (UN) World Environment Day 2005 Conference in San Francisco on 2 June, California Governor Arnold Schwarzenegger did an astonishing thing in his opening speech. Such occasions normally invite specimens of banal hospitality. "We welcome this distinguished gathering of international leaders to our great state..." Well, the Governor wasn't having any of that. Instead, he talked about global warming, laying out a real challenge to climate policy as it is practiced in Washington, DC, today. His talk has set up a heavyweight bout between two powerful Republican leaders over the proper role of science in politics. Best of all, we won't even have to pay to watch it!

So imagine that it's Fight Night. Before the action begins in the ring, I'll set the scene and report some of the background. In the lower right corner is President George Bush, the champion by virtue of his office as leader of the world's largest economy. He's wearing the red trunks. In various pre-fight interviews he has said that he thinks the climate may be changing, but his seconds are instructed to talk about "climate variability" and avoid the phrase "climate change" at international meetings. He didn't want to sign the Kyoto Protocol, which would have set targets for timed reductions in greenhouse gas emissions to below 1990 levels. As a White House official now explains, signing it would have cost jobs and raised energy prices. Bush's Climate Change Science Program, at first criticized by a National Academies report, now gets better reviews from the Academies. It focuses heavily on long-range research, but it contains no targets for reductions in greenhouse gas emissions, the primary cause of global warming. In a pre-fight meeting with reporters, the champ praised the virtues of fuel cells and the hydrogen economy envisioned in his climate plan, and added that his critics are "disassembling."

In the upper left corner is the challenger, representing the world's fifth-largest economy: California Governor Arnold Schwarzenegger, in the green trunks. Sportswriters who have visited his training camp report that the weight machines sit unused in a corner, and that the governor spends all his time reading journals like Science, Climatic Change, and the Journal of Atmospheric Chemistry. That may be why he selected the UN conference to stake out his pre-fight position, in which he asserted: "We know the science, we see the threat, and we know that the time for action is now." The plan he announced sets tough targets for reducing California's emissions of greenhouse gases: to 2000 levels by 2010, to 1990 levels by 2020, and to 80% below 1990 levels by 2030. These will require stringent regulatory measures, building on California's existing commitments to reduce automobile emissions. But the governor said: "We have no choice but to meet this challenge. We must leave a better world for our children and their children."

Early pre-fight commentary has produced newsworthy partisans on both sides. Representative John Dingell of Michigan, who represents the "Big Three" automakers in Congress, is said to be forming a Democratic Transportation Caucus to offer its crossover support to the president. The mayors of over 100 U.S. cities, who earlier had declared their own intentions to reduce emissions, voiced their enthusiasm for the challenger's plan. The mayor of Seattle, a prime mover in that effort, has offered to wager a 40-pound Washington salmon against an equivalent stake put up by a backer of the champ. Famed Bush strategist Karl Rove promptly designated a small striped bass, claiming it's worth more than its 8-pound weight because it's a celebrity fish, having been boated by the president in an event pictured on the front page of the New York Times.

Folks, this promises to be the Fight of the Decade in this division, so keep your dial where it is. The charismatic California challenger has a lively rooting section, including soccer moms and children, some carrying signs saying "Stop Polluting Our Greenhouse." On the other side, NASCAR dads and numbers of elegantly dressed older gentlemen are voicing enthusiastic support for the president. We asked for quick pre-fight statements from each contestant. The champ said that everything was just fine with the climate. His challenger, in a comment directed at his constituency or perhaps his opponent, merely said, "Hasta la vista, baby."

Donald Kennedy
Editor-in-Chief

17 June 2005

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Schwarzenegger: Calif. will reduce greenhouse gases

Governor's plan at odds with White House policy

By Terence Chea

Associated Press

SAN FRANCISCO — Gov. Arnold Schwarzenegger stole the show at the United Nations environmental conference Wednesday by unveiling a plan to combat global warming by setting goals for reducing California's emissions of greenhouse gases.

At the opening of the UN World Environmental Day Conference, Schwarzenegger signed an executive order that appeared to put the Republican governor on an opposite course from the Bush administration, which has rebuffed international efforts to address climate change.

"Today, California will be a leader in the fight against global warming," Schwarzenegger told an international audience of mayors and environmentalists at San Francisco City Hall. "I say the debate is over. We know the science, we see the threat and we know the time for action is now."

Schwarzenegger's executive order calls for reducing the state's emissions of such gases to 2000 levels by 2010, 1990 levels by 2020 and 80 percent below 1990 levels by 2050. The secretary of California's Environmental Protection Agency will be charged with overseeing efforts to meet those goals, and will report on the state's progress in January and every six months after that.

Schwarzenegger didn't announce any specific new policies, but said he would move ahead to impose greenhouse gas emissions standards for automobiles, increase use of renewable power and boost energy efficiency in state buildings and vehicles.

The California Assembly this week overwhelmingly passed a bill to meet international greenhouse gas reduction standards by 2010, which is more aggressive than the governor's 2010 target.

"We have no choice but to meet this challenge," Schwarzenegger said. "We must leave a better world for our children and their children."

But scientists said the state would have to launch more aggressive policies and programs to meet the governor's ambitious goals, such as setting state limits on greenhouse gas emissions and allowing companies to buy and sell permits to release such gases.

Many scientists believe that greenhouse gases — which include carbon dioxide, methane and nitrous oxide — are trapping heat in the Earth's atmosphere, altering weather patterns, shrinking wildlife habitats and raising sea levels around the globe.

California Greenhouse Gas

Roy Tenne
June 2005

- California adopts greenhouse goals like Kyoto.
- They plan to emit 80% less carbon dioxide (etc.) in 2050 than California did in 1990.
- He wants efficiency standards on automobiles, better energy efficiency for buildings, and more use of renewable energy.
- There is no sign that they are aware of the technical energy options and problems; the costs; the time needed for big energy changes; or the difficulty that other countries have in "doing" Kyoto. Yet they make these big promises.

Schwarzenegger breaks rank on climate change

California governor Arnold Schwarzenegger wants the state to slash its greenhouse-gas emissions, a move that challenges the Bush administration's rejection of the Kyoto Protocol on climate change.

Last week, after receiving a letter from 500 members of the Union of Concerned Scientists, Schwarzenegger announced that California would aim to cut emissions to 20% of their 1990 levels by 2050. His proposal contains few specific measures, but is thought to include incentives for businesses to cap and trade emissions.

9 June 2005
Nature Mag 1726
Mayors sign green treaty

By Justin M. Norton
Associated Press

SAN FRANCISCO — Mayors from around the world on Sunday signed an international treaty calling for increased use of public transportation and drastic cuts to the amount of trash sent to landfills.

The signing of the “Urban Environmental Accords” capped the United Nations World Environment Day Conference in San Francisco. The nonbinding accords list 21 specific actions that can make cities greener.

San Francisco was the first U.S. city to host the annual conference. Much of the conference focused on global warming and what mayors can do to curb emissions of “greenhouse gases” such as carbon dioxide that trap heat in the Earth’s atmosphere.

Mayor Newsom said.

Mayors participating in Sunday’s ceremony came from Zurich, Switzerland; Istanbul, Turkey; Melbourne, Australia; Seattle and dozens of other cities. They signed the agreement before heading outside to hear a 500-member gospel choir sing a song composed for the event called “Together We Can.”

“What you are doing here today is taking a different approach — a united approach — on the stewardship of the environment,” U.S. House Minority leader Nancy Pelosi said.

The accord calls for policies to expand affordable public transportation coverage for city residents within a decade. They also call for increasing access to safe drinking water, with a goal of access for all by 2015.

Other goals include creating an accessible park or recreation space within a half-mile of every city resident by 2015 and achieving zero growth in the amount of waste being sent to landfills and incinerators by 2040.

Among the most pressing issues was a recommendation to increase the use of renewable energy to meet 10 percent of a city’s peak electric load within seven years.

“The challenge is to take these goals and ideas and to manifest them. We are accountable to getting things done,” San Francisco Mayor Gavin Newsom said.

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A lot of mayors from around the world signed the agreement.

Schwarzenegger (Gov. of California) addressed this international meeting, and "stole the show" by saying that California adopts greenhouse goals like Kyoto. — Roy Jenner (see previous page)
US Mayors agree to do Kyoto

CHICAGO

U.S. mayors agree on Kyoto Protocol

The U.S. Conference of Mayors unanimously passed a resolution Monday requiring their cities to try to meet or surpass emissions standards set by the Kyoto Protocol, the international global-warming treaty ratified earlier this year without the United States. The resolution also urges federal and state governments to meet or beat the goal of reducing global warming pollution levels to 7 percent below 1990 levels by 2012.

The cities' efforts will include reducing dependence on fossil fuels by accelerating development of fuel-efficient technologies such as wind and solar energy, efficient motor vehicles and biofuels. President Bush opposes the 1997 Kyoto Protocol.

Camera wire services

This news was reported by the Daily Camera in Boulder, Colo. It is very pro-Kyoto.

June 14, 2005
Daily Camera
Page 8-1

They all agreed to "do Kyoto" within their cities

How many cities were at this meeting??

2012 is only 7 years away.

Most cities would not be able to meet this promise.

Did all mayors there really vote for this??

Roy Jenne

It is easy to vote for this

There are no penalties if you do not do it.

Roy Jenne
June 2005
West Coast states unite for cleaner air

At least six Northeast states look to adopt stricter rules

By Brad Cain 8-22-05
Associated Press

SALEM, Ore. — Despite an effort by auto industry lobbyists to kill the move, two Pacific Northwest states — Oregon and Washington — are getting ready to adopt California’s new vehicle emission standards to reduce greenhouse gases.

When that happens, California’s newly implemented emission standards — the toughest in the country — will be in effect along the entire West Coast from Canada to Mexico.

By 2016, all new cars, sport utility vehicles and light trucks sold in the West Coast states would have to comply with the tougher standards on emissions of greenhouse gases, such as carbon dioxide, which are believed to be a leading cause of global warming. The 2016 date was set to give automakers plenty of time to comply with the new standards.

At least six states in the Northeast also are moving to adopt California’s new tailpipe standards to reduce greenhouse gas emissions from cars.

It’s an environmental squeeze play — with states on the two coasts working to try to force the auto industry to turn out cleaner, more fuel-efficient cars, since those states comprise nearly a third of the U.S. car market.

“People realize that having more advanced-technology cars on the road will enhance our oil security and begin to address global warming issues,” says Rob Sargent of the Boston-based National Association of State Public Interest Research Groups.

Under the federal Clean Air Act, California is allowed to set pollution standards for cars and trucks that are more stringent than federal standards. Other states can choose either California’s standards or the looser federal rules.

Most northeastern states have followed California vehicle emission rules for years, and now those states are making the change to reflect California’s latest rules regulating carbon dioxide and other greenhouse gas emissions from vehicles.

While the movement has gained little traction in the Midwest and the South to date, it’s gotten a huge boost with the three West Coast states unifying around the tough new California standards.

Sargent said other states — such as Pennsylvania, Illinois and North Carolina — also are starting to look at moving to the new California standards.

“Despite what the Bush folks say, more people are realizing that global warming is a problem that we need to begin to address,” he said.

Climatologists have warned that if allowed to continue, rising temperatures caused by driving and other human activities will cause melting glaciers, rising sea levels and weather changes.

The auto industry is suing California over its new standards, saying the state lacks authority to implement such regulations and that the rules would eventually add $3,000 to the cost of a new car.

Please see WEST on 2A
Governors take the initiative over US carbon dioxide emissions

Nine US northeastern states have set targets for cutting back on regional greenhouse-gas emissions.

The move is a rare step forward for the United States, which in 2001 refused to ratify the international Kyoto Protocol for regulating emissions. It seems that in the face of federal inaction, individual states have begun making their own climate policy.

Under their plan, more than 600 power plants will cap their total carbon dioxide emissions at roughly 150 million tonnes — about what they emit now — starting in 2009. Between 2015 and 2020, they will cut back a further 10%.

In an arrangement not unlike the European Union’s carbon-trading scheme, power companies will be given — or perhaps sold — the right to emit a certain amount of carbon dioxide. They may then sell credits if they cut emissions below that allocation.

"This is a big deal," says Judi Greenwald of the Pew Center on Global Climate Change in Washington, D.C., and an active participant in designing the policy. "It will be a really important policy experiment."

The plan comes from the two-year-old Regional Greenhouse Gas Initiative (RGGI), a coalition led by the governors of Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont. Together, the nine states emit as much carbon dioxide as Germany.

"Many national programmes start out with the states as labs," says Richard Valentinetti, director of air-quality control for Vermont and an RGGI participant. "Since the national programme was being discussed to death and nothing was happening, we felt we had to do something."

State leaders for air-quality and energy issues say they are about a month away from a memorandum of understanding, a handshake agreement on their goals. That, in turn, will beget a 'model rule' that each state would have to adopt in order to trade emissions allocations. Supporters hope that the rules could be law two years from now.

The northeastern pact is the furthest along of several US regional climate-change initiatives. Washington, Oregon and California have similarly joined together in the West Coast Governors' Global Warming Initiative. California has adopted tough emissions regulations on its own: in June, Governor Arnold Schwarzenegger mandated a return to 1990 emissions levels by 2020, with a further reduction to 80% of 1990 levels by 2050.

In the northeast, the RGGI decided to take action in part because of the possible regional impacts of climate change on the states. "Most of them are coastal states — they are worried about rising seas," says Greenwald.

Temperatures are also an issue for states dependent on tourism. "Maine is worried about its forest. Vermont is worried about its sugar maples," Greenwald explains.

Details of the RGGI plan are still under debate, with environmental and industry groups wrangling — as might be predicted. "One bone of contention is offsets. These are separate actions, such as planting trees or capturing landfill gases, that companies could take in lieu of reducing emissions. The current draft suggests that offsets could make up half the difference between projected and capped emissions, a number that some think is too high and others too low.

Cap-and-trade strategies have worked before in the United States, most notably in the 1990s when they helped lower sulphur dioxide emissions from power plants, reducing acid rain. But capping and trading carbon dioxide is not so simple, given the politically charged atmosphere of climate-change discussions.

A regional solution for a global problem makes no sense, says Bill Fang of the Edison Electric Institute, a leading industry group based in Washington DC. He also argues that capping the power industry alone is unfair. "Why should we be singled out?" he asks. The RGGI plan, for instance, makes no mention of transport, the second largest source of carbon dioxide in the United States.

James Brooks, director of air quality for the state of Maine, says that the effort is more of a message than a solution. "The RGGI region represents probably 3% of the world's greenhouse-gas emissions, so it is not going to have a huge impact," he says. "The idea is to set an example and to establish a working model that could be used nationally."

Emma Marris
A Clean Energy Pact: US, Asia, Australia
(Agreement signed July 2005)

- Several countries made this agreement to reduce greenhouse gases
  - It is based on voluntary actions

- Goal: Develop technologies that cut emissions and capture carbon

- This is a "results oriented" partnership to speed development

- Six countries signed this pact:
  - China
  - India
  - USA
  - Australia
  - Japan
  - South Korea

(Also see the next four pages)

This agreement:

- Improves efficiency of energy use.
- Reduces carbon dioxide

Aug 2005
Roy Jenne
NCAR

Page 126
U.S. joins clean-energy pact

Agreement aims to curb climate change

By H. Josef Heibert
Associated Press

WASHINGTON — The United States and five Asian and Pacific nations, including China and India, agreed Wednesday on a partnership to use cleaner energy technologies in hopes of curtailing climate-changing pollution.

The agreement does not bind any country — Japan, Australia and South Korea are the others — to specific emission reductions. It also is not viewed as a replacement for the Kyoto climate pact, which several of the participants thought not the U.S. — have embraced.

White House officials see the partnership as an important step in setting up a system to help emerging industrial countries produce cleaner energy and slow the growth of climate-changing emissions, especially carbon from fossil fuels.

President Bush called it a "results-oriented partnership." It will speed the development and use of cleaner and more efficient ways "to meet national pollution reduction, energy security and climate change concerns," Bush said in a statement.

Secretary of State Condoleezza Rice and Energy Secretary Samuel Bodman will meet this fall with their counterparts in the partnership to move the effort forward.

The Bush administration hopes the agreement will complement Kyoto, said James Connaughton, chairman of the president’s Council on Environmental Quality.

The Kyoto pact, which the United States has rejected, requires that industrial countries reduce their greenhouse gas emissions. The Bush administration prefers to addresses climate change through voluntary actions and by emphasizing the need to develop technologies that cut emissions and capture carbon.

July 28, 2005
Cameron Boulter, Colo, USA

* The G8 meeting was in Scotland July 4-8, 2005. Bush was there.
* The G8 people pushed Bush to meet with big developing countries to have active climate programs. And Europe really wants Kyoto.
* They want Bush + China + India, etc at another meeting in England in Oct 2005.
* Then the big meeting to define a stronger Kyoto will be in Dec 2005.

The above is very interesting, and it even includes Japan (they did sign Kyoto). It is very unlikely that China or India would sign Kyoto or a new stronger Kyoto. - Roy Jones
Playing It Cool

Environment: What if the targets of the Kyoto treaty could be reached or exceeded, without resorting to Kyoto’s economy-strangling restrictions? Not good enough, says the United Nations.

At last week's Asia-Pacific security conference in Laos, Deputy Secretary of State Robert Zoellick announced that the U.S., India, Australia, China, Japan and South Korea have agreed to reduce greenhouse gases using technology.

The Asia-Pacific Partnership on Clean Development and Climate contrasts sharply with the Kyoto pact. That treaty, which the Senate and the Bush administration rejected, seeks to lower emissions by slashing energy use.

In a world where scientific advances are coming faster every day, it’s foolish not to use technology to protect the environment and to rely instead on the command-and-control elements of Kyoto.

While we prefer a cleaner world to a dirtier one, we remain skeptical that recent warming is due mainly to humans. And we are particularly concerned about solutions such as the Kyoto accord — an economy and job killer if there ever was one.

The Energy Information Agency has estimated that complying with Kyoto would cost the U.S. economy $225 billion to $400 billion and each U.S. household up to $2,700 a year. It would also put from 1.1 million to 4.9 million of Americans out of work.

And remember: These projections were made during the Clinton years, not by a Republican White House.

Eco-activists think the trade-off is worth it. What’s a few billion dollars lost in an $11 trillion economy and a few million jobs out of a work force of 132 million so long as we curb rising temperatures? Well, quite a lot actually, considering that despite all the restrictions and costs of Kyoto, it’ll have little effect.

Tom Wigley, a climatologist at the National Center for Atmospheric Research who often sides with green groups, conceded in the journal Science earlier this year that if Kyoto were fully implemented, we’d put off an inevitable warming by a mere six years. With Kyoto, global temperature would still rise 1.94 degrees Celsius by 2100. Without it, that increase would arrive in 2094.

The better approach is to research and develop technologies that cut greenhouse gas emissions as well as other pollutants. Doing so would help protect the planet without severely damaging high-tech economies like ours.

Which is exactly why the green lobby and the United Nations Environment Program give the idea only qualified approval while making it clear it’s no substitute for Kyoto. They seem intent on crippling the economies of the U.S. and other Western nations.

There’s a whole agenda at work — one not so much about protecting the environment as it is about leveling rich economies and choking off the West’s consumption. No wonder — and thank goodness — the White House is cool to such ideas.
An alternative to Kyoto

BANGKOK
America unveils a new plan to combat global warming

SUMMITS of the Association of South-East Asian Nations (ASEAN) are not known for suspense or surprises. But the regional club's latest pow-wow, which is due to conclude in Vientiane, Laos, on July 29th, involved plenty of both.

First, Myanmar's military regime waited until the last minute to announce that it would forgo ASEAN's rotating chairmanship, and so spare the group an embarrassing boycott. Then, at the ASEAN Regional Forum meeting, where South-East Asian countries get together with other Asian and Pacific nations, Australia agreed to sign a non-aggression treaty with the group in exchange for an invitation to yet another summit, where ASEAN hopes to start work on an East Asian free-trade area. But the biggest bolt from the blue was the announcement, by America and five Asia-Pacific countries, that they had devised a new pact to combat global warming.

The details of this non-binding "Asia-Pacific Partnership on Clean Development and Climate" are fuzzy. But it emphasises technology transfers to reduce emissions of greenhouse gases, rather than the fixed targets and caps of the Kyoto protocol, the UN treaty on climate change. Rich countries might help poorer ones develop devices to cut carbon dioxide emissions from coal-fired power plants, for example.

Two of the signatories of the new pact, America and Australia, have already rejected the Kyoto agreement as too rigid. Two others, China and India, are not bound by the protocol as it applies only to developed nations. Indeed, of the six signatories to the new pact, only Japan and South Korea have formally ratified Kyoto. In theory, therefore, the "partnership" could enormously extend efforts to counter climate change. The countries concerned account for almost half the world's population, economic output and greenhouse emissions.

Environmentalists dismissed the deal as toothless. Many fear it will stymie efforts to persuade developing nations to sign up to Kyoto by the target date of 2012. The new pact's members insist that it will complement Kyoto, not supplant it. One Australian official claims that it is designed to reduce emissions faster than Kyoto would have. His country has devised a copper-bottomed plan to convince sceptics: another summit, to be held in Adelaide in November.
OVERSIZED THE London terrorist attack and largely ignored by inattentive news media, the declaration on global warming at the G-8 summit of industrialized nations sounded far more like George W. Bush than Tony Blair and Jacques Chirac. Prime Minister Blair failed in his attempted coup at Gленегаles in Scotland to bring his close friend President Bush into conformity on the Kyoto protocol.

The British, French and Germans pushed hard for U.S. submission to binding carbon emission targets. To the amazement of the scientific community, Europe capitulated and backed away from immediate restraints on a growing American economy. Mr. Bush won agreement from the G-8 that the world should await further scientific conclusion rather than rush unwisely decisions that could deflate economic growth and lose jobs. Together with the route of pro-Kyoto forces in the U.S. Senate last month, the outcome at Gленегаles constitutes a major energy triumph for Mr. Bush when he had seemed headed for defeat. The week before Gленегales, the president displayed the stubbornness that often confounds allies but is his greatest strength. In a speech at the Smithsonian, he said efforts to "oppose development and put the world on an energy diet" would condemn two billion people in the undeveloped world to poverty and disease.

The totality of Mr. Bush's victory was cloaked by the outrageous rhetoric of French President Chirac, who claimed major U.S. concessions at Gленегаles. "We have noticed a shift in the American position," he declared, contending Mr. Bush has isolated his country in rejecting the Kyoto pact. But Mr. Chirac's claims are contradicted by what really happened in Scotland. U.S. negotiators there insisted on removal from the summit's communique language describing global warming as "an urgent threat to the world" requiring "immediate action." Also eliminated were references to melting glaciers and rising seas, plus an audacious effort by France to link Europe with pro-Kyoto U.S. cities and states (mainly California and New England).

