



Interoffice Memorandum

To: Terry Thorn

From: Rob Bradley

Department: Public Policy Analysis

Subject: Overview of Scientific Case Against
Global Warming Alarmism

Date: June 12, 1998

There are six major arguments that taken together are providing momentum to critics of anthropogenic climate change alarmism and a Kyoto approach to regulate greenhouse gas (GHG) emissions.

1. A steady and cumulatively significant decline in temperature estimates from a doubling of GHG concentrations in the atmosphere in the general circulation models over the last decade (a detailed memo to follow on this next week);
2. Continuing evidence that the warming is distributed toward the coldest air masses in the winter and at night, which makes the warming more benign than if the warming was evenly distributed or distributed toward the warmest regions in the warmest times of the year. The warming is also manifested in a "decreasing diurnal temperature range," which means the high-low range is decreasing with the lows increasing more than the highs. (I sent you a memo on this with documentation from IPCC-1995, Nature, Science, and Journal of Climate last week.)
3. A continuing scientific consensus that higher CO₂ concentrations in the atmosphere enhances photosynthesis to increase plant and crop yields, improve water efficiency for plants and yields, and generally "green" the planet. The so-called "CO₂ fertilization effect" is also part of the "warmer and wetter is better than colder and drier" argument.
4. Recent evidence that the rate of GHG buildup is less than expected (possibly .4%/year) due to less methane emissions and greater sink intake (James Hansen et al., "A common-sense climate index: Is climate changing noticeably?" Proceedings of the National Academy of Sciences, April 1998).
5. Evidence that an increase in major abnormal weather events remains unproven in the 20th century temperature record despite the GHG buildup; rising sea levels predate the buildup of GHGs and are predominantly a natural phenomenon; and disease control is far greater a function of public health control and societal wealth than warmer temperatures per se.
6. Calculations that Kyoto emission reduction would reduce global temperatures by less than .2C by 2050, making total compliance inadequate to address the alleged problem (the "multiple Kyoto problem").

This is *not* to suggest that the scientific debate is over and won by the skeptics. This analysis only suggests where the momentum currently resides in the debate. It is conceivable that this momentum could shift, particularly with new evidence of positive feedbacks amplifying the warming from CO₂ itself.

Finally, these arguments should be of more than academic interest to Enron. They are being actively popularized by critics of the Kyoto Protocol in business and the public policy community, and their authenticity must be carefully evaluated by us for not only future business strategies and lobbying efforts but to ensure a fair public debate by the Pew Center on Global Climate Change on behalf of Enron.

Respect

Integrity

Communication

Excellence

Talking Points on Global Warming Issue for World Economic Forum¹

- The Kyoto Protocol may be a virtual reality for many countries, but in the United States we expect a two to three year debate—and maybe more—over the extent of the problem of climate change and the costs of effectively addressing it.
- This debate will have three aspects:
 1. Science (sorry, it won't go away)
 2. Economic costs and technological alternatives
 3. Political realities

Science

The science behind the global warming debate is settled over the fact that greenhouse emissions are increasing and probably cause some degree of warming. Even leading scientific critics such as Richard Lindzen of MIT and Patrick Michaels of UVA can find common ground with the lower end of some warming estimates in the general circulation models from a postulated doubling of CO₂ concentrations (around 1°C).

But the debate remains unsettled in several important areas:

1. Reconciling temperature records to pinpoint the amount of actual warming.

The discontinuity of data between the surface thermometers and the atmospheric sensors needs to be resolved to disarm a major puzzle in the debate. As it now stands, the satellite/balloon data are not showing the warming that surface instruments show over the last two decades. The year 1997 was no exception with surface readings setting a warming record and satellite data showing a cooler-than-average year.

A related point is that 1997's warming, like the surface warming of the last century (as noted in the IPCC report), has not been uniform but more concentrated in the coldest air masses during the coldest times of the year. This would obviously be more benign than a warming in the warmest latitudes during the warmest periods.

2. Quantifying the global warming created by natural variability (including solar fluctuations) as opposed to greenhouse gas emissions

¹ Prepared by RLB for Ken Lay seminar on global warming, January 31, 1998.

As William J. Broad of the New York Times [(September 23, 1997), p. B9] has stated: "Today, a growing number of scientists contend that the Sun's fickleness might rival human pollution as a factor in climatic change. And some research, though sketchy and much debated, suggests that the Sun's variability could account for virtually all of the global warming measured to date."

3. Understanding feedback effects to estimate the sensitivity of CO₂ forcing on climate, particularly the water vapor feedback effect that is postulated to double the warming created by increased CO₂ emissions.

The positive feedback of water vapor is assumed in all the general circulation models postulating high warming. Despite the "herd instinct" to make this assumption, there is a logical theory and some accumulated evidence to challenge it. Richard Lindzen has long been challenging this assumption, and if he is successful the low-range warming school of thought would carry the day.

