# CHALLENGES IN DEVELOPING A DIVERSE DOMESTIC ENERGY PORTFOLIO: INTEGRATING ENERGY AND CLIMATE POLICY IN THE WESTERN UNITED STATES

GARY C. BRYNER*

## INTRODUCTION

Despite years of energy strategies, plans, and legislation, the United States has failed to fashion an ecologically sustainable energy policy, a policy that both secures a steady supply of energy resources and ensures that energy production, distribution, and use takes place in ways that protect the health of the ecosystems and ecological services on which all life depends. This article contributes to the debate about what an ecologically sustainable energy policy would look like and how we might generate support for such a policy.

Three themes help frame the central challenges to developing such an energy policy. First, our steadily increasing reliance on imported energy, particularly oil, to meet our growing demand for energy generates tremendous pressure to increase our domestic production of energy. Energy and national security policy have been intertwined for decades; in one sense, this is nothing new. Since at least World War II, when federal officials and energy companies came to realize that the U.S would come to rely on Middle Eastern oil supplies, national security concerns have been a major driver of energy policy.[1] Given the precarious and unstable sources on which Americans depend for much of their imported

* Professor, Public Policy Program and Department of Political Science, Brigham Young University; Research Associate, Natural Resources Law Center, University of Colorado School of Law. Comments are most welcome. Please contact the author at 801-422-3276 or gary_bryner@byu.edu.

[1] *See* MICHAEL T. KLARE, BLOOD AND OIL: THE DANGERS AND CONSEQUENCES OF AMERICA'S GROWING PETROLEUM DEPENDENCY 12, 29–30 (2004).

energy, however, our reliance on importing so much of our energy has become increasingly risky. The growing problems surrounding imported oil are, to some degree, independent of electricity production issues in the United States, because only a small fraction of electricity is produced from burning oil.[2] However, both electricity and petroleum issues are addressed here because they are each critical to formulating a comprehensive American energy policy.

A second, and related theme, is that energy policy in the United States has largely been aimed at increasing the supply of domestic energy sources, primarily fossil fuels, because of their relatively low prices and convenience, and that focuses attention on the western United States as a primary source of fossil fuels. However, expanded fossil fuel development in the western United States raises an array of serious issues. Development of these resources is intertwined with issues of water pollution, air pollution and climate change, the consequences of nuclear power, the protection of public lands and wild lands in particular, as well as other environmental concerns. As a result, energy policy requires a much more coordinated and comprehensive policy response than has occurred in previous policy-making efforts. As is discussed below, the complexity of these issues is particularly evident in proposals to replace imported petroleum by expanding production of oil from non-conventional sources in the West, such as oil shale, tar sands, and coal gasification.

Third, policy makers are mired in policy deadlock and are largely failing to address the ways in which energy use contributes to disruptive climate change, air pollution, and other problems. Because of the tremendous environmental impacts of energy development, energy policy needs to be carefully integrated with these other policy efforts, but this kind of policy integration is uncommon. Proposals to increase energy production often ignore impacts on critical environmental conditions, and, as a result, fail to provide a sustainable base for energy policy. A massive shift in resources to conservation, efficiency, and renewables is essential, but does not now appear to be politically possible. Thus, we need to figure out a policy that is immediately possible and that will set

---

[2] ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, ANNUAL ENERGY OUTLOOK 2006 WITH PROJECTIONS TO 2030, at 80 (2006), *available at* http://www.eia.doe.gov/oiaf/archive/aeo06/pdf/0383(2006).pdf [hereinafter ANNUAL ENERGY OUTLOOK 2006].

us on the trajectory toward less reliance on imported energy, reduced air pollution and greenhouse gas emissions, and protection of scarce water supplies, wild lands, and ecosystems that provide critical ecological services.

Rather than resting energy policy on the belief that the United States can discover and develop new fossil fuel resources in the western states, I argue, as others have, that a massive investment in conservation and renewable energy resources is the most ecologically sustainable strategy for the nation as a whole and for the western states in particular. An immediate investment of hundreds of billions and eventually trillions of dollars is required to produce a major shift in the nation's energy infrastructure. Along with that shift in resources comes the need for energy policies that carefully integrate meeting energy demand, reducing the threat of climate change, reducing dangerous levels of air pollution, and protecting critical ecosystem services. Because of the tremendous environmental consequences that result from energy development and use, energy policy design cannot proceed in isolation.

The shift in energy policy that I am proposing represents a tremendous political challenge, given the primacy of the goal of cheap, plentiful energy to which politicians of both parties are committed and that has been a core political expectation for generations. It is particularly difficult to generate support for policies that impose immediate costs in order to secure future benefits, but sustainability requires exactly that kind of political commitment. Policy solutions need to include long-term goals as well as immediate actions. Announcing policy goals to be achieved far into the future can provide a convenient political excuse for not taking actions now that are economically painful to powerful interests or for not raising prices and producing unhappy voters. Finally, ambitious energy policy goals will have to be built on creative compromises and tradeoffs. We may need, for example, to couple major investments in renewables with those aimed at clean coal and nuclear power. Political deal making is essential in moving us away from political deadlock and toward sustainable solutions. Otherwise, our choice may only be to wait until crises make the status quo untenable, and then quickly fashion radical new approaches that will come too late to avoid massive disruptions.

This paper examines the growing pressure to expand energy production in the western United States and the challenges posed by such expansion. As a response to these challenges, this paper proposes ways in which energy and climate policies in particular might be more effectively integrated, discusses how the idea of sustainability can help illuminate tradeoffs, priorities, and goals, and suggests how creative political compromises can help the United States move beyond policy gridlock and policy timidity. These compromises should help us fashion the kind of ambitious and future-oriented energy policy that the growing threat of climate change and environmental degradation compels us to pursue.

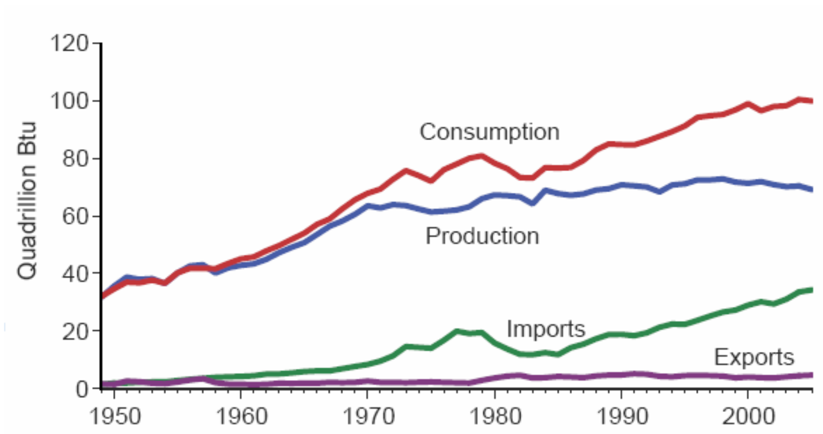
## I. THE GROWING PRESSURE TO DEVELOP WESTERN U.S. ENERGY RESOURCES

There is tremendous pressure to develop energy resources in the western United States. The United States has become heavily dependent on imported oil, and that addiction is projected to grow. According to the Department of Energy, "the United States was self-sufficient in energy until the late 1950s when energy consumption began to outstrip domestic production. In 2005, net imported energy accounted for 30% of all energy used."[3]

Figure 1 charts the steady growth in the gap between domestic energy production and consumption.

[3] ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, ANNUAL ENERGY REVIEW 2005, at xix fig.1 (2006), *available at* http://www.eia.doe.gov/emeu/aer/pdf/aer.pdf [hereinafter ANNUAL ENERGY REVIEW 2005].

FIGURE 1: U.S. ENERGY CONSUMPTION, PRODUCTION, AND IMPORTS[4]




U.S. dependence on imported oil is problematic for several reasons. Much of the attention has focused on the national security implications of imported oil. Most of the world's oil resources lie in countries, such as Saudi Arabia, Iraq, Iran, Nigeria, Venezuela, and Russia, that are politically unstable and often unfriendly to American interests. According to one study of energy and national security, America's "economic vulnerability is worsening" and the "danger of an oil disruption is high and increasing, as the world grows more and more dependent on unstable states and both inside and outside OPEC for the security of its energy supply."[5] Most oil-rich countries "have experienced significant social and political unrest and often violent conflict."[6] Figure 2 helps to highlight how risky current patterns of dependence are by showing how OPEC production levels can affect the global supply of oil. OPEC nations have cut oil exports in the past as an attempt to shape the policies of other nations. The cutbacks in Middle Eastern oil exports in 1973, for example, were engineered by Saudi Arabia as

---

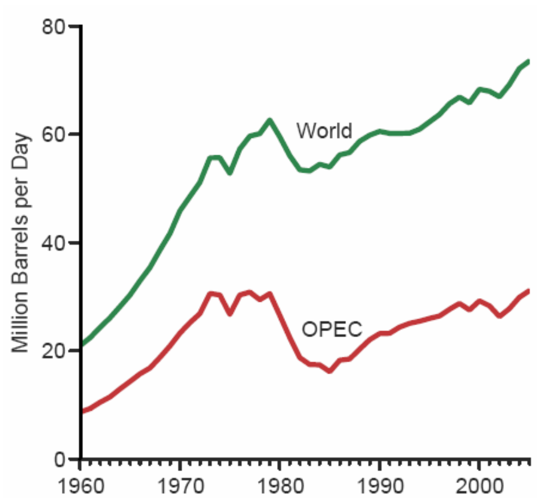
[4] *Id.*

[5] Jan H. Kalicki & David L. Goldwyn, *Introduction* to ENERGY & SECURITY: TOWARD A NEW FOREIGN POLICY STRATEGY 1, 4 (Jan H. Kalicki & David L. Goldwyn eds., 2005).

[6] Charles McPherson, *Governance, Transparency, and Sustainable Development*, *in* ENERGY AND SECURITY: TOWARD A NEW FOREIGN POLICY STRATEGY, *supra* note 5, at 461.

a way to protest against the U.S. decision to send weapons to Israel. The Saudis cut oil production by 10% and imposed a complete ban on shipments to the United States. By the end of 1973, the Saudi oil embargo had contributed to oil prices climbing by nearly 400% and demonstrated how OPEC nations could use their control over oil supplies to seek to pressure the United States and other nations.[7]

FIGURE 2: LEADING WORLD PRODUCERS OF CRUDE OIL[8]




A second risk of our dependence on foreign oil is that many petroleum engineers believe that world oil production will soon peak and then inexorably decline. Simple economics suggests that the world will never actually run out of oil but that prices will soar as supplies dwindle. King Hubbert, a well known petroleum engineer, projected in the 1950s that U.S. energy production would peak around 1970 and then decline, following a bell-shaped normal distribution curve.[9] Figure 3 shows Hubbert's projection and subsequent data on production that closely track his estimate. As the figure shows, oil prices jumped dramatically during the

[7] MATTHEW R. SIMMONS, TWILIGHT IN THE DESERT: THE COMING SAUDI OIL SHOCK AND THE WORLD ECONOMY 53–55 (2005).