Mr. Chirac's pretensions may be explained by France's lead role behind the scenes at Gленегаles trying to beat down the U.S. position. "In earlier drafts of the communique," a Bush aide told me, "the French aggressively pushed for pseudo-scientific, alarmist language on climate change."

Most surprising was what did get in the Gленегаles communique. It conceded that "uncertainties remain in our understanding of climate science," rejecting the environmentalists' demand for "settled science" about global warming. The G-8 summit's public conclusion in favor of stopping and slowing the growth of greenhouse gases "as the scientific justifies" lifts Mr. Bush's language verbatim from 2002.

Mr. Bush's lone "concession" was a line in the communique that use of fossil fuels is "associated with the warming of our Earth's surfaces." This, too, echoes past statements by Mr. Bush. "That's really a trivial concession," a White House source told me.

In the aftermath of the G-8, Mr. Blair did not emulate Mr. Chirac's absurd claims of victory at Gленегаles and, in fact, had little to say publicly about global warming. Less than a month earlier on his visit to Washington, the British leader was preparing his last chance to get Mr. Bush's reversal on Kyoto. Given Mr. Blair's steadfast support of Mr. Bush on Iraq, the White House had to swallow its indignant that the prime minister was secretly lobbying U.S. senators.

Mr. Blair hoped that the Senate in late June would repudiate Mr. Bush on global warming for the first time, creating a momentum for Kyoto at the G-8 summit. Just the opposite occurred. The McCain-Lieberman bill actually lost ground; a nuclear energy provision added to attract conservatives lost four liberal Democratic senators. Sen. Pete Domenici, the Energy Committee chairman, withdrew support from an alternative proposal when a headcount showed 52 senators opposed. A non-binding resolution by Sen. John Kerry urging international negotiations on global warming had passed two years ago but was defeated this time.

All that passed in the Senate was the message, with 53 votes, that cautiously called for "market-based" limits on greenhouse gases that "will not significantly harm the United States economy." For his first term and a half, Mr. Bush will have held the line against the global warming hysteria and even got his G-8 colleagues to go along with him.

Robert Novak is a nationally syndicated columnist.
Europe set for tough debate on curbing aircraft emissions

LONDON
Flight UA923 is a problem. When the Boeing 767 travels from London to Washington DC every week, it emits around a tonne of carbon dioxide for every passenger. The aircraft departs from a country that is intent on tackling such emissions, but lands in one that stands almost alone in resisting such measures. To further complicate matters, most of the emissions do not actually occur in the airspace of either nation. So how can UA923’s emissions, and those from other flights, ever be regulated?

A first stab at an answer, at least in Europe, is likely to come soon. The European Commission (EC) is due to release a proposal on the issue in September, and details are starting to emerge. Emissions trading, already used to limit emissions from other European industries, will play a central role. New taxes are also likely. But although environmental groups and the airlines can agree on these points, a battle looms over a critical issue: the quantity of greenhouse gases that the industry should be allowed to emit.

International aviation is a pressing environmental concern. The industry emits around 3% of global greenhouse gases and is the fastest-growing source of emissions. Yet it is omitted from the Kyoto Protocol, which regulates emissions from most industrial nations. Total emissions from the European Union (EU), for example, dropped by around 5% between 1990 and 2003 — but contributions from the booming aviation industry rose by 75%.

The EC plans would cover all flights taking off in Europe. They would either see emissions included in Europe’s existing carbon trading scheme, or in a stand-alone version for airlines. Under the existing scheme, which began in January, around 13,000 European firms monitor greenhouse-gas emissions. If companies produce more than their government-allotted quota, they must buy emissions credits from others that have emitted less than allowed.
CO₂ from airplanes

Some aspects of the plan to incorporate aviation are straightforward. As air travel is international, the European Union, not individual member states, will probably set emission targets. And the targets are likely to be based on the fuel burnt during each flight, not the distance flown, so that airlines will be rewarded for using more efficient engines.

Quantifying the impact of airline emissions may prove more difficult. As well as emitting carbon dioxide, aircraft exhaust gases promote the formation of ozone, another greenhouse gas. Aircraft contrails also create cirrus clouds, which have a warming effect. Together, these are believed to have a global-warming impact around two to four times greater than that of the carbon dioxide alone.

The EC’s environment directorate, which is drafting the September document, told Nature that it nonetheless favours including carbon dioxide emissions only, as this is the basis for the existing trading scheme.

Other emissions, such as the nitrogen oxides that promote ozone formation, would be tackled by extending existing taxes such as landing charges.

The final and thorniest part of the problem is the process of setting the industry an emissions target. An EC-commissioned report, published last month and led by a team from CE Delft, a Dutch environmental policy institute, explored the effect of setting allocations at 2008 levels. This would add only a few euros to the cost of an air ticket in the following years and is in line with industry thinking. “It’s in the right ball park,” says Robert Preston, executive officer of the British Air Transport Association.

But environmental groups take a different view. An analysis by the Tyndall Centre for Climate Change Research in Norwich, UK, commissioned by Friends of the Earth (FoE) and published this June, predicts that current aviation growth will more than wipe out any emissions reductions from other industries in coming decades. Even sticking to 2008 levels would leave airlines with much more than their current share of emissions, and possibly skew any carbon credit scheme, says Richard Dyer of FoE. The group wants airlines to cut emissions to 30% below 1990 levels by 2020, a massive challenge for an industry that is growing by 4% annually.

Better engines and improved routing are only likely to cut emissions by 1–2% per year and it is unlikely that other industries could supply airlines with enough credits to make up the difference. So FoE argues that the cuts can only be achieved by introducing extra taxes, such as passenger duty, which reduce demand by forcing up ticket prices.

With such issues to be resolved, it is no surprise that the date for implementing trading is already slipping. The UK government, which is leading the debate as part of its current EU presidency, wants trading to begin in “2008 or as soon as possible afterwards”. The EC environment directorate had also backed a 2008 target, but says now that 2012 may be a more realistic goal.

Jim Giles

11 Aug 2005
Nature, P.765

- Airline travel is growing rapidly.
  - So the CO₂ from airplanes is increasing.

- The efficiency of engines is increasing.
  - But not as fast as the growth in travel.

- The environmental group “Friends of Earth” wants to force up ticket prices to cut demand. But then more people cannot travel.

- We note: The cost of fuel has gone way up. Airlines have a huge incentive to try to save on fuel use. More laws would not speed up the quest for efficiency

- The proposed regulations would hurt the passengers and hurt the airlines.

- The US is against this European proposal.

Roy Jenne
Aug 22, 2005
U.S. Opposes EU Plan to Cut Aircraft Emissions

BRUSSELS—In the latest trans-Atlantic disagreement over aviation issues, the U.S. opposes a European Union plan to reduce emissions from aircraft as part of efforts to reduce global warming.

James Connaughton, chairman of the White House Council on Environmental Quality, signaled the U.S. position yesterday while speaking to reporters in Brussels ahead of a meeting with EU Transport Commissioner Jacques Barrot, who is due to unveil the emissions proposal this summer.

Since January, power plants and factories in the EU's 25 nations have been trading carbon-dioxide emission rights as part of efforts to reduce so-called greenhouse-gas gases and meet the bloc's commitment to the Kyoto Protocol accord, which aims to ease global warming. The European Commission, the EU's executive arm, now wants aircraft-tailpipe emissions to be included in a second phase, possibly as early as 2008.

Mr. Connaughton said that while "the EU's experience of carbon trading would be important to learn from," the U.S. is "not in favor of carbon-dioxide trading."

Carbon dioxide is the main greenhouse gas—so called because it traps the sun's rays in the earth's atmosphere—released by planes.

A spokesman for International Air Carriers Association, a group representing 35 European airlines, said Mr. Connaughton's comments confirmed "the U.S. is refusing to get involved at the moment because they say their airline industry is already suffering a lot and doesn't need to have any more cost burdens placed upon it."

The tailpipe proposal is part of the EU's drive for emissions cuts beyond those mandated by the Kyoto treaty. The U.S. has refused to join the accord, fearing it could harm economic growth.

Airlines are excluded from Kyoto, but a European Commission paper estimates that if unchecked, aircraft emissions will exceed all other polluters combined by 2025.

—Dow Jones Newswires

May 19, 2005

Europe

France, Britain to Proceed With Air-Travel Levy

Brushing aside opposition from the airline industry, the European Union and the U.S., finance ministers from France and Britain said they will use levies on air travel to fund health assistance for the developing world.

The French plan calls for a tax on airline tickets, while Britain plans to channel money from an existing duty. Both will use the funds to finance programs to fight AIDS and improve immunization against diseases such as malaria and tuberculosis.

The announcement comes after the European Commission, the EU's executive body, backed away from an aviation tax to help poor countries. The commission on Sept. 1 called for further study of the plan's impact on airlines, many of which have been hit hard by soaring fuel costs and four years of industry upheaval. The commission said any aid levy should be voluntary and should apply to all EU countries to avoid distorting the bloc's unified internal market.

The U.S. has opposed an involuntary levy because it could violate existing government agreements, cause administrative problems that make it unworkable and hurt the airline industry.

Airlines oppose the plan. Tony Concell, spokesman for the International Air Transport Association, said, "We don't see how taxing aviation and making travel more expensive can possibly be of assistance to developing countries," many of which depend heavily on air travel.

French politicians have defended the levy by saying that people who fly are among the world's wealthiest, so this would be a good way to help the poorest. Britain and France said Friday in a joint statement that a working group will make recommendations by January on how to implement the plan.

French Finance Minister Thierry Breton, speaking at a news conference in Manchester, England, with U.K. Finance Minister Gordon Brown, said the aviation levy will "not be too expensive, just a few euros." He added the level may vary depending on the class of travel and flight length.

Britain plans to draw funding from its existing Air Passenger Duty.

—Daniel Michaels, William Echikson and Andrew People

Sep 12, 2005

Wall St. J.
"We're not playing the issue. I'm not sure I can say that about others," Lee Raymond, Exxon's chairman and chief executive, said in a recent interview at Exxon headquarters in Irving, Texas. "I get this question a lot of times: 'Why don't you just go spend $50 million on solar cells? Charge it off to the public-affairs budget and just say it's like another dry hole?' The answer is: That's not the way we do things.'

The 66-year-old Mr. Raymond has emerged as the tallest lightning rod in the debate over global warming. At a London oil-industry dinner in February where he was the guest of honor, Greenpeace protesters poured red wine onto tables and called Mr. Raymond the "No. 1 climate criminal." Mr. Raymond, speaking on the same day the Kyoto treaty took effect, stuck by his prepared speech and called for a "reality check" on the treaty.

Exxon's approach to global warming typifies the bottom-line focus of its entire

Please Turn to Page A10, Column 1
Continued From First Page

business. It is straggling away to improve the energy efficiency of its refineries—primarily to cut costs, although this is also shaving global-warming emissions. But it says the business case for making more sweeping changes is still weak. It's a conservative, hard-nosed approach that has helped make Exxon the most profitable oil company in the world, with 2004 net income of $25 billion.

Even at its Annandale research lab, Exxon's focus is on adapting and improving fossil fuels—not replacing them. Its researchers are trying to make cars burn fuel more efficiently and reduce emissions. Some futurists, and the Bush administration, think cars could run on hydrogen some day. Exxon is looking into the idea but puts its research dollars into extracting hydrogen from petroleum, not water.

A growing chorus of critics says Exxon's strategy is short-sighted. As nations crack down on global-warming emissions, they argue, the foundation of the oil business is threatened because carbon dioxide, the chief suspected global-warming gas, is produced whenever fossil fuel is burned.

There are two possible scenarios.

One is that all the scientists in the world are wrong, in which case there's no climate change, in which case Exxon will do well,” says Andrew Logan of Ceres, a Boston-based environmental group that's trying to put shareholder pressure on Exxon to go greener. "But if the scientists are correct and we have to find a way to transform the way we use energy, then Exxon is going to lag significantly behind its competitors.”

Exxon isn't ignoring global warming. Besides its research in New Jersey, it has pledged $100 million over a decade for research at Stanford University into what it calls breakthrough “megas-technologies.” Among them: capturing carbon dioxide after it's emitted and burying it deep underground. The Stanford researchers are also looking at ways to slash the cost of renewable energy.

Exxon believes that if global warming really is a significant environmental problem, the only serious answer will be simple alternatives that even developing nations such as China and India can afford.

Though Exxon is touting the size of its Stanford investment in a new ad campaign, $100 million represents less than two days of Exxon's earnings. Shell says it has spent about $1.5 billion since 1990 building a business in renewable energy, mostly solar and wind power. BP says it has spent $550 million on solar since 2000 and about $30 million on wind over the past three years. Both Shell and BP continue to invest the overwhelming majority of their money in finding and pumping oil and gas.

Their renewable-energy investments are hardly big money makers. BP says its solar business has turned a profit but not its wind business. Shell says wind makes money but not solar. Both say short-term profits aren't the point. Enough is known about the likely contribution of fossil fuels to global warming, they reason, that it's prudent to start diversifying now as a kind of insurance policy. It’s “all about growing a business,” says Robert Wine, a BP spokesman.

Mr. Raymond disagrees. Spending shareholders' money to diversify into businesses that aren't yet profitable—and that aim to solve a problem his scientists believe may not be significant—strikes the Exxon chief as a sloppy way to run a company. “If I were to ask you if you want to buy an insurance policy, you've got to ask yourself a couple questions. No. 1, what are you trying to insure against? And No. 2, what are you willing to pay on the premium? And I haven't heard a very good answer to either one of those,” he says.

In the late 1970s, as oil prices skyrocketed, Exxon diversified into an array of fossil-fuel alternatives, including nuclear and solar energy. In 1983 it opened the lab here in Annandale, a sprawling brick complex with 19 acres of interior space. But after several years, Exxon still couldn’t see prospects for renewable energy turning into a money-maker, especially since oil prices were falling in the 1980s. In the mid-1980s, the company decided to get out of the business and tapped Mr. Raymond, a South Dakota native then in his 40s, to oversee the retraction. "I was sent to clean it all up," he recalls. "What all these people are thinking about doing, we did 20 years ago—and spent $1 billion, in dollars of that day, to find out that none of these were economic," he says. "That's why I feel so strongly about it—because I've been there and I've done that."

In 1988, the United Nations established a panel of scientists to study whether the science justified clamping down on greenhouse-gas emissions, so called because they are thought to create a blanket in the atmosphere that traps reflected heat from the Earth's surface just as a greenhouse locks in heat. The panel's conclusions helped spawn the Kyoto treaty.

Exxon had already hired a Harvard astrophysicist named Brian Flannery in 1980 to look into global warming using mathematical models. In 1987, he was joined in the climate-science group by Haroon Kheshgi, a chemical engineer who had come to Exxon the previous year and had earlier worked at the Lawrence Livermore National Laboratory in California. Over the next several years the pair dug deeper into global-warming research and Exxon made grants to several prestigious universities, starting with the Massachusetts Institute of Technology. Mr. Flannery says he told the MIT researchers: 'Embrace the uncertainty in all of this.'

On Mr. Kheshgi's office wall are pic...
Exxon Chief Makes Cold Calculation on Warming

tures of a climbing trip he took to a Peruvian glacier in 1987. He has also climbed glaciers in New Zealand, where he notes glaciers are receding. But he insists it’s not clear that human-induced emissions are the explanation. The link is “not that simple,” he says.

Messrs. Flannery and Kheshgi were among the scores of scientists who helped write the U.N. panel’s latest broad assessment of climate science, published in 2001. It said atmospheric concentrations of CO₂ had jumped by 31% since the start of the industrial age and the 1990s were “very likely the warmest decade in instrumental record.”

Most of the observed warming of the past 50 years, it said, is “likely” the result of human activities.”

Still, the panel said, models of climate change remain a work in progress. Among the remaining uncertainties it cited is to what extent “natural factors” unrelated to human activity play a role.

The Exxon scientists say they agree with much of the assessment. But they argue that policy makers often disregard the uncertainties noted in it. In 2003, Mr. Kheshgi and a University of Illinois scientist published a paper in an American Geophysical Union journal arguing that oceans, plants and soil suck up more of the carbon dioxide emitted from fossil-fuel burning than previously thought. As a result, the paper said, models that predict a big buildup of CO₂ in the atmosphere need to be rethought.

That’s the kind of research Mr. Raymond, himself a chemical engineer, likes to cite. “Our view is it’s yet to be shown how much of this is really related to the activities of man,” he says. “The world has gone through many cycles of climate change that man had nothing to do with, because man didn’t exist.”

Messrs. Flannery and Kheshgi argue in their papers for more research into how the world can live with, rather than avoid, the effects of global warming. That concept, known as “adaptation,” worries some environmentalists because they fear it will deflect attention from reducing fossil-fuel emissions. But it’s one of the subjects that the U.N. climate-change panel has studied, and Mr. Kheshgi argues it’s only prudent. “Climate change might pose serious risks,” he says. “But it might not.”

Even some who advocate stricter curbs on emissions profess respect for Exxon’s scientific work. “These are smart guys who shoot straight. I’m pretty impressed that their science is above-board and serious,” says David Victor, who heads an energy-policy research program at Stanford. The program receives money from BP but isn’t part of Stanford’s Exxon-funded program.

But most scientists take an approach to global warming that is fundamentally different from Exxon’s: They choose to emphasize what is known, rather than what isn’t. They believe it’s clear by now that fossil-fuel emissions are warming the earth and leading to dangerous consequences—or clear enough, anyway, that it’s more prudent to act than to wait until the science is airtight.

Last week representatives of scientific societies from 11 countries, including the National Academy of Sciences in the U.S., released an open letter saying global warming is prompting changes “such as rising sea levels, retreat of glaciers, and changes to many physical and biological systems. The letter said humans are likely to blame and called the science “sufficiently clear to justify nations taking prompt action.”

What particularly riles the green movement is Exxon’s funding of several groups that continue to argue that the science doesn’t justify caps. Among them is the Competitive Enterprise Institute, which received a total of $465,000 in 2003 from Exxon and the company’s charitable foundation, according to a corporate-giving report that Exxon posts on its Web site.

The antiregulatory Washington think tank has long opposed calls for a cap. Last week, one of its senior fellows, Iain Murray, wrote a column on a Web site calling the recent letter by the science academies an example of “climate alarmism” that has “needlessly thrown away the academies’ reputations for unbiased information.”

Several years ago, the institute filed a lawsuit against the Clinton administration challenging a report the administration had released highlighting concerns about global warming. Oklahoma Republican Sen. James Inhofe also was among the parties to the suit. Sen. Inhofe has called the idea that fossil fuels are contributing to global warming a “hoax.”

What does Exxon’s Mr. Flannery think about that? “If they’re expressing a view that there’s no risk that needs to be addressed, then yes, we would disagree with that,” he says.

For his part, Mr. Raymond downplays the importance of the money Exxon spends on groups that talk up doubts about climate science and climate caps. “The facts are you don’t have to spend a lot of money to aggravate the proponents,” he says. But he doesn’t apologize for Exxon’s role in keeping the debate alive.

“We think we have a responsibility,” he says. “If we think people are about to make some bad policy decisions that are going to have a big impact for a long period of time, somebody’s got to say something.”
Energy Efficiency Can Help Solve Energy Problems

- Efficiency decreases the energy use.

- Consumers are hurt less by high energy prices if they can use less energy to do the same task (such as cars that get more mpg).

- But the world will need much more energy.
  - More people, bigger houses, more money, and more travel gives more use of energy.
  - Efficiency helps, but it cannot solve the energy problem by itself.

- One company builds efficient, low cost motors.
  - See the next story.
  - This work helps!

Roy Jenne  
Sep 17, 2005
The Evangelist Of Smart Energy

International Rectifier’s Alex Lidow is on a mission to cut global power consumption

INTERNATIONAL RECTIFIER CORP. isn’t as famous as Intel Corp., but the company has been in the microelectronics game far longer. Founded in 1947, it has focused from the start on how smart power management can make machines and electronic devices more efficient. Today, IR is a world leader in the design and manufacture of chipsets that feed electricity to motors, lights, and a variety of other high-tech gear.

Chief Executive Alex Lidow is fiercely dedicated to efficiency. It’s a conviction that he traces back to the 1970s when he was a PhD student in applied physics at Stanford University. He and his colleagues were inspired by new ways to think about energy use. And that focus is just as timely today, with energy prices soaring and the whole world clamoring for cost-saving, power-conserving air conditioners, computers, and other gadgets.

Costly energy has stoked demand for IR’s solutions. Sales of devices for energy-efficient app-

pliances and lighting systems both surged by nearly 60% in the year through March. And IR’s power management solutions have helped hybrid vehicles take off. Consensus forecasts for the year though June predict revenues will grow by 11%, to $1.2 billion, with profits up by 93%, to $173 million. Lidow recently met with Industries Editor Adam Aston in New York to share his take on efficiency:

You are evangelical about IR’s role in improving efficiency. What’s to be gained?

It breaks down pretty easily. In 2001 the global energy budget was 404 quadrillion BTUs [British thermal units]. Electricity accounts for 39% of that, or about 160 quadrillion BTUs. Of that, about half goes into electric motion, not including transportation. It’s things like refrigerators, washing machines, pumps, valves, conveyer belts, elevators, you name it. And 85% of those motors are electro-mechanically actuated—either they’re on or they’re off. They’re dumb, wasteful motors.

If we could convert all of those motors to variable speed, we could cut their [power] consumption by half, which amounts to 10% of total global energy consumption. Another fifth of all energy goes to lights—you could save half of that easily by switching to high-efficiency fluorescents. In transportation, which eats up about 21% of the total global energy budget, if we could convert all vehicles to hybrids, you’d save another 10% of the world’s energy.

So what’s the total you see as possible?

Alltogether, about 30% of our global energy budget can be saved. This has profound implications. If you extrapolate economic growth out to 2025, we’ll need to add about that much energy to the total pie just to maintain our standard of living. Or think of it another way: 30% energy savings amounts to about $1.7 trillion a year in 2025 that we won’t have spent on energy, if we deliver the savings for free.

How do “smarter” electric motors help?

Imagine if you drove your car with your foot all the way on the gas, then your foot all the way on the brake. You’d get really crappy mileage, and your car wouldn’t last as long. Many electric motors work this way: either off or full-speed on. So the motors in most refrigerators, for example, control electricity with a switch—you can hear it go on and off. When it’s on, a little motor turns furiously to drive a compressor to cool the
refrigerator, then shuts off completely when the temperature falls. That’s not efficient. A motor drive that turns exactly as much as needed is a better solution. It goes a little faster after you open the door, to lower the temperature, then a little slower after it has been closed a while.

