

**The Energy Savings  
and  
Environmental Emission Reduction Benefits**

**Delivered by the  
Energy Service Company Industry**

**An Initial Assessment**

**Prepared for the  
DOE Energy Fitness Program**

**by**

**Leonardo Academy Inc.**

**May 15, 1998**

## **DOE Energy Fitness Program Partners**

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**1526 Chandler Street  
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Telephone: 608-255-0988**

**May 15, 1998**

## Executive Summary

Energy Service Companies make a major contribution to the reduction in electric energy use, reduction in demand for electricity, reduction in direct fuel use and reduction in environmental emissions. Energy Service Companies make these contributions to increased energy efficiency and emission reduction by working with customers to develop and implement cost-effective projects that upgrade buildings and increase their energy efficiency. This report provides an initial assessment of the energy efficiency and environmental benefits delivered by the Energy Service Company Industry based on current estimates. The DOE Energy Fitness Program (EFP) is also supporting the development of detailed project by project reporting of these impacts by a program partner, the National Association of Energy Service Companies (NAESCO). This means that in the future the DOE Energy Fitness Program and NAESCO will be able to update this initial assessment report with reports based on verifiable individual project reporting of the energy efficiency and environmental impacts of the Energy Service Companies Industry.

### Total Lifetime Energy and Demand Savings from ESCO Efficiency Projects Implemented Between 1990 and 2010

Impacts	Lifetime Impacts for Projects Implemented Between 1990 and 2010
Total Investment (M\$)	\$31,534
<b>Total Energy Savings</b>	\$94,601
Electricity Savings (GWh)	1,419,018
Electric Demand Reduction (MW)	17,999
Reduction in Direct Fuel Use (MMBTU)	7,883,437,500

### Total Lifetime Environmental Emission Reduction from ESCO Efficiency Projects Implemented Between 1990 and 2010

Impacts	Lifetime Impacts for Projects Implemented Between 1990 and 2010
<b>Pollutants</b>	
CO2 (short tons)	1,852,134,806
NOx (short tons)	7,568,583
SO2 (short tons)	10,378,802
PM10 (short tons)	179,414
<b>Toxic Metals</b>	
Mercury (lbs.)	99,994
Cadmium (lbs.)	9,230
Lead (lbs.)	174,827

More than half of the emission reduction will be delivered before 2010 and the balance will be delivered over the projects remaining lives after 2010. From these results it is clear that Energy Service Companies make a major contribution to the reduction in energy use and the reduction of environmental emissions. Energy Service Companies deliver this energy efficiency in the competitive marketplace. Removing the barriers to increased delivery of energy efficiency by Energy Service Companies will allow them to deliver even more building upgrades, energy savings, and reductions in environmental emissions for their customers.

The DOE Energy Fitness Program is working with its program partners, to remove the barriers to the increased delivery of energy efficiency, new advanced technologies and renewables by Energy Service Companies.

# ***DOE Energy Fitness Program Forward***

## **The Purpose of this Report.**

The purpose of this report is to provide energy and environmental policy makers and legislators with information on the amount of energy efficiency, and environmental emission reduction benefits delivered by the Energy Service Company (ESCO) industry. ESCOs already deliver a lot of building upgrades, energy savings and environmental emission reduction for their customers. ESCOs can deliver even more energy efficiency if the remaining barriers to the increased delivery of energy efficiency by Energy Service Companies are removed.

This report provides an initial assessment of the energy efficiency and environmental benefits delivered by the Energy Service Company Industry based on current estimates. The DOE Energy Fitness Program (EFP) is also supporting the development of detailed project by project reporting of these impacts by a program partner, the National Association of Energy Service Companies (NAESCO). This means that in the future the DOE Energy Fitness Program (EFP) and NAESCO will be able to update this initial assessment report with reports based on verifiable individual project reporting of the energy efficiency and environmental impacts of the ESCO Industry.

## **Introduction to the DOE Energy Fitness Program**

The objective of the Energy Fitness Program is to increase the delivery of energy efficiency, new high-efficiency technologies, and renewables by Energy Service Companies (ESCOs) in the nonfederal sectors of the economy. These sectors include state government organizations, local government organizations, private companies and other nongovernment organizations. The ongoing restructuring in the electric and natural gas industries is creating an environment where ESCOs are becoming an ever more important vehicle for delivering energy efficiency, new high-efficiency technologies, and renewables in the competitive marketplace.

