

# Electricity - The Preferred Fuel

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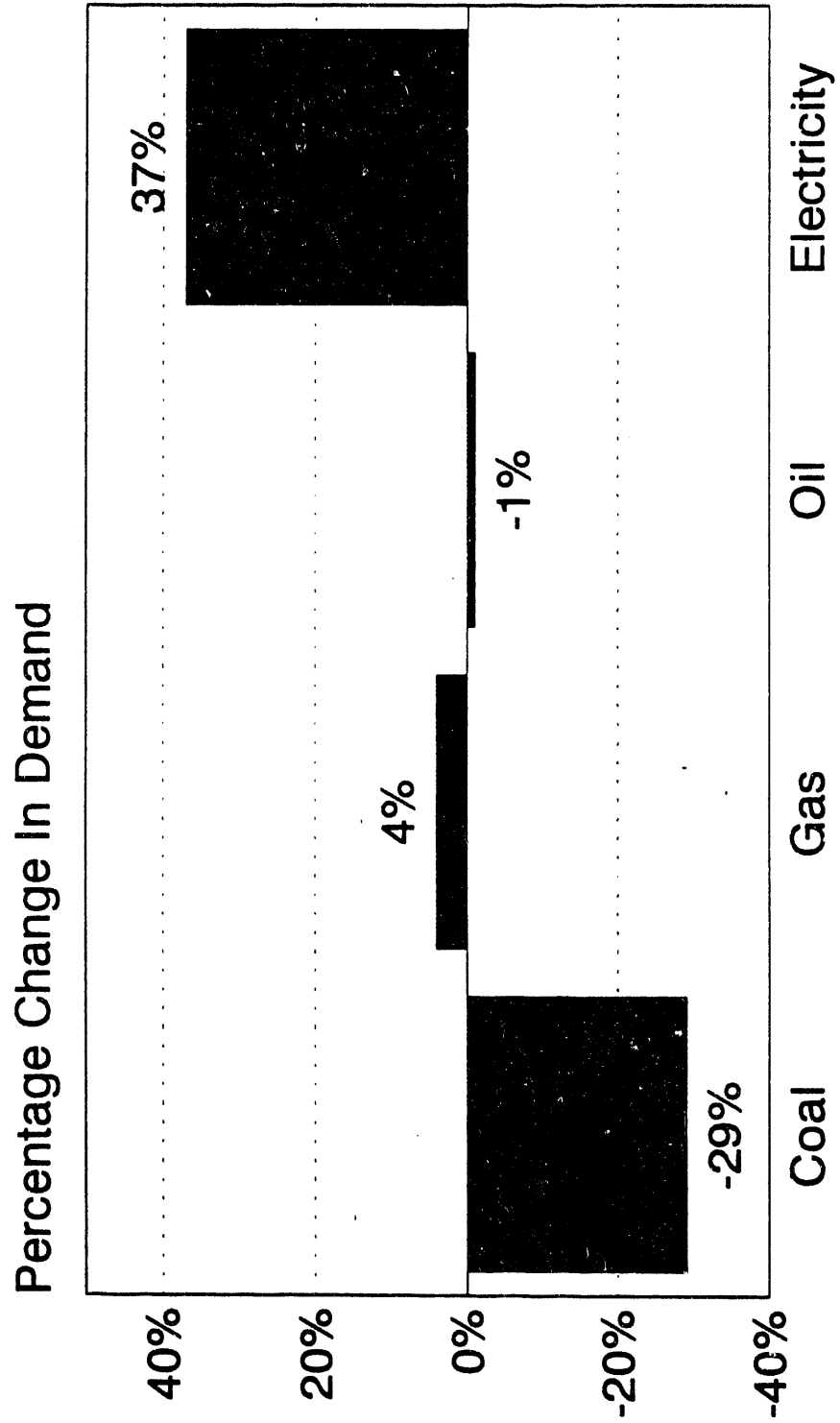
***"...the trend toward electricity as the preferred energy form for manufacturing continues."***

Second Biennial Report,  
National Critical Technologies Panel.  
January, 1993.

***"Use of electricity grew faster than other energy sources during 1960 to 1990.... The Growth is the result of electricity's superior quality, flexibility, and environmental cleanliness at the point of use."***

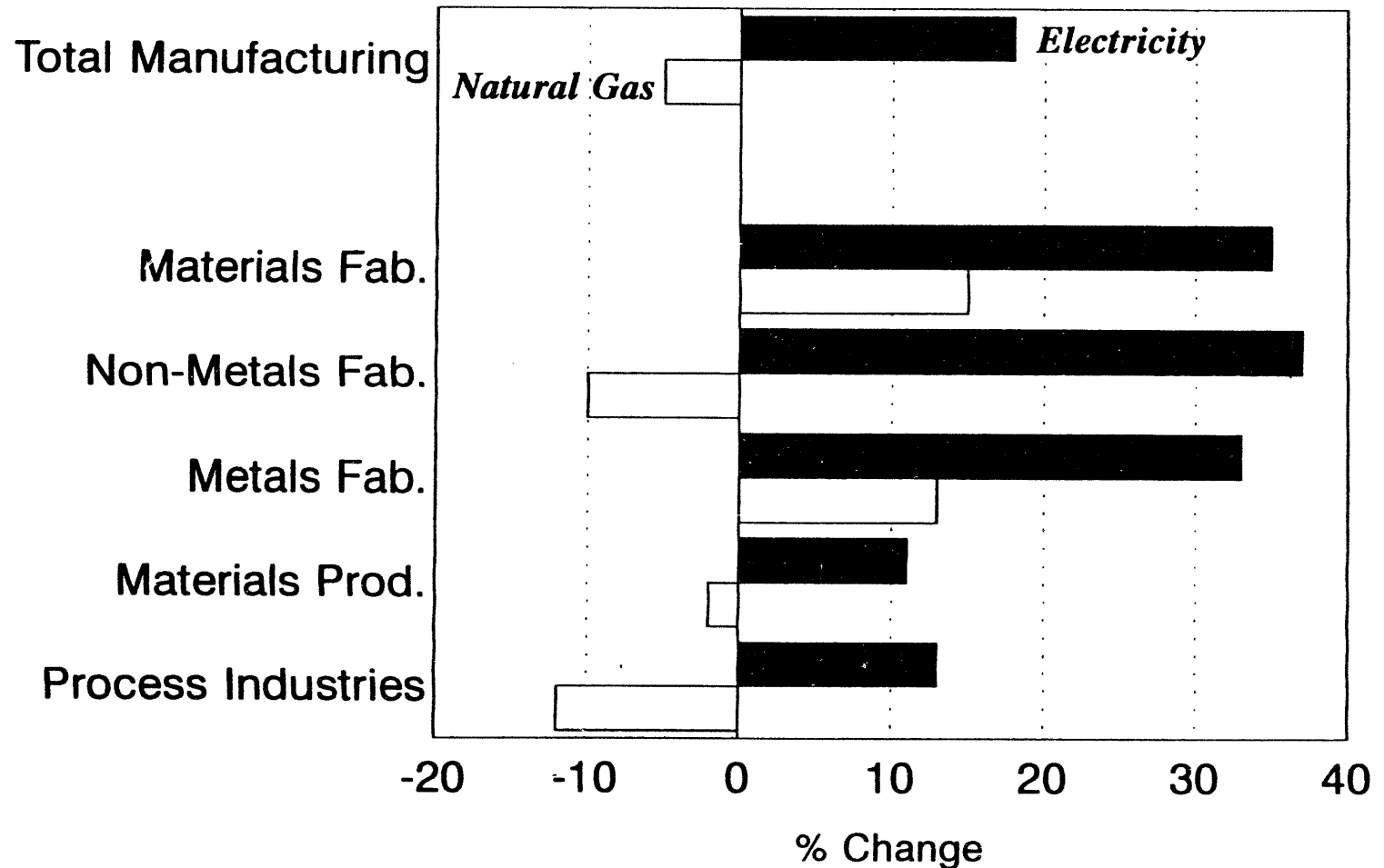
Industrial Energy Efficiency,  
Office Of Technology Assessment,  
Congress Of The United States.  
August 1993.

