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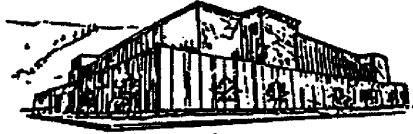
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**Energy Policy and Climate Change: A comparison of American
and European energy policy.**

By

Meagan M. Conry

B.A. Xavier University, Ohio. 2000

Presented in partial fulfillment of the requirements for the degree of

Master of Science


University of Montana

June 2004

Approved by:


Chairperson

Dean, Graduate School:



Date:

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Energy Policy and Climate Change: A comparison of American and European energy policy.

Chairperson: Hayley Hessel



ABSTRACT

Standards of living are fundamentally correlated with energy use, particularly the use of fossil fuels. In general, countries with high levels of per capita energy consumption have higher productivity and gross domestic product (GDP) as broadly evidenced by the United States and the European Union (Ferguson et al. 2000). Due to growing populations and economic advancement, energy consumption in developing countries is growing, thus increasing the total global demand for energy. The US and EU are concerned with securing their energy supply for the future. Historically, such growing demand has not been problematic; however, the cumulative effects of burning fossil fuels are being manifested as global climate change. This paper examines energy policy in the United States and European Union to assess whether energy policy is consistent with environmental policy. I examine the supply and demand of energy and energy policies designed to address environmental problems. My findings indicate that the EU has a more successful policy to reduce carbon dioxide emissions. While the US is making progress in this area, current policy instruments have done little to lessen carbon dioxide emissions.

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INTRODUCTION

A strong correlation exists between energy availability and standards of living; countries with high levels of fossil fuel consumption have higher productivity, larger GDP, and higher quality of life, as evidenced in the United States and the European Union (Ferguson et al. 2000).¹ The EU and US are demanding more energy each year, as are developing countries, whose populations and economies are growing rapidly. The escalating demand for and use of energy is problematic because it contributes to global warming. Although the science of global climate change is highly contentious and particularly difficult to address at smaller scales, scientists widely agree that human behavior is accelerating climate change. The potential impact of these changes is tremendous in the long run, given that the world's ecosystems and economy are fine-tuned to the current climate. Hence, much of the concern regarding climate change is over socioeconomic stability (Dotto 1993).

Research regarding energy policy has largely centered on examining individual policy mechanisms. Much research has examined regulations and incentives, looking at the effectiveness of such policy options. A large body of research is devoted to the use of incentives in energy conservation; Hutton and McNeill (1981), Hahn and Stavins (1992), Foster et al. (1998) and Krause et al. (2002) all discussed the value of using economic incentives to promote energy efficiency. Barthold (1994) researched various issues affecting the design of environmental excise taxes, and Rouwendal and de Vries (1999)

¹ For the purpose of this paper, I used GDP as a measure of economic health over other indicators (such as the UNDP quality of life index) because other indicators include factors such as literacy rates, which are outside the scope of this paper.

examined how taxes influence driving. While valuable, this research is frequently limited to a specific study area, and one particular program.²

Literature on renewable energy has largely focused on dissemination techniques, market competition, and feasibility. Menanteau et al. (2003) discussed different incentive schemes promoting renewable energy, finding that some methods might be better than others, though data cannot yet indicate long-term success. Meyer (2003) looked at several promotional models for renewable energy; he provided a survey of some popular European approaches, and cautioned against emphasizing free trade at the expense of long-range planning.³

Research pertaining specifically to energy policy and climate change is relatively limited, though Jean-Baptiste and Ducroux (2003) has written on the role of policy in climate change, and other literature details environmental factors (such as climate change) as driving forces behind energy policy (Black 2003, Krause et al. 2002; 2003).

The effectiveness of energy policy has not been widely examined in the literature to date, and international policy comparisons are very rare. There are several reasons for this. First, many policies are relatively new, and have not yet produced results. Second, establishing a causal relationship between policy and data is difficult. Policy studies can determine associations, but establishing a statistical cause and effect relationship between energy policies and outcomes has not been done. Third, most policies are significantly limited in application, making comparison of similar policies between regions difficult.

² For other articles on energy policy and specific approaches, see: Dinica and Artensen (2003), Menanteau et al. (2003), & Nivola (1993).

³ For more articles on policy pertaining to renewable energy, see: Foster et al. (1998), Herzog et al. (2001), Kreith et al. (1996), Klass (2003), Nielsen and Jeppensen (2003), & Gutermuth (2000).

The lack of long-term studies and comparative work is unfortunate; as such research is valuable in determining the relative efficacy of various energy policies. Furthermore research could provide policymakers and industry with successful policy instruments for the future.

The EU and US both seek to secure energy supplies to meet future demands yet not contribute to climate change. Energy policy has been written to balance growing energy demands with CO₂ reductions through efficiency improvements and renewable resource development. The objective of this paper is to determine whose energy policy better addresses climate change through achieving carbon dioxide (CO₂) emissions reductions. I examine the American and European policy approaches to ensuring energy supplies that mitigate increasing CO₂ emissions, based on the assumption that both regions are working to increase their energy supply and curb CO₂ byproducts.⁴

In particular, I highlight American and European strategies to improve efficiency in transportation and utilities sectors, and steps to increase the use of renewable resources in energy production. Some of the approaches are similar, while other approaches are vastly different between the regions. After providing an overview of specific selected energy policies with respect to transportation and utilities, I discuss the potential of the American and European plans to meet energy needs without further exacerbating climate change.

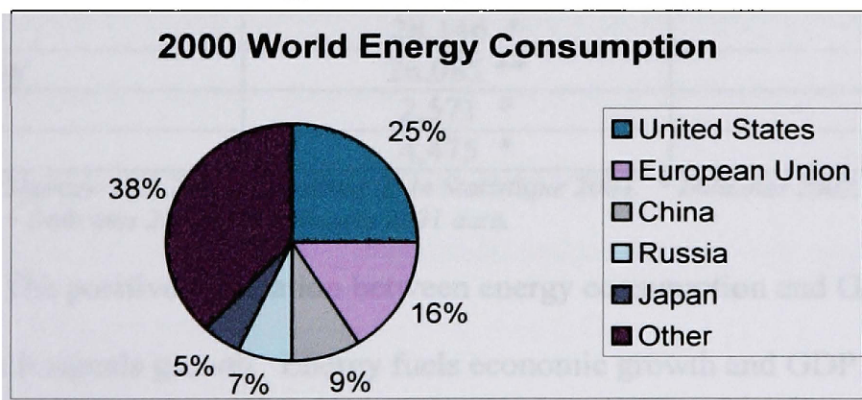
⁴ The EU has built climate change into European energy policy: “Efforts will have to focus on orienting the demand for energy in a way which respects the EU’s Kyoto commitments and is mindful of security of supply.” (European Commission 2000). The US policy also voices concern about the environment and climate change: “The US recognizes the seriousness of this global issue...The United States is making progress in reducing emissions of greenhouse gases...America must have an energy policy that plans for the future, but meets the needs of today. I believe we can develop our natural resources and protect our environment.” (National Energy Policy Development Group, 2001).

BACKGROUND

Energy consumption has increased over the last century, establishing a trend that is projected to continue due to economic and population growth. Based on current projections, it is clear that in the next decade, energy consumption is going to increase at a rate previously unmatched, by some accounts tripling by the year 2050 (Wirth et al. 2003).

Currently, industrialized countries consume the largest proportion of total energy produced. The US and the EU are the world's first and second largest energy consumers, with the United States consuming 98.8 quadrillion British thermal units (Btu) of energy, and the European Union consuming 63.3 quadrillion Btus annually (EIA 2002a). Figure 1 illustrates the breakdown of energy use: the United States uses 25%, and the European Union 16% of total world energy consumption.

Figure 1. World Energy Consumption



Source: EIA 2002a.

The combined populations of the US and EU total about one billion people and account for more than 40% of the world's energy consumption (UN 2003). In contrast, China, with a population of 1.3 billion, uses 9% of global energy (UN 2003). Table 1 shows this relationship on a per capita basis.

Table 1. Energy Consumption Per Capita

Nation	Energy Consumption per capita, 2001
US	341.8 million Btu
EU	168 million Btu
China	28.8 million Btu

Source: EIA 2002a, 2002b.

