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Energy and the Environment: Confronting Common Threats to Security

Lakshman Guruswamy
University of Colorado Law School

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*Lakshman Guruswamy**

I. Introduction

The United States recently confronted and apparently overcame a menacing threat to national and international security. The danger encompassed both a threat to world peace and order from armed aggression and military aggrandizement, as well as a threat to vital sources of energy.

National security has traditionally been equated with the ability of the United States to thwart armed aggression. However, the security umbrella is being enlarged. The Gulf War demonstrated that national security also embraces a threat to our critical sources of energy. The National Energy Strategy of the United States recognizes that economic prosperity and geopolitical power are dependent upon energy.[1] Accordingly, the concept of national security has been enlarged to embrace "energy security": the ability of this country to withstand disruptions to its sources of energy.[2] "Energy security" has begun to permeate the discourse and argot of national security.[3]

The successful completion of the Middle East war seems, at least for the moment, to have interdicted the threats to military and energy security. Unfortunately, other less apparent but more insidious and pervasive perils that constitute threats to our environmental security are often ignored. The most ominous of the many threats to our environmental security advancing upon us is the danger of global warming and climatic change. This Article recognizes that global warming presents the greatest threat to environmental security. It contends that the challenge to both energy and environmental security can be traced to a common cause: our dependence on fossil

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[1] DEPARTMENT OF ENERGY, NATIONAL ENERGY STRATEGY: FIRST EDITION 1991/1992 (1991)[hereinafter NATIONAL ENERGY STRATEGY].

[2] *Id.* at 3.

[3] *Id.* at 3-6.

fuels. The need for energy security, in the light of our dependence on imported oil,[4] brought us to war in the Middle East, while our unquestioning faith in coal and oil threatens our environmental security and has brought us to the brink of climatic change.

The intersection of the energy and environmental crises presents a common challenge. This Article argues that since fossil fuels are the root cause of the twin threats to national security, it is necessary to forge common legal and policy responses capable of meeting this challenge. We have an opportunity to redesign our energy and environmental policies in order to reduce dependence on carbon-emitting fossil fuels. But rather than accentuate the threat to our energy security from fossil fuel reliance, the success of the Gulf War has, in fact, obscured the reality of that threat.

Climatic change cannot be perceived as clearly as military operations in the Gulf. The buildup of trace gases leading to global warming does not photograph or televise like the dramatic build up of multinational forces in Saudi Arabia, the surgical precision of smart bombs, or the destruction of the Iraqi army. To many in the United States, the climatic threat moving inexorably towards us is only a distant, dim, and indeterminate possibility, compared to what we have seen and heard of the reality of war. The euphoria of victory blurs our perception of the real implications of the Gulf War, and the danger of global warming.

Furthermore, the Gulf War has camouflaged the true cost of oil. While attention has been riveted on the military face of the Gulf crisis, its flip side has generally been ignored. The Gulf imbroglio, correctly examined, exposes the extent to which the threat to energy security arises from our dependence on imported oil. It also reveals the actual cost of our reliance on fossil fuels. It is difficult to see how a major part of the enormous military expenses and loss of life suffered in the Gulf War can be excluded from any approximation of the cost of oil. Moreover, it is becoming strikingly evident that a continued and reliable flow of oil can only be assured by a permanent United States or allied presence in the region.[5] This will, of course, entail further expenditure.

Currently, the United States enjoys incomparable international stature. This country commands prestige and authority unparalleled since the conclusion of the World War II. From his position as leader of the world's greatest superpower, President Bush has been contemplating the creation of a "new world order." This Article ar-

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[4] Our growing dependence on imported oil intensifies the national security risk of relying on fossil fuels. Oil imports now constitute roughly 50% of U.S. consumption, up 73% in the past five years. Arizona Daily Star, Feb. 17, 1991, at 12, col. 2. The Department of Energy projects that oil imports may reach 67% of U.S. consumption by the year 2010. ENERGY INFORMATION ADMINISTRATION, ANNUAL ENERGY OUTLOOK 1990 20 (1990).

[5] Aho & Stokes, *The Year the World Economy Turned*, 70 FOREIGN AFF. 160, 162 (1990).

gues that the time is right for the United States to take the vanguard in fashioning this "new world order." The Article contends, however, that any new world order must not only include military and energy security, but must unequivocally and decisively embrace environmental security as well. The World Climate Convention (presently being negotiated)[6] and other bills presented to Congress propose a 20% reduction of global warming by the year 2000.[7] Such a reduction will advance environmental security.

Unfortunately, the U.S. record in combatting the environmental threat to security from global warming is replete with blemishes. For over three years the international community of states has been negotiating a World Climate Treaty that is scheduled to be signed at the Earth Summit in 1992.[8] Most industrialized nations believe that remedial action should be directed at the causes of global warming. They envision a stabilization of carbon dioxide emissions, and subsequent reductions up to 20% or 30%, in order to avert the otherwise inexorable march to tragedy.

During the negotiating process, the United States has wavered over the need for action against global warming. Equivocal at best, President Bush opposed urgent or decisive action to halt global warming for two major reasons. First, he argued that placing emission limitations on carbon dioxide would interfere with economic growth and the free market.[9] Second, he contended that greater scientific certainty was required before such drastic action could be taken.[10] Consequently, the United States has opposed proposals for emission limitations.[11] Not surprisingly, many European countries maintained that the United States was turning a blind eye to the dangers of global warming.[12] During the 1990 economic summit conference, European officials accused the United States of frustrating

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[6] *See infra* notes 81-84 and accompanying text.

[7] *See infra* note 92 and accompanying text.

[8] Preparations for the United Nations Conference on Environment and Development, or "Earth Summit," are underway and various regional meetings are scheduled to take place in 1991. *The UN Conference in Brazil Will Be the First "Earth Summit"*, UNEP NORTH AMERICA NEWS 2 (Dec. 1990).

[9] Shabecoff, *Bush Asks Cautious Response To Threat of Global Warming*, N.Y. Times, Feb. 6, 1990, at A1, col. 5. President Bush's Chief of Staff John Sununu capitalized on the American people's distaste for bureaucracy in rejecting the EPA's more rigorous stance on global warming last year. He claimed to counterbalance "a little tendency by some of the faceless bureaucrats on the environmental side to try and create a policy in this country that cuts off our use of coal, oil and natural gas." Sununu further stated: "I don't think that's what this country wants . . . I don't think America wants not to be able to use their automobiles." Engelberg, *Sununu Says He Revised Speech on Warming*, N.Y. Times, Feb. 5, 1990, at A15, col. 1.

[10] Shabecoff, *European Officials Dispute Bush Over Global Warming*, N.Y. Times, April 18, 1990, at B4, col. 5.

[11] *Document Implies U.S. Summit Position Will Oppose Greenhouse Gases Timetable*, 13 INT'L ENV'T REP. (BNA) No. 6, at 229-30 (June 13, 1990).

[12] Shabecoff, *European Officials Dispute Bush Over Global Warming*, N.Y. Times, April 18, 1990, at B4, col. 5.

their efforts to reach a new accord in combatting global warming.[13] The accuracy of that assessment was demonstrated by U.S. attempts to block reductions in carbon dioxide emissions.[14]

There is a three part explanation for the United States' reluctance to act, indicating that U.S. and international action on global warming is unlikely. First, global warming and climatic change fall outside the security sector. Second, when dealing with nonsecurity issues, scientific uncertainty obstructs policy decisions that entail high economic or political costs. Third, global warming is enmeshed in varying degrees of uncertainty. Therefore, to expect national or international action to arrest global warming is "wildly unrealistic."[15]

The premises relied upon for this explanation are deeply flawed, and the reasoning is circular. First, the assertion that environmental and energy security fall outside the realm of national and international security is demonstrably wrong. Second, the explanation assumes that scientific certainties or verities are immutable realities that formed the basis of previous environmental decision-making. The facts of the matter are to the contrary. Third, it presumes that political action follows scientific certainty. Such a presumption is incorrect. Finally, it supposes that the cost of cutting down carbon dioxide emissions will be prohibitively high. This supposition is also mistaken.

This Article argues that policy objectives directed toward non-carbon-emitting fuels, fuel efficiencies, and conservation are solutions not only for the environmental crisis, but for the energy crisis as well. These alternatives advance both environmental and energy security. By adopting such policies at a national level, the United States could mold a new world order.

To understand satisfactorily the solutions advocated in this Article, it is necessary to review the phenomena and the effects of global warming, and to sketch the international character of the responses

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[13] *Split Between U.S. Europe on CO_2 Spilling into IPCC Work, Chairman Says*, 13 INT'L ENV'T REP. (BNA) No. 7, at 283-84 (July 11, 1990).

[14] *U.S. View Prevails at Climate Parley*, N.Y. Times, Nov. 8, 1990, at A9, col. 1 (U.S. defeated efforts to reduce carbon dioxide emissions by setting specific limits).

