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FROM: READ, Peter: MASSEY UNIVERSITY

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 11/06/91

SUBJECT: RE: U.S. POLICY ON GLOBAL WARMING. HE ALSO REQUESTS
A MEETING WITH GOVERNOR SUNUNU.

DIRECTORATE STAFF
ASSIGNED: ENVIRONMENT ASSIGNED:

ACTION STAFF
REQUIRED: DRAFT FOR DAB/SUNUNU SIGN ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 12/04/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
Damar Hawkins
Tom Ratchford

WHITE HOUSE TRACKING #: CONTACT PERSON:
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EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

December 3, 1991

MEMORANDUM FOR GOVERNOR SUNUNU

FROM: D. ALLAN BROMLEY *Alan*

SUBJECT: Response to Peter Read

After reading the letter and attached chapter from Peter Read carefully, it became quite apparent to me that we should not respond to his letter at all. He intends to use any response from you as part of the preface to his forthcoming book!

If we provide him with an official response - even a polite thank you letter - he will then have license to use it any way he chooses (probably, out of context). It is clear from his comments that he intends to challenge you in the book because he was originally going to include an "open letter" to you in the preface. Now, he is providing you the "opportunity" to give him a statement of your views.

I strongly recommend that we not give Mr. Read any official words that he may then turn around and use to attack you, the United States, or our policies on this difficult issue.

THE WHITE HOUSE
WASHINGTON

RECEIVED

91 NOV 29 4 9:51
DATE: 11/25/91

TO:

OSTP
MAIL ROOM
DR. ALLAN BROMLEY

FROM:

GOVERNOR JOHN H. SUNUNU

Will you please draft a response to
the attached letter to be signed by
both of us?



MASSEY
UNIVERSITY

Palmerston North
New Zealand
Telephone (063) 69-099

FACULTY OF
SOCIAL SCIENCES

DEPARTMENT OF
ECONOMICS

Facsimile

6th November, 1991

Dr John H. Sununu,
Chief of Staff to the President,
Executive Office of the President,
1600, Pennsylvania Avenue,
Washington, DC, 20500,
USA.

THE CHIEF of STAFF
has seen

Dear Dr Sununu,

Coming across your Profile in April's American Scientist, it seemed that not only is the USA on its own amongst developed countries in its 'no regrets' position on global warming, but that you alone are holding the line on that policy. I don't suppose it is as simple as that, but I thought I would preface my forthcoming book with an open letter to you. And then I thought it would be more constructive to write prior to publication, sending you a draft of Chapter 1, *Introduction and Summary*, as enclosed with the Airmail confirmation of this Fax.

I am trained as an engineer and as an economist and have spent most of my working life on energy policy questions. Like you I am in favour of economic growth and reject solutions that adversely affect the quality of life for billions of people. It worries me that environmentalists muddle up a legitimate concern about the sustainability of our industrialised economic system with anti-growth, sometimes anti-capitalist, sentiment.

Yes, I am sure you are right in believing that the Global Climate Models are hopelessly inadequate for predicting what is happening to our climate system. But I rather doubt whether any model ever will do the job. Nor, for that matter, is our understanding of the global carbon balance all that good, though the prospects of improvement in that area seem better.

I had the good fortune, during a recent sabbatical, to sit in on a lecture course about non-linear dynamic systems. Of course, not every non-linear system displays chaotic dynamics, but there seems to be a strong possibility that the long run climate system does, and if it does prediction is impossible - the system can be divergent from initial conditions too close together for the difference to be measurable.

This means we need to look at ways of taking rational decisions in circumstances of genuine uncertainty, even ignorance, of the way in which nature is delivering our future. When I was a child we did not need a good model of Hitler's strategic thinking in order to make for the shelters when we heard the air raid sirens.

Were the world how most economists believe it to be, such precautionary decision taking might lead us into the painful choices which the environmentalists wish on us. Fortunately most environmentalists and economists have, through ignorance of energy technology, got it wrong. The solution to the Enhanced Greenhouse Emission problem which I outline in this book is more likely to have a positive rather than a negative impact on the living standards of today's billions, and certainly improves prospects for next century's.

Essentially, energy firms are given an incentive to move, over the next three decades, from a fossil fuel based system to a more or less equal cost renewable biomass basis. Unfortunately there doesn't seem to be a global economic model which is designed to show the impact of acquiring energy raw materials from third world wage earners rather than from OPEC rentiers, as is implied by this solution. However, attempts to replicate it on a version of the IMF's MULTIMOD are not discouraging.

The conclusions reached in my book are as follows:

1. It is the level of carbon dioxide in the atmosphere - or quite possibly for how long an above-normal level is maintained - that is of concern.
2. Therefore it is net emissions that matter, with increased absorption just as effective as reduced gross emissions.
3. Economic theory has little useful to contribute beyond the 'least cost theorem' for achieving net emissions abatement targets efficiently: this is incorporated in the proposal for Tradeable Carbon Absorption Duties (TCAD's) which combines the effectiveness of 'command and control' regulation with an efficient market oriented mechanism for achieving the required result.
4. In a situation of extreme, and possibly permanent, uncertainty about the effect of above-normal levels of carbon dioxide, precautionary measures should be undertaken until shown to be unnecessary, even if they are expensive.
5. But they are not expensive, unless the weight of evidence regarding three well known technologies is wrong. These involve absorbing carbon dioxide by growing biomass intensively.
6. The quantities involved are so great that they can only be disposed of by being used as raw material for a renewable energy system, replacing fossil fuels. Applications technologies include combined cycle gas turbines for electricity generation and the fermentation of biomass to alcohol fuels for vehicles.
7. A two to three decade timescale is required for these technologies to diffuse inexpensively into the mainstream of the global energy economy, as existing plant is retired. By the end of that period more advanced renewable technologies will probably begin to penetrate the market.
8. It would be wrong to simply sit back and await the more advanced technologies since, firstly they may take longer than hoped for to develop, and secondly, if nature turns out to have nasty surprises in store, a stitch in time can save nine.
9. Within the timescale, growth in LDC's energy use will result in a doubling of emissions unless global collaboration is achieved. The biomass technologies give a competitive advantage to LDC's located in hot wet climates.
9. LDC's collaboration requires compensation for not using their known coal reserves. A scheme for Fossil Fuel Abstention Rewards (FFAR's) is targetted on that objective.
11. A combination of the two measures, TCAD and FFAR, can achieve a result of mutual advantage to a politically effective majority of nations. A side advantage could be a substantial reduction in the Third World Debt problem as part of a global deal for securing LDC collaboration.
12. The forthcoming UNCED cannot be expected to reach agreement on these lines but we may hope for a Framework Convention which either gives explicit recognition to the net emission concept, as an alternative to limiting gross emissions, or which can be conveniently amended to do so.

13. Implementation of net emissions targets requires machinery for international monitoring of biomass production and for research and technical assistance programmes. Specifically, there is a need for a commitment to a massive 'ground truthing' of GIS data to establish global knowledge of land capability.

14. Also needed is a commitment to a major training programme in the bio-technical and other skills required for the realisation of the globally coordinated programme which may, towards the end of this decade, be recognised to be necessary.

15. The most formidable obstacles to securing an atmosphere made safe for our grandchildren appear to be political rather than technical or economic.

All this began for me when I asked myself a while back 'is there enough land in the world to grow cheaply all the fuel that we need?' It rather looks as though there is, but the massive research effort called for in 13 above is needed in order to be sure.

I know you are a busy man, but may I ask you to get one of your staff to brief you on the Chapter which I am forwarding. I will be in Washington from 19th to 22nd November and would be glad to discuss my work with one of your staff. I can be contacted by return FAX or c/o 3624 Van Ness St NW, Washington DC 20008.

Subsequently I would be willing to let you have a copy of the publisher's draft, say end February. I hope that, by the time the book is in the shops, you will have got on with putting a lot of the \$76 billions of research money - which Scientific American says will be spent in 1992 - on having a good look at the supply curve for cheap renewables. And that a more active policy on emissions than 'no regrets' is appropriate for the USA - so long as the focus is on *net emissions* rather than just on cutting back gross emissions.

Yours sincerely,

A handwritten signature in dark ink, appearing to read 'Peter Read', with a stylized, cursive script.

Peter Read.

WHAT TO DO ABOUT GLOBAL WARMING

- EVEN IF IT ISN'T HAPPENING

- AND EVEN IF IT MIGHT BE A GOOD THING

PETER READ

Contents (draft of late Oct with revised Ch1:- pp 18-37 repeat)

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Suggestions for further readings

Glossary of abbreviations, etc.

Preface

There is nothing very original in this book. I had been in the habit of waking up early and saying to myself "Why on earth don't they get on with it and put the stuff back underground?" After some of that I thought I'd better ask around a bit and found that nobody else seemed to be thinking on those lines. Having spent most of my life working on energy questions of one sort and another, I found that rather surprising. Anyway, that question was the origin of the 'making coal' idea, which plays a minor part in these pages, and which was what got me going.

But the broad scheme which I develop is obvious to anybody who knows a bit about energy technology and who has a training in economics to go with it. I suppose my experience a decade ago, working with the Open University's Alternative Technology and Energy Research Group, was fairly special. And the years I spent working in Whitehall with what used, rather wonderfully, to be called the 'Ministry of Power' may have given me a bent towards thinking in policy terms. But there must be dozens of people equally as competent to come up with a solution to the global warming problem on the lines described in this book, and I can't think why they left it to me.

If there's a spark of originality, it lies perhaps in the economic instrument I have devised for making it happen, if the politicians are inclined so to do, which I call the Tradeable Carbon Absorption Duty. But as nobody else seems to have got around to stating what seems so obvious, and as there may be a danger that much worse answers will be adopted - such as doing nothing and hoping for the best, or imposing mind boggling levels of taxation on carbon emissions - I have written it down in the hope it will catch on in due course.

As is stated at the outset, this is a work of advocacy, addressed to a general readership. Accordingly it is not burdened with the plethora of citations that afflict academic work. Of course acknowledgement is made to specific borrowings from the work of others, and my intellectual and practical debts are recognised below. Apart from a few footnotes on points of - hopefully interesting - detail, the reader may read on uninterruptedly. Suggestions for further reading are given at the end of the book.

For my title I am indebted to an American climatologist who spoke to a recent international conference. He seemed to believe that the possibility that prospective climate change could have 'mostly beneficial effects' was sufficient grounds for acting as though that outcome is a certainty. However it is a well known fact that the only way to stop it raining is to carry an umbrella, and even that doesn't always work.

My chief debts are to my mentors in engineering and economics. Arthur Shercliff - to whom this book is dedicated and whose untimely death was such a loss to Cambridge engineering - suggested I get into alternative technology at a time when I was finding Whitehall a mite frustrating. Richard Layard suffered me kindly at the LSE, as a student mature to the point of over-ripeness. I also learned a lot in Whitehall, perhaps more from Ray Willmott than most, and at the Open University where I am much beholden to Godfrey Boyle. In the last ten years I have been lucky to work at Massey University where my research interests have had ample rein. In particular I owe much to the indulgence of my colleagues in the Economics Department, most of whom teach more hours than I, and to the generosity of the arrangements for study leave. In the process of developing this book I am indebted to many who have been kind enough to read different parts of it. In particular to David Lomax, editor of the National Westminster Bank Review, where some of this material first saw the light of day, and Mick Common, who helped me to understand this as not just a problem in environmental economics. For my family, who put up with me and, extended, kindly put me up, no words can suffice. Of course nobody named or unnamed above can be held in any way responsible for what I have made of their wisdom and help.

Chapter 1

Introduction and Summary

This book is a work of advocacy. It is intended to give new hope that the problem of global warming can be dealt with at acceptable cost by a collaborative effort worldwide. Hopes have dimmed that such an effort would, on the basis of work now being done towards a Framework Convention on Climate Change (FCCC), be initiated at the second United Nations Conference on the Environment and Development (UNCED), to be held in Brazil in June. Bickering and procedural wrangling in the FCCC process have been symptomatic of deep seated disagreements.

These have roots in the feelings of some rich nations that some poor countries see the UNCED as a platform to castigate the rich for sins of commission and omission in the history of development assistance, and the proposed FCCC as an instrument for extracting a high price from the rich countries in order to secure poor countries' cooperation in measures to protect the environment and to secure its future development on a sustainable basis. The feelings of the rich countries are reflected in poor countries' beliefs that global warming and other concerns about the environment have been brought about by rich countries, are of no immediate concern to poor countries, and are for rich countries to deal with at their own expense.

Essentially, most parties are engaged in taking up prepared positions from which to protect perceived national interests and it is naive to suppose that they will disinterestedly apply themselves to solving a shared global problem. In this book it will be shown how common interest may be found in dealing with the external environmental effect of global warming that arises from the workings of the energy market as it currently operates.

Of course, above all in a work of advocacy, one must be careful to be accurate. It is not certain that there is a global warming problem and, if there is, it is almost certainly not due exclusively to commercial energy activities. But it will be argued that precautionary action should be taken until we are certain there is NOT a problem, that commercial energy activities almost certainly have a lot to do with it if there is a problem, and that it is by changing our commercial energy activities, in a deliberate and gradual way over the next few decades, that we can most surely and cheaply deal with the problem.

Furthermore, it will be argued that if we become sure that there is no problem, the cost of having taken unnecessary measures would not be very great, whereas, if we do nothing for ten to fifteen years and then find that the problem is in fact very serious, the cost of action begun then may be very great. In other words, the precautionary adage 'a stitch in time saves nine' is applicable.

The example of the Montreal convention on ozone destroying CFC's (chloro- fluoro-carbons used in refrigeration and aerosol cans) gives lie to the cynics who claim that international collaboration is a hopeless endeavour. However, EGE (Enhanced Greenhouse Effect) as the global warming problem is now being called, presents a much more difficult problem. With CFC's, the major players in the business had developed alternative products and expected to do well out of the elimination of the older CFC's where they no longer had control of the market.

Alternative products to fossil fuels do exist but major energy firms have no control of that market. One of the features of the proposals discussed in this book, implemented through a Tradable Carbon Absorption Duty (TCAD) is that it provides a framework for a continuing major role for existing energy firms, thereby softening one of the prospective resistances to effective action. However, the major cause for despondency, amongst those concerned to hand over a healthy globe to the next generation, is the perception that effective action on EGE would be so prohibitively expensive that politicians will choose to do nothing about global warming until too late.

It is the claim of this book that this perception is incorrect. The basis of this claim is recent advances in two areas of alternative energy technology research, and one advance in mainstream energy technology. These suggest that, although not quite economic at the present time, only a small penalty would be involved in achieving control over the rate of CO₂ emissions through their progressive adoption over the next few decades. They would be showing net benefits (in addition to the benefit of effective control over the EGE problem) by around 2020.

Thus the main theme of the book is technological and economic. But a subsidiary theme lies in the field of political economy and relates to the history of development and under-development. The problem of sustainability facing future global development, outlined in the Brundtland Report 'Our Common Future', is not simply one of coping with EGE. Whether failure to do anything about that problem would lead to climatic catastrophe we will hopefully never know for sure. But that there is some limit to the number of people that can live on this planet, and that it is inversely related to the per capita impact each makes upon the environment seems beyond doubt.

Whether that implies also a limit to per capita consumption, or whether alternative, non-environmentally damaging directions for improving our standard of living will evolve, is more open to question. But the introduction of sustainability considerations into the direction of human development requires a change of course to a system that has immense internal momentum. For that change to be enforced by a painful, possibly fatal lesson from nature, rather than the attempt made to bring it about by conscious effort, would be a dereliction of this generation's duty to posterity.

Immense momentum requires either immense force and a sudden damaging crunch for its redirection, or moderate force applied consistently over a long time. To manage such a global scale change of direction is a challenge to world statesmen, suddenly released from preoccupation with the Cold War. Whilst there are no short term electoral victories to be won from successes in meeting that challenge, neither were there in the Cold War. Rather was it seen as politically suicidal to pander to totalitarian communism.

So, equally, must it become suicidal for politicians to deviate from working for the common good of a viable posterity. For that to happen there must be the same public commitment to our common future as there has been to the maintainance of liberty. That commitment requires continuing with the education of the electorate which has been so great an achievement of environmental pressure groups and the media, however cranky some of their campaigns may at times seem to be.

But for hope to be sustained, for the advocacy of this book to be plausible, it has to seem possible that a way forward can be found that does not require unlikely revolutions of the consumerist manifestations of mass economic behaviour. So a subsidiary theme of this book is to trace out, perforce in general terms within the pages of a single volume, a feasible path for change. Over the next few decades this path can, unless nature holds in store some truly dreadful surprises, put the globe in shape to get global warming under control by the middle of the next century.