Building owners and managers can use performance-contracting ESCOs to partially or fully fund renovations by folding them into a larger project that includes energy efficiency upgrades. ESCO projects can include nonenergy renovations as well as measures to improve efficiency. These projects can be customized for each customer's particular needs. The Energy Fitness Program works with ESCOs, public and private ESCO customers, and other interested organizations to identify and remove barriers to increased delivery of energy efficiency by ESCOs. The Energy Fitness Program is part of the DOE Rebuild America Program and one of the Energy Star Partnerships.

## **The Energy Service Company (ESCO) Industry Role in Upgrading Buildings**

Commercial and industrial companies and state and local governments spend \$50 billion a year to renovate buildings. The Energy Fitness Program is designed to help make sure that this money leverages the installation of as much energy-efficient equipment as possible by helping performance-based ESCOs educate customers about how energy and maintenance savings can be used to fund their renovations. ESCOs design, install, finance, operate, and maintain energy improvement projects in buildings.

ESCOs already install more than \$1 billion worth of energy-efficient equipment each year. This investment in energy efficiency saves the United States more than \$600 million each year in energy costs. By redirecting this portion of customer spending from energy purchases to energy efficiency improvements and core business spending, these ESCO projects create jobs, expand economic activity, and enable American businesses to become more competitive. Tax burdens decrease due to lower tax rates associated with expanded economic activity and lower revenue requirements when public building renovations are financed with private capital. The energy efficiency measures installed by ESCOs also reduce environmental emissions. The Energy Fitness Program is working to increase these benefits by increasing the delivery of energy efficiency by ESCOs.

### **Energy Fitness Program's Action Plan**

Energy Fitness Program's Action Plan has four components:

- 1) To increase awareness of energy performance contracting among owners of buildings in the nonfederal sectors of the economy, including state government organizations, local government organizations, private companies, and other nongovernment organizations;
- 2) To work with customers, ESCOs and other organizations to identify and remove barriers to increased delivery of energy efficiency, new high-efficiency technologies and renewable energy by ESCOs;
- 3) To offer easily accessed information about the ESCO industry and its contribution to the delivery of energy efficiency, new high-efficiency technologies, renewable energy, and environmental emissions reductions;
- 4) To increase sales through ESCOs of high-efficiency and renewable energy products.

### **The Energy Fitness Program Achieves Its Objectives through Partnerships**

The Energy Fitness Program works toward achieving its goals through partnerships with providers of ESCO services, customers of these services, and other organizations that can contribute to removing barriers to energy savings performance-contracting project implementation. Partners to date include the National Association of Energy Service Companies (NAESCO), the National Conference of State Legislatures (NCSL), the National Association of Regulatory Utility Commissioners (NARUC), the National Association of State Energy Officials (NASEO), the U.S. Conference of Mayors (USCM) and the National League of Cities (NLC). Contact information for the program and the program partners is found on the inside of the front cover.

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## Section 1

### Summary of Impacts of Energy Service Company Industry on Energy Savings and Environmental Emission Reduction

Energy Service Companies make a major contribution to the reduction in electric energy use, reduction in demand for electricity, reduction in direct fuel use and reduction in environmental emissions.

This report provides an initial assessment of the energy efficiency and environmental benefits delivered by the Energy Service Company Industry based on current estimates. The DOE Energy Fitness Program (EFP) is also supporting the development of detailed project by project reporting of these impacts by a program partner, the National Association of Energy Service Companies (NAESCO). This means that in the future the DOE Energy Fitness Program and NAESCO will be able to update this initial assessment report with reports based on verifiable individual project reporting of the energy efficiency and environmental impacts of the ESCO Industry.

In 1996, the impacts from investments made during this year were:

Reduction in electric energy use:	<u>3,003</u> GWh
Reduction in demand for electricity:	<u>571</u> MW
Reduction in direct fuel use:	<u>16,683,333</u> MMBTU

Reduction in environmental emissions:	
NOx:	<u>16,017</u> short tons
CO2:	<u>3,919,582</u> short tons
Mercury:	<u>211.6</u> lbs.