The difference in energy use between industrialized and developing countries becomes more apparent when looking at per capita data in relation to GDP. Annually, the average American uses almost 12 times the energy that an average Chinese citizen uses. Typically, the wealthier, industrialized nations have much higher energy consumption than developing nations. Table 2 compares per capita GDP with per capita energy consumption.

Table 2. Per Capita GDP and Energy Use

Nation	Per Capita GDP (in US \$)	Energy Use Per Capita (in million Btu)
United States	37,784 **	341.8 ++
United Kingdom	28,783 **	166.1 +
France	28,146 *	177.8 ++
Germany	26,085 **	170.4 +
India	2,571 *	12.6 ++
China	4,475 *	28.8 ++

*Sources: EIA 2002a-d, Institut de la Statistique 2004. * Indicates 2002, ** indicates 2003 data. + Indicates 2000, ++ indicates 2001 data.*

The positive correlation between energy consumption and GDP is very important because it signals growth. Energy fuels economic growth and GDP. A high GDP per capita drives consumer demand for goods and services; as GDP increases, these consumptive demands increase, fueling more economic growth. Energy consumption is not increasing just in the industrialized world though. Developing countries account for

77% of the world's population and 90% of its total population growth. As these countries increase GDP, they demand more energy (Van DeVeer and Pierce 2003).⁵

Presently, two billion people do not yet have access to electricity; most of who live in developing countries (Galiteva 2003). The expectation is that the population of the 50 poorest nations will triple in size over the next 50 years, thus increasing energy demand (Wirth et al. 2003). Though per capita energy consumption in developing countries is currently only one-tenth of that in rich nations, it is doubling every fifteen years, with the expectation that per capita consumption will increase fivefold over the next thirty years. This suggests that developing countries will soon be the largest energy consumers in the world (Anderson 1996).

Meeting these growing energy needs raises international concern. The US and the EU may be adversely affected as energy competition increases. The magnitude of these effects, however, is uncertain, as the rates of fossil fuel depletion vary between sources. Campbell and Laherrère (1998) argue that global production of oil will peak in the first decade of the 21st century. Based on 2001 consumption levels, the Society of Petroleum Engineers (2002) puts the current reserves at about 44 years of oil and 65 years of gas. Chris Hayes, an oil-engineering consultant, argues that reserves could provide fuel for another 100 years (Smale 2004).

Experts suggest that energy prices are expected to increase as easy-to-obtain resources are reduced, and/or supply problems are encountered (Bent et al. 2002). Joseph Quinlan argues that the recent increases in US oil and gas prices are an early indication of

⁵ In addition to population growth, the economies of the larger countries (China and India) are growing quickly. Central Intelligence Agency data indicate that the real growth rate of China's GDP was 8% in 2002; India's real GDP growth rate was 4.3%. In contrast, the US had a real GDP growth rate of 2.4% in 2002, and France had a real GDP growth rate of 1.2% (CIA 2003).

a longer-term trend caused by China's growing consumption. As growth in demand outpaces production, energy prices will rise (Hill 2004).

Scarcity has inspired technological development and substitution in the past. The rising prices of copper and aluminum prompted the switch from copper cables to fiber optics, and a reduction of aluminum in cans by 32% in the 1960s and 70s (Anderson and Leal 2001). Scarcity and technological advance influence each other (Van DeVeer and Pierce 2003). Economic theory suggests that technological advances in energy production and conservation will likely spur economic growth contributing to a higher standard of living as fossil fuels become scarcer and more costly.

As of yet, relatively low fossil fuel prices paired with relatively abundant resources have provided little incentive for producers to improve or adopt new technology. Producers traditionally benefited from extensive government protection from competition; consumers have traditionally benefited from price caps. These distortions in conjunction with collusion and illegal behavior by energy producers and distributors mean that technological development of alternative energy sources has been slow (The Economist 2001). Furthermore, relatively low prices in the US suggest market failure has occurred in the form of externalities; pollutants (such as CO₂) are emitted without being accounted for in transactions costs.

An externality is a third party cost or benefit not included in production or consumption decision-making. In the case of energy consumption, negative externalities occur when the costs of global climate change are not reflected in the final price of energy. One of the major pollutants emitted during fuel combustion is carbon dioxide. It is widely accepted that carbon dioxide is the primary contributor to global warming.

According to the US Environmental Protection Agency, human activities have altered the chemical composition of the atmosphere through the buildup of greenhouse gases – primarily carbon dioxide, methane, and nitrous oxide. The heat-trapping property of these gases is undisputed; since the beginning of the industrial revolution, the atmospheric concentrations of these three gases have increased dramatically, with carbon dioxide concentrations increasing nearly 30% (EPA 2004).

As a result of increased greenhouse gases, average global surface temperatures have increased by 0.6°C over the 20th century.⁶ Nine of the ten hottest years recorded since 1860 were between 1990-2002 (DEFRA 2004). While climate follows natural cycles, scientists expect that the average global surface temperature could rise between 0.6°C –2.5°C in the next fifty years, and between 1.4°C – 5.8°C in the next century (EPA 2004). Studies of this warming trend indicate that it is statistically significant and is “unlikely to be entirely natural in origin” (DEFRA, 2004).

The increase in CO₂ concentration is attributed chiefly to the combustion of fossil fuels (EPA 2001, EPA 2004).⁷ Twenty-three billion tons of the approximate 29 billion tons released annually come from fossil fuel combustion. If this trend remains unchanged, CO₂ emissions are forecasted to exceed 50 billion tons annually by the year 2050 (Jean-Baptiste and Ducroux. 2003).

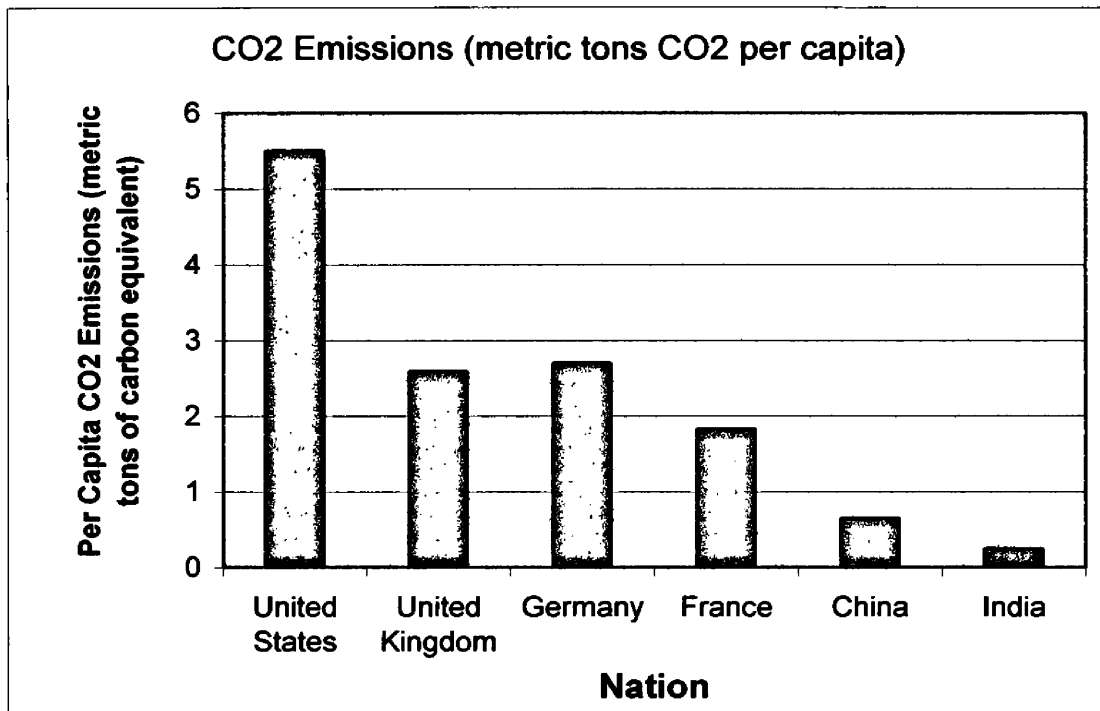
The EU and US are the world’s largest producers of CO₂ emissions. The US emits approximately twice the amount per capita as European countries, and approximately 11 times the amount emitted by China. If developing countries increase

⁶ This is +/- 0.2 °C.