However, it is a path that cannot be followed to its end without the willing involvement of the majority of nations. Achieving this requires the developed nations to give a lead and to accept what I call the 'burden of history' in a new relationship with less developed nations. The burden is likely to be not very great and short term in nature, leading to an outcome of mutual advantage to almost all nations.

The possibility of that coming about depends upon our leaders developing sustained statemanship to parallel the miraculous achievements of President Gorbachev since 1985. However likely or unlikely that may seem, the viability of the political path that is outlined under this subsidiary theme should not be muddled up with the feasibility of the technological and economic message which is the main theme.

The political path is one that will pioneer the track that must be followed in dealing with the increasing problems thrown up by the dominance of nature by homo sapiens. It is a track that

may enable the world to turn away from eventual ecological disaster. It may be followed in an untidy and muddled way, through initiatives by individual countries, such as New Zealand, through bilateral and/or regional arrangements, or under a global agreement negotiated through the good offices of the United Nations Environment Programme. One can only hope that statesmen seize the opportunity. But if they fail, we can - to return to our main theme - be sure that it is not because the task is technically impossible or economically very painful.

Sustainable energy at practicable cost

That the sustainable energy path outlined in this book eventually shows net benefits in the direct cost of delivered energy does not, of course, mean that fuel prices will be at or below their present level in 2020. We face rising fuel prices (in real terms, i.e. exclusive of the effect of general inflation) because it is getting harder and harder to find and extract new supplies of oil, and because the dominant position of Middle East reserves will give long run market power to suppliers in that region (quite apart from strategic costs involved in sustaining friendly regimes there).

Furthermore, by competing with oil and limiting the growth of its market, the alternative technologies will prevent oil prices rising as much as they otherwise would. So the eventual cost saving may appear less real than it is. However, as direct cost savers before the end of the century - the motivation, with apparently endlessly rising oil prices in the early 1980's, for initiating the research which has now born fruit - these technologies are not a great success. But when it comes to cutting net CO₂ emissions they are a knockout.

By using sustainable technologies based upon intensive fuel wood production - and its gasification for modern gas turbine based power generation, together with chemical processing to ethanol for motor transport fuels - we can achieve effective control over the rate of CO₂ emissions and, over time, reach a desired level of CO₂ concentration in the atmosphere. As far as existing extractive industries are concerned, the bad news is that this means more or less doing away with burning coal and, to a lesser extent, oil, over the next few decades.

But the good news is that the TCAD will ensure that they remain the major operators in the energy market, but based upon wood-fuel as the raw material. The idea of more or less doing away with coal and oil extraction and devoting vast areas to intensive fuel-wood production raises questions of acceptability and credibility which we come to shortly, and in more detail in later Chapters, merely noting that the land requirement does not seem to be so great, in competition with food production, as to present an insuperable obstacle over the next few decades.

However, it may be mentioned at this stage that the notion, advocated in some quarters, that the EGE problem be solved by creating "carbon sinks" - to drain CO₂ out of the atmosphere as fast as the man-made (anthropogenic) CO₂ sources (principally fossil fuel burning and tropical forest burn-off) pour it in - will not do. It will not do because it provides only a very temporary solution; the sink will fill up because there is not enough land available to do the job that way.

To absorb CO₂ at a given rate, long rotation tree growing, which is what would best provide such a sink, takes three to five times as much land as short rotation intensive fuelwood production techniques. And it cannot be done by creating sinks in the oceans as the transfer of CO₂ to the oceans goes on at a natural rate which cannot be hastened (and, indeed, may be slowed as one of the undesirable side effects of global warming). However, tree growing that is partly justified for other reasons, to combat soil erosion or provide windbreaks for instance, amongst a variety of amenity and conservation values, can certainly help boost the initial take off towards sustainability.

But with intensive fuel wood production using short rotation techniques such as coppicing, which involves cutting the tree crop at frequent intervals to get rapid re-growth from rootstock left in the ground, something has to be done with the crop. It would swamp the market for conventional timber if it were of commercial quality and the only answers to this disposal problem are either to bury it or to use the wood as fuel. The static 'carbon sink' concept is then replaced by a dynamic carbon fuel cycle concept which can, with care and with some degree of

international cooperation, do the trick. The concern of this book, showing how to achieve effective control of CO₂ levels in the atmosphere, therefore means a technological transition for the world's energy industries.

The investment needed to achieve such a transition averages about 10 per cent on raw energy prices over about 25 years, peaking at less than 20 per cent around 2005, a politically realistic prospect given that concerns regarding the EGE will thereby be met (and that raw energy costs are only a fraction of the total cost of supplying customized energy products such as gas through pipes, electricity by wire and automotive fuels into the tank). Because the elasticity of supply - an economists' term that captures the notion of how easily an activity such as this cheap and renewable energy base could be expanded - is large, net emissions could, at this low cost, be reduced to the rate at which CO₂ is absorbed naturally, with no further increase in its level in the atmosphere.

If climatological research eventually shows that it is necessary to reduce the level of CO₂ in the atmosphere, that also can be done, at slightly greater cost - how much greater depending on how quickly such a policy acceleration is required to act. If claims that the Enhanced Greenhouse Effect is not happening - or alternatively is on balance desirable - turn out to be true, the cost of having begun the policy are negligible: the trees can simply be allowed to grow to maturity for eventual commercial use. Hence the extended title of this book. Essentially, these technologies change the EGE problem from one which can at best be mitigated, or perhaps one to which the globe must perforce adapt, to one which can be controlled to the benefit of the natural environment and of this and future generations.

In contrast, the current perception amongst politicians and their advisors is that energy prices would need to increase by 100 per cent to achieve only a 20 per cent reduction in Carbon Dioxide (CO₂) emissions by 2020. That perception is based on the assumption made by economic analysts that the solution to the problem must be by deterring emissions. They calculate that a 100 per cent Carbon Tax is needed in order to deter fuel consumption and induce higher efficiency in use.

The difference between that scenario and the scheme outlined in this book is twofold. Firstly, the revenue from the (quite modest) fuel price increases envisaged is fed directly into the development of the alternative fuel wood based technologies, thus affecting both the demand side and the supply side of the energy market. Secondly, this scenario is focussed on net emissions, rather than the gross emissions which provide the focus of the current perception.

It should be emphasised that the real problem is not the rate of emissions of CO₂ into the atmosphere, but the level of CO₂ concentration in the atmosphere. This is rising because fossil fuels emit CO₂ without providing any mechanism for its recapture. However, biomass absorbs CO₂ during the plant's growth process so that, on a net basis, and over the duration of the growth and use cycle, first absorbing and then emitting, it leaves the CO₂ level unaffected.

Biomass based energy technologies therefore provide the basis for a renewable and sustainable energy system, providing enough land is available for growing the fuel wood, which seems likely to be the case. Furthermore, when burned efficiently in modern equipment, fuelwood is virtually free of the sulphur and nitrous oxide emissions which bedevil the use of fossil fuels.

Other technologies and economizing behaviour.

It should be mentioned that the emphasis on fuel wood production in this book - and its use for fueling furnaces and gas turbine power generation, together with conversion to ethanol for use as a transport fuel - is not intended to preclude other types of biomass (biomass being the term given in energy technology to any fuel raw material that is derived from plant material) or other types of biomass processing that yields fuel for industrial and other users, together with possible transport fuels. Rather are these particular technologies emphasized because they are known and practicable. They may thus be regarded as 'backstop technologies', a term used by economists to describe a technology that can be used if nothing better is available and which accordingly places an upper limit on the cost of doing whatever it is that the technology does.

Almost certainly better technologies than those emphasized in this book will become available, or improvements made to them, in which case the approach which is advocated will be less costly (or more beneficial) than claimed above. Thus, in general, references to fuel wood should be taken to mean fuel wood or some other better source of biomass. And references to the utilisation technologies mentioned above are to these or to some other better utilisation technologies based upon using biomass raw material.

Additionally, the price increases that are forecast to take place in any case, together with the additional approximately 10% cost increases arising from the progressive adoption of these alternative technologies, will induce economizing behaviour in all areas of energy supply and demand. Such behaviour (encouraged by public interest policies to break down the barriers of ignorance and prejudice which currently inhibit it - the so-called zero regret option) is anticipated in the cost estimates reported above. This has been done by making the simple assumption that the 'business as usual' scenario, against which the 10% cost increases are measured, will involve unchanging effective demand for conventional fuels, with growth in final end use (resulting from continued growth of economic activity) reflected by economizing behaviour between the mine head, the refinery gate, or the fuel wood coppice and the final end use, be that the frying of an egg or daily transport to work.

Such economising behaviour, including for instance the adoption of more efficient power generating plant and the more widespread use of diesel engines in motor vehicles (yes, ethanol can be used in diesel engines with the incorporation of additives, 'cetane improvers', to secure smooth burning) is not greatly dwelt on in this book. This does not mean that it is regarded as unimportant - quite the contrary - but that it would greatly overburden the text to elaborate on all the multifarious ways in which such economizing behaviour will take place.

Certainly the focus in this book, on biomass technologies for providing the raw material supply for a sustainable energy future, is not intended to imply that they are the only technologies that will play a part in dealing with global warming. Rather is it the message that biomass technologies provide an assurance that all the effort that will be going into economizing

behaviour will not be wasted on ineffectually mitigating a possibly catastrophic climate change, but can form part of an effective global programme for dealing with the problem.

Global redevelopment

The best places for intensive fuel wood production are the hot and wet tropical regions that have seen so much destruction of primeval rain forest since World War 2. An effect of implementing the environmentally sustainable energy future proposed in this book could therefore be a shift in rich country spending away from oil producing countries to impoverished third world countries, as wage income to workers in fuel wood plantations. This shift might be expected to do much to relieve the Third World Debt problem which threatens the stability of the rich nations' financial system as well as providing cash income to relieve famines, which are due far more to poverty than to the contrariness of nature. Thus the proposals in this book might be expected to yield a new and more equitable pattern of development as well as a remedy to the EGE problem.

However, the doubting 'might' rather than the more confident 'may' has been used in order to introduce a note of caution. The poorer countries have complex and precarious patterns of dependence on the soil which are better understood within the discipline of social anthropology than market oriented economics. For rich countries, or commercial organizations based in rich countries, to go barging in with the vast cash flows that would be yielded by diverting current payments for OPEC and other oil supplies, in order to grab millions of acres of land for growing trees to fuel the profligate energy demands of the rich, is a prospect that raises both panic and derision amongst those with experience of land use problems in poor countries.

Panic because a new colonialism based on corporate rather than sovereign power is conjured up. With the politicians, who might be expected to concern themselves with the interests of their own poor people bought off by corporate bribery, the peasants, deprived of land for their traditional subsistence farming, would become dependent on wages, ground down by competition, to meet the necessities of life. A new plantation slavery would emerge, driven to poverty by unsustainable depletion of soil fertility, with cash replacing the lash.

Derision because experience of tropical agriculture shows that such 'top down' enterprise in developing countries, which does not mobilize the knowledge and ingenuity of the people on the ground in a way that meets their own needs and aspirations, is doomed to failure. For those old enough to remember, the 'ground nuts scheme' became a by-word for the failure of well meaning but poorly conceived agricultural enterprise in poor countries.

To what extent the resistances that have been met from poor countries, in the skirmishing that surround the FCCC/UNCED process, are based upon such apprehensions, and to what extent they are based upon simple opportunism directed at extracting the maximum advantage from environmental concern coming from the rich, it is hard to say. In the main most probably the latter since the approach advocated in this book, though not a new concept, is not, as a coherent framework of ideas, widely known to those engaged in the negotiating process. But certainly they are apprehensions that should concern anybody from a rich country making proposals that imply extensive use of land in poor countries.

Given the right conditions of local involvement, it would be more efficient to grow trees for fuel purposes in hot, wet, and usually poor, countries. Given the ground nuts experience, it would clearly be inefficient to try to do so if the right conditions did not exist.

Fortunately it is not necessary to use such land this century since sufficient woody waste material is currently unused - and sufficient under-utilized land exists for fuel wood cropping in the rich countries - for the process of conversion to a fuel wood based energy system to go a very long way before any hot wet land need be used. How the poorer countries can become aware of their comparative advantage in fuel wood production and learn to resolve some of their development and economic problems by selling a new 'invisible export' of pollution clean up services to rich countries is a complex matter that may be resolved in different ways in different countries, as is considered later in this book.

However, the prospect remains that such a desirable outcome can, with wisdom and foresight, be brought about by implementing schemes that reflect the concept - that is to say the coherent body

of ideas - presented in this book, thus benefiting both rich and poor countries in the coming few decades, as well as handing on an atmosphere made safe for future generations. Accordingly this coherent body of ideas is called the GREENS concept, standing for Global Redevelopment and Energy Environment Sustainability.

It is hoped that readers' objections to the addition of yet another acronym (and I fear a few more later on) to the number already encountered are partly met by the inclusion at page [XX] of a quick reference list of all the acronyms that appear in this book. This particular acronym, it may need to be said, is not intended to convey any political platform - a concern for the environment is common currency amongst all modern political parties. Rather is it in the spirit of maternal admonitions to "eat your greens up dear, because they are good for you".

History and politics

That there is little justice in this world provides scant consolation to the underprivileged, be they individuals oppressed by their boss, ethnic or religious minorities by their local majorities, or impoverished nations that have gained little from the process of industrialisation. The governments of such less developed countries (LDC's) are informed, more often than not, by dependency theories of the development process. Such theories hold that the advance of more developed countries is at the expense of the less developed and that the capitalist system substitutes economic power for military power in a neo-colonialism that took over when old empire ended. There is no need, in this book, to take a position on that confused and confusing debate. History cannot be re-run and it must be accepted that, on account of their relative lack of economic progress, many less developed countries hold resentful attitudes towards richer countries.

That is a burden which history imposes on the present and which has the potential to frustrate achievement of the hopeful prospect that has just been signalled. The forces of emotion hold unforseeable perversions of backward looking logic which can leave constructive visions for the future in the trash dump. Witness Northern Ireland, the Punjab, Palestine, and now, again it seems, the Balkans.

Thus the achievement of hope fulfilled, along the lines of the GREENS concept, must depend not upon its imposition by powerful nations, nor upon its acceptability to all nations, but upon some combination of economic power and partial consensus. And perhaps upon partial and incomplete fulfilment in the early stages, with regional and/or bilateral arrangements anticipating its effective global coverage.

For the imposition of an energy technological transformation by force of arms is obviously ridiculous, and its imposition by economic power - for instance trade sanctions - would be counter-productive in relation to some of the major players in the game, most notably coal rich China. (Turned in on itself by external economic pressure, China would have no reason to refrain from using its vast resource of cheap coal). No more can reliance be placed on consensus, open as it is to obstruction by individual nations seeking to gain leverage for ulterior purposes. It would not do, for instance, for global agreement on GREENS to be held up by, say, Syrian conditionality related to the resolution of its dispute with Israel over the Golan Heights.

But out of the operation of GREENS some countries would gain more than others, and some, most notably coal rich countries in the first instance, would lose. The argument that would certainly be made by such losers that happen also to be less developed, is that rich countries have got where they are by using up more than their fair share of the atmosphere's capacity to absorb CO₂ pollution. A response from rich nations that they got where they are today by their own enterprise and that the whole world benefits immensely from the fruits of economic prosperity would fall on deaf ears.

It would not satisfy those that have benefitted only from the crumbs falling off the rich man's table. Especially those newly developing countries which, at the threshold of their own economic take off, find themselves asked by well-fed whitey to construct their own table in a more costly manner than was used by whitey himself in his hungrier young days. That the alternative energy technologies to be described in Chapter 4 are not much more costly than the fossil fuel technologies they can replace, maybe even cheaper in some circumstances, is a help in

practical terms. But it remains the case that there are some LDC's that have vast resources of cheap coal - and indeed that its cheapness arises in part precisely because they are less developed and consequentially pay low mining wages.

Accordingly, in achieving partial consensus involving at least those LDC's which are in a position to seriously vitiate the operation of a GREENS type scheme, there are two separate problems to be faced. One, problem A, is the problem arising from current energy needs, a problem that can be resolved by a transition to the alternative biomass based technologies that have been mentioned. As suggested, such a GREENS style resolution potentially carries rich rewards for LDC's that are in a position to provide a venue for the large scale growing of fuelwood on behalf of rich nations. To the extent that the GREENS technologies leave other LDC's somewhat better off than they would be under present prospects of having to import oil, then such other LDC's do not present a substantial difficulty.

However, the second problem, problem B, resulting from past use of fossil fuels by already rich nations, gives rise to the need to compensate those LDC's that have their own resources of cheap fossil fuels and which, for the operation of GREENS to be effective, must be persuaded to forego the benefit from exporting them - and indeed are asked to forego the benefit of using them within their own territory. Of course, almost all countries have fossil fuel resources of some sort, but account needs to be taken only of those resources which are cheaper to exploit than it would be to use the backstop renewable technologies.