[8] ANNUAL ENERGY REVIEW 2005, *supra* note 3, at 308 fig.11.5.

[9] M. KING HUBBERT, SHELL DEV. CO., PUBL'N NO. 95, NUCLEAR ENERGY AND THE FOSSIL FUELS 23–27 (1956), *available at* http://www.hubbertpeak.com/hubbert/1956/1956.pdf.

1970s. In response, the United States greatly increased the number of wells drilled. However, these wells were much less productive than earlier ones, and despite the massive increase in drilling activity, U.S. energy production continued its steady decline.

FIGURE 3: U.S. ENERGY PRODUCTION AND THE HUBBERT PROJECTION[10]

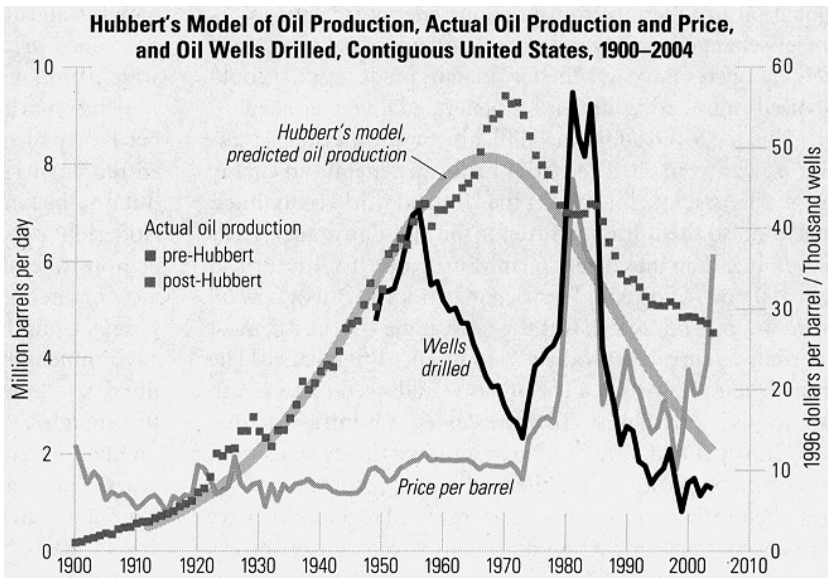
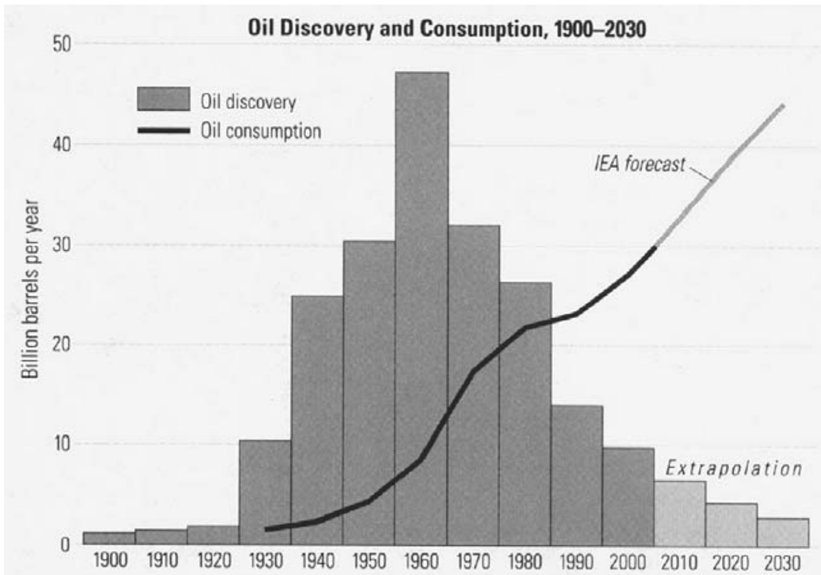



Figure 4 illustrates a similar pattern in global energy production. The world currently consumes about 80 million barrels of oil per day, and that figure, according to the International Energy Agency, will rise to 121 million barrels a day in 2030.[11] Until the 1980s, the discovery of new oil supplies greatly exceeded consumption. Since then, while consumption continues its steady rise, new discoveries have declined and we have been tapping oil reserves. These projections suggest that, given the expected steady rise in consumption, we will need to dramatically reverse the decline in discovery of new oil resources or face major shortages.

[10] Robert K. Kaufmann, *Planning for the Peak in World Oil Production*, WORLDWATCH, Jan.–Feb. 2006, at 19.

[11] Red Cavaney, *Global Oil Production About to Peak? A Recurring Myth*, WORLDWATCH, Jan.–Feb. 2006, at 13.

FIGURE 4: DISCOVERY AND CONSUMPTION OF GLOBAL OIL RESOURCES[12]




Many energy analysts have warned of an impending peak in oil production. Several studies project peak oil occurring within five to fifteen years, while the U.S. Department of Energy projects peak oil to be 20 years away.[13]

Figure 5 illustrates the challenge posed by the idea of peak oil. If peak oil were to occur in 2012, for example, the gap between demand and supply would explode, causing conflicts and struggles over access to the remaining resource. Some analysts, such as Michael Klare, argue that the struggle for access to increasingly scarce energy resources is already well underway. Klare draws attention to the military bases that the United States and Russia have already established in the Persian Gulf and Central Asia, respectively, arguing that these are aimed at ensuring influence in these key oil-producing regions.[14]

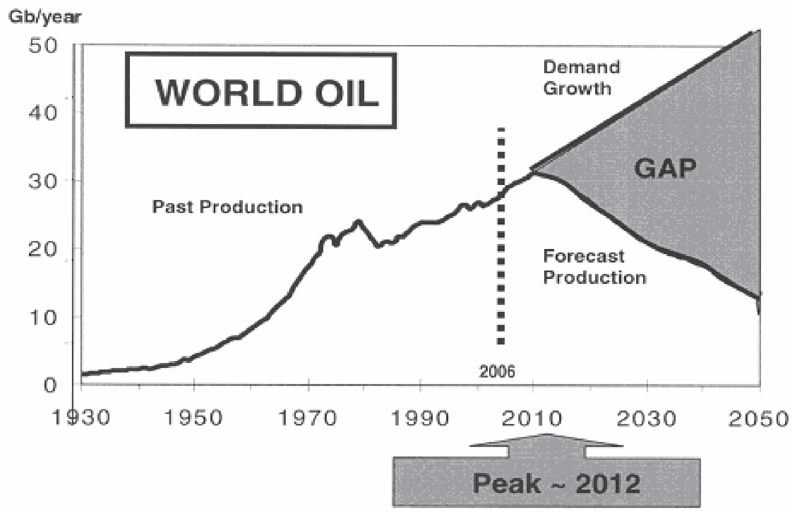
---

[12] Kjell Aleklett, *Oil: A Bumpy Road Ahead*, WORLDWATCH, Jan.–Feb. 2006, at 12.

[13] Robert L. Hirsch, Senior Energy Program Advisor, Science Applications Int'l Corp., Presentation at the 6th Nat'l Conference on Sci., Policy and the Env't, Peaking of World Oil Production: The Problem & Its Mitigation, 6 (Jan. 27, 2006), *available at* http://ncseonline.org/2006conference/presentations/symposium3hirsch.pps.

[14] KLARE, *supra* note 1, at 147.

FIGURE 5: PEAK OIL IN 2012[15]




However, not all petroleum analysts agree that peak oil is approaching. Energy analyst Daniel Yergin, for example, argues that "bouts of anxiety" about the world "running out of oil" have recurred since the 1880s and, most recently, in the 1970s, but global oil production has increased by 60% since the 1970s. According to Yergin, higher oil prices will result in new investment, improved yields from existing oil fields, and the development of nontraditional supplies such as Canadian tar sands and deposits in ultradeep water.[16] American Petroleum Institute President and CEO Red Cavaney believes that "revolutionary advances in technology," such as directional and horizontal drilling (allowing companies to withdraw more oil from reservoirs) and 3-D seismic technology (generating more precise information about reserves), will help stave off any gap between oil production and demand.[17]

Figure 6 shows one estimate of the petroleum resources that might be found in the United States. While the map highlights the coastal resources, most of these hoped-for resources are expected to be found within the forty-eight contiguous states. While some optimists believe that these undiscovered resources will counter

---

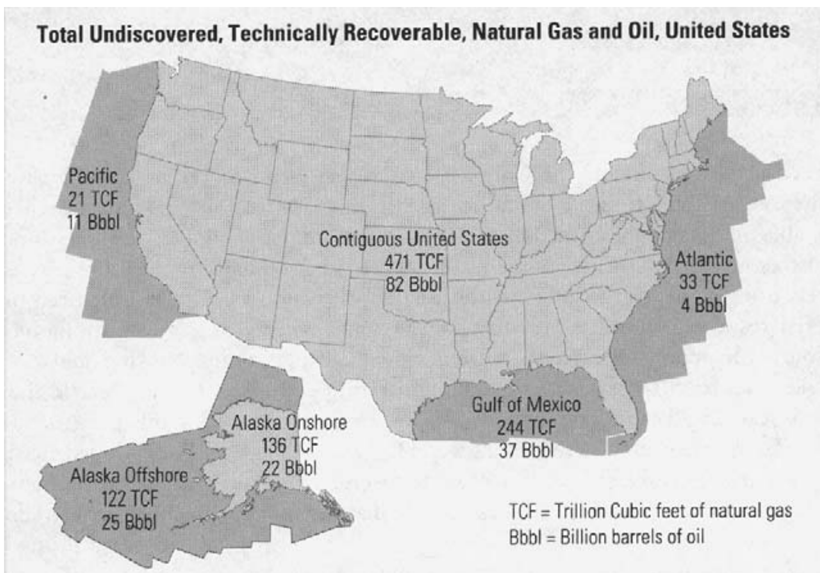
[15] Hirsch, *supra* note 13, at 21.

[16] Daniel Yergin, *Ensuring Energy Security*, FOREIGN AFF., Mar.–Apr. 2006, at 69, 74.

[17] Cavaney, *supra* note 11, at 13.

the threat of peak oil, this is unlikely for several reasons. First, these are undiscovered resources that engineers hope may exist because of their similarity with other oil and gas fields, but there is no certainty that they will be productive. Second, most of these hoped-for resources are largely located in environmentally sensitive areas such as wilderness lands, national parks, and coastal areas, and, as discussed below in terms of western lands, any development must be balanced against conservation values. Finally, as indicated above, the world consumes 80 million barrels a day or 29.2 billion barrels a year, and that figure is expected to grow to 121 million barrels a day or nearly 44.2 billion barrels a year by 2030.[18] So, even if these optimistic projections are somehow realized, they will only add a few years to the world oil supply.

