

Global Warming: How California is Helping

by Danae Jean Aitchison

INTRODUCTION

During the heat waves of the summer of 1988, a great deal of media and public attention was devoted to global warming, the greenhouse effect, and imminent climatic disasters being forecast in tabloid-style journalism.¹ The heat has subsided, the media has fixated on trendier environmental crises, but the problem of global warming has not disappeared. The issues that caused Americans great concern in 1988 still concern us today. This article examines what has happened in the area of global warming since the groundswell of attention subsided. First, this article provides a brief explanation of global warming. Next, it explores federal activity which has helped increase knowledge about global warming. Finally, the article discusses California's role in causing global warming, and what the state can do to ameliorate it.

BACKGROUND ON GLOBAL WARMING

Global warming, a climatic phenomenon, is intimately tied to the greenhouse effect. The greenhouse effect is a well-established theory in atmospheric science.² Simply stated, it describes the warming of the earth's surface and lower atmosphere due to increased levels of carbon dioxide and other greenhouse gases such as methane and nitrous oxide.³ Greenhouse gases permit more shorter wavelength, infrared radiation from the sun into the atmosphere than they allow longer wavelength, infrared radiation released by the earth to escape back to space.⁴ These gases, therefore, trap the radiation and reradiate it back to the earth. Greater concentrations of greenhouse gases in the atmosphere lead to more infrared radiation being reradiated back to the Earth's surface causing a warming effect.⁵ Greenhouse gases provide the earth with a thermal blanket essential to life processes. Without it, temperatures on the earth would be about 60 degrees Fahrenheit colder than they are today,⁶ and life would be drastically different.

One must emphasize that the greenhouse effect is a natural process that has been operating on the earth for thousands of years. The present concern stems from rapid increases in greenhouse gases from anthropogenic sources which may enhance the greenhouse effect. For example, pre-industrial levels of carbon dioxide in the atmosphere were approximately 280 parts per million (ppm), while current levels are about 350 ppm.⁷ Several of man's activities contribute to this 25 percent increase: burning fossil fuels, increases in pollution, and deforestation. Similarly, increases in methane, nitrous oxide, and chlorofluorocarbons cause concern because their total contribution to the increased greenhouse gases equals that of carbon dioxide.⁸

Increasing concentrations of greenhouse gases cause problems due to their long lifetime in the stratosphere. The most commonly used chlorofluorocarbons have lifetimes ranging from 75 to 170 years. Nitrous oxide also has a 170 year lifetime. Carbon dioxide can remain in the atmosphere for nearly 600 years. Methane has a much shorter lifetime, about seven years, however emissions are increasing rapidly as the global population grows. Thus, even if emissions of carbon dioxide, nitrous oxide, methane and chlorofluorocarbons were to be cut 75 percent by 1993, the atmosphere would still face a century's inheritance of greenhouse gas build-up.⁹ Humanity is already committed to a certain amount of global warming.¹⁰

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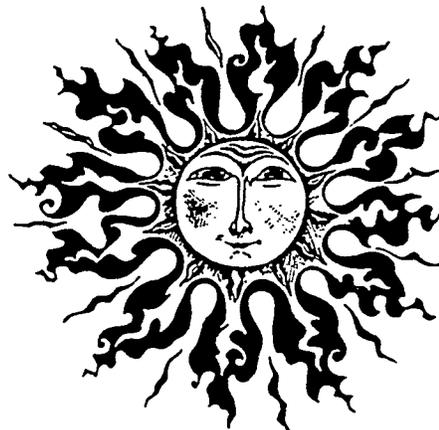
The validity of the greenhouse effect theory is not at issue in the global warming debate. Scientists agree the greenhouse effect exists and increases in greenhouse gas concentrations will lead to climatic changes eventually. The scientific debate involves three other issues: (1) how much the atmospheric temperature increase will be, given an increase in a greenhouse gas like carbon dioxide, (2) whether global warming has actually been detected in this century, and (3) whether a policy to mitigate global warming should be developed.¹¹ Currently, scientists estimate that doubling atmospheric carbon dioxide concentrations could bring about anywhere from a 0.9 to 9 degree Fahrenheit warming before the end of the next century.¹² This small variation may not seem significant, but even small temperature changes can have drastic effects.