# Changes In Industrial End-Use Patterns (1975-1991)

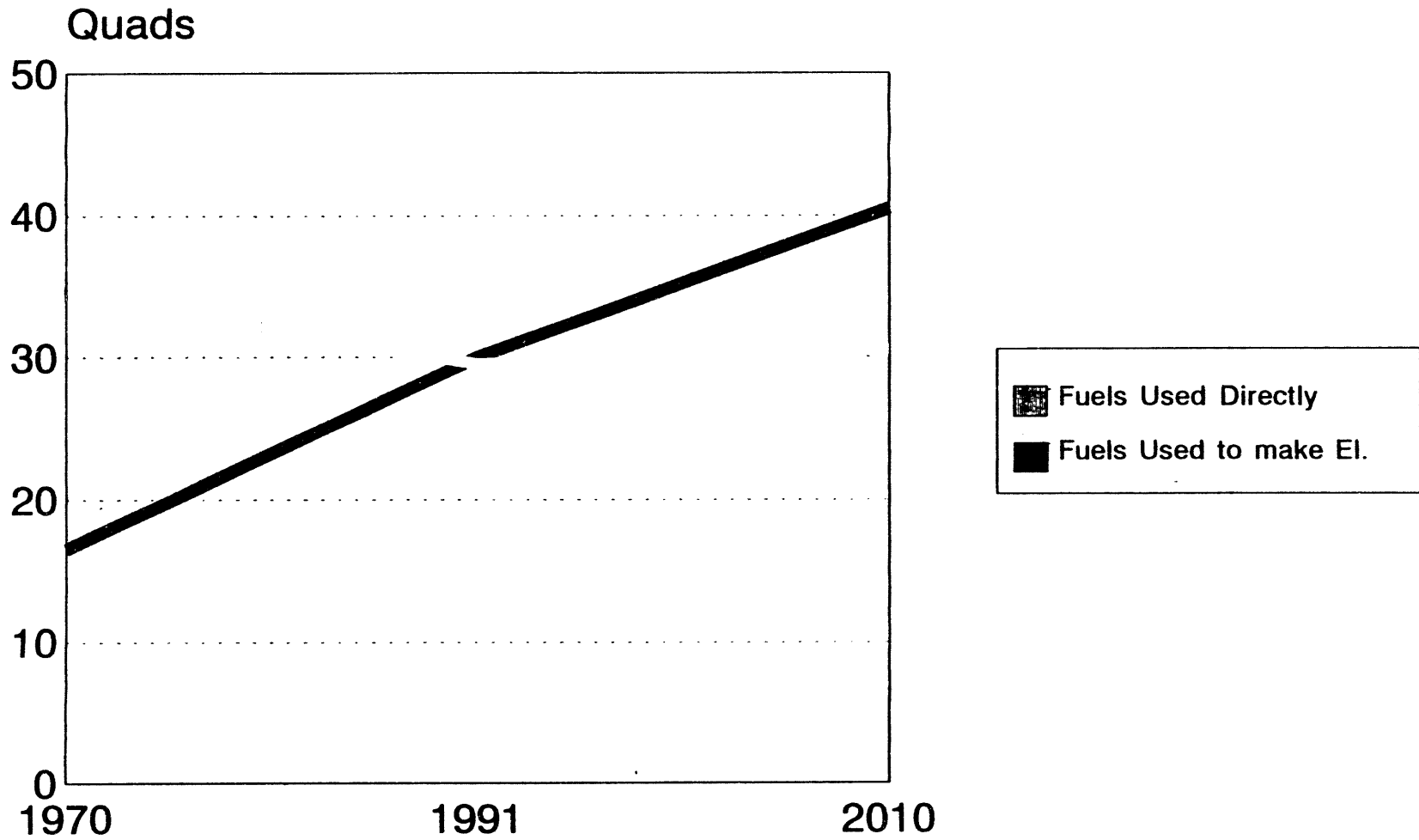


Source: U.S. DOE, EIA, Monthly Energy Review, July 1992

# Change in Market Share for Fuels Manufacturing Sector 1980-1990



# Fuel Use in the Industrial+Commercial+Residential Sector



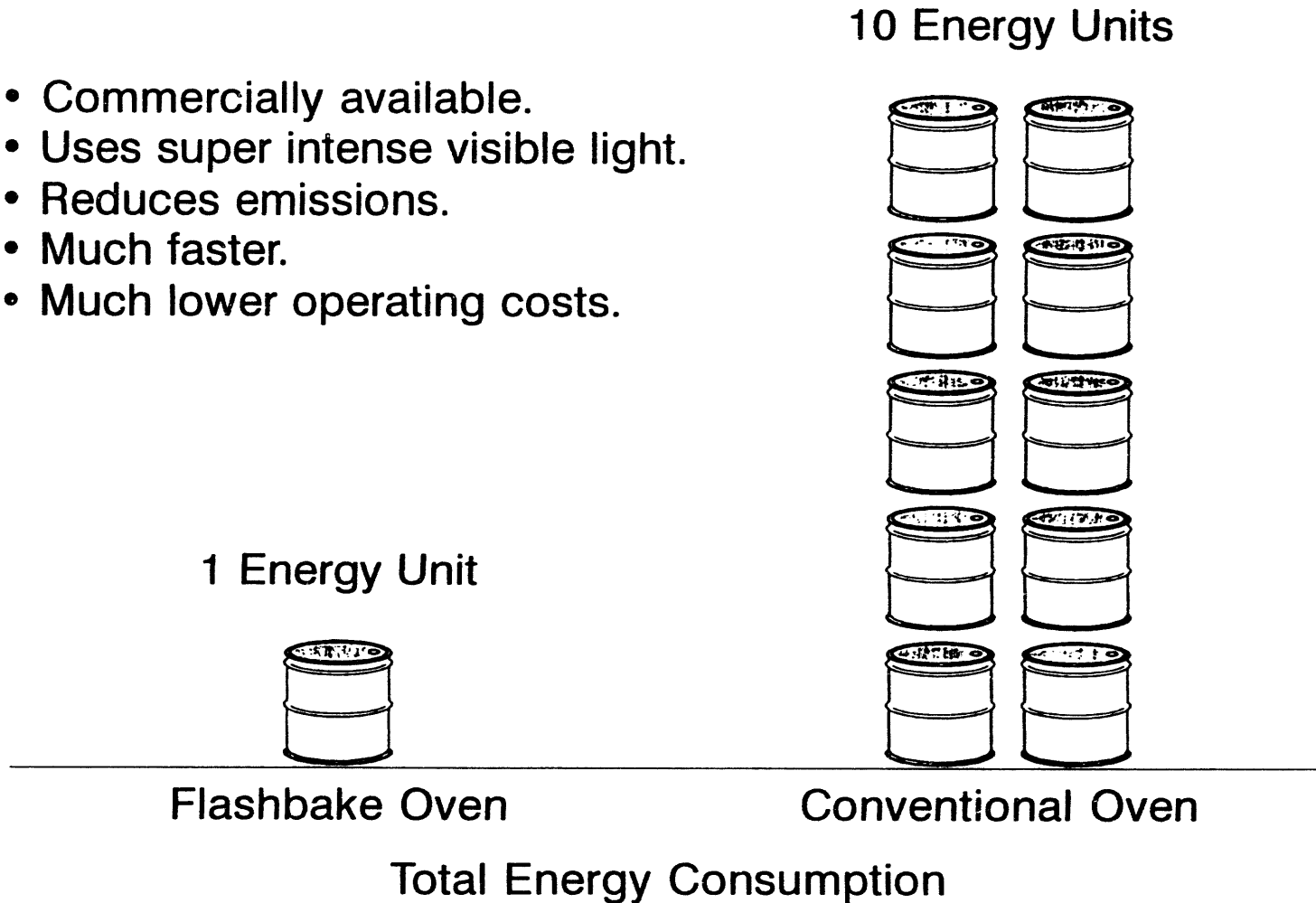
EI. Electricity

Source: Annual Energy Review, EIA, May 1991.

# Electric Technologies Conserve Energy

## Flashbake Oven Vs. Conventional Oven

- Commercially available.
- Uses super intense visible light.
- Reduces emissions.
- Much faster.
- Much lower operating costs.



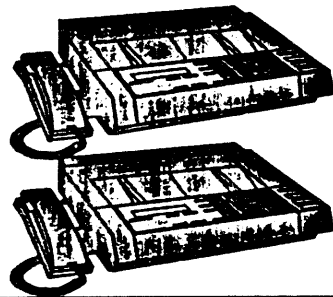
# Electric Technologies Conserve Energy

## Fax Machine vs. Overnight Delivery

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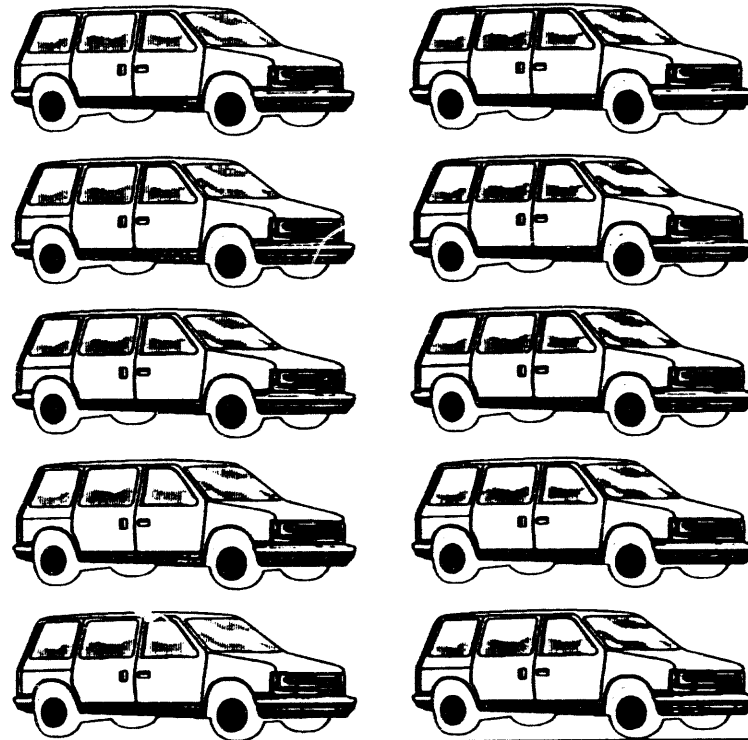
- Reduces emissions.
- Quicker.
- Reliable.
- Cheaper.