FIGURE 6[19]

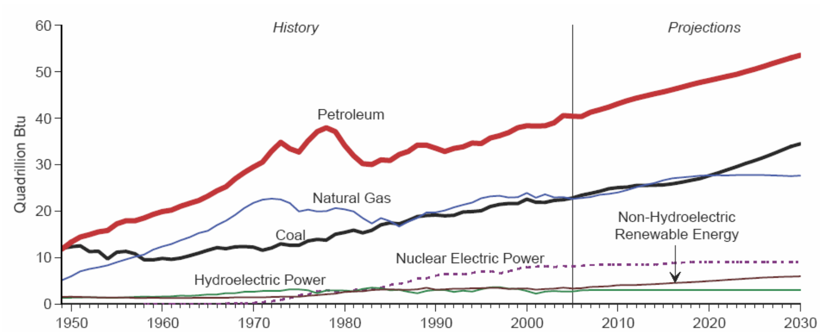



The debate over peak oil may continue for years but the consequences of a peak in oil production are so critical that the possibility of it occurring requires aggressive steps to address the threat. Given uncertainty in this area, as well as other elements of energy policy, the suggestion that we do nothing but hope that most experts are wrong is a recipe for reckless risk taking.

[18] *Id.*
[19] *Id.*

It should be noted that while peak oil is the most dramatic threat to fossil fuel supply, there is growing concern about the rising prices of natural gas and the limited role that this fuel may be able to play in meeting future energy needs. In North America, natural gas prices are almost four times higher, in constant terms, than they were a decade ago,[20] generating strong political pressure to expand domestic production and imports. Demand for electricity, largely produced in the United States through burning coal and natural gas, is expected to continue to rise steadily, putting significant pressure on development of coal and gas resources in the West, as shown in Figure 7.

FIGURE 7: U.S. ENERGY CONSUMPTION HISTORY AND OUTLOOK, 1949-2030[21]




Along with the problems posed by our dependence on foreign oil, these projections about the future of petroleum and natural gas contribute to an inexorable pressure to explore the potential for domestic energy development. In any plan for increasing domestic energy production, the western states play a key role. Our ability to respond to these problems through increased domestic production depends crucially on how much energy the western states can produce, and at what cost.

[20] ANNUAL ENERGY OUTLOOK 2006, *supra* note 2, at 82 fig.65.
[21] ANNUAL ENERGY REVIEW 2005, *supra* note 3, at xx fig.6.

## II. CHALLENGES IN DEVELOPING WESTERN ENERGY RESOURCES

The previous section addressed the tremendous pressures driving development of energy resources in the western United States. This section will discuss the significant challenges involved in the development of western energy resources.

The West is often seen as the solution to the nation's energy problems. Natural gas, coal, oil, oil shale, tar sands, and other resources are relatively plentiful in the western United States. These fossil fuels represent secure domestic resources and have some potential to address the growing demand for domestic energy. Additionally, western deserts are often seen as the solution for the storage of spent nuclear fuels. However, there are significant challenges surrounding the development of these western natural resources. First, in the western states, many fossil fuel resources are located within or adjacent to protected lands, such as designated wilderness and proposed wilderness areas, and other valuable open space.[22] As a result, energy development must be balanced with protection of wild lands, habitat for critical species, and recreation areas. Second, even aside from the impact on wild lands, energy development in the West threatens significant pollution and environmental impact.[23] The western United States is heavily dependent on coal mining and coal fired power plants. This dependence on coal poses serious air and water pollution problems, from mine runoff, to urban air pollution that harms public health, to regional haze that mars vistas of national parks. Hydroelectric power in the West produces an important share of total electricity but also produces serious environmental impacts. Third, the aridity of the western states raises further difficulties. Developing energy resources is often water intensive, and must compete with other uses of that most scarce western resource.[24] In addition, the possibility of developing western resources will also be affected regional and local attitudes. While energy developers promise jobs and money, the boom and bust cycle of past energy development has been a sobering influence on some western communities, who now greet with skepticism proponents of new energy projects that promise to bring jobs and

---

22 *See infra* Part II.A.
23 *See infra* Part II.B.
24 *See infra* Part II.C.

revenue.[25]

To take a specific example, it has been suggested that oil shale is the fuel of the future. According to a May 2005 report of the American Association of Petroleum Geologists, oil shale resources can be found in many parts of the world and total world resources of oil shale have been estimated to be worth 2.6 trillion barrels of oil.[26] Oil shale only contains about one-tenth of the energy in crude oil and one-sixth of the energy in coal;[27] it would take millions of years for it to produce oil naturally. Not surprisingly then, crude oil is much cheaper to produce than shale oil because of the costs of mining the shale and extracting the oil, and, as a consequence, oil shale resources are currently being developed in only a few places in the world. However, proponents argue that as conventional petroleum supplies dwindle and oil prices rise, oil shale will become economically attractive.[28]

Some members of Congress and others believe that Colorado, Utah, and Wyoming are the Saudi Arabia of oil shale and the key to energy independence for America.[29] Legislation enacted in 2005 required the Department of the Interior to lease 35% of the federal government's oil shale lands within one year, granted tax incentives for energy developers, and compressed multiple environmental assessments into a streamlined analysis.[30] Some

---

[25] *See, e.g.*, Amanda Paulson, *Fury on the Frontier of Energy Drilling*, CHRISTIAN SCI. MONITOR, Mar. 8, 2004, § USA, at 1, *available at* http://www.csmonitor.com/2004/0308/p01s01-ussc.html; Judith Kohler, *'Ground Zero' for U.S. Energy Riles Some Locals*, MSNBC.com, Feb. 3, 2004, http://msnbc.msn.com/id/4087725/; Ed Marston, *This Boom Will End Like All the Others—in a Deep, Deep Bust*, HIGHCOUNTRYNEWS.ORG, Sept. 5, 1994, http://www.hcn.org/servlets/hcn.Article?article_id=543. Fears of repeating the boom and bust history of energy development in the West was a consistent theme of a recent hearing on oil shale development before the Senate Committee on energy and Natural Resources. *See Hearing on the Implementation of the Oil Shale Provisions of the Energy Policy Act of 2005 Before the S. Comm. on Energy and Natural Resources*, 109th Cong. (2006) [hereinafter *Energy Policy Act Hearing*].

[26] Am. Ass'n of Petroleum Geologists, Energy Minerals Division, Oil Shale Committee, Oil Shale, http://emd.aapg.org/technical_areas/oil_shale.cfm (last visited Feb. 21, 2007).

[27] Randy Udall, *Oil Shale is Still a Pig in a Poke*, HIGH COUNTRY NEWS: WRITERS ON THE RANGE, Mar. 13, 2006, http://www.hcn.org/servlets/hcn.WOTRArticle?article_id=16197.

[28] Am. Ass'n of Petroleum Geologists, *supra* note 26.

[29] Julie Cart, *U.S. Backs Squeezing Oil From a Stone*, L.A. TIMES, Nov. 20, 2005, at A1.

[30] *Id.*

proponents of development believe the area contains as much as eight times the proven oil reserves of Saudi Arabia, and Royal Dutch Shell plans to decide by 2010 whether to develop its leases commercially.[31] Shell officials believe that oil shale production is economically viable when oil prices are least $20–30/barrel.[32]

However, there are significant challenges surrounding the development of oil shale. Exxon invested $5 billion in building a shale project in Garfield County, Colorado. This project closed in 1982 after producing several hundred thousand barrels of oil whose cost of production typically exceeded their value.[33] Shell plans to use a much different technology, but some residents remember "Black Sunday" in 1982 when Exxon closed the project. Twenty-two hundred workers were laid off, and local bankruptcies doubled and foreclosures quadrupled.[34] Studies warn that technical and environmental problems are "pervasive."[35] Oil shale development may require three barrels of water for each barrel of oil produced, thus competing for the limited water supplies in the Colorado River basin.[36] In order to produce 100,000 barrels of oil per day from shale, Shell would need to create the largest power plant in Colorado simply to fuel the project. This plant would consume five million tons of coal annually and produce ten million tons of greenhouse gases.[37] Unocal Corporation's experimental facility that operated in the western United States between 1980 and 1991 produced 4.5 million barrels of oil from oil shale at an average of 34 gallons of shale oil per ton of rock.[38]

The remainder of this section will discuss the challenges to the development of a variety of energy resources in the western United States in greater detail.

---

[31] *Id.*
[32] *Id.*
[33] *Id.*
[34] *Id.*
[35] *Id.*
[36] *Id.*
[37] Udall, *supra* note 27.
[38] Am. Ass'n of Petroleum Geologists, *supra* note 26.

## A. *Energy Resources Under Public Lands*

Many energy resources in the western United States are located within or adjacent to protected lands such as wilderness and proposed wilderness areas, and energy development must be balanced with protection of wild lands, habitat for critical species, and recreation areas.[39] Intensive energy development can also clash with expectations of ranchers and farmers who have been working both private and public lands for generations and with those of the residents of rural communities who were attracted to the West because of its wild, undeveloped lands. According to a government estimate, some 78% of the 131 billion barrels of oil and 62% of the 1000 trillion cubic feet of natural gas that some believe exist undiscovered in the nation are expected to lie underneath public lands.[40]

On the other hand, Wilderness Society analyses of energy resources located under national parks, wilderness areas, and other protected lands suggest that conflicts between resource development and wild lands have been over-emphasized.[41] Using U.S. Geological Service data, the Wilderness Society estimated that the economically recoverable oil and gas underlying all fifteen national monuments managed by the Bureau of Land Management, for example, would only meet U.S. demand for oil for about 15.5 days and for gas, about 7 days.[42] Production would, of course, stretch out for years, but these figures suggest that only very modest resources may be available in western protected lands. These estimates of economically recoverable oil and gas are based on oil prices of $30/barrel and $3.34/thousand $ft^3$ of gas; as prices increase the amount of economically recoverable resource also grows.[43] Figure 8 is a Wilderness Society map of Colorado that shows the lack of overlap between protected and energy resources.

---

39 *See generally* U.S. DEP'T OF THE INTERIOR, AGRICULTURE, AND ENERGY, SCIENTIFIC INVENTORY OF ONSHORE FEDERAL LANDS' OIL AND GAS RESOURCES AND RESERVES AND EXTENT AND NATURE OF RESTRICTIONS OR IMPEDIMENTS TO THEIR DEVELOPMENT (2003), *available at* http://www.blm.gov/energy/epca.htm.