Some possible effects of a small temperature increase include alteration of regional climate patterns, with subtropical areas becoming wetter and mid-latitude areas becoming drier during the summer; increased probability of heat waves and cold snaps; rising sea level, and dramatic changes in vegetation covering the biosphere as it adapts to changing conditions.¹³ A specific regional climatic change has been predicted for the Sacramento-San Joaquin Delta. A temperature increase as slight as 1.5 degrees Fahrenheit could cause salt water to intrude into the Delta due to greater evaporation of fresh water and rising sea level, making the large estuary inhospitable to many freshwater species. The area where fresh and salt water mix, a critical spawning area, would be forced inland, potentially harming freshwater fish species that migrate through the estuary to reproduce. In addition, the influx of salt water could pollute nearby aquifers used for drinking and irrigation.¹⁴

FEDERAL ACTION ON GLOBAL WARMING

The global warming debate has more than a decade of politically charged history. The United States Congress began to focus attention on climatic change and global warming in 1978 with the passage of the National Climate Program Act (NCPA), authored by Representative George Brown of California. The NCPA supported scientific research in natural climatic variability as well as climatic change induced by man's activities. Its goals were (1) to improve current understanding and prediction of climate; (2) to promote better planning for climatic contingencies through climate risk and impact analysis; and (3) to evaluate the risks and consequences of artificial climate modification.¹⁵ As Representative Brown pointed out before Congress, the original NCPA was not created by policy makers. Rather it sprang from recommendations by the scientific community that the United States be at the forefront of important global climatic change research.¹⁶ Between 1978 and the present, understanding of global climatic mechanisms progressed rapidly under the auspices of the NCPA.

The issues of global warming and climate change became politicized while being explored in the late 1970s and early 1980s in national research and university laboratories. A meeting sponsored by the Department of Energy (DOE) in 1979 brought



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together experts in disciplines ranging from political science, history, and psychology, to climatology and atmospheric chemistry. This meeting led to formation of a small group, under the patronage of the American Association for the Advancement of Science (AAAS), that sought to utilize integrated-scenario analysis to assess the impacts of global warming. In 1980, the AAAS group put together a proposal for DOE to sponsor such a program. The type of work anticipated for the program included scenarios of the impacts of climatic change on agriculture and water supplies, economic problems, and development and growth problems on a national scale. In 1981, however, the Reagan Administration assumed leadership, bringing a new secretary to DOE who was unsympathetic to climatic change research. DOE rejected the proposal for the integrated-scenario analysis program on climate change.¹⁷

Little support for climatic change research came from DOE or the Reagan Administration between 1981 and 1986. The Administration was at times openly hostile to many environmental and scientific interests.¹⁸ By 1986, however, the tone of the Reagan Administration began to change. The Congressional election of that year yielded a Congress more concerned with environmental issues. In 1986, Congress pledged millions of dollars to the Environmental Protection Agency for an assessment of the potential environmental and social consequences of global warming and climatic changes, much to the chagrin of DOE.¹⁹

Jim Hansen, an atmospheric physicist at NASA's Goddard Institute for Space Studies acted as a catalyst in the global warming debate in 1988. In June of 1988, Hansen testified before the Senate Energy Committee of the United States Congress that he was 99 percent sure the warming trend experienced in the decade of the 1980s was attributable to the greenhouse effect.²⁰ Hansen's statements, coming during the formidable 1988 heat waves, caused a furor in the scientific, political, and environmental communities. Newspapers began publishing quotes from scientists contradicting Hansen's statements that global warming had probably already occurred this century.²¹ The public called for action, and the Bush Administration promised to declare war on global warming.

Early into Bush's term it became clear Administration efforts to cope with global warming would be largely symbolic. At the first meeting of the Intergovernmental Panel on Climate Change (IPCC), in Geneva in November, 1988, the United States delegation was cautious, urging more research before formulating a response to global warming.²² This cautious tone was repeated in October of 1989 at another Geneva working session of the IPCC, convened to discuss the possibility of a global warming treaty. Other nations showed their willingness to take specific actions to stabilize greenhouse gas emissions, but the United States refused to make any commitment.²³ At the November 1989 United Nations Conference on global warming, the United States formally refused to endorse a commitment to control emissions of carbon dioxide by the year 2000.²⁴ Bush convened an international conference on climatic change in Washington, D.C. in April, 1990 which was mired in political posturing. Little policy resulted from the conference, and many nations left alienated.²⁵