2 Energy Units



Fax Machine

10 Energy Units



Overnight Delivery

Total Energy Consumption

# Electricity's Story

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- Economic Growth
- Technology Development
- Environmental Improvement

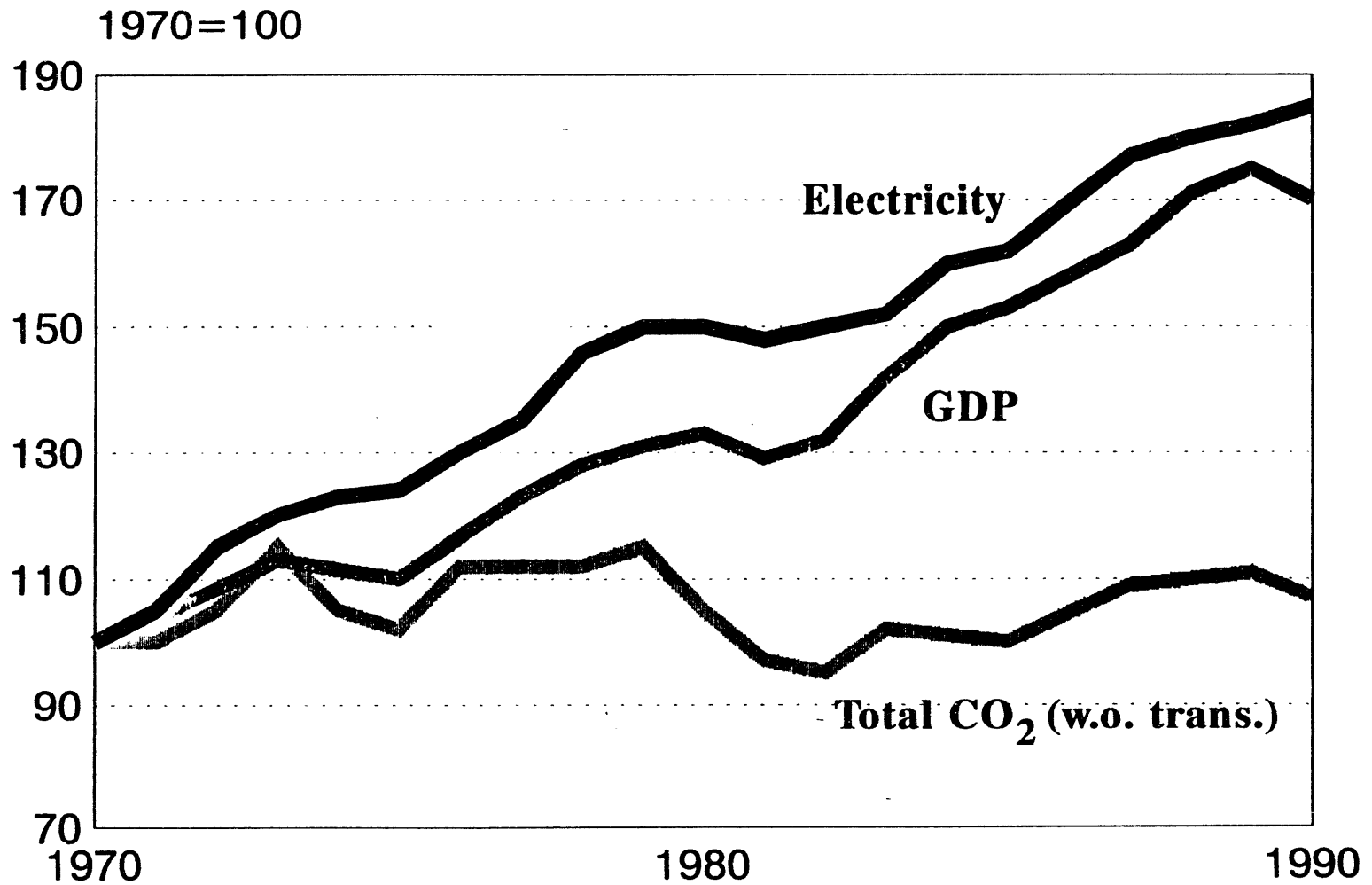
# Electricity Consumption and CO Efficiency





# CO<sub>2</sub> Emissions, Electricity Use and GDP

(Excludes Transportation)



# Carbon Reductions Through Electricity Substitutions

Efficient Electric Technologies vs.  
Comparable Systems

Average Net Reductions In  
- Carbon Emissions In End Uses

Electric Arc Furnace vs. Open-hearth  
or Oxygen Furnace

75%

Infrared Heating vs. Gas Convection Oven

50%

Electric Microwave Oven vs. Gas Oven

90%

Induction Heating vs. Gas-fired Furnace

35-44%

Electrical Glass Condition vs. Gas Furnace

67%

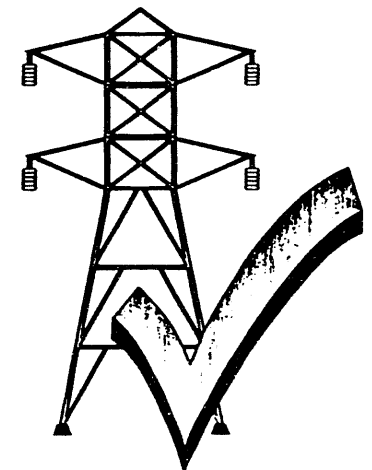
Electric Melting vs. Gas Melting

8%-31%

Electric Chiller vs. Gas-fired Absorption

Chillers

23-31%



# Carbon Reductions Through Electricity Substitutions

Efficient Electric Technologies vs.  
Comparable Systems

Average Net Reductions In  
Carbon Emissions In End Uses

Ground Source Heat Pumps vs.

Oil Heating

48%

Ground Source Heat Pumps vs.