[15] Skolnikoff, *The Policy Gridlock on Global Warming*, 79 FOREIGN POL'Y 77, 78 (1990). Skolnikoff suggests that "[t]he central problem is that outside the security sector, policy processes confronting issues with substantial uncertainty do not normally yield policy that has high economic or political costs". *Id.* Skolnikoff concluded that

> [u]nless overwhelmed by strong and enduring public consensus or by political leadership not yet in evidence, the political processes within and among nations are not likely to bring forth substantial policy action until the uncertainties surrounding climate change are greatly reduced, and probably not until evidence of warming is palpable. This conclusion holds, even though the Earth's climate may sustain irreversible changes if some of the forecasts are correct.

Id. at 88.

demanded by this challenge. The Article will discuss the expanding security umbrella, the nature of decision-making under uncertainty, and will also evaluate the true costs of emission controls. This Article concludes that the United States should take decisive affirmative action to restrict emissions of carbon dioxide.

II. The Phenomenon

The earth's temperature rests on a delicate heat balance.[16] Solar radiation passes to the earth through the mass of gases found in the atmosphere, and is reflected back through the same gases. A complex system of ocean and air currents, evaporation and precipitation, surface and cloud reflection, and absorption form the involved feedback system that keeps the global energy balance nearly constant. While our climate is the result of a gigantic and complicated system that humans cannot control or direct, the fragility of the heat balance makes it possible for human activities affecting "greenhouse" gases to damage critical leverage points in the climatic system.

Greenhouse gases are trace gases,[17] such as carbon dioxide (CO_2), methane (CH_4), nitrous oxides (NO_4), chlorofluorocarbons (CFC), and tropospheric ozone (O_3), that allow solar radiation into the earth's atmosphere but prevent heat radiated by the earth from being reflected back. Carbon dioxide is the most abundant of the trace gases, composing 0.03% of the atmosphere. There is overwhelming consensus that intervention in the form of increased atmospheric concentration of greenhouse gases might affect the fragility of the heat balance, and lead to global warming.[18]

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[16] Solar radiation (sunlight) which is absorbed by and warms the earth must be balanced by radiation in the form of heat that is re-emitted to space. Natural conditions in the earth's atmosphere ensure that the global mean temperature will not fluctuate greatly over time. A disruption in the radiation balance could, however, cause relatively large fluctuations in the global mean temperature over time. A reduction in the available energy from the sun by 2% can, "in theory, lower the [global] mean temperature by 2°C and produce an ice age." *Report of the Study of Critical Environmental Problems (SCEP)*, MAN'S IMPACT ON THE GLOBAL ENVIRONMENT 10 (1970).

[17] The atmosphere is made up of 78.08% nitrogen, 20.95% oxygen, and 0.93% argon. The remaining 0.04% of the atmosphere consists of a mixture of less abundant gases which include carbon dioxide, methane, nitrous oxides, chloroflourocarbons, and ozone. These less abundant gases are commonly referred to as "trace gases". W.T. SPROULL, AIR POLLUTION AND ITS CONTROL 15 (1970).

Moreover, because of the great attention that carbon dioxide has received as a greenhouse gas, the remaining "trace gases" are also referred to as "other greenhouse gases" in literature that is primarily focussed on carbon dioxide. *See, e.g.*, Bolle, Seiler & Bolin, *Other Greenhouse Gases and Aerosols*, in THE GREENHOUSE EFFECT, CLIMATE CHANGE, AND ECOSYSTEMS 157 (B. Bolin, D. Doos, J. Jager, R. Warrick eds. 1986).

[18] W.T. SPROULL, *supra* note 17, at 15. The importance of preserving global ecological and climatic balances was recognized in July of 1989 at the meeting of the Group of Seven major industrialized democracies in Paris, France. *Key Sections of the Paris Communique by the Group of Seven*, N.Y. Times, July 17, 1989, at A7, col. 1 ("There is a growing awareness throughout the world of the necessity to better preserve the global ecological bal-

Two international groups of scientists under the auspices of the United Nations[19] have been studying the problem of global warming and have come to identical conclusions. They conclude that the planet faces a real danger of irreversible harm from increased carbon dioxide emissions. These conclusions are supported by a formidable body of scientific studies implicating greenhouse gases in global warming.[20]

The effects of global temperature increases vary with the extent and rapidity of the increases. Historically, climatic changes have been staggered over many centuries, enabling plants and animals to adapt. For example, although temperatures warmed about five degrees centigrade over thousands of years during the Ice Age 18,000 years ago, this increase was slow enough to allow for adaptation.[21] To study the current effects of global warming, experts have developed "scenarios" to illustrate the possible effects of certain mean global increases in temperature. In some areas of the world, an increase of one degree centigrade[22] would have helpful effects. For example, a modest warming in the far northern latitudes could carry some advantages for countries such as Canada, China, and the Soviet Union: resources in their arctic regions would become more accessible and more easily exploitable. On the other hand, an increase of one degree centigrade could be accompanied by nontrivial consequences in other regions, especially with regard to climate-sensitive,

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ance. This includes serious threats to the atmosphere, which could lead to future climatic changes.").

[19] The first is the Intergovernmental Panel on Climate Change (IPCC) formed in 1988 to advise governments attending the world climate conference. The second, which was formed in 1986, has no government affiliation but is an association of independent scientists called the Advisory Group on Greenhouse Gases. According to the New York Times the latter body was the progenitor of IPCC. *See* Stevens, *Earlier Harm Seen in Global Warming*, N.Y. Times, Oct. 17, 1990, at A9, col. 1.

[20] A review of the scientific evidence is found in THE GREENHOUSE EFFECT, CLIMATE CHANGE, AND ECOSYSTEMS (B. Bolin, D. Doos, J. Jager, R. Warrick eds. 1986) [hereinafter THE GREENHOUSE EFFECT]; M. BARTH & J. TITUS, GREENHOUSE EFFECT AND SEA LEVEL RISE (1984); E. EL-HINNAWI & M. HASHMI, THE STATE OF THE ENVIRONMENT, A UNEP REPORT (1987); ROYAL COMMISSION ON ENVIRONMENTAL POLLUTION, TENTH REPORT: TACKLING POLLUTION-EXPERIENCE AND PROSPECTS (1984) [hereinafter ROYAL COMMISSION REPORT]; INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS (ICSU), UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP), WORLD METEOROLOGICAL ORGANIZATION (WMO), WORLD CLIMATE PROGRAMME: REPORT OF THE INTERNATIONAL CONFERENCE ON THE ASSESSMENT OF THE ROLE OF CARBON DIOXIDE AND OF OTHER GREENHOUSE GASES IN CLIMATE VARIATIONS AND ASSOCIATED IMPACTS (1986) [hereinafter WORLD CLIMATE PROGRAMME].

[21] U.S. ENVIRONMENTAL PROTECTION AGENCY, THE POTENTIAL EFFECTS OF GLOBAL CLIMATE CHANGE ON THE UNITED STATES (DRAFT REPORT TO CONGRESS), EXECUTIVE SUMMARY 8 (1988) [hereinafter U.S. CLIMATIC CHANGE].

[22] When experts discuss the global effects of a warming of the atmosphere in terms of a 1°C rise or a 2-4.5°C rise in temperature it is important to keep in mind that these are *mean* global increases; "[t]emperature increases significantly higher than [the projected mean increase], with attendant changes in precipitation patterns, will occur in latitudes north and south of the equator." Cooper, *The CO_2 Challenge*, in SCIENCE FOR PUBLIC POLICY 207 (1987).

localized sectors of national economies.[23] For example, a one degree centigrade temperature increase could shift the corn belt area of the United States over 100 kilometers northward.[24] Increases of between two to four degrees centigrade could present much greater problems.

Modeling studies have suggested that increased carbon dioxide concentrations could slow the atmospheric heat engine that is driven by the differences between equatorial and polar climates.[25] This could change the hydrological cycle and affect rainfall patterns. Tropics and eastern coasts of continents could become wetter, while subtropics would become drier and increase in area toward higher latitudes.[26] Although higher carbon dioxide concentrations per se may increase plant growth[27] and wateruse efficiency,[28] increased temperatures are detrimental to agriculture on the whole.[29] Crop impact analyses show that warmer average temperatures of one to four degrees centigrade are detrimental to both wheat and maize yields in the Great Plains and in Western Europe. Average yields may be reduced by three to seventeen percent.[30]

Warmer average temperatures could also lead to sea level rises of between 20 and 140 centimeters.[31] A rise of near 140 centimeters

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[23] Some regional areas of the world would be particularly sensitive to increases in temperature. For example, an area that is economically based on agricultural crops that are sensitive to small climatic changes would suffer more than areas that may not be hurt or even benefited by small rises in temperature. *See id.* at 207-08.

[24] *Id.* at 207. This illustrates the possibility that seemingly insignificant average temperature changes could have very real consequences in terms of an increase in the frequency of such low-probability events such as droughts, crop failures, and floods.