Other feedbacks must be better understood by the models as well. Kevin Trenberth, a leading defender of high-range warming estimates and a leading critic of the accuracy of the satellite data, has stated: "Probably the single greatest uncertainty in climate models stems from their treatment of clouds, whose enormous variety and variability pose a special challenge."

Economic costs and technological tradeoffs

Science aside, what are the economic costs of restructuring the economy away from carbon-intensive fuels?

This depends on several key assumptions:

1. The costs of carbon-free renewable energies to substitute for fossil fuels
2. The costs of increasing increments of energy conservation
3. The costs of sink creation
4. The applicability of emissions trading
5. The availability of government subsidies to accelerate technological development in developed countries and transfer technology from the developed to the developing world
6. Political constraints on doing the right things

- The costs of the Kyoto Protocol can change dramatically depending on the above assumptions. For the U.S., for example, one major model shows an annual GDP loss by 2010 of 1.9% (\$170 billion*) without emissions trading compared to a loss of .4% (\$38 billion*) with emission trading and other optimistic assumptions (such as high subsidy transfers from developed to developing countries). [Charles Rivers Associates—high case is public information but low case is not public but under review; please do not reveal the source of this estimate] * based on a \$9.4 trillion economy in 2010, which assumes 1.8% real annual growth
- Paul Portney at Resources for the Future has heard of another estimate of meeting the Kyoto Protocol that is around a .5% annual GDP loss by 2010 (\$47 billion). This model is from EPRI, and I have not been able to make contact with a Rick Rickels there to confirm. It is not an equilibrium model incorporating secondary effects (like trade flows) like the CRA model. Portney told me that he respects David Montgomery's model at CRA, so I believe you can use the above numbers as a "high" and "low" range for now.
- DOE, interestingly, has not committed to doing a formal analysis of the effects of Kyoto on energy demand and fuel substitution. Secretary Pena has stated that the analysis will be done in 2004 according to Oil Daily. Yet the Protocol's timetable is that "substantial progress" must be made by 2005 toward an emission reduction deadline between 2008-2012.

The Primacy of Economic Growth

- Extrapolating the U.S. National Center for Atmospheric Research Climate Model that is consistent with the 1995 IPCC Report, we find that:
 1. The original U.S. position (1990 levels) would reduce the average global temperature by .13°C by 2050
 2. The revised U.S. position (1979 levels) would reduce the global temperature by .18°C by 2050

With a "crisis" warming scenario of as much as a 3.5°C increase by 2100 from a doubling of CO₂ emissions, a .2°C reduction is not on a solution trajectory

- Whether one or many Kyotos are necessary, the question of sustaining economic growth comes into play
- The "gentleman's agreement" between business and the environmental community is that energy and environmental sustainability must be sustainable with economic growth.

Al Gore's Earth in the Balance (foreword, p. xv) calls for a new "central organizing principle" of "protecting the earth's environment while fostering economic progress"

The "vision statement" of the President's Council on Sustainable Development (PCSD), a leading U.S. environmental-business collaborative, speaks of "a growing economy that provides equitable opportunities for satisfying livelihoods and a sage healthy, high quality of life for current and future generations"

But we also know that as a rule, wealthier nations are the cleanest, healthiest, and the most supportive of ecological betterment

- The growth constraint means that new energy technologies to reduce man-made greenhouse emissions on the demand side and the supply side must be not only technologically feasible but sufficiently cost-effective to not interfere with economic growth.

Lifestyle changes are probably out as far as most Americans go. The phenomenon of rising expectations is entrenched. Taxes are at or near their political ceiling. "Sacrifice" is a limited option over the short run and longer run. That is why the Kyoto Protocol is spread out over 15 years with near-term targets undefined.

If downsizing America and other developed countries is not an option, neither is keeping billions of people in developing countries from entering the energy age. Mechanized transportation and electricity are in their future; the question is how the energy will be generated and utilized.

2. Cap-and-trade permits for greenhouse gases and other market-based mechanisms are a necessary but not sufficient condition for the Kyoto Protocol to meet the economic viability test, at least in the United States

You can bet that the Republican Senate will cover the waterfront on all alternatives to achieve the desired carbon balance at the most affordable cost

Lawmakers will be looking for cheaper technological alternatives to reduced energy usage per se, such as creating new carbon sinks by seeding the oceans, building carbon-trapping structures, and whatever else. What are the pro's and con's of a high-tech sink approach vs. an energy transformation approach?

Conclusion

The Kyoto Protocol must comport with scientific, energy, economic, and political realities to be successful. There is little room for error. The quest by more people for the good life is a moral right, and there are enough technological optimists such as myself who think there are as many solutions as problems. But the problem must be well posed and the solutions not artificially constrained to achieve a global win-win to achieve sustainable economic, environmental, and social development.