Since problem B arises as a consequence of yesterday's actions, no purpose is served by burdening today's emitters of CO₂ with the cost of dealing with the problem, or tomorrow's for that matter. The problem of how to persuade, say, China to refrain from using its cheap coal would not go away even if today's emissions by other countries were reduced to zero in response to such a burden, since problem B arises as a consequence of the accumulation of past emissions. Thus, while the economic mechanism that is proposed in this book for dealing with problem A constitutes a particular way of influencing private behaviour through 'internalising the market externality' - to use some economists' jargon which is explained in Chapter 5 - problem B is

more appropriately dealt with on a government to government basis that does not directly affect the choices that are made in the energy market.

For this, the funds needed to compensate for non-use of fossil fuels are related to the relative level of under-development of different LDC's, to their relative endowment with low cost fossil fuels, and to the difference in costs between using that endowment and using alternative renewable biomass fuels (as a measure of the LDC's sacrifice in not using fossil fuels).

Similarly, the raising of such funds would be related to the different historic contributions of rich countries to the current level of CO₂ in the atmosphere (allowing for natural absorption). In practice, delivery of such compensatory funds could well - at least in part - take the form of relief of the Third World debts which impose such a strain on private sector international money markets. In that case relevant LDC obligations to the private sector finance institutions of rich countries would become a liability of rich country's governments or of their central banks.

To describe such an arrangement as politics rather than economics may be a distinction without a difference: political will is needed to implement a solution to either problem whilst each solution is amenable to quantification based upon the estimation of economic activities. However, problem B relates to economic activity in the past and is more of the nature of accountancy than economic policy, insofar as it is not designed to influence today's actions of agents in the market, or tomorrow's.

Furthermore it is designed in response to grievances held at the national level, and involving national prides and prejudices, and hence may be regarded as essentially in the realm of politics rather than economics. In essence such an arrangement provides a basis upon which the political will for collaboration in dealing with global warming may be built. In addition, it provides a pretext for doing something about dismantling the third world debt problem. Many would regard this as desirable in its own right, for the health and stability of the world financial system. But without some such ulterior pretext as is being suggested, it is an action which it is difficult to undertake on account of the precedent which such debt relief provides to potential debt defaulters in the future.

Economists and engineers.

It is perhaps worthwhile taking time to understand why it is that well intentioned analysts come up with very different answers when trying to answer the question of how much it is going to cost to deal with EGE. Two quite different modes of thought are involved when engineers and economists address themselves to this question. Economics has been said to be about 'making the best of things' whereas an engineer has been defined as 'a person who can do for six pence (2.5p in the modern coinage) what any fool can do for a shilling (5p)'.

The economist is trained to believe that people behave rationally and therefore produce as cheaply as possible given the available technology. If you say to them that there are better (cheaper) ways of, for instance, producing cabbages, they will ask you why it is not being done, why is it that profit loving business people are not in there producing cabbages more cheaply and underselling the current producers. Well-trained modern economists recognize that there are costs involved in acquiring information, and in getting into a business where others are already engaged, which explain the slowness with which new technologies diffuse into the productive system.

An engineer however, faced with a problem, is trained to acquire applicable information and to come up with an answer: if it's cheaper than continuing to bear with the problem well and good, if it's not then its 'back to the drawing board'. It is this constant striving to improve on the status quo - sometimes altruistic, sometimes motivated by the sheer pleasure of problem solving, and often (always according to the crasser type of economist) spurred on by profit seeking - which sharply differentiates the engineer from the economist.

The latter's mental set is towards optimizing in the context of constraints presented by a known, or calculably risky, state of the world as it is. It is the engineer's improving approach which offers hope that the problems set by an increasingly complex and interactive global society can be satisfactorily resolved in the context of a decision taking framework that takes prudent account of our uncertainty, or even plain ignorance, regarding many aspects of our situation.

The two disciplines tend to give very different answers because engineers employ a 'bottom up' approach which involves new technologies, or putting together known technologies in a different way, and thus alter the productive possibilities available to the economy. Economists solve the problem in a 'top down' way taking as given some model of the economy as a whole and seeing how it would have to alter its behaviour in order to reduce carbon emissions. By a model of the economy is meant an abstraction, usually in the form of a set of mathematical equations representing those parts of economic theory which pertain to the problem, with the equations 'calibrated' by reference to past behaviour.

Subjectivity enters when, as is often the case, there is more than one theory which purports to explain a given economic phenomenon and bias arises when the statistics available fail to conform exactly to the economic concepts they are used to represent. Thus the behaviour of the model may reflect the behaviour of the real world only rather loosely. However, this approach has the advantage that it can take account of the complex system effects that follow from a change to one small part of it, whereas the engineer's problem solving approach is perforce partial and local.

To an economist, since the economy has always shown a close link between energy use and production, and since energy use, within past technological experience, has always been closely linked to fossil fuel use, which means CO₂ emissions, the expectation is that abatement of CO₂ emissions results in a corresponding loss of production. Production in an economy is conceptually quite clear but its measurement, as Gross Domestic Product (GDP) is a little bit murky.

One way of thinking of it is as being equivalent to the payments made to the owners of all the inputs to production (wages to workers, rents to landowners and royalties to landowners who are lucky enough to be sitting on minerals such as coal and oil, interest to the suppliers of finance and profits to entrepreneurs and risk takers). Note that nobody pays mother nature for her inputs. Lost production thus means both less for people to consume and, to balance it, less income for

the owners of the inputs, and therefore a reduced standard of living - in short a very costly business. 'Bottom up' analyses on the other hand, usually show the cost of reducing CO₂ emissions to be small or, even, not a cost at all, but a benefit.

The two disciplines come together in what is called 'cost benefit analysis' (CBA) in which economists' rules are applied to evaluate the system effect of a particular change proposed by an engineer. Indeed, this book in essence takes its departure from a rudimentary cost-benefit analysis of the impact of technological advances mentioned above (intensive fuel wood production, gas turbine power generation and biomass to ethanol by a fermentation process) on the assumption they are applied on a global basis.

However, even if the result were considerably less attractive than it turns out to be, it is argued herein that precautionary steps to anticipate the possible climate effect of rising CO₂ concentrations should still be taken. One reason for this, amongst others to be discussed later, is that CBA is only properly applicable when the project under consideration is small in relation to the economy as a whole, so that the penalty from being wrong is not very great and can be set against the risks arising from a multiplicity of other small projects. This is clearly not the case for a one off decision like globally agreed policy towards global warming.

For it to be argued - as has been by one extremely clever economist writing in the widely read and influential Economist magazine - that because climate affects only agriculture, forestry and fishing, which constitute only 4 per cent of US GDP, then the damage is likely to be insignificant even if EGE occurs, is really rather silly. One may as well say that, because the air we breathe makes no contribution to GNP, we can quite easily do without it. Furthermore it demonstrates a certain insularity of approach given that the bulk of the world's population can far less easily do without 4 per cent of their income than can affluent US citizens.

Most of these poorer countries are far more dependent upon climate than for a mere 4% of their output. Subsistence farmers are 100 per cent dependent upon climate. In relation to a single, global, and essential asset such as climate, a much more cautious decision taking framework than

CBA is needed. Accordingly we shall, despite the attractiveness of the rudimentary cost-benefit results that have been mentioned, be looking at the implications of the technological approach that is being advocated from a precautionary perspective.

Acceptability and credibility.

Apart from the disagreements that have been mentioned, as between rich nations and poor, quite other disagreements exist, and much closer to home, to entrap the would-be reformer of our energy system. Indeed, it sometimes seems, in advancing the GREENS concept, that the twin navigational dangers have grown together, leaving no passage between the Scylla of conservative industry pouring scorn on the notion that fossil fuels - oil in particular - might ever be dispensed with, and the Charybdis of environmentalists, snarling with disappointment that a technical fix might be found for their longed for ultimate obstacle to hated growth. It is not out of deference to the feelings of the latter group that this book is not entitled 'how to fix global warming' since the GREENS concept involves far more than just a shift in energy technology.

Neither, however, has the zero - or even negative - growth path seemed to be a sensible component of a practicable basis for a sustainable energy future. Apart from the damage that would result from a crash stop to the immense momentum referred to previously, a moral difficulty arises. For zero growth would be to condemn billions of the world's population to a no hope future since there is certainly no prospect of rich nations pooling their attained standard of living with that of the less well off. Greater equity between nations can only come about by the less well off growing more rapidly than the rich, with the latter comfortably enough off to accept slow growth.

Nor can the prospect of the motor car's demise be taken seriously: clearly it is out of place in congested city centres, and the growing recognition by even rightist politicians of the need for public transport that works - in the sense of being willingly used by the bulk of inner city travellers - is a hopeful sign that this particular kind of 'no regret' economizing behaviour will yield significant emissions reductions in many places. But nobody who has taken children on

holiday, who has taken commercial samples around, or who has to do the weekly shopping would seriously doubt the immense benefits yielded by Henry Ford's invention of the mass produced auto.

But even though GREENS posits no such implausible assault on consumerism, there remains a credibility gap in the concept, given the record in energy related matters of successive US administrations in the 1980's. To criticize the administration from a foreign base is to risk alienating just those US citizens whom one most hopes to influence: when a foreigner criticizes even the most outrageous actions of the British government - say in Northern Ireland - the most liberal of Brits will start talking about the kneecappings of the Provos. Equally, when the US criticizes New Zealand's nuclear free policy, Kiwis start in on the Americans Cup and the iniquities, not to mention inequities, of New York State's Court of Appeal.

But, however great ones admiration may be for the Constitution of the USA, with its checks and balances, its countervailing powers and its liberty of expression, however beholden to the generosity and kindness of many Americans, however moved by the great achievements of Americans in the performing and creative arts, and however aware that the roots of modern concern for the environment were sprung in the USA (and still largely watered by American money) it remains the case that the Reagan era, heralded by the symbolic dismantling of solar panels from the roof of the White House, brought in a most foolish and damaging episode in US energy policy.

Damaging not only in the profligate use of exhaustible resources in careless unconcern for later generations and in consequential pollution of the atmosphere, but damaging in withdrawal from the economizing behaviour of other nations that has seen the development of autos that leave the Detroit product unsellable outside the USA and its work force on the street. And damaging to allies and alliances when greater than necessary global dependence on internationally traded oil involves them also in the consequential strategic risks.

And economically damaging also, in terms of the falling value of the US dollar, when to have gone with the economizing trend in Japan and Europe could have released Alaskan oil for export

to Japan, to the benefit of the US trade balance. For a President with an oilman's instinct, it must be an unpalatable reality that a statesmanlike concern for future generations is going to damage the coal industry (but not ruin it - remember that the TCAD is designed to provide existing operators with a continuing role in bio-energy supply) and, eventually, hurt the oil industry also.

But, in the USA of all places, no industry can assume the world owes it a living, certainly not when it hazards voters by its operations, and their grand- children. Let us hope that readers of this book in the USA will raise such storm of protest, against the current ineffectual 'no regrets' US policy on CO2 emissions reduction, that a more active policy will come to yield least political regret to the Presidency. Let us hope that President Bush will grasp this opportunity for statesmanship.

Summary

The pretentiously busy reader will no doubt have read no more than the conclusions listed in the Preface. Here we provide a summary to enable the knowledgeable to decide which parts can be safely skipped.

Chapter 2 is concerned with the scientific nature of the problem presented by EGE. It shows that the atmosphere upon which life on earth depends is quite fragile. Fragile in the sense that the enormous fluxes of energy that pass inward from the sun and outward to outer space can change its condition very substantially if some minor change in the environment alters the balance of transmission, reflection and absorption of those energy flows. In recent times quite minor volcanic episodes have had noticeable effects whilst pre-history has featured cold phases ("ice ages") of which a recurrence would be catastrophic.

It is the level of CO2 concentration in the atmosphere that is of concern, possibly some combination of the level and the length of time for which the level is sustained above normal. Over the last 50 years, a business as usual industrial scenario has taken the atmosphere into a regime which is without precedent as regards the high level of CO2 which has already been reached and which is climbing fast.

The nature of the dynamics of complex non-linear systems (which is how the global climate system and its interactions with the biosphere are classified from an analytic point of view) is such that there is increasing probability of a sudden, and quite possibly severely damaging - maybe even catastrophic - change of climate regime as feedback processes become unstable under parameter shifts induced by levels of CO₂ forced ever higher, and ever further away from any that the planet is known to have experienced previously. Thus it seems that a better understanding of the scientific evidence will eventually lead to a time constrained target specified as a need to return to a particular level of CO₂ in the atmosphere by a particular date.

The record, over the last 160,000 years for which there is good scientific information, shows a very close association between climate change and changes in the level of CO₂ in the atmosphere. The time-scale should be emphasized: a global climate system change that takes a century to complete has happened in the twinkling of the eye as far as geological history is concerned. The forcing upwards of CO₂ levels is not only without precedent, but is occurring at an unprecedentedly rapid rate. It may be hoped that, if a time-constrained target can be met, the 100 or so year excursion into above-normal CO₂ levels, brought about by a phase of dependency upon intensive use of fossil fuels, will be over before the more catastrophic possible responses of the system have time to develop.

Nothing else of a scientific nature is known about global warming with any degree of certainty. In particular two crucial scientific dimensions of the problem, climate dynamics and the carbon cycle are very poorly understood from a quantitative point of view. About 25 per cent of the net anthropogenic emission of CO₂ is unaccounted for. Global Climate Models (GCM's) vary by a factor of three as regards the impact on average temperature that is most likely to result from the forecast increase in the level of CO₂.

It should be emphasized that the better GCM's of the future are not certain, or even likely, to show a clear need for a time constrained target of the kind suggested above. Indeed, it may be doubted whether they will ever match up to the problem of telling us, for sure, whether the

climate system is prone to unforeseeable 'jumps' or not. Thus the development of these models to the limit of their capability may do nothing to resolve the current policy uncertainties.

However, we do know enough to know that these possibilities cannot be ruled out. Nor can we rule out the possibility that some regime change has already begun and is currently masked by the transitory effects of vulcanism and the more lasting but not everlasting effect of polar melting. In the circumstances, failure to take a precautionary stitch in time may impose severe burdens on future generations. On a worst scenario it may leave them with no world to live in.

Chapter 3 is concerned with how to take policy decisions about important and unique problems under conditions of uncertainty. Policy on global warming is in a muddle which is compounded by research output based on inappropriate methodology that imposes currently unattainable data requirements and provides confusing signals to policy makers. The regret approach, yielding a measure of 'social objection' provides an appropriate way for thinking about once for all decisions in an uncertain world. Once for all in the sense that what we do for the next two decades determines the choices available in 2110. Of course, policy evolves as research provides new information and, indeed, appropriate research directions constitute an important aspect of policy.

As with any analytic procedure, whether computerised or not, the "garbage in garbage out" dictum applies. However, one needs only to assume a finite possibility of an adverse, possibly catastrophic, climate jump, to see that plausible orders of magnitude, for the cost of emergency policies begun late, point clearly towards an active emissions reduction policy, especially if such precautionary policy is low cost. Such a conclusion emerges intuitively from a concern for future generations and the main function served by the regret/objection approach is that it enables such concerns to be formalised in an operational manner. It thus provides an appropriate alternative to the familiar cost-benefit analysis (CBA) methodology. It says 'get into the bomb shelter when you hear the air-raid warning'; CBA says 'lets calculate the costs and benefits of getting into the shelter as opposed to not doing so'.

CBA has provided the operational basis for environmental policies in many areas but gives little guidance in relation to global warming policy since it imposes infeasible data requirements. To wait for knowledge of the 'damage function' (the relationship between CO₂ emissions and the expected cost of the damage that results) may cause the opportunity for cheap remedial action to be lost.

Global warming presents a global "externality" upon the global market system. This externality and the requirement for global policy that arises, is no less real because of uncertainties whether as to the likelihood of climate jumps or as to the size of the damage function even if unprecedented CO₂ forcing does not cause a climate jump. Requiring a global policy solution means global cooperation towards securing a sustainable climate future. Having in two Chapters explained the nature of the problem and a rational basis for policy under these uncertainties, the remainder of the book is devoted towards explaining how such a cooperative outcome may be brought about.

Chapter 4 outlines the technological basis for dealing with EGE through a transformation of the energy technological basis of commercial activity away from the reliance on fossil fuels which has given rise to the problem. The timescale for such a transition process is 20 to 25 years, with the 1990's devoted mainly to preparation and learning by doing.