[25] *See* Manabe, *The Effect of Increasing the CO_2 Concentration on the Climate of a General Circulation Model*, in DEPARTMENT OF ENERGY, CARBON DIOXIDE EFFECTS RESEARCH AND ASSESSMENT PROGRAM: WORKSHOP ON THE GLOBAL EFFECTS OF CARBON DIOXIDE FROM FOSSIL FUELS 100-01 (W. Elliot & L. Machta eds. 1979); *see also* Dickinson, *How Will Climate Change?*, in THE GREENHOUSE EFFECT, *supra* note 20, at 249-52; ROYAL COMMISSION REPORT, *supra* note 20, at 159.

[26] ROYAL COMMISSION REPORT, *supra* note 20, at 159.

[27] Under laboratory conditions, increased atmospheric CO_2 conditions increase the rate of photosynthesis and nitrogen fixation in some plants. Warrick, Gifford, & Parry, *CO_2, Climatic Change and Agriculture*, in THE GREENHOUSE EFFECT, *supra* note 20, at 406.

[28] Stomata (microscopic pores on the leaf surface) allow the inward diffusion of carbon dioxide used in photosynthesis and, at the same time, allow the loss of transpired water. An increase in the atmospheric carbon dioxide concentration could reduce the opening of the stomata required to allow a given amount of carbon dioxide to enter the plant and might thus reduce the loss of water from a plant. *Id.* at 402-05.

[29] Higher temperatures shorten the crop's life cycle. Although crop yields may increase in some areas, in other areas where heat stress is already a problem and rainfall is low crop yields will decline. "In most regions of the country, climate change alone could reduce site to site dryland yields of corn, wheat, and soybeans, with losses ranging from negligible amounts to 80%." U.S. CLIMATIC CHANGE, *supra* note 21, at 21-22. *See also* E. EL-HINNAWI & M. HASHMI, *supra* note 20, at 23; Warrick, Gifford & Parry, *CO_2, Climatic Change and Agriculture*, in THE GREENHOUSE EFFECT, *supra* note 20, at 425.

[30] WORLD CLIMATE PROGRAMME, *supra* note 20, at 22. *See* Warrick, Gifford & Parry, *CO_2, Climatic Change and Agriculture*, in THE GREENHOUSE EFFECT, *supra* note 20, at 425; E. EL-HINNAWI & M. HASHMI, *supra* note 20, at 23.

[31] E. EL-HINNAWI & M. HASHMI, *supra* note 20, at 22. Other predictions range from a

would submerge whole cities, agricultural land, and fragile ecological coastlands, as well as swamp dump sites and salinate freshwater aquifers.[32] Such a scenario will lead to socio-economic and environmental problems of striking magnitude.[33]

III. An International Problem

Enormous supplies of inexpensive energy allow us the widespread prosperity we enjoy. Material abundance and "quality of life," historically restricted to numerically microscopic affluent elites, have rightfully become the claim of ordinary people the world over. Fossil fuels such as coal, oil, and gas make such high standards of living possible. They provide the primary source of energy and power for transportation, heating, cooling, lighting, and industrial, commercial, domestic, and leisure activities.[34] However, fossil fuels which have generated the affluence we enjoy are also responsible for much of our environmental degradation.[35] Fossil fuels have caused diverse forms of air pollution, acid rain, and urban smog. Moreover, they are also suspected to cause global warming and climatic change.

Because cheap energy is the foundation of our present material prosperity, the implications of cutting carbon dioxide emissions by 20% are simply enormous. These implications touch the deepest roots of our economy and will affect the prosperity and quality of life not only of this country, but of the entire community of nations. A decision to cut substantially carbon dioxide emissions can only make sense within the framework of an international agreement. The mak-

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sea level rise of 56 cm by the year 2100 to a sea level rise of 345 cm by the year 2100. Titus & Barth, *An Overview of the Causes and Effects of Sea Level Rise*, in M. BARTH & J. TITUS, *supra* note 20, at 16.; Robin, *Changing the Sea Level*, in THE GREENHOUSE EFFECT, *supra* note 20, at 355.

[32] *See* Titus & Barth, *An Overview of the Causes and Effects of Sea Level Rise*, in M. BARTH & J. TITUS, *supra* note 20, at 19-21.

[33] Even more dramatic changes have been forecast. It has been suggested that global warming could lead to the melting of the marine West Antarctic ice sheet raising the global sea level by several meters. Mercer, *West Antarctic Ice Sheet and CO_2 Greenhouse Effect: A Threat of Disaster*, 271 NATURE 321 (1978). Such predictions are based on evidence "that the West Antarctic Ice Sheet completely disappeared during previous global warmings, raising sea levels by 5-6 meters 120,000 years ago." Hoffman, *Estimates of Future Sea Level Rise*, in M. BARTH & J. TITUS, *supra* note 20, at 94. Nevertheless, most glaciologists now believe that any problem of this scale is "long term and unlikely to occur in the next century or two." ROYAL COMMISSION REPORT, *supra* note 20, at 159.

[34] Coal, oil, and natural gas are used to generate 72% of the electricity in the U.S. NATIONAL RESEARCH COUNCIL, CONFRONTING CLIMATE CHANGE: STRATEGIES FOR ENERGY RESEARCH AND DEVELOPMENT 47 (1990) [hereinafter CONFRONTING CLIMATE CHANGE]. Transportation needs are met almost exclusively on petroleum products. *Id.* at 67.

[35] *Id.* at 45. Transportation and electric power generation contribute equally to total approximately 90% of the carbon dioxide emissions in this country. Together they emit over 900 million metric tons of carbon into the atmosphere. *Id.* at 47, 68. Petroleum products account for 7% of the electric power emissions and virtually all of the transportation sector emissions. *Id.* at 47. Coal, a particularly heavy polluter, generates 85% of electric power generating emissions. *Id.*

ing of such an agreement falls within the province of international law. There is no doubt that global warming cannot be arrested by the actions of individual states acting unilaterally.[36] Even the biggest producer of carbon dioxide emissions, the United States, accounts for only 25% of total emissions.[37] Even if the United States reduced its emissions by 20%, the process of global warming would proceed unabated.[38] Furthermore, any such unilateral reductions would put the United States in a disadvantageous competitive position unless other nations reduced emissions as well. Nations cannot be expected to make reductions in carbon dioxide emissions that are both disproportionately costly and economically disadvantageous.

Only universally accepted global norms and international standards will suffice. Such standards alone can reduce trace gases that are causing global warming. Unfortunately, existing international law possesses neither the substantive law, standards, remedies, nor institutions to confront the current planetary environmental peril. What is required, therefore, is a new global treaty creating standards accepted by all nations.[39] The community of nations envisages such

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[36] Richardson, *How To Fight Global Warming*, N.Y. Times, Feb. 7, 1990, at A25, col. 1.

[37] *Id.*

[38] *Id.*

[39] To rely on customary international law in a substantial, as distinct from interstitial, manner displays surprisingly poor judgment. The problems of international law are magnified by customary international law. There is no law-making, law-declaring, or law-enforcing body in international law. *See generally*, H.L.A. HART, THE CONCEPT OF LAW 222-26 (4th ed. 1961). These impediments are compounded by the tortuous processes, first of state practice and opinio juris involved in the creation of customary international law, and secondly, in applying it. I. BROWNLIE, PRINCIPLES OF PUBLIC INTERNATIONAL LAW 4-11 (1990).

It is, therefore, hard to comprehend the advice of an editor of the American Journal of International Law. Relying on a recent resolution of the United Nations General Assembly on the "Protection of Global Climate for Present and Future Generations of Mankind," he suggests that nation states should uphold international law by relying on obligations erga omnes to protect the atmosphere. Kirgis, Editorial Comment, *Standing to Challenge Human Endeavors That Could Change Climate*, 84 AM. J. INT'L L. 525 (1990). To begin with, he does not answer the fundamental question of how a resolution of the non-legislative General Assembly can create such an obligation when the resolution itself does not purport to do so. The resolution in question rejected the concept of the common heritage essential to the creation of rights erga omnes. Moreover, there are a cluster of other difficulties surrounding such an approach. The Chernobyl disaster vividly demonstrated that nation states display little interest in pursuing remedies in international law even where they are demonstrably and deeply affected. After Chernobyl, Poland, Rumania, Sweden, the United Kingdom, Austria, and Italy suffered tangible damage from fallout. Note, *The International Fallout From Chernobyl*, 5 DICK. J. INT'L L. 319 (1987). Note, *After Chernobyl: Liability for Nuclear Accidents Under International Law*, 25 COLUM. J. INT'L L. 647 (1987). It can be argued, furthermore, that customary international law places an obligation on the Soviet Union to prevent the kind of nuclear damage it caused. I. BROWNLIE, PRINCIPLES OF PUBLIC INTERNATIONAL LAW 437-40 (1990)(based upon principles of objective responsibility); J.SCHNEIDER, WORLD PUBLIC ORDER OF THE ENVIRONMENT: TOWARDS AN INTERNATIONAL ECOLOGICAL LAW AND ORGANIZATION 48-50 (1979)(based on case law on state environmental responsibility). *See also* principles 21 and 22 of the Stockholm Declaration on the Human Environment, U.N. Doc. A/Conf.48/14 (1972). Secondly, a recent case from Nicaragua reaffirmed that international litigation, based on customary law, has hardly

a treaty, which is scheduled to be negotiated at the United Nations Conference on Environment and Development in 1992.[40]