Gas Heating

19%

Electric Fryer vs. Gas Fryer

11%

Electric Forklift vs. Diesel Forklift

54%

Fax Machine vs. Overnight

Delivery Service

64%

Electric Vehicle vs. Gasoline Car

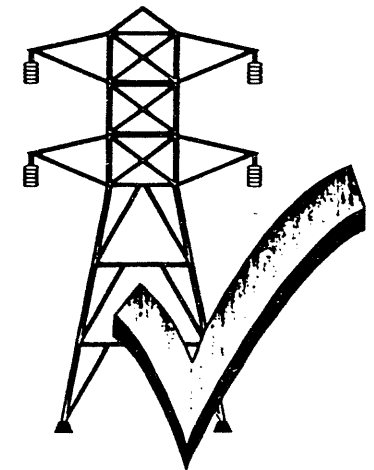
43-54%

Electric Train vs. Diesel Train

14.8%

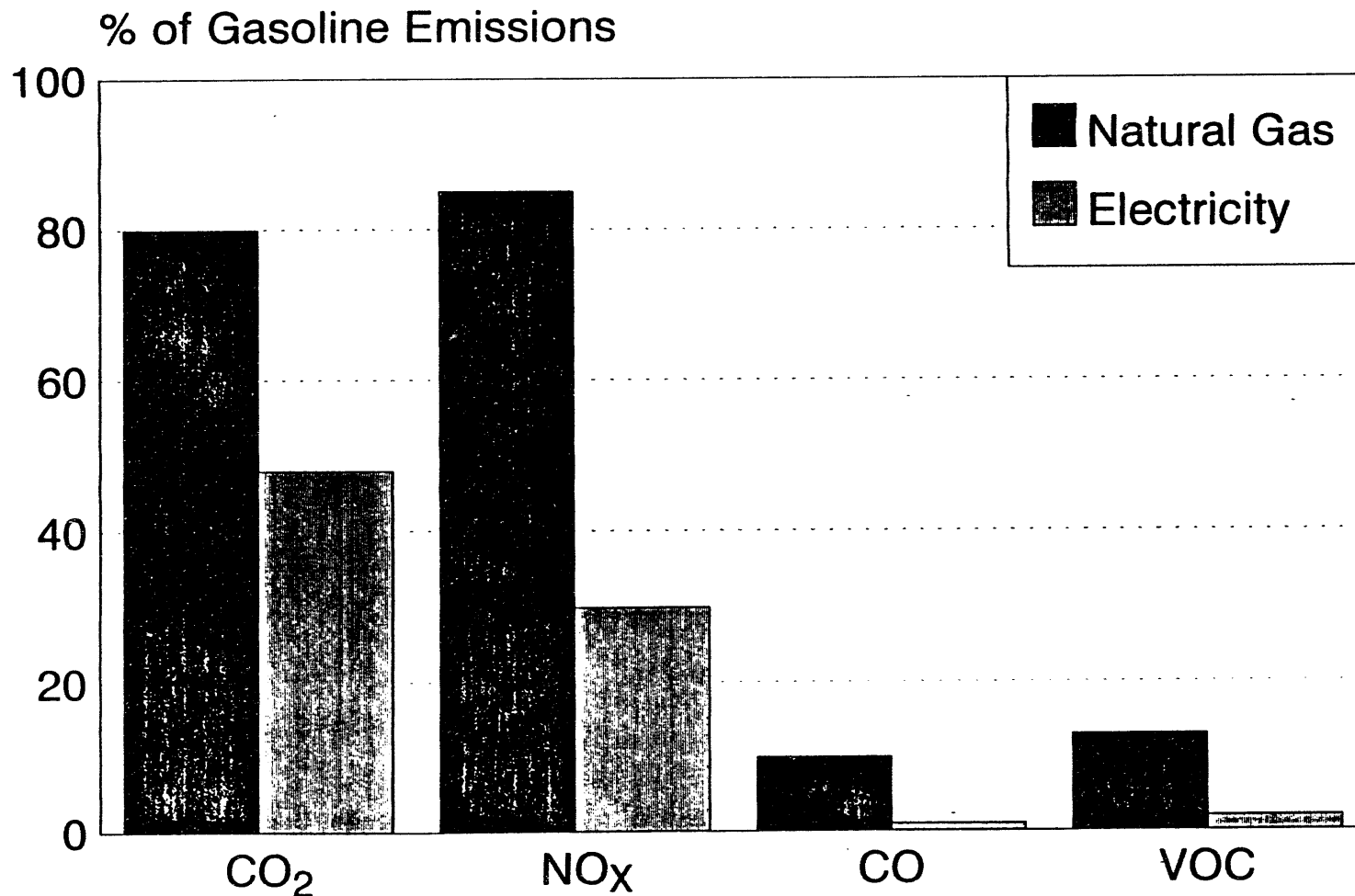
Electric Trolley vs. Gasoline Bus

71.8%

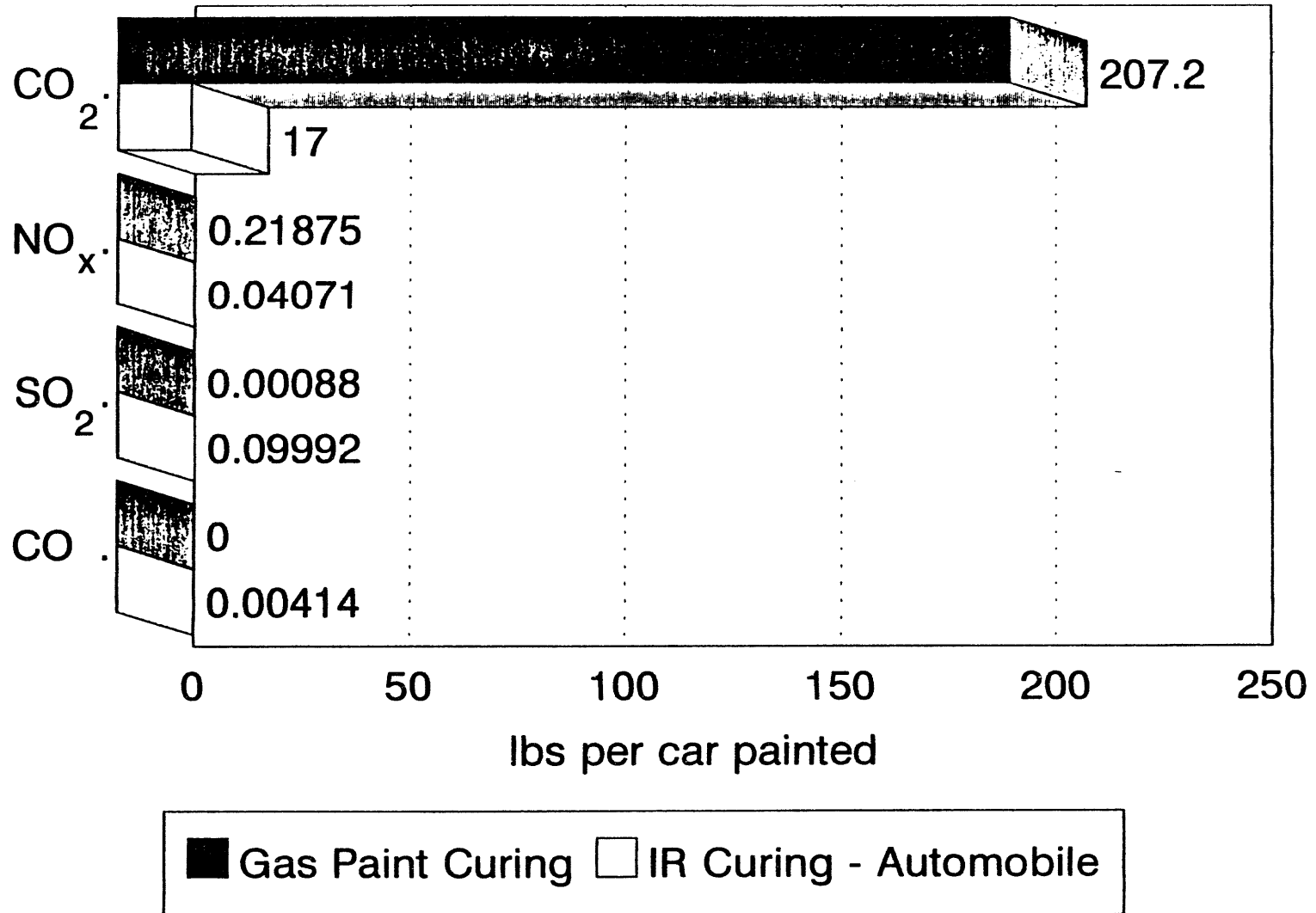


# Total Fuel-Cycle Emissions - Year 2010

## Compressed Natural Gas v. Electric Vehicle

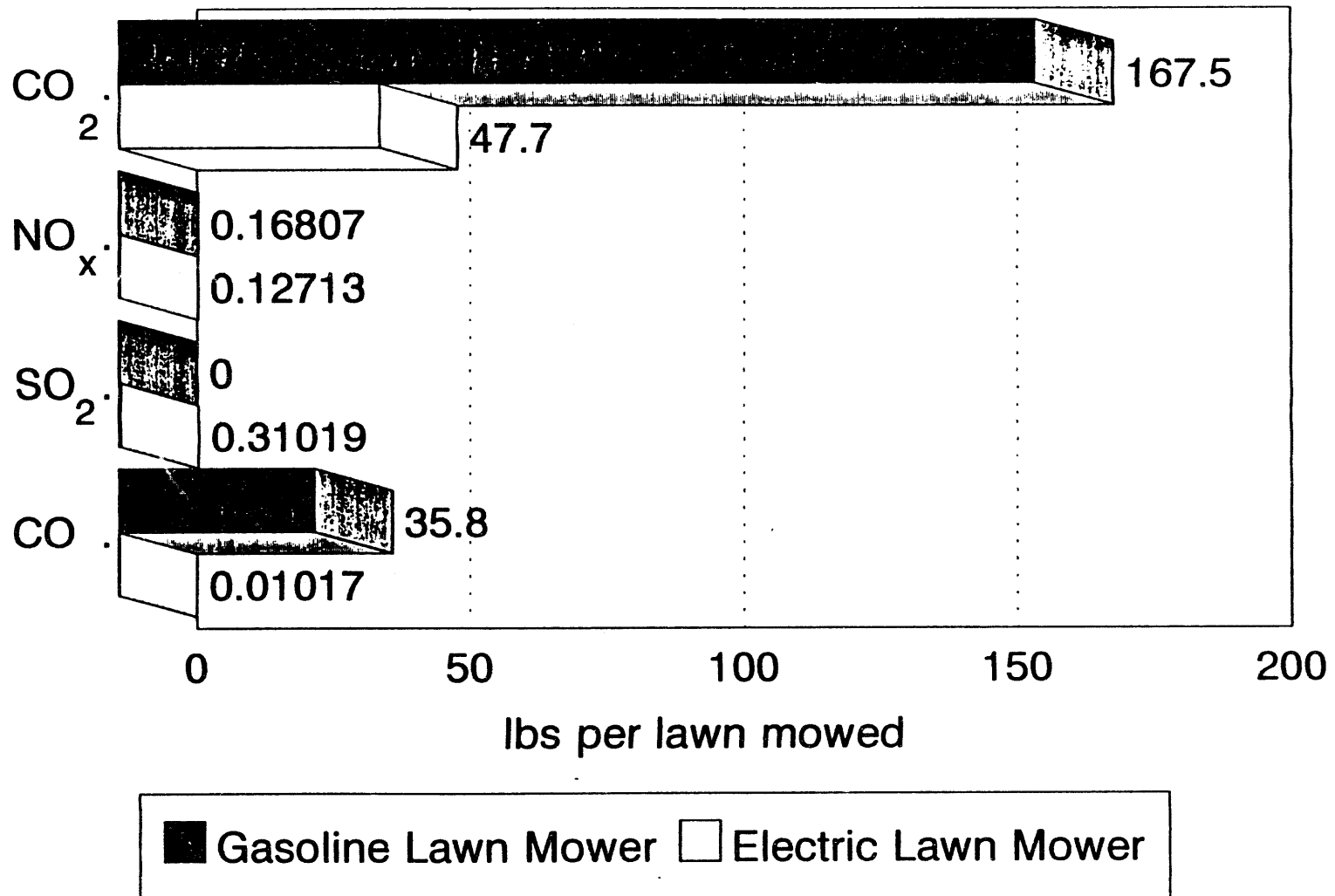


# Total Emissions - Commercial Coating Application



\* Preliminary data

# Total Emissions - Off-Road Engines



\* Preliminary data

# Major Areas of New Technology Adoption

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- **Advanced Materials**
- **Electronics**
- **Automation**
- **Computing**
- **Medicine**
- **Advanced Batteries**