Scientific research on global warming continues. The Bush Administration supports research, as well as economic impact analysis of various methods for reducing greenhouse gas emissions. Scientific knowledge about global warming remains imperfect and the risks difficult to assess, but the potential effects of a warming merit prompt responses. A variety of policy options exist that can mitigate global warming by reducing greenhouse gas emissions within the boundaries of current environmental efforts. Climatologist and global warming policy advocate Stephen Schneider recommends a tie-in strategy. By pursuing actions that provide widely agreed upon societal benefits the United States can begin to mitigate global warming short of complete scientific certainty. The Bush Administration calls this approach

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“no regrets,” and has given it tacit approval. By pursuing “no regrets” policies, communities can begin to take action on global warming without waiting for national legislation or international agreement.

CALIFORNIA’S ROLE IN GLOBAL WARMING

California’s contribution to global warming is already significant, and it is expected to grow substantially by early in the next century. The United States, with approximately 5 percent of the world’s population, contributes nearly 25 percent of the global carbon dioxide increase, from 280ppm to 350 ppm between 1860 and 1991. California, with approximately 0.6 percent of the world’s population, contributes nearly 1.5 percent of the global carbon dioxide increase.²⁶ The 25 percent global increase in carbon dioxide emissions between 1860 and 1991 is attributed to several of man’s activities including burning fossil fuels, increases in pollution, increased use of chloroflourocarbons in industry, and deforestation.

In the United States as a whole, the majority of carbon dioxide emissions, 34 percent, comes from electric power plants. In contrast, only 9 percent of California’s carbon dioxide emissions comes from power plants. The major California contributor is transportation, 58 percent of carbon dioxide emissions. To make matters worse, a study by Caltrans estimated that California motorists will drive 50 percent more miles in 2010 than drive today.²⁷ The Southern California Rapid Transit District currently experiments with alternative fuels in buses such as methanol, ethanol, and compressed natural gas. Investment into alternative fuel vehicles will increase under 1990 Clean Air Act Amendment provisions, but it is unclear whether they will have a major impact on carbon emissions.²⁸ While California contributes significant amounts of carbon dioxide in the transportation sector, it contributes much less carbon dioxide from power plants than other states. For example, about 84 percent of electricity used in the United States comes from coal-fired power plants. California, on the other hand, gets only 18 percent of its electricity from coal-fired plants. Most power plants within the state rely on relatively cleaner natural gas. These figures do not, however, account for the carbon dioxide emitted in other states by power plants in production of electricity and other products that California imports.²⁹

Every aspect of global warming, from science to policy, is uncertain. Scientists agree that increasing concentrations of greenhouse gases in the atmosphere will cause climatic changes. Exactly what type of changes, and how soon they will occur are still unknown. While global warming may not yet be detected on the Earth, the amount of greenhouse emissions from human sources between 1860 and 1991 may have already committed the earth to at least a degree or two of warming. Scientists, lay people, and policy makers, concerned about the amount of warming already “in the bank,” recommend countermeasures to ameliorate a warming as much as possible. Since California makes a significant contribution to global warming in the form of greenhouse gas emissions, it must also be part of the cure. Legislation specifically dealing with global warming promises to be politically difficult and will likely lead to ineffective and overly broad compromise measures. The key is to pursue generally beneficial environmental policies that have the added benefit of reducing greenhouse gas emissions.

POLICY OPTIONS FOR CALIFORNIA

A variety of existing policy options can help reduce greenhouse gas emissions from California. Ending chloroflourocarbon (CFC) use in industry could be critical, although new

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scientific developments complicate this policy approach. Reducing carbon emissions will be the most important method for reducing greenhouse gas emissions as a whole. Possible methods of reducing carbon emissions from California include increasing forest coverage, implementing a gasoline tax, switching to cleaner fuels in the transportation sector, and conserving energy through utility programs. Some policy options are easier and cheaper to implement than others. Some options clearly help reduce greenhouse gas emissions while others may not be as effective. And some options have multiple benefits while others have fewer. Mitigating global warming must necessarily be a multi-pronged policy, with the benefits of many different approaches contributing to the entire greenhouse gas reduction.