⁷ Anthropogenic activity is believed to be the primary cause of the increase in greenhouse gas concentrations. The combustion of fossil fuels is responsible for 98% of US CO₂ emissions, 24% of methane emissions, and 18% of nitrous oxide emissions; however, other factors such as increased agriculture, industrial production, and deforestation play a role as well (EPA 2004).

their CO₂ emissions to American or European levels, climate change is expected to accelerate. Figure 2 illustrates the difference in per capita carbon dioxide emissions between industrialized and developing countries

Figure 2. Carbon Dioxide Emissions Per Capita



Source: EIA 2002a, 2002b, 2002c

Climate change will be problematic on several fronts. Water levels and weather patterns are expected to change, as temperatures increase in some regions and decrease in others. As such, climate change may have a profound effect on food production and natural disturbance regimes (such as fire and drought cycles).

Both the EU and the US propose energy policies to guarantee a steady energy supply, while curbing carbon dioxide emissions. The goals of the policies are the same, but the approaches, somewhat different. The following section illustrates the similarities and differences in policy by looking at the transportation and utilities sectors.

POLICY

Policy mechanisms can be used to alter behavior to reduce carbon dioxide emissions. Regulatory and incentive-based policies are two predominant options. Regulations are typically implemented when expected market failure would prevent other policy from meeting environmental objectives (World Energy Council 2001). The regulatory approach is based on limits and restrictions. In contrast to regulation, incentives encourage particular behavior through economic instruments that leave participants with more choices. Incentives can be positive or negative: positive incentives reward favorable behavior, while negative incentives are designed to deter unfavorable behavior. Incentives may include tax rebates, investment subsidies, guaranteed pricing, etc.

Policies affect market supply and/or demand. In the case of energy policy, the US policy largely attempts to manage energy and product supply, while the EU centers its policy on managing consumer demand. This section will discuss policy efforts by both the US and EU, looking at how they are managing producers and consumers. The policies discussed here are centered on the transportation and utilities sectors, because these two sectors are the largest contributors to climate change in both regions (DOE, 1997). The first section examines policy aimed at supply/production. The following section looks at policies influencing demand/consumption.

Transport - Production Policies

The transportation sector accounts for two thirds of the oil consumed in the US (Wirth et al. 2003); likewise for the EU (EU 2004). In both the American and European

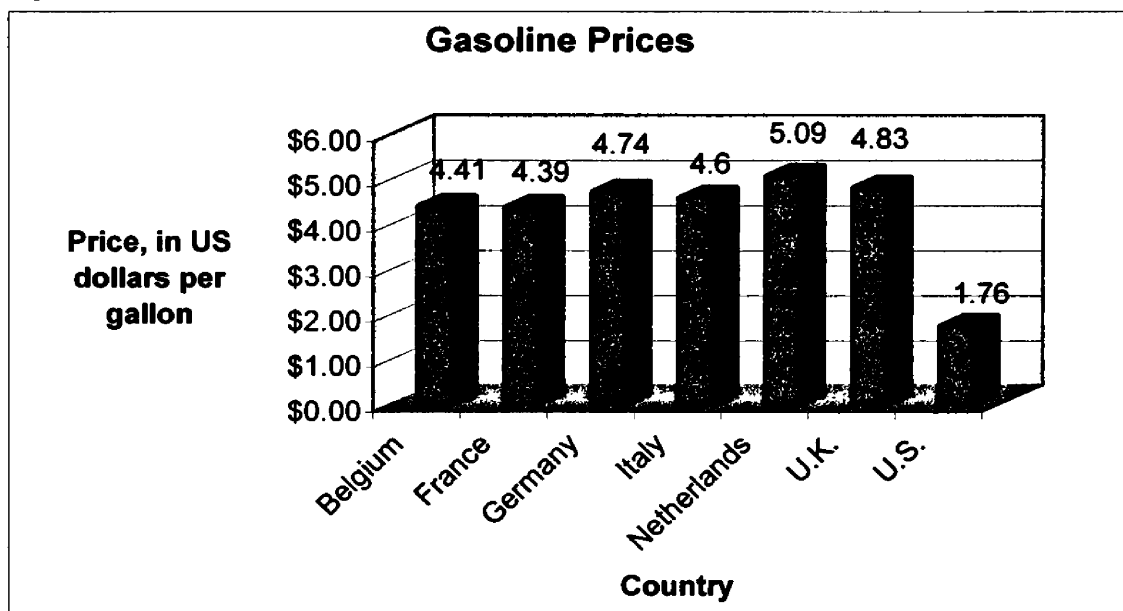
transportation sectors, the majority of oil resources is consumed by passenger travel via car, motorcycle, and light truck (ECDGET, 2003). Because motorized travel accounts for a large proportion of CO₂ emissions, it is believed that improving fuel economy will reduce overall CO₂ emissions. American efforts to improve fuel economy mandate minimum standards to automobile manufacturers, affecting the supply of cars available to consumers. European efforts to improve fuel economy focus on influencing consumer demand for fuel.

When the US Congress passed the Energy Policy and Conservation Act of 1975, it established the Corporate Average Fuel Economy (CAFE) program. CAFE required automobile manufacturers to increase the sales-weighted average fuel economy of the passenger car and light-duty truck fleets sold in the US. This regulatory approach has been criticized, as the CAFE standards have not resulted in higher demand for fuel-efficient vehicles. Increasingly more Americans are purchasing sport utility vehicles (SUVs), which fall under the “light-duty truck” category, rather than the “passenger car” classification. In the US, the light truck market share increased from 22% to 50% of total vehicle sales between 1980 and 1999 (Alliance of Automobile Manufacturers 2004).

Fuel economy is only one of many features that American consumers are looking for. Trucks and sport utility vehicles, for example, have low fuel economies, yet offer a luxury image, more size, and frequently more power - tradeoffs Americans readily make, given the relatively low price of gasoline. The United States has some of the lowest fuel prices among oil importers; prices have always been significantly higher in Europe than in the US. The American average retail price in October 2003 was \$1.76 USD per gallon. The average retail price in the UK was \$4.83 USD per gallon during the same week. The

British price is almost three times (274%) higher than the American price for unleaded gasoline. Figure 3 demonstrates the difference in gasoline prices between the US and European countries.

Figure 3. European and American Gasoline Prices



Source: EIA, 2003a. Prices are the weekly average of the week of October 20, 2003.

Transport - Consumption Policies

Aggressive taxation in the EU causes gasoline prices to be higher than in the US, with gasoline being the most expensive in the Netherlands and the United Kingdom, and least expensive in the United States. In the EU, 75% of the average retail price of gasoline is tax – excise and value-added tax (World Energy Council, 2001). In the United States, only 25.7% of the average retail price is tax – federal and state tax (API 2004).

Taxes on road fuels in the EU serve two purposes. First, the tax is expected to change consumer behavior, reducing the use of personal automobiles. The second aim of fuel taxes is to raise government revenue (Smith 2000). Previous studies illustrate that

countries with high gasoline taxes tend to have high average vehicle fleet efficiencies (EIA 2003b). The fuel economy of vehicles in the US and Canada improved markedly after the oil shocks of 1973 and 1979. However, the fuel economy of automobiles in the European countries was higher between 1973-1991, and remains so today (EIA 1998a). The US Environmental Protection Agency (EPA) states that the average fuel economy of the American passenger car has declined almost 7% between 1987 and 1997 (EPA 2000b).

The average fuel economy is higher in the EU than in the US largely because Europeans purchase more small cars than Americans. A recent report from the Alliance of Automobile Manufacturers states that small cars make up 64% of all new car purchases in Europe, while in the US, small cars account for only 29% of new car purchases (AAM 2004). In addition, advanced diesel technology has better fuel economy than gasoline engines. In Europe, 29% of light-duty motor vehicles are diesel-fueled, while in the US, only 1% of light-duty motor vehicles are diesel (AAM 2004). The difference in consumer choices between the US and the EU can be attributed in part to the higher cost of driving in Europe. As such, efficiency is a more important attribute in European lifestyles than in North America, and an International Energy Agency report suggests that European countries are more aware of, and sensitive to, global warming issues than the US (IEA 2000). While driving more fuel-efficient cars certainly cannot account for all of the differences between the EU and US, it will help explain CO₂ trends discussed later in this paper.

Efforts to offset CO₂ emissions are important as the demand for personal vehicles is on the rise in both the US and the EU (EU 2000). As such, both regions are taking

steps to encourage consumer demand for hybrid and alternative-fuel automobiles. Both the US and EU are promoting hybrid technology through tax incentives, believing that this will increase demand for hybrid cars.