Conventional projections of demand are assumed, with slower growth in developed countries and more rapid growth in other countries. It is assumed that increased efficiency, both within the energy conversion system and in use by final consumers, will be brought about by rising prices and 'no regrets' economizing behaviour and that this will result in approximately constant demand for energy raw materials. Within the period, economic growth in Less Developed Countries (LDC's) means that the transition must cover both developed and other countries to be effective. Rich nations cannot deal with EGE on their own.

Three technologies, all basically proven and available, provide a backstop technology system for the transition. These are

- 1) combined cycle gas turbine technology for power generation at higher efficiency and in smaller units than conventional modern thermal power stations
- 2) intensive biomass production using short rotation tree cropping techniques such as coppicing of selected fast growing species
- 3) motor transport fuel production from biomass by fermentation to ethanol.

The application of these technologies can see the end of coal mining, save possibly for isolated special applications, and a major slowing down of oil depletion within the period. This will be accomplished by increased use of natural gas in existing installations and the development of fuelwood gasification and/or direct fuelwood firing for new furnace installations and by retrofitting existing plant, including a less centralised electricity generating system located in fuelwood production areas. Where fossil fuels are too difficult to replace, the alternative of 'making coal' (or at least initiating the process) takes the form of controlled burying of biomass, maybe at remote and more suitable locations from those where replacement is so difficult.

Tropical and semi-tropical LDC's provide the most naturally efficient venue for biomass production but the technological transformation should begin in temperate regions to avoid unacceptable impacts upon existing land use and social patterns. While sufficient land to meet all demands may well exist in temperate regions, LDC's can eventually realise their competitive advantage and achieve economic growth through 'invisible exports' of pollution clean-up services together with the adoption of the up-to-date and energy efficient new technologies. A side benefit would be the provision of an alternative economic structure with rising standards of living in lieu of subsistence patterns which have seen much destruction of tropical rainforest.

These backstop technologies provide a transition to more advanced sustainable technologies which are expected to become technologically proven and/or economic over the next two decades. These include steam injection and intercooling developments of the combined cycle gas turbine generator (for which biomass is a technically superior fuel), photo-voltaic electricity, fuel-cell powered automobiles and eventually, perhaps, a hydrogen based energy system in which carbon (and therefore CO₂) have no place. This further transition becomes necessary as

population growth raises demand for land for recreational and food growing purposes, and the sun's renewable energy increasingly has to be collected in the deserts or, perhaps, in outer space.

The Chapter concludes with a qualitative scenario describing one possible pattern of development for the global energy system over the next few decades.

Chapter 5, with its successor, are mainly expository of those parts of economics which are needed to understand policy on EGE - needed because economics is accepted to be the main language of policy making. The first of these Chapters explains the basis of "invisible hand" theorising which leads economists to look for market outcomes as the benchmark against which proposals for policy intervention require to be measured. The market, in principle, delivers an outcome in which nothing is wasted so that more for me means less for you and more of one good - say pollution abatement - means less of another, say guns or butter. A geometric explanation is offered, showing how the invisible hand depends upon special assumptions regarding the nature of technology.

The market outcome depends also upon the distribution of spending power, with a different blissful equilibrium resulting from each conceivable pattern of ownership of the means of production, and of consequential income. However, the Marxian critique is sidestepped, as is the Keynesian problem of macro-economic under-employment. A variety of possible reasons why the invisible hand may fail to work very well are explained, with particular attention to externalities, public goods and imperfect competition as significant in relation to the EGE problem and its inter-connections with the energy sector of the economic system.

The problem of responding to market failure is considered in the light of the 'second best' theorem which demonstrates that there is no general rule for improvement in an imperfect world (i.e. more market policies may result in worse outcomes). In the energy sector, which may be treated as a natural economic unit with strong internal links, indicative planning methods may be useful as an information sharing process that can help avoid mistakes. For instance, long lead time investments in coal fired power stations could be avoided with good information about the

availability of biomass to fuel combined cycle gas turbine plant (and in relation to forecasts of electricity demand based on more than the wishful thinking of power engineers).

With environmental pollution under 'second best' theory there should in principle be a level of pollution tax which results in the desirable level of pollution clean-up where the benefit from further clean-up just balances its cost (so that further clean-up is not worthwhile). The possibility of the so-called property rights approach yielding this result is shown to fail in the face of transactions costs problems.

Chapter 6 dismisses the possibility of the efficient taxing of pollution on grounds of informational difficulties which are two-fold. First the state of pure ignorance regarding the costs of pollution damage, of which ignorance regarding the 'damage function' in relation to CO₂ pollution is but an example - albeit a rather extreme one. Secondly much of the information requires the truthful disclosure of privately held information by agents who, at best, have negligible interest in its accuracy, and often have a direct interest in its inaccuracy.

A rather 'coarse' variety of economics is perforce applied, in which the only useful result is the so-called least cost theorem which shows that a policy is better if it results in the cost of abatement, per unit of reduced pollution - say per ton of CO₂ emitted - being the same for all emitters. The target level of abatement to be aimed for is decided by experts rather than by economic analysis.

A variety of conventional policy instruments - command regulation, and market oriented taxation and tradeable emissions permits - are considered in relation to the least cost theorem, with the first shown to be inefficient. For instance, a mandatory reduction of CO₂ emissions by 20 per cent is more easily achieved in copper smelting, that just needs heat, than in steel making where some carbon is needed in the process.

The special problems for economic theory raised by CO₂ pollution arise because it is the level of CO₂ that matters, and possibly for how long the level persists above normal. This means

- a) that it is net emissions that matter, i.e. gross emissions minus absorption from the atmosphere, so that both emitting and absorbing activity are open to policy intervention; and
- b) that the problem becomes essentially dynamic in nature, since the level is the result of net emissions rates, possibly changing rates, and the length of time for which emission persists.

It is, of course, (a) which makes the renewable technologies of Chapter 4 so much more powerful a response to the EGE than the simple taxes on gross emissions - or equivalent schemes for tradeable permits - which have so far pre-occupied policy analysts. (b) raises difficulties for economics which is mainly pre-occupied with comparing static equilibria. Various tools of the trade for analysing time-dependent economic problems (essentially the discounting of cash flows using compound interest) are presented and the significance of the rate of interest used in policy choices explained*.

footnote*Issues of inter-generational equity, such as are central to our concern for sustainability, are involved, with the interests of future generations served by low social discount rates which result in high investment for the future and lower rates of depletion of exhaustible resources. Higher growth - and more rapid depletion of resources - does not follow from such higher public investment, where the purpose is to conserve resources. In fact it squeezes out growth generating resource-using private sector investment - a low discount rate for policy decisions can thus be an instrument for balancing growth and sustainability.*end footnote

The essentially dynamic nature of the EGE problem carries advantages in the sense that earlier policy errors can be corrected as part of a framework for taking account of new information as it becomes available from research, be it research on GCM's, on energy technology, or upon land use and related matters. However, the credibility of policy requires policy to be 'time-consistent', with its adjustment over time in a manner which is surprise free, save for surprises due to nature. This calls for the maximum certainty in the effect of policy, with the minimisation of so-called agent-principle variability. None of the conventional policy instruments does well under that requirement.

Chapter 7 describes the Tradeable Carbon Absorption Duty (TCAD), a policy instrument which is designed to overcome the difficulties of conventional instruments. Under the TCAD, energy firms are motivated by market forces to adopt biomass as the basic sustainable energy raw material for the opening decades of the next century. Energy sellers, at the wholesale level, are required to absorb some proportion of the carbon that is emitted when their product is used by

the purchaser, or to contract with other firms to carry out this duty. The tradeability of the duty, i.e. that it can be discharged by third party contractors means that the cost per ton of carbon emitted is the same for all emitters, thus achieving economic efficiency in terms of the least cost theorem.

Although equivalent in steady state equilibrium to tradeable permits with absorption offsets, its impact is more direct. The regulatory nature of the Absorption Duty means that energy firms have no management discretion as to whether to undertake absorption offsets and the agent-principle problem is circumvented, save for monitoring performance, a need which is no less present with offsets. Furthermore, energy firms become owners of biomass fuel raw material which has zero opportunity cost and will therefore be used by them in preference to non-zero cost supplies of traditional fossil fuels. Of course the use of the biomass is not free as it involves a further TCAD to grow more biomass. But the use of fossil fuels involves both the TCAD and the cost of mining the fossil fuel.

Such a policy cannot be implemented at a high level overnight and the dynamic time path for implementation, and for consequential CO₂ absorption and the assimilation of biomass into the energy system, provides the context for defining what is meant by a net target in a dynamic sense. Under New Zealand conditions, this adds an average of about 10 per cent to raw material energy costs over 25 years (peaking at about 17 per cent in 2005 and falling to zero by 2015) secures a 70 per cent reduction in net emissions. This may be compared with the 100 per cent tax which has been considered necessary in the USA to achieve a 20 per cent reduction in gross CO₂ emissions by 2020.

The policy affects different countries differently. To the (rather small) extent that its implementation, and the ensuing global transition to a biomass based renewable energy system, imposes a burden, the question of international equity is addressed. It is suggested that, since the distribution of spending power internationally has not been made equitable, or at least politically acceptable (in the way that it can be within a single country in pursuit of a preferred blissful invisible hand outcome) acceptance of this policy by LDC's should be sought by relating the

burden of TCAD to per capita income levels. As these countries improve their standard of living - in part by exporting pollution clean-up services through contracting to discharge the TCAD's of energy wholesalers in developed countries - their level of TCAD will rise towards that of the developed countries, with the burden becoming shared more equally.

Chapter 8 returns to what we have called 'problem B', that is to say the problem presented by the hopes of some countries to achieve economic development by following the same development path as far as energy technology goes, as has been followed by the now developed countries. This means, in the main, compensating LDC's that happen to have large coal and lignite resources for leaving them in the ground. A scheme for doing this is referred to as FFAR - Fossil Fuel Abstention Rewards.

The basis of receipts under FFAR is coal resource weighted by relative under development, whilst the basis of payment is relative development and accumulated past emissions. Receipts are restricted to coal that would actually have been burned and the difference between (rising) coal costs and constant renewable costs, all appropriately discounted over future time.

Payments could partly take the form of debt relief and partly continuing payments. Examination of the data suggests that China, India, South Africa, the USSR, and some East European countries would be the main beneficiaries, with the position of Australia, Germany, and the USA, amongst developed economies, damaged by future non-use of existing commercial coal reserves. As far as debt relief is concerned, Germany, Japan and certain other European countries, together with leading oil exporters, have most to lose.

However, as substantial losers in the long term, the southern Arabian states can hardly be expected to participate, whilst the position of the USA as a heavily indebted country deserves special consideration. Despite the rather few countries that can easily offer debt relief, the benefit to the international financial system, labouring under a heavy burden of unsound third world debt, of a substantial round of debt relief can hardly be doubted.

As a once for all measure, linked to collaboration with other aspects of the GREENS concept, and with adequate monitoring of energy sector performance and enforcement of residual and future loan commitments, there may be sufficient mutual global advantage to get a general settlement. The proportion settled through debt relief must in any case be limited by retaining sufficient of the FFAR as continuing payment to secure, with some possibility of collateral pressures through potential trade sanctions, continuing compliance from countries which would always have their known coal reserves available in the ground.

This global reform would essentially relate environmental concerns and energy sector transformation to debt settlement and new trading relationships, possibly involving a review of the GATT. It is hoped that the possibility advanced in these pages - that the EGE aspect of these linked problems may be resolved at much lower cost than has hitherto been supposed, and in a manner that presents LDC's not with a constraint on their growth prospects but with an opportunity for growth based on the most modern energy technology - may help to make that more likely.

Clearly the achievement of a general, end of the century (millennial?), settlement of that nature is not going to occur overnight. In the meantime there is no need for the application of the GREENS concept to hang fire. Many countries may, like New Zealand, find it beneficial - or at worst least costly - to achieve modest net emissions targets in the year 2000 using renewable biomass technology within their own borders. Such modest targets may be on a trajectory to ambitious achievements a decade or so later. Or if global warming ceases to be a worry, the relatively small acreages of initial plantings can find a commercial outlet as conventional timber after being allowed to grow to maturity.

Alternatively, many LDC's may, like Brazil has done, adopt biomass as an escape from a balance of payments bind on their growth prospects. And some countries may opt for bi-lateral arrangements subject to reciprocal trading arrangements. These prospects depend on the claims made for these technologies in these pages being shown to be true from experience. All of this will constitute a learning by doing process which, the proof of the pudding being in the eating,

will either draw in more participants until there is effective political will for a global settlement or reveal that some other remedy for EGE must be used, if a remedy still seems to be needed.

Chapter 9 is concerned with the problems of implementing a comprehensive programme of transition to Global Redevelopment with Energy Environment Sustainability. Implementation requires initiation in the first instance, and that requires starting from where we are in the process of developing a global response to the problem of Enhanced Greenhouse Effect.

At the time of writing it is not possible to foresee the outcome of negotiations towards a Framework Convention on Climate Change which is expected to be signed at the Second United Nations Conference on Environment and Development at Rio de Janeiro in June 1992.

Whatever that outcome is, no negotiation will take place at Rio where the final draft FCCC will be available to be signed on a take it or leave it basis. However, that will not obviate future policy discretion since the FCCC will not be written on tablets of stone but subject to review at future Conferences of the Parties which sign it. For the sake of argument - which can easily be adapted to the actual outcome from Rio - it is assumed that the detailed regime for CO₂ emissions will be contained in a Protocol which will commit the signatories to targets for gross CO₂ emissions to be achieved by the Year 2000.

Such an outcome cannot result in effective control of the *level* of CO₂ but merely in a slowing down of its rate of increase. A significant slowing down - needed for effective control of the level of CO₂ pollution and such as can be got from a switch to more easily achieved and more effective *net* targets - will thus require amendment of such a Protocol. It is inconceivable that net targets can be adopted at Rio since the necessary technical work cannot have been done in time by negotiators preoccupied with the problems of defining gross targets to a standard appropriate for a legally enforceable treaty.

A possible escape from this procedural awkwardness may be for agreement to be reached in principle, either at Rio or at an early subsequent Conference of the Parties, for the adoption of alternative net targets, such net targets to be more effective than the gross target agreed on at

Rio. For instance a country which was committed to stabilizing its gross emissions at the 1990 level by 2000 might meet that commitment by alternatively reducing net emissions by 20 per cent by the same year. Being easier to achieve, such an alternative would provide signatories with an incentive to complete the necessary technical work in time for the achievement of the alternative net target to be verified, say in 2000.

The technical problem of measuring net emissions boils down to measuring absorption, given that the problem of measuring gross emissions must be resolved before the CO2 Protocol can be signed. However, a difficulty that arises with measuring gross emissions in the informal sector, in particular with fuelwood systems in traditional societies, is much simpler in the context of net emissions since such activity, involving the burning of biomass fuel, can be regarded as essentially self-cancelling as regards net emissions.

Thus the problem is to measure absorption in the formal (market) economy, a problem which can be split into defining what is to be included and measuring what has been defined. As regards definition, biomass growth to be included as absorbing should have been registered with an enforcement agency as planted for commercial biomass energy purposes on a medium or long term basis. Annual crops used partly or wholly as fuel count for absorption and emission simultaneously and equally and therefore require no separate absorption measurement. Fuelwood and conventional afforestation count for absorption whilst they grow, with eventual deduction to the extent that conventional timber is eventually not used for fuel purposes.

As regards actually measuring the absorption achieved by growing fuelwood and conventional forestry, a major research exercise is required in the 1990's to establish the statistical properties of alternative coppicing cycles (and, to a lesser extent, conventional forestry) with different species grown in different soils and in different climates. The objective would be to be able to rely on satellite observation as the main basis for global statistical coverage, with 'ground truthing' on a random basis as a check on the reliability of the satellite data and as a check against misreporting by firms as regards the discharge of their TCAD's.

The political sensitivity of such monitoring and investigation activity is met by several aspects of the proposals which have been developed in this book. Firstly, as outlined in the Chapter 4 scenario, initial progress with GREENS would be in developed temperate countries. Secondly, the move into less developed tropical countries would be by invitation, as they came to appreciate the economic advantage of emulating the advanced biomass energy technology path being adopted in developed countries. Thirdly, the relationship would not be a country to country relationship involving potential sovereign conflicts but country to firm relationships of a normal commercial type. Fourthly, countries would be assisted by the enforcement agency in achieving their net emission target by securing the effective discharge of the Absorption Duty laid on energy firms.

Thus the enforcement agency, in securing good behaviour by firms, would work to become perceived as benevolent agents of technology transfer and progress towards sustainable development, rather than heavily intrusive. Given the complex nature of its task and the far reaching implications of its successful accomplishment, such an agency might more appropriately be called the United Nations Agency for International Development Sustainability, rather than a more narrowly conceived United Nations Climate Change Agency.