By varying the speed, a lot of good things happen. For one, you don’t have all the energy losses from acceleration and deceleration. Also, you don’t need as big a compressor, since it doesn’t have to deliver all the energy in such a short period. You can also replace the old-style AC induction motor. These are about 60% to 65% efficient, but a DC brushless or permanent magnetic AC motor is 85% to 90% efficient. Put it all together, and you can save half the energy.

Yet sales of variable speed motors make up a small share of the market. Why?
You have to do it cost-effectively. It’s goal is to add this sort of efficiency for no additional cost. About 10 years ago we committed to delivering a far more complex motor drive, able to do variable speed motion, for the same cost as the technology then in use—about $39. We built a variable motor drive for a washing machine and it added $250 to the final cost. Though expensive, it still sold—proving there was a demand for these systems, especially in Asia where apartments are small and quiet appliances are preferred.

But how do you get down to $29?
We set out a roadmap. It involved many technologies, some of which we had, some we didn’t. Developing and acquiring them defined a new strategy for IR—what I call “technology pull.” As a company, we didn’t want to ride a single technology till it died, like buggy whips. Instead we wanted to have the ability to pull in the technology to follow this roadmap all the way to $29. Lo and behold, in 2004 we had a $35 to $40 solution, and by the end of next year, it will hit $29.

In the meantime, those washing machines have become the hottest sellers in the market, whether it’s Maytag’s Neptune, Miele’s, or Bosch’s. Sales of high-efficiency washing machines have grown about 33% a year. IR has an Intel-like market share in that business, supplying the motor drives that make them work.

How does this technology transfer to hybrid vehicles?
We make electronics that help control the electric drivetrain in hybrids. It’s related to the architecture we use in washing machines and other appliances. The same “technology pull” approach is guiding our hybrids strategy. In the late 90s we asked, can we save 60% of the energy in a vehicle with no compromise in cost or performance? The answer’s yes. By 2015 or so, there will be no price premium for hybrids, and they’ll outperform their gasoline predecessors.

How do you lower the cost of hybrids?
The key is understanding the cost trade-offs between old and new technologies. If you add an electric motor, you shrink the engine and use the cost savings to finance more electric systems. That’s your energy equation. Today you can build a hybrid drivetrain that’s about one-third electric and two-thirds gas. For a midsize car, that means you’ve saved about $150 by shrinking the engine. But to equal that capacity, the electric motor and batteries still cost $300 to $400. That differential is one reason hybrids still cost more.

We’re not there yet, but we can see how to get to $150, especially as hybrids multiply: volume production will lower costs, you standardize some of the systems, and amortize the research and development. By 2015 or so, I think about 25% to 35% of vehicles will be hybrids.

You said that savings from better lighting still offer huge potential energy gains.
This surprises me.
About 11 billion incandescent bulbs are sold every year. Each one is an enormously inefficient way to convert electrons into photons. They give off so much heat that you increase the air conditioning load. There are two good replacements: today, fluorescents, which use about one-fourth the energy of incandescents; later, possibly light-emitting diodes (LEDs).

Fluorescents cost less to run, but they’re expensive.
Compared with a 100-watt bulb used for 6,000 hours, a fluorescent bulb will save you about $60 worth of energy if power costs 10¢ per kilowatt hour. Yet there are only 400 million or so fluorescents sold every year.

By 2015 or so, I think about 25% to 35% of vehicles will be hybrids.
IR sells integrated circuits that dramatically reduce the cost of controlling fluorescent bulbs and that capture all of the efficiency gains. But this is very difficult. It’s important that we try to lower the price of fluorescents because still today, if someone is faced with a $4 fluorescent and a $1 light bulb—even if the fluorescent saves them $30—they’ll often buy the $1 bulb.

You also sell power management chips to computer makers. Do you agree that info tech sales have passed their boom time?
Not at all. The broadband revolution is going to be a major transformation, on par with the birth of the PC and the rise of the Net. I think we’re about to hit a significant inflection point in the next two years as various technologies—the most promising of which is WiMax—hit the market.

How does widespread broadband translate into better sales for you?
For consumers, the shift to broadband digital media will lead to a huge migration to new digital TVs and digital audio. There are 1.6 billion TV sets in the world, and there are about 700 million PCs in the world. So you have more than twice the number of TVs as PCs. In the next five to seven years, all those TVs will begin to go from analog to digital—and each digital TV has about the same chip content as a PC. So you won’t just see a computer upgrade cycle, you’ll see a force twice as big as computers driving TVs and audio. In addition, more bandwidth directly increases sales of servers, routers, and switches. It won’t make our job any easier. Cyclicality won’t go away. But it’s sure to increase the underlying growth rate.
One Plan to Remove CO$_2$ from Atmosphere

- They plan a **synthetic tree** to remove CO$_2$

- One should recycle the chemicals needed

- It takes energy to remove CO$_2$
  - To remove the CO$_2$ from burning a barrel of oil requires 40% of the energy in the barrel of oil.
  - Thus if we remove a lot of CO$_2$ it will mean that we must use a lot more energy.
  - A future problem will be to deliver an adequate supply of energy at reasonable cost.
  - If a lot of energy is used to capture CO$_2$, then the energy supply problem will get worse:

See the next 2-pages about synthetic trees.

Roy Jenne
NCAR
Sep 14, 2005
NO EASY WAY OUT OF THE GREENHOUSE

Heading toward twice the CO₂ in the atmosphere by 2100

WALLACE BROECKER, NEWBERRY PROFESSOR OF EARTH AND ENVIRONMENTAL SCIENCES AT COLUMBIA UNIVERSITY, HAS SOME ADVICE FOR GLOBAL WARMING ACTIVISTS TO FOLLOW OVER THE NEXT 100 YEARS OR SO: GET REAL. ECLOGISTS, HE ARGUES, HAVE WRONGLY FOCUSED ON DEVELOPING POWER-GENERATING TECHNOLOGIES THAT DON'T USE FOSSIL FUELS AND DON'T SPEW CARBON DIOXIDE, WHICH CAN TRAP SOLAR RADIATION AND WARM THE PLANET. "BUT WE ARE NOT FAR FROM BEING ABLE TO GET 30 OR 40 PERCENT OF OUR ENERGY FROM SOLAR POWER," BROECKER SAYS. "IF WE BANK ON THAT, AND IT DOES NOT HAPPEN, WE WILL BE STUCK." IN HIS VIEW, NO CARBON-FREE TECHNOLOGY—INCLUDING NUCLEAR, WIND, GEOTHERMAL, AND TIDAL—IS LIKELY TO BE DEPLOYED QUICKLY ENOUGH TO HEAD OFF INCREASING ACCUMULATIONS OF THE GREENHOUSE GAS.

A SIMPLE MOLECULE'S TANGLED TALE

Carbon dioxide, a gas made up of one carbon atom and two oxygen atoms, seems like an insignificant part of Earth's atmosphere. In 2004 it constituted just .038 percent by volume. But based on data gleaned from ice-core samples, the level of concentration is higher than it has been for 420,000 years. Many scientists think that increasing amounts of carbon dioxide and other gases in the atmosphere, much of which are attributable to human activity, trap solar radiation and slowly warm the planet. The theory is supported by the Intergovernmental Panel on Climate Change, the National Academy of Sciences, and other major scientific organizations. Detectors argue that Earth has warmed and cooled naturally for millennia and that the warming trend we are experiencing is unrelated to human activity.

ATMOSPHERIC CHANGES

The greenhouse effect and the ozone hole are separate but related problems. For example, chlorofluorocarbons (CFCs) not only destroy stratospheric ozone but are also greenhouse gases.

CARBON TALLY

About 40 percent of the carbon added to the atmosphere by human activity since 1850 has remained in the atmosphere. The remaining 60 percent has been absorbed by the oceans and the terrestrial biosphere.

STEAM HEAT

Water vapor is the most potent greenhouse gas. Atmospheric warming caused by CO₂ and other gases produced by fossil-fuel combustion heats the oceans' surface and boosts humidity, putting more water vapor into the air. In some models, the added moisture triples the warming effect of fossil fuels.

Four greenhouse gases—carbon dioxide, methane, nitrous oxide, and tropospheric ozone—occur naturally in small amounts. The other 10 major ones—CFC-11, CFC-12, CFC-113, carbon tetachloride, methyl chloroform, HFC-22, HFC-23, perfluorocarbon, sulfur hexafluoride, and trifluoromethyl sulfur pentafluoride—did not exist before 1750.

NATURAL RESPIRATION

A human being exhales 2.2 pounds of carbon dioxide per day.

NOBEL ORACLE

The first person to predict that carbon dioxide released by burning fossil fuels would cause global warming was Swedish chemist and Nobel laureate Svante Arrhenius. He published a paper titled "On the Influence of Carbonic Acid in the Air Upon the Temperature of the Ground" in Philosophical Magazine in 1896.

MULTIPLIER EFFECT

Burning one gallon of gasoline, which weighs 6.3 pounds, produces 20.6 pounds of carbon dioxide because combustion lacks atmospheric oxygen in the carbon in the gasoline.
fossil fuels. "The Athabasca tar sands in Canada are being mined and converted to petroleum at a cost of about $20 a barrel," he says. As long as oil prices remain at more than $50 a barrel, that's irresistibly profitable. "The next step would be to make petroleum out of coal, much like the Nazis did in World War II when their supply was cut off. It might double the price of gasoline, but that would still be cheaper than other alternative forms of energy."

Broecker adds that what the developed wealthy world will do is largely irrelevant, because China, India, and much of the third world will grow increasingly wealthy and thirsty for fossil-fueled growth. "Since there are a billion and a half of us, and 5 billion people in the poorer parts of the world, it is more what they do to increase their fossil-fuel usage than what we do to decrease that matters," he says.

In short, there is simply no realistic way to clamp down on carbon-generating technologies before they fill the skies with high levels of carbon dioxide. Atmospheric CO₂, measured in parts per million, has been climbing steadily for more than 150 years and threatens to keep doing so. "We are headed toward 900 parts per million early in the next century," or more than double the current level of 380 ppm, Broecker says. "That would mean four to five Fahrenheit degrees of warming for the world as a whole, raising sea levels by a meter or more." And it won't stop there, he says. Sea levels might eventually even rise five meters, submerging the world's low-lying lands, including most of Florida.

The answer? "We need to work out a way to take CO₂ out of the air and bury it," Broecker says. He points to Klaus Lackner, a Columbia University geophysicist, and Alan Wright, an engineer formerly with the Biosphere 2 project, who are designing and building the first atmospheric CO₂ extraction machine. Gary Comer, founder of the Land's End clothing company, is funding the project. Although he won't divulge exact figures, Broecker says the "cost of development is peanuts. If it turns out that the models that predict warming are not right, we can leave the technology on the shelf. But if we need it, it will be there."

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**SOAKING UP CO₂**

KLAAUS LACKNER is a geophysicist at the Earth Institute at Columbia University and codeveloper of the synthetic tree, a device designed to remove carbon dioxide from the air. By Lackner's calculations, one synthetic tree could absorb 1,000 times more CO₂ than a living tree.

**How would the synthetic tree remove carbon dioxide from the air?**

L: The device itself would look something like goalposts with venetian blinds. It would be equipped to use liquid sodium hydroxide, which converts to sodium carbonate as it pulls CO₂ from the wind stream.

**How much could one tree remove?**

L: The unit, which has a collection area of 50 meters by 60 meters, could gather 90,000 tons of CO₂ a year. That means one synthetic tree could handle an amount equivalent to the annual emissions of 15,000 cars.

**How many of these synthetic trees worldwide would be needed to soak up the 22 billion tons of CO₂ produced annually from fossil fuels?**

L: About 250,000.

To make this process efficient, you need to recycle the sodium hydroxide, which means you need to take the absorbed carbon back out. How do you do that?

L: You percolate the liquid sodium carbonate over solid calcium hydroxide, and the calcium catches the carbon. So you have taken the carbon out of your sodium hydroxide, and you can use it again. But then you have to get the carbon out of the calcium so that you can repeat the process. You do this by heating the calcium carbonate to 900 degrees Celsius, and it leaks loose the CO₂. So now we have the CO₂ back in hand as a concentrated stream, with which we can do whatever we want.

What do you suggest?

L: It can be sequestered underground. The question is, is there enough capacity? Short term, it will work, but for the long term we need to develop other alternatives. I have proposed mineral sequestration. There are entire mountain ranges made of magnesium silicates that over millions of years would naturally turn into magnesium carbonate. We could speed up that process in an industrial fashion. We could make a stable, harmless solid.

What percentage of the energy in, say, gasoline would be consumed in the process of cleaning it up?

L: About 40 percent. People say 40 percent is a big hit. But it's not, compared with producing hydrogen from coal, which I think is the most likely way large quantities of hydrogen would be made. Those guys also have a 40 percent energy hit, if not larger. So in a sense, the cleanup will cost that much, whether it is converting hydrogen from coal or pulling carbon dioxide from the air. In one case, you pay for the energy upstream; in the other you pay for it downstream.

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"The unit could gather 90,000 tons of CO₂ a year. That means one synthetic tree could handle an amount equivalent to the annual emissions of 15,000 cars'.
Climate Trend Information

- World surface temp, 1880 – 2005
  
  Cooling – 1880 – 1907
  Warming – 1907 – 1945
  Cooling – 1945 – 1976
  Warming – 1976 – 2005

  Note: Greenhouse warming is a stronger effect since about 1970.
  (But also remember the cooling effect from SO₂ and particles.)

- Changes in world glaciers, 850 AD – present
  
  Glacier retreat since 1820

- Glacier retreat and advance for 6000 years

- Hurricanes: many in some years, few in others
  Atlantic Ocean (weak and strong hurricane years)
  
  Weak periods: 1903-1925 and 1971-1994 (47 yrs)

- Climate and fish, Pacific Ocean, 1905 – 2000
  
  Up and down changes each 25-35 years

- Activity of the sun, 900 AD to 2000 AD
  
  This has helped make warm and cold changes. How big is it?

Roy Jenne
Sep 15, 2005
History: A Big Change in Climate Trends
- Comes about each 30 years

How Has the Global Temperature, 1880 – 2005, Changed?
- Overall warming, but periods of cooling

Jan - Dec Global Surface Mean Temp Anomalies
National Climatic Data Center/NESDIS/NOAA

NOTE: There is reason for concern about global warming
- But the hype has been much too strong.
- The heavy hype hurts policy and it hurts public understanding of climate.

Aug 2005
Roy Jenne
Changes in World Glaciers, 850 AD – Present

A) The recent growth, then melting of glaciers (305 years)
   • 1700 – 1750: glaciers increasing
   • 1750 – 1820: glaciers steady (at a maximum value)
   • 1820 – 2005: glaciers in retreat (now near minimum)

B) Glaciers during 1350 – 1700 AD
   • A glacier max about 1350 AD
   • Then a glacier min about 1500 AD
   • A glacier max about 850 AD
      – Then came the Medieval Warm Spell

C) Information sources:
   • Item A from Science, 29 Apr 2005, p 675-677.
   • Item B derived from a figure in Burroughs Climate Book
     – Question: How much picture and moraine data did they have to make the figure about
     glaciers? Don’t know.

Roy Jenne
Aug 2005
Changes in World Glaciers

1. Most glaciers have retreated since 1820
   The glaciers have been melting for 180 years. They were melting before there was much buildup of greenhouse gases. What has caused this?

2. Glacier history
   - Periods of advance and retreat of glaciers during the past 3000 years.
   - Most of this is a part of natural climate cycles.

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*Image with graphs and text.*
Extracting a Climate Signal from 169 Glacier Records

J. Oerlemans

I constructed a temperature history for different parts of the world from 169 glacier length records. Using a first-order theory of glacier dynamics, I related changes in glacier length to changes in temperature. The derived temperature histories are fully independent of proxy and instrumental data used in earlier reconstructions. Moderate global warming started in the middle of the 19th century. The reconstructed warming in the first half of the 20th century is 0.5 kelvin. This warming was notably coherent over the globe. The warming signals from glaciers at low and high elevations appear to be very similar.

Compared with biogenic climate indicators like tree rings, glacier systems react in a relatively simple way to climate change. The transfer function does not change in time and geometric effects can be addressed. Interestingly, many glaciers are found at high elevations. This implies that a climate signal reflected in glacier fluctuations can be studied as a function of height.

Although glacier retreat is mentioned in almost all assessments on climate change, the number of systematic studies of longer records is quite small.

Records of glacier length were compiled from various sources, building on a data set from an earlier study (14). It was possible to extend the set of 48 records to a set of 169 records from glaciers found at widely differing latitudes and elevations. The core of the data set comes from the files of the World Glacier Monitoring Service in Zürich (15). Records were then included from glaciers in Patagonia (16), southern Greenland (17), Iceland (18), and Jan Mayen (19). Additional information was taken from the Satellite Image Atlas of Glaciers of the World (20) and from reports of the Swiss Academy of Sciences (21).

Data points in the earlier parts of glacier records are sparse but normally quite reliable. The information on maximum stands from sketches, etches, paintings, and photographs can be checked with moraine systems that are still in place today.

The records are not spread equally over the globe. There is a strong bias toward the European Alps, where a wealth of documents exists and glacier monitoring was introduced relatively early. Fluctuations of some glaciers in Iceland and Scandinavia before 1800 have also been documented well (18, 23, 24). Glacier records in North America have not been kept up to date and many series do not extend beyond 1985. The 169 glaciers in the data set are located in the European Alps (93 records), Caucasus (8), tropical Africa (5), Central Asia (9), Irian Jaya (2), New Zealand (2), Patagonia (6), Northwest America (27), South Greenland (1), Iceland (4), Jan Mayen (1), Svalbard (3), and Scandinavia (8).

From: Science Mag
29 April 2005
Page 675-677

Fig. 3. (A) Temperature reconstruction for various regions. The black curve shows an estimated global mean value, obtained by giving weights of 0.5 to the Southern Hemisphere (SH), 0.1 to Northwest America, 0.15 to the Atlantic sector, 0.1 to the Alps, and 0.15 to Asia.

(B) Best estimate of the global mean temperature obtained by combining the weighted global mean temperature from 1834 with the stacked temperature record before 1834. The band indicates the estimated standard deviation.
Figure 4.15 An analysis of the fluctuations of glaciers in the northern and southern hemispheres during the last 7,600 years, compared with radiocarbon production variations. Periods of negative radiocarbon production signal lower solar activity and are associated with glacial advance, which is a sign of a cooling climate (Burroughs, 1994, Fig. 4.10).
Atlantic Climate Pacemaker for Millennia Past, Decades Hence?

An unsteady ocean conveyor delivering heat to the far North Atlantic has been abetting everything from rising temperatures to surging hurricanes, but look for a turnaround soon implying that real-world conveyor variability does indeed drive the AMO.

Such strong similarities between a model and reality “suggest to me it’s quite likely” that the actual Atlantic Ocean works much the same way as the model’s does, says climate modeler Peter Stott of the Hadley Centre unit in Reading, who did not participate in the analysis. Hadley model simulations also support the AMO’s involvement in prominent regional climate events, such as recurrent drought in Northeast Brazil and in the Sahel region of northern Africa, as well as variations in the formation of tropical Atlantic hurricanes, including the resurgence of such hurricanes in the 1990s.

On page 115, climate modelers Rowan Sutton and Daniel Hodson of the University of Reading, U.K., report that they could simulate the way relatively warm, dry summers in the central United States in the 1930s through the 1960s became cooler and wetter in the 1960s through 1980s. All that was needed was to insert the AMO pattern of sea-surface temperature into the Hadley atmospheric model. That implies that the AMO contributed to the multicadal seesawing of summertime climate in the region.

If the Hadley model’s AMO works as well as it seems to, Knight and his colleagues argue, it should serve as some guide to the future. For example, if North Atlantic temperatures track the conveyor’s flow as well in the real world as they do in the model, then the conveyor has been accelerating during the past 35 years—not beginning to slow, as some signs had hinted (Science, 16 April 2004, p. 371). That acceleration could account for about 10% to 25% of the global warming seen since the mid-1970s, they calculate, meaning that rising greenhouse gases haven’t been warming the world quite as fast as was thought.

Judging by the 1400-year simulation’s AMO, Knight and colleagues predict that the conveyor will begin to slow within a decade or so. Subsequent slowing would offset—although only temporarily—a “fairly small fraction” of the greenhouse warming expected in the Northern Hemisphere in the next 30 years. Likewise, Sutton and Hodson predict more drought-prone summers in the central United States in the next few decades.

But don’t bet on any of this just yet. The AMO “is not as regular as clockwork,” says Knight; it’s quasi-periodic, not strictly periodic. And no one knows what effect the

Benjamin Franklin knew about the warm Gulf Stream that flows north and east off the North American coast, ferrying more than a petawatt of heating power to the chilly far North Atlantic. But he could have had little inkling of the role that this ponderous ocean circulation has had in the climatic vicissitudes of the greater Atlantic region and even the globe.

With a longer view of climate history and long-running climate models, today’s researchers are tying decades-long oscillations in the Gulf Stream and the rest of the ocean conveyor to long-recognized fluctuations in Atlantic sea-surface temperatures. These fluctuations, in turn, seem to have helped drive the recent revival of Atlantic hurricanes, the drying of the Sahel in the 1970s and ’80s, and the global warming of the past few decades, among other climate trends.

The ocean conveyor “is an important source of climate variability,” says meteorologist James Hurrell of the National Center for Atmospheric Research in Boulder, Colorado. “There’s increasing evidence of the important role oceans have played in climate change.” And there are growing signs that the conveyor may well begin to slow on its own within a decade or two, temporarily cooling the Atlantic and possibly reversing many recent climate effects. Greenhouse warming will prevail globally in both the short and long terms, but sorting out just what the coming decades of climatic change will be like in your neighborhood could be a daunting challenge.

Researchers agree that the North Atlantic climate machine has been revving up and down lately (Science, 16 June 2000, p. 1984). From recorded temperatures and climate proxies such as tree rings, researchers could see that temperatures around the North Atlantic had risen and fallen in a roughly 60- to 80-year cycle over the past few centuries. This climate variability was dubbed the Atlantic Multidecadal Oscillation (AMO). Ocean observations suggested that a weakening of the ocean conveyor could have cooled the Atlantic region and even the entire Northern Hemisphere in the 1950s and ’60s, and a subsequent strengthening could have helped warm it in the 1980s and ’90s. But the

Wobbly ocean. North Atlantic temperatures have wavered up and down at a roughly 60- to 80-year pace.

colleagues analyzed a 1400-year-long simulation on the Hadley Centre’s HadCM3 model, one of the world’s leading climate models. The simulations included no changes in climate drivers such as greenhouse gases that could force climate change. Any changes that appeared had to represent natural variations of the model’s climate system.

At April’s meeting of the European Geosciences Union in Vienna, Austria, Knight and colleagues reported that the Hadley Centre model produces a rather realistic AMO with a period of 70 to 120 years. And the model AMO persists throughout the 1400-

Bad warmth. The AMO’s warm years favor more U.S. hurricanes (right).
The atmosphere has natural up cycles in temperatures for 30-35 years followed by a down cycle.