Americans purchasing a qualified hybrid gas-electric car are eligible for a tax deduction. This one-time deduction must be taken in the tax year that the vehicle was originally used, and the taxpayer must be the original owner of the car. The deduction applies to IRS-certified hybrid cars, currently several Honda and Toyota models. However, the hybrid vehicle tax reduction is being phased out. The full \$2000 deduction may be claimed only if the vehicle was used prior to the end of year 2003. For 2004, the vehicle deduction will be \$1500; this will be reduced incrementally until the tax deduction program expires in 2007 (IRS 2004).

While tax deductions can influence consumer behavior, the \$2000 deduction is too small relative to the higher price of the hybrid vehicles to prompt a large market response. Comparing some prices among Toyota models illustrates how the deduction fails to provide upfront purchase savings. The baseline manufacturer's standard retail price (MSRP) for the Toyota Corolla is \$14,085. The Toyota Prius, eligible for the tax deduction, is priced at \$20,510. Therefore, the \$2000 deduction reduces the price only 9.75%. After savings, the Prius costs \$18,510, still almost \$8000 more than the Toyota Echo. Table 3 details the price differences among models.

Table 3. Toyota Model Cost Comparisons

2004 Model	Baseline MSRP (actual retail price may vary)
Toyota Prius (<i>eligible for deduction</i>)	\$20,510
Toyota Corolla	\$14,085
Toyota Echo	\$10,730
Toyota Camry	\$19,560
Toyota Celica	\$17,905

Source: Toyota, 2004.

France, like the US, offers a tax credit for the purchase of a hybrid vehicle or a vehicle fueled by natural gas or liquefied natural gas (IEA 2002b). The French tax credit originally offered an additional credit if the purchase coincided with the scrapping of an older vehicle (prior to the requirement of the catalytic converter, 1992). This credit was instituted in 2002 to be effective through 2005, though it may be extended beyond 2005 (IEA 2002b).

In the EU, taxes incurred on the purchase of automobiles are higher than in the US. In an effort to promote vehicles with a high fuel economy/low CO₂ emissions rate, EU members have reduced or eliminated various vehicle taxes based on CO₂ ratings. In the UK, the vehicle excise duty (VED) has been determined by the vehicle's fuel type and CO₂ emission figure since March 2001. Cars with better fuel economies will pay up to £65 per year (\$37) less than vehicles requiring more of the same type of fuel (Department for Transport 2002).

Sales tax reductions and exemptions will help bring hybrid vehicle costs in line with the comparable conventional vehicle costs. It is questionable whether or not these tax benefits are significant enough to keep prices comparable. Whether these efforts are being introduced and eliminated too rapidly also remains to be seen.

Minimum fuel economy standards, road fuel taxes, and hybrid car incentives are the predominant approaches to energy conservation and emissions reductions in the

transport sector. Approaches not discussed in this paper include road pricing (toll roads), biofuel programs, and public transportation improvements and incentives. These models are newer, and have not been widely or uniformly adopted, limiting the potential for international comparison.

Utilities Policies

The utilities sectors in the US and EU are also energy intensive. In the EU, the largest energy consumers are households and the tertiary sector (Commission of the European Communities 2000). In the US, over one-third of all primary energy consumption is for the production and delivery of electricity (EIA 1998b). As such, the American and European energy policies are geared to conservation and developing new renewable fuel sources.

Market structure with regards to supply plays a vital role in determining the success of energy policy aimed at the utilities sector. Traditionally, the utilities sectors in the US and the EU benefited from extensive government protection. The monopolistic nature of energy production has begun to change though, as both the US and EU agree that increasing competition is an important step to achieving greater energy efficiency. Open markets are vital to providing a dispersal mechanism for alternative energy. The deregulation of utilities (particularly the electricity market) has been controversial and challenging in both regions and has encountered mixed results.

The European Commission identified competitiveness as one of its three primary energy concerns (EU 2004). In 1996, the Commission adopted a directive for the Internal Market for Electricity, which established various targets for opening markets. This agreement concludes by 2007, when all member nations are expected to have their

electric markets 100% open (Smith 2003). Currently, five of the fifteen EU member countries have open markets: Germany, Austria, the UK, Finland, and Sweden. The remaining ten countries have at least 33% of their markets open. The directive's goal will mean that in 2007, all large and medium-sized purchasers of electricity will be able to choose a supplier from any country in the EU (Smith 2003).

Deregulation has significantly affected the electricity market in the EU, adding more power grids and causing electricity prices to drop. In the year Germany deregulated, household consumers saw electricity prices drop 30-50% (Andrews 1999). Though price changes did not occur as quickly as in Germany (*Daily Policy Digest* 2001), electricity prices in the UK dropped 21-23% in real terms between 1990-99 (Whitwill 2000). The primary challenge Europe faces with deregulation is capacity surplus, which creates fears that European energy generation could fall into a boom and bust cycle.

The American deregulation efforts began in 1978 with the Natural Gas Policy Act and the Public Utility Regulatory Policies Act, which lifted price controls on natural gas and allowed growth of non-utility generators. In 1992 and 1997, further steps lifted controls on the utilities industry, unbundling services in natural gas pipelines and opening access to the electricity transmission networks. The results of limited deregulation varied regionally, resulting in both price increases and decreases, and supply interruptions. California encountered critical problems in 2000-2001, when its power crisis resulted in high power prices and rolling blackouts as it transitioned to an open electric market.⁸ As California was facing power losses and increased prices, however, deregulation in the

⁸ The electricity market in California was not completely deregulated, however, as price caps were put into effect, the state employed surcharges, and new facilities were slow to be built due to extensive environmental regulations.

Midwest resulted in a power surplus and lower prices. Largely due to California's experience, price instability, and shifting political pressures, deregulation in the US has essentially stalled, with only 18 states actively restructuring.⁹

The US and the EU face similar challenges to liberalization. Different states in the US and different member nations of the EU are at varying stages of market liberalization. While the EU has made greater relative progress, some members are hesitant to open their markets; notably France, who did not pass legislation to open its electric sector until a full year after the EU deadline (Smith 2003). Changing political priorities in the US, along with fears that the California power crisis could be repeated elsewhere, have reduced interest in deregulation among the many regulated states.

The advantage to deregulated power markets is that more competitors and more power sources have access to power grids. Highly protected utilities markets currently prevent new competitors from gaining access to the public grids. As such, new producers have no means to deliver energy, and therefore little incentive to develop new production technology. The hope is that open markets will allow more competition between power producers and providers, and cultivate an active market for green power.

Open power markets can have some disadvantages to climate change mitigation, however. In both the US and the EU, the lower cost of energy provides a disincentive to production, particularly where revenues are insufficient to cover operating costs. Lower retail prices can also provide disincentives to conserve. It is difficult to gauge the long-term success of energy deregulation, as the deregulation process is inherently difficult.

⁹ The 18 states actively restructuring their electricity markets are: Arizona, Connecticut, Delaware, District of Columbia, Illinois, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, & Virginia. List current as of February 2003, Energy Information Administration. Online: http://www.eia.doe.gov/cneaf/electricity/chg_str/regmap.html. Accessed 4/15/04.

However, the success in energy deregulation will influence the success of developing renewable resources in both regions.

Utilities Efficiency Policies

The American national energy plan states that renewable fuels offer hope for the future, but that the US must continue meeting its energy requirements by the means currently available (National Energy Policy Development Group 2001). Energy conservation through efficiency improvements can extend the life of traditional fuel reserves while new technology is developed. Energy efficiency improvements come from technological advance. High energy prices during the 1970s and 1980s helped spur new technology, and some recent legislation has been proposed to prompt product development (Nivola 1993, Runci 1999).¹⁰

The Environmental Protection Agency (EPA) instituted the Energy Star Program in 1992, which is a voluntary labeling program identifying products meeting energy efficiency requirements. Computers and monitors were the first to be labeled; the Energy Star label is now found on an array of products including major appliances, equipment, new homes, and industrial buildings built to code (EPA, 2000a). Energy Star is largely about directing private capital into more energy efficient investments. The program provides product information to industrial and household consumers, stressing the savings on energy bills resulting from purchasing the more efficient product.