Under its aegis, with the high cost commitment to gross targets as stick and the example of progressive countries like New Zealand as carrot, it may be expected that market incentives will drive individual countries, bilateral pairings, and regional groupings - as envisaged in Chapter 8 - towards the piecemeal, but eventually general adoption of net emissions targets which is needed if there is to be the prospect of controlling the Enhanced Greenhouse Effect.

Chapter 10 at present exists only as an assemblage of extracts from earlier papers. It emphasizes the contingent nature of the GREENS concept developed in this book and calls for the massive programme of research envisaged in Chapter 9 - essentially a global collective effort to learn how to sustainably cultivate the garden of nature in a sustainable manner - to be adequately supported as the first priority on the road from Rio.

It discusses the macro-economic multiplier effects of shifting the energy payments cash flow from royalty payments to oil rich countries to wage payments in third world countries and suggests that, when these are taken into account alongside the benefits of dismantling the Third World Debt problem, the burden of dealing with EGE may turn out not to be burden at all, but a boon (not to mention a boom).

It deals, in less detail than they deserve, with a whole spectrum of concerns regarding water, soil, ecosystemic and socio-anthropological sustainability. For instance, it is hardly desirable to substitute a sustainable energy system at the cost of unsustainable soil use practices.

The conclusions reached are embedded in an Envio which takes the form of a letter addressed to the US Administration, from where has emanated much of the resistance to reaching agreement on an effective FCCC. They are as follows:

1. It is the level of CO₂ that is of concern, or, quite possibly, for how long an above-normal level is maintained.
2. Therefore it is net emissions that matter, with increased CO₂ absorption just as effective as reduced gross emissions.
3. In a situation of extreme, and possibly permanent, uncertainty about the effect of above normal levels of CO₂, precautionary measures should be undertaken until shown to be unnecessary, even if they are expensive.
4. But they are not expensive, unless the weight of evidence regarding three well known technologies is wrong. These involve absorbing CO₂ by growing biomass, the quantities involved being so great that they can only be disposed of by being used as raw material for a renewable energy system, replacing fossil fuels.

5. A two to three decade timescale is required for these technologies to diffuse inexpensively into the mainstream of the global energy economy, by the end of which period more advanced renewable technologies will probably begin to penetrate the market.

6. It would be wrong to simply sit back and await the more advanced technologies since, firstly they may take longer than hoped for to develop, and secondly, if nature turns out to have nasty surprises in store, a stitch in time can save nine.

7. Within the timescale, growth in LDC's will result in a doubling of CO₂ emissions unless global collaboration is achieved. The biomass technologies give a competitive advantage to LDC's located in hot wet climates.

8. Economic theory has little useful to contribute beyond the 'least cost theorem' for achieving net emissions abatement targets efficiently: this is incorporated in the proposal for Tradeable Carbon Absorption Duties which combines the effectiveness of 'command and control' regulation with an efficient market oriented mechanism for achieving the required result.

9. LDC's collaboration requires compensation for not using their known coal reserves. A scheme for Fossil Fuel Abstention Rewards targets that objective

10. A combination of the two measures, TCAD and FFAR, can achieve a result of mutual advantage to an effective majority of nations. A side advantage could be a substantial reduction in the Third World Debt problem as part of a global deal securing LDC collaboration.

11. The forthcoming UNCED cannot be expected to reach agreement on these lines but we may hope for a Framework Convention which gives explicit recognition to the net emission concept, which provides machinery for international monitoring and technical assistance programmes related to GREENS style initiatives.

12. Specifically, a research commitment to a massive 'ground truthing' of GIS data to establish global knowledge of land capability and a training commitment to a major programme in non-OECD countries in the bio-technical and other skills required for the realisation of the globally coordinated programme which may, towards the end of this decade, be recognised to be necessary..

13. The most formidable obstacles to securing a safe future for our grandchildren appear to be political rather than technical or economic.

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9124103
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS C

FROM: THUEBEL, Joan M.

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 09/11/91

SUBJECT: RE: SHORT TERM VEIW OF THE THREAT OF GLOBAL WARMING.

DIRECTORATE STAFF
ASSIGNED: ENVIRONMENT ASSIGNED:

ACTION STAFF
REQUIRED: DIRECT REPLY ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 09/30/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

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PHONE: EXT:
REMARKS: No answer necessary (or requested)

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FILE: P-EOP-SUNUNU TRACKING
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4103

JOAN M. THUEBEL

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78 Orchard Road
Chatham, New Jersey 07928
(201) 635-0668

91 SEP 20 A 9:33

OFFICE OF THE
DIRECTOR

September 11, 1991

Bramley

Mr. John H. Sununu
Chief of Staff to President Bush
The White House
Washington, DC

Dear Mr. Sununu:

A short-term view of the global warming threat does not make sense because:

1. If there is a real threat, there will be no way to "turn the clock back" after we have warmed up the atmosphere with carbon dioxide emissions
2. If there is no threat, we can always go back to using fossil fuels without danger

I believe that many of our current problems, including our economic weaknesses, are due to government, individuals and business leaders taking short-term views.

What's wrong with planning for the long-term? Is it too intellectually demanding? or not politically expedient? I suggest that true leadership requires the guts to look to the future, and to have a vision of an improved world.

Sincerely,

Joan M. Thuebel

(→ put to send to Admin

"Document Control"

TYPE: ACTION

ORIGINATOR: 02

STATUS I

DOCUMENT NUMBER: 9124394

DIRECTORATE STATUS

FROM: ARONOWITZ, Jason

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 09/10/91

SUBJECT: INTERNATIONAL PROJECT DEVELOPING A SATELITE PROGRAM
TO HARNESS SOLAR POWER.

DIRECTORATE

ASSIGNED: ENVIRONMENT

STAFF

ASSIGNED:

ACTION

REQUIRED: DIRECT REPLY

STAFF

ACTION:

SENDER'S DUE DATE:

OSTP DUE DATE: 10/22/91

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

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4394

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43-25 Douglaston Pkwy. #1E
Douglaston, N.Y. 11363

Bromley

91 OCT 15 AM 11:31

Mr. John Sununu
White House Chief of Staff
The White House
1600 Pennsylvania Avenue
Washington, D.C.

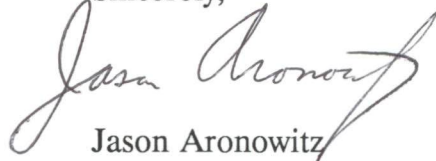
OFFICE OF THE
DIRECTOR

Dear Mr. Sununu:

Your position on economic health versus possible global warming makes sense, and, I hope, allows for synergistic solutions. There exists a window of opportunity for converting a portion of our energy production to a source that would produce no greenhouse gasses, provide a substantial boost to our economy, and gladden many defense contractors. We would also provide substantial long term aid to the Soviet Union while availing ourselves of some bargain priced capabilities.

I am attempting to point out that this is an opportune time to establish a joint venture with the USSR (and any other nations that can usefully contribute) to build solar power satellites. I am sure you are already familiar with the concept and its advantages. What has changed recently is the price to orbit that could be negotiated with the Soviet Union, which could be argued down enough to make a solar power satellite project a positive net present value investment that could be funded by bonds that the cash flows from the project would pay back. I think the combination of long term usefulness and opportunity for the Administration to demonstrate impressive vision makes this project an idea whose time has come.

Sincerely,


Jason Aronowitz

"CORRESPONDENCE TRACKING"

TYPE: ACTION DOCUMENT NUMBER: 9124051
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

FROM: BOLTON, C.W.: CYPRUS COAL COMPANY

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 08/27/91

SUBJECT: RE: THE THIRD MEETING OF THE PREPATORY COMMITTEE FOR
THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND
DEVLOPMENT.

DIRECTORATE STAFF
ASSIGNED: ENVIRONMENT ASSIGNED:

ACTION STAFF
REQUIRED: AS NECESSARY ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 09/30/91 STAFF DUE DATE
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DEPT RECEIVED:

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9124051
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS C

FROM: BOLTON, C.W.: CYPRUS COAL COMPANY

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 08/27/91

SUBJECT: RE: THE THIRD MEETING OF THE PREPATORY COMMITTEE FOR
THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND
DEVLOPMENT.

DIRECTORATE STAFF
ASSIGNED: ENVIRONMENT ASSIGNED:

ACTION STAFF
REQUIRED: AS NECESSARY ACTION:

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OSTP DUE DATE: 09/30/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT: 12/18/91

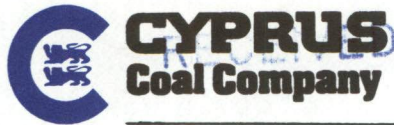
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91 SEP 17 All: 25

C. W. Bolton
Government Affairs Advisor

OFFICE OF THE
DIRECTOR

August 27, 1991

Bromley

THE WHITE HOUSE
Chief of Staff John Sununu
1600 Pennsylvania Avenue, N.W.
Washington, DC 20500

Dear Chief of Staff Sununu:

The third meeting of the Preparatory Committee (PrepCom) for the United Nations Conference on Environment and Development (UNCED), OR "Earth Summit," is being held in Geneva from August 12 - Sept. 4.

PrepCom 3 will begin substantive negotiations on the Earth Charter and an authoritative statement of principles on the world's forests.

One more PrepCom session will be held prior to the June 1992 summit in Rio de Janeiro. Separate negotiations are underway on biodiversity and climate change conventions to be signed in Rio.

Pressure continues to rise for the Administration to take a more-active leadership role in combatting climate change.

- o The European Community has challenged the United States to join the "CO₂ club" of other industrial countries that have made specific commitments to reducing their CO₂ emissions.

"It is our strongest wish that the United States change its position in order to play with the other OECD (Organization for Economic Cooperation and Development) countries a leading role in combatting climate change," said Hans Alders, chairman of the Environment Ministers and environment minister for the Netherlands. He addressed members of Congress and senior administration officials at a July 24 dinner hosted by the Ambassador of the Netherlands.

Alders noted, "The world looks to the United States for decisive leadership on the climate issue. In our perception, there are no technical or economic reasons for the United States not to join the other OECD countries." Currently, the United States and Turkey are the only OECD countries that have not made specific commitments on CO₂ emissions.

Alders emphasized that the EC countries view firm commitments by each industrial country to stabilize CO₂ emissions by the year 2000 at 1990 levels as a "crucial part of the package to be agreed upon" in the negotiations currently underway on an international climate change convention.

British Prime Minister John Major and Japan's Minister of Environment Kazuo Aichi also have leveled criticisms of the U.S. position on CO₂ targets in recent weeks.

- o Forty-two U.S. senators wrote to President George Bush on July 25 urging him to lead the U.S. delegation to the June 1992 Earth Summit in Rio de Janeiro.

Co-authored by Sens. John F. Kerry (D-Mass.) and Bob Kasten (R-Wis.), the letter pressed Bush to "take an active leadership role at the conference and take full advantage of the opportunities UNCED offers."

The letter noted that the U.S. park system and clean air, clean water and toxic waste laws are international models, but argued that domestic policy "can no longer be considered the cornerstone of global environmental policy."

- o A separate July 23 letter from 26 members of the House of Representatives, co-authored by Reps. John Edward Porter (R-Ill.) and Anthony Beilenson (D-Calif.), told the president, "Your participation would enhance the visibility to any action taken during, or as a result of, the conference.

The Porter-Beilenson letter stressed that UNCED "may well determine the course of all international environmental action into the 21st century."

- o The House Science, Space & Technology Committee has launched hearings on necessary research to slash greenhouse gas emissions, adding to building congressional pressure that the White House abandon its cautious approach to global warming. White House

witnesses at the July 17 hearing stressed that existing Administration policies are an effective tool for stabilizing greenhouse emissions at a minimal cost. But some members of the committee were sharply critical of the White House approach and argued that technologies are emerging to take a more aggressive stance against global warming.

The administrations restraint from flowing with the political tide concerning CO₂ should be commended in light of the scientific data available now. Quoting from Dr. Bert G. Drake and his colleagues at the Smithsonian Environmental Research Center are at the forefront of work aiming to determine the effects of rising CO₂ levels on plants.

Scientists increasingly agree that higher carbon dioxide levels on the atmosphere will raise the earth's temperature, but how much is not known.

One thing they are sure of, however, is that increasing carbon dioxide levels can dramatically affect plant production. Although they are far from understanding all the ramifications, this fact intrigues and excites scientists.

And well it should. What if world food provided by plants could double or triple? What if more prolific plants could contain or slow the increase in CO₂ levels? What if non productive areas of the world could support crops or forests because plants could use water more efficiently?

Carbon is a primary element of life. In the photosynthetic process plants convert solar energy and carbon dioxide from the atmosphere into food through the formation of carbohydrates, protein, amino acids, and fats.

Most Plants respond to higher CO₂ levels by producing more fruit, seeds, stems, leaves, roots, trunks, etc. Add to that an increase in temperature, and plants take in even more CO₂ and grow even better. So whatever way temperature levels go -increased or stay the same - most plants will benefit from increased CO₂ levels. Those in warmer climates, such as tropical forests, could benefit most.

Some of the significant findings of Dr. Drake and his colleagues include:

Plants respond to increased CO₂ by increasing photosynthetic capacity and decreasing respiration, rather the opposite.

And, decomposition of plants growing in elevated levels of CO₂ seems to slow down.

There are many scientific facts that are not clearly understood today. The necessity for continued and expanded research into these areas are necessary and should be funded shortly by Congress.

Let us hope that this situation doesn't culminate in a purely political decision whereby International agreements are reached requiring now legislation to be passed leading to expenditures in the billions.

If laws are passed and regulations are implemented to reduce CO₂ emissions, we could, in fact, be hindering the potential increase in plant and food production which is so sorely needed throughout the world.



C. W. BOLTON

CWB/je

"CORRESPONDENCE TRACKING"

TYPE: ACTION DOCUMENT NUMBER: 9123885
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

FROM: WARNICK, Walter L.

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 08/22/91

SUBJECT: REQUEST TO ACCEPT HIS BRIEF PROPOSAL FOR BRINGING
SCIENCE TO BEAR ON ENVIRONMENTAL ISSUES.

DIRECTORATE STAFF
ASSIGNED: ENVIRONMENT ASSIGNED:

ACTION STAFF
REQUIRED: DIRECT REPLY ACTION:

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TYPE: ACTION DOCUMENT NUMBER: 9123885
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS C

FROM: WARNICK, Walter L.

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 08/22/91

SUBJECT: REQUEST TO ACCEPT HIS BRIEF PROPOSAL FOR BRINGING
SCIENCE TO BEAR ON ENVIRONMENTAL ISSUES.

DIRECTORATE STAFF
ASSIGNED: ENVIRONMENT ASSIGNED:

ACTION STAFF
REQUIRED: DIRECT REPLY ACTION:

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OSTP DUE DATE: 09/18/91 STAFF DUE DATE
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REMARKS: NO RESPONSE NECESSARY PHONE: EXT:

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Laytonsville, Maryland 20882
office phone: 301-353-3122
home phone: 301-774-8085
August 22, 1991

91 SEP 4 A9:37

Bromley
Dr. John Sununu

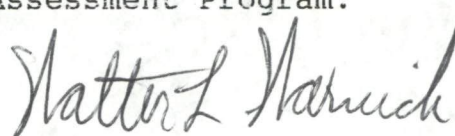
OFFICE OF THE
DIRECTOR

In Tuesday's "Washington Post," EPA Administrator Reilly acknowledges that "the environmental debate has long suffered from too little science." By citing this problem, his article implicitly invites proposals for solutions. Here is a brief proposal for bringing science to bear on environmental issues.

1. Citing the problems and principles highlighted in Reilly's article, someone with standing (you or a member of the Cabinet, the Chairman of CEA, the Chairman of CEQ, the Director of OMB, or the Science Advisor) should propose that an interagency group be formed to review the ways that science has been brought to bear on environmental issues in the past. The group would review a number of particular cases: the Montreal Protocol on CFC's; the National Acid Precipitation Assessment Program; the U.S. Global Climate Change Research Program under CEES; decisions made regarding dioxin and alar; and others.
2. The group would evaluate the strengths and weaknesses of the various approaches by which science has been brought to bear on environmental issues. Criteria for the evaluation would be the extent that the approaches answered Reilly's key questions: "How much do we know? What are the critical questions to which we need answers? Are we organizing to get key information (for the future)? What do the data tell us about the seriousness of the problem and the magnitude of the appropriate response?"
3. Drawing from the evaluation, a group of Agency principals would propose interagency organizational arrangements to encourage bringing science to bear on environmental issues.

The ultimate outcome of all this should be interagency scientific fora for critically examining the causal chain linking human activities to environmental effects, taking into account natural variation and alternative hypotheses. It may be anticipated that future decisions on environmental laws and regulations would be better founded in science.

