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[Climate Change] [Binder 1] [2]

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Table 7. Unquantified Ancillary Emissions Benefits

Effect Category	Effects	Other Possible Effects
Human Health	Cancer Mortality Non-cancer Effects -neurological -respiratory -reproductive -hematopoietic -developmental -immunological -organ toxicity	
Ecological	Effects on: -wildlife -plants -ecosystem -biological diversity	Loss of habitat for endangered species
Welfare	Decreased recreation opportunities Decreased agricultural yield Decreased visibility	Loss of biological diversity Building deterioration

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International Impacts Associated with Reducing Greenhouse Gas Emissions

Just as in the United States, all Annex I countries would benefit significantly from effective implementation of the Kyoto Protocol's flexibility mechanisms. Further, Non-Annex I countries would accrue two kinds of benefits: 1) under international trade with binding targets at or slightly below business as usual and the CDM, they will enjoy economic gain from trade in emissions allowances; and 2) reductions in carbon emissions will reduce emissions of local air pollutants.

- **Economic benefits:** With growth targets, developing countries could enjoy substantial net gains through the international sale of emission reductions achieved at lower cost than the world price. Such participation by developing countries in international emissions allowance markets would greatly lower the costs to industrial countries, including the United States, of meeting their Kyoto targets. In particular, costs would be lower than with trading among only Annex I countries. On a project-by-project basis, the Clean Development Mechanism would also result in net gains to developing countries and cost-savings to industrial countries. Given the anticipated difference in scale, a system including effective trading of developing countries' emissions would yield greater gains to developing countries and much greater cost-savings to industrial countries than the Clean Development Mechanism. (B1) (B2) (B3)
- **Environmental benefits:** Developing country growth targets would lower global greenhouse gas emissions relative to a world with only Annex I targets. Further, reducing carbon dioxide emissions generates ancillary air quality benefits through lower particulate matter, sulfur dioxide, and nitrogen oxides emissions. By adopting a growth target and engaging in trading, developing countries could achieve environmental benefits not achievable by pursuing CDM alone. (B4)

Effects of Climate Change Policy on U.S. Competitiveness

Some have expressed concern that the Kyoto Protocol might adversely affect the competitive position of American industry. Evaluating how the Kyoto Protocol could affect competitiveness of a few specific manufacturing industries -- especially those that are especially energy-intensive, such as aluminum and chemicals -- is complex. However, the modest energy price effects associated with permit prices of \$14/ton to \$23/ton would likely have little impact on competitiveness. There is no reason to expect that there would necessarily be a negative effect on the trade balance. Indeed, the efforts to reduce greenhouse gas emissions would likely decrease oil exports to the United States, benefitting the trade balance. (B5)

In general, structural changes in the economy have the effect of expanding some sectors and contracting others. But to provide some perspective on this issue, consider the following facts. First, on average, energy constitutes only 2.2 percent of total costs to U.S. industry. Second, energy prices (B6)

**A Proposal for Developing Countries:
Participation in a "Target and Trade" System**

I. This analysis demonstrates that the gains will be substantial if developing countries (a) accept binding targets at or slightly below their business as usual (BAU) emissions levels, and (b) trade from their respective targets. We believe that participation in a "target and trade" system should be the cornerstone of our international negotiations.

The economic and environmental rationale for such participation includes

- **Greater economic benefits to developing countries:** With targets at or only slightly below BAU, developing countries would enjoy net gains of many billions of dollars through the international sale of emission reductions achieved at lower cost than the world price. (B1)
- **Greater cost savings to the U.S.:** Participation by developing countries in international permit markets would greatly lower the costs to the U.S. of meeting its Kyoto target (as CEA testimony showed). In particular, costs would be lower than with trading among only Annex I countries. (B2)
- **Greater environmental benefits:** Targets slightly below business as usual would lower global emissions relative to a world with only Annex I targets. Further, reducing carbon dioxide emissions generates ancillary air quality benefits through lower particulate matter, sulfur dioxide, and nitrogen oxides emissions. (B4)
- **Target and trade yields greater benefits than CDM:** While the Clean Development Mechanism will likely result in cost savings to the U.S. relative to a world with only Annex I trading, a system including effective target and trade of developing countries' emissions would yield much greater cost savings to the U.S. and greater gains to developing countries than CDM. Further, target and trade could achieve environmental benefits not achievable by pursuing CDM, which only redistributes emissions geographically. (B3) (B4)
- **The principle of full participation:** Other rationale include the long-run benefits of including developing countries into global negotiations, for example, as recognized by the Byrd-Hagel resolution. By establishing participation now, further commitments might be feasible in future periods.

**TESTIMONY OF DR. JANET YELLEN
CHAIR, COUNCIL OF ECONOMIC ADVISERS
BEFORE THE
U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SMALL BUSINESS**

JUNE 4, 1998

Thank you, Mr. Chairman. The President has said that we can work to avert the grave dangers of climate change, while at the same time maintaining the strength of our economy. I agree and am pleased to have this opportunity to appear before the Committee to elaborate on the Administration's views on these issues.

The international agreement that was reached in Kyoto this past December is a crucial step forward in addressing global climate change. But it is only one step in a journey. Since the international effort to reduce greenhouse gas emissions is still in some respects a work-in-progress, it is not yet possible to provide a full authoritative analysis of it. Many of the specifics in several crucial areas are not completely resolved in the diplomatic arena, forcing analysts to make a variety of assumptions about the ultimate form of the international regime. In my testimony today, I will attempt to identify key elements of the agreement and the Administration's policy, such as international emissions trading, meaningful developing country participation, inclusion of land-use activities that absorb carbon ("sinks") and six categories of gases, as well as domestic initiatives, that together can ensure that reductions in global greenhouse gas emissions are consistent with continued strong economic growth. I will explain the reasoning underlying our conclusion that, under these conditions, economic impacts are likely to be modest.

The Administration is strongly committed to ensuring that these key elements are reflected in our domestic and international climate change policies. We are firmly committed to meaningful developing country participation, the use of sinks to offset emissions requirements, and emissions trading both domestically and internationally. And as you know, the President's FY 1999 budget includes a \$6.3 billion package of tax cuts and R&D investments over the next 5 years; this package makes good sense in terms of energy policy and will jumpstart our efforts. A final component of the President's climate change policy is his support for electricity restructuring in a manner that will offer approximately \$20 billion in cost savings to electricity consumers, while reducing greenhouse gas emissions.

I. Basic Economic Rationale of the Kyoto Treaty

To begin our analysis, it may be worth stepping back and examining the larger question of the basic rationale, from an economist's perspective, for the Kyoto Protocol.

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The President has made clear that he will not submit the Kyoto Protocol to the Senate without meaningful participation from key developing countries (who are not included in Annex I).

There are several reasons why meaningful participation from developing countries is essential. First, developing countries are projected to contribute a majority of world emissions around 2030 under a continuation of business-as-usual. Without the participation of developing economies, efforts by the industrialized countries to limit emissions will therefore not provide adequate protection from climate change.

Second, developing country participation is crucial because it would permit relatively low-cost emissions reductions to be internationally recognized as a substitute for more expensive emissions reductions that might otherwise be achieved domestically by U.S. companies and those in other industrialized countries. Since greenhouse gas emissions have the same basic impact on the climate regardless of where they occur, emission reductions in developing countries have the same environmental benefit as reductions in the U.S. But these reductions are much less costly than reductions in the U.S. or in other developed nations, because of the very inefficient and carbon-intensive uses of energy in these countries today. It thus makes sense, from both an environmental and an economic perspective, to incorporate emissions reductions in developing countries into the international system.

Third, principles of basic fairness suggest all countries should do their part, depending, in part, on their ability to contribute to the solution. Thus even poor countries should participate, although the lack of resources in such countries may limit the extent of their participation.

Some have expressed fears that the Kyoto Protocol might adversely affect the competitive position of American industry. Evaluating how the Kyoto Protocol could affect competitiveness of a few specific manufacturing industries -- especially those that are especially energy-intensive, such as aluminum and chemicals -- is complex. The answer depends, in part, on the impact of the agreement on energy prices, which we will shortly address. In general it is difficult to undergo a structural change in the economy without having the effect of expanding some sectors and contracting others. But to provide some perspective on this issue, consider the following facts. First, on average, energy constitutes only 2.2 percent of total costs to U.S. industry. Second, energy prices already vary significantly across countries. According to the *1997 Statistical Abstract*, for example, in 1996 premium gasoline cost \$1.28 per gallon in the United States -- but only 8 cents per gallon in Venezuela. Similarly, gas prices were \$3.71 per gallon in Switzerland and \$4.41 per gallon in France. Electricity prices also vary significantly: in the U.S., for industry, they were 5 cents per kilowatt hour in 1995, a fraction of prices in Switzerland of 13 cents per kilowatt hour. Yet U.S. industry is not moving en masse to Venezuela, nor is Swiss industry moving to the United States. Third, roughly two-thirds of all emissions are not in manufacturing at all, but in transportation and buildings, sectors which, by their very nature, are severely limited in their ability to relocate to other countries. We therefore believe we need developing country participation because the problem is global and cost-effective solutions are essential, than to avoid adverse effects on competitiveness.