A distinct problem with the program, however, is that while it promotes long-term savings on energy costs, many of the products with the rating (household appliances, in particular) have significantly higher prices. An EPA publication estimates that a home

¹⁰ For more information on American energy legislation, see the US Senate Committee on Energy and Natural Resources website: <http://energy.senate.gov/legislation/legislation.html>. Accessed 6/2/04.

fully equipped with Energy Star products will operate on approximately 30% less energy than a house equipped with standard product, saving the average homeowner around \$400 a year (EPA, 2003). However, to equip a home with only Energy Star goods would likely be prohibitively expensive. Refrigerators provide an example – when four refrigeration units (all the same size, similar features) were priced, the refrigerators that were noncompliant with Energy Star were significantly less expensive than similar refrigerators offering the Energy Star approval. Table 4 compares the prices of energy star refrigerators with non-compliant refrigerators.

Table 4. Price Comparisons of Similar Refrigeration Units

Kenmore Model	Energy Star Compliant	Kilowatt Hours per Year	Cost
53232 (21.9 cu. Foot)	No	671	\$750
53234 (21.9 cu. Foot)	No	671	\$770
53332 (21.9 cu. Foot)	Yes	605	\$1050
54382 (22.0 cu. Foot)	Yes	540	\$1350

Source: Sears, 2004. All units compared were Kenmore, white side-by-side units, with through door water and ice, approximately 22 cubic feet in size. Prices effective as of 3/24/04. Price comparison done online: <http://www.sears.com>.

As with purchasing hybrid vehicles, consumers must choose between long-term and short-term savings. And unlike hybrid vehicles, there are no government-supported programs or tax incentives to offset the cost. At an average retail price of \$0.0719 per Kwh, the two non-Energy Star compliant models would cost an American household \$48.25 per year to operate.¹¹ Annually, the Energy Star compliant models would cost \$43.50, and \$38.83 respectively. The savings of \$4.75 - \$9.42 per year on electricity is insignificant when weighed against an initial price difference of \$300 - \$600. It would require almost 67 years of use for model 54382 to realize a savings (based on an average \$9.00 savings per year, compared to model 53232). The payback period on energy

¹¹ The average retail price for electricity in the United States was \$.0719 per kilowatt-hour (EIA 2002d).

efficient appliances is too long for many households to realize a benefit by purchasing the compliant model.

The European approach to household energy efficiency is similar to the American approach. As of 2001, the EU participates in the Energy Star labeling program, in an effort to coordinate labeling efforts on office equipment (EU 2001). The program has initially been established for five years, with the hopes of developing an international market for efficient office equipment with standardized measures (EC 2002). While the program is expected to expand eventually, it currently is much more limited than the American Energy Star program.

Labeling programs are not the only approach to energy efficiency in the EU. The UK has developed a bold strategy with its Climate Change Levy (CCL), enacted in April 2001. This tax was developed after ratification of the Kyoto Protocol, with expectations that the tax would motivate business and industry to reduce energy consumption. The CCL is a single-stage tax to end-users of energy in the business sector. It does not apply to domestic consumers or to charities. The tax is charged on the industrial and commercial consumption of taxable commodities such as electricity, natural gas, coal, liquid petroleum for lighting, heating, and power. It does not apply to commodities used for other purposes, such as oil, gasoline, and steam. The levy is applied at a specific rate per nominal unit of energy, differentially across commodities. For example, the CCL rate for electricity is £0.0043/KWh, and £0.0015/KWh for gas supplied by a gas utility.

The UK Customs and Excise Department explains that the Levy on electricity is the highest because the production of electricity requires the highest relative amount of fossil fuels (HMCE 2002). Thus far, the levy is considered a success and a substantial

incentive to improving energy efficiency (DEFRA 2003a). Through corresponding Climate Change Agreements (CCAs), participants receive an entitlement to a CCL reduction or a rebate of 80%, provided they meet energy efficiency or carbon savings targets, with five targets identified from 2002-2010 (DEFRA 2003b). Targets vary by sector (from agriculture to manufacturing), but all targets outline specific goals to be met in 2002, and every two years until 2010 (DEFRA 2001).

While improving efficiency is an immediate step in reducing carbon dioxide emissions, the EU and US policies also encourage expanding the role of renewable resources (EC 2000, NEPDG 2001). For this paper, renewable resources include biomass, wind, and solar power. Hydropower has been excluded from this discussion due to its questionable negative environmental impacts on resources (fisheries for example).

Renewable Energy Policies

The US historically has used more renewable energy than the EU.¹² However, the displacement of fossil fuel usage by renewable energy sources has occurred at a very low rate over the past 30 years (Klass 2003). No federal goals or standards for national renewable energy use have emerged during this time. Instead, the federal government has developed renewable energy goals for its own bureaucracy (Bush 1999) and provides various grant funding to state projects, rather than mandating national standards.¹³ In the

¹² This is true regardless of whether hydropower is included.

¹³ This executive order sets forth requirements for federal agencies to increase their use of renewable energy and required the Secretary of Energy to set a goal for federal use. A goal was established requiring the government to utilize 1384 GWh of renewable energy by 2005.

absence of federal orders, much of the movement towards renewable energy comes from incentives established by individual states (Aitken 2002).

States employ both voluntary and regulatory approaches to renewable resources. Forty-seven states offer incentives to promote renewable energy use or generation, however, they are largely voluntary and do not provide direct benefits for doing so. Along these lines, ten states require consultation between utilities and utility commissioners, where state energy plans and public service commissions must consider renewable sources in planning and utilization (Foster et al. 1998). While recommending renewable resources gives the state an “environmentally friendly” appearance, it does little in practice to prompt the use and generation of renewable energy.

Many voluntary approaches are structured as fiscal incentives, which can be funded from a variety of sources.¹⁴ These incentives provide a more tangible benefit to firms and individuals desiring renewable energy sources. The incentives range from low-interest loans to tax exemptions for constructing and operating renewable power generation facilities or the use of renewable energy (Ritesema et al. 2003). Some incentives are more popular than others, particularly production incentives and corporate, personal, and property tax benefits.

In addition to voluntary programs, most states have adopted regulatory measures towards renewable energy use or production. Thirty-one states have access laws permitting wind and solar power easements (DOE 2004c). Thirty-eight states have a net-metering regulation in place, allowing self-generated electricity to flow to and from the consumer’s household (DOE 2004c). Some states require utilities to purchase designated

¹⁴ The incentives can come from government revenues, tax expenditures, or from specific fees and charges. For more information on funding of state-specific renewable energy projects, see DOE, 2004b.

amounts of power generated by renewable sources or implement renewable energy programs. These types of programs are often known as renewable portfolio standards (RPSs), where a certain percentage of energy provided by a company must come from renewable sources. To date, there are 19 RPSs in place across the US, most implemented at the state level (DOE 2004c). As a recent example, the state of Nevada instituted an aggressive renewable portfolio standard in June 2003. Nevada's RPS requires that 15% of all electricity produced in the state come from renewable sources by 2013, and as a technology minimum, 5% of the renewables portfolio must be solar (DOE 2003, Aitken 2002).

Some states are building green certificate trading mechanisms into their renewable portfolio standard.¹⁵ This type of program, called cap and trade, establishes a minimum amount of green energy that must be generated, allowing trade to meet these standards. Texas has an RPS requiring an additional 2000 Megawatts (MW) of new renewables to the system by 2009, to be maintained through 2019. Each retailer in the market has been assigned a pro rata share of this 2000 MW mandate. However, each retailer also receives renewable energy credits (RECs), which can be traded, sold, or retired through an administered program (DOE 2004a).

In the EU, individual nations have taken their own steps to encourage energy efficiency and renewable energy development, much as states have in the US. In Europe,

¹⁵ The states that currently have state supported RPS are: Arizona, California, Connecticut, Hawaii, Illinois, Iowa, Maine, Maryland, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico, Pennsylvania, Texas, and Wisconsin.

however, the European Commission has also set forth standards for the Community members, with a program called ALTENER II.¹⁶

The EU experienced a 31% increase in growth in energy production from renewables between 1985 and 1998; however, this is relatively insignificant in absolute terms, particularly as these gains have been offset by increases in energy demand (Commission of the European Communities 2000). With this in mind, the Commission has established a target for the EU to double its absolute share of renewables from 6% in 1997 to 12% in 2010. Under this target, all member states were expected to adopt national energy policy objectives aligned with this proposal (Commission of the European Communities 2000).