International law can only be created by international consensus. A world convention placing restrictions on carbon dioxide emissions will be hopelessly ineffective without the agreement of the powerful world economies. In light of the United States, the Soviet Union, and Saudi Arabia's opposition to emission limitations, the prospects of a successfully negotiated treaty—which would require stabilization of emissions, or even more pointedly, that stipulates numerical emissions limitations and would provide a fixed timetable for the implementation of reductions in emissions—are not particularly high.[41]

A. Global Security

As already stated, global warming presents a threat to environmental security that must be addressed. But outside the security sector, the belief is that scientific uncertainties encountered in dealing with global warming render the prospect of international or U.S. action against global warming wildly unrealistic.[42]

This conclusion is based on assumptions which are untenable. First, global warming constitutes a threat to the security of the world. In the past global insecurity encompassed military threats, armed aggression, and the Cold War.[43] The concept of security was expanded in the 1970's to include international economics, as it became clear that the U.S. economy was no longer an independent

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been determinative of fundamental political problems. Case Concerning Military and Paramilitary Activities In and Against Nicaragua (Nicaragua v. United States), 1986 I.C.J. 14 (Judgment of June 27). Finally, even if an obligation erga omnes exists, such obligations, especially in an amorphous and "soft" area of law such as international law, are notoriously obscure, indefinite, and surrounded by controversy. *See generally*, Gaja, *Obligations Erga Omnes, International Crimes and Jus Cogens: A Tentative Analysis of Three Related Concepts*, in J.H. WEILER, A. CASSESE & M. SPINEDI, INTERNATIONAL CRIMES OF STATE 151 (1989).

[40] U.N. Doc. A/Res.44/228 (1990).

[41] *Talks on Climate End With Accord*, N.Y. Times, Feb. 15, 1991, at A7, col. 1. Although the United States apparently agreed to negotiate about emission limits, it has consistently refused to commit to fixed targets or a timetable for emission limitations. That resistance to targets and timetables remains firm. There is no indication, moreover, that the problems of technology transfer or assistance to third world countries has been resolved.

[42] Skolnikoff, *supra* note 15, at 78.

[43] We witness the staggering collapse and death throes of the Soviet empire that is perceived as the primary cause of insecurity. Security has usually been viewed as the freedom from danger posed by military threats and armed aggression. National security has, therefore, been thought of as the capacity of the U.S. to thwart armed aggression by the Soviet Union. Unfortunately, even the removal of the Soviet threat, and the dismantling of the nuclear arsenals, the cause of military insecurity, will not usher in an era of security. *See* Krauthammer, *The Unipolar Moment*, 70 FOREIGN AFF. 23, 28-30 (1990); ARMS CONTROL ASSOCIATION, ARMS CONTROL AND NATIONAL SECURITY 5-15 (1989). The Gulf War demonstrated the extent to which small nations can pose a major threat to military security. Krauthammer, *supra*, at 28-33.

force, but was powerfully affected by economic policies in other countries.[44] It is alleged that threats to economic security have grown in importance. It is claimed that national security in the 1990's faces a challenge not confronted during the Cold War period—where, though not clear and present dangers, economic issues present dim, perhaps distant threats. Notwithstanding the absence of proximity or intensity, economic issues are perceived as dangers to security.[45] Furthermore, as already noted, the National Energy Strategy of the United States brings energy security within the security umbrella.[46]

The threat to security, as Lester Brown pointed out with percipience and insight, "may now arise less from the relationship of nation to nation and more from the relationship of man to nature."[47] For the first time in history, human action is dramatically altering the physiology and metabolism of the entire planet. The crisis confronting humankind today is massive and widespread global assaults on our planetary system rather than containable pockets of high pollution. In light of this peril, redefining national security to include environmental dangers is demanded.[48]

Second, fossil fuels are nonrenewable, and in the case of oil, the time frame for its exhaustion is very limited. Oil is a self-contained fuel that is combustible without subsidiary components. When it is exhausted, there will be no more oil. While it is conceivable that a technological solution that prolongs the life span of oil could be developed, there is no guarantee this will happen. The prospect of a world without oil is horrendous. While other sources of energy could provide alternative fuels, the question is whether or not we are attempting to find such fuels or, as seems the case, whether we are intent on using up our oil reserves without concern for the future energy or environmental security of the world.

These environmental problems are not issues of concern only to

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[44] Mathews, *Redefining Security*, 68 FOREIGN AFF. 162, 162 (1989).

[45] Moran, *International Economics and Security*, 69 FOREIGN AFF. 74, 74 (1990). From the standpoint of the United States the most pressing problems of national security include:

> encouraging stability and reform in the Soviet Union, maintaining a cooperative U.S.-Japanese relationship, . . . avoiding vulnerabilities from the globalization of America's defense industrial base[,] . . . reducing dependence on oil from the Persian Gulf, moderating the impact on the Third World of the prolonged debt crisis and limiting the damage from the narcotics trade.

Id.

[46] *See supra* notes 1-3 and accompanying text. According to Brooks Yeager, a lobbyist for the National Audubon Society, oil policy and the Persian Gulf conflict have been "eerily disengaged from each other." *Why America Still Hates the Word 'Energy Policy'*, N.Y. Times, Feb. 17, 1991, at 4, col. 1.

[47] L.R. BROWN, HUMAN NEEDS AND THE SECURITY OF NATIONS 6 (1978). An elegant and compelling current restatement of the threats is found in Mathews, *supra* note 44, at 162.

[48] Mathews, *supra* note 44, at 162.

environmentalists. The global economy, health, and modern civilization as we know it depend on these planetary systems.[49] Anything that seriously threatens them also threatens the human prospect. The security problem presented by global warming cannot be solved between two superpowers, or even by the efforts of the major industrialized countries. Safeguarding the world requires a truly global effort. International law must become the principal instrument to this effect.

B. Uncertainty

The second assumption made by those who argue that no action should be taken on global warming is that scientific uncertainty precludes national and international lawmaking. Although we do possess strong evidence of the global warming phenomenon, it is by no means conclusive. There is still some uncertainty about (a) the existence, (b) the extent, and (c) the consequences or effects of global warming. These uncertainties are compounded by differences in the nature of action required to combat climatic change.

The false premise, that scientific certainty is a precondition for national and international environmental lawmaking, implies that lawmaking should be limited to areas where scientific certainty exists—exactly the position of the United States—thus positing what

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[49] Although it is the most ominous among the global perils, global warming shares many attributes with other second generation environmental problems. *See* Wetstone, *A History of the Acid Rain Issue*, in SCIENCE FOR PUBLIC POLICY 163, 191 (1987). Examples of other second generation problems include: ozone depletion; the destruction of genetic diversity; and the cycling of toxic chemicals through the environment. The massive increase of chlorofluorocarbons has resulted in the depletion of the ozone layer.

The genetic diversity of the species inhabiting the planet has been endangered by massive deforestation and destruction of natural habitat. Tropical forests harbor a disproportionate share of the earth's biological diversity. Each year an area the size of Austria is being deforested from these tropical forests. Biologists estimate that species are being lost at a rate 1,000-10,000 times faster than the natural rate of evolution. BIODIVERSITY 3-18 (E.O. Wilson ed. 1988). As many as 20% of all the species now living may disappear by the year 2000. Mathews, *supra* note 44, at 165. Mathews argues that the loss will be felt aesthetically, scientifically, and above all economically. *Id.* These genetic resources are an important source of food, materials for energy and construction, chemicals for pharmaceuticals and industry, vehicles for health and safety testing, natural pest controls, and dozens of other uses. "The bitter irony is that genetic diversity is disappearing on a grand scale at the very moment when biotechnology makes it possible to exploit fully this resource for the first time." *Id. See also* Wolf, *Avoiding a Mass Extinction of Species*, in STATE OF THE WORLD 101 (1988).