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already vary significantly across countries. For example, premium gasoline cost \$1.28 per gallon in the United States in 1996 -- but only 60 cents per gallon in Saudi Arabia. Similarly, gas prices were \$3.71 per gallon in Switzerland and \$4.41 per gallon in France (Bureau of the Census 1997). Electricity prices also vary significantly: in the U.S., for industry, they were 5 cents per kilowatt hour in 1995, a fraction of prices in Switzerland of 13 cents per kilowatt hour. Yet U.S. industry is not moving en masse to Venezuela, nor is Swiss industry moving to the United States. Third, roughly two-thirds of all emissions are not in manufacturing at all, but in transportation and buildings, sectors which, by their very nature, are severely limited in their ability to relocate to other countries. We therefore believe that the reason we need developing country participation is because the problem is global and cost-effective solutions are essential, rather than to avoid adverse effects on competitiveness.

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APPENDICES

Appendix A

Annex I and Non-Annex I Countries

Appendix B

Construction of Non-Carbon Dioxide Emissions Baselines

Appendix C

Potential Electricity Restructuring Cost-Savings

Appendix D

Historical Trends in U.S. Energy Prices

Appendix E

Country Specific Energy and Emissions Data

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APPENDIX A: ANNEX I AND NON-ANNEX I COUNTRIES

The 1992 Framework Convention on Climate Change called for, among other issues, a voluntary emissions reductions goal for the industrialized countries of the world. These countries, including most developed countries and the economies in transition of the former Soviet bloc, are identified in the treaty as members of "Annex I". Countries not included in this list are identified as "Non-Annex I". Non-Annex I is composed of primarily developing countries, but also includes the newly industrialized countries of Asia, and some OECD members (e.g., Mexico and Korea). In general, Annex I has often been used to refer to industrial countries and Non-Annex I has been used to refer to developing countries.

Under the Kyoto Protocol, the industrialized, or developed countries that agreed to binding emissions targets are identified as Annex B countries. The list of Annex B countries is virtually identical to the list of Annex I countries (see below).

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Annex I Countries under Framework Convention

Australia
Austria
Belarus
Belgium
Bulgaria
Canada
Czechoslovakia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Japan
Latvia
Lithuania
Luxembourg
Netherlands
New Zealand
Norway
Poland
Portugal
Romania
Russian Federation
Spain
Sweden
Switzerland
Turkey
Ukraine
United Kingdom
United States

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Annex B Countries under Kyoto Protocol

Australia
Austria
Belgium
Bulgaria
Canada
Croatia
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Japan
Latvia
Liechtenstein
Lithuania
Luxembourg
Monaco
Netherlands
New Zealand
Norway
Poland
Portugal
Romania
Russian Federation
Slovakia
Slovenia
Spain
Sweden
Switzerland
Ukraine
United Kingdom
United States

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APPENDIX B: CONSTRUCTION OF NON-CARBON DIOXIDE EMISSIONS BASELINES

Emissions of greenhouse gases for countries were drawn from the countries' national communications to the Framework Convention on Climate Change. The following details the derivation of emissions baselines for non-carbon dioxide greenhouse gases.

- Australia: Non-CO₂ greenhouse gases comprise 33% of all greenhouse gas emissions in 1990. These are assumed to be 25% of all greenhouse gas emissions in 2010 based on the trends projected in the United States and the European Union. The 1990/95 baseline excludes SF₆ and HFCs.
- Austria: For methane and nitrous oxide, 2010 emissions are based on a linear extrapolation from the projected 2000 level using the average annual growth rate over the 1990-2000 period. For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP times the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.
- Belgium: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP times the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.
- Canada: For non-CO₂ greenhouse gases, Canada is assumed to have the same non-CO emissions/total greenhouse gas emissions ratio as the United States (0.17 in 1990/95 and 0.13 in 2010). Total greenhouse gas emissions are then calculated based on historical and projected CO₂ emissions.
- Denmark: For methane and nitrous oxide, 2010 emissions are based on a linear extrapolation from the projected 2005 level using the average annual growth rate over the 2000-2005 period. For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP times the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.
- Eastern Europe: For non-CO₂ greenhouse gases, Eastern European countries are assumed to have the same non-CO₂ emissions/total greenhouse gas emissions ratio as the Former Soviet Union (0.25 in 1990/95 and 0.19 in 2010). Total greenhouse gas emissions are then calculated based on historical and projected carbon dioxide emissions.
- Finland: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP times the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

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- Former Soviet Union: Non-CO₂ greenhouse gases comprise 25% of all greenhouse gas emissions in 1990. These are assumed to be 19% of all greenhouse gas emissions in 2010 based on the trends projected in the United States and the European Union. The 1990/95 baseline excludes SF₆, PFCs and HFCs.
- France: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP times the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.
- Germany: For methane and nitrous oxide, 2010 emissions are based on a linear extrapolation from the projected 2005 level using the average annual growth rate over the 1990-2005 period. For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP times the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.
- Greece: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP times the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.
- Ireland: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP times the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.
- Italy: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP times the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.
- Japan: Non-CO₂ greenhouse gases comprise 4% of all greenhouse gas emissions in 1990. These are assumed to be 3% of all greenhouse gas emissions in 2010 based on the trends projected in the United States and the European Union. The 1990/95 baseline excludes SF₆, PFCs, and HFCs.
- Luxembourg: For methane and nitrous oxide, 2010 emissions are based on a linear extrapolation from the projected 2000 level using the average annual growth rate over the 1990-2000 period. For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP times the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.
- Portugal: For the three categories of synthetic gases, estimated emissions for 1995 and 2010 are based on multiplying 1995 GDP times the emissions/GDP(1995) average ratios derived from the Netherlands, Sweden, and the United Kingdom.

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- Spain: The United Nations has not posted a national communication for Spain on the FCCC webpage. Estimates of the methane and nitrous oxide emissions are based on the average methane/GDP(1995) and nitrous oxide/GDP(1995) ratios for the other 14 EU countries multiplied by Spain's 1995 GDP. Similar calculations were done for the three categories of synthetic gases, but only based on the average of the Netherlands, Sweden, and the United Kingdom's emissions.

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APPENDIX C: POTENTIAL ELECTRICITY RESTRUCTURING COST-SAVINGS

The Administration's electricity restructuring proposal provides potential cost-savings in four areas: cost reduction (including fuel procurement, non-fuel operation and maintenance [O&M] expenses, and administrative and general [A&G] expenses), dispatch efficiency, improved capital utilization, and savings in capital additions. These four categories of savings very likely could reach or exceed \$20 billion annually. Table C1 summarizes these potential savings.

Table C1. Summary of Restructuring Cost-Savings Potential

Source of Savings	Potential Size of Benefit (billions of \$ per year)
Cost Reduction (Fuel, non-fuel O&M, A&G)	\$24.6
Dispatch Efficiency	\$0.6
Improved Capital Utilization	\$0.8 to \$2.6
Reduced Capital Additions	\$0.3 to \$3.8
TOTAL	\$26.3 to \$31.6

Several sources of important additional savings are not considered in this analysis.

- First, as pricing becomes more efficient, load shape adjustments from consumers on the demand side of the meter can reduce the need to add expensive new capacity that would otherwise be necessary to meet peak demands of only a few hours duration per year (e.g., on the hottest summer days). A recent study of the New York State power pool suggests that savings in that one area alone could reach \$660 million annually by 2010.
- Second, our cost analysis assumes that regulators and firms would not repeat past mistakes with respect to capacity planning, choice of technology, or project management that have raised the cost of power to consumers. While regulators have undoubtedly learned from past events, future regulation is unlikely to be perfect.
- Finally, experience in other sectors suggests that competition will lead to the creation of new product combinations with greater economic value to consumers. Our estimates do not reflect this benefit at all.

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Appendix C follows
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U.S. DEPARTMENT OF ENERGY

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DEPUTY DIRECTOR

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Com. Action
+
plus for
A36*

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COMPREHENSIVE ELECTRICITY COMPETITION PLAN: SUPPORTING ANALYSIS



Office of Economic, Electricity and Natural Gas Analysis
Office of Policy and International Affairs

June 1998

APPENDIX C:

POTENTIAL COST SAVINGS FROM ELECTRICITY COMPETITION

Summary:

This paper quantifies potential savings opportunities in four areas: cost reduction (including fuel procurement, non-fuel operation and maintenance (O&M) expenses, and administrative and general (A&G) expenses), dispatch efficiency, improved capital utilization, and savings in capital additions. Table 1 summarizes these potential savings.

Table 1
Summary of Cost Savings Potential from Competition

Source of Savings	Potential Size of Benefit (billions of \$)
Cost Reduction (Fuel, non-fuel O&M, A&G)	\$24.6
Dispatch Efficiency	\$0.6
Improved Capital Utilization	\$0.8 to \$2.6
Reduced Capital Additions	\$0.3 to \$3.8
TOTAL	\$26.3-31.6

Several sources of important additional savings are not considered in this paper.