These cycles are tied to decades-long oscillations in the Gulf Stream, in the drying of the Sahel of Africa in the 1970s and 1980s, in the recent revival of Atlantic hurricanes in the 1990s (and much more).

These cycles also speed up or slow down global warming.

The two recent big changes in world temperature trends were at about 1945 (temp falls some until 1976), and at about 1976 when faster warming started.

The cycles are very important, yet they get very little attention compared with all of the news about global warming (which they also affect).
- We need more attention on these cycles.
- More, more, more

A British climate model was run for 1400 years.
- It produces these cycles in a rather realistic way.

See the hurricane chart (previous page) for the 1900s as observed. There are many more hurricanes during one part of these cycles (1928 – 1970 and 1995 – 2000) then during the other part.
Hurricane forecasters: Hits may keep coming

By Jim Erickson
ROCKY MOUNTAIN NEWS

There's a 43 percent chance that a hurricane will hit the U.S. coastline this month, according to Colorado State University researchers who will issue an updated storm forecast today.

Hurricane forecaster William Gray and his colleagues are calling for four Atlantic hurricanes this month. Computer models suggest that two of them will be Category 3 storms or higher, with sustained winds of 111 mph or more.

Hurricane Katrina was a Category 4 storm when it slammed the Gulf Coast on Monday morning just east of New Orleans. Category 4 hurricanes have sustained winds of 131 to 155 mph.

"Obviously, no one wants to see another one of these anywhere near us this year," said Philip Klotzbach, a CSU atmospheric scientist who works with Gray.

"But we think the rest of the season is going to be very active, and the more active the season is — the more darts you throw at the board — the more likely you are to get a hit somewhere."

Long-term records show that the Atlantic normally spawns 2.4 hurricanes in September and that 1.3 of them are Category 3 or higher.

Gray and his colleagues have been forecasting hurricanes since 1984. He is widely regarded as a leader in the field.

The U.S. entered a period of increased hurricane activity in 1995. After last year's Florida hurricanes, and again when Katrina hit Monday, some observers blamed the brutal storms on global-warming.

The idea is that global warming is heating the Atlantic, providing the fuel that allows hurricanes to grow into destructive monsters.

"The hurricane that struck Louisiana yesterday was nicknamed Katrina by the National Weather Service. Its real name was global warming," Ross Gelbspan, author of The Heat Is On and Boiling Point, wrote in a Boston Globe op-ed piece Tuesday.

In the Aug. 4 edition of the journal Nature, MIT climatologist Kerry Emanuel reported that the maximum wind speed and duration of hurricanes and typhoons has increased by about 50 percent over the past 50 years.

Emanuel suggested that global warming was partly to blame.

But Klotzbach said Thursday that the increase in Atlantic hurricane activity seen since 1995 is likely because of natural variations in ocean salinity and temperature, not global warming.

The Atlantic was colder than normal from about 1970 to 1995. Then it warmed, triggering increased hurricane activity. The current active phase could last another two decades before subsiding, Klotzbach said.

"To try to tie this to global warming is kind of nebulous, because in the '70s, '80s and early '90s the globe was warming but the Atlantic was cooler," he said.

Roger Pielke Jr., director of the University of Colorado's Center for Science and Technology Policy Research, agrees.

Pielke analyzed the damage caused by hurricanes that have hit the U.S. coast since 1900. He concluded — after taking into account the explosive urban growth that has occurred there over the last century — that "there is no trend of increasing damage from hurricanes that hit the U.S. coast."

"I don't think you could find any hurricane scientist that would be willing to make the statement that the hurricanes of last year or Katrina are caused by global warming," he said.

From the June 1 beginning of the hurricane season through the end of August, 12 named tropical storms, four hurricanes, and three Category 3 or above hurricanes have occurred in the Atlantic.

The long-term average for that period is four named storms, two hurricanes and one Category 3 or above hurricane.

Sept. 2, 2005

Ray James
The ups and downs of climate, \( \text{CO}_2 \), and fish (Prepared by Fisheries Scientists)

\[
\begin{align*}
\text{A. Global Air Temperature} & \quad \text{B. Pacific Decadal Oscillation} \\
\text{C. Atmospheric Circulation Index} & \quad \text{D. Mauna Loa \( \text{CO}_2 \)} \\
\text{E. Regime Indicator Series} & \quad \text{F. Southeastern Pacific Ecosystem Index}
\end{align*}
\]

\[
\begin{align*}
\text{RIS} & \quad \text{PDQ} \\
\text{Ecosystem Index} & \quad \text{Mauna Loa \( \text{CO}_2 \)}
\end{align*}
\]

Source: Science Mag 10 Jan 2003, "From Anchovies to Sardines, and Back to Pacific Ocean.

California Current

A stronger and broader California Current, brought about during the anchovy regime, is associated with a shallower coastal thermocline from California to British Columbia, leading to enhanced primary production (Fig. 2). Off Peru, biological variability is similar to that observed off California.
A new study of the weaning weights of California’s elephant seal pups predicts that a 25-year trend of Pacific Ocean warming has ended. That means that the second half of a 50-year cycle has begun to cool the northern Pacific. In addition, historical fish catch data indicate the ocean cooling trend is likely to last until about 2025.

Burney Le Boeuf and David Crocker of the University of California, Santa Cruz, monitored the weaning weights of central California seal pups for 29 years, from 1975 to 2004. The ocean's temperatures generally increased, and the pups' weaning weights declined 21% over 24 years from the study's beginning until 2000.

The seal pups' weight decline coincided with an increase in their mothers' foraging time of 36%. A decline in the mothers' own weights confirmed that fish were relatively scarce. After 1999, however, ocean temperatures began to decline, fish became more abundant and the pups' weaning weights abruptly began to rise. By 2004 the pups' weaning weights had recovered to 90% of their 1975 weaning size.

Anchovy Weather

Seal pup weight trends confirm a cycle also found in northern Pacific salmon catchers. Columbia River salmon numbers declined sharply after 1977. And Columbia River salmon catch data, which date back to 1900, clearly reveal 50-year cycles, with 25 years of salmon abundance interspersed with 25-year periods of salmon scarcity. Gulf of Alaska salmon catch data show a similar but opposite cycle in salmon numbers. When the count of Columbia salmon fishery is down, Alaskan salmon numbers are up.

Dr. Francisco Chavez of the Monterey Bay Aquarium led a 2003 study that found shifts in sardine and anchovy populations across the Pacific followed the same 50-year cycle, and did so in such widely disparate places as California, Peru and Japan, all with sharply different fishing pressures. Chavez's data show the most recent shift toward cooler temperatures, which favor anchovies over sardines, occurred in the late 1990s.

The previous shift toward warmer temperatures, which disadvantaged the California seal pups and anchovies, occurred in the mid-1970s. Researchers have begun to call the 50-year ocean cycle the Pacific decadal oscillation (PDO).

During the PDO, ocean temperatures rise and fall, fish species wax and wane, and fish are caught in different places, but total ocean productivity remains stable. Do seals, salmon and sardines have something to tell us about man-made global warming? Yes.

Earth's temperatures have definitely increased since 1850 — the end of the widely noted Little Ice Age — by 0.8 degrees Celsius. However, 0.6 degrees of the warming occurred before 1940, and therefore before much human-emitted CO2 was produced. After 1940, the Earth's temperature declined moderately until the late 1970s, despite huge increases in human CO2 emissions and in defiance of the greenhouse theory. Is it just coincidence that during this period the PDO was cooling the Pacific? The current surge of public concern about human-caused global warming occurred after the Earth's average temperatures began to rise again in the late 1970s — which coincided with the PDO's shift back to its ocean warming phase.

So does the recent shift in the PDO mean the Earth's average temperatures will start to cool again? Was the "warmest decade" of the 1990s an artifact of expanding urban heat islands and a 25-year Pacific Ocean warming phase?

Up And Down

Ice cores and seabed sediments have already told us that the Earth has a long, moderate, natural 1,500-year cycle that raises temperatures in New York 2 degrees Celsius during its warming phase and drops them 2 degrees Celsius during little ice ages. The Little Ice Age, from 1300 to 1850, was the most recent of these cooling phases.

Now seal pups and sardines are instructing us that even temperature trends as long as 25 years can mislead us about cause and effect in the Earth's climate — which has been cycling constantly for at least the last million years.

We might want global climate modelers and the United Nation's Intergovernmental Panel on Climate Change to address evidence of the PDO before we agree to give up 85% of society's energy supply on behalf of man-made global warming.

Avery is a senior fellow of the Hudson Institute and an adjunct scholar with the National Center for Policy Analysis. He is writing a book, with climate researcher Fred Singer, on the broad physical evidence of the Earth's 1,500-year climate cycle.
Climate sceptics place bets on world cooling down

A British climate modeller has finally persuaded global-warming sceptics to wager money on their contrarian predictions about climate change.

James Annan, who is based at the Japan Agency for Marine-Earth Science and Technology in Yokohama, has agreed a US$10,000 bet with Galina Mashnich and Vladimir Bashkirtsev, two solar physicists who argue that global temperatures are driven by changes in the Sun’s activity and will fall over the next decade. The bet, which both sides say they are willing to formalize in a legal document, came after other climate sceptics refused to wager money.

Annan began his quest last winter after hearing Richard Lindzen, a meteorologist at the Massachusetts Institute of Technology who questions the extent to which human activities are influencing climate, say he was willing to bet that global temperatures will drop over the next 20 years. “A pay-off at retirement age would be a nice top-up to my pension,” says Annan.

But no wager was ever agreed. Annan says that Lindzen wanted odds of 50-to-1 against falling temperatures: this meant that Annan would pay out $10,000 if temperatures dropped, but receive only $200 if they rose.

In total, Annan says he tried and failed to agree terms with seven sceptics.

Other potential climate gamblers have drawn a blank with their attempts to enter similar bets with climate-change sceptics. In May, environmental activist George Monbiot challenged climate sceptic Myron Ebell to a £5,000 (US$9,000) wager live on BBC radio. Ebell, a global-warming specialist at the Competitive Enterprise Institute, a think-tank in Washington DC, declined, saying he has four children to put through university and so does not “want to take risks”.

But Annan’s search ended with Mashnich and Bashkirtsev, who are based at the Institute of Solar-Terrestrial Physics in Irkutsk, Russia. They say that global surface air temperatures closely correlate with the size and number of sunspots. Sunspot levels follow regular patterns and the Sun is expected to be in a less active phase over the next few decades, leading Mashnich and Bashkirtsev to predict a drop in temperature.

Both sides have agreed to compare the average global surface temperature between 1998 and 2003 with that between 2012 and 2017, as defined by the records of the US National Climatic Data Center. If the temperature drops, Annan will pay Mashnich and Bashkirtsev $10,000 in 2018, with the same sum going the other way if the temperature rises.

Piers Corbyn, head of Weather Action, a private meteorological service based in London, told Nature he would like to enter into a similar bet. Corbyn’s theory, the details of which he has not revealed, predicts that changes in solar activity will cause “considerable world cooling” by 2040. Annan challenged him to a bet in May, but Corbyn says he did not receive the e-mail.

“I’m happy to bet loads of money,” he says. — Jim Giles

Two Russian climate sceptics have $10,000 riding on their prediction that a reduction in sunspot activity will lower Earth’s temperature.

- Sunspots have been very active for a few decades
- This gives more global warming
- Now, it is expected that sunspots will be less active for a few decades
- That will help give less global warming
- Or give global cooling.

Me: Probably a lower rate of warming for 30 years or so.
Unusual activity of the Sun during recent decades compared to the previous 11,000 years

S. K. Solanki, I. G. Usoskin, B. Kromer, M. Schüssler & J. Beer

1Max-Planck-Institut für Sonnensystemforschung (formerly the Max-Planck-Institut für Aeronomie), 37191 Katlenburg-Lindau, Germany
2Sodankyla Geophysical Observatory (Oulu unit), University of Oulu, 90014 Oulu, Finland
3Heidelberger Akademie der Wissenschaften, Institut für Umweltphysik, Neuenheimer Feld 229, 69120 Heidelberg, Germany
4Department of Surface Waters, EAWAG, 8600 Dübendorf, Switzerland

Direct observations of sunspot numbers are available for the past four centuries, but longer time series are required, for example, for the identification of a possible solar influence on climate and for testing models of the solar dynamo. Here we report a reconstruction of the sunspot number covering the past 11,400 years, based on dendrochronologically dated radiocarbon concentrations. We combine physics-based models for each of the processes connecting the radiocarbon concentration with sunspot number. According to our reconstruction, the level of solar activity during the past 70 years is exceptional, and the previous period of equally high activity occurred more than 8,000 years ago. We find that during the past 11,400 years the Sun spent only of the order of 10% of the time at a similarly high level of magnetic activity and almost all of the earlier high-activity periods were shorter than the present episode. Although the rarity of the current episode of high average sunspot numbers may indicate that the Sun has contributed to the unusual climate change during the twentieth century, we point out that solar variability is unlikely to have been the dominant cause of the strong warming during the past three decades.

Figure 2. Comparison between directly measured sunspot number (SN) and SN reconstructed from different cosmogenic isotopes. Plotted are SN reconstructed from $\Delta^{14}C$ (blue), the 10-year averaged group sunspot number (GSN, red) since 1610 and the SN reconstruction from $^{10}Be$ under two extreme assumptions of local (green) and global (magenta, dashed) production, respectively. The slightly negative values of the reconstructed SN during the grand minima are an artefact; they are compatible with $SN = 0$ within the uncertainty of these reconstructions as indicated by the error bars. $\Delta^{14}C$ is connected with the $^{14}C$ production rate via a carbon cycle model. The connection between the $^{14}C$ production rate, $R$, and the cosmic ray flux is given by $R = \int_{1000}^{100} P(\theta) X(\phi) Y(\phi) \sin \phi d\phi$, where $\phi$ is the colatitude relative to the geomagnetic dipole axis, and $P(\theta)$ is the local cosmic ray rigidity cutoff which depends on $\phi$ and the virtual geomagnetic dipole moment, $M_0$.

Figure 1. Atmospheric radiocarbon level $\Delta^{14}C$ (expressed as deviation, in %, from the AD 1950 standard level) derived from mostly decadal samples of absolutely dated tree-ring chronologies (IntCal98 data set). The $\Delta^{14}C$ measurement precision is generally 2–3%, although in the earlier part of the time series it can reach up to 4–5%. The IntCal98 data for times earlier than 11,400 yr are not directly employed for the reconstruction because of larger errors and uncertainties in the time.

---

*Note: More sunspots give a little more solar energy.
And it gives more high energy solar flux.
This changes temperature and oceanic stratification.

• High energy flux from the Sun produces more isotopes (carbon $^{14}$ and $^{10} Be$).
These can be measured.
• Late more isotopes 9000 BC to 1000 BC.
Blair to seek consensus on safe greenhouse-gas levels

Jim Giles, London
Tony Blair, the British prime minister, plans to adopt a controversial new approach to international negotiations on climate change, according to UK scientists.

The approach, which his government is expected to announce later this month, would ask world leaders to seek agreement on an acceptable target level for the concentration of greenhouse gases in the atmosphere. But climate-change experts in Britain have expressed concern that such a strategy could dilute existing attempts to cut emissions of greenhouse gases, through the implementation of the Kyoto Protocol (see page 613).

With Blair hosting a meeting of the Group of Eight industrialized nations (G8) at Gleneagles in Scotland next July, and Britain holding the rotating presidency of the European Union for six months after that, the prime minister wants to provide some global impetus towards action on climate change.

Blair's initiative would get government leaders to work out how they could declare a level at which atmospheric greenhouse-gas concentrations would become "dangerous", say researchers who have discussed the idea with UK government officials. Supporters of the idea believe that discussion of such a long-term limit could help break the deadlock between countries that have ratified the Kyoto Protocol and others, led by the United States, that have rejected it.

UK scientists who have been consulted on the plan welcome Blair's focus on climate change, but warn that it will be hard to reach political or scientific agreement over what constitutes a dangerous level of greenhouse gases. They say that they have expressed their concerns during consultations for a government-run conference on greenhouse-gas stabilization that will take place next February at the Hadley Centre for Climate Prediction and Research in Exeter.

"Any attempt to launch negotiations on a target would be extremely dangerous and misguided," says Michael Grubb, a specialist in climate-change policy at Imperial College London. He says he received a "stony reception" from environment ministry officials when he made this point to them last month at a meeting at the Tyndall Centre for Climate Change Research in Norwich.

Grubb and others say that consideration of such a greenhouse-gas target will lead different countries in divergent directions, with each one looking at local problems, such as the effect of climate change on staple crops or on the frequency of summer heatwaves. David Griggs, director of the Hadley Centre — who has also been consulted by the environment ministry — says he fears that nations will find little common ground for identifying such a target.

And Mike Hulme, director of the Tyndall Centre, who is due to meet with ministry officials next week, says that the idea of a global target for greenhouse gases is too distant from people's immediate concerns about the impact of climate change. "It's too remote," he says. "It's not good at changing people's behaviour."

David Warrilow, a ministry official who is involved in the consultation, says that the British government wants other nations to "start to think about progress" towards setting a stabilization level, rather than establishing a firm target. Such debate could feed into future Kyoto Protocol negotiations, he adds.

But some climate-change analysts say the issue will simply divert attention from the pressing need to control emissions of greenhouse gases. "We could invest an enormous amount of time in a fruitless exercise," says Elliot Diringer, director of international strategy at the Pew Center on Global Climate Change in Washington, "rather than focussing on what can be done now."

Diringer agrees that the scope of the Kyoto Protocol should be broadened during its second phase, but he suggests that any new targets should focus on variables over which nations have direct control, such as levels of energy efficiency or the capture and storage of carbon dioxide.
## World Carbon Emissions
(Million tonnes carbon per year)

<table>
<thead>
<tr>
<th>Year</th>
<th>Oil</th>
<th>Gas</th>
<th>Coal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>423</td>
<td>97</td>
<td>1077</td>
<td>1638</td>
</tr>
<tr>
<td>1960</td>
<td>850</td>
<td>235</td>
<td>1419</td>
<td>2586</td>
</tr>
<tr>
<td>1970</td>
<td>1838</td>
<td>516</td>
<td>1564</td>
<td>4084</td>
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<tr>
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<tr>
<td>2000</td>
<td>3060</td>
<td>1312</td>
<td>2571</td>
<td>6944</td>
</tr>
<tr>
<td>2010</td>
<td>3673</td>
<td>1706</td>
<td>3116</td>
<td>8495</td>
</tr>
<tr>
<td>2015</td>
<td>3976</td>
<td>1936</td>
<td>3442</td>
<td>9353</td>
</tr>
</tbody>
</table>

## Carbon Release from Fossil Fuels
(Millions of tonnes of carbon)
Carbon Release to 2080 from Oil and Gas
(And Coal Carbon 1970 – 2030)

Roy Jenne
NCAR
Sep 2005

1. The carbon release from oil and gas is limited (1970 – 2080)
   During years 2020 to 2060 the carbon emissions from world use of oil and natural gas are expected
to be near a peak. During this period, the carbon release will vary from 5341 mt/yr to 6439 mt.
The peak will be near year 2040. See Table 1.

   Carbon release from world oil and gas during 2020 – 2060 will be near 6.0 Gt per year. Then it goes down.

   TABLE 1. CARBON EMISSIONS FROM OIL AND GAS (AND COAL TO 2030)

<table>
<thead>
<tr>
<th>Burn Oil</th>
<th>Use Gas</th>
<th>Use Oil + Gas</th>
<th>Use Coal</th>
<th>All Fossil Fuels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt C</td>
<td>Mt C</td>
<td>Mt C</td>
<td>Mt C</td>
<td>Mt C</td>
</tr>
<tr>
<td>1970*</td>
<td>1838</td>
<td>516</td>
<td>2354</td>
<td>1564</td>
</tr>
<tr>
<td>2000</td>
<td>2539</td>
<td>1306</td>
<td>3845</td>
<td>2422</td>
</tr>
<tr>
<td>2020</td>
<td>3521</td>
<td>1820</td>
<td>5341</td>
<td>3264</td>
</tr>
<tr>
<td>2030</td>
<td>4052</td>
<td>2132</td>
<td>6184</td>
<td>3780</td>
</tr>
<tr>
<td>2040</td>
<td>3995</td>
<td>2444</td>
<td>6439</td>
<td>?</td>
</tr>
<tr>
<td>2060</td>
<td>2912</td>
<td>2860</td>
<td>5772</td>
<td>?</td>
</tr>
<tr>
<td>2080</td>
<td>1828</td>
<td>2392</td>
<td>4220</td>
<td>?</td>
</tr>
</tbody>
</table>

   *NOTE 1: Mt C from oil, gas, coal in 1970 are 1838, 516, 1564 Mt C. From IEA in 1971 these are 1736,
   562, 1429. We use the first one (CDIAC, Oak Ridge).
   NOTE 2: There is limited oil and gas. There is more coal.

2. Trends in the use of oil, gas, and coal
   We project that plentiful oil (from crude, NGL, and oil sands) will come to a peak about year 2035
   and then start to decrease. Then there may be added liquid fuels from other sources (shale oil,
   GTL, bio-diesel, etc.) Also, carbon release from natural gas will peak and start down about 2060.

   If we include carbon from coal use, the total emissions will increase to about 9.96 Gt/yr by year
   2030.
Increase of Carbon in Atmosphere from Oil and Gas

Roy Jenne
Aug 28, 2005

Most climate model runs assume a rate of increase of CO₂ that seems too large. This page shows the CO₂ increase from burning all the world’s oil and gas.

<table>
<thead>
<tr>
<th>Year</th>
<th>Carbon to atmos since 2000*</th>
<th>% incr CO₂ in atmos</th>
<th>Carbon to atmos from 2000*</th>
<th>% incr of CO₂ in atmos</th>
<th>Oil &amp; Gas % CO₂ incr from yr 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 to date</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By 2029</td>
<td>97.4 Gt</td>
<td>6.2%</td>
<td>50.9 Gt</td>
<td>3.3%</td>
<td>9.5%</td>
</tr>
<tr>
<td>By 2060</td>
<td>209.0 Gt</td>
<td>13.4%</td>
<td>130.4 Gt</td>
<td>8.4%</td>
<td>21.8%</td>
</tr>
<tr>
<td>By 2080</td>
<td>258.7 Gt</td>
<td>16.6%</td>
<td>184.0 Gt</td>
<td>11.8%</td>
<td>28.4%</td>
</tr>
<tr>
<td>All oil or gas</td>
<td>286.8 Gt</td>
<td>18.4%</td>
<td>234.0 Gt</td>
<td>15.0%</td>
<td>33.4%</td>
</tr>
</tbody>
</table>

*Half of this stays in the atmosphere.