The cycling of toxic chemicals through the environment has proved pandemic and assumes the character of a global threat. There are over 5 million known chemicals of which about 60,000 to 70,000 are in use. Both conventional and toxic pollutants are cycled through the oceans, the atmosphere, the biosphere, and the geosphere. Toxic chemicals moving through the environment pose a global threat because of their toxicity, persistence, and bioaccumulation. They cause death or serious illness in very low concentrations—in the low parts per billion or parts per trillion. As they journey through the oceans, the atmosphere, and the biosphere they leave a trail of sometimes deadly harm that can only satisfactorily be dealt with through international mechanisms. The international magnitude of the problem has resulted in a number of international conventions.

ought to be as if[50] it were an empirical or "descriptive" thesis.[51]

Such a supposition is based on a fundamental misconception of the interaction between science and policymaking. It assumes that scientifically certain answers or verities are to be found. Such is clearly not the case. As Weinberg so powerfully demonstrated, many of the questions asked of scientists by policymakers cannot be answered by science. Though they are epistemologically questions of fact and can be stated in the language of science, they are unanswerable by science. They transcend science and involve "trans-scientific" answers which are inextricably tied to policy and politics.[52] For example, the question of whether a substance causes cancer or other adverse health effects assumes an affirmative or negative answer. Yet there are few chemicals on which human data is unequivocal. Conclusive direct evidence of a threat to human health is rare. Fewer than thirty chemicals have been definitely linked with cancer in humans. In contrast, some 1,500 are reportedly carcinogenic in animals.[53]

Ethical considerations prevent deliberate human experiments with potentially dangerous chemicals, while the length of the latency period for cancer and other effects complicate epidemiologic studies. Thus, animal models are used to investigate whether exposure to chemicals is related to human health effects. Here, Weinberg's original examples of trans-scientific questions are still compelling: "to determine at the 95 percent confidence level by direct experiment whether 150 millirems will increase the mutation rate by 1/2 percent requires about 8,000,000,000 mice!"[54]

Weinberg's example related to the effect of radiation on mice. Certainty becomes even more elusive when assessing the effects of chemicals on humans. A positive answer to the question whether a particular chemical causes cancer in animals is treated as evidence that it may pose a threat to humans.[55] Scientists consider the effects on laboratory animals and extrapolate the results to humans.[56] The inference that results from animals are applicable to humans is fundamental to toxicologic research,[57] despite known metabolic differences between animals and humans,[58] and the absence of evidence

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[50] *See* H. VAIHINGER, THE PHILOSOPHY OF "AS IF" (1925).

[51] The distinction between a "descriptive" and "prescriptive" analysis is elegantly and authoritatively delineated by H.L.A. HART, THE CONCEPT OF LAW 182-83 (4th ed. 1961). The need to analytically distinguish what "is" from what "ought" to be serves clarity. W. FRIEDMANN, LEGAL THEORY 210 (4th ed. 1960).

[52] Weinberg, *Science and its Limits: The Regulator's Dilema,* in HAZARDS: TECHNOLOGY AND FAIRNESS 9 (1986).

[53] *Id.* at 11.

[54] Weinberg, *Science and Trans-Science,* 10 MINERVA 209, 210 (1972).

[55] Weinberg, *supra* note 52, at 19.

[56] *Id.* at 12.

[57] *Id.* at 22.

[58] For example, when determining the response of different species to chemicals,

establishing human carcinogenicity as a scientific fact. Not surprisingly, legislative and administrative action on environmental questions have been taken, internationally and in the United States, despite almost endemic uncertainty.[59]

The view that environmental law and policy is based on objective science has been trenchantly criticized,[60] and has now been sub-

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many chemicals appear to be carcinogenic in one species or strain and not in another — even when only rodents are being compared. Notice, Chemical Carcinogens, Review of the Science and its Associated Principles, 49 Fed. Reg. 21594, 21597 (1984).

[59] The uncertainties surrounding risk evaluation have been illuminatingly delineated by Rodgers. They relate to: data uncertainty, indeterminacy, historical uncertainty, and transcientific or global policy choice. Rodgers, *Guerilla Decisionmaking: Judicial Review of Risk Assessments,* 15 J. HAZARDOUS MAT. 205 (1987).

Data shortages include uncertainty about groups exposed, routes of exposure, patterns and practices of uses, and behavior of chemicals within the environment. For example the Office of Science and Technology Policy described "[t]he most comprehensive reference on the subject" as a well referenced "semi-technical" review of the physical, chemical and biological data on which decisions are made. Office of Science and Technology Policy, *Chemical Carcinogens; Review of the Science and Its Associated Principles,* 49 Fed. Reg. 21,594 (1984) (citing 15TH ANNUAL REPORT OF THE COUNCIL ON ENVIRONMETAL QUALITY).

An exposure assessment involves an estimate of the amount of a given chemical substance that is absorbed by an individual over time. This is a highly complex technical specialty. *Id.* at 21,649. The process involves consideration of the magnitude, frequency, and duration of encounters between individuals and the chemical in question. This exercise is often associated "with a dearth of data." *Id.* While some data may be available on the direct exposure by breathing the emissions from a manufacturing plant, estimates of the indirect exposure resulting from potential bioaccumulation in the food chain may be less precisely known.

Indeterminacy embraces the shape of the dose-response curves, the relevance of animal studies, the relationship of exposures to effects observed in epidemiological studies, and even whether there are safe threshold levels of exposures to given substances. Indeterminacy abounds when extrapolating from high dosage representative samples to low dose exposures in large populations. No single mathematical procedure is recognized as the most appropriate for low dose extrapolation in carcinogenesis. *Id.* at 21,649, 21,652. For a given exposure source, the concentration or amount of the chemical in that medium is determined by measurement, estimated by modeling, calculated from physical-chemical properties and other information on the agent, or projected form data on surrogate chemicals. Indeterminacy continues into hazard or dose response assessment. This is a quantitative exercise that attempts to describe the expected human response to any given level of carcinogenic exposure. *Id.* at 21,657.

By historical uncertainties, Rodgers refers to uncertainties arising out of attempts to understand events that are non-recurring and non-replicable. Saccharine was banned because it was found to be carcinogenic, but even this easy example, Rodgers argues, offers a virtual blank in assessing the costs and benefits of a product used for years by over 50 million people.

Whether a chemical should be banned despite its benefits is a trans-scientific question. It usually involves a total evaluation of the qualitative evidence, the exposure information, and the quantitative results. The final product of this evaluation is, typically, the generation of a quantitative estimate of the human cancer risk associated with the projected exposure profile. Such a qualitative estimate is arrived at by resolving scientific uncertainty on the basis of judgement. In the result, we receive further confirmation that risk assessment is an amalgam of scientific data, assumptions, and judgments based upon prevailing scientific thought and policy decisions. *Id.* at 21,660-61.

[60] An eminent scientist observes that decisive data concerning the harmful health effects of chemicals at low doses are unavailable and will never be determined. He argues that, as a result, extrapolations rest on "an uncertain scientific foundation." Hornig, *Science and Government in the USA,* in SCIENCE FOR PUBLIC POLICY 22-23 (1987). In fact, EPA ad-

stantially qualified by a recent report of the National Research Council.[61] The report draws attention to the uncertainties involved in the scientific process and the fallibility of scientists' judgments.[62]

But those opposing action against global warming seek to distinguish the control of toxic chemicals from attempts to control global warming. It is argued that the kind of socio-economic disruption caused by attempts to remedy global warming is so enormous that it might be better to defer action until stronger evidence is forthcoming. They conclude that the cost of overreaction is much too onerous, and that no precipitate and costly action should be taken.[63] Decisions might rationally be deferred until conclusive scientific proof is available, were it certain that we would not be overtaken by the feared peril. However, global warming offers no such certainty. When confronting irreversible effects, the cost of postponement is too high. Lawmakers have rightly assumed that decisions should be made despite uncertainty. Postponing action on the basis of a false negative—a wrong finding that something does not pose a risk—could be disastrous.[64] The only way to obtain direct and conclusive evidence is to incur the risk involved. Such a course of action is foolhardy where the disaster is irreversible. Scientific evidence points to the likelihood, though not the certainty, of a global threat. Such a

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mits that risk assessments, although conducted by scientists, are not "science" and that no one should be misled into believing that results using present techniques have the status of scientific findings. 15TH ANNUAL REPORT OF THE COUNCIL ON ENVIRONMENTAL QUALITY/1984 SPECIAL REPORT: RISK ASSESSMENT AND RISK MANAGEMENT 217 (1984). Even the National Research Council explicitly and unequivocally admitted to "great" and "pervasive" uncertainty. NATIONAL RESEARCH COUNCIL, RISK ASSESSMENT IN THE GOVERNMENT: MANAGING THE PROCESS 11 (1983). Indeed they referred to the many policy decisions that may need to be taken at the risk assessment stage. *Id.* at 33-37.

[61] NATIONAL RESEARCH COUNCIL, IMPORVING RISK COMMUNICATION (1989).

[62] *Id.* at 37-47.

[63] *Global Climate Change: Hearings Before House Subcomm. on Oceanography and the Great Lakes of the Comm. on Merchant Marine and Fisheries*, 101st Cong., 1st Sess 128 (1989)(statement of Dr. Andrew R. Solow).