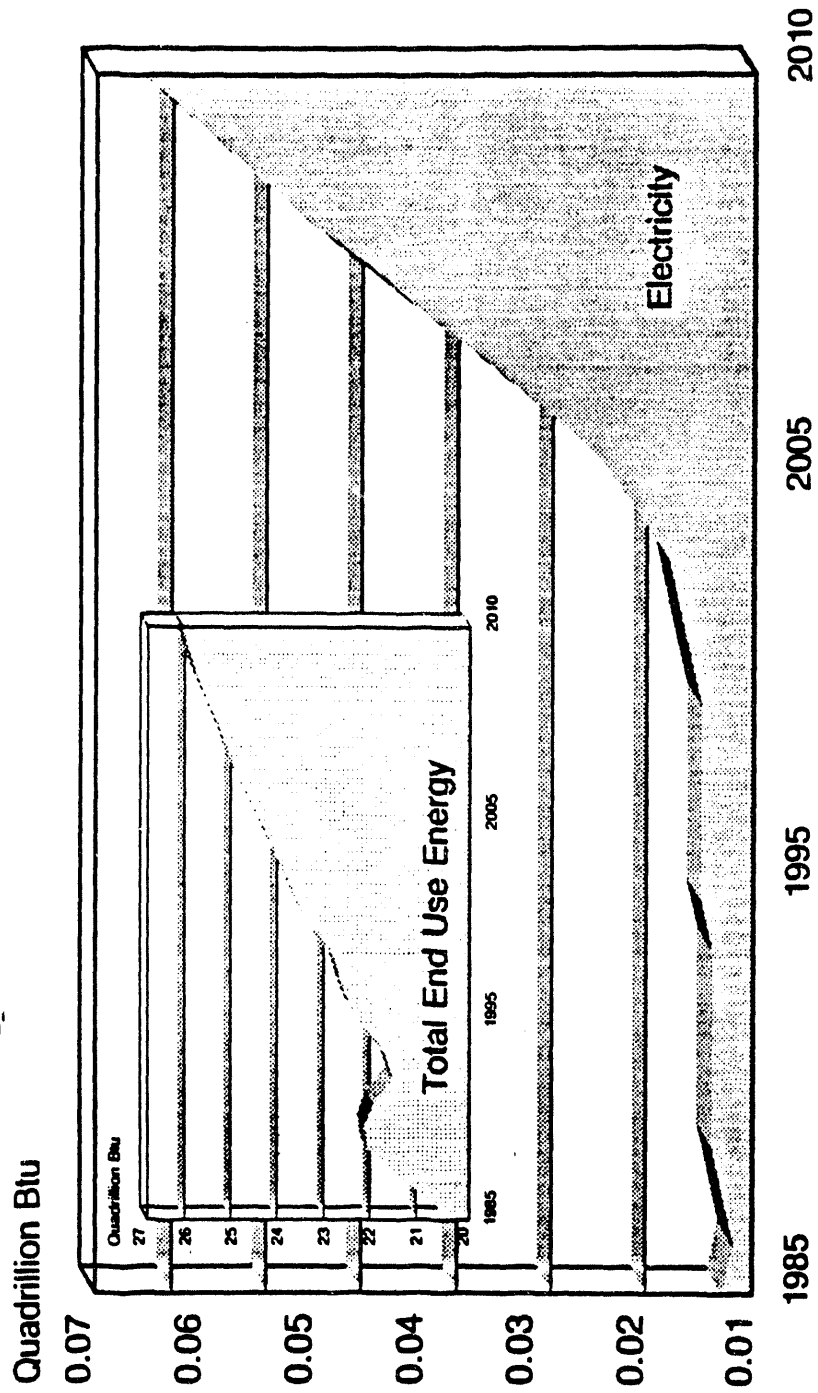
# Electricity and Innovation

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- Preliminary Study 40,000 U.S. Patents
- Detailed Evaluation 1,158 Patents
- Electrotechnologies 30 - 40% of All Technological Innovation
  - Typically Higher Impact
  - Typically Evolve Faster
- Electrotechnologies Over 50% of Process Innovation



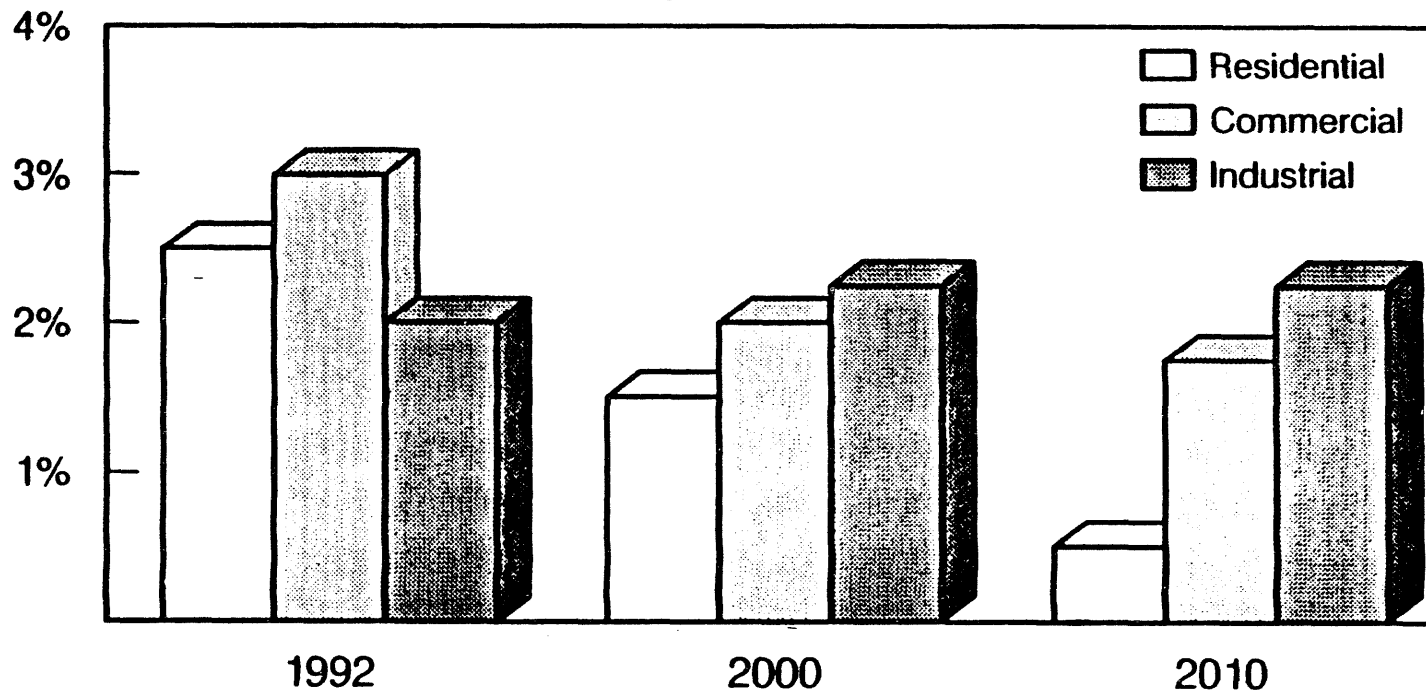
# Energy Use in Transportation



*Electric Technologies: Taking America Into the Future*

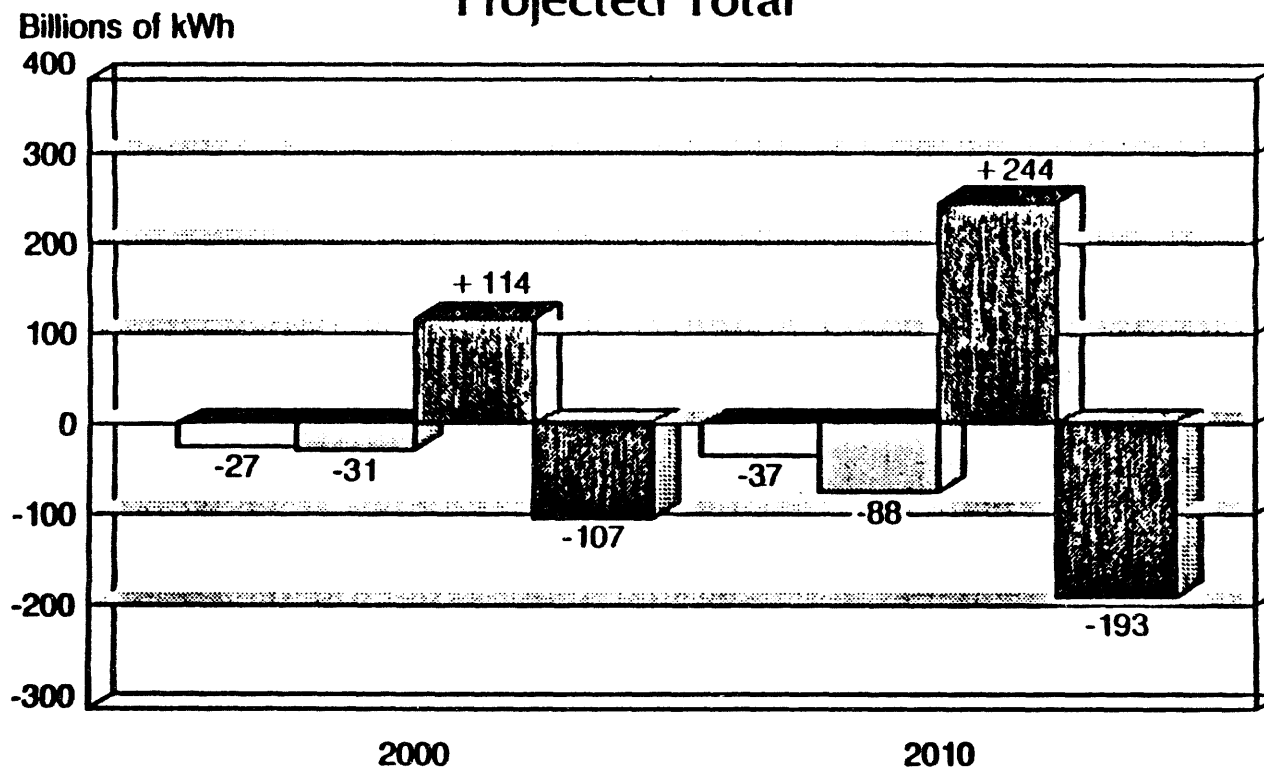
## Industrial Sector Will Drive Future Electricity Growth