NOTE: The "by 2060" is really "by 2059" for oil (by the end of given year)
NOTE: All oil starting 2000 is 3100 bbl (includes 580 bbl of oil from oil sands—not in the USGS numbers).
NOTE: This is mean oil estimates. The differences between USGS low (95%) and high (5%) estimates are very large. See their chart.

~~~~~~~~~~ Some Comments ~~~~~~~~~

- Many climate model runs assume double CO₂ by 2070.
  - This increases CO₂ too fast.
- All the oil and gas used through 2080 only adds 28% to the world’s CO₂ in 2000
- It is unlikely that the world would burn enough coal by 2080 to get a doubling of CO₂ by then (and some of the coal CO₂ may be captured).
The Increase in CO₂ from Using Fossil Energy

Roy Jenne
Jan 31, 2005

The world's output of carbon (as CO₂) from burning fossil fuels will increase from about 6430 Mtonnes in 2000 to 10,143 Mtonnes in 2025, a rate of increase of 1.9% each year (Table 1).

Table 1. The Annual World Increase in Added CO₂ from Fossil Fuels
The annual Mtonnes of carbon from using oil, gas, and coal is given for 1990 to 2025.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>2492</td>
<td>2743</td>
<td>3270</td>
<td>4335</td>
<td>(1.9%)</td>
</tr>
<tr>
<td>Gas</td>
<td>1077</td>
<td>1313</td>
<td>1564</td>
<td>2255</td>
<td>(2.2%)</td>
</tr>
<tr>
<td>Coal</td>
<td>2322</td>
<td>2375</td>
<td>2738</td>
<td>3553</td>
<td>(1.6%)</td>
</tr>
<tr>
<td>Total</td>
<td>5890</td>
<td>6430</td>
<td>7572</td>
<td>10143</td>
<td>(1.9%)</td>
</tr>
</tbody>
</table>


We have seen that the amount of fossil energy used in the world is increasing at 1.9% each year. The rate of increase in the atmospheric pool of carbon is much less than this. From 1960 to 2000 the CO₂ in the atmosphere increased from 316.9 ppm to 369.5 ppm, an increase of only 16.6% in 40 years. The increase in each decade has stayed rather steady at 4.0 to 4.5% per decade. Near year 2000, the world puts almost 7 Gtonnes of carbon into the atmosphere from burning fossil fuels, and about half of it stays in the atmosphere, which gives an annual increase of 3.54 Gt in the total pool of atmospheric carbon of around 780 Gt. So this is an increase of 1 part in 200 (or 0.5% each year). By 2025 the world will put about 10 Gt of new carbon from fossil fuels into the atmosphere, and by then the pool will be about 800 Gt. The rate of increase is 5/800 (or 0.6% per year). The observed ppm of CO₂ in the atmosphere increased from 354.2 in 1990 to 369.5 in 2000, an increase of 15.3 parts, which is an increase of about 0.42% per year in the amount of CO₂.

\[ \text{CO}_2 \text{ increase of } 0.6\% \text{ a year is good (not 60\%)} \]

The total CO₂ in the atmosphere will increase at a rate of about 0.5% per year (near 2000) to about 0.6% a year (near 2025).

NOTE: Most runs of climate models for years 2000 – 2100 are set to increase CO₂ at a rate of 1% per year. This seems too fast.

Too Fast – 100 –
## Amount of CO₂ in Atmosphere

<table>
<thead>
<tr>
<th>Year</th>
<th>(ppmv)</th>
<th>Increase in Decade (ppmv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>296</td>
<td>23 ppmv in 60 yrs (4 per decade)</td>
</tr>
<tr>
<td>1960</td>
<td>316.9</td>
<td>8.7 ppmv</td>
</tr>
<tr>
<td>1970</td>
<td>325.6</td>
<td>13.1</td>
</tr>
<tr>
<td>1980</td>
<td>338.7</td>
<td>15.5</td>
</tr>
<tr>
<td>1990</td>
<td>354.2</td>
<td>15.3</td>
</tr>
<tr>
<td>2000</td>
<td>369.5</td>
<td>20 per decade</td>
</tr>
<tr>
<td>2030</td>
<td>est 430</td>
<td></td>
</tr>
</tbody>
</table>

- Many models assume that double CO₂ (from 2000) would happen about year 2070.
  - This is much too fast.

- It would require a fast CO₂ increase of 55 ppmv per decade to double the CO₂ in the atmosphere by 2070.

- The rate of CO₂ increase will increase.
  - But an average of 55 ppmv per decade during 2010 – 2070 is highly unlikely (too fast).

Source of CO₂ data: Mauna Loa observations by Keeling, from CDIAC, Oak Ridge.

---

**Note:** If CO₂ is "Too Fast", then the predicted heating is: Too much

Roy Jenne  
Aug 22, 2005
Carbon Dioxide in Atmosphere during Past 400,000 Years
Roy Jenne
Oct 10, 2005

1. Previous ice age periods each lasted about 100,000 year.
   Each had a long period getting colder, followed by a warm period that lasted about 10,000 years.
   - Natural level of CO₂ in warmer period was about 280 ppm (190 ppm in coldest period).

2. The present warm spell on earth started about 10,000 years ago.
   - About 5000 to 6000 years ago Europe was ~2 or 3° C warmer than now in summer (called climate optimum).

3. The previous warm spell was around 125,000 years ago. It ended about 118,000 years ago.
   - It was somewhat warmer than the present warm period.
   - The earlier warm periods were at 235,000 years and 330,000 years ago.

4. Level of CO₂ in coldest part of each long ice age (each 100,000 years)
   - The coldest part is about 10,000 years before the next big warm period starts.
   - At the coldest time, CO₂ was about 190 ppm.

   - It has many graphics and plots.

6. The past 1000 years
   - By 900 AD, the CO₂ in air was up to 275 ppm.
   - The pre-industrial level of CO₂ was about 282 ppm.
   - At 1900 the CO₂ level was about 296 ppm.

Figure 8.9 CO₂ concentrations over the last 1,000 years from ice-core records (D47, D57, Siple and South Pole – all in Antarctica) and (since 1958) Mauna Loa, Hawaii, measurement site. The smooth curve is based on a 100-year running mean. The rapid increase in CO₂ concentration since the onset of industrialisation is evident and has etc.
Rate of CO₂ Growth (and Greenhouse Warming) in Climate Models (2000 – 2100)

- The model people put in rules to say how much CO₂ will be added each year. More than one different case is run.

- They also put in rules for other greenhouse gases (like methane) and when volcanoes will erupt.

- There are wide regions with surface air pollution including sulfur dioxide (such as Asia). These patterns (and the intensity) are fed into the model, along with changes over time.

- The dot in Fig 1 (next page) shows the carbon expected to be added in 2030 (10.3 Gtonnes). This is less than five of the cases on the chart.

- Define a CO₂ case D. Use the dot by 2030. Then use 13 Gtonnes per year for 2040 – 2100. Get 430 ppm CO₂ by 2030 and 622 ppm by 2100.

- The CO₂ emissions for burning of oil plus gas: The supply will constrain the sum of these to be about 5.7 to 7.2 Gtonnes/yr during 2020 – 2060 and then lower. Case D assumes that coal use will add enough to give 13 Gt/yr for 2040 – 2100.

Many cases in Fig 1 (next page) release CO₂ much faster than present estimates of fossil fuel use out to at least 2030.

- This means that CO₂ increases faster and therefore atmospheric warming appears to be too much, too fast from these popular cases.
Carbon Dioxide in the Atmosphere, 2000 – 2100, Several Cases

Table 1 shows CO₂ in the atmosphere for eight cases that have different rates of burning fossil fuels. The ppm values were read from the Woods Hole Fig 1 curves (next page) except for the 1%/yr case, the .6%/yr case, and Case D. The latter three were calculated assuming that only half of the CO₂ from fossil fuels stays in the atmosphere beyond 2 or 3 years. Case D is based on a fossil energy estimate, where present forecasts are assumed through 2030, and then 13 Gtonnes C/yr emissions are used for 2040 – 2100.

**Table 1.** Approximate CO₂ (ppm) in Atmosphere, 2030 – 2100

The CO₂ ppm is in the table followed by ( ) which have the percentage of CO₂ above the observed ppm in 2000 (369.5 ppm).

<table>
<thead>
<tr>
<th>Emission Case</th>
<th>CO₂ PPM in Atmosphere for Given Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2030</td>
</tr>
<tr>
<td>1%/Yr</td>
<td>498  (35%)</td>
</tr>
<tr>
<td>.6%/Yr</td>
<td>442  (20%)</td>
</tr>
<tr>
<td>A1FI</td>
<td>450  (13%)</td>
</tr>
<tr>
<td>A1B</td>
<td>450  (13%)</td>
</tr>
<tr>
<td>A2</td>
<td>445  (20%)</td>
</tr>
<tr>
<td>A1T</td>
<td>430  (16%)</td>
</tr>
<tr>
<td>B1</td>
<td>420  (14%)</td>
</tr>
<tr>
<td>D</td>
<td>430  (16%)</td>
</tr>
</tbody>
</table>

Royal Jenne  
May 9, 2005
**Figure 1.** In (a), the dot shows the expected CO₂ added in year 2030 from the world's two main energy forecast groups (USDOE and IIEE), as well as from many other energy forecast groups. The B1 scenario is a point forecast that dramatically underestimates the expected CO₂ addition, which is consistent with the findings from over 40 different energy forecast groups.

**Figure 2.** Future climate projections.

- **Major uncertainties:**
  - Emissions (social, political, economic)
  - Atmospheric inventories (climate-carbon feedbacks)
  - Climate sensitivities (clouds, water vapor)

- **Figure 2 (a)**: CO₂ emissions over time for different scenarios.
- **Figure 2 (b)**: Temperature change projections with multiple models and scenarios.
Growth in CO₂ from Fossil Fuel Forecasts and from 1%/Year Increase

Roy Jenne
Apr 27, 2005

Many climate model runs have assumed that CO₂ in the atmosphere will increase by 1% per year. We will see that this is much too fast.

1. Table 1. A common climate model assumption is to increase CO₂ in the atmosphere by 1% per year during 2000 – 2100 AD. This leads to a doubling of CO₂ from 2000 to 2070.

<table>
<thead>
<tr>
<th>Year</th>
<th>CO₂ in Atmosphere</th>
<th>(1%/Yr) CO₂ ppm</th>
<th>CO₂ ppm from Energy Forecast</th>
<th>Carbon in Atmosphere</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1.0</td>
<td>369.5 (obs)</td>
<td>369.5</td>
<td>779.7 Gt</td>
</tr>
<tr>
<td>2030</td>
<td>1.35</td>
<td>498</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2050</td>
<td>1.65</td>
<td>608</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2070</td>
<td>2.01 (double)</td>
<td>742</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2100</td>
<td>2.71</td>
<td>999</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   Much smaller than the growth of 1% per year (to 498 ppm)

2. Carbon from fossil fuels (2000 – 2030, 31 years)
(From energy forecasts by Intl Energy Agency in WEO 2000)

   Year: 2000 2020 2030
   Carbon from fossil: 6.21 Gt 8.97 Gt 10.33 Gt

   - Total carbon emitted 2000 – 2030 (31 yrs) = 256.6 Gt
     - Only half stays in atmosphere = 128 Gt → Gives 430 ppm in 2030

   - Thus carbon in atmosphere is up 16.4% (during 2000 to 2030)
     - It will be up 61 ppm from 369.5 in 2000 to 430 ppm in 2030

   • The 1%/year increase for models says CO₂ will be up by 129 ppm (2000 to 2030)

   • But CO₂ should be up only 61 ppm from the energy forecast

   • The 129 ppm increase is much too fast! ——— too fast

---

-166-
## Reference Scenario: World

<table>
<thead>
<tr>
<th>Energy Demand (Mtoe)</th>
<th>Shares (%)</th>
<th>Growth Rates (% per annum)</th>
</tr>
</thead>
</table>

## Transportation (Mtoe)

|------|------|------|------|------|------|------|------|------|------|

## Electricity Generation (TWh)

|------|------|------|------|------|------|------|------|------|------|

## Reference Scenario: World

### Carbon Dioxide

<table>
<thead>
<tr>
<th>CO₂ Emissions (Mt)</th>
<th>Shares (%)</th>
<th>Growth Rates (% per annum)</th>
</tr>
</thead>
</table>
OVERVIEW OF THE COUPLED MODEL INTERCOMPARISON PROJECT

by Gerald A. Meehl, Curt Covey, Bryant McAvaney, Mojib Latif, and Ronald J. Stouffer

...climate model runs for increasing CO₂...

For the last decade the Coupled Model Intercomparison Project (CMIP) has worked to improve our understanding of processes and simulation capabilities in global coupled models (Meehl 1995). The varying output from the models typifies the problems addressed in CMIP. For example, Fig. 1 from Covey et al. (2003) shows recent results from such simulations for model responses to idealized increases in atmospheric CO₂ of 1% yr⁻¹. The models reach about 2°C global mean surface warming by the time CO₂ doubles (around year 70), and the range of model results stays within roughly ±25% of the average model result throughout the experiments. Experiments in which the models are run to equilibrium when coupled to a nondynamic slab ocean show a greater spread of output, in part due to compensating ocean heat uptake in the most sensitive models (e.g. Cubasch et al. 2001).

The precipitation responses of the models span a much wider range than the temperature responses. As shown in Fig. 1 (bottom), the increase in global and annual mean precipitation at the time of CO₂ doubling varies from essentially 0 to ~0.2 mm day⁻¹. The correlation between precipitation increases and temperature increases is weak.

CMIP was launched in late 1995 by the Climate Variability and Predictability (CLIVAR) Numerical Experimentation Group 2 ([NEG2]) subsequently reconstituted as the World Climate Research Programme (WCRP)/CLIVAR Working Group on Coupled Models (WGCM). The planning and commencement of the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) has prompted rapid coupled-model development, which is leading to an expanded CMIP-like activity to collect and analyze results for the control, 1% CO₂ and twentieth-, twenty-first-, and twenty-second-century simulations performed for the AR4.

The first phase of CMIP, dubbed CMIP1, was aimed at collection and analysis of present-day control runs from the coupled models. That was followed closely...
by CMIP2, which additionally collected model data from 1% yr\(^{-1}\) CO\(_2\) increase experiments from the coupled models (Meehl et al. 1997).

Thus the next phase of CMIP was called CMIP2+, with the intention being to collect all model data generated from control and 1% CO\(_2\) increase experiments for the atmosphere, ocean, sea ice, and land surface. This represented a significant and massive data collection and archival exercise for the U.S. Department of Energy Program for Climate Model Diagnosis and Intercomparison (PCMDI). Due to the extreme logistical issues involved with CMIP2+, only a subset of all of the modeling groups submitted data, but there are currently 12 complete sets of model output available for analysis.

![Figure 1](image)

**Figure 1.** Globally averaged difference between increasing CO\(_2\) and control run values of annual mean (top) surface air temperature and (bottom) precipitation for the CMIP2 models (Covey et al. 2003).

---

**Climate Model Information**

*Roy Jenne*

*26 July 2005*

- These were coupled climate model runs. They include an atmospheric model that interacts with an ocean model.
- By 80 years (such as 2000 to 2080) the global surface air temperature increased by about 2°C in most of these models.
- These assume that CO\(_2\) does increase at 1%/year during the next century. This seems somewhat faster than is likely. Thus the temperature increase will probably be somewhat slower than in Fig 1.
- The model runs in Fig 1 were probably made in about 2001 – 2002.
Global-Annual Means (1% / yr CO₂ - control)

Fig. 1. Globally averaged difference between increasing CO₂ and control run values of annual mean (top) surface air temperature and (bottom) precipitation for the CMIP2 models (Covey et al. 2003).

MULTIMODEL ANALYSES FOR UPCOMING IPCC REPORT

For AR4 studies, the list of runs includes the following.

1) Twentieth-century simulation to year 2000, then fix all concentrations at year 2000 values and run to 2100 (CO₂ ~ 360 ppm).
2) Twenty-first-century simulation with SRES A1B to 2100, then fix all concentrations at year 2100 values to 2200 (CO₂ ~ 720 ppm).
3) Twenty-first-century simulation with SRES B1 to 2100, then fix all concentrations at year 2100 values to 2200 (CO₂ ~ 550 ppm).
4) Twenty-first-century simulation with SRES A2 to 2100.
5) 1% CO₂ run to year 80 where CO₂ doubles at year 70 with corresponding control run. -1% to yr 80
6) 100-yr (minimum) control run including same time period as in 1 above.
7) 2xCO₂ equilibrium with atmosphere-slab ocean (also as input to CMIP).
8) Extend one A1B and B1 simulation to 2300.
9) 1% CO₂ run to quadrupling with an additional 150 yr with CO₂ fixed at 4xCO₂.
10) 1% CO₂ run to doubling with an additional 150 yr with CO₂ fixed at 2xCO₂.
11) Participate in AMIP, OMIP, and CFMIP.
Consider China, India, Indonesia

- Their economic output has grown rapidly
- The use of electricity has grown by huge amounts
- They travel a lot more
- Oil use by China and India, 2002 – 2030
- The total use of energy is growing fast

Roy Jenne
Apr 2005

4 pages here
Table 7.5: Total Primary Energy Demand in China (Mtoe)

<table>
<thead>
<tr>
<th></th>
<th>1971</th>
<th>2000</th>
<th>2010</th>
<th>2030</th>
<th>Average annual growth 2000-2030 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>192</td>
<td>659</td>
<td>854</td>
<td>1,278</td>
<td>2.2</td>
</tr>
<tr>
<td>Oil</td>
<td>43</td>
<td>236</td>
<td>336</td>
<td>578</td>
<td>3.0</td>
</tr>
<tr>
<td>Gas</td>
<td>3</td>
<td>30</td>
<td>57</td>
<td>151</td>
<td>5.5</td>
</tr>
<tr>
<td>Nuclear</td>
<td>0</td>
<td>4</td>
<td>23</td>
<td>63</td>
<td>9.3</td>
</tr>
<tr>
<td>Hydro</td>
<td>3</td>
<td>19</td>
<td>29</td>
<td>54</td>
<td>3.5</td>
</tr>
<tr>
<td>Other renewables</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>6.8</td>
</tr>
<tr>
<td>Total primary energy demand</td>
<td>241</td>
<td>950</td>
<td>1,302</td>
<td>2,133</td>
<td>2.7</td>
</tr>
</tbody>
</table>

Table 7.7: Electricity Generation Mix in China (TWh)

<table>
<thead>
<tr>
<th></th>
<th>1971</th>
<th>2000</th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>98</td>
<td>1,081</td>
<td>1,723</td>
<td>2,509</td>
<td>3,503</td>
</tr>
<tr>
<td>Oil</td>
<td>16</td>
<td>46</td>
<td>51</td>
<td>53</td>
<td>54</td>
</tr>
<tr>
<td>Gas</td>
<td>0</td>
<td>19</td>
<td>74</td>
<td>209</td>
<td>349</td>
</tr>
<tr>
<td>Nuclear</td>
<td>0</td>
<td>17</td>
<td>90</td>
<td>163</td>
<td>242</td>
</tr>
<tr>
<td>Hydro</td>
<td>30</td>
<td>222</td>
<td>333</td>
<td>511</td>
<td>622</td>
</tr>
<tr>
<td>Other renewables</td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>16</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>1,387</td>
<td>2,282</td>
<td>3,461</td>
<td>4,813</td>
</tr>
</tbody>
</table>

Figure 7.4: Oil Balance in China

Population

<table>
<thead>
<tr>
<th>Year</th>
<th>People, m</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>845 m</td>
</tr>
<tr>
<td>2000</td>
<td>1,272</td>
</tr>
<tr>
<td>2030</td>
<td>1,481 m</td>
</tr>
</tbody>
</table>

Econ

<table>
<thead>
<tr>
<th>Year</th>
<th>Value, $US$1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>$493 b</td>
</tr>
<tr>
<td>2000</td>
<td>$4861 b</td>
</tr>
<tr>
<td>2030</td>
<td>$19,753 b</td>
</tr>
</tbody>
</table>

PPP method
Table 6.11: Primary Energy Demand in Korea (Mtoe)

<table>
<thead>
<tr>
<th></th>
<th>1971</th>
<th>2000</th>
<th>2010</th>
<th>2030</th>
<th>Average annual growth 2000-2030 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>6</td>
<td>42</td>
<td>58</td>
<td>79</td>
<td>2.2</td>
</tr>
<tr>
<td>Oil</td>
<td>11</td>
<td>104</td>
<td>126</td>
<td>165</td>
<td>1.6</td>
</tr>
<tr>
<td>Gas</td>
<td>-</td>
<td>17</td>
<td>33</td>
<td>61</td>
<td>4.4</td>
</tr>
<tr>
<td>Nuclear</td>
<td>-</td>
<td>28</td>
<td>45</td>
<td>65</td>
<td>2.8</td>
</tr>
<tr>
<td>Hydro</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Other renewables</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>10</td>
<td>4.0</td>
</tr>
<tr>
<td>TPES</td>
<td>17</td>
<td>194</td>
<td>264</td>
<td>378</td>
<td>2.3</td>
</tr>
</tbody>
</table>

From: WEO 2002

Figure 6.9: Total Primary Energy Demand in Korea

Total energy use in S. Korea: A huge increase

Table 11.3: Total Primary Energy Demand in Indonesia (Mtoe)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>0</td>
<td>14</td>
<td>24</td>
<td>40</td>
<td>63</td>
<td>5.2</td>
</tr>
<tr>
<td>Oil</td>
<td>8</td>
<td>53</td>
<td>73</td>
<td>96</td>
<td>118</td>
<td>2.7</td>
</tr>
<tr>
<td>Gas</td>
<td>0</td>
<td>28</td>
<td>45</td>
<td>64</td>
<td>78</td>
<td>3.4</td>
</tr>
<tr>
<td>Hydro</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3.8</td>
</tr>
<tr>
<td>Other renewables</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>6.7</td>
</tr>
<tr>
<td>TPES*</td>
<td>9</td>
<td>98</td>
<td>152</td>
<td>213</td>
<td>276</td>
<td>3.5</td>
</tr>
</tbody>
</table>

* Excludes biomass.
Saudis Woo India on Oil Projects

Possible Ventures Illustrate A Shift in Energy Markets Toward Big Asian Nations

Saudi Arabia proposed a partnership with India in a series of big energy deals, underscoring how global petroleum markets' center of gravity is shifting toward the vast and fast-growing Chinese and Indian markets.

The Asian overture by Saudi Arabia, the world's largest oil exporter, comes as another big energy provider—Canada—has signaled its eagerness for energy-investment deals with China.

The Saudi pitches came in meetings that oil minister Ali Al Naimi and other Saudi officials held with counterparts in New Delhi. The Saudis proposed that Indian companies join them in building an oil refinery in Saudi Arabia and invited New Delhi to bid in the next round of natural-gas-exploration contracts to be offered by the kingdom. "The Saudis are very keen on setting up an export-oriented refinery with Indian companies in Saudi Arabia," an Indian Petroleum Secretary S.C. Tripathi said.

He said senior officials of Saudi Aramco, the Saudi state-owned oil giant, will visit New Delhi this month for talks with Oil & Natural Gas Corp. and Indian Oil Corp. to finalize a joint venture. "We may invest in India, and we would welcome investment by Indian companies in Saudi Arabia," Mr. Naimi said.

The move comes as India, which accounted for more than half the increase in world oil demand in the past two years, looks abroad to secure supplies of oil and other raw materials to feed its booming economy. Canadian and Chinese government officials have been discussing China's oil interest in recent months, with Canada saying business decisions must be made by Canadian companies rather than by the government, said a person familiar with the matter.

Philippe Reichel, a spokesman for Terasen Inc., a Vancouver, British Columbia, pipeline concern, said the company has held recent discussions with Chinese state-owned oil concerns Sinopec and China National Petroleum Corp. concerning the Chinese companies' interest in shipping Canadian oil on a proposed pipeline expansion.

Enbridge Inc., of Calgary, Alberta, a Terasen rival that is proposing to build a pipeline from northern Alberta to British Columbia, hopes soon to sign memorandums of understanding with Asian parties, which the company declined to identify, according to Canadian oil executives. But that oil is heavier and more difficult to refine.

China has been seeking oil opportunities in Venezuela and Ecuador. China has also been seeking mining assets, with China Minmetals Corp. in talks to acquire Canada's Noranda Inc. But that potential deal has sparked political debate in Canada. Major foreign investments in Canada are subject to government review, and some politicians have argued that Ottawa should block a takeover by state-owned Minmetals.

The moves by Saudi Arabia and Canadian companies to shift focus to Asia from the U.S., which remains the No. 1 market for oil, is the result of fast-growing demand in the region. The International Energy Agency estimates that China and India together will consume 3.6 million barrels a day more oil by 2030 than they did in 2002, accounting for a large portion of the global demand increase of 13.4 million barrels a day expected during that period.

The Saudis also floated the idea of building a joint-venture refinery in India, which is fast becoming a major customer of Saudi Arabia. A Saudi official said the idea was to "cement the relationship" with India, whose companies have lately become aggressive in seeking to expand their operations.

Diplomatic niceties apart, the Saudi proposals also make business sense, according to oil-industry officials. For the first time in more than two decades, refining operations have become profit centers for oil companies because capacity constraints to produce gasoline and other transportation fuels have pushed up prices. High refinery margins are expected to last for years, in part because it has become difficult to obtain permits to build refineries in rich countries, notably in the U.S. The world's largest consumer of gasoline, the U.S. hasn't built any refineries since the 1970s and now needs to import gasoline to meet its needs.

World demand for oil grew by about 4.5 million barrels a day in 2003 and 2004, but global refining capacity is estimated to have grown by as little as one-fifth of that.

To capture more of the world-wide increase in oil prices, Saudi Arabia apparently has decided to build export refineries to process more of its crude oil and export the resulting products, according to industry officials.

"The concept of refineries is anathema to major oil companies," said Lawrence Goldstein, president of the industry-funded Petroleum Industry Research Foundation in New York. But Saudi Arabia alone, or in cooperation with the emerging but feisty oil companies of India and...
World Population AD 1 to year 2020

The population of the world has been increasing rapidly, especially in the recent one or two hundred years. Table 1 summarizes the population in different regions of the world.

Table 1. World Population AD 1 to year 2020.
The population for regions of the world and the total is given. The estimates for 1500-1900 were from the *Atlas of World Population History* (McEvedy and Jones, 1979), and estimates for 1950-2020 were from *World Population Profile: 1994* (Jamison & Hobbs, 1994, U.S. Department of Commerce). There are small differences between the sum of regional numbers and the world totals, mostly due to rounding, but before 1950 there may be other small differences.

<table>
<thead>
<tr>
<th>Regions</th>
<th>AD 1</th>
<th>1500</th>
<th>1800</th>
<th>1900</th>
<th>1950</th>
<th>1994</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>16.5</td>
<td>46</td>
<td>70</td>
<td>110</td>
<td>228</td>
<td>701</td>
<td>1351</td>
</tr>
<tr>
<td>N. America</td>
<td>0.3</td>
<td>1.0</td>
<td>6.5</td>
<td>81</td>
<td>166</td>
<td>289</td>
<td>358</td>
</tr>
<tr>
<td>Latin America and Caribbean</td>
<td>4.2</td>
<td>13</td>
<td>17.5</td>