Ending CFC Use: One possible policy option for California would be a complete phase out of chlorofluorocarbons under the auspices of the Montreal Protocol on Substances that Deplete the Ozone Layer. This international treaty addresses the problem of ozone depletion due to the manmade chemical substances. As a signatory of the Montreal Protocol, the United States agreed to a slow phase out of chlorofluorocarbons and halons between 1990 and the year 2000. In 1988, however, the EPA called for the immediate and full phase out of chlorofluorocarbons. E.I. Du Pont, the world's largest manufacturer of CFCs, has already invested millions of dollars into development of CFC substitutes, and has promised to suspend production of CFCs by the year 2000 or sooner.³⁰ Viable CFC substitutes have not, however, been fully developed. Those that currently exist may have even more global warming potential than CFCs.³¹ In addition, production of substitutes is energy intensive, causing even more global warming potential. A huge market exists for CFC substitutes, and potential windfall profits encourage the development of more effective substitute compounds. Until effective substitutes exist though, it may be harmful for California to advocate a phase-out of all CFCs in all uses.

Governor Wilson signed a bill, AB 859, to phase-out automobile air conditioners using CFCs by 1995. New cars will no longer contain CFC air conditioners, while old cars will require retrofitting as supplies of CFC coolants for air conditioners dwindle. Provided there are good CFC substitutes available within the next four years, this will be one good way to reduce California's greenhouse gas emissions. The tie-in benefits are clear. Banning CFC use in automobile air-conditioners is a first step toward compliance with the Montreal Protocol to end ozone depletion. In addition, it will reduce greenhouse gas emissions from California which can reduce the likelihood of global warming. California can increase these benefits by banning CFC use in foams, small containers, and solvents. The importance of good CFC substitutes cannot be overemphasized though. If we introduce substitutes with higher global warming potentials than CFCs into industrial production, we will be doing more harm than good. A CFC phase-out is a wise policy to pursue to help reduce stratospheric ozone depletion and to mitigate global warming, but can only be implemented once good CFC substitutes are available.

Lower Carbon Dioxide Emissions: Carbon dioxide is the main anthropogenic contributor to increased greenhouse gases in the atmosphere. It therefore should be the primary target of policies designed to reduce greenhouse gas emissions from California. However, since most carbon dioxide emissions result from burning fossil fuels, it may be the most difficult policy goal to achieve. Two basic approaches for reducing carbon exist: offsetting carbon emissions and cutting carbon emissions. Tree-planting is the main offsetting approach. Reducing the amount Californians drive with a gasoline tax, switching to cleaner fuels in new automobiles, and reforming utility policies are the main cutting approaches.

Sustainable Forest Management: Trees and other vegetative matter use the carbon from carbon dioxide in photosynthesis to produce oxygen. Thus, actively growing forests

act as a form of “carbon sink,” reducing the amount of carbon in the atmosphere. Trees release this stored carbon when they burn, decay, or are cut down. The timber industry should not be halted in California, but reforestation and forest management plans could be implemented to build up the state’s “carbon sink.” Several issues must be considered to make reforestation and forest management to be useful. First of all, the type of forest necessary for the “carbon sink” to be effective is a large stand of closely placed trees. To help offset carbon emissions, timber legislation must include reforestation of large land areas into this type of stand. Planting trees in and around neighborhoods will not be adequate. Second, stands of trees must be kept living to offset carbon emissions. Once trees die or are cut down, they release the carbon they store into the atmosphere. Forest management plans therefore must include specific timelines for staggered cutting to ensure more trees are growing at any one time than are being cut. Finally, forest management designed to offset carbon emissions must also balance the carbon released from cut trees with that saved by replacing fossil fuels with fast growing, soft wood fuel.

Governor Wilson recently vetoed the Sierra Accord timber bill, AB 860. The accord would have limited clear-cutting, restricted cutting of old growth timber, and specified some limits on harvesting. The measure also would have incorporated provisions for different growing conditions around the state and for delays in compliance with the bill for communities facing economic hardship. Sustainable forest management can give California a wide variety of benefits. Managed forests preserve biodiversity, reduce air and noise pollution and also reduce soil erosion. At the same time forest management can reduce greenhouse gas concentrations in the atmosphere by providing a “carbon sink.” There are some problems with the forestry approach though. Tree planting requires huge amounts of space and human labor, forest management plans must have long time horizons which live beyond the originators of forest policy, and the amount of carbon offset by trees may not outweigh the costs of planting and maintaining them. Offsetting carbon emissions by increasing tree coverage is not however, intended to be the sole answer to reducing greenhouse gas concentrations in the atmosphere. Sustainable forestry is a worthwhile policy goal on its own. Sustainable forestry which incorporates global warming abatement is even more worthwhile.