% Avg. Annual Growth in Electricity Use



# Key Trends Impacting Industrial Electricity Use

Projected Total



Components of Change

Net Change from Frozen Case 1990 Tech & Econ Mix

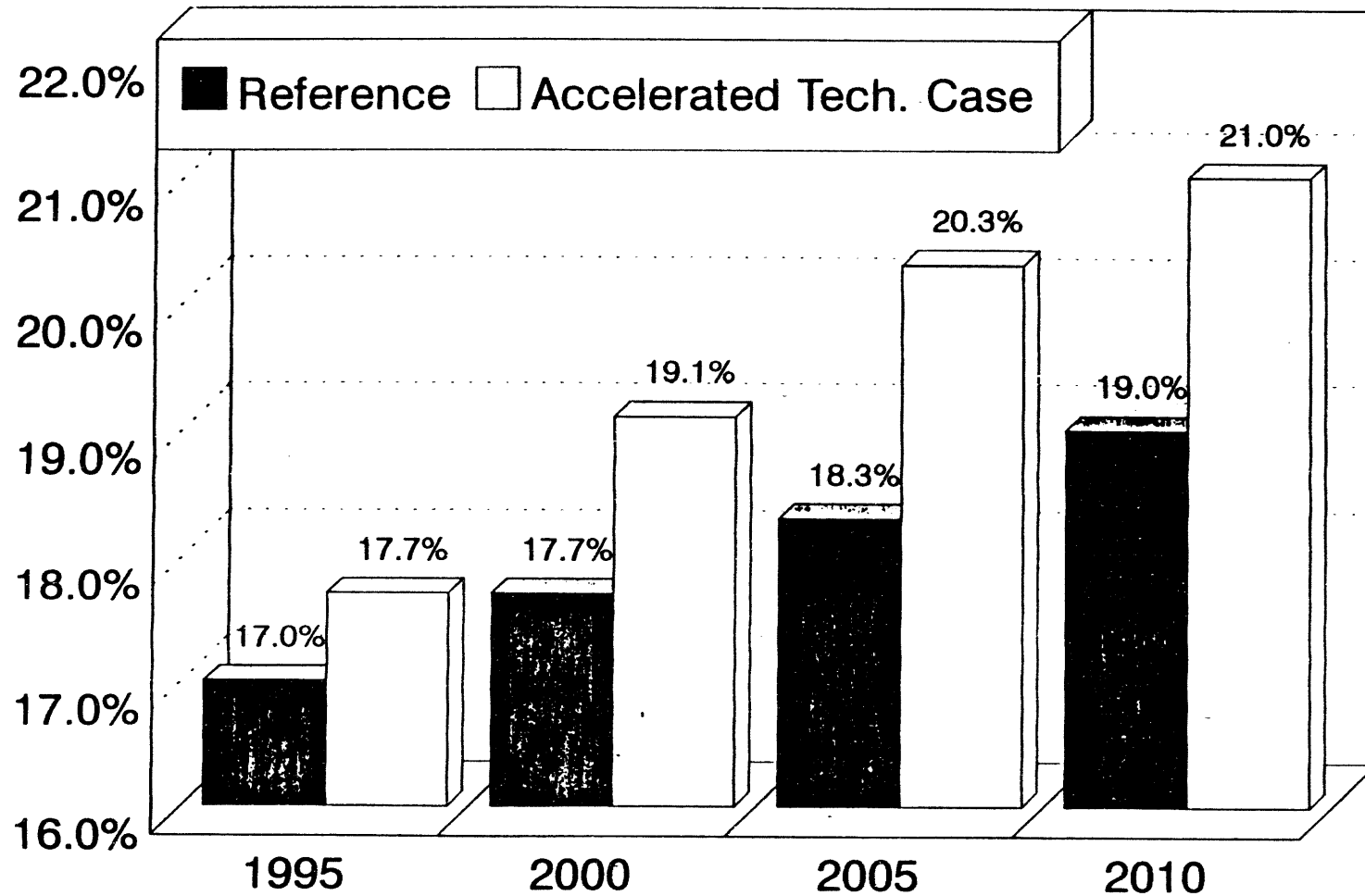
Shift in Economic Mix

Incremental Process Electrification

Enhanced Efficiency

# Electricity Share of Total End-Use Energy

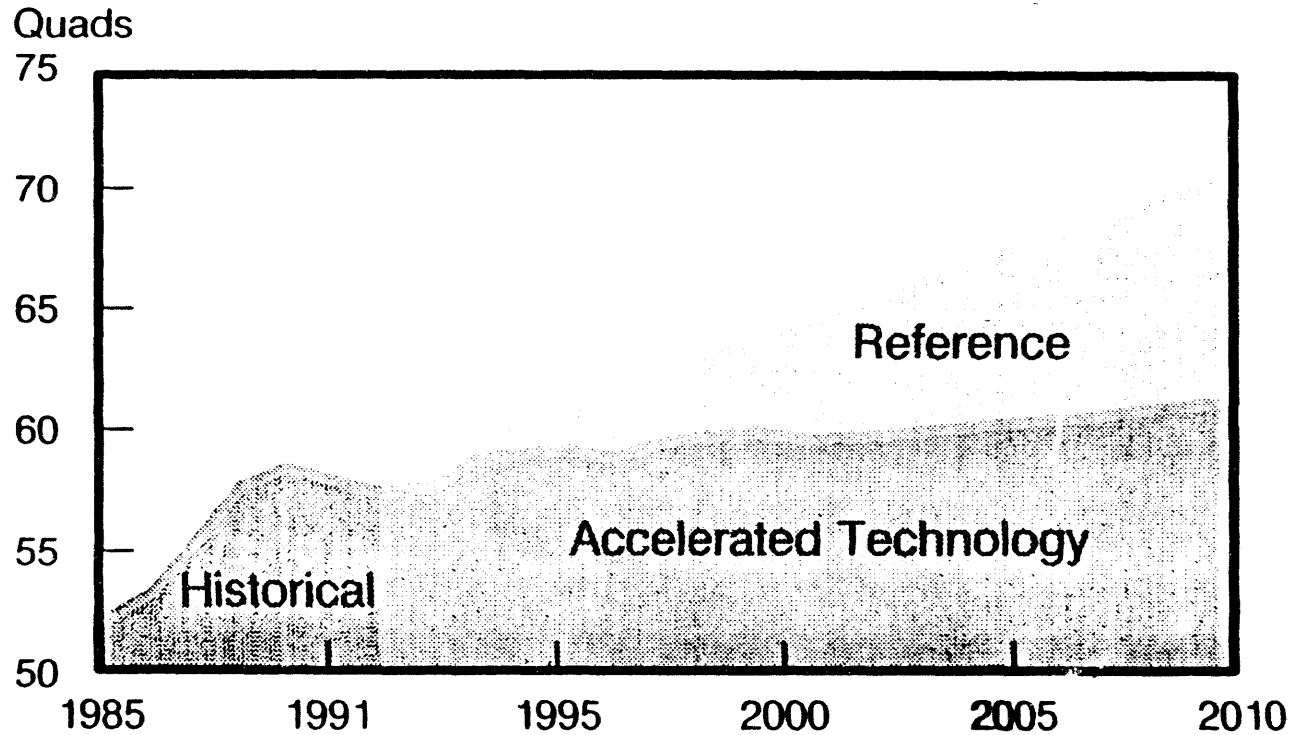
## Reference and Accelerated Technology Cases



*Electric Technologies: Taking America Into the Future*

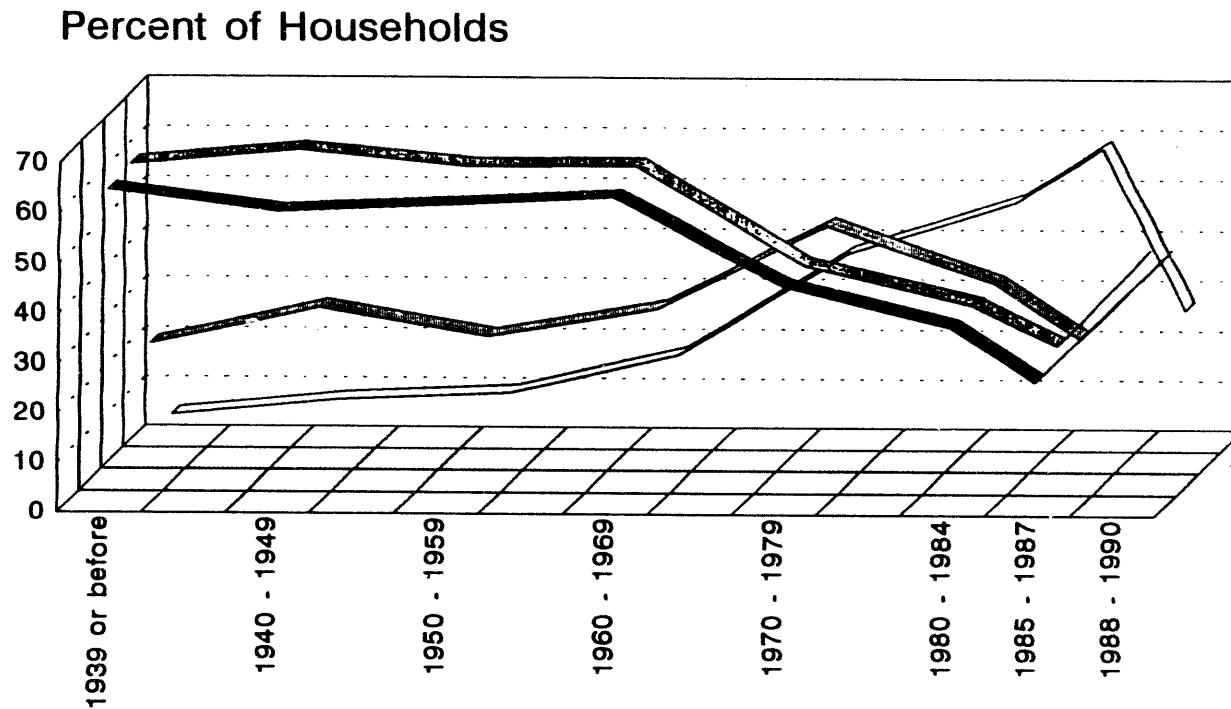
## End-Use Energy Totals

### ***Reference and Accelerated Technology Cases***



# Use of Electricity and Natural Gas for Main Space and Water Heating in U.S. Households by Year of Construction, 1990

(Percent of Households)



	1939 or before	1940 - 1949	1950 - 1959	1960 - 1969	1970 - 1979	1980 - 1984	1985 - 1987	1988 - 1990
Natural Gas Water	63.5	59.1	60.5	62.1	44.5	36.6	25.7	41.9
Natural Gas Main Space	64.2	67.1	64.	64.1	44.4	36.6	28.6	46.2
Electric Water	24.1	31.4	25.8	31.3	48	36.6	25.7	41.9
Electric Main Space	5.4	8.6	10.1	17.7	38.1	48.4	59.2	27.1

Year of Construction

Source: DOE/EIA-0314(90), p.13

# Causes Of The Efficiency Gap

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- Lack of information
- Uncertainty about fuel prices
- Uncertainty about investment benefits (i.e. equipment performance)
- Misplaced managerial incentives
- Equipment supply infrastructure problems

# Accelerated Technology Adoption

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## **Utility Barriers**

- Cost Effectiveness Tests Exclude Productivity Benefits
- State Laws & Regulations
- Prudence Issues
- Promotional Practices & Load Building Restrictions
- Economic Development & Customer Retention



# Industry Changes

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- Capacity Margins Down
- Generating Construction Up (\$25 - \$30 Billion/Year)
- T&D Construction Also
- NUGs Up
- Transmission Access
- Downsizing

## Overview of Industry Direction

Regulation	➡	Competition
Economic Reg.	➡	Envir. and Social Reg.
Cost Pricing	➡	Market Pricing
Supply Orientation	➡	Demand Orientation
Cost Alloc. by Reg.	➡	Cost Alloc. by Mgt. (by Market Segment)

## Overview of Industry Direction (Cont'd)

Strict Oblig. to Serve	➔	Eval. of Impact on Stakeholders
Reliability Obligation	➔	Negotiated Reliability
Vertical Integration	➔	Cost Division (G, T, & D)
Need-Based Resource Allocation	➔	Profit-Based Resource Allocation
Cost Centers Managed to Budget	➔	Profit Centers Guided by Performance

# The Pleased Customer...

*doesn't often gush about it...Only rarely do we receive an embossed resolution of thanks...Very rarely.*

But then, we don't expect it.