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Second, our cost analysis assumes that regulators and firms would not repeat past mistakes with respect to capacity planning, choice of technology, or project management that have raised the cost of power to consumers. While regulators have undoubtedly learned from past events, future regulation is unlikely to be perfect.

Finally, experience in other sectors suggests that competition will lead to the creation of new product combinations with greater economic value to consumers. Our estimates do not reflect this benefit at all.

The remainder of this paper provides detail on the four categories of potential savings summarized in Table 1.

1. Fuel Costs, Non-Fuel Operation and Maintenance (O&M) Costs, and Administrative and

General (A&G) Costs

Fuel Costs, Non-Fuel O&M Costs, and A&G Costs, which together accounted for roughly \$94 billion in reported utility cost in 1995, largely reflect the current operations of electric utilities. (Note: A portion of A&G costs also reflect historical operations to the extent that pension liabilities have not been funded on a current basis.)

Information reported in standard industry filings suggests a wide range of cost experience across reporting units and companies. These data can be used to gain insight into opportunities for cost reduction. Our approach here is to estimate the value of bringing the cost performance of the entire industry up to the standard already demonstrated by top industry performers -- represented in this paper as the average of the top quartile of reported performance.

Some of the difference in cost experience clearly reflects circumstances that will not be changed by the advent of competition. For example, coal prices differ according to the distance from low-cost coal supplies; heat rates reflect the vintage, type, scale, and operating rate of plants and pollution control requirements; and distribution costs are systematically related to the density of customers on a system. To account for such factors, the reported data is stratified along key dimensions prior to developing the quartile analysis. Stratification (details reported in Appendix) narrows the range of cost variation, but significant differences remain, as reported in Table 2.

Table 2
Cost-Reduction Opportunities

Category	Potential Savings (billions of 1996 dollars)
Fuel Acquisition	\$6.7
Heat Rates	\$0.9
Non-fuel Operation and Maintenance	\$11.0
Administrative and General	\$6.0
TOTAL	24.6

The reported total of \$24.6 billion in cost-saving potential could either underestimate or overestimate actual cost reduction opportunities. On the underestimation side, top quartile performance under regulation may understate achievable efficiencies under competition as even the best current performers re-engineer and rethink their activities. Moreover, the lack of data for existing non-utility generators, who are widely believed to be among the most cost-effective operators, could lead to some underestimation of even the current state-of-the-art efficiencies. On the overestimation side, the stratification underlying the quartiles reported in Table 2 for fuel and O&M costs may fail to account for all sources of irreducible cost differences. Moreover, the portion of the variation in cost across plants that reflects contract cycles for fuel and other inputs could be expected to narrow over time independent of the advent of competition.

2. Dispatch Efficiencies

Competition is likely to result in improved dispatch efficiencies. The advent of competition will shift the market from a "shared savings" paradigm to one in which the party that identifies a cost-effective trade can reap the benefits, providing dispatch efficiencies beyond those that might result from wholesale competition alone. Analyses using the Policy Office Electricity Modeling System (POEMS) suggest that dispatch efficiencies resulting from retail competition can reduce aggregate system fuel costs by approximately \$600 million relative to a scenario reflecting a continued cost-of-service regime.

3. More Efficient Utilization of Capital.

The generation, transmission, and distribution of electricity are among the most capital-intensive activities in the U.S. Yet, the relatively inflexible price signals provided to consumers under traditional cost-of-service regulation have resulted in relatively poor utilization of our substantial investment in electricity-related capital. Retail competition will allow electricity markets to emulate the experience of airlines and communications providers in implementing load-sensitive pricing regimes (such as 5 cents per minute calls on Sundays), allowing the additional use of electricity in price sensitive applications during off-peak and off-season periods.

Ideally, the gains from more efficient capital utilization would be calculated separately for each load segment in each season. However, absent estimates of segment-specific demand responses to price variation, the impacts of competition on average prices can be used to develop a rough estimate of capital utilization benefits. Model results and recent experience with restructuring at the state level suggest that average delivered prices in a restructured industry will average 6 to 9 mills (9 to 13 percent) lower than prices projected under continued cost-of-service regulation, depending upon what provisions are made for stranded cost recovery. Using an estimate of -0.1 to -0.2 for the price elasticity (the percentage change in demand resulting from a 1% increase in price), the 9 to 13 percent price drop translates into an increase of between 0.9 and 2.6 percent in electricity sales.

The net welfare benefit from these extra sales includes two components. First, there is additional "consumer surplus" which reflects the extent to which the value of the extra electricity to buyers exceeds its price. Second, since extra sales under load-sensitive market pricing do not increase transmission or distribution system costs or stranded costs, any transmission, distribution, or stranded cost charges on these sales are also a net welfare gain. In 1995, the national average for transmission and distribution was 2.38 cents per kilowatt-hour. For a level of baseline demand of 3250 billion kilowatthours, the estimated net welfare gain from more intensive capital utilization is estimated to fall between \$820 million and \$2.6 billion.

It is important to note that the estimates in this section focus narrowly on the more efficient use of the baseline capital stock and do not include an estimate of the substantial benefit of more nimble pricing in curtailing peaks that often necessitate the addition of expensive new capacity.

4. Reduced Capital Costs at Existing Plants

Capital additions at existing plants are another area where available data suggest a considerable range of experience across utilities. However, the analysis of such additions can be quite complex. First, a considerable portion of the observed variation in the cost of capital additions per unit of capacity can often result from environmental or nuclear regulatory decisions or determinations affecting specific units that would not be sensitive to the shift to a more competitive regime. Second, capital additions occur at irregularly spaced intervals, and many plants will have no significant capital additions in a particular year.

To address the issue of irregularly-spaced capital additions, we focused on average capital additions over a decade rather than additions in a single year. Over the 1985 to 1995 period, reported capital additions at existing power plants averaged approximately \$6.3 billion per year, with average additions of \$3.1 billion at nuclear plants, \$2.6 billion at coal fired plants, and \$0.6 billion at oil and gas steam plants.

For present purposes, the most interesting comparisons can be made within the set of coal plants commissioned after 1965 that were operating without scrubbers or NO_x controls at the end of the sample period. Capital additions at these plants would not reflect the costs of repowering, emissions control requirements, or nuclear regulation. Assuming that the average of the top quartile of reporting units reflects the typical standard of performance in competitive markets, annual cost savings opportunities relative to actual reported costs for capacity additions within this relatively homogeneous subgroup of coal plants are estimated at \$274 million out of \$468 million. The application of quartile analysis to the capital additions data for the stratified sample of all plants of all fuel types suggests an overall potential savings of \$3.8 billion, but this is likely to be a significant overestimate for reasons outlined above. The real potential for cost-savings in capital additions likely lies in the lower portion of the range of \$0.3 to \$3.8 billion.

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Fuel Costs, Non-Fuel Operation and Maintenance (O&M) Costs, and Administrative and General (A&G) Costs

Fuel Costs, Non-Fuel O&M Costs, and A&G Costs, which together accounted for roughly \$94 billion in reported utility costs in 1995, largely reflect the current operations of electric utilities.²³

Information reported in standard industry filings suggests a wide range of cost experience across reporting units and companies. These data can provide insight into opportunities for cost reduction. Our approach here is to estimate the value of bringing the cost performance of the entire industry up to the standard already demonstrated by top industry performers -- represented in this paper as the average of the top quartile of reported performance.

Some of the differences in cost experience clearly reflect circumstances that will not change under competition. For example, coal prices differ according to the distance from low-cost coal supplies; heat rates reflect the vintage, type, scale, and operating rate of plants and pollution control requirements; and distribution costs are systematically related to the density of customers on a system. To account for such factors, we stratified the reported data along key dimensions prior to developing the quartile analysis. Stratification narrows the range of cost variation, but significant differences remain, as reported in Table C2.

Table C2. Cost-Reduction Opportunities

Category	Potential Savings (billions of 1996 dollars)
Fuel Acquisition	\$6.7
Heat Rates	\$0.9
Non-fuel Operation and Maintenance	\$11.0
Administrative and General	\$6.0
TOTAL	\$24.6

The reported total of \$24.6 billion in cost-saving potential could either underestimate or overestimate actual cost reduction opportunities. On the underestimation side, top quartile performance under regulation may understate achievable efficiencies under competition as even the best current performers re-engineer and rethink their activities. Moreover, the lack of data for existing non-utility generators, who are widely believed to be among the most cost-effective operators, could lead to some underestimation of even the current state-of-the-art efficiencies. On the overestimation side, the stratification underlying the quartiles reported in Table C2 for fuel and O&M costs may fail to account for all sources of irreducible cost differences. Moreover, the portion

²³ A portion of A&G costs also reflect historical operations to the extent that pension liabilities have not been funded on a current basis.

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of the variation in cost across plants that reflects contract cycles for fuel and other inputs could be expected to narrow over time independent of the advent of competition.