Will you adopt this proposal? I am also presenting it to principals in my Agency, but am available to work for you if that would advance the implemetation of this proposal. I am a career Federal technical manager at the level of the Senior Executive Service with over 10 years experience representing my Agency on the National Acid Precipitation Assessment Program.

A handwritten signature in cursive script, reading "Walter L. Warnick". The signature is written in dark ink and is positioned above the printed name.

Walter L. Warnick, Ph.D.

... as was intended in the original plan, and possibly causing interference in our foreign policy, it was taking an enormous difference in our defense plans, and it was making an enormous difference in a lot of regional conflicts in the world. We even were on the threshold of perhaps being able to work with the Soviets on things that we could have never dreamed of in the

publicly for the people to revolt. I think that the two things that really probably precipitated this, at least as I view it, are the threat to the central control that the treaty that was going to be entered into tomorrow, represented. That threatened the central government in the views of the hard-liners, I

changes in the United States vis-a-vis the superpower relationship and possibly events surrounding NATO...

Nunn: Catherine, I think we'll have to wait and see what happens here. I certainly would agree with what President Bush said this morning. We may see a real reaction from the people in

abroad? Certainly there's been a call for the EC to hold off on aid. The United States has proposed doing the same. What about Senate action in regard to the most favored nation trade status for the Soviet Union?

Nunn: As far as economic, I think we ought to put everything on hold, as

the men see. He is the only person in the people of the Soviet Republic. It makes him an enormously powerful person in terms of people power.

William K. Reilly

Facing Facts on the Environment

A recent poll by the Roper Organization on "Environmental Protection in the 1990s" shows that environmentalism tops safe sex, patriotism and "The Simpsons" for what's "in" in 1991. That's heady company, and I hope the environment continues to keep it. It is good news for those of us in the business of protecting it.

But evidence suggests the environment's high standing reflects growing concern over risks large and small, and a feeling that there is no risk so small—and none so expensive—that government should not work to eliminate it.

Until recently we have made little effort to assess our overall environmental quality objectives, to target our laws and scarce resources to reduce the greatest risks to human health and natural systems. Now I think we've got to. There simply are more anxieties than we can possibly create laws to alleviate, and far more risks than resources to eliminate them. Determining which risks need a full-scale response by government and which do not is a value-laden task. If there is a source of trustworthy information that can lend authority and coherence in helping characterize and even rank risk, it is good science.

In my opinion, the environmental debate has long suffered from too little science. There has been plenty of emotion and politics, but scientific data have not always been featured prominently in environmental efforts, and have sometimes been ignored even when available. As major new environmental problems arise, I propose we approach them as scientifically as possible, asking, "How much do we know? What are the critical

questions to which we need answers? Are we organizing to get key information? What do the data tell us about the seriousness of the problem and the magnitude of the appropriate response?

Suppose we apply this to the Kuwait oil fires. I traveled to Kuwait at the request of the president to assess the environmental threats from the fires and to observe firsthand both the containment and cleanup efforts and the environmental monitoring work of an interagency team of U.S. scientists and technical experts. Two concerns are uppermost: impacts on global climate and short- and long-term health effects.

Both a U.S. interagency team and another team of federally funded scientists operating under the auspices of the National Science Foundation—as well as British scientists from the Royal Meteorological Society—believe global climatic effects from the fires are unlikely. The plumes generally rise to between 10,000 and 12,000 feet, with the highest readings to date taken at around 20,000 feet. This suggests they will not reach heights of 38,000 to 40,000 feet, at which altitude we might see the plumes distributed around the globe by the stream.

So, regarding the risk to the global environment, there is emerging scientific consensus that the volcanic eruptions at Mount Pinatubo in the Philippines—which do reach the upper altitudes—pose a greater threat worldwide to the atmosphere.

And what of risks to public health? Our air monitoring data and those of the Kuwaitis thus far show significant levels of toxic gas-

es—sulfur dioxide or hydrogen sulfide, for instance—that would have meant acute effects for those living in the region. Particulates are heavy—but our initial analyses did not reveal heavy metals, hydrocarbons or volatile organics that would mean problems. We are still studying the samples, and we are mounting a more extensive monitoring effort, so we may yet find something troubling.

We have urged Kuwait to link air monitoring and weather reports, and issue daily air quality advisories. And the World Meteorological Organization is overseeing a long-term monitoring plan at the request of the Saudi Arabian and Kuwaiti governments. These efforts should provide real-time air alerts and establish with some certainty what's happening. Coupled with the work of the World Health Organization, the air monitoring also should begin to give us a picture of any potential for long-term, chronic health effects on the people living in the Persian Gulf countries. Our Department of Defense is monitoring the health of U.S. troops—those who served and those still there.

I caution—as I've made clear all along—that our findings are preliminary and may change as results of ongoing scientific assessments come in, as Kuwait's full monitoring system comes on line, or as the wind and weather patterns shift. It runs counter to experience to see pollution on the scale encountered in Kuwait without also seeing impacts on health, particularly affecting asthmatics and others with lung disorders. Nevertheless, thus far, hospital admissions for respiratory disorders are no greater this

year than in prior years. Much of the most polluted area is uninhabited desert or water.

To date, the risk to public health in no way compares to the deadly London fog of 1952, in which almost 4,000 people died, or to the dense fog of 1948 in Donora, Pa., in which 10,000 people were overcome and 20 died. These were acute episodes in heavily populated areas—with clear but immediate evidence of health effects.

Despite the recent U.S. findings, some refuse to believe the data. The Bush administration is committed to environmental policies that are grounded in science. In the matter of the Kuwaiti oil fires—as I hope in all other environmental matters before us—we are prepared to subject our work to the review of outside experts, to be inclusive in the fact-finding process as possible, and to be open always to revising our opinions and strategies in the light of new information. I invite anyone with hard information from Kuwait that contradicts our preliminary findings to get it to us as quickly as possible.

We will continue to monitor the environment of Kuwait, to analyze pollution samples and to calculate risks and advise on any protective policies needed. But we also need to recall that to equate every incident, every problem, with a major risk undermines our ability to focus on the most significant risks. Nothing is 100 percent safe. Neither are all risks equal. That is as true in the United States as it is true in Kuwait.

The writer is administrator of the Environmental Protection Agency.

Washington Post
August 20, 1991

"CORRESPONDENCE TRACKING"

TYPE: PRESIDENTIAL PRIORITY DOCUMENT NUMBER: 9123394
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

FROM: THE HONORABLE DON RITTER: HOUSE OF REPRESENTATIVES

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 08/09/91

SUBJECT: WRITES REGARDING GLOBAL WARMING AND THE NAS STUDY

DIRECTORATE STAFF
ASSIGNED: ASSIGNED:

ACTION STAFF
REQUIRED: INFO COPY ONLY ACTION:
NO ACTION NECESSARY

SENDER'S DUE DATE:

OSTP DUE DATE: STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: Carl Bretscher
ENVIRONMENT
D. Allan Bromley

WHITE HOUSE TRACKING #: CONTACT PERSON: SALLY KELLEY
PHONE: EXT:
REMARKS:

OSTP RECEIVED: 08/09/91 FILE: P-PRES PRIORITY*SUNUNU TRACKIN
DEPT RECEIVED:

RECEIVED

91 AUG 9 10:09 WHITE HOUSE OFFICE

REFERRAL

OFFICE OF THE
DIRECTOR

AUGUST 9, 1991

TO: OFFICE OF SCIENCE AND TECHNOLOGY POLICY
ATTN: ALLAN BROMLEY

ACTION REQUESTED:

INFORMATION COPY - NO ACTION NECESSARY

DESCRIPTION OF INCOMING:

ID: 257970

MEDIA: LETTER, DATED JULY 23, 1991

TO: JOHN SUNUNU

FROM: THE HONORABLE DON RITTER
U.S. HOUSE OF REPRESENTATIVES

WASHINGTON DC 20515

SUBJECT: WRITES REGARDING GLOBAL WARMING AND THE NAS
STUDY

PROMPT ACTION IS ESSENTIAL -- IF REQUIRED ACTION HAS NOT BEEN
TAKEN WITHIN 9 WORKING DAYS OF RECEIPT, PLEASE TELEPHONE THE
UNDERSIGNED AT 456-7486.

RETURN CORRESPONDENCE, WORKSHEET AND COPY OF RESPONSE
(OR DRAFT) TO:

AGENCY LIAISON, ROOM 91, THE WHITE HOUSE, 20500

SALLY KELLEY
DIRECTOR OF AGENCY LIAISON
PRESIDENTIAL CORRESPONDENCE

THE WHITE HOUSE
CORRESPONDENCE TRACKING WORKSHEET

INCOMING

DATE RECEIVED: JULY 29, 1991

NAME OF CORRESPONDENT: THE HONORABLE DON RITTER

SUBJECT: WRITES REGARDING GLOBAL WARMING AND THE NAS
STUDY

		ACTION		DISPOSITION	
ROUTE TO: OFFICE/AGENCY	(STAFF NAME)	ACT CODE	DATE YY/MM/DD	TYPE RESP	C COMPLETED D YY/MM/DD
JOHN SUNUNU		ORG	91/07/29	JS	A91/08/05TC
OSTP Allan Bromley	REFERRAL NOTE: _____	I	910809	C	T / 1 TC
	REFERRAL NOTE: _____		/ /		/ /
	REFERRAL NOTE: _____		/ /		/ /
	REFERRAL NOTE: _____		/ /		/ /
	REFERRAL NOTE: _____		/ /		/ /

COMMENTS: _____

ADDITIONAL CORRESPONDENTS: MEDIA: L INDIVIDUAL CODES: 1240 _____

CS MAIL USER CODES: (A) _____ (B) _____ (C) _____

*ACTION CODES:	*DISPOSITION	*OUTGOING	*
*	*	*CORRESPONDENCE:	*
*A-APPROPRIATE ACTION	*A-ANSWERED	*TYPE RESP=INITIALS	*
*C-COMMENT/RECOM	*B-NON-SPEC-REFERRAL	*OF SIGNER	*
*D-DRAFT RESPONSE	*C-COMPLETED	*CODE = A	*
*F-FURNISH FACT SHEET	*S-SUSPENDED	*COMPLETED = DATE OF	*
I-INFO COPY/NO ACT NEC		*OUTGOING	*
*R-DIRECT REPLY W/COPY *			*
*S-FOR-SIGNATURE *			*
*X-INTERIM REPLY *			*

REFER QUESTIONS AND ROUTING UPDATES TO CENTRAL REFERENCE
(ROOM 75, OEOb) EXT-2590
KEEP THIS WORKSHEET ATTACHED TO THE ORIGINAL INCOMING
LETTER AT ALL TIMES AND SEND COMPLETED RECORD TO RECORDS
MANAGEMENT.

THE WHITE HOUSE

WASHINGTON

August 5, 1991

Dear Don,

Keep fighting the good fight! Your help really makes a difference.

Sincerely,

A handwritten signature in dark ink, appearing to read "John".

John H. Sununu
Chief of Staff

The Honorable Don Ritter
U.S. House of Representatives
Washington, D.C. 20515



CONGRESS OF THE UNITED STATES
HOUSE OF REPRESENTATIVES
WASHINGTON, D. C. 20515

DON RITTER
FIFTEENTH DISTRICT
PENNSYLVANIA

257970

July 23, 1991

Dear John,

THE CHIEF OF STAFF
HAS SEEN

Yours truly couldn't
attend the S, S, & T Comm
hng. on Global Warming
but am unearthing
some pretty good stuff
on the NAS report
(Gore - Wirth!).

We'll also ask for
a Full Comm. hng. on the
Science / Just the Science. 
encl.

[This is a typed version of the attached memo; comments or additions in brackets]

MEMORANDUM

TO: J.E. (Joel Eisen - Minority Counsel to Environment Subcommittee)
FROM: Don Ritter, Ranking Republican Member, Subcommittee on Environment (House Science, Space, and Technology Committee)
RE: Global Warming: NAS Report; Observations following the July 21, 1991 Woods Hole Conference [weekend retreat for SS&T Members with NAS scientists]

(1) The "Report" appropriation was requested by guess who? GORE & WIRTH.

Action: I believe it was in Senate HUD-Independent Agencies Appropriations Bill - please locate exactly and locate exact language of "what was to be done." (Key flaw as I see it was major focus on the "What if's" rather than the science itself; still very debatable. The "what if's" really dominated the activities, the volume, etc.)

(2) Dinner conversation [at Woods Hole] indicated to me that "favorably disposed" (to global warming) outnumbered skeptics [on the panel] big time.

Action: Please investigate where the scientists stood on global warming prior to the study ("where you stand depends on where you sit"). Joel: Dr. Press [of NAS] was quite uncomfortable with my line of questioning.

(3) Whatever happens in (1) and (2), I believe it is essential to the national debate that our Republican Minority on the Science Committee (all signed on) call for a comprehensive full Committee hearing on the pros and cons of the science!!

(4) The NAS caters to an enormous scientific constituency [of] nice social scientists who see this as the Big Buck Bonanza for research - economic impacts, psychological, sociological, political impacts, etc. There seems to be [a] real predisposition toward this as [a] funding fount.



JOEL B. EISEN
REPUBLICAN COUNSEL
SUBCOMMITTEE ON ENVIRONMENT

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE,
SPACE AND TECHNOLOGY

HOUSE ANNEX II, RM. 388
WASHINGTON, D.C. 20515
(202) 226-6993

LEADING THE WAY TO TOTAL QUALITY:
MAKING THE LEAP FROM RHETORIC TO REALITY



QPMA

Quality & Productivity Management Association

AQP

Association for Quality
and Participation

7/23/91

To: J.E. (Joel Eish - Minority Counsel)
to Envir. Subc.
From: Don Ritter, Ranking Rep. b. (Envir. Subc. SSIT)
Re: Global Warming: NAS Report: Observations

1. The "Report" ^{appropriation} was requested by guess
who? ~~FOER + WIRTH~~ ~~CONF.~~

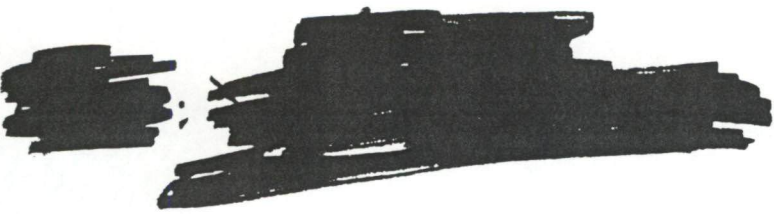
Action I believe it was in Senate
Hud Indep. Agencies Appropri. Bill - - Pls.
locate exactly and locate exact
language of "what was to be done"

Key flaw as I see it was major focus on
the "what ifs" rather than the science itself
still very debatable. The what ifs really
dominated the activities, the volume, etc.

2. Dinner Conversation indicated to me that
"favorably disposed" (+ Global Warming)
outnumbered Skeptics big time.

Action: Pls. investigate where the
Scientists stood on ~~the~~ G.W. prior to
study (where you stand depends on where you sit)
... quite uncomfortable with (or)

my line of questioning.

- ③ Whatever happens in ① and ②, I believe it is essential to the nat'l. debate that our Republican Minority on the Sci. Comm. (all signed on) call for a comprehensive full Comm. hearing on the pros and cons of the science!!
- ④ The NAS caters to an enormous Science Constit. incl. Social Scientists who see this as the Big Buck Bonanza for research -- econ. impacts, psychological, sociological, political ~~impacts~~ impacts, etc. There ~~is~~ seem to be a real predisposition towards this as funding fount.
- 

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9123580
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS C

FROM: DAVIS, Jeff

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 07/29/91

SUBJECT: REQUEST FOR A RESPONSE REGARDING HIS THEORY ABOUT
GLOBAL WARMING

DIRECTORATE STAFF
ASSIGNED: ENVIRONMENT ASSIGNED: Nancy Maynard

ACTION STAFF
REQUIRED: DIRECT REPLY ACTION: As Necessary

SENDER'S DUE DATE:
OSTP DUE DATE: 09/05/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT: 10/22/91

COPIES TO:

WHITE HOUSE TRACKING #: CONTACT PERSON:
PHONE: EXT:
REMARKS: No Response Necessary

OSTP RECEIVED: 08/23/91 DEPT RECEIVED:
FILE: P-EOP-SUNUNU TRACKING
CENTRAL FILES:





Bromley

John,

RECEIVED

91 AUG 23 AM 16

OFFICE OF THE
DIRECTOR

I have a theory about global warming which may shock some because it is so simple while annoying others because it makes them look foolish. If you read this letter and think my theory could be true I hope you have some tests run to prove it before we have this massive and expensive experiment inflicted on our planet.