## **We are not selling "kilowatts,"**

so of course can't complain about the size, the color, or the fact that we could not fill your last order and you were kept waiting a long time.

## ***We are selling electric service -***

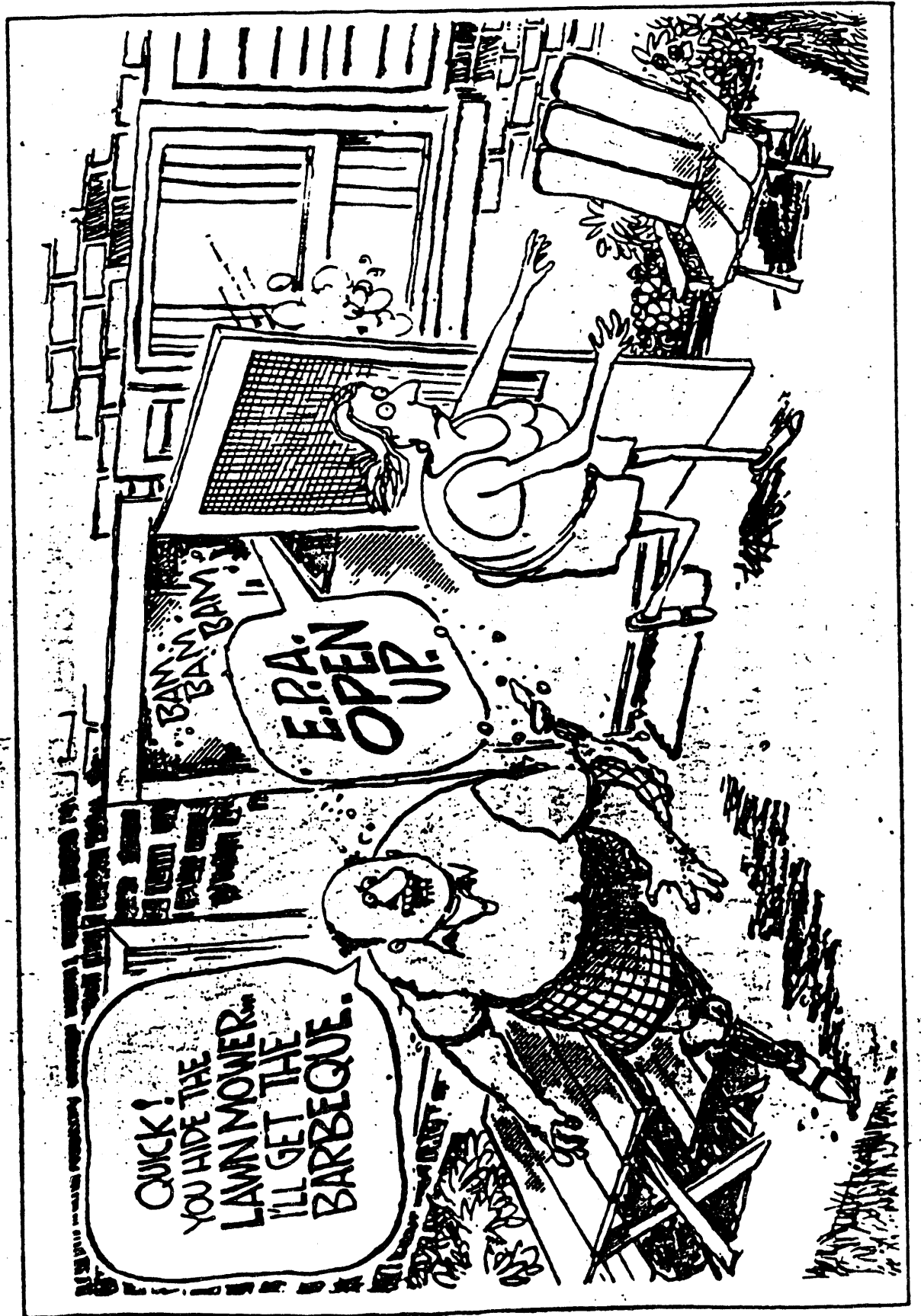
the mere flick of a switch and it does your bidding, no matter what the task, no matter at what hour of the day or night. Whether it is the family wash or the moving of a great trans-continental train; the cleaning of a rug, or turning the wheels of some gigantic factory; the lighting of the individual home, or the lighting of the whole city, electricity is ready to do its part.

We believe we are furnishing the best, the most dependable service it is humanly possible to render, at the lowest cost consistent with good business policy. But we are human and liable to make mistakes.

- **So -- If you are not one of our *pleased* customers, tell us about it.**

## **Name of Light & Power Co.**

**CITY AND STATE ADDRESS**



***CLEAN COAL TECHNOLOGIES***

***AND***

***GLOBAL CLIMATE CHANGE***

***Speech by  
Robert S. Long  
Vice President, Government Affairs  
National Coal Association  
and Chairman of Operating Committee  
Global Climate Coalition***

***to***

***Second Annual Clean Coal Technology Conference  
September 9, 1993***

## I. Introduction

Good afternoon ladies and gentlemen. I am Robert Long, with the National Coal Association (NCA), and I also serve as Chairman of the Operating Committee of the Global Climate Coalition (GCC). GCC is a broad-based organization with over 50 companies and trade associations, formed to represent business interests in the global climate issue. Our members include oil, gas, coal, utilities, autos, steel, aluminum, chemicals, railroads, forest products and cement. I will be discussing the role for Clean Coal Technologies in the context of the global climate change debate.

Global climate change is, of course as the name implies, a global issue. This clearly distinguishes this issue from acid rain or ozone non-attainment, which are regional in nature. Therefore, the issue requires a global perspective, one that looks at the issue not just from a U.S. policy standpoint but from an international policy view. This includes the positions of other individual nations, trading blocs, common interest groups, and the evolving United Nations bureaucracy.

To begin examining this big picture, we take as a given the assumption that as the global economy continues to grow, energy demand will also grow. With growth in economic activity and energy use, will come growth in worldwide greenhouse gas emissions, including growth in Carbon Dioxide (CO<sub>2</sub>) emissions. Much of this growth will occur in developing economies which intend to fuel their growth with coal-fired power, especially China and India.

Next, let me give you two basic premises which set out the boundaries of this topic. First, there is the premise that global climate change is occurring, or is about to occur, and that governments must do something to mitigate the causes of climate change. This is the principle behind the Climate Treaty, which I will discuss in a moment. Although this premise is highly rebuttable, and not based on scientific certainty, political science has driven it to the forefront of the debate. Second is the premise that advanced combustion CCT's, with their higher efficiencies, will result in lower CO<sub>2</sub> emissions, and hence lessen any contribution of greater coal use to potential global climate change. This promise is demonstrably true.

Within this context, this discussion will focus on recent and emerging public sector policy actions, which may in large part establish a new framework in which the private sector will find new challenges and new opportunities.

## II. The United Nations Framework Convention on Climate Change

Global climate change is not a new issue on the international scene. Formal international negotiations, under United Nations (U.N.) auspices, began in February 1990. These negotiations, steered by the U.N. Intergovernmental Negotiating Committee (Intergovernmental Negotiating Committee), ultimately lead to the U.N. Framework Convention on Climate Change (FCCC), or Climate Treaty for short. This is the document which then-President George Bush signed in Rio de Janeiro in June 1992. Since it is a Treaty, the document then went to the U.S. Senate, which ratified it in October 1992.

Much of the attention on the Treaty was focused on Article 4, the Commitments section of the document. This is the section that establishes the aim of developed country Parties to the Treaty to return to 1990 levels of greenhouse gas emissions by the year 2000. Note that this is defined in the Treaty as an aim, and not a binding commitment. However, Article 2 of the Treaty, which establishes the objective, speaks in terms of "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." Although this is not a binding commitment either, increasing reference is made to this objective in the ongoing international debate over implementation of the Treaty.

Although the Treaty has been signed and ratified by the U.S., it has not yet entered into force. Entry into force will not occur until 90 days after 50 nations have ratified the Treaty. We currently expect that this may occur in early 1994, or perhaps even by the end of this year. In the interim, there are many as-yet unanswered questions about how the Treaty will be implemented by its various Parties. Those questions are now being debated by the Intergovernmental Negotiating Committee, which will continue in existence until the Treaty enters into force, after which a Conference of the Parties will be created as the new governing body to administer the Treaty.