Dispatch Efficiencies

Competition likely will result in improved dispatch efficiencies. The advent of competition will shift the market from a "shared savings" paradigm to one in which the party that identifies a cost-effective trade can reap the benefits, providing dispatch efficiencies beyond those that might result from wholesale competition alone. Analyses using the Policy Office Electricity Modeling System (POEMS) suggest that dispatch efficiencies resulting from retail competition can reduce aggregate system fuel costs by approximately \$600 million relative to a scenario reflecting a continued cost-of-service regime.

More Efficient Utilization of Capital

The generation, transmission, and distribution of electricity are among the most capital-intensive activities in the United States. Yet, the relatively inflexible price signals provided to consumers under traditional cost-of-service regulation have resulted in relatively poor utilization of our substantial investment in electricity-related capital. Retail competition will allow electricity markets to emulate the experience of airlines and communications providers in implementing load-sensitive pricing regimes,²⁴ allowing the additional use of electricity in price sensitive applications during off-peak and off-season periods.

Ideally, the gains from more efficient capital utilization would be calculated separately for each load segment in each season. However, absent estimates of segment-specific demand responses to price variation, the impacts of competition on average prices can be used to develop a rough estimate of capital utilization benefits. Model results and recent experience with restructuring at the state level suggest that average delivered prices in a restructured industry will average 6 to 9 mills (9 to 13 percent) lower than prices projected under continued cost-of-service regulation, depending upon what provisions are made for stranded cost recovery. Using an estimate of -0.1 to -0.2 for the price elasticity,²⁵ the 9 to 13 percent price drop translates into an increase of between 0.9 and 2.6 percent in electricity sales.

²⁴ An example of such a pricing regime can be found in the telecommunications industry where some firms offer lower prices during off-peak times, such as 5 cents per minute calls on Sundays.

²⁵ This represents the percentage change in demand resulting from a 1% increase in price.

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It is important to note again that the estimates in this section focus narrowly on the more efficient use of the baseline capital stock and do not include an estimate of the substantial benefit of more nimble pricing in curtailing peaks that often necessitate the addition of expensive new capacity.

Reduced Capital Costs at Existing Plants

Capital additions at existing plants are another area where available data suggest a considerable range of experience across utilities. However, the analysis of such additions can be quite complex. First, a considerable portion of the observed variation in the cost of capital additions per unit of capacity can result from environmental or nuclear regulatory decisions or determinations affecting specific units that would not be sensitive to the shift to a more competitive regime. Second, capital additions occur at irregularly spaced intervals, and many plants will have no significant capital additions in a particular year.

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For present purposes, the most interesting comparisons can be made within the set of coal plants commissioned after 1965 that were operating without scrubbers or NO_x controls at the end of the sample period, since capital additions at these plants would not reflect the costs of repowering, emissions control requirements, or nuclear regulation. Assuming that the average of the top quartile of reporting units reflects the standard of performance likely to be typical in competitive markets, annual cost savings opportunities relative to actual reported costs for capacity additions within this relatively homogeneous subgroup of coal plants are estimated at \$274 million out of \$468 million. The application of cartel analysis to the capital additions data for the stratified sample of all plants of all fuel types suggests an overall potential savings of \$3.8 billion, but this is likely to be a significant overestimate for reasons outlined above. The real potential for cost-savings in capital additions likely lies in the lower portion of the range of \$0.3 to \$3.8 billion.

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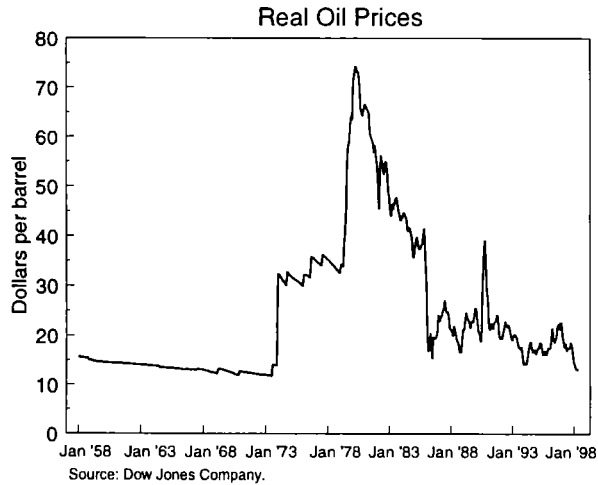
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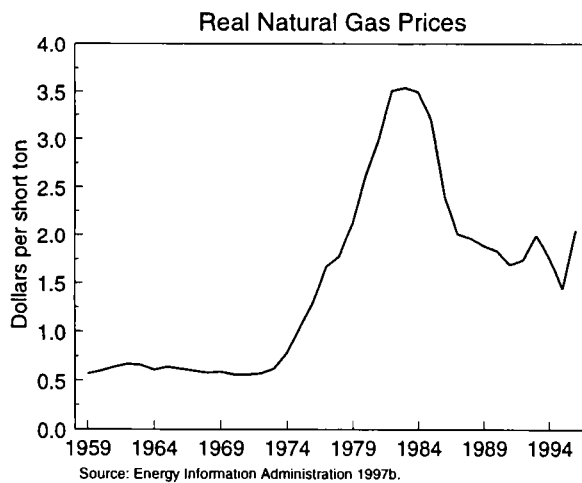
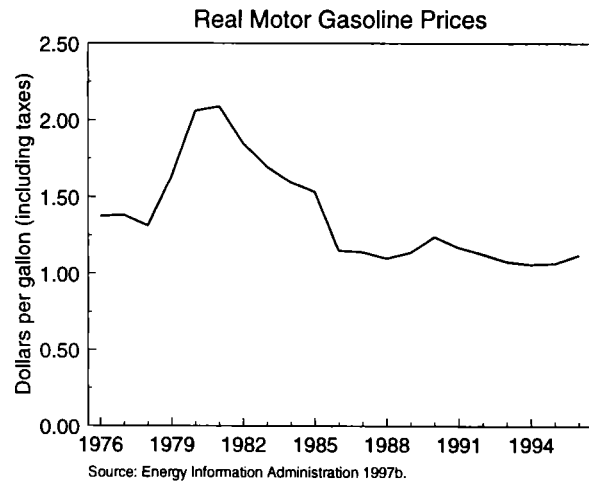
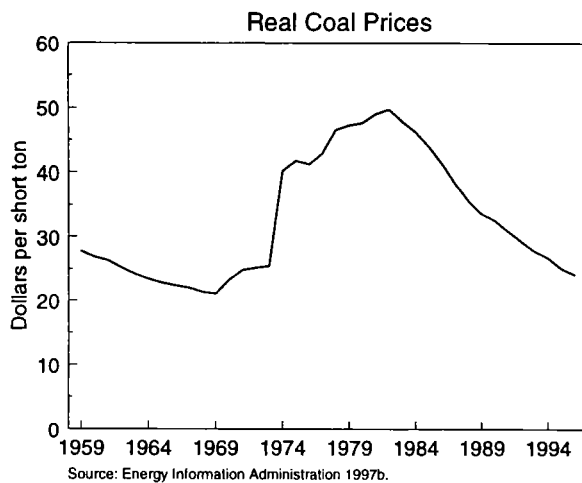
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APPENDIX D. HISTORICAL TRENDS IN U.S. ENERGY PRICES



Predicted changes in real energy prices in the illustrative \$14/ton and \$23/ton permit price scenarios are smaller than the variations observed historically.