To explain my theory I must tell you a little about how an air conditioner works. Many people think that air conditioners cool the air and technically that is correct but if you really want to know what takes place go outside by your condensing unit and feel the air blowing from it. It is very warm, isn't it? This heat is not being created but rather being removed from your house and "pumped" into the atmosphere. I know of one company that even calls their units heat pumps. They are called that because that is basically what it does. Therefore if so many homes are being "pumped" cool the outside must be receiving it. If the heat is being "pumped" into the environment, it has to get warmer. I don't think anyone can dispute that.

There are three areas in which statistics may give some validity to my theory:

- (1) Heat should congregate in the largest cities for that is where most of the air conditioners are.
- (2) The average summer temperature should have the largest increase over the other three seasons.
- (3) The increase in global warming might correlate with increased air conditioner use as air conditioners are used now in the third world countries.

My reason for writing this is not to stop global warming because I don't believe it is a big threat but rather I am trying to stop us from causing a catastrophe (environmental or economic) with a cure worse than the alleged disease itself.

I don't want the Democratic Congress to do to the environment what it has done to the urban poor, the judicial system, or the schools? Their will always be poor, everythings relative, maybe a lot more since we declared war on it, but some none the less. We can use preventive methods against robbers, rapist, and murders. We can send our kids to private schools but we only have one planet. You can't throw money at the environment and then think things will work out. This scares me and should scare you also.



JEFF DAVIS
1706 W. 47th St.
NORTH LITTLE ROCK
ARKANSAS 72118
POINT OF LIGHT #730

P.S. I spent days condensing this letter so John Sununu would need only a few minutes to read it. I deserve this letter being delivered to him.

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9122971
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS C

FROM: NELSON, Barbara A.

TO: John Sununu

DATE OF
CORRESPONDENCE: 07/19/91

SUBJECT: RE: THE EFFECTS OF GLOBAL WARMING.

DIRECTORATE STAFF
ASSIGNED: ENVIRONMENT ASSIGNED: Nancy Maynard

ACTION STAFF
REQUIRED: DIRECT REPLY ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 08/13/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT: 12/16/91

COPIES TO:

WHITE HOUSE TRACKING #: CONTACT PERSON:
PHONE: EXT:
REMARKS: NO RESPONSE NECESSARY

CLOSE

OSTP RECEIVED: 07/30/91 DEPT RECEIVED:
FILE: P-EOP-SUNUNU TRACKING
CENTRAL FILES:

"CORRESPONDENCE TRACKING"

TYPE: ACTION DOCUMENT NUMBER: 9122971
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

FROM: NELSON, Barbara A.

TO: John Sununu

DATE OF
CORRESPONDENCE: 07/19/91

SUBJECT: RE: THE EFFECTS OF GLOBAL WARMING.

DIRECTORATE STAFF
ASSIGNED: ENVIRONMENT ASSIGNED:

ACTION STAFF
REQUIRED: DIRECT REPLY ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 08/13/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO:

WHITE HOUSE TRACKING #: CONTACT PERSON:
REMARKS: PHONE: EXT:

OSTP RECEIVED: 07/30/91
DEPT RECEIVED:

FILE: P-EOP-SUNUNU TRACKING

271
July 19, 1991

Dr. Bromley
Mr. John Sununu
White House Chief of Staff
1600 Pennsylvania Ave.
Washington, DC 20500-0001

RECEIVED
91 JUL 30 A 9:13

OFFICE OF THE
DIRECTOR

Mr. Sununu,

The effects of global warming have been ignored by our government leaders. President Bush has not followed through on promises made during his campaign to protect the environment. One of these campaign promises was to decrease greenhouse gases, which cause global warming. President Bush must pass regulation that will decrease emissions caused by burning coal and oil. The Bush administration is doing nothing to promote actions that will help protect our environment because they don't want to accept the responsibility of spending money to do so.

According to many studies carbon dioxide is responsible for more than one-half of gases that cause global warming. Deforestation and the combustion of fossil fuels are the major sources of carbon dioxide. The United States contributes a major percentage of this greenhouse gas to the atmosphere. We have failed in protecting the environment by not regulating the burning of coal and oil. Not acting on the global warming issue now will be more detrimental to our environment and our economy as time goes on.

The greenhouse gases in the troposphere, carbon dioxide, chlorofluorocarbons, methane and nitrous oxide build up and radiate heat back to earth. There have been many projections of a 2° to 9° F temperature increase by the middle of the next century. If we choose to do nothing to prevent this possibility now, we may have no choice in the future but to face the consequences. If the global warming trend continues there will be major crop losses and loss of coastal areas because of a rise in ocean levels. There will be major climate changes world-wide, which will affect food production, especially in the U.S.

There are relative easy things that can be done now to reduce emissions from greenhouse gases. Power plants can be regulated to be more energy efficient and anit-pollution devices added to them. We can reduce the burning of coal or use clean coal technology. We can use cleaner fuels more, such as natural gas and develop solar and geothermal energy sources. By raising the automobile mileage standards we could greatly increase our fuel efficiency.

July 19, 1991
Page 2

Canada and many European nations have moved ahead of us to prevent global warming. We can no longer allow politics to decide our environmental decisions because that seems to be indecision. Industry and power companies have too much influence on governmental policies regarding the environment. Energy producing companies want to keep producing and developing coal and oil. Nuclear power to create electricity is not an efficient way to produce energy. Our government energy plan is insufficient in protecting the environment especially from the causes of global warming.

The impact we would have by regulating greenhouse gases now, will ultimately be decreased the longer we wait. If we keep putting off our responsibility, mankind and the environment will be the losers.

Sincerely,

A handwritten signature in cursive script that reads "Barbara Nelson". The signature is fluid and elegant, with the first name "Barbara" being more prominent than the last name "Nelson".

Barbara A. Nelson
1327 Lyonsville Lane
San Jose, California 95118

→ admiral 5/14/92

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9120673
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS C

FROM: SASSONE, Robert L.

TO: JOHN SUNUNU



DATE OF
CORRESPONDENCE: 02/20/91

SUBJECT: REQUEST FOR INFORMATION ON CO2 ATMOSPHERIC
CONCENTRATION, DISSOLUTION IN WATER, LACK OF
ANALYSIS OF EFFECT, AND ALLEGED GLOBAL WARMING.

DIRECTORATE STAFF
ASSIGNED: ENVIRONMENT ASSIGNED: ENVIRONMENT

ACTION STAFF
REQUIRED: DIRECT REPLY ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 03/20/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO:

WHITE HOUSE TRACKING #: CONTACT PERSON:
PHONE: EXT:
REMARKS: No Response Necessary *per NY*

OSTP RECEIVED: 03/08/91 DEPT RECEIVED:
FILE: SUNUNU TRACKING*ENVIRONMENT
cop
CENTRAL FILES:



"CORRESPONDENCE TRACKING"

TYPE: ACTION

DOCUMENT NUMBER: 9120673

FROM: SASSONE, Robert L.

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 02/20/91

SUBJECT: REQUEST FOR INFORMATION ON CO2 ATMOSPHERIC
CONCENTRATION, DISSOLUTION IN WATER, LACK OF
ANALYSIS OF EFFECT, AND ALLEGED GLOBAL WARMING.

*Sent to
R. Venton @
NASA for
draft response
3/26/91*

ASSIGNED TO: Nancy Maynard

ACTION REQUIRED: DIRECT REPLY

SENDER'S DUE DATE: OSTP DUE DATE: 03/20/91

DATE COMPLETED: -----

COPIES TO:

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 03/08/91

FILE: ENVIRONMENT-GLOBAL WARMING

"CORRESPONDENCE TRACKING"

TYPE: ACTION

DOCUMENT NUMBER: 9120673

FROM: SASSONE, Robert L.

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 02/20/91

SUBJECT: REQUEST FOR INFORMATION ON CO2 ATMOSPHERIC
CONCENTRATION, DISSOLUTION IN WATER, LACK OF
ANALYSIS OF EFFECT, AND ALLEGED GLOBAL WARMING.

*Sent to
R. Watson @
NASA for
draft response
3/26/91*

ASSIGNED TO: Nancy Maynard

ACTION REQUIRED: DIRECT REPLY

SENDER'S DUE DATE:

OSTP DUE DATE:

03/20/91

DATE COMPLETED:

COPIES TO:

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 03/08/91

FILE: ENVIRONMENT-GLOBAL WARMING

17
ROBERT L. SASSONE

ATTORNEY AT LAW

9120673
RECEIVED

900 North Broadway - Suite 725
Santa Ana, California 92701
(714) 547-5611

91 MAR 8 A 8:34

February 20, 1991

OFFICE OF THE
DIRECTOR

A. Bromley

Hon John Sununu
White House
Washington DC

re: CO2 atmospheric concentration, dissolution in water, lack of
analysis of effect of, and alleged global warming

Dear Governor Sununu:

I am a patent attorney with a physics/ecology specialty.

A client wants me to do some research on atmospheric CO2
concentration. I was sent to Washington to the Library of Congress
and I feel I exhausted their information which did not take long.
Enclosed are copies of OTA reports.

CO2 dissolves in water fairly well to form H2CO3. The most important
factor in reducing atmospheric CO2 levels may be the fact that rain
probably washes out of the atmosphere at least 10% of the CO2 each
month. The ocean both removes and expires atmospheric CO2, depending
on water temperature which affects CO2 solubility. The ocean should
expire more CO2 than it removes or the vast amounts removed by rain
would soon sweep most CO2 from the atmosphere.

This should mean that atmosphere CO2 concentrations will increase
slower than other data indicates, since much, perhaps most CO2
released into the atmosphere will soon be stored in the ocean, and
released CO2 has a much bigger sink to fill, the atmosphere plus the
ocean, not just the atmosphere.

Can you refer this to someone who can discuss this ocean CO2 balance
or refer me to appropriate articles if they exist?

Thank you for your assistance.

Sincerely yours,

Robert L. Sassone

Robert L. Sassone

RS/lrs
encl OTA 2/91-CO2
cc OTA

Admin copy

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9120669
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS C

FROM: ASHLEY, Carlye M.

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 02/19/91

SUBJECT: THE LACK OF GREENHOUSE EFFECT OF CO.

DIRECTORATE STAFF
ASSIGNED: ENVIRONMENT ASSIGNED: ENVIRONMENT

Nancy Maynard

ACTION STAFF
REQUIRED: DIRECT REPLY/ ACTION:
IF APPROPRIATE

SENDER'S DUE DATE:
OSTP DUE DATE: 03/20/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

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CARLYLE M. ASHLEY
CONSULTING ENGINEER
7320 BARBERRY LANE
MANLIUS, NEW YORK 13104
February 19, 1991

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DIRECTOR

Dr. John H. Sununu
Chief of Staff
White House
Washington, D. C. 20500

Subject: Lack of Greenhouse Effect of CO₂

Dear Dr. Sununu;

I have been CHief Engineer at Carrier Corporation and Presidential Member of ASHRAE. When they first started talking about the added "Greenhouse Effect" of more CO₂ in the air I dismissed it as being just some crank. Now I discover they seem to be serious about it. The memorandum which I am enclosing tries to present the case against it. I believe that the effect will be almost negligible but in some ways even an improvement.

I am strongly in favor of conservation and I believe that we need to keep other greenhouse gases out of the atmosphere because these could have a serious effect, but the restriction on CO₂ could be very costly and also unnecessary. The effct on the weather is not nearly as great as some of the other things which we do such as cutting down our forests.

I will be glad to send added copies to others whom you might suggest. You may also be interested to know that ASHRAE is planning on studies of the Greenhouse Effect of the possible future refrigerants which take the place of the present R-11 and R12.

Yours very truly

Carlyle M. Ashley

CARL V. W. L. L. L.
CONSULTING ENGINEER
YOUNG & BECKETT
MINNEAPOLIS, MINN. 55402
February 19, 1951

Dr. John E. Hunsaker
Chief of Staff
White House
Washington, D. C. 20500

Subject: Lack of Greenhouse Effect of CO₂

Dear Dr. Hunsaker:

I have been Greatly interested in your paper on the
Greenhouse Effect of CO₂ in the atmosphere. I am
glad to hear that you have started thinking about the
possibility of a discovery that would be of great
importance to the world. I am glad to hear that you
are working on this problem. I believe that the effect
will be almost negligible but in some ways even an
improvement. I am extremely in favor of conservation and I believe that we
need to keep our atmosphere as clean as possible. I
think that we have a serious effect, but the restoration of CO₂
could be very costly and also unnecessary. The effect on the weather
is not nearly as great as some of the other things which we do
such as cutting down our forests. I will be glad to send you copies to others whom you might
suggest. You may also be interested to know that NASA is planning
on studies of the Greenhouse Effect of the possible future
effects which take the place of the present H-1 and H-2.

Yours very truly

Carl V. W. L. L.

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WILL MORE CARBON DIOXIDE IN THE ATMOSPHERE WARM OR COOL THE EARTH?

by Carlyle M. Ashley, Consulting Engineer

Water vapor is the principal "Greenhouse Gas" which reradiates heat energy back to the earth from the atmosphere. Carbon dioxide has only a minor role and doubling its concentration in the atmosphere has a very slight effect. Both gases absorb incoming solar radiation so that more carbon dioxide could cool the earth instead of heating it. This memorandum gives the engineering data to support these statements. Turn first to the Figure page.

Figure 1 shows the absorption bands of carbon dioxide plotted vs wave length of the heat radiation. Note that the absorption bands are high compared to the length of travel so that they should have 100% absorption in travelling through a small part of the atmosphere. But they are widely spaced so that most of the radiation will pass through the transparent part of the spectrum.

Figure 2 shows the absorption bands of water vapor plotted vs wave length of the radiation. Note that there are multiple overlapping absorption bands, particularly in the long wave lengths of the earth radiation at ordinary temperatures.

Figure 3 shows the solar radiation and also the earth radiation spectrums plotted vs wave lengths. The visible radiation lies between 0.4 and 0.8 microns. The solar radiation shows a plot outside of the atmosphere and at ground level (for direct radiation).

In the ultraviolet section the atmospheric absorption is largely by ozone in the upper atmosphere. In the visible section, particulates reflect and absorb the radiation and the air molecules diffuse it. In the infra-red section, water vapor and carbon dioxide absorb the radiation as shown by the absorption bands as shown in Figure 3 which may be compared with the bands in Figures 1 and 2. Most of this absorption occurs in the upper atmosphere and does not directly affect the radiation in the lower atmosphere.

Note also that the earth radiation spectrum peaks at 10 microns for 95°F and slightly higher wave lengths for lower temperatures. Carbon dioxide has no absorption bands close to the peak.

Figure 4 shows the emissivity (absorptivity) of carbon dioxide vs the partial pressure P_p and the length of travel s with separate curves for temperature. Ordinary temperatures can use the 500 800 C curve. Note that these curves are very flat, particularly at the upper end where a doubling of the abscissa will increase e by only about 10%. The maximum value of e is only 20% which checks with the information on Figures 1 and 3.

Figure 5 shows the emissivity (absorptivity) of water vapor. Even with a dew point temperature of -25°F the point is off to the right of the chart and the value e is very high compared to the values on the carbon dioxide chart. For higher water vapor dew points the value of e close to the earth is still very high.

Table 1 shows typical summer-winter temperatures and pressures vs the altitude of the atmosphere. If no energy was transferred (adiabatic), the temperature would drop 9.1C for every kilometer increase in elevation. Thus, the deviation from this relationship provides insight as to the addition of energy at different elevations which is large at the bottom and top and minimum in the middle. The stabilization at the top is probably due in part to the addition of solar energy and in part to the decrease in density.

Since water vapor and carbon dioxide are both absorptive (emissive), the values must be combined to be able to solve problems. Since there is an overlap of their spectrums as shown in Figure 1 and 2 this must be compensated. If we assume that the carbon dioxide is 100% absorptivity within its range as measured by its emissivity, then the emissivity of water vapor energy in this range should be eliminated but there is a band of carbon dioxide near the upper end of the earth's spectrum which should be included.

Thus, a conservative equation would seem to be:

$$e_{c,w} = e_w + e_c(1 - 0.8e_w) \text{ and } \alpha_{c,w} = \alpha_w + \alpha_c(1 - 0.8\alpha_w)$$

To be realistic, there must be an energy balance between the amount of energy into and out of the earth. Thus there is the equation:

$$E(\text{earth radiation}) = E(\text{solar absorption}) + E(\text{gas radiation})/2 + (\text{gas convection}).$$

The reason for the gas radiation being divided by 2 is because only half of the radiation is toward the earth.

Example 1 is to set up a model of the pre-existing situation under mean conditions. Assume:

Clear sky over ground on March 21

Solar energy outside the atmosphere 438 btu/hr.ft²

Solar energy striking the ground 337 " "

Solar energy absorbed by the ground 261 " "

Mean solar energy per ft² of ground 65.25 btu/hr.ft² ground.