[64] Page, *A Generic View of Toxic Chemicals and Similar Risks*, 7 ECOLOGY L.Q. 207, 230-36. (1978). It is sometimes assumed that the effects of a chemical should be proved like the guilt of an accused in a criminal trial. *Id.* at 233. In criminal law two basic kinds of mistakes can occur. A guilty man can be found innocent or an innocent man can be found guilty. According to Page, the former type of error is called a false negative, the latter a false positive. *Id.* Limiting false positives is the guiding principle of criminal law. This is because of the exceptional social value placed on liberty, and the abhorrence attaching to the wrongful deprivation of liberty. *Id.* at 233-34.

The evidence required before acting to prevent environmental risk, however, cannot be compared to the burden of proof required in a criminal trial. *Id.* at 234. The importance of liberty requires that a false positive be avoided. Accordingly a heavy burden of proof beyond reasonable doubt is required. When confronting risk it is more important to prevent a false negative that a false positive. *Id.* at 236-39. This is because the consequences of a false negative that seriously affects public health and the environment are so important that society attaches exceptional value to its protection. Societal desire to avoid mistakes affecting health and the environment results in its limiting false negatives more than false positives. Accordingly the evidence required is less onerous than might be the case in situations where it is more socially important to avoid false positives. *Id.* at 239.

likelihood of harm warrants the adoption of remedial measure, despite scientific uncertainties. This conclusion was recently endorsed by scientists at the Second World Climate Conference.[65]

C. *The Costs of Emission Reductions*

A comprehensive Environmental Protection Agency study "concluded that very large reductions (on the order of 50-80% of current levels) in worldwide CO_2 emissions are required, starting now, to achieve stabilization of atmospheric [greenhouse gases] at their current levels."[66] Some deem the price of an insurance policy against global warming to be too high. They view emission limitations as an "unifocal" remedy that seeks only to negate the consequences of global warming.[67] It has been estimated that the cost of stabilizing carbon dioxide emissions for the United States would be $50 billion annually. For the world economy, the cost would be around $5.2 trillion.[68] This very high cost reflects the economic regression that may result from abandoning coal and oil, in the absence of other tried and tested sources of cheap reliable fuel that can take their place.

The cost of oil, however, may have taken a dramatic leap, in light of the Gulf War. A major part of the military expenses and loss of life suffered in the Gulf should be added to the cost of oil. Furthermore, it is becoming clearer that a continued and reliable flow of oil can only be assured by a permanent U.S or allied presence in the Gulf,[69] costing billions of additional dollars per year. This is the true cost of oil.

If, however, the United States were to change to a different energy policy, (one that relied, for example, on energy efficiency and hydrogen based fuels, instead of carbon-based fossil fuels)[70] we would provide answers not only to the Middle East crisis, but also to global warming.[71] Therefore, the move to noncarbon-emitting alter-

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65 *Response Strategies Should Be Developed in Spite of Uncertainties, Scientists Say*, 13 INT'L ENV'T REP. (BNA) No. 13, at 455 (Nov. 7, 1990).

66 CONFRONTING CLIMATE CHANGE, *supra* note 34, at 21 (citing Environmental Protection Agency, Office of Planning and Evaluation, Presentation to the Committee on Alternative Energy Research and Development Strategies, National Research Council Washington, D.C., June 12, 1989).

67 *Id.*

68 *Report Calls for Coordinated Research on Economic Effects of Climate Change*, 13 INT'L ENV'T REP. (BNA) No. 13, at 458 (Nov. 7, 1990) (citing U.S. DEP'T OF ENERGY, THE ECONOMICS OF LONG TERM GLOBAL CHANGE (1990)).

69 Aho & Stokes, *supra* note 5, at 162.

70 Kieschnick & Helm, *Energy Planning in a Dynamic World: Overview and Perspective*, in NATIONAL ACADEMY OF ENGINEERING, PRODUCTION, CONSUMPTION AND CONSEQUENCES 15 (J.L. Helm ed. 1990).

71 Energy experts at the University of Texas view the current instability in the world oil market as a mandate to start making investments in alternative energy sources. While admitting that the lead time to implement new sources will be long and painful, these

natives to oil could be justified on energy, as well as environmental, grounds.

Energy security arising from the ability of the United States to extricate itself from the morass of the Middle East[72] must be included in the cost of reducing emissions of carbon dioxide. Such a move cannot be attributed to the fear of global warming alone. Taking the vanguard against climatic change will both motivate and enable the United States to adopt domestic policies allowing it to break loose from carbon-based fossil fuel dependence. New sources of noncarbon-based fuels will strengthen, not weaken, the international competitive position of the United States. Some energy sources offering significant exploitation potential include biomass,[73] geothermal,[74] Ocean Thermal Energy Conversion, wind,[75] solar power,[76] and photovoltaics.[77]

Similarly, energy efficiency, grounded in the conservation ethic, is also a multifocal remedy that addresses both energy and environmental security. Climate change is only one of several good reasons to consider a policy of energy efficiency. Energy efficiency can be applied to electric power generation,[78] transportation,[79] and residential and commercial buildings.[80]

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experts agree that formulating a proper energy policy will be a meaningful first step. 16 ENERGY STUDIES 1 (September/October 1990).

[72] Aho & Stokes, *supra* note 5, at 162. The costs of not doing so could be devastating. An increase of $10 in the price of a barrel of oil translates into a $80 billion cost increase to the nation's economy. This increase drives interest rates up, exports down, and causes prices to generally increase 2%. *Id.*

[73] Burning biomass is a renewable resource that makes no net contribution to atmospheric carbon dioxide. CONFRONTING CLIMATE CHANGE, *supra* note 34, at 53. At present, the biomass generating capacity in the United States is about 8 GW (gigawatts) and is concentrated in the pulp and paper industry, where the fuel used is low cost wood wastes. *Id.* Promising new technologies have the potential to make biomass competitive with coal generated electricity. *See Expanding Roles for Gas Turbines in Power Generation*, in ELECTRICITY: EFFICIENT END-USE AND NEW GENERATION TECHNOLOGIES, AND THEIR PLANNING IMPLICATIONS (R.H. Williams, et. al. eds. 1989).

[74] Although only 3 GW of electricity is currently being produced by geothermal sources, the U.S Geological Survey estimates potential "total U.S. geothermal resources usable for power generation to be 2,400 quads, located primarily in the western states, Alaska and Hawaii." CONFRONTING CLIMATE CHANGE, *supra* note 34, at 54.

[75] Coupled with its high acessibility, wind power may become a cost effective energy source in the future. *Id.* at 54. California has 1.5 GW of installed wind capacity and the best of these farms have reduced costs fourfold since 1981. *Id.* Because wind is less dependent on latitude than other solar sources, it is highly accessible. It is estimated that wind can produce 1,000 times the power it currently generates. *Id.*

[76] The National Research Council also sees solar-thermal electric power as promising. *Id.* at 54. Currently, 280 MW are supplied by solar power and a further 320 MW are planned, as new technologies unfold. *Id.*

[77] Photovoltaic modules may also become a more attractive source, given that new technologies are reducing costs and enabling systems to be used at small scale. *Id.* The price of photovoltaic modules has fallen from its 1970s price of about $120 per peak watt to $4 or $5 per peak watt today. *Id.*

[78] NATIONAL ENERGY STRATEGY, supra note 1, at 30-39.

[79] *See id.* at 60-72.

[80] *See id.* at 40-59.

Cars and light trucks account for 57% of the carbon dioxide emissions of the transportation sector. Environmental and energy security demand improved fuel efficiency, and an increase in the use of smaller vehicles. Also, reducing the amount of energy consumed for heating, cooling, ventilating, and lighting buildings in the United States would reduce greenhouse emissions while contributing to energy security.

D. The World Climate Convention

The assumption that there is an absence of international commitment to global action directed at averting climatic change is simply incorrect. Numerous meetings of international scientists, as already noted,[81] demonstrate the extent and nature of international concern. A multilateral convention treaty that protects global climate is expected to be signed at the United Nations Conference on Environment and Development in 1992,[82] having been preceded by negotiations at the Second World Climate Conference,[83] where representatives from 137 countries agreed on the need to stabilize emissions of greenhouse gases.[84]

VI. United States Action

The most productive developments in international environmental law have arisen from domestic pressures within nations, such that domestic laws and policies have become the building blocks of international law.[85] If the United States, as the leading emitter of

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[81] *See supra* notes 8 & 19 and accompanying text.

[82] *Preparations for Global Change Pact Could Begin in Fall Under IPCC Meeting Plan*, 13 INT'L ENV'T REP. (BNA) No. 2, at 41-42 (Feb. 14, 1990).

[83] Geneva, 29 October to 7 November 1990. *See* World Meteorological Organization (WMO), United Nations Environment Program (UNEP), United Nations Educational, Scientific and Cultural Organization (UNESCO), Food and Agricultural Organization (FAO), International Council of Scientific Unions (ICSU): Doc /M/SWCC-MF (Oct. 12, 1990).