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APPENDIX E: COUNTRY SPECIFIC ENERGY AND EMISSIONS DATA

United States
Australia
Canada
China
European Union
India
Japan
Mexico

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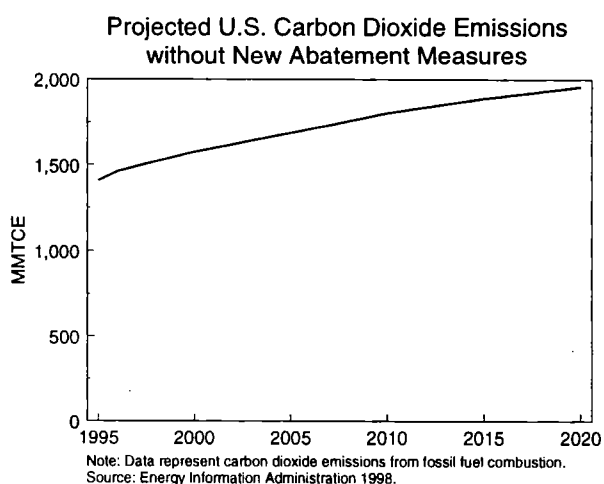
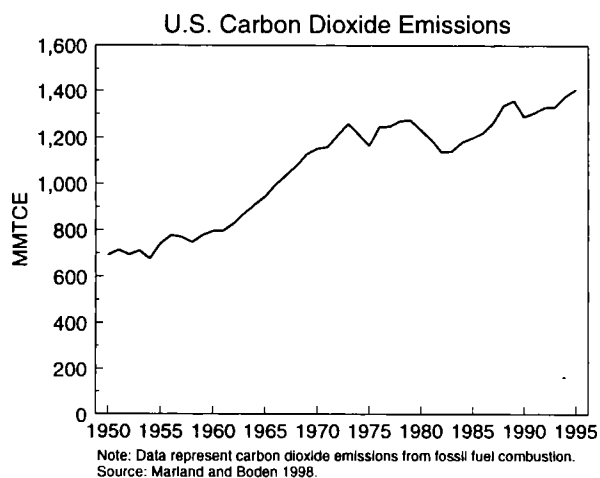
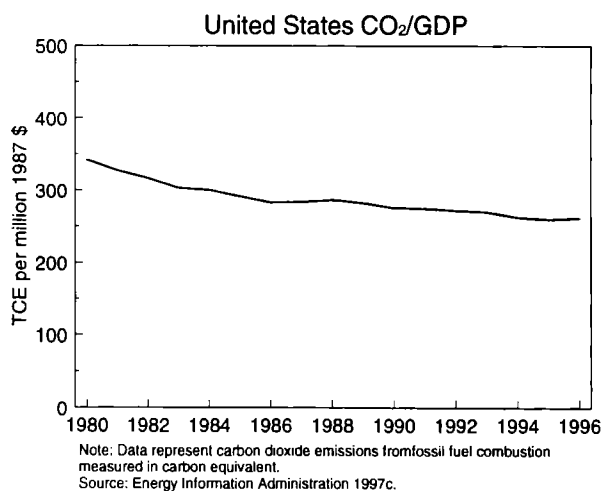
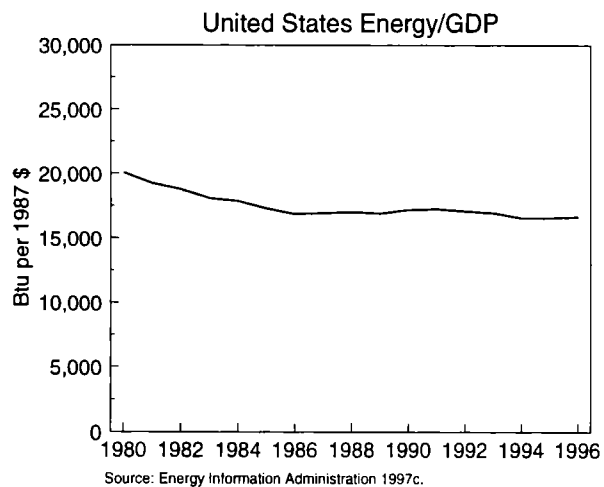
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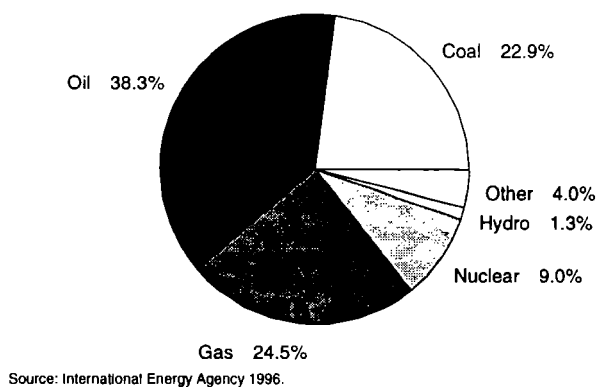
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Divider Title: _____

United States



U.S. Total Primary Energy Supply Shares, 1995



Clinton Presidential Records Digital Records Marker

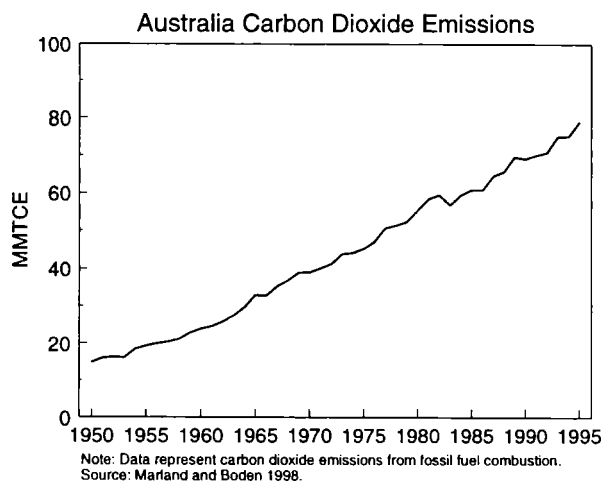
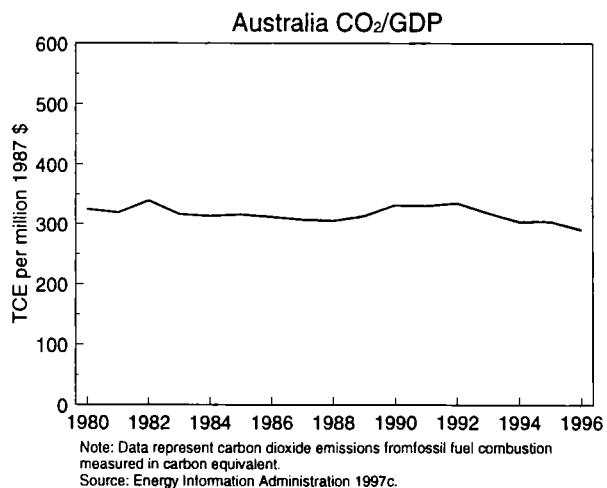
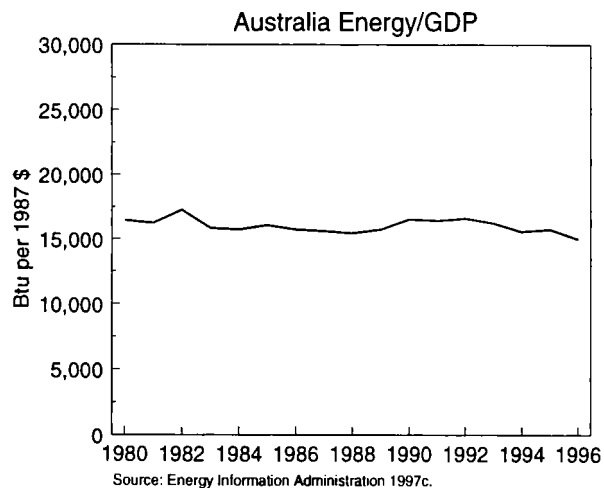
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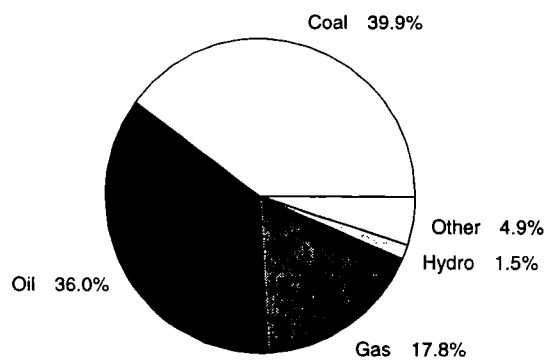
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Divider Title: _____

Australia



Australia Total Primary Energy Supply Shares, 1995



Source: International Energy Agency 1996.