One of the models proving successful in bringing renewable energy to market is the feed-in model (FIM). Under an FIM, a long-term minimum price is guaranteed for electricity produced via renewable sources (Meyer 2003). This is typically accompanied by relatively inexpensive or guaranteed access to the power grid. In Germany, the electricity feed law obliges a network operator to purchase power from renewable sources when it does not originate from a public sector power provider, and the law sets a minimum price for the green electricity (Gutermuth 2000). This pricing system has been especially effective in promoting wind power, particularly in Germany, which has outperformed other nations (Meyer 2003).

While the feed-in-model is generally seen as a successful means to move green energy through the market, it is not perfect. Feed-in tariffs guarantee a specified price for green electricity that serve to reduce debt default risk and encourage financing of

¹⁶ ALTENER II is the successor of ALTENER I, whose 5 year term ended in 1997. The program is designed to extend activities in the renewable energy field, helping develop the strategy outlined in the White Paper "Energy for the Future: Renewable Sources of Energy" (EC, 1997).

renewable projects. FIMs vary between EU members; in some member nations power distributors are responsible for the feed in tariff¹⁷, in others, government grants cover the charge (EVA 1998). The prices are often set for a fixed period, which does not account for technological advance and can result in windfall profits for those with favorable locations and facilities (Gutermuth 2000, Meyer 2003).

A certificates trading model (CTM)¹⁸ is being adopted across the EU. The CTM aims to introduce competitive market conditions in renewable energy deployment. The market mechanisms behind the tradable green certificates (TGCs) are similar to those supporting emissions trading programs, and the programs' premises is the same in the EU and the US.¹⁹ A green certificate represents a unit of electricity that has been produced from a renewable source. In an electricity market with a quota for "green" electricity, these certificates can provide an efficient means to get renewable energy to market, reducing overall costs by allowing efficient firms to produce green energy cheaply, and inefficient firms to purchase green certificates. Energy suppliers can purchase TGCs to fulfill their respective quotas. Those generators providing renewable energy at the lowest cost will be able to sell TGCs. If there are only a small number of firms providing TGCs, prices will be high, eliciting additional firms to enter the market.

Because of their market-based nature, TGCs are expected to offer cost-effective means to meet the EU renewable energy goals. Currently, Denmark, Belgium, Germany,

¹⁷ The feed-in tariff is the price per unit of electricity that a utility or supplier has to pay for electricity from a renewable source from private generators. The government regulates this tariff rate.

¹⁸ The Certificate Trading Model (CTM) is also referred to as Tradable Green Certificates (TGC).

¹⁹ Emissions trading programs are being utilized around the world marketing the "right to emit pollutants". A fixed national level of emissions is established, such as the American limit on sulfur dioxide emissions. Firms that can reduce emissions easily will do so, and sell their "rights" to firms that cannot reduce emissions so efficiently. BP Amoco has instituted a large-scale emissions trading program, for more information see Akhurst et al. 2003.

Italy, the Netherlands, and the United Kingdom have developed such systems (Nielsen and Jeppensen 2003). These markets are national, and must be harmonized before trade can take place between countries. One difficulty is differences in the type of energy eligible for TGCs across countries, as certain technologies are already competitive without additional financial support (Nielsen and Jeppensen 2003). This is a local issue that must be resolved before international markets can be developed.

The Role of Renewables

Currently, biomass is the most popular renewable energy source in both the US and EU. Biomass accounted for 47% of the renewable resource use in the United States, which is primarily waste product (EIA, 2002e). In the EU, biomass composes 51% of renewable resource use, primarily wood biomass (EC, 2003a). There is interest in biomass as a fuel for the future²⁰, but there are some serious questions about the effect it can have on air quality. Developing uses for landfill gas is a major driver behind expected growth in biomass use (EIA, 2001).

The European Union established a new installation record for wind power capacity in 2002, adding 5,809 MW of capacity, bringing the total installed capacity to 23,509MW (EC 2003b). Germany is currently producing about one-third of the world's wind energy; 8,759 MW in 2001 (EC & ADEME 2003). This capacity meets 3.5% of Germany's national electricity requirements (EC & ADEME 2003). Due to high population density, many of the wind farms in Europe are close to established electricity grids, easing the dissemination of wind power electricity.

²⁰ There is a particular interest in developing biomass plants in the western United States at this time, as a means to utilize small diameter timber generated from forest thinning activities.

The United States had only 6,374 MW of installed capacity at the end of 2003 (DOE 2004d). The market for wind power has lagged in the US, due to a reduction in research and development dollars during the 1980s and 90s. Another factor slowing wind power growth is concern over environmental impacts of turbine installation (noise, wildlife effects, etc.). Much of the wind power in the US is generated on prairie land, far from large population centers, with little grid access, presenting a disincentive to producers (Aston 2003). Currently, some power producers in the US are giving customers an option to buy green electricity generated by wind power, and several states have instituted RPSs, which might increase the market for wind power.

Solar power is produced in both the EU and US and is much acclaimed for its environmental benefits: it does not create noise pollution, nor does it interrupt bird migration, as wind power can. As such, there is widespread hope for the future of solar power. Both the US and Germany have solar energy development programs underway. In the US, a federal program called the Million Solar Roofs (MSR) project was announced in 1997, with the goal of installing one million solar energy systems in buildings by 2010. Germany's national program, the 100,000 Roofs Program, was initiated in 1999 with a goal of installing 100,000 photovoltaic systems by 2005.²¹ The goals are similar, but the means to achieving the goals are different.

In the US, the federal government is focused on establishing a solar market by bringing local and national businesses together with energy organizations and agencies, to increase the market for solar energy. The federal government does not provide funding for the design or installation of photovoltaic systems, but provides grants from the Department of Energy to groups interested in expanding the use of solar energy (DOE

²¹ The program aimed at 100,000 rooftops or about 300 MW of installed capacity.

2004e). The installed solar capacity of the US was 57 peak MW in 2002 (Solarbuzz 2004). The US is the world's leading producer of photovoltaic cells and technology, exporting cells internationally, primarily to Germany.

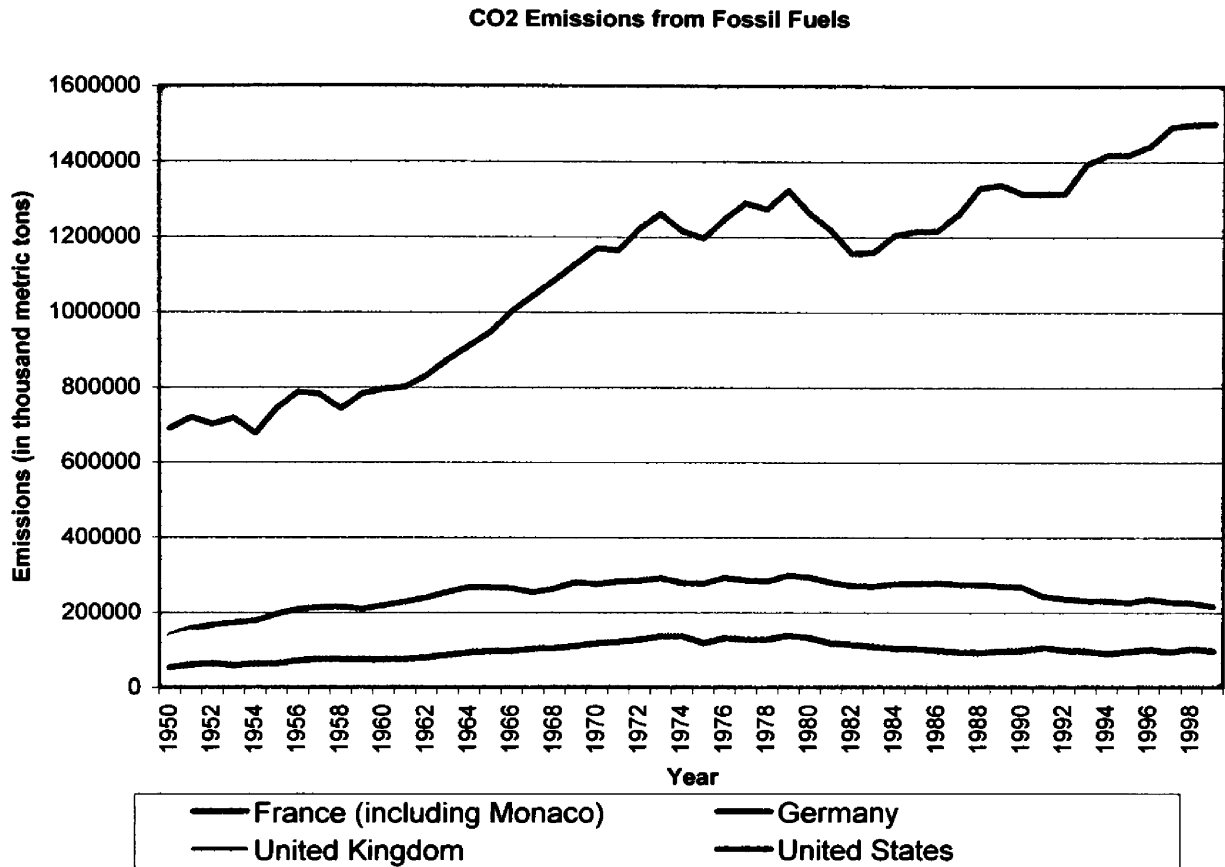
In Germany, the 100,000 Roofs Program provides low interest loans to businesses and homeowners to cover photovoltaic installation costs. Other incentives, such as high buyback rates at which consumers can sell surplus green power, worked in conjunction with the loans to further consumer interest. Studies in Germany showed that the rate of photovoltaic installment was directly related to the amount of financial support provided (Wiess and Sprau 2002). Consumer interest in photovoltaic power is increasing, and the EU's total installed capacity for photovoltaic energy grew by 37.7% in 2002, to 392 peak MW (EC 2003c).