<td>64</td>
<td>166</td>
<td>474</td>
<td>652</td>
</tr>
<tr>
<td>Europe, East and West</td>
<td>29</td>
<td>69</td>
<td>144</td>
<td>290</td>
<td>392</td>
<td>509</td>
<td>530</td>
</tr>
<tr>
<td>Former Soviet Union</td>
<td>4</td>
<td>17</td>
<td>44</td>
<td>125</td>
<td>180</td>
<td>296</td>
<td>335</td>
</tr>
<tr>
<td>Asia (including near east)</td>
<td>113</td>
<td>275</td>
<td>617</td>
<td>945</td>
<td>1411</td>
<td>3345</td>
<td>4660</td>
</tr>
<tr>
<td>Australia, New Zealand, islands</td>
<td>1</td>
<td>2</td>
<td>2.5</td>
<td>6.8</td>
<td>12.5</td>
<td>28</td>
<td>37</td>
</tr>
<tr>
<td>World</td>
<td>170</td>
<td>425</td>
<td>900</td>
<td>1625</td>
<td>2555</td>
<td>5642</td>
<td>7924</td>
</tr>
<tr>
<td><strong>Some Countries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China (Mainland)</td>
<td>53</td>
<td>110</td>
<td>328</td>
<td>472</td>
<td>563</td>
<td>1190</td>
<td>1425</td>
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<tr>
<td>India</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Old India**</td>
<td>34</td>
<td>100</td>
<td>185</td>
<td>280</td>
<td>455</td>
<td>1174</td>
<td>1782</td>
</tr>
</tbody>
</table>

* N. America includes U.S. and Canada through 1900. Starting 1950, it also includes Greenland (22,000), Bermuda (39,000), and other (5,000).

** India, Pakistan, Bangladesh.
### Table A14. World Population by Region, Reference Case, 1990-2025 (Millions)

<table>
<thead>
<tr>
<th>Region/Country</th>
<th>History</th>
<th>Projections</th>
<th>Average Annual Percent Change, 2001-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrialized Countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North America</td>
<td>366</td>
<td>405</td>
<td>417</td>
</tr>
<tr>
<td>United States</td>
<td>255</td>
<td>276</td>
<td>288</td>
</tr>
<tr>
<td>Canada</td>
<td>28</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Mexico</td>
<td>83</td>
<td>99</td>
<td>100</td>
</tr>
<tr>
<td>Western Europe</td>
<td>376</td>
<td>390</td>
<td>391</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>57</td>
<td>59</td>
<td>59</td>
</tr>
<tr>
<td>France</td>
<td>57</td>
<td>59</td>
<td>60</td>
</tr>
<tr>
<td>Germany</td>
<td>79</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>Italy</td>
<td>57</td>
<td>58</td>
<td>57</td>
</tr>
<tr>
<td>Netherlands</td>
<td>15</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Other Western Europe</td>
<td>112</td>
<td>116</td>
<td>117</td>
</tr>
<tr>
<td>Industrialized Asia</td>
<td>144</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Japan</td>
<td>124</td>
<td>127</td>
<td>127</td>
</tr>
<tr>
<td>Australia/New Zealand</td>
<td>20</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Total Industrialized</td>
<td>886</td>
<td>946</td>
<td>959</td>
</tr>
<tr>
<td>EE/FSU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Former Soviet Union</td>
<td>290</td>
<td>290</td>
<td>289</td>
</tr>
<tr>
<td>Russia</td>
<td>148</td>
<td>146</td>
<td>145</td>
</tr>
<tr>
<td>Other FSU</td>
<td>141</td>
<td>144</td>
<td>144</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>122</td>
<td>121</td>
<td>121</td>
</tr>
<tr>
<td>Total EE/FSU</td>
<td>412</td>
<td>411</td>
<td>410</td>
</tr>
<tr>
<td>Developing Countries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developing Asia</td>
<td>2,791</td>
<td>3,246</td>
<td>3,288</td>
</tr>
<tr>
<td>China</td>
<td>1,155</td>
<td>1,275</td>
<td>1,285</td>
</tr>
<tr>
<td>India</td>
<td>846</td>
<td>1,017</td>
<td>1,033</td>
</tr>
<tr>
<td>South Korea</td>
<td>43</td>
<td>47</td>
<td>47</td>
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<tr>
<td>Other Asia</td>
<td>746</td>
<td>907</td>
<td>923</td>
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<tr>
<td>Middle East</td>
<td>193</td>
<td>242</td>
<td>247</td>
</tr>
<tr>
<td>Turkey</td>
<td>58</td>
<td>68</td>
<td>69</td>
</tr>
<tr>
<td>Other Middle East</td>
<td>136</td>
<td>174</td>
<td>178</td>
</tr>
<tr>
<td>Africa</td>
<td>622</td>
<td>796</td>
<td>814</td>
</tr>
<tr>
<td>Central and South America</td>
<td>358</td>
<td>421</td>
<td>428</td>
</tr>
<tr>
<td>Brazil</td>
<td>149</td>
<td>172</td>
<td>174</td>
</tr>
<tr>
<td>Other Central/South America</td>
<td>210</td>
<td>250</td>
<td>254</td>
</tr>
<tr>
<td>Total Developing</td>
<td>3,965</td>
<td>4,705</td>
<td>4,777</td>
</tr>
<tr>
<td>Total World</td>
<td>5,263</td>
<td>6,061</td>
<td>6,145</td>
</tr>
</tbody>
</table>

*Includes the 50 States and the District of Columbia.*

Notes: EE/FSU = Eastern Europe/Former Soviet Union. Totals may not equal sum of components due to independent rounding.

Figure 1. US consumption of energy by sector of the economy, in quadrillion BTU. Observed data 1950-2000 and projections to 2020 from US Dept of Energy. The energy for transportation is almost all in the form of petroleum.

- Roy Jenne
June 2003
Short Papers for Energy Strategy

2. I have a nightmare (Envr groups), NY Times, Mar 15-05
3. Big solutions - out of reach (Business Week, Mar 14, 2005)
4. Quest for Energy - a Decades-long debate (Forbes, June 6, 2005)
5. Renewable energy (takes lots of land area), Apr 15, 2004
6. General Electric broad push on green issues (WSJ, May 9)
8. The problem of Energy Talk in 2003 (Ramos, May 2003)

There are 9 pages here that follow:
Our Energy Conundrum

The average driver who pulls into a gas station these days and barks, "Fill 'er up!" focuses primarily on the rising price of gas and gives little or no thought to where it comes from or why the price is so high. Some may understand the rising demand that comes from a billion Chinese and a billion Indians who have joined the oil market as consumers—not only to fuel their cars and planes but as an ingredient in fertilizers, pesticides, medicines, paints, and plastics. Guess how many barrels of oil we import a day? A million? Five million? No, the staggering answer is ... 12 million barrels a day, and we're heading for 20 million barrels a day by 2025. The price increases over the past year mean that we consumers will send oil producers an additional $50 billion this year—on top of the $120 billion we spent last year.

What makes this so maddening is that we're sending all these dollars to countries that use a good chunk of them to promote anti-American ideas, to spread radical Islam, and to finance the jihadists who are waging the war of terrorism against us. Some of these same countries are also using this largess to develop weapons of mass destruction. As if all that weren't enough, we're also spending hundreds of billions of dollars on a U.S. military presence to protect this Middle East energy source. It is a tax on consumers here—not to mention the fact that, yes, these same Middle East oil producers have entwined us in two wars over the past two decades. Their capricious governments are increasingly vulnerable to religious fundamentalists and Islamist terrorists who, any day, could devastate the world's economy by sabotaging production.

How dumb are we, anyway? Illusions. There is much talk these days about energy independence—a fantasy. Any program to reduce our 60 percent dependence on foreign oil will take anywhere from five to 10 years. And neither the Republican answer—more production—nor the Democratic answer—more conservation—will solve the problem. Any coherent energy program will require us to do both. It is also fantasy to imagine that we can rely on alternative power sources from waves or windmills or solar panels. That kind of power is weak, intermittent, and expensive—costing roughly twice the cost of the electrical power produced by either coal or gas.

Most Americans believe they're entitled to cheap fuel, regardless of how much they consume. As gas prices rise, the American public looks for someone to blame, even though gas is cheaper today by at least a third than it was 25 years ago, if you adjust the peak prices then for inflation and for the drop in the dollar. Our gasoline tax is only 43 cents a gallon, compared with $4 in most of Europe, making a gallon of gas cheaper than a bottle of water. Is it any wonder so few Americans don't bother to conserve? When fuel prices did go up, drivers switched to smaller, less wasteful cars, and we began a program of energy efficiency. That was great, but when prices fell, we went back to the gas guzzlers, and now, with just 5 percent of the world's population, we use a quarter of the world's oil.

What are the options? Higher fuel taxes and tighter controls by business. CAFE, the corporate average fuel efficiency standards imposed on carmakers, have barely risen in 20 years. By some estimates, reasonably phased higher standards could save us about a million barrels of oil a day.

On the production side, we are going to have to start building nuclear power plants, particularly since new nuclear technologies are safer and cleaner than ever. We are also going to have to look to find places to drill, such as the Arctic National Wildlife Refuge, which has become a symbolic issue to environmentalists. The refuge is far from the picture postcard of green forests and snowcapped mountains its defenders would have us believe. It's the Alaskan tundra, and drilling there would involve only a minuscule portion of the 18.5 million acres that are being set aside for conservation. Drilling there makes sense.

This isn't to say that we should overlook the environmental consequences of fuel consumption, particularly when you think about the fact that as China and India explode economically and are able to buy cars, we may have to face the possibility that the number of cars by the year 2050 will go from 800 million today to as high as 3.25 billion then—an unimaginable threat to our environment and a surefire guarantee of global warming.

Any energy program we come up with will involve some cost or controversy. But this is one of the great national issues facing the nation, and there is no justifiable excuse for avoiding the kind of informed debate that must take place if we're to put a coherent policy in place before too much more time elapses.

The failure of our elected officials in both parties to come to grips with this vital issue long before now is a national disgrace. Continued failure is not an option.
When environmentalists are writing tracts like "The Death of Environmentalism," you know the movement is in deep trouble.

That essay by two young environmentalists has been whirling around the Internet since last fall, provoking a civil war among tree-huggers for its assertion that "modern environmentalism, with all of its unexamined assumptions, outdated concepts and exhausted strategies, must die so that something new can live." Sadly, the authors, Michael Shellenberger and Ted Nordhaus, are right.

The U.S. environmental movement is unable to win on even its very top priorities, even though it has the advantage of mostly being right. Oil drilling in the Arctic National Wildlife Refuge may be approved soon, and there's been no progress whatsoever in the United States on what may be the single most important issue to Earth in the long run: climate change.

The fundamental problem, as I see it, is that environmental groups are too often alarmists. They have an awful track record, so they've lost credibility with the public. Some do great work, but others can be the left's equivalents of the neocons: brimming with moral clarity and ideological zeal, but empty of nuance. (Industry has also hyped risks with wildly exaggerated warnings that environmental protections will entail a terrible economic cost.)

"The Death of Environmentalism" resonated with me. I was once an environmental groupie, and I still share the movement's broad aims, but I'm now skeptical of the movement's "I Have a Nightmare" speeches.

In the 1970s, the environmental movement was convinced that the Alaska oil pipeline would devastate the Central Arctic caribou herd. Since then, it has quintupled.

When I first began to worry about climate change, global cooling and nuclear winter seemed the main risks. As Newsweek said in 1975: "Meteorologists disagree about the cause and extent of the cooling trend but they are almost unanimous in the view that the trend will reduce agricultural productivity for the rest of the century."

This record should teach environmentalists some humility. The problems are real, but so is the uncertainty. Environmentalists were right about DDT's threat to bald eagles, for example, but blocking all spraying in the Third World has led to hundreds of thousands of malaria deaths.

Likewise, environmentalists were right to warn about population pressures, but they overestimated wildly. Paul Ehrlich warned in "The Population Bomb" that "the battle to feed humanity is over. Hundreds of millions of people are going to starve to death." On my bookshelf is an even earlier book, "Too Many Indians," with a photo of a mass of Indians on the cover. The book warns that the threat from relentlessly multiplying Asians is "even more grave than that of nuclear warfare."

Jared Diamond, author of the fascinating new book "Collapse," which shows how some civilizations in effect committed suicide by plundering their environments, says false alarms aren't a bad thing. Diamond argues that if we accept false alarms for fires, then why not for the health of our planet? But environmental alarms have been screeching for so long that, like car alarms, they are now just an irritating background noise.

At one level, we're all environmentalists now. The Pew Research Center found that more than three-quarters of Americans agree that "this country should do whatever it takes to protect the environment." Yet support for the environment is coupled with a suspicion of environmental groups. "The Death of Environmentalism" notes that a poll in 2000 found that 41 percent of Americans considered environmental activists to be "extremists." There are many sensible environmentalists, of course, but overzealous ones have tarred the entire field.

The loss of credibility is tragic because reasonable environmentalists — without alarmism or exaggerations — are urgently needed.

Given the uncertainties and trade-offs, priority should go to avoiding environmental damage that is irreversible, like extinctions, climate change and loss of wilderness. And irreversible changes are precisely what are at stake with the Bush administration's plans to drill in the Arctic wildlife refuge, to allow roads in virgin wilderness and to do essentially nothing on global warming. That's an agenda that will disgrace us before our grandchildren.

So it's critical to have a credible, nuanced, highly respected environmental movement. And right now, I'm afraid we don't have one.
For nearly all of U.S. history, American political life has been sharply polarized. For two centuries deep ideological divisions have split U.S. society. Yet each era also bred advocates for pragmatism who pushed back against partisan extremism to seek common ground. By necessity, a frontier culture populated by immigrants who had to work together often chose practicality and common sense over dogma. America needs to make the same choice today in the battle over the tort system. It's only one of many fights being waged almost entirely in political rather than more practical terms. Social Security, Medicare, global warming, education—all critical issues—are debated with junk facts marshaled and marketed by one side or the other, with the best possible solutions all the more difficult to discern. Even universities—centers for research and learning—increasingly hew to a political correctness that refuses to respect ideas that veer from political orthodoxy.

America needs a nonpartisan space where numbers can be trusted, arguments can't be bought and sold, and all possible solutions and outcomes can be considered. That space doesn't exist in today's tort debate. There is little question that doctors and executives feel plagued by plaintiffs' lawyers who haul them into court again and again. Yet there are no reliable data showing that this amounts to a serious threat to the economy. The latest Bureau of Economic Analysis statistics show legal services accounting for less than 1.5% of gross domestic product, a lower share than in 1990. The "litigation tax" of $246 billion that the anti-plaintiffs' lawyer lobby says is imposed on the economy is in fact a number that includes everything from payouts for fender-benders to the salaries of insurance industry CEOs. It's a wild exaggeration. Meanwhile, with no real data available on medical-malpractice payouts, the Physician Insurers Assn. says the average size of those awards is $350,000, while the Consumer Federation calculates it to be as low as $30,000. Professors called as expert witnesses are often consultants to plaintiffs' lawyers or their organizations, while conservative institutes have their own experts on the payroll. Where are the facts?

And where are the facts in the debate over the Medicare drug benefit? Yes, many seniors complain about the high and still-rising cost of drugs. But there are no numbers showing patients can't afford to buy them. Indeed, there are figures that indicate that most seniors are already covered by insurance or have sufficient income and assets to buy their medicines with no government help required. A plan that should have focused on the elderly poor became a huge middle-class benefit costing twice initial estimates and carrying unfunded liabilities three times that of Social Security. Why? The numbers used in the public discussion were politicized. AARP, the lobbying group for retirees, hyped the drug-expense issue. Drugmakers, which stood to gain financially from the bill, lobbied for it, too. And the GOP White House and Congress obfuscated the real cost and funding-liability figures. Is this the best way to forge public policy?

The same can be said for Social Security. There are many advantages to private accounts owned by individuals. But they have little to do with fixing Social Security's solvency problem. That would require lower benefits or higher taxes. And the very idea that Social Security even faces a crisis is not supported by the numbers. If no action is taken, retirees will still get 73% of their benefits in 2042 (or 2052, according to the Congressional Budget Office). That's a problem, but it's not an emergency. Yet no one is listening. Liberals won't acknowledge that private accounts have any merit, and conservatives won't admit that Social Security needs only modest tinkering.

From tort reform to Medicare, answers lie in the "practical center." Today, Americans learn partisanship early. They observe a news media increasingly split between Right and Left. And students at many top Ivy League and state universities are educated by partisan faculties who see the world ideologically. Many professors teach a postmodern relativism, arguing that there are no objective facts, only what is seen through the lenses of class, gender, and power. No wonder twenty- and thirtysomethings seek an echo chamber of their own beliefs on blogs, Web sites, and TV. They're taught to distrust the possibility of common ground, a community of interests, and shared values.

Corporate America can ill afford this polarization. Offering support to partisans in Washington on social policy creates the risk of a strong backlash when power changes hands, as it inevitably does. Companies operate best in a pragmatic environment. And America operates best from the practical center. It is time to find our way back there.
The Quest for Energy—A Decades-Long Debate

Writing about energy legislation is difficult because for far too long the story has been the same: The President (alternating with pleading for his Social Security plan) keeps reminding Congress how vital our need for more energy is and how crucial it is that we increase our use of new technologies to reduce our dependence on expensive and increasingly uncertain foreign oil.

In April President Bush met with Saudi Crown Prince Abdullah to encourage Saudi Arabia to produce more crude oil. Worries that the Saudis may not follow through have been a big factor in the rather sudden spike in the price of crude.

The Democrats, playing the class-warfare card (seemingly their only game plan), predictably oppose everything President Bush suggests. Fallen icon Senator John Kerry says the President’s energy proposals won’t help truckers, farmers and small business owners, who are experiencing the effects of high gas prices now. The Sierra Club (also predictably) says that with such proposals it is clear the President is just trying to help Big Business and step on states’ rights.

Business leaders do like many of Mr. Bush’s proposals, particularly those involving tax credits to encourage the production and use of hybrid cars, as well as a cleaner-burning diesel fuel (soon to come on the market) for cars and trucks. The President and his supporters point out that tax incentives in western Europe have led 42% of new-car buyers there to buy diesels. In the U.S., only 3.3% of new cars and light trucks are diesel-powered.

Moving Forward

Despite the newspaper headlines proclaiming that the U.S. is in dire straits, much progress has been made. NuStart Energy Development, a consortium of nine nuclear power companies, has recently signed an agreement with the Energy Department to participate in a cost-sharing program to complete the engineering and design work (expected to cost $520 million) for new nuclear reactors. Mr. Bush has also asked Congress for legislative changes that would encourage more companies to build nuclear power plants.

The Administration also supports the production of ethanol, which is popular among congressmen whose states grow corn, the crop from which this alternative fuel is made. It also stands behind the extraction of oil from shale and the use of windmills to generate power. Wind power is clean and can be generated at a reasonable price. As GE claims in its current ad campaign: “One GE wind turbine can produce enough electricity for about 400 homes each year.”

It looks as if small parts of the Arctic National Wildlife Refuge may finally be available for oil exploration and drilling. In March the Senate approved by 51-to-49 the inclusion of exploration and drilling there in its budget. It must now come up with an energy bill. Most of Alaska’s elected representatives are in favor of going into the ANWR. It is an issue we have debated for 46 years, and there is little that can be added to the debate by more delay. The price of crude oil will continue to climb unless we add to the supply. The world’s demand for oil, particularly in India and China, is growing exponentially, as has been the case for many years. In April the House passed its energy bill, which allows oil drilling in ANWR. The President would like Congress to give him an energy bill by August.

We should also keep in mind that for 29 years the U.S. has built no new oil refineries. We are running our old refineries at more than 90% capacity, and there are bound to be breakdowns. Congressman Joe Barton (R-Tex.), who is chairman of the House Committee on Energy & Commerce, says it well: "America has spent nearly a half-century finding ways not to provide energy—not to explore, not to drill, not to refine. Now it is time to decide what we will do. And whether it’s in ANWR, Iraq or the Gulf of Mexico, we had better begin where the oil is.”

If we are to maintain our rate of economic growth, we must have reasonably priced oil from more reliable sources. We would have enough oil if we developed what we have. We cannot afford more debate. (Incidentally, the increase in oil prices cannot be laid solely at the door of India’s and China’s continuing high demand. This has been going on for at least three decades. A major reason for the surge in U.S. prices is the Federal Reserve’s failure to reduce the excess money its mistaken policies have poured into the market. [See Fact & Comment, May 23, p.27].)

A Light on the Horizon

Energy Secretary Samuel Bodman sees the energy problem quite clearly. As John Fialka in a Wall Street Journal article reported: “Bodman] wants more countries to consider nuclear power as an alternative to fossil fuels, which pose pollution and global-warming problems. 'One of our great concerns is the unbridled expansion and use of coal in China and India,' said Secretary Bodman, who hopes to encourage officials of both countries to diversify their energy sources. More fuel diversification, he said, would help ease demands for oil and other fuels, and would make their economies less vulnerable to price spikes or sudden shortages.” To this end, Bodman is promoting the sale of U.S. nuclear power and clean-coal technologies. Bodman went on to say, Fialka wrote, “'We believe that energy is a global, not just a domestic problem,' noting that investments must be made now to bring on new energy resources within the next decade…. [A] lack of investment has helped produce tightness in world energy markets and nations will have to invest $16 trillion to meet energy needs by 2030.”

Bodman is right: The energy problem is global. At least part of the solution for the U.S. requires legislation that has been urged repeatedly by President Bush—and has been debated for decades. It is now time to act.
Hurricane Tort

If some plaintiff lawyers have their way, CO₂ is the next tobacco.
By Tomas Kellner

Six days before Hurricane Katrina hit New Orleans in August, a federal judge in San Francisco unleashed a different kind of monster. The judge granted legal standing to a global warming lawsuit against the U.S. government for the first time, brought by a coalition of cities and environmental groups, including the Friends of the Earth and Greenpeace. The plaintiffs (including the cities of Santa Monica and Boulder) are charging that the U.S. government has provided billions in loans and insurance to oil companies, electric utilities and other emitters of gases like carbon dioxide that may have contributed to global warming. A hearing is scheduled for February 2006.