Clinton Presidential Records Digital Records Marker

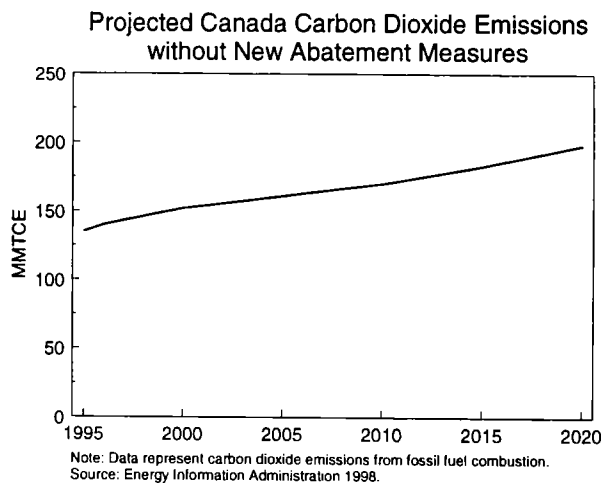
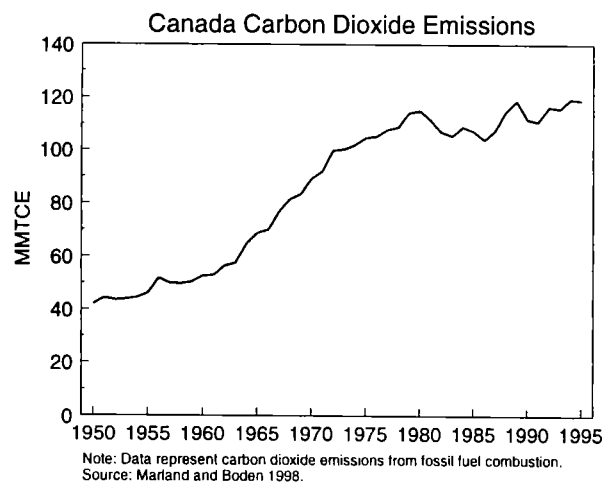
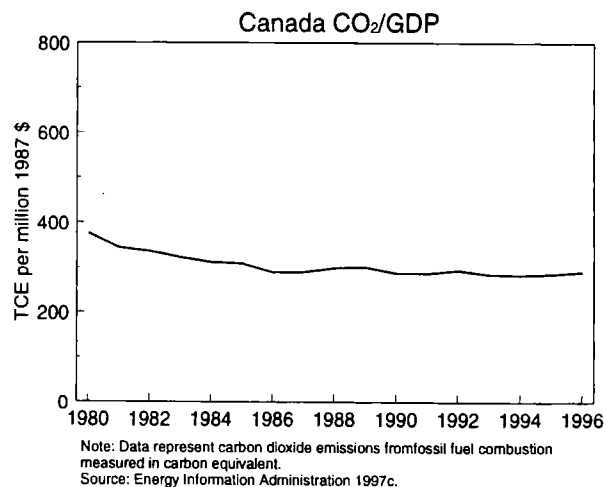
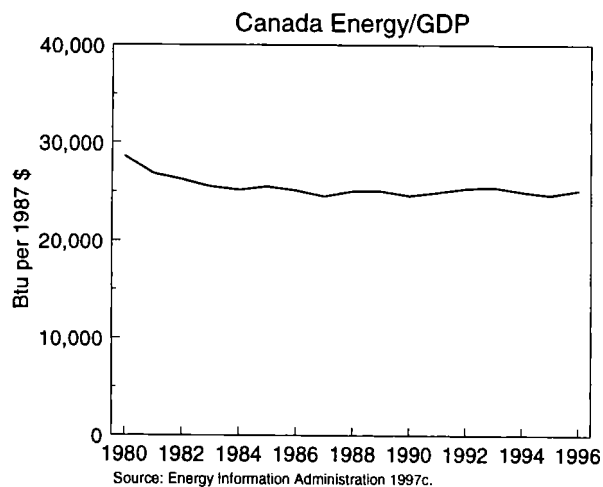
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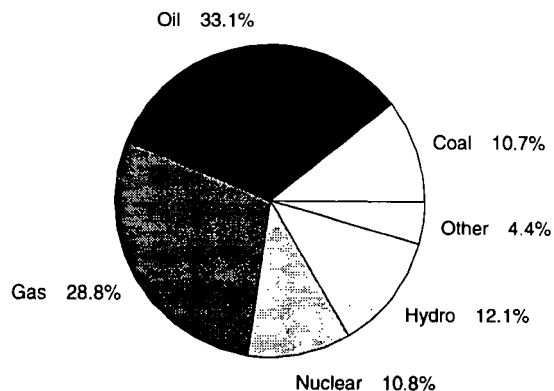
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Divider Title: _____

Canada



Canada Total Primary Energy Supply Shares, 1995



Source: International Energy Agency 1996.

Clinton Presidential Records Digital Records Marker

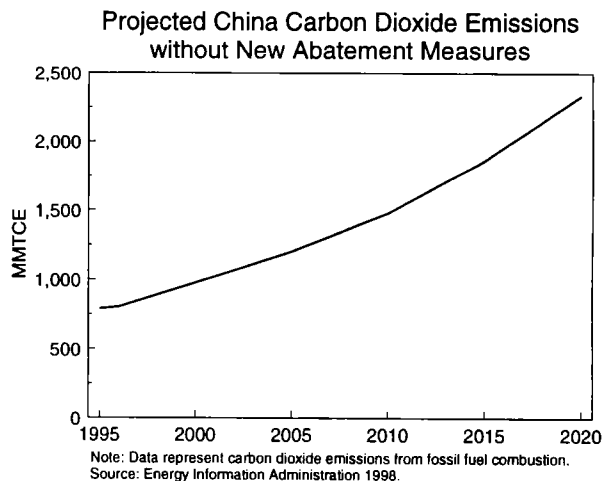
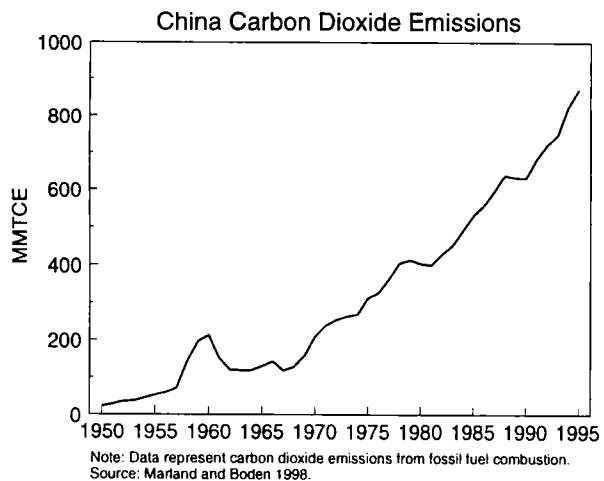
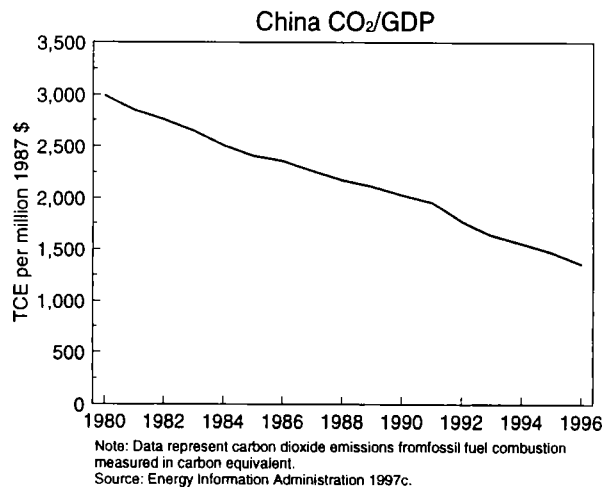
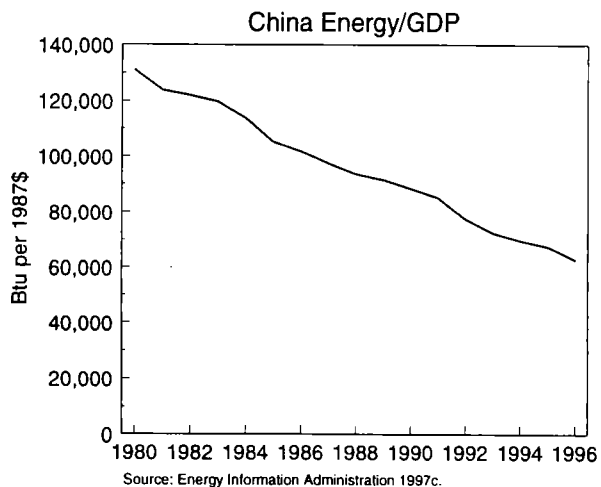
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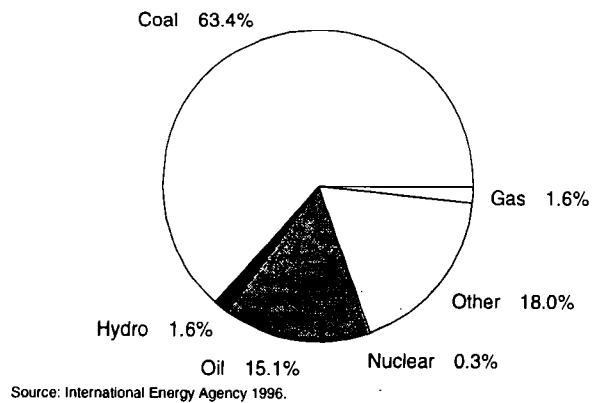
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Divider Title: _____

China



China Total Primary Energy Supply Shares, 1995



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This is not a presidential record. This is used as an administrative marker by the William J. Clinton Presidential Library Staff.