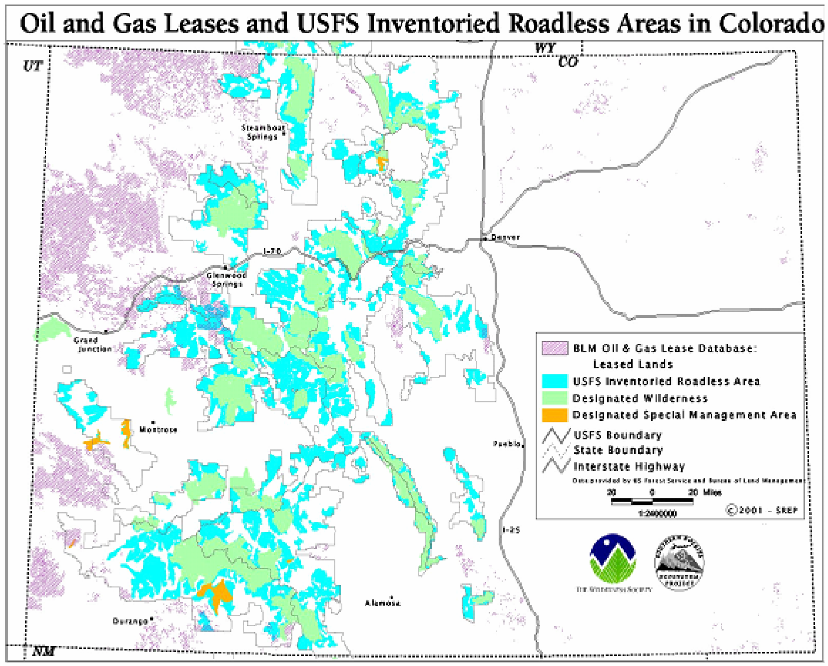
40 Cavaney, *supra* note 11, at 14–15.

41 Pete Morton et al., *CBM and Public Wildlands: How Much and at What Cost?*, *in* COALBED METHANE DEVELOPMENT IN THE INTERMOUNTAIN WEST 156, 160 (Gary Bryner ed., 2002).

42 *Id.*

43 *Id.*

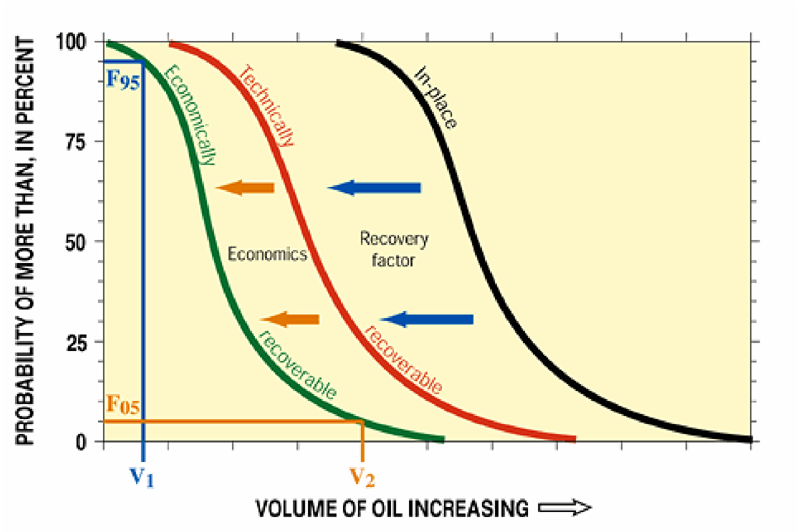
FIGURE 8: OVERLAP BETWEEN PROTECTED LANDS AND ENERGY RESROUCES[44]




A major reason why projections of energy resources vary so widely is that the Wilderness Society focuses on estimates of *economically* recoverable resources, while others estimate *technologically* recoverable resources or even simply the total volume of resources in place, regardless of the technical or economic feasibility of recovery. Figure 9 illustrates the different results in estimates of resources depending on which method is used to make estimates.

44 *Id.* at 161 map 2.

FIGURE 9: OIL VOLUMES AND PROBABILITIES FOR ESTIMATING UNDISCOVERED QUANTITIES[45]




It makes sense to use the economically recoverable estimates when making immediate decisions about whether to open a particular resource to development. Colorado's experience with oil shale, discussed above, is an example of how optimistic promises about the development of new energy resources have been quashed by the reality of economics. The costs of extracting and shipping energy resources in the rugged and remote wild lands of the West have resulted in major limits on development. It is true, however, that as scarcity of fuels increase and prices rise, development of some of these resources will become economically feasible. Once that occurs, there remains the very important and difficult question of how to balance development with protection of lands and habitat.

Cost-benefit analysis, typically used by federal agencies and others to make these kinds of judgments, is a problematic framework for securing the level of environmental quality essential for human life to flourish for several reasons.[46] For example, cost-

[45] Morton et al., *supra* note 41, at 157 fig.1. Note: Oil volumes and probabilities for estimating undiscovered quantities: there is a 95% chance of at least volume V1 of economically recoverable oil and a 5% chance of at least V2 of economically recoverable oil.

[46] *See generally* FRANK ACKERMAN & LISA HEINZERLING, PRICELESS: ON

benefit analysis generally fails to give priority to ecological values, even though protecting environmental values are a prerequisite for economic growth and material progress; if ecological values are severely compromised, economic activity will decline. Rather than assuming that environmental and economic values can be balanced through cost-benefit analysis, ecological science recognizes that the economy is best understood as a subsidiary of the environment. A broader decision-making framework that gives priority to ecological values is needed to make decisions about energy development on public lands.[47]

### B. *Energy Development and Conventional Air Pollution*

The West is heavily dependent on coal mining and coal fired power plants that pose serious air and water pollution problems, from mine runoff, to urban air pollution that harms public health, to regional haze that mars vistas of national parks. Since 1988, EPA and other agencies have monitored visibility in national parks and wilderness areas. In 1999, the EPA issued its Regional Haze Rule,[48] calling for state and federal agencies to work together to improve visibility in national parks and wilderness areas, primarily in the West.[49] The first state regional haze plans are due between 2003 and 2008;[50] the goal is to reduce air pollution levels to

KNOWING THE PRICE OF EVERYTHING AND THE VALUE OF NOTHING (2004) (emphasizing the use of cost-benefit analysis under a broader perspective).

[47] One candidate for such an integrative approach is ecological sustainability. Knowledge of how ecosystems function, their productive capacity, required tradeoffs, and long-term consequences is essential in ensuring that prices reflect true costs. Prices need to accurately reflect costs so we can make efficient tradeoffs between competing values and set priorities for limited resources. Ecosystem services are priceless. Without them, life is not possible. But finding some rough measures of the value of natural resources and ecosystem services is essential in moving towards the goal of true costs. Only crude estimates are currently available for some ecosystem services. *See* KAI N. LEE, COMPASS AND GYROSCOPE: INTEGRATING SCIENCE AND POLITICS FOR THE ENVIRONMENT 191–95 (1993); THOMAS PRUGH ET AL., THE LOCAL POLITICS OF GLOBAL SUSTAINABILITY, at xiii (2000). One pioneering study concluded that global ecosystems provide a yearly value to humans in the range of $16 to $54 trillion. Robert Costanza et al., *The Value of the World's Ecosystem Services and Natural Capital*, 387 NATURE 253, 259 (1997).

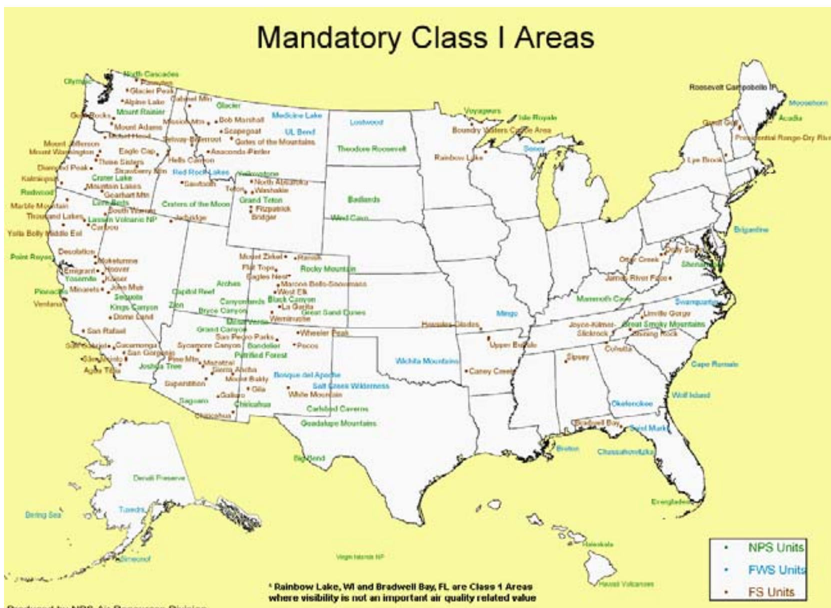
[48] Regional Haze Regulations, 64 Fed. Reg. 35,714 (July 1, 1999) (codified at 40 C.F.R. §§ 51.300–.309 (2006)).

[49] EPA, EPA's Regional Haze Program, http://www.epa.gov/air/visibility/program.html (last visited Jan. 29, 2007).

[50] *Id.*

background levels within sixty years.[51] Intensive energy development will make that goal all the more difficult to achieve, because of the contribution of fossil fuel combustion to regional haze. Regional haze is a result of natural and anthropogenic sources; the latter include motor vehicles, electric utilities, industrial fuel burning, and manufacturing operations. Particulate matter pollution from these sources is the major cause of haze.[52] Figure 10 plots the wilderness and other protected areas in the West that are the target of the regional haze efforts to improve air quality.

FIGURE 10: NATIONAL PARKS AND WILDERNESS AREAS PROTECTED AS CLASS I AREAS[53]




[51] Regional Haze Regulations, 64 Fed. Reg. at 35,731.

[52] EPA, Visibility, http://www.epa.gov/oar/visibility/what.html (last visited Jan. 29, 2007).

[53] EPA, Mandatory Class I Areas, http://www.epa.gov/ttn/oarpg/t1/fr_notices/classimp.gif (last visited Jan. 29, 2007).

## C. *Energy and Water*

Developing energy resources is often water intensive, and must compete with other uses of that most scarce of western resources. Americans consume about 40 gallons of water a day, but in the Southwest, the average is 120 gallons as desert dwellers use large quantities of water to produce green lawns.[54] But the vast majority of water use in the West goes to ranchers and farmers.[55] All the major rivers of the West have been dammed to produce water for irrigation and to generate electricity.[56] Proposed fossil fuel projects challenge scarce water resources already allocated or planned for human use and for the growing commitments to use water for ecological protection purposes. For example, developing oil shale into usable fuel may require as much as three barrels of water for every barrel of oil produced.[57] As a result, western water resource managers have cautioned against the rapid development of western oil shale.[58]

Figure 11 illustrates the limited rainfall in the West, which leads to dependence on surface and underground water storage.