[84] *U.S., Western Europe Reach Compromise on Dealing With Greenhouse Effect Gases*, 13 INT'L ENV'T REP. (BNA) No. 14, at 479 (Nov. 21, 1990).

[85] For example, the environmental consequences of acid rain were made known to the Swedish public by Swedish scientists in the 1960s. Public pressure prompted the Swedish government to take action on acid rain within Sweden. Thereafter the government submitted a case study on the environmental aspects of sulphur dioxide to the UN Conference on the Human Environment 1972 (The Stockholm Conference). Wetstone, *A History of the Acid Rain Issue*, in SCIENCE FOR PUBLIC POLICY 165-66 (H. Brooks & G.L. Cooper, eds. 1987). *See also* ROYAL MINISTRY FOR FOREIGN AFFAIRS, AIR POLLUTION ACROSS BOUNDARIES: THE IMPACT ON THE ENVIRONMENT OF SULPHUR IN AIR AND PRECIPITATION, SWEDEN'S CASE STUDY FOR THE UNITED NATIONS CONFERENCE ON THE HUMAN ENVIRONMENT IN STOCKHOLM (1972).

West Germany, the third largest producer of sulphur dioxide in Western Europe, was originally unconcerned about international air pollution. This attitude of indifference soon changed when experts revealed to the Federal Government that fully 560,000 hectares or nearly 8% of Germany's forest area had been damaged by acid rain. G.S. WETSTONE & A. ROSENCRANZ, ACID RAIN IN RAIN EUROPE AND NORTH AMERICA: NATIONAL RESPONSES TO AN INTERNATIONAL PROBLEM 79-80 (1983). West Germany soon became the chief protagonist within the EC for controls on acid rain and in pressing for the enactment

carbon dioxide in the world, could formulate and adopt effective policies adaptable to the rest of the international community, it would simultaneously be filling a lacunae in international law. In short, U.S. environmental laws addressing global warming could offer rational and compelling legal responses to a planetary peril, that could be adopted internationally. Obversely, U.S reluctance to take steps to reduce the use of carbon dioxide will obstruct international accord. Even if a global treaty places limits on carbon dioxide emissions, there is no guarantee that the United States will sign it.

Emerging international laws against global warming should, therefore, reflect the convergence of national and international thinking. Conversely, the obvious helplessness of national law (caused by problems that have outstripped and outgrown their existing jurisdiction and outreach) can only be overcome by a new generation of national environmental laws that seek to integrate national and international law and policy. A new synthesis of national and international law is needed.

Recent attempts at international lawmaking have taught us some salutary lessons. The world's nations, through fifteen years of protracted negotiations, developed the United Nations Convention of the Law of the Sea, a constitution for the oceans.[86] Unfortunately, this major historic global treaty was rejected by the United States, West Germany, the United Kingdom, and other European nations because it did not accord with their national laws and policies. The saga of the United Nations Convention on the Law of the Sea contains a fundamental lesson for those seeking action on global warming—international lawmaking cannot be divorced from national lawmaking. Indeed, changes in national laws and policies may well

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of the EC directive controlling air pollution from industrial plants. 27 O.J. EUR. COMM. (No. L 188) 20 (1984).

The U.S. was one of the prime movers in the Montreal Protocol which regulated CFC's more seriously. Mintz, *Keeping Pandora's Box Shut: A Critical Assessment of the Montreal Protocol on Substances that Deplete the Ozone Layer*, 20 U. MIAMI INTER-AM. L. REV. 565, 575 n.58 (1989). The U.S was one of the first nations to have introduced legislation to curb CFC's. *See* Clean Air Act Amendments of 1977, 42 U.S.C. §§ 7450-7459 (1986).

[86] The saga of the United Nations Conference on the Law of the Sea (UNCLOS) has been ably chronicled by John Stevenson and Bernard Oxman. *See* Stevenson & Oxman, *The Preparations for the Law of the Sea Conference*, 68 AM. J. INT'L L. 1 (1974); Stevenson & Oxman, *The Third United Nations Conference on the Law of the Sea: The 1974 Caracas Session*, 69 AM. J. INT'L L. 1 (1975); Stevenson & Oxman, *The Third United Nations Conference on the Law of the Sea: The 1975 Geneva Session*, 69 AM. J. INT'L L. 763 (1975); Oxman, *The Third United Nations Law of the Sea: The 1977 New York Session*, 72 AM. J. INT'L L. 57 (1978); Oxman, *The Third United Nations Law of the Sea: The Seventh Session (1978)*, 73 AM. J. INT'L L. 1 (1979); Oxman, *The Third United Nations Law of the Sea: The Eighth Session (1979)*, 74 AM. J. INT'L L. 1 (1980); Oxman, *The Third United Nations Law of the Sea: The Ninth Session (1980)*, 75 AM. J. INT'L L. 211 (1981); Oxman, *The Third United Nations Law of the Sea: The Tenth Session (1981)*, 76 AM. J. INT'L L. 1 (1982). A useful narrative tracing the unfolding developments of UNCLOS is found in the introduction to the United Nations Convention on the Law of the Sea. *See Third United Nations Conference on the Law of the Sea*, 21 INT'L L. MAT. 1261, 1271-72 (1982).

constitute a vital step in the creation of international laws and standards dealing with global warming.

The United States recently joined seventy-three other nations in agreeing that human activity is causing the earth's atmosphere to heat up. The U.S. delegation chief stated that U.S. agreement to the report amounted to a formal recognition of the reality of global warming and climatic change.[87] At a subsequent international conference, however, the United States opposed specific targets for emission reductions.[88] Such conduct testifies to reluctant agreement, rather than principled and enthusiastic support, for addressing global warming. In the United States, those who reluctantly accept the need for some international action to avoid global warming have stated that it is not in the country's self-interest for the United States to take the vanguard in the war against global warming. Doing so would adversely affect the economic position of the United States.[89] We have already dealt with this argument in the context of the alleged prohibitive cost of measures to control global warming, finding that a policy conferring energy security on the United States is not against the country's self-interest.

Climatic change is a serious national problem. Climatic change could have a traumatic impact on all aspects of North American life, particularly on agriculture,[90] human habitation, and water supply.[91]

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[87] *Global Warming, Caused By Humans U.N. Report Says*, 13 INT'L ENV'T REP. (BNA) No. 9, at 355 (Sept. 12, 1990).

[88] *Coal Important Element in Planning National Energy Strategy*, 13 INT'L ENV'T REP. (BNA) No. 14, at 487 (Nov. 21, 1990).

[89] *Bush Says World Must Strike Balance Between Economic Growth, Environment*, 13 INT'L ENV'T REP. (BNA) No. 2, at 43 (Feb. 14, 1990).

[90] Agriculture contributed 17.5% of the GNP of the United States in 1985. The United States produces nearly 50% of the world's corn and nearly 60% of its soybeans. Wirth, *Climate Chaos*, 74 FOREIGN POL'Y 1, 3 (1989). The immense productivity of U.S. farmland has been a major reason why the U.S. has evolved into a giant economic power. *Id.* at 11. The United States pre-eminence in world affairs is largely due to its economic strength. For this reason, the U.S. has a large investment in the status quo, and has a considerable stake in the global climate battle. *Id.* Crop production is sensitive to temperature, precipitation, soils, and irrigation. "During the dust bowl years of the 1930s wheat and corn yields dropped by up to 50%, and during the drought of 1988, estimates of corn yield showed a decline of 37%." U.S. CLIMATIC CHANGE, *supra* note 21, at 21.

[91] The most comprehensive study on the environmental effects of climate change in the United States has been undertaken by the EPA. U.S. CLIMATE CHANGE, *supra* note 21, at 14. The study concludes that a rise in sea levels is one of the most certain impacts of climate change. *Id.* Some scientists fear that an estimated rise of between 50 and 200 cm. The study estimated the potential nationwide loss of wetlands, and the cost of defending currently developed areas from the rising sea for three scenarios (50, 100 and 200 cm) of sea level rise will drown coastal wetlands. *Id.* at 16. Historically, wetlands have kept pace with a slow rate of sea level rise. The report argues that in the future, sea levels will probably rise too fast for marshes and swamps to keep pace. If there were to be a one meter rise in the sea level, 26-66% of coastal wetland would be lost if wetland migration is not blocked by bulkheads and levees. If all shorelines were protected, total wetland losses would increase to 50-82% because bulkheads and levees would prevent the formation of inland wetlands. *Id.* at 15. Coastal lowlands would be inundated. If so there would be a need to hold back the sea. Given high property values of developed coastlines, for a one

In response, a number of bills before Congress have undertaken the urgent and compelling task of providing answers to global warming.[92] The underlying conclusions and articulated purposes of the Global Climate Protection Act of 1987 (GCPA),[93] and the bills being examined by Congress[94] emphasize that affirmative action should be taken in the United States and internationally to address the causes of global warming. The GCPA, for example, after recounting that carbon dioxide and other trace gases "may be producing a long term and substantial increase in the average temperature of the earth,"[95]

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meter rise the capital cost of protecting currently developed areas until the year 2100 is estimated at $73-111 billion (in 1988 dollars). *Id.* at 15. Sea level rises will increase coastal flooding, erode beaches and increase salinity in estuaries and coastal aquifers. For example, there may be an enlarged and more saline Sacramento-San Joachin Delta, while New York, Miami and other coastal communities would have to increase the current efforts to combat salinity increases in ground and surface water supplies. *Id.* at 19.