DISCUSSION

Have the different energy policies prompted different results in the pursuit of maintaining energy flows while reducing carbon dioxide emissions? Given the broad assumptions regarding energy goals, we can compare the outcomes of various policy mechanisms. Here, I look at energy policy in the context of CO₂ emissions trends and renewable resource usage.

The EU has decreased carbon dioxide emissions from fossil fuels steadily over the last 30 years; conversely, carbon dioxide emissions have increased in the US (EIA 2002a, EIA 2002d). CO₂ emissions related to fossil fuel use peaked in France, Germany and the UK between 1977 and 1980. Between 1990 and 2000, emissions in the EU increased 1.5%, and emissions in the US increased 17.4% (ECDGET 2003) as illustrated by figure 4.

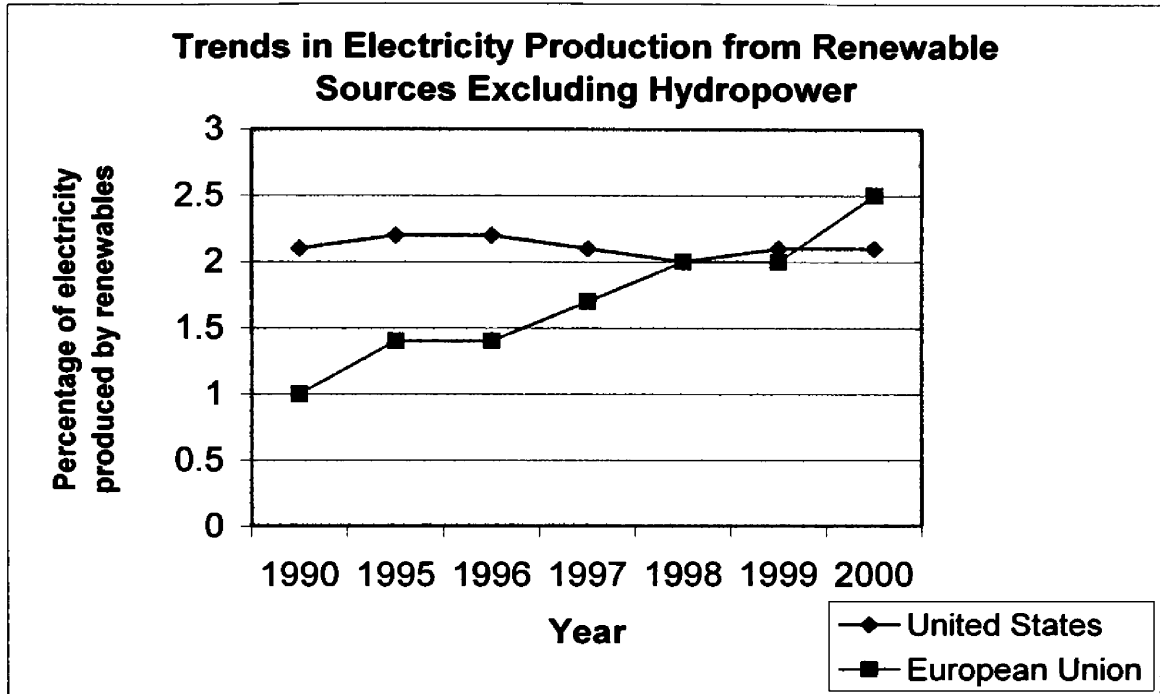
Figure 4: CO2 Emissions From Fossil Fuels



Source: EIA 2002d, 2002a.

In recent years, the EU has surpassed the US in its use of renewable resources. Renewables are primarily used to make electricity. From 1990-2000 in the US, the total increase in renewable-produced electricity was 0.1%, with the national share of renewable-generated electricity remaining constant at just over 2%. The EU increased its renewable-produced; in 1990, just 1% of the EU electricity came from renewables; by 2000, the share was 2.5% (IEA 2002a). Germany has made some of the most significant changes in Europe, with increases of 16% between 1990-2000. Figure 5 illustrates this recent trend.

Figure 5. Trends in Electricity Production from Renewable Sources Excluding Hydropower



Source: IEA, 2002.

Because US and EU energy goals are the same, it is not clear why the EU has been more successful securing energy services and reducing CO₂. There are several differences between the American and European approaches that may explain the different trends. This discussion will center on policy approaches designed to target regional and international consumption and production.

Supply Management v. Demand Management

The principal contrast between American and European energy policy is that US policy is geared largely towards energy supply with slight attention given to demand, while the EU policy primarily targets energy demand. The European policy targets demand through the pricing mechanism, using higher prices to alter consumer behavior. Higher energy prices reflect scarcity and environmental costs. Prices in Europe are

significantly higher than in the United States, largely due to heavy taxation on fossil fuels and automobiles. As such, European consumers have strong incentives to reduce energy intake and to seek substitute goods.

In the case of transportation, Europeans drive less than Americans; they also tend to drive smaller, more fuel-efficient vehicles. Demand for fuel-efficient vehicles is evidence that strong incentives influence behavior. Fuel taxes may be the most effective tool to reduce carbon dioxide emissions from exhaust, as many other options (e.g. road tolls, insurance costs) are either selective or fixed, with no connection to how much someone drives. The significantly lower energy prices in the US may not accurately reflect energy's scarcity or environmental costs. As a result, consumers have little reason to make efficient choices. Furthermore, there is little incentive for either energy producers or consumers to find or adopt more environmentally friendly behavior. However, the EU and US have significant differences in population densities and infrastructure, which affect measures to reduce CO₂ emissions. Public transportation is more prevalent and sophisticated throughout Europe, while in the US public transportation options are largely limited to major metropolitan centers. The higher population density in Europe is more conducive to more public transportation, and shorter distances traveled.²²

Primarily through steering demand, the EU developed a market for green power and more efficient goods. Corporations succeed by meeting consumer demands, and in the EU, competition is encouraged through open access to energy grids and markets. In

²² In 2000, the US had a population density of 29 people per km². Germany had a population density of 230 people per km²; France had a population density of 107 people per km²; and the UK had a population density of 245 people per km² (UN 2002).

the US, private industry is being funded or subsidized to create goods for which there are not yet markets. Additionally, in the US, there are no guarantees on whether producers have access to energy markets.

In Europe, policies are used to increase the use of renewables through regulation and market incentives, frequently working together. The regulatory approach is more widespread in the EU, with higher renewable requirements and expectations. However, these requirements are frequently set in a cap and trade type system, allowing industries or the market to determine how best to meet requirements. The financial incentives employed in the EU appear to be greater than in the US, and some of the incentives are directed at consumers, which is more effective in stimulating demand than funding research and development. The European policy is achieving its emissions reduction goals because of the focus given to climate change in its energy policy and planning.