The Bush Administration, which successfully resisted firm emission reduction targets and timetables in the Treaty, had however, chosen to emphasize the need for a "prompt start" to implementing the Treaty on a voluntary basis. To this end, they produced and published in the Federal Register a proposed U.S. National Action Plan (NAP) in December 1992. Many organizations, including NCA and GCC provided comments on this proposed plan. National action plans are the vehicle by which Parties to the Treaty will communicate to the Conference of the Parties how they plan to implement the Treaty.



The Clinton Administration chose to up the ante on Treaty implementation somewhat. In his Earth Day Speech in April of this year, President Clinton announced his personal and our national commitment to return to 1990 levels of greenhouse gas emissions by 2000. While this also may not be a legally binding commitment, it is a step in that direction, and in diplomatic terms, a strong signal to other Parties of a shift in U.S. policy. President Clinton also announced in the same speech his intention to have a revised U.S. National Action Plan ready in time for the just-completed eighth session of the Intergovernmental Negotiating Committee, held in Geneva, Switzerland, August 16 - 27. For a number of reasons, including vigorous lobbying by the business community, the Administration found it could not hold to this schedule. The Administration now plans to issue a revised plan sometime this fall.

### III. Joint Implementation

This brings me to one of the most hotly debated topics at the Intergovernmental Negotiating Committee meeting, and within the Administration, and which is most relevant to this discussion. This is the topic of joint implementation of the Treaty. This concept grew out of a recognition, by some of the developed country Parties during the negotiations leading up to the Treaty, that they might have great difficulty in attaining the aim of the Treaty solely through internal, domestic actions. This led to language in the Treaty that creates the opportunity for Parties to the Treaty to implement climate mitigation measures jointly with other Parties.

This concept is still not well-defined, and as I mentioned earlier, is still the subject of strong debate within the Intergovernmental Negotiating Committee. However, it is generally understood to mean that one Party could sponsor a project in another host Party, and receive credit for emissions reductions achieved. Projects are generally thought to span a wide range, and to include projects to enhance greenhouse gas sinks, such as reforestation and afforestation projects, as well as greenhouse gas emission reduction projects, such as energy efficiency projects, and other industrial process applications. This presents an opportunity to comply with the Treaty by obtaining reductions where it is easiest and most cost-effective to do so in developing countries.

The debate on joint implementation is far from being resolved, since the international community is seriously split on the issue. Developing countries, as represented by a loose affiliation known as the Group of 77, are split on the issue. Some have expressed great skepticism about joint implementation. Many in this camp seem to see it only as a means by which developed countries could circumvent their commitments under the Treaty. Or, worse still, is the view expressed by the head of the delegation of Argentina, who is also Chairman of the Intergovernmental Negotiating Committee, that joint implementation may be merely a stalking horse to allow developed countries to practice some sort of "environmental colonialism" on hapless and unsuspecting developing country partners. Others, such as Mexico, see it as a very positive force, which can bring new partners and new resources to their efforts to develop.

Developed countries, for their part, are also split. The European Community (EC), when speaking with its official interest bloc voice, is opposed to joint implementation between developed countries and developing countries. They maintain that joint implementation should be allowed between developed countries only. However, not all members of the EC are in full agreement with this position.

Other developed countries, including the U.S., Canada, Australia, New Zealand and Japan, maintain that joint implementation should be available to and between all Parties to the Treaty. They point out that joint implementation represents a means, and here is the key for this audience, to involve the private sector, and to increase the flow of resources available to developing countries for climate change mitigation projects.

The U.S. statement on joint implementation to the Intergovernmental Negotiating Committee was particularly interesting, especially since there were some factions within the Administration who were opposed to including it at all. The U.S. did endorse joint implementation, with some qualifications.

#### **1. Legal Issues**

In terms of legal issues, the U.S. believes that joint implementation is available as a measure between all Parties. Further, the U.S. maintains that joint implementation is available to developed countries in the context of meeting their commitment to reach 1990 levels by the year 2000. In other words, it can be an element of our national action plan.

## **2. Criteria**

As far as criteria for joint implementation, the U.S. put forward several suggestions. Joint implementation should be voluntary; it should consist of mutually voluntary projects between partners, aimed at reducing net emissions of greenhouse gases, and could be agreed to by governments of participating countries.

Joint implementation should embody additionality. That is, it should incorporate commitments and projects above a certain baseline level, to ensure that real reductions occur.

Verifiable reductions should be required; a system should be developed in which emissions are monitored to ensure that projected reductions are achieved.

Joint implementation should incorporate a diverse system of projects; a wide range of projects should be encouraged, including energy projects and agricultural projects, as well as projects having to do with greenhouse gas sinks.

## **3. Overall Context**

The U.S. sees joint implementation as leading to a program which can significantly increase the flow of resources between participants. This would include technology transfer and increase in technology cooperation. There are only limited global resources available to take mitigation measures, and joint implementation offers the potential to use those resources as wisely and efficiently as possible.

## **IV. Global Climate Coalition Position**

The Global Climate Coalition, has consistently and strongly supported technology cooperation, as part of a rational approach to the question of potential global climate change. We recognize that there are still considerable impediments to broad-scale technology cooperation efforts, and that to be successful on a broad-scale such efforts should be on a private sector-to-private sector basis.

**Second Annual Clean Coal Technology Conference**

**Robert Long**

**Page 7 of 7**

However, the Federal government's resources can play an important role in helping industry identify opportunities for technology cooperation, and in providing market-based financing facilities for technology cooperation efforts. What we do not need is another impediment, such as closing the door on joint implementation projects. It is difficult to estimate the exact impact this might have on CCT project opportunities, but the effect most certainly would be chilling.

As I mentioned earlier, the GCC has recently lobbied the Administration and key Members of Congress, to keep joint implementation in the mix. We are gratified by the position taken by the U.S. delegation in Geneva. But the battle is not yet over, and I would suggest that all of us who have a stake in this one need to continue to express our support for keeping joint implementation an available option under the Treaty.

**REGULATORY ISSUES THAT MAY AFFECT  
THE FUTURE DEVELOPMENT OF  
CLEAN COAL TECHNOLOGIES**

**Craig S. Harrison, Esq.  
Utility Air Regulatory Group  
Hunton & Williams**

**(The comments of Mr. Harrison were not  
available at the time of publication.)**

# **Appendix A**

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List of Attendees

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## Second Annual Clean Coal Technology Conference List of Attendees

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## Second Annual Clean Coal Technology Conference List of Attendees

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## Second Annual Clean Coal Technology Conference List of Attendees

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## Second Annual Clean Coal Technology Conference List of Attendees

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## Second Annual Clean Coal Technology Conference List of Attendees

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Department of Technology  
Ministry of Electric Power  
People's Republic of China

Quansheng Zhou  
Division Chief  
Department of Technology  
State Education Commission  
People's Republic of China

# **Appendix B**

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## Conference Schedule

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**Wednesday  
September 8, 1993**

**Thursday  
September 9, 1993**

7:30 a.m.								
8:00 a.m.	<b>Speakers' Breakfast, Paulding Room</b> <b>Continental Breakfast, Grand Salon East</b> 7:30-9:00				<b>Speakers' Breakfast, Paulding Room</b> <b>Continental Breakfast, Grand Salon East</b> 7:30-9:00			
9:00 a.m.	<b>Plenary Session 1</b>  Ballroom East 9:00-12:00  5 Speakers				<b>CCT Deployment/ Technology Transfer/Outreach Session</b> Rockdale/Forsythe 9:00-10:15	<b>Session 5 Coal Combustion/ Coal Processing</b>  Ballroom A 9:00-10:15	<b>Session 6 Adv. Elec. Power Gen. Systems</b>  Ballroom B 9:00-10:15	<b>Session 7 Comb. NO<sub>x</sub>/SO<sub>2</sub> Control Tech.</b>  Fayette/Newton 9:00-10:15
10:00 a.m.					Break 10:15-10:30	Break 10:15-10:30	Break 10:15-10:30	Break 10:15-10:30
11:00 a.m.					(Session cont.)	<b>Coal Combustion/ Coal Processing (cont.)</b> Ballroom A 10:30-12:00 5 papers	<b>Adv. Elec. Power Gen. Systems (cont.)</b> Ballroom B 10:30-12:00 5 papers	<b>Comb. NO<sub>x</sub>/SO<sub>2</sub> Control Tech. (cont.)</b> Fayette/Newton 10:30-12:00 6 papers
12:00 p.m.					<b>International Forum</b> Paulding/Dekalb 10:50-12:00			
12:00 p.m.	<b>Luncheon</b> Grand Salon East 12:00-1:30 Speaker				<b>Luncheon</b> Grand Salon East 12:00-1:30 Speaker			
1:30 p.m.	<b>Clean Coal Technology Markets Session</b> Rockdale/ Forsythe 1:30-3:00	<b>Session 1 NO<sub>x</sub> Control Technologies</b>  Ballroom A 1:30-3:00	<b>Session 2 Advanced Elec. Power Gen. Systems</b> Ballroom B 1:30-3:00 3 papers	<b>Session 3 SO<sub>2</sub> Control Technologies</b>  Fayette/Newton 1:30-3:00	<b>International Forum (cont.)</b> Paulding/Dekalb 1:30-4:00	<b>Plenary Session 2 Emerging Issues/Environmental</b>  Ballroom East 1:30-4:00  6 Speakers		
3:00 p.m.	Break 3:00-3:20	Break 3:00-3:20	Break 3:00-3:20	Break 3:00-3:20				
4:00 p.m.	<b>Clean Coal Technology Markets (cont.)</b> Rockdale/ Forsythe 3:20-5:00 7 papers	<b>NO<sub>x</sub> Control Technologies (cont.)</b>  Ballroom A 3:20-5:00 6 papers	<b>Session 4 Industrial Applications</b>  Ballroom B 3:20-5:00 4 papers	<b>SO<sub>2</sub> Control Technologies (cont.)</b>  Fayette/Newton 3:20-5:00 5 papers				
5:00 p.m.								