[54] ATLAS OF THE NEW WEST 81 (William E. Riebsame et al. eds., 1997).

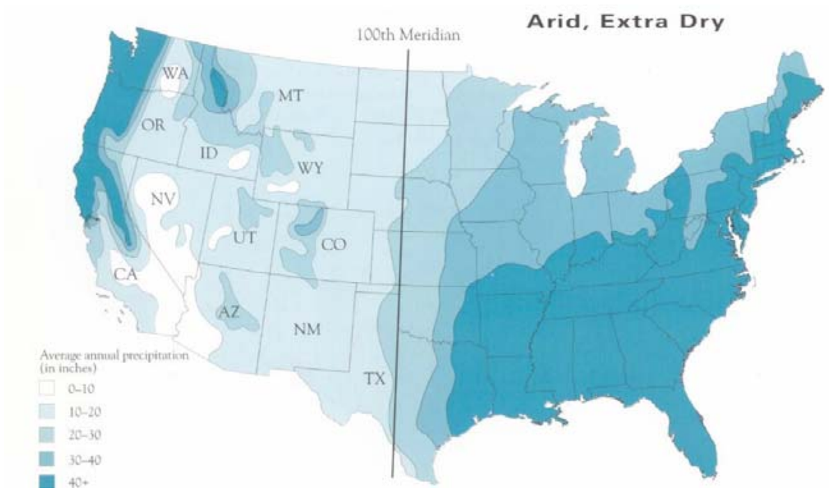
[55] *Id.* at 82–84.

[56] *Id.* at 84.

[57] Cart, *supra* note 29, at A1. *See also Energy Policy Act Hearing*, *supra* note 25, at 57 (statement of Steve Smith, Assistant Regional Director, The Wilderness Society, noting that the ratio is between 2 and 5 barrels of water per barrel of fuel).

[58] *See, e.g.*, *Energy Policy Act Hearing*, *supra* note 25, 50–51 (statement of Christopher J. Treese, Manager for External Affairs, Colorado River Water Conservation District).

FIGURE 11: THE ARID WEST[59]




### D. *Energy and the Threat of Disruptive Climate Change*

Over the past fifteen years scientists and others have debated the question and examined the uncertainty surrounding climate change. In that time, scientific developments have largely confirmed the threat. There are still many uncertainties, but there is little reason to think that they will be resolved by showing that climate change is not a threat after all. Climate change is, of course, a global concern, and reaches well beyond the energy issues of the western United States. But it is emblematic of how regional and global environmental concerns interact. A decision to develop western fuel sources, particularly coal and oil shale, could have a significant impact on the global problem. Oil shale, for example, poses a particularly acute problem. Once oil shale is processed into fuel oil, its use contributes to greenhouse gas emissions in just the same way as oil, but its total impact is potentially much greater. The energy required to process shale into this usable form is enormous, and if it is generated through coal fired power plants, as proponents are suggesting, it could

[59] ATLAS OF THE NEW WEST, *supra* note 54, at 80.

represent a significant increase in greenhouse gas emissions.[60]

Almost all climate scientists agree that the risks are great enough that we should be taking actions to reduce the buildup of carbon dioxide and other greenhouse gases.[61] Given the nature of the problem, if we wait until there is no uncertainty, it will be too late to take preventative action. The impact of a less than one degree change in average temperature has been remarkable. A host of studies—some commissioned by the Bush administration, including the National Academy of Science's Committee on the Science of Climate Change, some done in other countries, and some done under the direction of the United Nations—have concluded that human activity has already altered the climate in harmful ways and should be expected to continue to do so throughout the 21st century.[62]

Scientists are focusing increasingly on the possibility that, because of feedback loops, global warming will accelerate and become even more threatening. A 2002 National Academy of Science report concluded that climate change could occur with startling speed, rather than along a linear path of gradual change.[63] While there is considerable uncertainty in each climate model and in much of the evidence, many lines of inquiry converge on the conclusion that we face serious risks. The accumulation of different kinds of evidence, independently developed, that point in a similar direction, is striking. It suggests that the uncertainty of climate change, emphasized by those who oppose any preventative action, likely cuts the other way: problems could develop more quickly, feedback loops could accelerate warming, and impacts could be greater and more disruptive than previously projected. There is uncertainty about whether this will happen and what the other impacts will be, but again, the trajectory of research does not suggest that disruptive climate change is a manageable threat. The case for immediate action is growing stronger each year along with

---

[60] Udall, *supra* note 27.

[61] The research is voluminous. For a useful summary, see K. Hasselmann et al., *The Challenge of Long-Term Climate Change*, *in* SCIENCE MAGAZINE'S STATE OF THE PLANET 2006–07, at 172, 172–73 (Donald Kennedy ed., 2006).

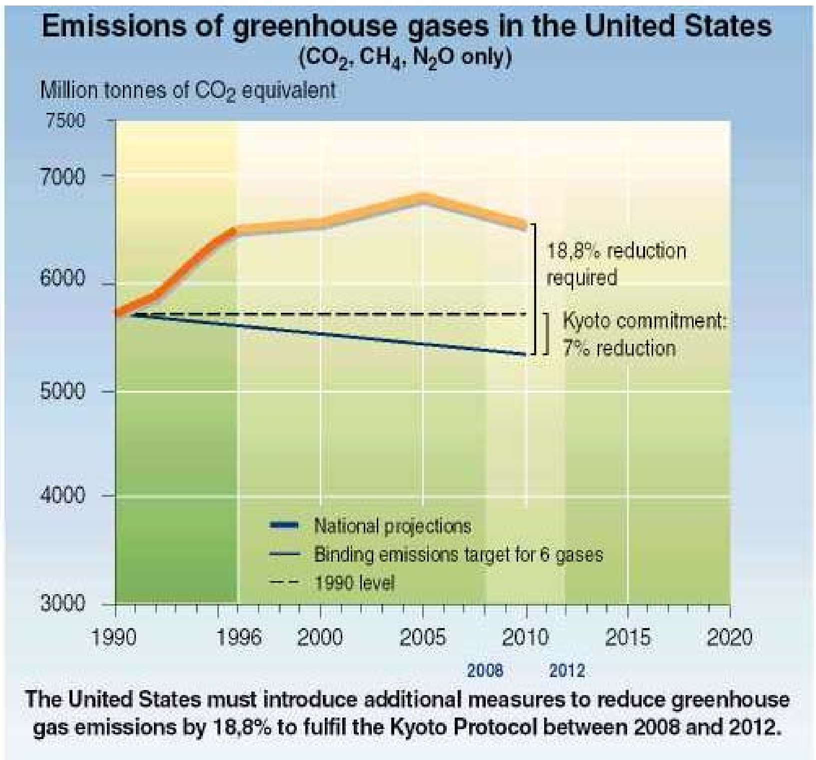
[62] *See, e.g.*, COMM. ON THE SCI. OF CLIMATE CHANGE, NAT'L RESEARCH COUNCIL, CLIMATE CHANGE SCIENCE: AN ANALYSIS OF SOME KEY QUESTIONS (2002).

[63] *See* COMM. ON ABRUPT CLIMATE CHANGE, NAT'L RESEARCH COUNCIL, ABRUPT CLIMATE CHANGE: INEVITABLE SURPRISES (2001).

the growing fear that climate change is not linear, gradual, or predictable.

Despite years of efforts to encourage greenhouse gas cuts, total emissions have, thus far, continued to rise, as shown in Figure 12.

FIGURE 12: U.S. EMISSIONS OF GREENHOUSE GASES ($CO_2$, $CH_4$, $N_2O$) PROJECTED THROUGH 2010 AND KYOTO PROTOCOL TARGET[64]




Decisions we have made about how to produce energy drive our impact on the climate. Burning coal to produce electricity results in the most carbon dioxide emissions per unit of energy, but because we use so much petroleum, it represents the largest source

[64] UNEP/GRID Arendal Maps and Graphics Library, USA Emissions of Greenhouse Gases (CO2, CH4, N2O) 1990 and 2010 Projections, http://maps.grida.no/go/graphic/usa_emissions_of_greenhouse_gases_co2_ch4_n2o_1990_and_2010_projections (last visited Jan. 29, 2007).

of $CO_2$ emissions in the United States.[65] Between 1990 and 2005, $CO_2$ emissions from petroleum have grown by 19.0%, from coal by 19.8%, and from natural gas by 14.4%. The numbers below chart the increase in $CO_2$ emissions by type of fossil fuel.

TABLE 1: U.S. ENERGY-RELATED CARBON DIOXIDE EMISSIONS BY FOSSIL FUEL[66]

| Million Metric Tons of Carbon Dioxide | | | | |
|---|---|---|---|---|
| *Year* | *Petroleum* | *Coal* | *Natural Gas* | *Total* |
| 1990 | 2173 | 1783 | 1027 | 4989 |
| 1995 | 2188 | 1879 | 1185 | 5263 |
| 2000 | 2392 | 2120 | 1238 | 5760 |
| 2005 | 2585 | 2136 | 1175 | 5909 |

In order to reduce emissions of greenhouse gases to levels that will avoid "dangerous interference" with the earth's climate (the goal that the United States and other nations agreed to in the 1992 Framework Convention on Climate Change[67]), emissions from the United States (and other countries) will have to decline dramatically. Scientists estimate that greenhouse gas emissions must be cut by 70–80% from 1990 levels by the year 2050.[68] In order to meet that goal, we must completely revamp the way in which we produce and use energy in the western United States, in the country as a whole, and around the world.[69]

[65] ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, U.S. CARBON DIOXIDE EMISSIONS FROM ENERGY SOURCES: 2005 FLASH ESTIMATE (2006), *available at* http://www.eia.doe.gov/oiaf/1605/flash/pdf/flash.pdf.

[66] *Id.* Note that the numbers for 2005 represent preliminary estimates.

[67] United Nations Framework Convention on Climate Change art. 2, May 9, 1992, S. TREATY DOC. NO. 102-38, 1771 U.N.T.S. 107, *available at* http://unfccc.int/resource/docs/convkp/conveng.pdf.

[68] *See, e.g.*, TIM FLANNERY, THE WEATHER MAKERS: HOW MAN IS CHANGING THE CLIMATE AND WHAT IT MEANS FOR LIFE ON EARTH 6 (2005) ("The best evidence indicates that we need to reduce our $CO_2$ emissions by 70% by 2050.").

[69] *See* H.R. 5642, 109th Cong. (2d Sess. 2006) for congressional endorsement of that goal.