Gasoline tax: Motor vehicles account for approximately 34 percent of carbon dioxide emissions in California.³² A gasoline tax would be the most straightforward economic incentive to reduce carbon dioxide emissions. By raising the cost per mile of driving, a gasoline tax would reduce the number of miles driven per car. According to a study by the California Senate Office of Research, a tax of \$.37 per gallon would adequately account for the societal costs of air pollution.³³ The same study estimates that if the fuel efficiency of cars increased by just ten miles per gallon, the carbon dioxide reduction would be the equivalent of planting 13 million trees if per car mileage did not increase. The problem with relying solely on fuel efficient vehicles is that they may encourage Californians to drive more, thus increasing carbon emissions.³⁴ Some tie-in benefits to a gasoline tax which reduces miles driven include less noise pollution, better air quality due to reductions in urban smog and particulates, and a corollary reduction in greenhouse gas concentration due to less smog, a powerful greenhouse gas.³⁵ A tax incorporating the environmental harm caused by gasoline use would be generally beneficial for people and for the environment. Global warming abatement provides an added incentive to pursue this policy option.

Clean Fuels: Motor vehicles in California rely almost entirely on gasoline and diesel fuels. Using alternative fuels for transportation could significantly reduce the amount of carbon dioxide emitted by the transportation sector, depending on which alternative is used. For example, ethanol produced from crop or tree farms that also use ethanol fuel for harvesting

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and processing has zero carbon dioxide emissions. Electricity produced from a mix of sources emits approximately 27 percent less carbon dioxide than gasoline. Electricity emissions will be lower if solar energy or lower carbon dioxide-generating energy sources are used for generation. Compressed natural gas and liquified natural gas emit approximately 15 percent less carbon dioxide than gasoline. Methanol derived from natural gas emits approximately the same carbon dioxide as gasoline. Fuels derived from coal, on the other hand, emit much more carbon dioxide than gasoline.³⁶ Ethanol produced from corn emits more carbon dioxide than gasoline and diesel when coal is used in the distillation process.

Current prices of gasoline and diesel do not incorporate negative externalities, the cost of environmental harm caused by their use. Thus, fuel users do not have an economic incentive to use more expensive, cleaner fuels. To encourage development and use of alternative fuels and alternative fuel vehicles, the legislature must provide economic incentives to make alternative fuel vehicles attractive to the public. Sales tax deductions for purchase of low-emission vehicles and retrofitting cars for alternative fuels will encourage alternative fuel development for transportation. Tax incentives for farmers to devote some crop land for ethanol production will also encourage alternative fuel development.

Voluntary conservation: A group of electricity producers in California have committed to a “collaborative effort” toward significantly reducing carbon emissions through conservation. The Los Angeles Department of Water and Power and Southern California Edison Company have undertaken to reduce carbon dioxide emissions twenty percent from current levels by 2010. Reductions will be achieved through conservation and efficiency, modernization of facilities, and use of renewable energy sources like solar and wind power. Pacific Gas and Electric (PG&E) has developed a ten year plan to stabilize carbon emissions through conservation and renewable energy sources instead of building new fossil fuel plants. PG&E intends to meet 75 percent of the expected growth in energy demand through conservation and 25 percent through renewable energy. Residential conservation programs involve consumer rebates for purchasing energy efficient refrigerators, installing ceiling insulation and central air conditioners, and planting shade trees. Commercial and industrial conservation programs focus on better building insulation, more efficient industrial motors, and relamping buildings with fluorescent bulbs.³⁷

Although only 9 percent of California’s carbon dioxide emissions come from electric power plants, the “collaborative effort” by electric utilities is an important method of reducing emissions. First, unlike methods to reduce emissions from the transportation sector, voluntary conservation programs do not involve any flat taxation. The utility programs will thus be less susceptible to political opposition than a gasoline tax. Second, in both transportation and utility programs consumers benefit from better air quality and better health, but the utility programs also give consumers items in return for their efforts. The energy conservation techniques allow consumers to purchase rebated conservation appliances that eventually pay for themselves in energy savings. Consumers who materially gain from conservation programs will tend to give them support. Finally, and most importantly, the utility conservation programs are already operating, providing opportunities for residential, industrial, and commercial consumers to begin conserving energy now. Realistically, a gasoline tax will be crucial to reducing carbon dioxide emissions. Such a tax may not, however, materialize for many years and should not be relied on as a “best method” for cutting carbon dioxide emissions from California.