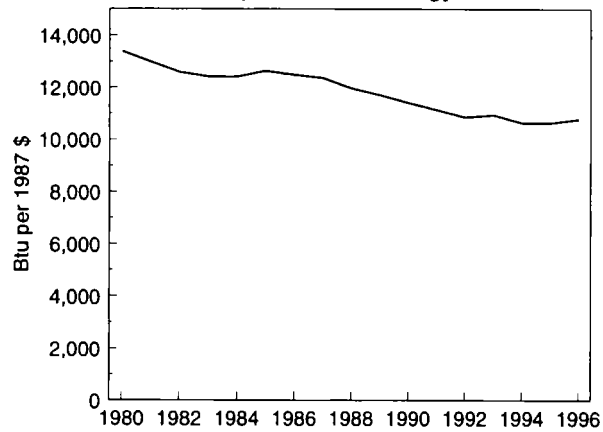
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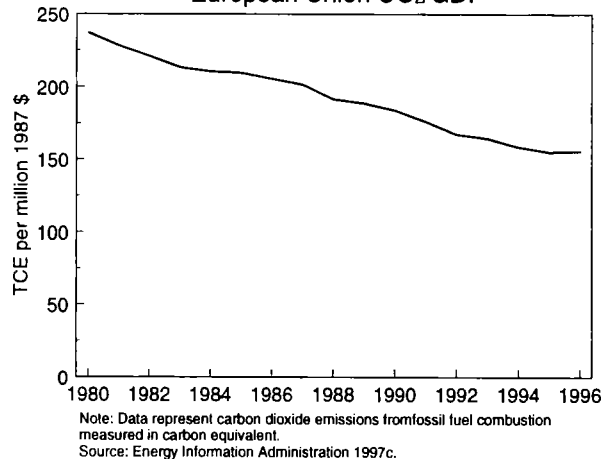
Divider Title: _____

European Union

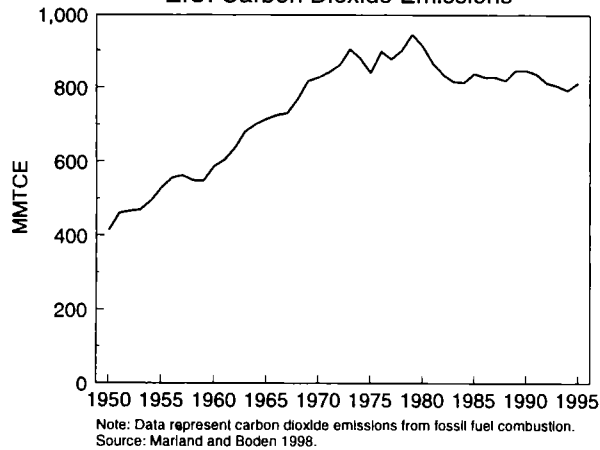
European Union Energy/GDP



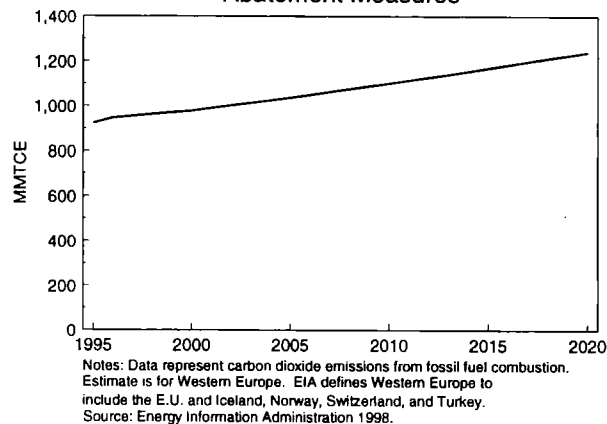
European Union CO₂/GDP



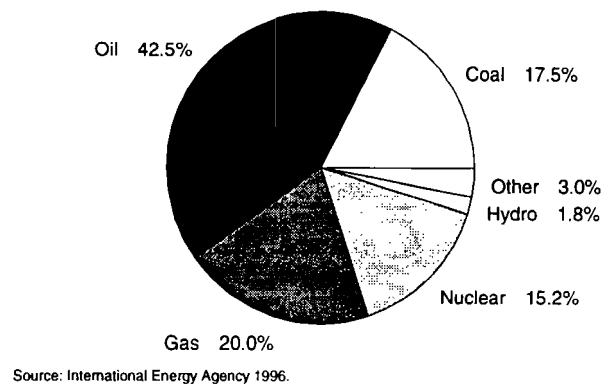
E.U. Carbon Dioxide Emissions



Projected E.U. Carbon Emissions without New Abatement Measures



E.U. Total Primary Energy Supply Shares, 1995



Clinton Presidential Records Digital Records Marker

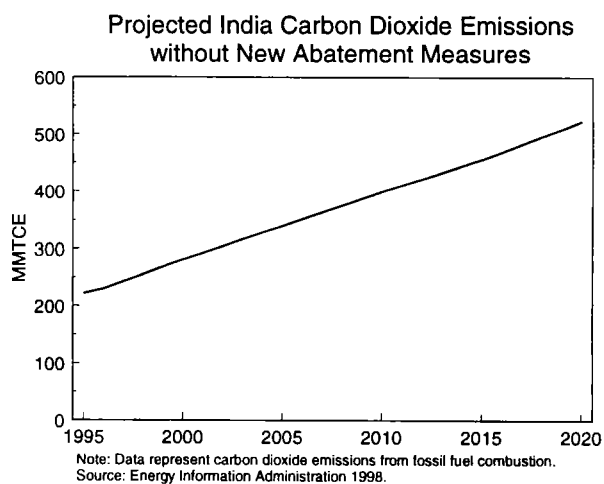
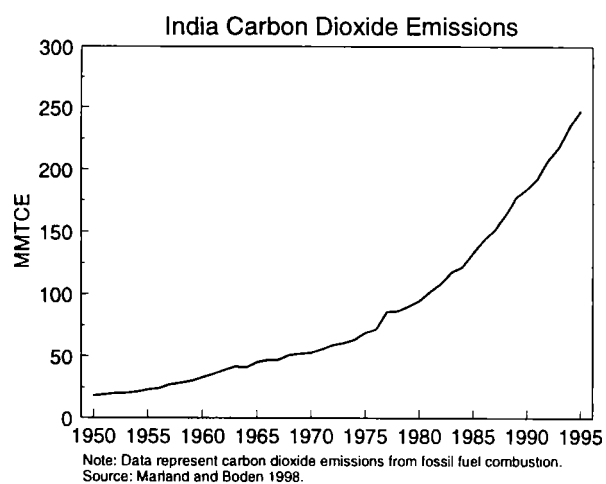
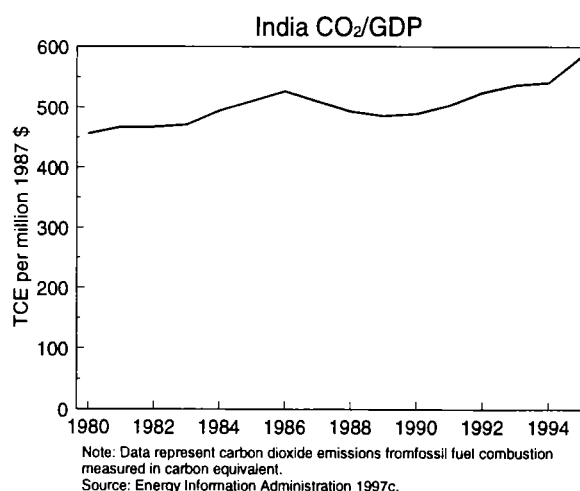
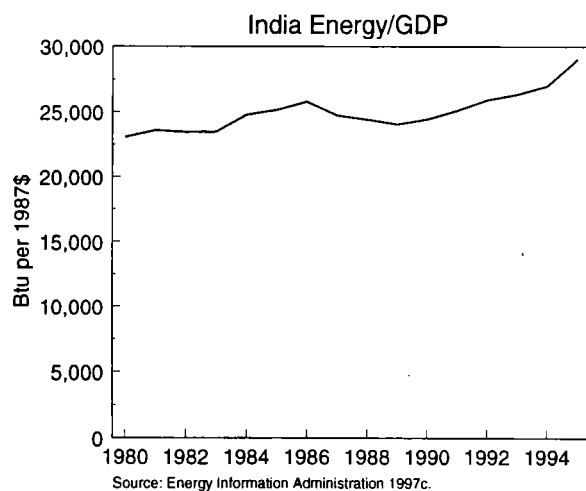
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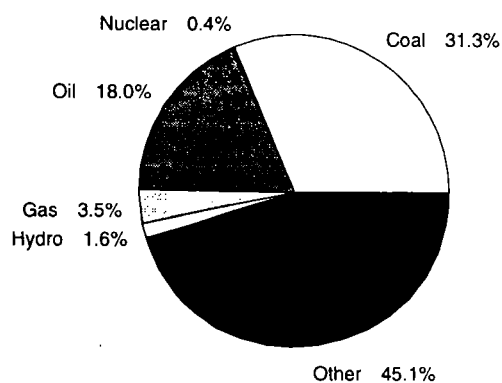
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Divider Title: _____