CHARLES RIVER ASSOCIATES INCORPORATED

BOSTON ♦ PALO ALTO ♦ WASHINGTON

January 22, 1998

Rob Bradley
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1400 Smith Street
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Dear Rob:

I have enclosed the materials I promised describing our recent work and the estimates we have recently completed on the costs of the Kyoto agreement. The three bound items are a description of our International Impact Assessment Model (IIAM), that deals with a large number of individual countries, a copy of a report we did using that model early last year, and a copy of the report we did in December for the AAMA. These reports also contain summary descriptions of our databases and the models we used in these studies.

The single sheet labeled "United States" gives results from the IIAM for the United States under the Kyoto Protocol. It shows U.S. GDP losses of 1.9% in 2010 and 2.7% in 2030. The three tables labeled "Percentage change in GDP under the Kyoto Protocol" are the most recent results from our multi-region trade model. You will note that there are some differences in the results for the U.S. – the multi-region trade model is using a higher elasticity of substitution between energy and other goods and a lower backstop price than the run from the IIAM.

I hope these are helpful for Ken Lay's presentation. I would enjoy talking to you at greater length about our work.

Sincerely yours,

CHARLES RIVER ASSOCIATES INCORPORATED

W. David Montgomery
Vice President

WDM/wdm

Percentage change in Consumption, GDP, and Investment under the Kyoto Protocol with no trading, Annex 1 trading, and global trading.

No emissions trading

		2000	2005	2010	2015	2020	2025	2030
GDP	Asia	-0.25	-0.01	0.00	-0.46	-0.62	-0.75	-0.77
	Canada	-0.19	-0.80	-2.44	-3.09	-3.52	-3.91	-4.10
	OECD-Europe	-0.10	-0.47	-1.62	-2.18	-2.59	-2.87	-3.04
	EE & FSU	-0.09	0.30	-0.19	-1.22	-2.03	-2.77	-3.17
	Japan	-0.34	-1.22	-1.59	-1.92	-2.19	-2.39	-2.46
	AUS & NZ	-0.38	-0.46	-1.72	-2.49	-3.03	-3.46	-3.68
	MOPEC	-1.23	-1.27	-2.62	-3.46	-4.09	-4.62	-4.97
	ROW	-0.50	-0.30	-0.80	-1.43	-1.77	-2.12	-2.23
	USA	0.07	-0.28	-1.36	-1.79	-2.17	-2.53	-2.69

Annex 1 trading only

pct_gdp		2000	2005	2010	2015	2020	2025	2030
pct_gdp	Asia	-0.17	-0.10	0.10	0.09	0.16	0.23	0.26
	Canada	-0.26	-0.56	-1.35	-1.71	-2.08	-2.42	-2.66
	OECD-Europe	-0.09	-0.18	-0.49	-0.68	-0.88	-1.07	-1.22
	EE & FSU	4.33	2.62	7.49	7.71	7.95	8.38	8.88
	Japan	-0.27	-0.39	-0.59	-0.78	-0.97	-1.15	-1.31
	AUS & NZ	-0.20	-0.51	-1.19	-1.53	-1.88	-2.17	-2.39
	MOPEC	-0.76	-0.86	-1.40	-1.77	-2.17	-2.57	-2.98
	ROW	-0.29	-0.24	-0.28	-0.39	-0.46	-0.57	-0.66
	USA	-0.18	-0.37	-0.91	-1.11	-1.36	-1.62	-1.80

Global trading only

GDP		2000	2005	2010	2015	2020	2025	2030
GDP	Asia	0.27	-0.32	-0.33	-0.35	-0.27	-0.13	0.03
	Canada	-0.16	-0.25	-0.50	-0.60	-0.74	-0.88	-0.98
	OECD-Europe	-0.05	-0.08	-0.11	-0.14	-0.17	-0.21	-0.22
	EE & FSU	0.70	-0.14	0.92	0.44	-0.05	-0.38	-0.80
	Japan	-0.05	-0.05	0.02	0.04	0.06	0.08	0.09
	AUS & NZ	-0.18	-0.29	-0.61	-0.73	-0.89	-1.00	-1.10
	MOPEC	-0.39	-0.75	-1.57	-2.03	-2.59	-3.05	-3.40
	ROW	0.10	-0.24	-0.57	-0.72	-0.82	-0.90	-0.93
	USA	-0.14	-0.21	-0.36	-0.41	-0.50	-0.59	-0.66

These optimistic scenarios by Charles River Associates assume robust energy conservation opportunities, low-cost fuel substitution, and high subsidy transfers from the developed to underdeveloped countries. Note also how global trading lowers the GDP loss for each country. Unfortunately, a global average is not generated by the model.

Note: Not for attribution per David Montgomery, head modeler, CRA.