Infrared 53% absorbed in atmosphere 53.5 btu/hr.ft²

Ground temperature 51F. Emissivity 92.5%

Air temperature, ground 51F, 1/32nd atmosphere 45F, 1/16th atmosphere 38.5F, 1/8th atmosphere 30.5F.

Water vapor partial pressure $P_{pw} = 0.00343$ atmospheres, 20F D.P.

Carbon Dioxide partial pressure $P_{pc} = 0.0003$ atmosphere

Beam length for the atmosphere: 2x elevation.

The calculations were based on the Radiant -Heat Transmission Chapter by Hoyt C. Hottel in the book: Heat Transmission by McAdams. The data were designed primarily for enclosed vessels but it has been possible to adapt them to the atmospheric problem. The Hottel data are slightly different from that shown on Figures 4 and 5.

Atmospheric Elevation, $P/P_{\text{atmos.}}$	1/16	1/8	1/4
Atmospheric temperature	45F	38.5F	30.5F
Abscissa, $2P_w L$ water vapor	11.4	22.8	45.6
Water vapor Emissivity, adjusted e_w	.59	.645	.69
Abscissa, $2P_c L$ carbon dioxide	1.0	2.0	4.0
Carbon Dioxide Emissivity, adjusted e_c	.155	.174	.191
Combined Emissivity $e_{w,c}$	.672	.732	.776
Equivalent $\text{btu} = \sigma (T_a/100)^4 e_{w,c} / 2 *$	37.45	40.63	42.81
mean solar energy absorbed by ground	51F		65.25
Total			108.06
Ground Emissions = $\sigma (511/100)^4 \cdot 0.925$			108.00
<u>Double the concentraion of carbon dioxide in the atmosphere</u>			
Abscissa, $2P_c L$	2.0	4.0	8.0
Carbon Dioxide Emissivity, adjusted e_c	.174	.191	.206
Combined Emissivity, $e_{w,c}$	.682	.737	.782
Equivalent $\text{btu} = \sigma (T_a/100)^4 e_{w,c} / 2 *$	38.01	40.92	43.15
Added btu radiation due to doubling			.34
Equivalent temperature rise of ground			0.37°F

Assumed extra solar radiation absorption by extra $\text{CO}_2 = 1.6 \text{ btu}$
Mean value $1.6/4 \text{ btu/hr} \cdot \text{ft}^2$ ground = 0.4 btu vs 0.4 btu

* the btus for the higher elevations are the for the difference in $e_{w,c}$ added to the lower values.

The absorption of radiation for the doubling case was not given because it is essentially the same as the emission and thus the gas temperature is not changed.

For higher water vapor content the possibility of any increase in ground temperature is still further decreased while for lower contents it is increased. However, this should not be objectionable because it should result in a longer growing season and a higher growth rate for more carbon dioxide.

The example chosen is somewhat idealized because it fails to take into account the convection which the solar radiation stimulates and because it does not make allowance for the evaporation of water which might occur over most of the earth surface. Both of these would reduce any possible temperature increase.

The reason that the added carbon dioxide has so little effect on the total "Greenhouse Effect" is that there was already enough carbon dioxide in the atmosphere to make a significant contribution and the added amount increases this effect very slightly. Of course, compared to water vapor, carbon dioxide makes a very small contribution.

However, one of the serious dangers is that some of the pollutants which humans have added to the atmosphere will contribute new absorption bands which could have a very significant addition to the "Greenhouse Effect"

There are a number of human activities which can contribute either to the "Greenhouse Effect" or to other environmental changes. The nearly four to one increase in human population during this century and the increasing use of fossil fuels have both exacerbated the damage. The stripping of the earth of its trees and other vegetation is important because these normally absorb the solar energy. The increasing vaporization of water in lakes, irrigation, cooling towers tends to absorb solar energy. The release into the atmosphere of very fine particulates absorbs and reflects solar energy before it reaches the earth and the natural release has in the past been associated with "ice ages".

Clouds are an important part of our weather pattern. Not only do they as well as snow have a high reflectivity for solar radiation but they also have a very high emissivity for the long wave-length radiation at ordinary atmospheric temperatures. Low overcast traps the earth's energy and re-radiates it back to the earth. Higher altitude clouds which are at a lower temperature still help to mediate the effect of the solar radiation in between them.

The example which is given above for a single set of conditions can be expanded to other conditions so as to cover other environmental and atmospheric conditions so that it should be possible to compute what to expect from both increased carbon dioxide as well as other pollutants of the atmosphere. It also should be combined with the effects of convection, evaporation and condensation of water. The effect of cloud cover should be added to the equation.

The amount of re-radiation can be measured using a btu meter and a repeated measurement of the atmospheric column temperature should be made to determine whether there have been any changes with time. The message of population as well as environmental control must be made effective. But please let us get our facts straight so that we can control the things which need control and not proclaim a false apocalypse.

We scientists and engineers have a responsibility to get the technical facts straight and to put proper priorities on the things which need to be done urgently and avoid putting needless controls on others which don't need them.

The example chosen was intended to be the mean value of the various variables as far as it is possible to get a mean. It must be realized that the temperature and radiation levels change for any one location from minute to minute and hour to hour and day to day. Also they are different for different locations on the earth. In addition there is a substantial heat storage in the ground and some heat storage in the air. In addition there is heat storage due to evaporation and condensation of water and plant growth.

Also, in the air the emissivity is normally somewhat greater than the absorptivity but this may be compensated in energy flow by a higher ground than air temperature. In any case, the difference between the emissivity and the absorptivity is virtually constant when the carbon dioxide is doubled so that that should not be a factor in comparing the two conditions.

Another important variable is the convective heat transfer. At 15 MPHr the convective heat transfer is about 5 btu/hr.ft².degF and at about 7.5 MPHr about 3 btu. However, when the ground is cooler than the still air the convective transfer is a small part of 1 btu and when it is warmer it is about .7 btu. This compares with radiative heat transfer varying between about 0.7 and 1.0 btu/hr.ft².degF for cooler and warmer temperatures. The convective heat transfer between the ground and the air is primarily a local situation. But on hot sunny days there can be dust devils which extend several thousand feet into the air. Furthermore, the convective weather pattern which creates winds which have a vertical as well as a horizontal component.

The earth reflectivity for solar energy is different for the whole earth and for reflection directly from the earth. Also, the emissivity of the earth for long wave lengths may be a slight variable. But neither of these should affect the conclusion about the lack of further "greenhouse effect" of carbon dioxide.

It should be recognized that the combination of the water vapor and carbon dioxide provide more than 75% of the available re-radiation at a given ground temperature and a still higher amount when taking into account cloud cover. But at the same time they also remove about half of the infra-red solar radiation. In evaluating the effect of other greenhouse gases it is important to evaluate both the re-radiation and the absorption of solar radiation to get the net effect.

It is important to expand this model with respect to both time and place so as to show clearly what the effects of the greenhouse gases are. Then, when evaluating new gases their effect can be superimposed on the available model.

It should be possible to measure the reradiation at any one point and time. This can be done using the "Btu meter" modified to make it a radiation measuring device. Along with this it is desirable to measure the atmospheric temperature gradient, and of course the amount of solar radiation.

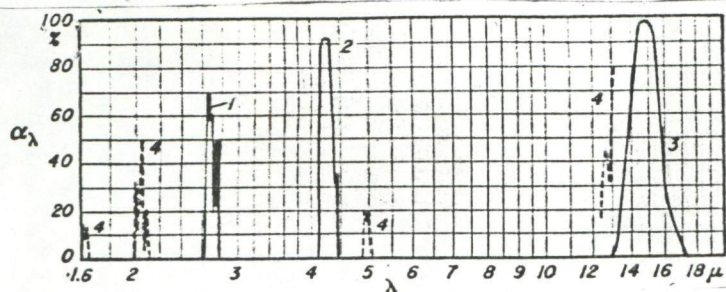


Figure 1. Absorption Bands of Carbon Dioxide. (1) 5-cm, (2) 3-cm, (3) 6.3-cm, (4) 100cm layers.

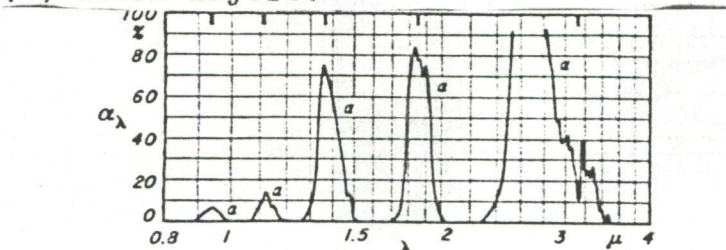


Figure 2. Absorption Bands of water vapor. (a) 127 C & 109cm, (b) 127C & 104cm, (c) 127C & 32.4cm, (d) 81C & 32.4 cm at 4 cm atm. (e) R'm Temp. & 220cm at 7c.

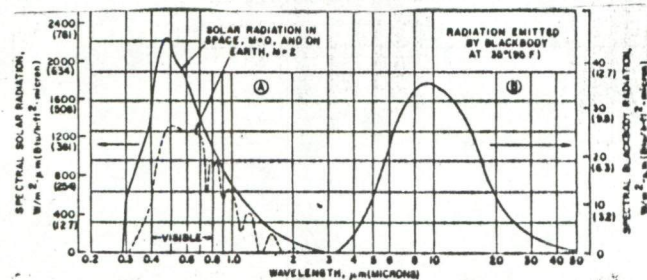


Figure 3. Spectral Transmittances and Solar Radiation

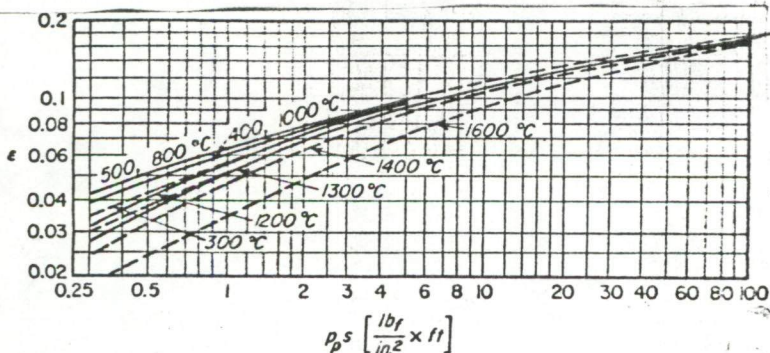


Figure 4. Emissivity of carbon dioxide in mixture with nitrogen or air. s is the thickness of the gas layer; p_p is the partial pressure of CO₂.

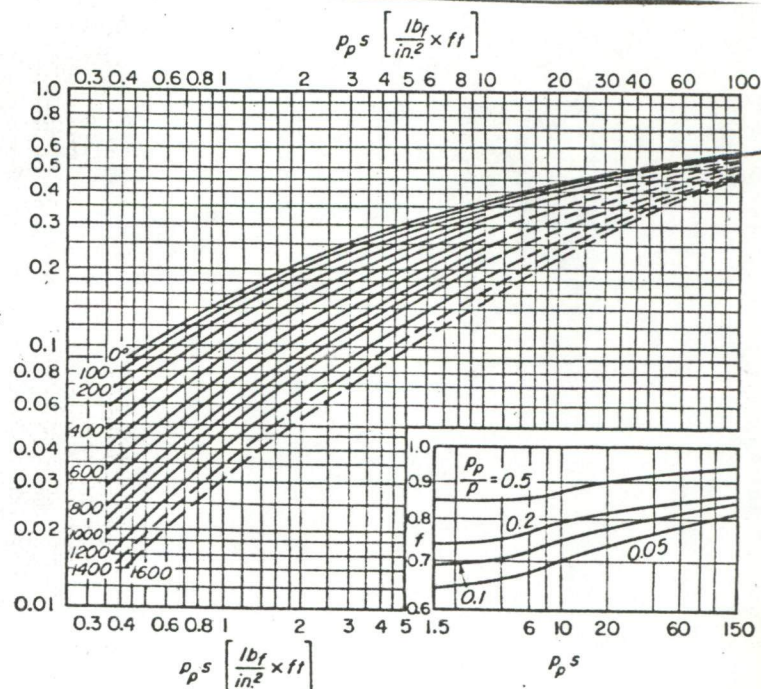


Figure 5. Emissivity of water vapor with Nitrogen or Air. s is the thickness of the gas layer, p_p is the partial pressure of water vapor, total pressure p = 1 atm. When the partial pressure p_p is different from 1., the emissivities read in the big figure have to be multiplied by f read from the small diagram. Dashed lines indicate extrapolated values.

Table 1

Variation of Temperature, Pressure and Density of the Atmosphere with Altitude

Compiled by Humphreys

Elevation		Summer			Winter		
Km	Mi.	Temp. °C	Pressure mm of Hg.	Density, dry air g/cm ³	Temp. °C	Pressure mm of Hg.	Density, dry air g/cm ³
20.0	12.4	-51.0	44.1	0.000092	-57.0	39.5	0.000085
19.0	11.8	-51.0	51.5	.000108	-57.0	46.3	.000100
18.0	11.2	-51.0	60.0	.000126	-57.0	54.2	.000117
17.0	10.6	-51.0	70.0	.000146	-57.0	63.5	.000137
16.0	9.9	-51.0	81.7	.000171	-57.0	74.0	.000160
15.0	9.3	-51.0	95.3	.000199	-57.0	87.1	.000187
14.0	8.7	-51.0	111.1	.000232	-57.0	102.1	.000220
13.0	8.1	-51.0	129.6	.000270	-57.0	119.5	.000257
12.0	7.5	-51.0	151.2	.000316	-57.0	140.0	.000301
11.0	6.8	-49.5	176.2	.000366	-57.0	164.0	.000353
10.0	6.2	-45.5	205.1	.000419	-54.5	192.0	.000408
9.0	5.6	-37.8	237.8	.000470	-49.5	224.1	.000466
8.0	5.0	-29.7	274.3	.000524	-43.0	260.6	.000526
7.0	4.3	-22.1	314.9	.000583	-35.4	301.6	.000590
6.0	3.7	-15.1	360.2	.000649	-28.1	347.5	.000659
5.0	3.1	-8.9	410.6	.000722	-21.2	398.7	.000735
4.0	2.5	-3.0	466.6	.000803	-15.0	455.9	.000821
3.0	1.9	+2.4	528.9	.000892	-9.3	519.7	.000915
2.5	1.6	+5.0	562.5	.000942	-6.7	554.3	.000967
2.0	1.2	+7.5	598.0	.000990	-4.7	590.8	.01023
1.5	0.9	+10.0	635.4	.001043	-3.0	629.6	.01083
1.0	0.6	+12.0	674.8	.001100	-1.3	670.6	.01146
0.5	0.3	+14.5	716.3	.001157	0.0	714.0	.01215
0.0	0.0	+15.7	760.0	.001223	+0.7	760.0	.01290

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FROM: CAFFEY, H. Rouse: LOUISIANA STATE UNIVERSITY AGRICULTURAL
CENTER

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 01/17/91

SUBJECT: NOMINATION OF CHARLES HESS FOR THE POSITION OF
SECRETARY OF AGRICULTURE.

DIRECTORATE STAFF
ASSIGNED: ASSIGNED:

ACTION STAFF
REQUIRED: ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley

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AGRICULTURAL CENTER**

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OFFICE OF THE CHANCELLOR

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504 388-4161
FAX (504) 388-4143

January 17, 1991

OFFICE OF
DIRECT

The Honorable John H. Sununu
Chief of Staff
The White House
Washington, DC

Dear Governor Sununu:

I would like to place in nomination for the position of Secretary of Agriculture the name of Dr. Charles E. Hess, Assistant Secretary, Science and Education, U. S. Department of Agriculture. I realize that there will be many prominent names submitted for your consideration, but many of us in the Land-Grant system believe that a thorough working knowledge of higher education is an important factor for this position of U.S. agricultural leadership.

Dr. Charles E. Hess brings to his present office an outstanding record of service at Rutgers University and the University of California-Davis. He is a member of the National Academy of Science and, yet, he is involved in agricultural research and extension so that he also knows the practical and applied side of U.S. agriculture. As Assistant Secretary for Science and Education, he administers one of the very important programs within the U.S. Department of Agriculture. I would like to recommend Dr. Charles E. Hess as the appropriate replacement for Secretary Yeutter.

Sincerely,

H. Rouse Caffey
Chancellor

HRC/gb

xc: Dr. Allen Bromley, Science Advisor to the President of the United States
Senator J. Bennett Johnston
Senator John Breaux
Dr. Robert L. Clodius, NASULGC
Dr. Pat Jordan, CSRS