### E. *Nuclear Power and Nuclear Waste.*

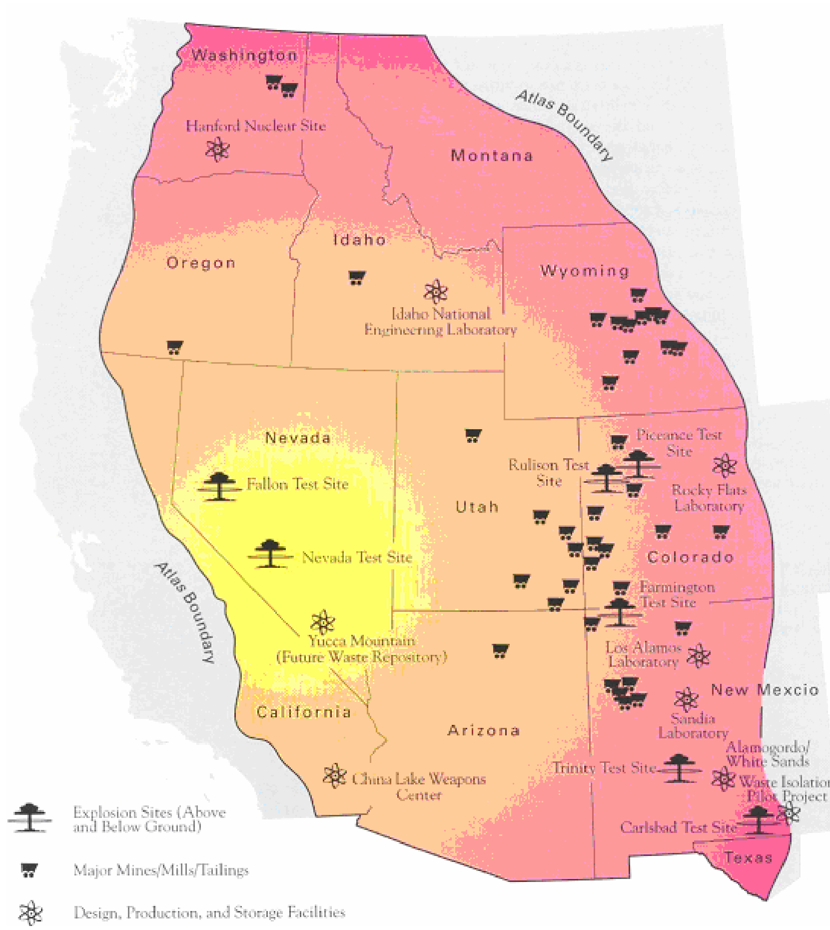
Pressure to develop domestic energy resources manifests itself not only in the demand for domestic carbon-based fossil fuels, but also in the demand for domestic nuclear power. There is a critically important debate over nuclear power and climate change that goes well beyond the western United States. Proponents argue that nuclear power plants are the most cost-effective way to produce electricity without burning coal and are essential in reducing the threat of climate change,[70] while skeptics focus on a host of technical and political challenges that must be overcome before expanding nuclear power is a viable option.[71] In so far as nuclear power is a potential solution to our energy problems, the West is often seen as a critical part of that solution because of its potential for providing fuel for nuclear power plants and storing nuclear waste. However, the development of nuclear power poses its own set of challenges for the United States and for western states in particular. The history of uranium development and the testing of nuclear weapons in the West makes it very difficult to locate new nuclear facilities, since local residents are particularly wary of having nuclear materials nearby. These fears are exacerbated by proposals to build power plants closer to cities (at least nuclear testing sites were in isolated areas, but were unfortunately upwind of many communities) and by the need to transport wastes from remote plants to western storage sites. Though transportation concerns affect all points from plant to storage facility, they would be particularly acute in the West as the waste from numerous plants converges on a storage site such as Nevada's Yucca Mountain. Figure 13 illustrates the distribution of the legacy of nuclear power in America that continues to pose serious environmental challenges in the West.

---

[70] John M. Deutch & Ernest J. Moniz, *The Nuclear Option*, SCI. AM., Sept. 2006, at 76.

[71] Jon Gertner, *Atomic Balm?*, N.Y. TIMES, July 16, 2006, § 6 (Magazine), at 36.

FIGURE 13: THE WEST'S NUCLEAR LANDSCAPE[72]




## III. TOWARD AN ECOLOGICALLY SUSTAINABLE ENERGY POLICY

With a few exceptions, politicians have been slow to recognize the need to ensure that economic activity be made compatible with the environmental conditions on which that economic activity, and life itself, depends. Instead, economic growth has long been the paramount value driving American

[72] ATLAS OF THE NEW WEST, *supra* note 54, at 134.

public policy and politics. But the inexorable environmental consequences of growth are now so significant and so threatening that this monolithic political imperative is no longer tenable.

A shift to an ecologically sustainable energy policy would represent a major change of orientation for public policy.[73] As a paradigm for public policy, ecological sustainability frames the economy as a subsidiary of the environment. Because all activity depends on ecological services, environmental preservation is the paramount value. This places a major constraint on the economy; only economic activity that is consistent with the fundamental criterion of ecological sustainability is acceptable. This means that the current distribution of critical natural capital must be maintained in some form, so that the ecosystem services it provides are maintained. It cannot simply be harvested to generate economic wealth that is to be passed down to subsequent generations. Industrial activities, energy production, transport-tation, and consumption must be fundamentally transformed to avoid ecological disruptions and protect regenerative processes. Ecological survival simply outweighs economic growth as the primary public priority. Since ecological conditions make all life, including economic activities, possible, preserving those conditions should be given top priority. Balancing is not enough; ecological values must come first and must define and limit what kinds and levels of economic activity are acceptable.

Ecological sustainability can seem to be a narrow value, as it seeks to give priority to environmental protection in a world where economic growth is paramount. However, it is compatible with and often supports a broad range of social justice values. Because environmental hazards and harms tend to fall disproportionately on the poor and politically marginalized, some advocates of sustainability argue that we should care about not only the relationship between ecological protection and economic activity, but also about social equity and political empowerment.[74] This has been an important issue in western states, as environmental injustices have characterized a host of environmental issues

[73] For general discussion of the idea of ecological sustainability and its place in public policy, see TODD SANDLER, GLOBAL CHALLENGES (1997) and BUILDING SUSTAINABLE SOCIETIES (Dennis C. Pirages ed., 1996).

[74] For a broad collection of essays discussing the interaction between environmental and social justice issues, see JUSTICE AND NATURAL RESOURCES: CONCEPTS, STRATEGIES, AND APPLICATIONS (Kathryn M. Mutz et al. eds., 2002).

affecting Native Americans, Latinos, and others.[75] Because climate change and other environmental problems are more likely to threaten people of color and the poor who are often more directly dependent on natural resources, and who often lack the resources to protect themselves against the consequences of environmental problems, sustainable development is quite consistent with a concern for reducing poverty and helping the poor gain some measure of self-sufficiency through a more equitable distribution of resources. Furthermore, by ensuring that decisions affecting economic and environmental conditions are made inclusively, broad and substantial political participation could be a key ingredient in promoting sustainability. Thus, sustainability need not be seen as an ecological concept alone; it may incorporate a concern for social justice, inclusion, fairness, community well-being, and political engagement.[76] These social and political values are important. They should be valued in their own right in addition to their contribution to ecological protection.

In the current political environment, the immediate, short-term benefits of cheap energy through fossil fuels overwhelm the long-term benefits of reliance on renewable energy sources. Policy inertia is powerful. Despite years of energy reports, plans, programs, and legislation, U.S. energy policy continues to fall short of developing a sustainable plan for managing and meeting energy needs. Congress passes energy bills that fund research and development for alternative energy sources, but the amount of money appropriated is only a tiny fraction of the $12 trillion economy and only a tiny slice of the value of ten trillion dollars reflected in the American energy infrastructure.[77] The 2005 Energy Policy Act, for example, included a total of $1.8 billion over two years to improve the energy efficiency of low-income homes, $325 million for state energy conservation programs over three years, $250 million for state appliance energy efficiency

---

[75] *See, e.g.*, Sarah Krakoff, *Tribal Sovereignty and Environmental Justice*, *in* JUSTICE AND NATURAL RESOURCES: CONCEPTS, STRATEGIES, AND APPLICATIONS, *supra* note 74, at 161.

[76] *See* William Lafferty, *The Politics of Sustainable Development: Global Norms for National Implementation*, 5 ENVTL. POL. 185, 189 (1996) (arguing that, within "sustainable development," "development" should be understood to mean progress toward reasonable standards of human welfare and more equitable standards of living).

[77] John P. Holdren, *The Energy-Climate Challenge: Issues for the New U.S. Administration*, ENV'T, June 2001, at 10.

programs, $1 billion in consumer rebates over five years to encourage the installation of renewable power energy systems in homes and small businesses, $550 million over five years to encourage electricity production from biomass, $200 million over ten years to encourage hydroelectric power and improve its efficiency, and $250 million over five years for federal agencies to purchase and use solar power.[78] These may all be laudable programs, but they reach only a tiny fraction of the nation's energy infrastructure. Similarly, the Bush administration's 2007 budget proposal called for increasing spending on alternative energy research by $300 million and proposed cutting spending on conservation by $100 million.[79]

The political challenge is to formulate and enact an energy policy that puts the United States on course to an ecologically sustainable path, including a long-term goal that gives clear direction and a set of short-term actions that begin to create incentives for immediate and incremental changes in behavior. While the idea of sustainability can serve as an ultimate goal, what we need are specific measures taken now. We cannot change our massive energy infrastructure quickly, and there is a great danger that if we simply set the kind of long-term goals that we need, we may reduce pressure to design and implement critical short-term changes that will move us in the right direction. Claiming that we are addressing a problem by setting a long-term goal without also establishing clear, short-term policy goals to help us get there is politically tempting, but fatal to addressing the challenges of climate change, energy dependence, public health, and building sustainable communities. The remainder of this section proposes goals for an ecologically sustainable energy policy and some immediate steps toward attaining them.

[78] Congressional Quarterly, *Details of the Energy Policy Overhaul*, CQ ALMANAC PLUS 2005, at 8-9, 8-9 to 8-16 (2006). Larger amounts were budgeted for clean coal programs (a total of $4.8 billion over several years to reduce greenhouse gas and conventional air pollutant emissions from coal fired power plants).

[79] Rick Klein, *Energy Gaps Seen in Bush's Budget*, BOSTON GLOBE, Feb. 8, 2006, at A1.