While rainfall will vary within regions of the continental U.S., it is unlikely that current rainfall patterns will remain the same. It is certain that higher temperatures will increase evaporation and reduce snowpack. The rainfall in the U.S. falls more heavily on the east than the west and changes in temperature alone will cause new stresses in water resource management particularly in the west. Even without rainfall decline higher temperatures alone will likely lead to lower riverflow and lake levels, due to increased rates of evaporation. *Id.* at 19. In California, for example, decreased water availability and increased demand for irrigation may intensify conflicts between agricultural and urban use. Higher temperatures may degrade water quality. This would arise from (a) less water available to dilute pollutants; (b) enhanced thermal stratification of lakes leading to increased algal production; and (c) runoff and leaching of land caused by increased irrigation. *Id.* at 20.

92 Bills before the 101st Congress in the Senate and House included:

S. 169, 101st Cong., 1st Sess., 135 Cong. Rec. 522-24 (1989) ("[t]o provide for a national plan to improve scientific understanding of the earth and the effect of changes [the earth] system on climate and human well-being").

S. 201, 101st Cong., 1st Sess., 135 Cong. Rec. 575-78 (1989) ("[t]o respond to global environmental degradation brought about by human activities and to ensure that U.S. policies provide for the protection of the world environment. . . .").

S. 324, 101st Cong., 1st Sess., 135 Cong. Rec. 1034-61 (1989) (to provide for energy conservation and explore policy options that reduce energy use by 2-4% annually; use of nuclear energy and clean coal technologies; reforestation; cut carbon dioxide by 20% by year 2000 in the U.S.; convening of international convention to reduce carbon dioxide by 20% in year 2000 and 50% in year 2015).

S. 333, 101st Cong., 1st Sess., 135 Cong. Rec. 1069 (1989) (to enact the Global Environment Protection Act of 1989).

S. 491, 101st Cong., 1st Sess., 135 Cong. Rec. 1999-2005 (1989) ("[t]o reduce atmospheric pollution to protect stratosphere from ozone depletion; 20% reduction of carbon dioxide by 2005 in the U.S.; convening of an international convention to do likewise globally; energy research; reforestation").

S. 603, 101st Cong., 1st Sess., 135 Cong. Rec. 2829-40 (1989) ("[t]o establish within the Department of State, the Office of Global Warming. . . .").

S. 676, 101st Cong., 135 Cong. Rec. 3135-45 (1989) (global atmospheric and environmental protection).

H.R. 1078, 101st Cong., 1st Sess. (1989) (to establish national energy conservation policies and encourage international agreements on conservation).

H.R.J. Res. 207, 101st Cong., 1st Sess. (1989) (to establish that it is the policy of the U.S. to reduce greenhouse gases).

93 15 U.S.C. § 2901 (1988).

94 *See supra* note 92.

95 Global Climate Protection Act of 1987, § 1102(1), 15 U.S.C. § 2901 (1988).

concludes that necessary action must be identified and implemented in time to protect the climate.[96]

At an international level, we have noted that there is overwhelming evidence of an international commitment to a 1992 treaty on global warming. After dragging its feet, the United States, even though opposing emission limitations, has now formally recognized the reality of global warming and climatic change. This Article argues that a move to reduce carbon dioxide emissions is not against the self-interest of the United States.

In any event, there are alternatives to self-interest when evaluating responses to environmental problems. A significant body of U.S. legislation incorporates well-understood nonutilitarian rationales. In these laws, there is a clear intention to preserve nature for its own sake, not merely because of its market value. For example, the National Environmental Policy Act clearly requires consideration of adverse environmental effects on natural areas, and the preservation of the "natural aspects of our national heritage."[97] Among the goals of the Clean Water Act are the attainment of water quality "which provides for the protection and propagation of fish, shellfish, and wildlife."[98] The Clean Air Act contains provisions protecting parks and wilderness areas.[99] The Marine Protection, Research and Sanctuaries Act of 1972 commits the nation to preserve the "health of the oceans."[100] The Endangered Species Act of 1973 finds that various fish, wildlife, and plants in the United States are in danger of extinction, and seeks to provide a means whereby the ecosystems upon which endangered species depend may be conserved.[101] The Act pledges that the United States, as a sovereign state in the international community, will conserve to the extent practicable various species of fish, wildlife, and plants facing extinction.[102] The U.S. Supreme Court has held that section 7 of the Endangered Species Act contained no exceptions, and required all federal agencies and departments to ensure that actions authorized, funded, and carried out by them not jeopardize the continued existence of any endangered species.[103] Such U.S. legislation lays the foundation and provides a powerful alternative argument for U.S. espousal of such rationales in the international community.

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[96] *Id.* § 1102(4).

[97] National Environmental Policy Act of 1969, 42 U.S.C. § 4331(b)(4) (1988).

[98] 33 U.S.C. § 1251(a)(2) (1988).

[99] 42 U.S.C. §§ 7470(2) & 7471 (1988).

[100] 33 U.S.C. §§ 1401 & 1444 (1988).

[101] 16 U.S.C. §§ 1531(a) & (b) (1988).

[102] *Id.* at § 1531(a)(4).

[103] Tennessee Valley Auth. v. Hill, 437 U.S. 153 (1978). Following the outcome in *TVA v. Hill*, Congress amended the Act in 1978 to include procedures for exempting agency actions, in some situations, from rigid compliance. 16 U.S.C. § 1537(7)(e)-(p) (1988).

Finally, influential advisors to the President and some economists feel that the United States should focus on reducing the effects of global warming, rather than addressing its source. This Article contends that a problem as monumental as global warming calls for permanent solutions, which can only be achieved when causes are found and confronted.

V. Conclusion

When faced with the likelihood of a new Soviet threat, giving rise to global insecurity in the aftermath of World War II, the western powers agreed that a credible defense of Western Europe was necessary. Although the western powers disagreed on how to execute that commitment, they concurred on the need for action to avert the threat to security.[104] Despite the easing of tensions, the need for massive military expenditures to meet a potential threat continued to be the conceptual linchpin of defense policy. Analysts who were convinced of the necessity to incur enormous expenses in guarding against a potential Soviet attack can hardly demand a more onerous standard of proof from those seeking action against the potentially irrevocable and devastating impact of global warming.

The convergence of the military and energy crises leading to the Gulf War and the environmental crisis bringing global warming come at a pivotal moment in history. They dispel any remaining doubts about the need for redesigning our energy policies. One of the most important long-term implications of the Middle East crisis is recognition of the need to shake our reliance on fossil fuels in order to realize energy security. The overwhelming consensus about the need for ensuring environmental security in the face of global warming demonstrates that problems which place us in a common quandary call for common answers. Answers that integrate solutions both to problems of energy and environmental security are not merely prudent, but vital.

The United States enjoys unparalleled geopolitical authority. Almost incontrovertibly, it is the preeminent nation in the world. Undoubtedly, it is the only country with the military, diplomatic, political, and economic assets empowering it to become a decisive player in conflicts around the world, wherever they may be.[105] From this exalted position, the United States has called for a "new world order." Such a vision will be tragically distorted unless it rests upon a tripod of military, energy, and environmental security.

When addressing environmental and energy security, what is

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[104] This is an obvious point. For a historical survey see Schwartz, *A Historical Perspective*, in ALLIANCE SECURITY: NATO AND THE NO-FIRST-USE QUESTION 5-9 (J.D. Steinbruner & L.V. Sigal eds. 1983).

[105] Krauthammer, *supra* note 43, at 24.

striking in both these areas is the confluence of the domestic self-interest of the United States and the communitarian interests of the international community. This situation gives rise to the possibility of United States environmental lawmaking that leads to, or at least parallels, international lawmaking. By taking action without waiting for international solutions, the United States will be displaying the Congressional commitment to "effective United States leadership in the international arena."[106] President Bush embraced precisely such a response, promising in his first year of office to summon at the White House a global conference on the environment to discuss ways to control global warming, acid rain, the loss of tropical forests, and the saving of the oceans.[107] The environmental problems to which President Bush was reacting have been compounded by the energy crisis. The way is clear for the United States to forge a genuine new world order addressing the problems of environmental and energy security. Would that such a vision be embraced.

[106] Global Climate Protection Act of 1987 § 1102(6); 15 U.S.C. § 2901 (1988); 16 U.S.C. § 1536(e)-(p) (1988).

[107] NATIONAL ENERGY STRATEGY, *supra* note 1, at 2.