The legal theory behind climate change tort is very much in flux—and so, of course, is the science. But energy companies and their insurers are starting to worry about their potential liability under global warming theories. “I think there’s going to be a lot of ambitious lawyers that try to do a kind of tobacco-type suit,” says Christopher Walker, managing director of sustainable business development at Swiss Re, the reinsurance giant that sells policies to many multinationals.

Making these cases stick won’t be easy. In the case of Katrina, lawyers would have to link the force of the hurricane to climate change, and climate change to carbon emissions. And as climate change is a global phenomenon, they would have to link damage to the emissions of a particular defendant. All this assumes that a judge agrees that human activity indeed makes the Earth warmer.

Two global warming suits were recently tossed out and are on appeal. In one, eight states (New York, Wisconsin and Iowa among them) and a group of private plaintiffs like the National Audubon Society sued five big carbon dioxide emitters, including American Electric Power and Cinergy, in federal court in New York. They claimed the gas posed “serious threats to our health, economy and environment.” The judge ruled the issue was a political matter best resolved by the legislative and executive branches.

In the other, a coalition of states and cities charged that the Environmental Protection Agency and automobile manufacturers failed to curb greenhouse gases under the Clean Air Act. Dismissing it, a Washington, D.C. federal appeals court panel ruled that CO₂ is not regulated by the EPA and therefore emitters can’t be sued.

But even corporate lawyers don’t take much comfort. “Common law is an evolutionary process that’s pushed along in an adversarial way,” says J. Kevin Healy, partner at the law firm Bryan Cave, which represents insurance companies and other businesses. “Plaintiff lawyers will be finding whatever they can to hold corporations liable,” Ronald A. Shems, who’s representing the Friends of the Earth in the California lawsuit, agrees. “As information becomes more available and lines of liability clearer, things will mature,” he says.

Scientists are also stoking the fire. Recent papers in journals like Nature and Science that link global warming to carbon emissions could serve as evidence. “In principle it should be admissible,” wrote Oxford physicist Myles R. Allen and lawyer Richard Lord in Nature. “Computer simulations are not unknown in the courtroom.”

Walker of Swiss Re sounds glum. “[These lawsuits] are certainly a nuisance and bad publicity,” he says. “I wouldn’t want to be an oil company having to defend myself in New Orleans in a local court with a local jury that’s living in Houston.”

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Renewable Energy, Enviros and New Job Creation

Thursday, April 15, 2004

By Steven Milloy

FOX NEWS

The global warming (search) controversy took a new twist this week. Global warming hand wringers are now trying to make it a "jobs" issue.

"Investing in renewable energy such as solar, wind and the use of municipal and agricultural waste for fuel would produce more American jobs than a comparable investment in the fossil energy sources in place today," a new report from researchers at the University of California at Berkeley states. The report was accompanied by a call from a coalition of environmental activist and labor groups for a 10-year, $300 billion program to increase the nation's use of renewable energies (search).

Probably not coincidentally, California Gov. Arnold Schwarzenegger and New Mexico Gov. Bill Richardson issued a joint recommendation this week for more renewable energy use in part to "create lasting jobs." The Berkeley researchers say that increasing renewable energy use, mostly agricultural biomass burning (search), could create as many as 240,000 new jobs by 2020. That's compared with only about 75,000 new jobs if the nation sticks to fossil fuels, according to the researchers.

But even giving the Berkeley researchers the benefit of the doubt, renewable energy as a jobs issue is downright silly. Our recovering economy added 308,000 jobs in March alone. Who cares about a comparatively measly 240,000 jobs that only might be added over the next 16 years?

Regardless, significant reliance on renewable energy in the foreseeable future is essentially a pipedream, according to Dr. Tom Wigley of the National Center for Atmospheric Research (search). Wigley, by the way, is one of those scientists who firmly believes in global warming.

About a year-and-half ago, Wigley and some of his colleagues laid bare the dubious prospects for renewable energy in an article in the journal Science. With respect to solar power, Wigley said current U.S. energy consumption would require an array of photovoltaic cells (search) covering 26,000 square kilometers; worldwide energy consumption might require about 220,000 square kilometers of photovoltaic cells. These requirements would triple by 2050. Unfortunately, however, "all the photovoltaic cells shipped from 1982 to 1998 would only cover about three square kilometers," according to Wigley.

Space-based solar power (search) might require less than 25 percent of the area of land-based photovoltaic cells. But even with adequate research investments, that technology wouldn't deliver energy to global markets until the latter half of the century.

Wind power (search)? Forget it, says Wigley. "It's often available only from remote or offshore locations," he said. Bio-fuels (search), the chief hope for those 240,000-jobs-by-2020, aren't the answer either for the same reason as all other forms of renewable energy — they take a lot of space to produce only a little energy, said Wigley.

More ridiculous still is the notion that it's actually a good thing to employ more people to produce a given amount of energy. Realize that economics is not a strong suit of environmental activists, but "labor productivity" — the value of output per unit value of labor — is a pretty basic concept. It's generally desirable to be more productive, not less. We want to produce more energy per worker rather than having more workers producing less energy. Workers thus freed from producing energy can then go on to do other productive work.

Renewable energy as a "jobs" issue is another laughable example of how environmental activists want to take us backward to the future. Under the ill-fated Kyoto Protocol (search), the environmentalists would have had us cut back on energy use by about one-third by 2010. But economies need more energy, not less, in order to grow. And jobs tend to be produced by sustained economic growth. What will the enviros think of next? How about that fantasy of Al Gore's espoused in his book "Earth in the Balance" — a ban on the internal combustion engine (search)? Think of all the jobs that would need to be created to clean the horse dung off the streets.
General Electric Plans Broad Push On Green Issues

By KATHRYN KRANHOLD
And JEFFREY BALL

Seeking to make money on the global push toward tougher environmental regulation, General Electric Co. plans to roll out today a comprehensive investment, marketing and policy initiative that addresses environmental issues such as global warming and water shortages.

The Fairfield, Conn., conglomerate plans to more than double its investment, to $1.5 billion by 2010, in technologies that include cleaner coal-fired power plants, a diesel-and-electric hybrid locomotive and agricultural silicon that cuts the amount of water and pesticide used in spraying fields.

GE aims to achieve $20 billion in sales of environmentally cleaner products by 2010, or double the amount it currently has—a target that would comprise as much as 20% of the company’s estimated industrial sales. Already, GE, the biggest publicly traded company in the U.S., sees a business case for its strategy as utilities such as Cinergy Corp. and American Electric Power Co. line up to build plants using cleaner coal-burning technology.

GE Chairman and Chief Executive Jeffrey Immelt plans to urge the U.S. energy industry to take the lead in dealing

Green Goals

General Electric sets out a new environmental program:

- More than doubling research budget to $1.5 billion by 2010 on new environmentally friendly technologies including coal sequestration and a hybrid locomotive.
- Double its sales of eco-friendly technologies by 2010 to $20 billion. Those products include wind turbines, solar panels, coal-gasification power plants, water-purifying and conservation technologies, and energy-efficient dishwashers and lighting.
- Reduce its greenhouse-gas emissions, which are mostly carbon dioxide, by 1% by 2012 from 2004 level of around 11 million metric tons.
- Improve its energy efficiency by 30% by 2012.
- Report publicly on its progress toward carbon dioxide reductions on an annual basis.

Source: the company

with carbon-dioxide emissions in a “carbon-constrained world.” Carbon dioxide is produced when fossil fuels are burned and is widely believed to be the main global-warming gas.

Green Strategy Is Planned by GE

Continued From Page A2

growth, though emissions would increase at a slower rate.

To be sure, a 1% cut over several years, even by a huge company like GE, won’t make an appreciable dent in global warming. Its importance is more symbolic. GE’s move is likely to intensify the political debate over whether the U.S. should impose a federal global-warming emissions cap.

GE says its emissions-reduction pledge is significant, given that the company’s emissions were on track to grow by 2012 between 40% and 45% if the company did nothing to curb them.

In the past, GE executives have stayed away from publicly addressing issues like global warming or from marketing itself as a company producing environmentally-friendly products. That’s partly because the company is facing a continuing controversy over dumping polychlorinated biphenyls in the Hudson River in New York state. GE is negotiating with the Environmental Protection Agency over the best way to dredge the Hudson and remove the chemicals, which were banned by the federal government in 1977.

Given its past, GE risks environmentalists’ wrath with what it calls its new “Ecomagination” campaign. In one television ad, attractive male and female models, their biceps exposed and flexed, pose as coal miners as a voiceover says GE is making coal more beautiful.

Environmental activists called GE’s move significant. “GE is a potent symbol and sends a powerful message to the private sector and the public-policy sector,” said Jonathan Lash, president of World Resources Institute, an organization in Washington that tries to persuade companies that investing in environmentally friendly technologies can be good for their bottom lines.

Mr. Immelt isn’t shy to say that global warming is good for GE and its shareholders, because the company sells technology such as wind turbines and natural-gas-fueled turbines that produce fewer emissions than traditional technology. “We’re at a tipping point where energy efficiency and emission reductions also equal profitability,” he says.
Bushwhacked

Did you know we have something of a socialist in the White House? The Group of Eight countries have given their imprimatur to an anticapitalist energy plan. George W. Bush signed off on it. The news about the July G-8 meeting in Genoa focused on the fellow with the fire extinguisher. Less noticed was the G-8’s blueprint for funneling subsidies and tax breaks to solar, geothermal and wind power. What about those devilishly dirty fossil fuels? All government support for them should be removed, the G-8 concluded.

Maybe it should be. But this woolly-headed declaration ignores the principles of the free market: If an energy source like biomass is so great, it should be able to prove itself without handouts. Remember the expensive alternative energy debacle launched by Jimmy Carter?

What’s insidious about the G-8’s energy communiqué is that it calls on international lending agencies to expand renewable energy in developing nations. So we’re just a step away from having the World Bank and the International Monetary Fund demanding that, as a condition for a loan, poor societies waste resources building windmills.

You would think that Bush and Dick Cheney would know better than to countenance this nonsense. That’s especially true given the genesis of the report that the G-8 rubber-stamped in Genoa. The G-8 manifesto is redolent with the rhetoric of left-leaning nongovernmental organizations, known as NGOs, which had a major hand in drafting the thing. Strangely, these NGOs get major funding from the very companies and governments they seek to undermine (see my Aug. 6 column).

Some of these NGOs, like the World Wildlife Fund and the European Network on Debt & Development, were allowed into the G-8 communiqué-drafting tent because they sound moderate. World leaders on the order of Bill Clinton, Britain’s Tony Blair, France’s Lionel Jospin and Germany’s Gerhard Schröder have parroted their lines about fostering public/private partnerships aimed at enhancing environmentally correct economic development that is fairly distributed.

The Third Way approach of Clinton, Blair and their gang is eerily reminiscent of the Fabian Socialism of the late 1800s, which sought to win over ordinary folk by making socialism appear reasonable. Prime Minister Jospin updates Fabianism nicely when he says France is “delighted to see the emergence of a planetary citizens’ movement.” The goal, he says, “is to put in place a lasting system of regulation that makes the planet a common asset exploited in an equitable manner.”

The inspiration for the energy portion of the Genoa manifesto originated at a closed-door meeting at 10 Downing Street on Nov. 11, 1999 with a bunch of greens Blair wanted to appease. He carted their ideas to the G-8’s July 2000 summit in Okinawa. There he won approval for a renewable-energy task force made up of government reps, industry figures and NGO types. The task force’s final report was to be unveiled at the Genoa 2001 conclaves, where Blair assumed Al Gore, a committed green, would be on hand as President to help shepherd the thing through. Well, Blair didn’t need to worry. Even though his man didn’t end up occupying the U.S. chair in Genoa, it mattered not a bit because Bush went along with the report.

The scary aspect of the President’s G-8 acquiescence is that his own energy plan for the U.S. has a spiritual kinship to the Genoa document, relying less on the invisible hand of the marketplace than on the heavy hand of government. In fact, the plan, as approved by the Republican-controlled House, has outdone Bush in its extravagance with government subsidies.

True, the greens are upset about the Bush-Cheney domestic energy program and its endorsement of oil drilling in the Arctic National Wildlife Refuge. The greens want it all. They want to take government handouts themselves while also killing subsidies for coal, oil and nuclear fission. Bush is different in that he wants to subsidize everything, renewable or nonrenewable. Instead of letting capitalism sort out energy needs and sources, he wants his government to sort them out. He has become a Third Way kind of a guy.
The Problem of Energy Talk in 2003
(This really worries me)

1. People assume that the one big problem is global warming.
   □ So there are huge politics to limit use of fossil fuels.

2. But the problem of adequate energy could be a bigger problem in 35 years.
   □ The world needs both adequate energy and a good price.
   □ The energy has to be in the right form. We cannot fly airplanes with electricity.

3. Many preach that it would be easy and affordable to convert to the use of wind and solar and stop fossil fuel use.
   □ These have a role, but there are limits and cost issues.
   
4. Many tell poor countries that they can “do it all” with solar.
   □ But they will need adequate low cost energy for development.
   □ Good energy analyses are needed, not sales pitches.

5. The talk about global warming is partly factual.
   □ But the hype factor is so large that it is difficult to have good energy policies.

6. Some say that energy problems can be solved with more efficiency.
   □ Efficiency has an important role, but it cannot solve energy problems by itself.

7. We will need several decades to move the world toward a good energy position.
   □ There should be a mix of energy sources.
   □ The reliability and cost of the energy has to be demonstrated.
   □ The energy policy must be grounded in facts, technical possibilities, and good analyses.

From Dec RJ0443, Aug 2003

Roy Jenne
NCAR
May 10, 2003
Science exiled

How the complexities of science suffer in the arena of public policy.

**Politics of Policymaking**

*Politizing Science: The Alchemy of Policymaking*

**Paul M. Grant**

This is not suitable bedtime reading — not if you want to fall asleep, that is. Those who think that public policy should be based on sound science will be left in despair that such a goal can ever be achieved in the midst of the competing political interests endemic to modern industrialized democratic societies, exacerbated by scientific illiteracy on the part of both leadership and electorate.

*Politizing Science* relates the personal trials and tribulations of 12 scientists whose careers were directly affected when their scientific advice conflicted with the political interests of those in power. Although several of its US stories pertain to the Clinton administration, the recent death of Edward Teller, bringing with it memories of the Oppenheimer affair, reminds us that conflicts between science and policy determination are ideologically invariant. These days, for instance, scientists who thoughtfully question the efficacy of the Bush administration's limited missile-defence initiative are not exactly welcome to spend the weekend on the president's ranch at Crawford, Texas. The essays in *Politizing Science* illustrate that the risk of a given scientific issue becoming politicized depends on the difficulty of its proof and falsification, and on its perceived risks and potential benefits. A few examples from the book will illustrate the point.

The first essay is by William Happer, a professor of physics at Princeton University, who was director of basic energy sciences in the US Department of Energy during the administration of the first President Bush. Happer's tenure saw the 'discovery' of cold fusion, an event that rapidly became politicized. After all, who could ignore gossiping on the energy deliverance of mankind? Happer compares this episode with the Soviet agronomist Trofim Lysenko's subversion of genetic inheritance in favour of 'environmental determinism'. What they had in common was that each was clearly subject to Karl Popper's litmus test: scientists must attempt to falsify their hypotheses. Cold fusion was quickly disposed of in the West, where the litmus test could not easily be politically coloured. By contrast, the totalitarian Soviet Union protected the 'correct' interpretation of genetic inheritance until Stalin's demise.

When a hypothesis or assertions are precise and can be tested, a free society that demands full disclosure will eventually sort it all out. A recent example of just that was the satisfactory resolution of last year's Bell Labs scandal (see *Nature* 419, 419–421; 2002). But when the science gets 'fuzzy', as with carbon dioxide-forced global climate change, the effects of radiation or chemical agents, or bioengineering plants or animals for human purposes, opportunities for the politicization of science compound and abound.

Bernard Cohen, a nuclear physicist, has spent a large part of his later career on efforts, mostly unsuccessful, to attract coverage in the wide-circulation media of the facts about radiation and health. Especially revealing is his compilation of the numbers of stories relating to various 'everyday' accidents in *The New York Times* during the years 1974–78, before the 1979 crisis at the Three Mile Island nuclear plant. There were, on average, 120 reports per year on road accidents (US death toll: 50,000 per year), 50 on industrial accidents (12,000 killed each year in the United States) and 20 on asphyxiation (4,500 US deaths per year). For accidents involving radiation, there were 200 entries, despite the fact that none involved related illnesses or fatalities.

Robert Nilsson, a professor of toxicology, has worked for the Swedish Environmental Protection Agency, as well as that country's National Chemicals Inspectorate. Nilsson recounts the rise of politicized environmentalism in Sweden, enforced through a plethora of regulatory agencies created by a parliament long dominated by a single party and whose oversight seldom involves a single scientist. These agencies have a long reach, descending even to the composition of the sand piles in playgrounds (crystalline silica has been identified as a low-risk carcinogen). Roger Bate is concerned with the harm that the imposition of environmental standards devised for industrialized nations can do to developing societies. In particular, he focuses on how a ban on the use of the pesticide DDT in Africa has led to a disastrous re-emergence of malaria, which now kills 3,000 African children a day. DDT spraying in Africa began in the 1950s and greatly reduced the incidence of malaria. But environmental and economic pressures brought by developed nations led to its almost total discontinuance until recently, when attempts were begun to 'vector' its application to the walls of houses. However, the long-standing ban on DDT use means that almost none is now made, and there is a danger that the supply may run out.

But perhaps the most egregious example of political interference in the free and open discussion of unsettled scientific issues was the campaign conducted by an associate of the former senator and later vice-president Al Gore and members of his staff against Fred Singer and his colleagues, all vocal sceptics of a link between carbon dioxide emissions and climate change. Singer, a pioneer in the field of atmospheric measurements, was the first to predict that population growth would result in a greater concentration of methane, an important greenhouse gas. He is also a prolific writer on issues of the environment and climate change. In *Politizing Science*, Singer recounts the pressure that was exerted on him to remove the name of the
As the world gathers in Argentina this week for its latest group hug over the Kyoto Protocol, joining in the merriment are a few new faces: U.S. energy companies. We thought readers might want to know what's behind this budding corporate enthusiasm for mandatory reductions in greenhouse gases.

The Kyoto idea is 10 years old now, and no better for its age. The U.S. wisely chose to forgo the pact, as the long-term costs add up to hundreds of billions a year across the world economy, not to mention untold lost economic opportunities. The energy industry has heretofore backed this U.S. decision, noting that even Kyoto's defenders have admitted the pact wouldn't slow climate change.

Yet suddenly business pooh-bahs are claiming they've seen the eco-light. Cinergy, the big Ohio utility, issued a report this month fretting that human activity is "likely contributing" to global warming and endorsing a national CO2 program. The nation's largest utility, AES, says what's needed to address this "serious challenge" is "a committed policy response." The media are meanwhile making hay about the self-appointed "National Commission on Energy Policy," a panel containing energy executives from the likes of Exelon and Conoco-Phillips, which last week called for CO2 limits.

These executives are thinking green all right—as in greenbacks. The real story behind their conversion is that the industry has figured out that a U.S.-based climate program holds profit opportunities, while any costs can be foisted on the backs of others—consumers, taxpayers or competitors. This new cynical approach to regulation is worrying, if for no other reason than that the quickest way to bad policy is a co-opted business community.

What's changed the industry's tune at the broadest level may be the Bush Administration's Clear Skies program, a smart pollution-reduction proposal that may pass Congress next year. That program, about to be partially instituted via regulation, requires energy producers to reduce sulfur dioxide and nitrogen oxide emissions 70%. But a natural consequence of reducing those true pollutants can be fewer greenhouse gas emissions. A "cap-and-trade" program—creating a property right in CO2 reductions that can be traded for cash—would thus allow companies to get paid for simply complying with other air-quality rules.

For example, both Cinergy and AES rely heavily on old coal plants that are big polluters and CO2 emitters. But many of those plants are nearing the end of their shelf lives, and will soon need replacing with cleaner alternatives. Since a climate program rewards companies that make the biggest CO2 reductions, Cinergy and AES would stand to rake in cash from a cap-and-trade regime simply by enacting their business plans.

Other firms will benefit by virtue of their niche markets. Exelon CEO John Rowe is only too happy to root for a mandatory program, as his firm is a big nuclear producer that can watch more fossil-fuel-dependent competitors struggle to meet climate requirements. Wind and solar producers are also sitting pretty, since utilities will have to turn to these more expensive renewables to hit their targets.

Finally, many utilities that are still highly regulated by the states simply don't care. They know regulators will pass along any CO2 reduction costs to consumers via rate hikes. They also view public support of a CO2 program as a low-risk way of soothing environmental antagonists and "socially conscious" investors.