### A. *Integrating Energy and Climate Policy*

The year 2050, half-way through the 21st century, provides a useful target for thinking about a long-term energy policy goal. In a December 2005 lecture, NASA's Jim Hansen summarized the situation this way: "[T]he Earth's climate is nearing, but has not passed, a tipping point, beyond which it will be impossible to avoid climate change with far ranging undesirable consequences."[80] The first such consequence would be the loss of the Arctic as we know it; sea level will increase slowly but once Greenland and the West Antarctic Ice Sheet begin disintegrating, feedback loops will kick in and that could raise sea levels by twenty-five meters.[81] As a result, Hansen and other scientists have called for a 60–80% reduction in greenhouse gas emissions from current levels in order to reduce significantly global warming risks, and a bill introduced in Congress in 2006 sets a goal of reducing greenhouse gas emissions by 80% from 1990 levels by 2050.[82] The Kyoto Protocol, as is well recognized, is only a first step and a much more aggressive and comprehensive set of efforts are required to reduce the seriousness of the threat of climate change. It is quite possible that, given the long atmospheric lifetimes of greenhouse gases, it is already too late to prevent significant warming. The more effective the actions that can be developed, the more likely we can reduce warming from taking dramatic, nonlinear, and catastrophic directions, and reduce the level of climate-driven disruption that will occur.

The first task in pursuing that goal should be a massive investment in deploying existing energy efficiency technologies in order to reduce demand. This should be coupled with an equally large investment in research and development of new energy efficiency technologies. Reducing demand is far superior to increasing supply because efficiency improvements almost always

---

[80] James E. Hansen, Columbia Univ. Earth Inst., Presentation at the American Geophysical Union, Is there Still Time to Avoid 'Dangerous Anthropogenic Interference' with Global Climate? 1 (Dec. 6, 2005), *available at* http://www.columbia.edu/~jeh1/keeling_talk_and_slides.pdf.

[81] *Id.*

[82] H.R. 5642, 109th Cong. (2d Sess. 2006). The bill mandates a 2% a year reduction in emissions beginning in 2011, so that emissions in 2020 revert to 1990 levels. Beginning in 2021, emissions would be cut by 5% a year, so that by the year 2050, they would be reduced by 80% from 1990 levels.

reduce environmental impacts.[83] As suggested above, in a $12 trillion economy, with a multi-trillion dollar energy infrastructure, we need to invest trillions of dollars during the next decade in order to transform the energy production and distribution system of 2050.[84] Some of that investment can come in the form of government assistance to help pay for new energy investments; market-based incentives such as a carbon tax and government procurement and efficiency standards can stimulate private sector funding. It is especially important that these can be put in place quickly. Because power plants and other energy facilities typically have a forty year life span, it is critical that we begin now to invest in cleaner sources of electricity production. Decisions made today will have climate consequences for decades to come.

The major target for conservation and efficiency should be energy use in buildings, since almost 40% of all energy used in the United States goes to heat, cool, ventilate, light, and otherwise operate buildings.[85] Improving energy efficiency of vehicles provides for a much smaller, but nevertheless significant, opportunity to reduce total energy use.[86] According to a 2001 National Academy of Science study, the fuel efficiency of cars, light-duty trucks, and SUVs could be increased by one-third with existing technologies and without sacrificing safety or comfort.[87]

EPA data on energy efficiency programs demonstrate that they usually cost less than producing additional electricity from power plants; these programs save energy at cost of about $0.03/kWh, 50–75% of the cost of electricity from new power sources and less than one-half the average retail price of electricity.[88] Combined heat and power (CHP) systems, power

83 Edward L. Vine, *Using Energy Efficiency to Achieve Air Quality Compliance*, EM, May 2003, at 30, 30–34.

84 Holdren, *supra* note 77, at 10. For data on federal government spending, see Congressional Quarterly, *President Submits Fiscal 2006 Plan: A Thousand Pages of Political Pain*, CQ ALMANAC PLUS 2005, at 4-3, 4-3 to 4-8 (2006).

85 Greg Franta, *High-Performance Buildings Through Integrated Design: Strategies Toward Sustainable Development*, RMI SOLUTIONS (Rocky Mtn. Inst., Snowgrass, Colo.) Summer 2006, at 6, 6, *available at* http://www.rmi.org/images/other/Newsletter/NLRMIsummer06.pdf.

86 *Id.*

87 Kathleen C. Taylor & Anil Sachdev, *Materials Technologies for Future Vehicles*, *in* ENERGY AND TRANSPORTATION: CHALLENGES FOR THE CHEMICAL SCIENCES IN THE 21ST CENTURY 56 (2003), *available at* http://www.nap.edu/catalog/10814.html.

88 EPA, CLEAN ENERGY-ENVIRONMENT GUIDE TO ACTION, at ES-2 to ES-3

plants that produce electricity as well as heat that can be used to warm buildings, achieve efficiency as high as 60–75% over the average efficiency of separately produced power and heat.[89] Implementing existing efficiency technologies that are economically and technologically feasible today could reduce total electricity demand nationwide by about 25% by 2025, which represents at least a 50% reduction in expected electricity demand growth.[90]

Innovative industries have already demonstrated that improved efficiency can save money. Concluding that precautionary action to reduce the threat of climate change is in their self interest, many American and multinational companies have developed voluntary programs to cap and reduce greenhouse gas emissions.[91] In 1998, British Petroleum (BP) pledged that by the year 2010, it would reduce its emissions of greenhouse gases to 90% of their 1990 levels.[92] By 2001, BP had achieved a 10% reduction in emissions (from 1998 levels) and saved some $650 million in the process.[93] Similarly, Shell agreed to cut emissions by 25% from 1990 levels by 2002 and actually exceeded that goal.[94] DuPont committed to reduce emissions by 65% between 1990 and 2010.[95] Johnson & Johnson has agreed to reduce greenhouse gas emissions by 7% (from 1990 levels) by 2010; IBM promised to reduce emissions by 4% by 2004; Polaroid, 20% by 2005; Nike, 13% by 2005; and LaFarge (the world's largest concrete manufacturer), 10% by 2010.[96] Michael Northrop, co-founder of the Climate Group, a coalition of companies and

(2006), http://www.epa.gov/cleanenergy/pdf/gta/guide_action_full.pdf.

[89] *Id.* at ES-3.

[90] *Id.*

[91] Amanda Griscom, *In Good Company: Cutting Emissions to Raise Profits*, GRIST, July 31, 2002, http://www.grist.org/news/powers/2002/07/31/griscom-emissions/.

[92] Graham Cooper, *Case Study: BP/Shell: Energy Giants Lead the Way on Emissions Trading*, ENVTL. FIN., Oct. 2000 supp., at xxvii. To accomplish this goal, BP implemented a cap and trade system within the company. It began with 12 business units, and expanded to all 127 units of the company in 2000, after it had merged with Amoco. According to a company spokesperson, BP achieved most of the emissions reductions from making operational changes rather than capital expenditures. *Id.*

[93] John Carey, *Global Warming*, BUS. WK., Aug. 16, 2004, at 69.

[94] Griscom, *supra* note 91.

[95] Carey, *supra* note 93, at 69.

[96] Griscom, *supra* note 91.

governments committed to reducing greenhouse gas emissions, said, "It's impossible to find a company that has acted and has not found benefits."[97]

A second step towards sustainability involves the development of renewable energy sources. Part of the multi-trillion dollar investment over the next decade should fund a massive shift to renewable energy sources. Since we produce about 90% of the energy we use from fossil fuels and 10% from renewables, a rough target for 2050, in order to reduce $CO_2$ emissions by 70–80%, would be to roughly reverse the numbers and set as a goal procuring 70–90% of our energy from renewables and the balance from fossil fuels. Funding should give priority to deploying existing technologies for renewable energy, such as solar, wind, and geothermal sources. Technologies already being used are the key to immediately beginning the energy transformation. Research and development into new forms of renewable energy should also be greatly expanded, but we cannot afford, environmentally, to wait until those new technologies are in place. Requiring government-industry partnerships can help create incentives for research, development, and demonstration projects that are sufficiently promising to attract private funding, and using public resources can help ensure resulting technologies are widely available. As is shown in Table 2, some renewable technologies are already able to compete with conventional power generation. Wind power is typically the cheapest source of renewable energy power, but solar power costs have been dropping at a rate of about 5% a year in California.[98]

---

[97] Carey, *supra* note 93.

[98] Daniel M. Kammen, *The Rise of Renewable Energy*, SCI. AM., Sept. 2006, at 84, 86.

TABLE 2: COMPARING THE COST OF RENEWABLE AND FOSSIL FUEL ENERGY SOURCES [99]

| *Type of renewable energy* | *Cost (¢) per kilowatt-hour* |
|---|---|
| Photovoltaics | 20–25 |
| Wind | 4–7 |
| Nuclear | 2–12 |
| Natural gas | 5–7 |
| Conventional coal fired power plants | 4–6 |

Incentives are needed to develop renewable energy sources and restructure the energy market. Oddly, we lack a sense of urgency about restructuring the energy market, and little progress has been made in committing the United States to a new Manhattan Project for energy independence. America's open, competitive economy has stimulated tremendous efforts to develop new energy technologies. Entrepreneurs and inventors are trying to turn corn, sugar, switchgrass, waves, wood chips, sunlight, and a variety of other natural resources into energy. But the rate of innovation must be ramped up dramatically by creating the kind of market conditions necessary to prompt a massive shift in energy production and use. Subsidizing these efforts through cost-sharing programs aimed at raising large amounts of capital are essential. Subsidies are risky because they may reward activities that would be undertaken anyway or may not be competitive in the market. Nonetheless, they are a powerful tool for fostering innovation. For example, a national carbon or gasoline tax is essential. These taxes could be used to ensure that gas prices reach and remain at $3.50–$4.00 a gallon, high enough to guarantee that new technologies remain competitive and that more of the costs of burning gasoline are reflected in prices, and to raise money for energy efficiency and conservation.[100] Another way to create market incentives is for the federal government, the largest single user of energy, to set high standards for fuel and energy efficiency

[99] *Id.* Note that estimates of the cost of nuclear power vary greatly depending on which costs are included. *Id.*

[100] Thomas L. Friedman, Op-Ed., *A Million Manhattan Projects*, N.Y. TIMES, May 24, 2006, at A27 (quoting K.R. Sridhar, owner of IonAmerica, a maker of solid oxide fuel cells).

when making purchases.[101]

One of the most powerful tools for governments to stimulate new markets in renewables is a Renewable Portfolio Standard (RPS). An RPS is a state policy requiring that a certain amount of the state's energy be generated from renewable resources.[102] Iowa was the first state to create an RPS, setting a goal in 1991 of requiring power companies to produce 105 MW of renewable power.[103] By mid-2006, twenty-two states and the District of Columbia had put RPSs in place.[104] Most state targets require that a specific percentage of total electricity sold, ranging from 0.2–33%, be produced from renewable sources.[105] A few, like Iowa, specify an absolute amount of renewable power to be sold.[106] Each state defines what sources qualify and most allow parties to produce Renewable Energy Credits that can be bought and sold by companies seeking to meet their mandates.[107] While RPSs have been supported as a way to reduce greenhouse gas emissions, reduce conventional air pollution, and reduce the need to manage nuclear power and nuclear waste, the primary motivations have been promoting economic development and increasing reliability.[108]

In addition to RPSs and Renewable Energy Credits, other steps can be taken to encourage the development of green energy markets. Taxes, for example, can ensure that more of the real costs of using fossil fuels are reflected in their prices. Utility planning requirements can remove disincentives that keep utilities from investing in renewable energy and energy efficiency projects, and they can encourage energy users to determine true costs of energy use.[109] For example, requirements that utilities purchase

---

[101] *Id.*

[102] Ctr. for Renewable Energy & Sustainable Technology, Renewable Energy Policy Project, Renewable Portfolio Standards, http://www.crest.org/rps/index.html (last visited Jan. 29, 2007).