The US policy attempts to keep fossil fuel prices down by increasing production to enhance supply. Though American policy states its desire to reduce emissions, the low price of fossil fuels reflects the cost of extraction, refining, and distribution, without reflecting the social costs of climate change. Ideally, the prices of such fuels could be increased to internalize the costs. Assuming that energy is a normal good, a 20% increase in costs would result in a 20% decline in consumption (Taylor 2001), thus, achieving a reduction in fossil fuel reliance through the substitution effect or through efficiency. Realistically, this is unlikely, particularly in the US, where higher fuel prices currently have consumers clamoring for government price controls and increased production levels (Associated Press 2004).

Increasing the price of traditional fuels to internalize social costs would enable other technologies to be more competitive without regulation or subsidization. While we are unsure at what point prices reflect the true cost of pollution byproducts (negative externalities), we can be sure that the increased price will result in substitution.

American policy has likely provided producers with incentives to research and develop new technology. Unfortunately, such technology has not always had market access, as many of the energy markets in the US are still closed. Additionally, the low price of fossil fuels means that renewable energy is still more costly than traditional energy: a disincentive to change. The true cost of fossil fuels has been distorted in the past through subsidization and market failure; it is still perpetuated in the US energy plan today.

The difference in policy approaches explains some of the disparity in renewable resource adoption and investment. The US policy, with the priority of increasing energy supplies, has not done so in a manner to reduce CO₂ emissions. The EU, by heavily influencing demand and pairing incentives with regulations, has created a market for renewable resources, open to new producers. Open market access presents an opportunity for competition and investment in non-traditional fuel sources, providing an impetus for technological improvement. While decreased prices can discourage energy efficiency, an open market is still the first step to promoting renewable energy.

While a demand approach seems more successful in reducing emissions, such an approach has equity implications: increased energy prices can impose hardship on consumers with smaller budgets, reducing mobility resulting in social exclusion. The EU has more readily adapted to higher prices, given the strong social welfare structure.

On a macroeconomic level, higher energy prices are likely to dampen economic growth, particularly in a sluggish economy. Powerful American lobbies in transportation and agriculture sectors would likely resist higher energy prices. Such pressures help to explain why policymakers have not readily adopted new policies.

Energy Security – What it Means

In addition to supply and demand management, there is another fundamental difference between energy policies. Both American and European policies are designed to enhance energy security, although this term has different meanings in the US and EU. To the US, energy security means a constant, adequate supply of fossil fuels. Increasing supplies of traditional fuels, largely from domestic sources, is the priority of the American energy plan. Domestic oil and gas reserves in the States are thought to be significant; however, tapping new fuel reserves in the US is proving problematic. Many of the prospects lie within the boundaries of federally protected lands, such as the Arctic National Wildlife Refuge.²³ The US is particularly interested in funding and creating “clean coal technology”, as coal is one of the most abundant domestic resources.

Expanding the oil and gas supply is far more important than developing renewable energy. Policymakers feel that alternative resources will eventually be an important energy source, but do little to promote development today. American financial resources have largely been allocated to further developing traditional supplies domestically and internationally. However, while the US seeks to increase supply for security, it will likely have to rely heavily on foreign energy providers. Furthermore,

²³ This is a major point of contention in the Bush administration’s energy plan, and is one of the factors responsible for the delay in the bill being passed into legislation.

Americans might also have to rely more heavily on traditional coal technology; options that contradict its energy policy mission statement.

The EU is limited by small domestic fossil fuel reserves, which means that its approach to energy security is different from America's. Rather than developing domestic fossil fuel resources, the EU is diversifying its market through development of renewable resources. Both the EU and US acknowledge that fossil fuels will remain the predominant energy source, but the EU is taking bigger steps to develop alternatives.

Politics

The EU has a legal obligation to change its energy markets, while the US does not. The EU ratified the Kyoto Protocol and has since written numerous emissions reduction targets, signed into law in the member states. Several member nations have set even more ambitious targets for themselves.²⁴ The EU has been one of the strongest proponents of the protocol, reflecting its commitment to CO₂ emissions reductions.²⁵

During the 1990s, environmental aspects of energy policy garnered political attention in the United States, although the US did not ratify the Kyoto Protocol. Instead, the US developed voluntary programs such as the Clear Skies Initiative and the Global Climate Change Program. These initiatives encourage firms to voluntarily set targets for emissions reductions.

²⁴ Germany is a good example of this behavior. The general goal under the Kyoto Protocol is for developed countries to reduce their greenhouse gas emissions by 5% below 1990 levels by 2008-2012, with Germany's specific goal being a reduction of 8%. Germany's national goals are to reduce CO₂ emissions to 25% below 1990 levels by 2005. Since 1990, CO₂ emissions in Germany are down by 15.4%. Data taken from the German Embassy website and the EIA website. Online: <http://www.germany-info.org/relaunch/info/publications/infocus/environment/kyoto2.html#kb>, <http://www.eia.doe.gov/emeu/cabs/germany.html>. Accessed 4/1/04, 6/11/03.

²⁵ The EU government has a history of lobbying other nations to ratify the Kyoto Protocol. For instance, EU leaders met repeatedly with Australian heads of state in 2001-2002, and recently (spring 2004) have been meeting with Vladimir Putin of Russia.

Europe's Kyoto targets were established in the late 1990s, which means that member nations have had several years to enact emissions reductions strategies. The American Global Climate Change plan was not unveiled until February 2002. The timing difference could certainly account for some of the observed results, as European nations have had years of legal pressure to institute change. The US has not had such pressure, and its voluntary program continues this trend.

Other political factors may be negatively affecting progress on energy security and climate change in the US. The US has been in sustained military operations since 2001, and the American economy is sluggish. Consequently, energy policy is not a top priority for policymakers.

Many of the approaches to promote energy efficiency and renewable resources development are the same in the US and EU. Programs such as certificate trading, renewable portfolio standards, and tax incentives are used on both sides of the Atlantic in an effort to transition to cleaner energy. However, the results of energy policies are diverging. The EU is striving to achieve preset CO₂ reductions targets. In the EU, it appears that achieving energy security will largely occur through energy conservation efforts and alternative fuel development. The EU, with a limited amount of domestic natural resources, has stated repeatedly that its energy policy will focus on influencing demand (Commission of the European Communities 2000).

The US is striving to achieve energy goals through increasing oil and gas supplies. Though its policy states that the US seeks energy security in an environmentally sound manner, its current approach places more emphasis on

maintaining and enhancing current reserves than it does on developing renewable resource markets.

CONCLUSION

In the face of changing climate, the US and EU both state that they are developing policies to ensure energy supply while reducing carbon dioxide emissions. The EU has reduced emissions; conversely, the US has increased emissions. The EU has surpassed the US in renewable resource usage, while the US has not increased its use of renewable resources in over a decade. As such, this research finds that the European approach to energy and climate change is more effective than the American approach.

Improving energy efficiency and developing a market for renewable resources can be done effectively through demand-side approaches, as illustrated by the EU. Consumer-based incentives can steer demand towards new, efficient technology. Through a demand-centered approach, the government does not have to pick the technological winners; private industry can develop innovative technology as markets grow. The European energy policy that works to reduce fossil fuel use is consistent with the European goals of reducing carbon dioxide emissions.

While American energy policy states an interest in reducing CO₂ emissions as well, its energy policy is not designed to achieve this goal. Maintaining large fossil fuel supplies and low fossil fuel costs does not provide an incentive to reduce carbon dioxide emissions. Better consistency among policies and more incentives to reduce consumer demand for fossil fuels could strengthen the American policy approach to energy and climate change.

In developing a policy for an uncertain energy future, market-based and incentive approaches can be very effective, and have some advantages over regulatory approaches. Changes that can be effected through a market system will have lower administrative costs than most regulatory government programs and be more efficient by encouraging

consumers and industry to develop practical solutions (Wirth et al. 2003). Market based incentives and regulations can work well together in cap and trade systems. Future research on the long-term effects of policy discussed here today will provide a better understanding of successful energy policy.

If the US wants to reduce carbon dioxide emissions and develop renewable resources, it must commit to such policy. Without binding treaties and domestic pressure, the US is not effectively developing better technology or alternative energy sources. The EU has put climate change concerns at the forefront of its energy policy. Renewable energy and efficiency measures are proving more successful in Europe because policy has made them a priority, creating incentives for clean energy markets and CO₂ reductions by targeting consumer demand.

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