We have nothing against companies exploiting the business opportunities that regulation sometimes creates; that's capitalism. The difference here is that because CO2 isn't even a pollutant, and because no realistic program will even slow global warming, any market for trading CO2 emissions would be entirely unnecessary. There's nothing capitalist about lobbying government to erect a program that serves no other purpose than the redistribution of wealth, whether it be from one company to another, or from consumers to corporations.

These business potentiates might also remember that, whatever the short-term gains for select players, the long-run costs to the economy will hurt everyone. As CO2 emissions targets are inevitably ratcheted down, all companies will eventually have to pay the piper.

If these CEOs get their way, they may also find that costs for a national program exceed anything imposed by the increasingly falling Kyoto rules. Much was made of Russia's recent decision to sign the pact, officially putting Kyoto into effect. But Russian officials made clear this was pure quid pro quo: its signature in return for European support of its WTO bid. Russia also stands to make an enormous amount of money from the pact in the short term.

As for the long run, let's not forget that all those supposedly enlightened countries that joined Kyoto also insisted there be no penalties for missed targets. Most are already failing to make promised cuts, with many actually increasing emissions. About the only effect the pact has had is to enrich thousands of consultants and companies whose job it is to advise and set up the program. Hmmm, more Kyoto capitalists. Anyone see a theme here?
Flabby Math

Why the good news about obesity was bad news to the CDC—an agency that has a vested interest in health scares | By Dan Seligman

Government officials found to have conflicts of interest are guaranteed to be in terrible trouble. But what about government agencies with conflicts of interest? Like, say, the Centers for Disease Control & Prevention, a.k.a. CDC. A huge bureaucracy inside one that's even huger (the Department of Health & Human Services), the CDC has a staff of 15,000, a budget of $7 billion and a reputation for supporting superior medical research. But it also has a built-in conflict of interest. And this can affect the research.

In a report published in March 2004, four of CDC's scholars stated that 400,000 people a year in the U.S. were dying early as a result of obesity and that obesity might soon pass smoking as the country's leading cause of preventable death. One of the four scholars was CDC boss Julie Gerberding, who had earlier compared the obesity epidemic in America with the plagues of the Middle Ages. Announcing the new findings, she said, "Our worst fears were confirmed." The media swallowed the "worse than smoking" story line whole. For the month the results were announced, there were 1,400 articles on the mortality competition between smoking and obesity.

Come April 2005 a research report offered a quite different perspective on obesity. This time the researchers were led by a CDC epidemiologist named Katherine M. Flegal. Their report estimated obesity-driven deaths at 112,000, and added that moderately overweight people gain some protection from the extra poundage, so that net deaths from overweight were in the neighborhood of 26,000. The new finding transformed obesity from fearsome killer to pitiable also-ran, ranking in seventh place on the CDC's list of preventable death causes. It came in just behind gun-related incidents.

As if this were not bad enough, the new report also convincingly demonstrated that the original CDC report had major statistical errors—and all the errors cited had the effect of boosting obesity deaths. The most egregious error had to do with the population sample chosen for analysis. A standard approach in epidemiological studies is to first garner health data on a cross section of the population in some past period, then over time observe the death rates of different groups in the sample. Health researchers recurrently work with three large, elegantly designed population samples created in 1971-73, 1976-80 and 1988-94.

The flawed CDC paper used only the first sample for its follow-up study, i.e., it was examining mortality rates for the obese and the nonobese in a population sample put together in the early 1970s. But this distorted reality. Obesity causes deaths primarily because it is associated with much higher levels of cardiovascular disease. And treatment of heart attacks and strokes has improved steadily and enormously over the past 30 years. Obvious implication: Obesity was far more life-threatening to the obese population of 1971 than it was to the obese in the later samples, and generalizations drawn from the 1971 group are simply not transferable to those who are obese today, or even those who were obese in the years covered by the two later samples. When Katherine Flegal used the results of all three populations, instead of relying only on the first, she found that obesity-caused deaths declined by 63%.

How can such mistakes take place in a high-IQ organization like the CDC? The only answer that makes sense is the agency's built-in ax in need of grinding. As hinted by its unabridged moniker (note the term "Disease Prevention"), it is expected to do more than research. The mission also includes selling the people on healthy lifestyles. And over the years, with plenty of encouragement from the CDC itself, obesity has become an all-too-visible symbol of unhealthy if not immoral living, linked in public thinking to inactivity and overeating. (The CDC has tactfully declined to call them sloth and gluttony.) So obesity became a certified good-guy cause to be promoted, and you are in trouble when serious scholars are also expected to be promoters.

Especially when you are in the public sector. In the private sector, as we keep getting reminded, insurance- and energy-company executives sometimes go overboard in pursuit of earnings growth. The comparable sin in the public sector is to go overboard in pursuit of more funding. The standard way to pursue it is by overstating the menace your agency is combating—comparing it, say, with the Black Death.

Where are the ethics police when we need them?
In Oil Quest, U.S. Says Rock On

Shale Extraction Sees Renewed Government, Corporate Interest

By John J. Fialka

Rising oil prices have sparked new government and corporate interest in developing oil shale, a tantalizingly plentiful but difficult-to-access resource largely abandoned after oil prices crashed in the early 1980s.

The Pentagon is working on plans to direct, within four years, a portion of its $5.5 billion fuel-purchasing budget for high-quality oil, extracted from sedimentary-rock formations called shale, here and in the surrounding region. The move is designed to "catalyze" a new industry that can supply the military with oil from untapped domestic sources, according to a Defense Department official.

The Interior Department, meanwhile, soon will lease tracts of land in the West for research and development of oil shale—something it hadn't done since the 1970s. Officials have received positive comments from independent producers and two big oil companies, Royal Dutch/Shell Group and Exxon Mobil Corp.

Shell has informed the Interior Department it has spent "many tens of millions of dollars" on field research for a new development process and plans to start a U.S. research project by year end. Shell said in a filing with the Interior Department that the U.S. should designate oil from shale as a "strategically important domestic fuel that should be developed on an accelerated basis." The company isn't seeking government assistance but would like the government to elevate oil shale on its energy-priority list. Shell also announced in January that it was working with China's Jilin province to develop oil-shale deposits there.

With an estimated two trillion barrels of shale oil under American soil—roughly 60% of the world's known deposits—successful development would, at least on paper, begin to change the international oil business. The U.S. would become the world's single biggest oil source, far surpassing Saudi Arabia's proven reserves of 261 million barrels.

As oil prices head toward the $50-a-barrel mark and uncertainty hangs over the Middle East and other major suppliers such as Venezuela and Russia, there is renewed interest in so-called unconventional hydrocarbons: fossil fuels that can't be extracted using traditional methods. Canada, the world leader, now pumps more than a million barrels of oil a day from tar-sand formations in Alberta—selling 95% to the U.S.

"We are going back, looking at the old reports and reanalyzing old samples—we're confident you can make a quality jet fuel from shale," said Theodore K. Barna, who heads a team of Pentagon fuel experts, in a recent interview. "We'll be using our domestic potential to produce petroleum and keeping the money here in this country."

Oil shale is found in this remote part of Utah amid the remnants of a thick layer of sediment including algae and plants that accumulated on ancient lake beds. Over millions of years the sediment was compressed into clay-like formations that contain kerogen—a high-quality oil, comparable in quality to "sweet" crude. There are two ways to extract the fuel. One is to mine the rock containing it, then to crush the rock and heat it in giant retorts, or vessels, that trap the oil. A second method—under research by both

Shell

Oil shale in USA

March 10, 2005

Next page
The Forgotten Oil?
The prospects for tapping domestic oil-shale reserves have waxed and waned along with the price of crude oil. A brief timeline:

<table>
<thead>
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<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1979</td>
<td>Congress establishes U.S. Synthetic Fuels Corp. to develop oil shale and other new fuels; Exxon buys land for oil-shale mine a year later.</td>
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<td>1982</td>
<td>Exxon leads an exodus of major oil companies out of oil-shale country.</td>
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<tr>
<td>1985</td>
<td>Congress kills the U.S. Synthetic Fuels Corp.</td>
</tr>
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<td>2004</td>
<td>Energy Dept. report finds &quot;strategic significance&quot; in oil shale.</td>
</tr>
<tr>
<td>2005</td>
<td>Interior Dept. plans to lease oil-shale land for research and development.</td>
</tr>
<tr>
<td>2008</td>
<td>Shell starts field research for new oil-shale process.</td>
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Crude Oil
In dollars per barrel, monthly data

Note: Prices prior to March 1983 are for West Texas Intermediate crude; Nymex near-month futures prices are used thereafter; prices are not adjusted for inflation.
Sources: St. Louis Federal Reserve; Energy Information Administration; Nymex via Thomson Reutersstream

Shell and Exxon Mobil—heats the rock while it still is in the ground and then pumps the kerogen out.

There is no serious talk about offering direct government subsidies or tax credits for shale, the way President Carter did amid the oil crisis of the late 1970s. The closest federal policy now is through the Pentagon fuel program, which buys 300,000 barrels of oil a day. Mr. Barna says the military will declare that a certain, as yet unspecified, portion of that spending will be earmarked starting in 2009 for fuel specifications that match oil shale and other unconventional domestic sources such as oil made from coal.

The world's richest source of oil shale is called the Green River Formation, 16,500 square miles of deposits beneath parts of Colorado, Utah and Wyoming. The most productive part of that is the "Mahogany Zone," a layer of rock that runs through it. The owner of 80% of the resource is the Interior Department, which became the caretaker after Congress zeroed out the Energy Department's shale program in 1985.

There has been interest from various independent investors. One is Byron Merrell, a 63-year-old self-taught inventor from nearby Vernal, Utah. He has bought tons of kerogen-containing rock from the White River Mine, the large mine that was dug into the Mahogany Zone, then abandoned. Mr. Merrell has since cobbled together his own extraction process from equipment and ideas the big oil companies abandoned.

His venture, Oil Tech, has attracted $2 million in backing from a retired golf-club maker and other investors. He says he plans to "go commercial" in the fall. Working with a couple of technicians and followed by his dogs, "Smith" and "Wesson," he showed a visitor his silo-size test retort. An enlarged version, he estimates, soon will produce 1,000 barrels of crude oil a day for a cost of about $13 a barrel. "At these prices, we figure in about 90 days it'll be paid for," he said.

For the moment, though, the only people known to have made big money in ventures on shale-rich land are two caretakers whom the Interior Department's Bureau of Land Management hired to patrol the deserted facilities of the White River Mine. After weeks of watching suspicious movement of water trucks over the mine's roads, federal agents raided the place in 1993. They seized more than $3 million of marijuana.

Senate Deadlock Clouds the Future Of Clear Skies Bill

By John J. Fialka

WASHINGTON—President Bush's premier environmental proposal was dealt a setback in the Senate Environment and Public Works Committee after the panel's Republican leaders failed to break a deadlock over the measure.

The 9-9 tie vote over the so-called Clear Skies bill, coming after four weeks of negotiations, means chances for enactment this year are slim without renewed efforts from both Republicans and Democrats to get it to the Senate floor.

The Clear Skies bill would amend sections of the Clean Air Act, which permits states to regulate air-pollution sources according to federal standards and mandates. Clear Skies would set much tighter emissions controls on the nation's largest single pollution source: power plants. The proposed legislation also would relax federal mandates, giving utilities more than a decade to meet the new, lowered levels. Under Clear Skies, power-plant owners could decide how to meet the lower emissions levels, using a "cap and trade" system that rewards utilities that go below their assigned cuts.

Environmental groups fought the Clear Skies bill, which would rewrite a portion of the Clean Air Act that restricts power plants from modernizing or enlarging facilities without adding state-of-the-art antipollution equipment.

That also earned Clear Skies the support of electric utilities and the coal-mining industry, which backed the bill's provision for a nationwide emissions-trading program to ease the financial burden of retrofitting older coal-fired power plants.

Clear Skies would cut emission levels of three pollutants from power plants—sulfur dioxide, nitrogen oxides and mercury—by 70% during the next two decades.

Tempers flared before yesterday's committee vote after the panel's chairman, Sen. James Inhofe (R., Okla.) blamed the impasse on "environmental extremists" who wanted to make a "political statement" by insisting on putting limits on a fourth man-made pollutant, carbon dioxide.

President Bush has ruled out mandatory controls on carbon-dioxide emissions; many scientists believe such emissions from power plants and human activities are raising global climate change.
Caution is urged on oil shale plans

Analysts say U.S. has huge reserve, but hurdles remain

By Jennifer Talhelm
ASSOCIATED PRESS

WASHINGTON — The United States has an oil reserve at least three times that of Saudi Arabia locked in oil shale deposits beneath federal land in Colorado, Utah and Wyoming, according to a study released Wednesday.

But the researchers at the RAND think tank caution the federal government to go carefully, balancing the environmental and economic impacts with development pressure to prevent an oil shale bust later.

"We've got more oil in this very compact area than the entire Middle East," said James Bartis, RAND senior policy researcher and the report's lead author. How-ever, he added, "If we go faster, there's a good chance we're going to end up at a dead end. You could end up bogged down."

For years, the industry and the government considered oil shale — a rock that produces petroleum when heated — too expensive to be a feasible source of oil.

However, oil prices, which spiked above $70 a barrel this week, combined with advances in technology could soon make it possible to tap the estimated 500 billion to 1.1 trillion recoverable barrels, the report found.

But the risks are high. It's unclear how new technologies will affect the land, air and the Colorado River, Bartis said.

The U.S. has tried to develop oil shale in the West before. Energy giant Shell is conducting a patented technique on a piece of land between the towns of Rangely, Rifle and Meeker to extract oil from shale formations. The project was restarted four years ago, and the company says it will be 2012 before it makes a commercial decision.

- About 500 to 1,100 billion barrels of oil that can be recovered
- One project to extract oil was restarted four years ago
- This oil shale is located in Colorado, Utah and Wyoming
Energy Policy in the 21st Century

Peter D. Blair


The Arab oil embargoes of the 1970s shook the United States and created a sense of urgency about the role of energy in U.S. and world economies that persists to this day. It is not that energy wasn’t central to geopolitical events prior to the embargoes (it often was), but only in the last 30 years have concerns over the price and availability of oil spurred development of an impressive portfolio of new technologies for increasing energy supplies and reducing demands—some of which (high-efficiency natural gas-fired combustion turbines, for example) have been deployed extensively worldwide. Such technologies have reshaped the landscape of what is possible in fueling modern economies.

These changes took place throughout the 1980s and 1990s. Nowadays, policy makers are less focused on oil price and availability and instead consider a complicated combination of factors, such as the environment, economic competitiveness and national security. The attention currently being paid to such complexities is natural enough.

In The End of Oil: On the Edge of a Perilous New World, Paul Roberts chronicles the evolution of the world’s insatiable appetite for oil and the realization that at some point a switch to another type of fuel is inevitable. Roberts contrasts the views of oil optimists with those of pessimists, develops the range of economic and political issues surrounding world oil use, analyzes the problems and promise of alternatives, and concludes that unless we act to manage the transition, disruption and violent dislocation will almost certainly occur.

Vaclav Smil, in Energy at the Crossroads: Global Perspectives and Uncertainties, zeroes in even more sharply than does Roberts on the issue of reconciling the world’s accelerating demand for energy with the imperative of preserving the integrity of the biosphere.” He asserts that our dependence on fossil fuels must be reduced, not because of imminent resource shortages but because widespread burning of oil, coal and natural gas is increasingly compromising the biosphere and causing economic and security problems as the cost of those fuels and volatility in the Middle East increase.

The concluding paragraph of his epilogue, “The Future’s a Gas,” is especially thoughtful:

Stopping the use of fossil fuels completely and immediately would be foolish and needlessly expensive, but a thoughtful, phased shift to hydrogen-fired micropower would not. On the contrary, the innovative

Still, the conspicuous lack of attention to economics in his characterization of alternative futures makes those scenarios seem somewhat simplistic and renders any assessment of their relative likelihood difficult.

Treatments of energy policy are usually easily identified as coming from the left or the right of the political spectrum. These books all approach energy policy mostly from the left, but Vaitheeswaran strikes a more careful balance. The concluding paragraph of his epilogue, “The Future’s a Gas,” is especially thoughtful:
China: 241

China info: Pages 237 - 268

India: P 285 - 300

Brazil: P 301 - 316

Russia: P 269 - 284

Europe: 177 - 196

(and lots more)

Print Aug 2002

WEO 2002

530 pages

WORLD ENERGY OUTLOOK 2002
Economic Growth, Energy Supply, and Climate Change

Roy L. Jenne

- World Economic Growth is Rapid
- People Travel More and Buy More Things
- The Use of Energy is Increasing
- The Amount of CO₂ in the Atmosphere is Growing
- Ice Ages Have Been Common in the Past 2.4 Million Years
- Some Past Climates Were Warmer Than Now
- What is the Effect of Dust and Aerosols?
- Energy Strategy

Scientific Computing Division
National Center For Atmospheric Research
Boulder, Colorado

The National Center for Atmospheric Research is Operated by the University Corporation for Atmospheric Research under sponsorship of the National Science Foundation
Energy and Environment Issues, Mar 2005, for Talk
(Visitors from South Korea)

- World energy use to 2030 (7 slides) ................................................. 11
- Energy use in Korea, Indonesia, China, India (3 slides) ....................... 18
- A program for the environment needs an information center .............. 22
- Several useful texts about energy, environment, China, climate, etc.
  - Energy supply and the environment
- Solar and wind energy ....................................................................... 30
- Transition to renewable energy; can it happen? ................................... 38
  - Likely need nuclear plus some renewable
- About nuclear energy .......................................................................... 39
- Energy for transportation, buildings .................................................... 41
- Some target audiences for information ............................................... 48
- Land use, forests, etc. .......................................................................... 50
- Activities to sell a program .................................................................. 53
- Try to avoid extreme ideas ................................................................... 59
- Ready to scan Mar 16, 2005 (61 pages), doc RJ0381

Doc RJ0381

Roy Jenne
Mar 17, 2005
Some Documents about Energy

Roy Jenne
June 30, 2005

1. Why study energy issues?
   There are concerns about the future supply and cost of energy. But there is most talk about environmental issues which are associated with energy use. We need a better conversation about both energy and climate issues.

2. The energy crisis in the US in the 1970s was difficult
   There were long lines of cars waiting to buy gas. The big increase in energy prices caused high inflation, high interest rates, recessions, and job loss.
   - Big government energy programs were started.
   - But many energy solutions require 8 to 30 years of work. Thus quick solutions can not be expected.
   - See Docs RJ0048, 49 for energy information re 1970s.

3. The US needs a good supply of energy
   There are some possible good energy solutions. There are also many proposals that can lead to high costs, not enough energy supply, and no overall solution to the energy problems.
   - A crisis atmosphere motivates thinking but often there is too much hype, special interests, money grabbing, and politics to achieve the careful analysis of options and costs that is needed for real solutions.
   - Bad policy directions that do not solve the energy problems are perfectly possible. History shows this. It is a worry!
   - We need a mix of energy “solutions” that can add up to an overall solution.

4. The present high oil imports of the US can lead to economic and social shocks
   A number of political events could interrupt the supply of imported oil. The imports are now very large and make the US vulnerable to economic and social shocks.

Information about three documents follows:

   The energy problems; clippings (158 p) (The energy crisis periods of the 1970s)
   I selected short articles that contain some of the best of the technical discussions. Other stories convey the frustrations and hype of this difficult period of time.

2) RJ0012, 13: Economic Growth, Energy Supply and Climate Change (150 p)
   This text shows how increases in consumption, buildings, cars, air travel, etc., are linked to the growth in the economy. This gives more energy use. Efficiency is very important, but the world will still need much more energy. The text was finished in 1997, but it is still (in 2005) very useful in showing these relationships.

3) RJ0306: Index to Documents with Kyoto Climate News (16 p)
   These Kyoto documents show part of the living history of Kyoto climate meetings, discussions, and arguments (a pie in your face). It is lively.
   - There are now (2005) about 15 Kyoto documents. The index pages for 8 of them are here.

NOTE: A list of many more energy documents follows:
# Documents about Energy

The below listed documents can be found at: [http://dss.ucar.edu/docs/papers-scanned/papers.html](http://dss.ucar.edu/docs/papers-scanned/papers.html)

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<td>01-Mar-97</td>
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<td>7/28/00</td>
<td>85 89 97 98</td>
<td>4 docs: world climate, energy, etc. - many clippings - African Drought (1985), (59 p); World Changes (1989); Energy Docs 1998, 1997</td>
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<td>Information about Energy - US energy graphs, 1949 – 88; World 1974 – on; Biofuel research 1988 – 92; Solar thermal; etc.</td>
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Page 200
<table>
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<th>Title of Document</th>
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NOTE: RJ0306 is an index to several online documents: "Index to documents with Kyoto climate news."