CONCLUSION

Global warming could have drastic consequences for California. Higher global temperatures could reduce growing seasons and shrink the areas suited to growing food. Sea

levels could rise, engulfing coast lines and radically changing ecosystems. Regardless of when a warming will occur, or how much temperatures will increase, it is sensible to take preventative measures now to reduce the likelihood of climatic disaster. Preventative measures such as phasing out CFCs, planting trees, implementing a gasoline tax, switching to alternative transportation fuels, and encouraging voluntary energy conservation can reduce the amount of greenhouse gases contributing to global warming. These policy options are worthwhile on their own merit because they provide general environmental benefits. The added benefits of reducing greenhouse gas emissions makes them even more desirable. Californians have a reputation for being at the forefront of environmental action. As significant contributors to global warming Californians can take the lead in implementing policy to mitigate global warming and the potential for drastic climate changes.

Endnotes

¹Time Magazine featured a cover depicting earth as a burning fire ball on 1/2/89. Newspapers, and magazines ranging from Time, and U.S. News and World Report to The Economist have featured stories on global warming on a regular basis for the past several years.

²Stephen H. Schneider, "The Greenhouse Effect: Science and Policy," Science, Vol. 243, February 10, 1989, p. 771.

³The most important greenhouse gases include water vapor, carbon dioxide, methane, chloroflourocarbons, nitrous oxide, ozone, and sulfur dioxide.

⁴The greenhouse analogy is useful in visualizing the process. Like panels of a greenhouse, the gases allow more light in than they allow heat to escape.

⁵Stephen H. Schneider, Global Warming: Are We Entering the Greenhouse Century, (San Francisco, California: Sierra Club Books, 1989), p. 13. See also Schneider, "The Changing Climate." Scientific American, (New York, NY: Scientific American, Inc., September, 1989), pp. 70-79.

⁶Schneider, supra note 5, p. 13.

⁷Warren Washington, "Where's the Heat?" Natural History, (New York, NY: Museum of Natural History, March 1990), p. 67.

⁸Schneider, supra, note 2, p. 773. Main sources of methane include cows, rice paddies, and coal and gas exploration. Chloroflourocarbons are a manmade compound used in industry for insulation, cleaning circuit boards, propellants, and refrigeration. The main source of nitrous oxide is burning fossil fuels.

⁹At this time, the role of chloroflourocarbons in global warming is seriously in doubt. Recent data suggests that chloroflourocarbons may not have the positive effect on global warming previously assumed. There is no doubt, however, that a CFC phase out is crucial for dealing with stratospheric ozone depletion.

¹⁰The scientific community does not unanimously support this assertion. Peter Rogers provides some interesting skepticism about whether increasing greenhouse gas concentrations will necessarily lead to atmospheric warming in "Climate Change and Global Warming," Environmental Science and Technology, vol. 24, no. 4, p. 428. See also Andrew Solow, "Pseudo Scientific Hot Air: The Data on Climate are Inconclusive," New York Times (12/28/88), p. A15; Patrick Michaels, "The Greenhouse Climate of Fear," Washington Post (1/8/89).

¹¹Many other factors influence atmospheric change, including cloud formations, the geochemical carbon cycle, and ocean circulation. Stephen Schneider provides an understandable discussion of these factors in Global Warming, chapters 2 and 5.

¹²Schneider, supra note 2, pp. 242-243.

¹³Dr. V. Ramathan, Testimony before Senate Committee on Energy and Natural Resources, Hearings on the Greenhouse Effect and Global Climate Change, 11/09/87 and 11/10/87. 100th Congress, 1st session. See also Schneider, Global Warming, p. 107.

¹⁴Tom Harris, "Scientist: Global Warming Threatens to Pollute Delta." The Sacramento Bee, 10/06/91, at B12.

¹⁵Subcommittee on the Environment and the Atmosphere of the Committee on Science and Technology, U.S. House of Representatives, Report on the Hearings on The National Climate Program Act. (Washington, D.C.: U.S. Government Printing Office) p.42.