[103] BARRY G. RABE, RACE TO THE TOP: THE EXPANDING ROLE OF U.S. STATE RENEWABLE PORTFOLIO STANDARDS 3, 4 tbl.1 (2006), *available at* http://www.pewclimate.org/docUploads/RPSReportFinal%2Epdf.

[104] *Id.* at 3.

[105] *Id.* at 4 tbl.1.

[106] *Id.*

[107] *Id.* at 5.

[108] *Id.* at 6.

[109] EPA, CLEAN ENERGY-ENVIRONMENT GUIDE TO ACTION, *supra* note 88, at 6-26.

the cheapest power available, in markets where the environmental costs of fossil fuels are not reflected, lead to more use of coal fired power plants than would occur if effective market forces were in place.[110]

In order to achieve the broad goals just outlined, we need to develop specific short-term goals and benchmarks that will ensure progress. A sustainable energy policy should include energy efficiency, renewable energy, and combined heat and power. These can be designed and implemented immediately, with specific benchmarks in place. New investments will take time, and a full transition to sustainability could take decades, but consistent progress must be made. These benchmarks should include targets for energy savings in public buildings and renewable and efficiency purchase commitments for public facilities. Efficiency standards for appliances and energy efficiency targets for energy providers should also be set. And we must encourage governments at all levels to play a role in bringing about incremental changes. For example, building codes can include energy efficiency requirements. Finally, developing future short-term goals and benchmarks will require planning, and this in turn requires that we track and measure our progress. This could be facilitated by requiring sources to track and report emission reductions. Public funds, including tax incentives, grants, and rebates, will be needed to support all of these energy efficiency and planning efforts.

These steps would not only help us move toward the goal of ecological sustainability; they would also help states achieve cleaner air and comply with their Clean Air Act obligations. States can use clean energy investments as emissions reduction measures in their implementation plans under the Clean Air Act.[111] For example, states are required to implement quickly the new air pollution standards for fine particulate pollution. In 2004 and 2005, the EPA identified and designated areas that were not in attainment with national standards (NAAQS) for fine particulate pollution, also referred to as PM 2.5.[112] In September 2005, the EPA issued a proposed rule to implement the PM 2.5 NAAQS; for

[110] *See id.* at ES-6 to ES-10.

[111] *Id.* at ES-12.

[112] *See* EPA, Fine Particle (PM 2.5) Designations, http://www.epa.gov/pmdesignations/regs.htm (last visited Jan. 29, 2007).

areas not in attainment, the proposed rule calls for states to submit implementation plans for achieving the new standard. These state plans are due in April 2008 and states are to meet the PM 2.5 standard by 2010.[113] By investing in energy efficiency and renewable energy, states will put themselves on a path toward meeting this obligation.

This kind of an approach to energy policy will produce nation-wide benefits by reducing the threat of a massively disruptive climate change, improving air quality, creating jobs in energy conservation and renewable energy production, and stimulating technological innovation that can be marketed around the world. Developing renewable technologies would position U.S. companies for economic opportunities in the future. Because renewable energy sources are, by definition, inexhaustible, communities that foster renewable energy will be well positioned for the future. Renewable energy sources that consume low volumes of water ensure that more of this precious resource is available for other uses. These environmental and economic benefits will be particularly important in the western United States. Although there will still be conflicts between land preservation and the development of wind, solar, geothermal, and other resources, the move toward sustainability will help preserve western wild lands. By easing the pressure to develop western fossil fuel resources, a sustainable energy policy will significantly increase the ability of westerners to protect the wild lands, national parks and monuments, and open spaces that are central to the Amercian West's unique identity. Of course, this dramatic benefit accrues not only to the region, but to the nation as a whole.

### B. *Transforming Energy Politics*

Despite growing warnings of the seriousness of climate change, the national security costs of reliance on imported oil, and projections of increasing energy use from economic and population growth, national policy makers have continued to press for irrationally modest actions. While Republicans in Congress have rolled back some subsidies to oil companies and extended tax credits for purchasing fuel-efficient vehicles, they have focused on

[113] *See* EPA, Proposed Rule to Implement the Fine Particle National Ambient Air Quality Standards, 70 Fed. Reg. 65,984 (proposed Nov. 1, 2005) (to be codified at 40 C.F.R. pt. 51–52).

opening the Arctic National Wildlife Refuge and increasing incentives to build new refineries and explore for new oil. Democrats have proposed a modest set of policies of their own, including increasing subsidies for renewables, expanding the number of alternative-fueled vehicles, and restoring financial assistance to low-income Americans to help them pay for rising energy costs.[114] In the spring of 2006, when gas prices spiked, policy makers from President Bush down focused attention on the need to reduce oil imports. But instead of looking for steps toward a real, long-term solution, congressional Republicans proposed giving American drivers $100 each to help with gas prices, and Democrats suggested a 60 day suspension of the federal gasoline tax.[115]

Despite increasing urgency, Republicans appear unwilling to take on oil and gas companies, and Democrats appear unwilling to challenge auto companies and their workers. If anything, the political stagnation has gotten worse. While Republicans have long been staunch opponents of most regulatory initiatives in this area, Democrats used to favor at least some. In 1990, for example, almost three-fourths of Senate Democrats voted for a bill that would have required auto manufacturers to meet, in effect, a 40 mpg average fuel economy standard for passenger automobiles by 2001 (up considerably from the current 27.5 mpg standard);[116] a 2005 proposal to require a 40 mpg average by 2016 garnered about half of the Democrats.[117]

The timidity of Democrats, focusing on reducing gas prices and somehow increasing energy independence, demonstrates that, like Republicans, they have failed to grasp the nature of the energy challenge we face. The conventional wisdom used to be that the

[114] Michael Janofsky, *Democrats Offer Alternative to Republican Energy Plan*, N.Y. TIMES, May 18, 2006, at A23.

[115] Thomas L. Friedman, Op-Ed., *Let's (Third) Party*, N.Y. TIMES, May 3, 2006, at A25.

[116] *See* S. 1224, 101st Cong. § 9(a) (1990) (requiring a 40% increase in average fuel economy); 136 CONG. REC. 25,642 (1990) (recording the vote against closing debate on S. 1224); Richard L. Berke, *Bill to Raise Cars' Fuel Efficiency Dies with Senate Vote on Debate*, N.Y. TIMES, Sept. 26, 1990, at A12 (explaining that S. 1224 would have had the effect of raising efficiency from about 27.5 mpg to about 40 mpg and that the vote against closing the debate was, in effect, a vote to "kill" the measure).

[117] 151 CONG. REC. S7105 (2005) (recording Sen. Durbin's proposed amendment to the bill H.R. 6); 151 CONG. REC. S7263 (2005) (recording the vote against the amendment).

legislative process was purposely and wisely designed to make passing major laws difficult and that emergencies were typically required before dramatic policy shifts could occur. But after September 11th, Hurricane Katrina, the explosion of gas prices, the Iraq War, growing tensions with Iran, and other crises have amply demonstrated the consequences of our reliance on fossil fuels and on imported fuels in particular, we may have reason to worry that the political system cannot even respond effectively to a crisis. We appear to be paralyzed, unable to act even as we see evidence that our future will likely be torn apart by economic and ecological crises if we don't.

The problem is not a lack of technologies or programs but a refusal to make the difficult political choices. This is also not a choice between markets and politics; most of the policy changes that are required to produce an ecologically sustainable energy system can be achieved by changing prices and market incentives. Developing western fossil fuel sources will produce substantial short-term benefits, quickly and temporarily addressing national security concerns, promoting economic growth, and promising a new round of economic benefits to western communities. While a major shift toward energy efficiency and renewable energy sources promises greater benefits to the West and the nation as a whole over the long-term, achieving those benefits will require steps that are disruptive and harmful to the profits and prospects of fossil fuel industries. Aggressive long-term goals, once set, can reduce the political pressure for taking the short-term actions that are essential for achieving the future goals as politicians claim credit for taking action but escape imposing unpopular measures that affect voters immediately.

This barrier is obvious and well-recognized, but as the need for policy change becomes more compelling, the powerful grip these interests have on policy making may loosen. One way to help break through the logjam is by constructing a series of grand policy compromises that include increased domestic production, energy efficiency, and renewables. Ronald Brownstein's political commentary nicely summarized the situation: "The key to greater energy independence isn't so much a scientific breakthrough as a political accommodation between the forces supporting more domestic production and those focused on greater conservation. And that won't come without the kind of hardball bargaining so far missing."[118] Some decisions, such as a commitment to build only those coal fired power plants that employ the best clean coal technologies available, are essential. Given the environmental costs of traditional coal combustion, no compromise is rational. But for most energy decisions, hardball bargaining is required. Every policy aimed at increasing domestic energy production, for example, must be matched by major commitments to improve efficiency and invest in renewables. Expanding nuclear power can be part of the bargaining if we can find acceptable solutions to the problems of disposing of nuclear waste, effectively securing materials, and reducing the tremendously high costs of constructing new plants. We will need to employ all forms of current energy production and conservation technologies in order to meet national and global needs. Energy policy requires comprehensive, integrated efforts that link actions by all levels of governments and by all energy producers and consumers.

A variety of values can contribute to the political will for transforming energy production. For some, national security is the key driver. For others, it's ensuring the preconditions for economic growth and preserving environmental quality, which are clearly in our self interest. Ethical obligations to future generations and to those who currently live in poverty throughout the world can also drive effective energy policy, as can religiously-rooted commitments to planetary stewardship and caring for creation. The way in which we produce and use energy permeates our lives, and transforming that production and use will require a similarly broad set of actions. We are likely to fall short of the kind of transformation compelled by the idea of ecological sustainability. So we will also have to turn our attention to the great challenge of adapting to a less hospitable climate and a more constrained set of energy options. However, the sooner we take action, the more choices we will have available to make that adaptation a little less painful and disruptive.

[118] Ronald Brownstein, *Senator Could Play a Smarter Hand on Energy*, L.A. TIMES, Mar. 19, 2006, at A18.