India



India Total Primary Energy Supply Shares, 1995



Clinton Presidential Records Digital Records Marker

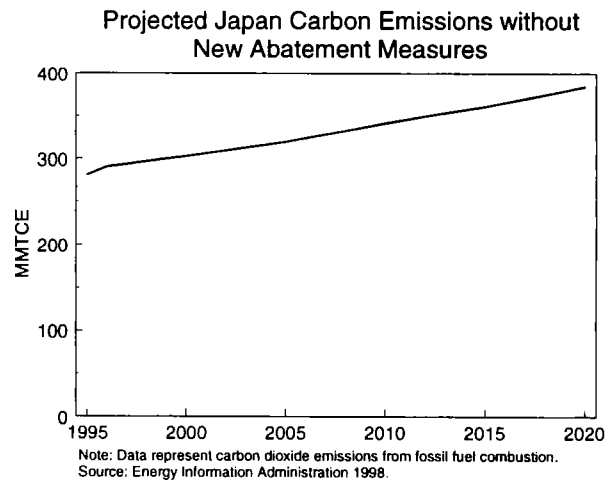
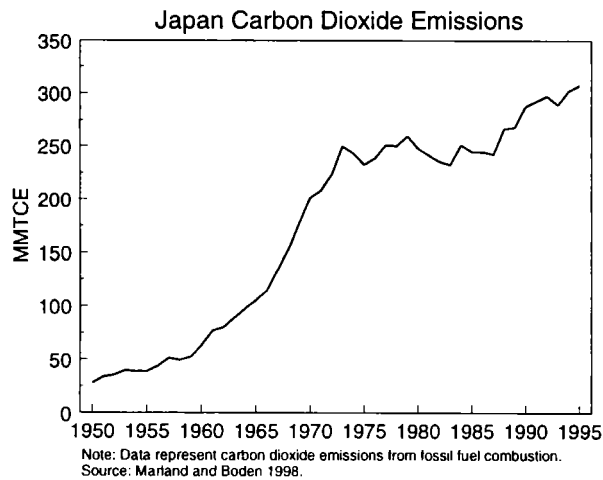
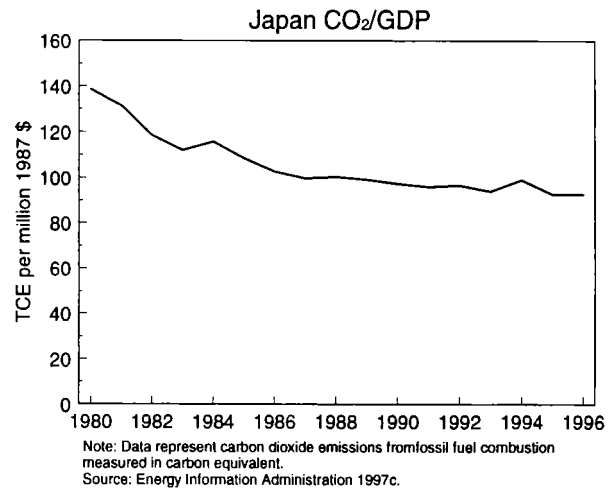
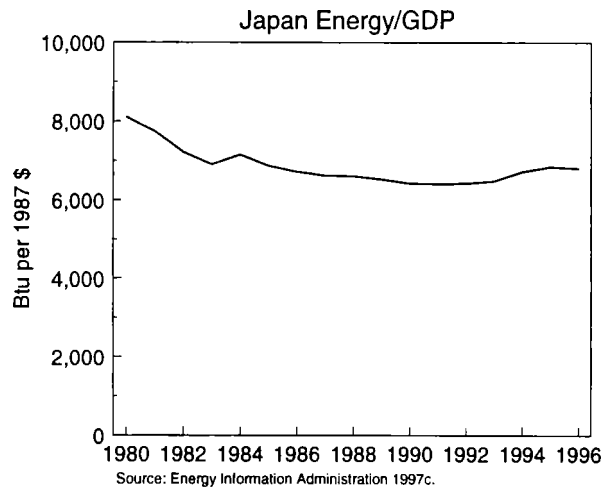
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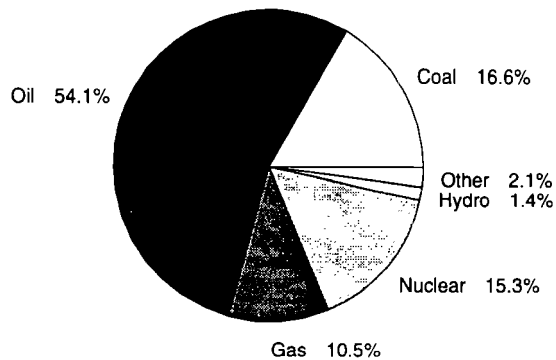
13

Divider Title: _____

Japan



Japan Total Primary Energy Supply Shares, 1995



Source: International Energy Agency 1996.

Clinton Presidential Records Digital Records Marker

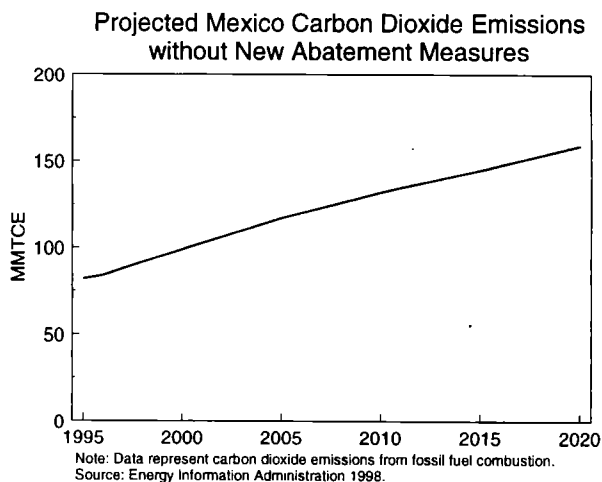
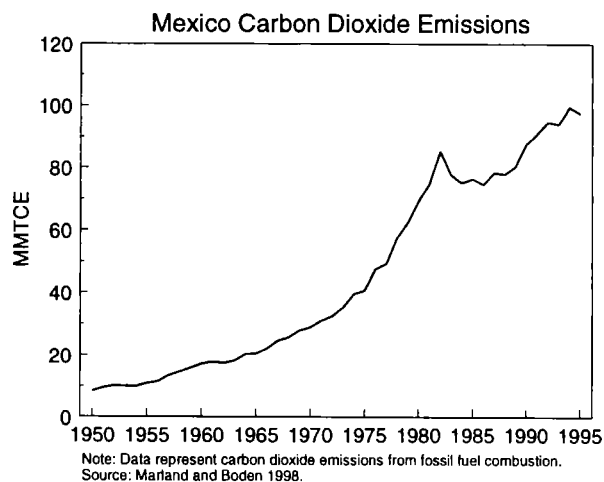
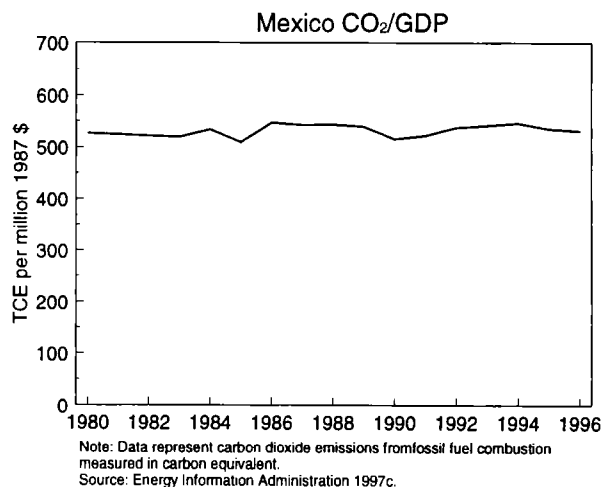
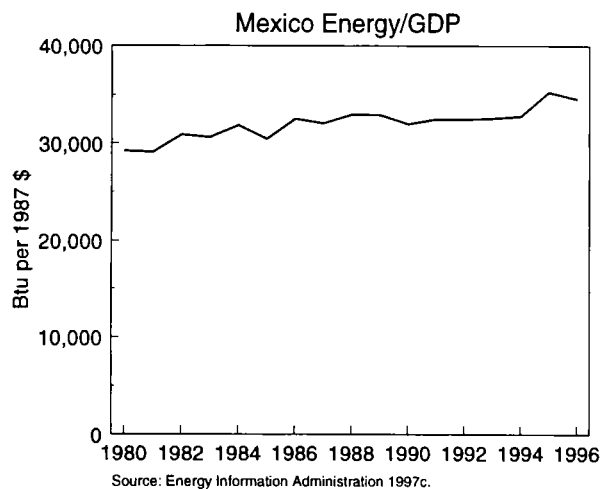
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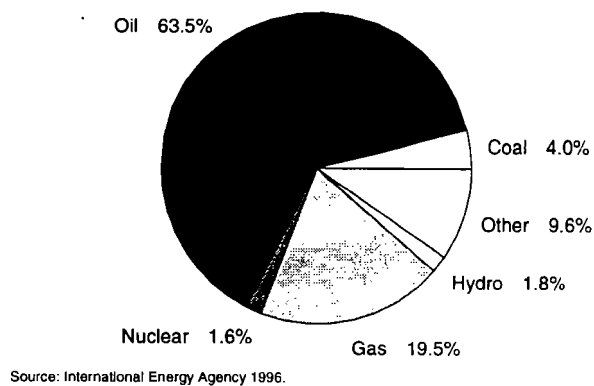
30

Divider Title: _____

Mexico



Mexico Total Primary Energy Supply Shares, 1995



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31

Divider Title: _____