¹⁶Rep. George Brown, Statement before the Subcommittee on Natural Resources, Agricultural Research, and the Environment and the Subcommittee on International Scientific Cooperation of the Committee on Science and Technology, U.S. House of Representatives. Hearings on the National Climate Program Act and Global

Danae J. Aitchison is a LL at King Hall. She has a background in international relations and environmental policy and is interested in sustainable development problems in 1st and 3rd world countries.

Climate Change, 07/22. 100th Congress, 1st session, 1987. (Washington, D.C.: U.S. Government Printing Office), pp. 3-4.

¹⁷Schneider, *supra* note 5, pp. 122-123.

¹⁸Alternative fuel research programs of the Carter Administration were cut early in 1981. In addition, Reagan appointed two anti-environmentalists to key positions: James Watt to the position of Secretary of the Interior and Anne Burford to the position of Administrator of the Environmental Protection Agency. Environmentalists regarded these appointments as outright attacks on the environmental movement. For more detail, see Congressional Quarterly Almanac, 1981, pp. 503-504.

¹⁹J.B. Smith and D. Tripak, eds., The Potential Effects of Global Climate Change on the United States: Draft Report to Congress, vols. 1 and 2, U.S. Environmental Protection Agency, Office of Policy, Planning, and Evaluation, Office of Research and Development (Washington, D.C.: U.S. Government Printing Office, October, 1988).

²⁰J.E. Hansen, testimony before Senate Committee on Energy and Natural Resources, Hearings on the Greenhouse Effect and Global Climate Change. 6/23, 100th Congress, 1st session, 1988, (Washington, D.C.: U.S. Government Printing Office), pp. 42-49. Note that this testimony was altered by the Office of Management and the Budget before it was printed in the Congressional Hearings.

²¹See note 10 for two examples. In chapter 7 of Global Warming, Stephen Schneider provides an interesting discussion of the difficulties that occur due to media misinterpretation of scientists' language regarding the greenhouse effect and global warming.

²²William A. Nitze, "The Intergovernmental Panel on Climate Change," Environment, vol. 31, no. 5 (Washington, D.C.: Heldref Publications, 1989), pp. 44-45.

²³Allan R. Gold, "Global Warming Means New Global Politics," New York Times, 11/12/89.

²⁴Paul L. Montgomery, "U.S. and Japan Refuse Curbs on Carbon Dioxide," New York Times, 11/7/89, at A12. The Soviet Union also resisted any specific timetable for carbon dioxide emissions limits.

²⁵G. Christopher Anderson, "Diplomatic Squalls Spoil U.S. Climate Conference," Nature, vol. 344, No. 6269 (London: Macmillan Magazines, 1990), p. 799.

²⁶Senate Office of Research, California State Legislature, The Greenhouse Effect and Global Climate Change: Doing Something About the Weather, (Sacramento, CA: Senate Office of Research), 08/89, p. 1.

²⁷*Id.*, at 1.

²⁸Matthew Wald, "Gasahol May Cut Monoxide But Add to Smog, Study Says." The New York Times, 05/16/90.

²⁹*Supra*, note 26, p. 12.

³⁰Cynthia Pollock Shea, "Why DuPont Gave Up \$600 Million." The New York Times, 03/28/88. Also, Amy Bernstein, "Going for Green: E.I. Du Pont, Best New Corporate Environmentalist." U.S. News and World Report, vol. 109, no. 2, p. 53.

³¹This point must be underscored. Car manufacturers are using the CFC substitute HFC 134A for new automobile air conditioners. This compound is beneficial for the environment because it does not break down stratospheric ozone. It may prove to be harmful to the environment, however, because of its high, positive global warming potential. Scientists currently assess that HFC 134A does have a higher global warming potential than the CFC it is substituting. Exactly how much higher is being determined.

³²*Supra* note 27, p. 25.

³³*Id.*, at 38-39.

³⁴For an interesting analysis of why increasing fuel efficiency in automobiles will not benefit the environment, see Michael Sykutta and Kenneth Chilton, "No Benefits from Toughened Fuel-Economy Standards." The Sacramento Bee, 10/29/92, p. B9.

³⁵Smog, or tropospheric ozone, is formed when nitrogen oxides in the air and reactive organic gases from fossil fuel combustion react in sunlight. It has extremely damaging health effects in addition to being a greenhouse gas.

³⁶*Supra*, note 27, p. 28.

³⁷Pacific Gas and Electric, "Energy Efficiency: Residential Programs." Pamphlet no. 03-3913.