Energy and emission reduction savings resulting from each Energy Service Company project continue to accumulate over many years. From 1990 through 2010 the cumulative reductions at the end of 2010 will be the following, assuming that the amount of energy efficiency delivered by the Energy Service Companies continues to grow at same rate as between 1990 and 1996.

Reduction in electric energy use:	<u>720,656</u> GWh
Reduction in demand for electricity:	<u>17,999</u> MW
Reduction in direct fuel use:	<u>4,003,645,833</u> MMBTU

Reduction in environmental emissions:	
NOx:	<u>3,843,745</u> short tons
CO2:	<u>940,616,552</u> short tons
Mercury:	<u>50,783</u> lbs.

Cumulative reductions measured at the end of 2010 do not take into account the energy and emission savings from the remainder of project lifetimes that occur after 2010 from investments made during and previous to the year 2010. Total lifetime energy savings from ESCO efficiency projects implemented between 1990 and 2010 will be 1,419,019 GWh. Additional lifetime impact measurements can be found in Tables 6 and 7 in Section 2.

From these results it is clear that Energy Service Companies make a major contribution to the reduction in energy use and the reduction of environmental emissions. Energy Service Companies deliver this energy efficiency in the competitive marketplace.

Removing the barriers to increased delivery of energy efficiency by Energy Service Companies will allow them to deliver even more building upgrades, energy savings, and reductions in environmental emissions for their customers.

The DOE Energy Fitness Program is working with its program partners, to remove the barriers to the increased delivery of energy efficiency, new advanced technologies and renewables by Energy Service Companies.

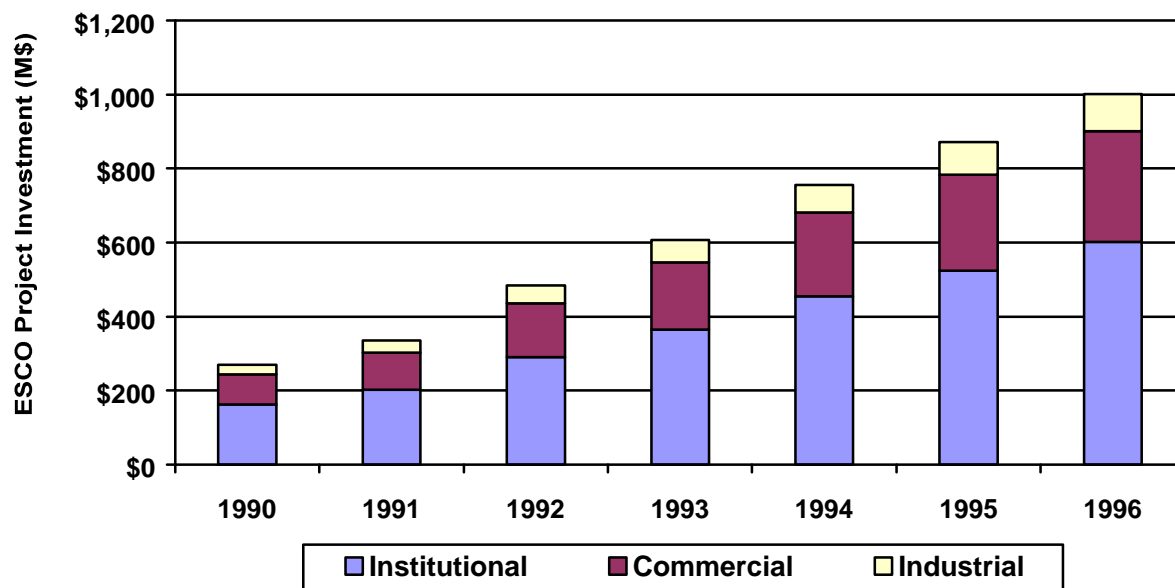
## Section 2

### Tables and Figures

**Table 1**  
**Yearly ESCO Efficiency Project Investment (M\$)<sup>1</sup>**

<b>Year</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>
<b>Facility Type</b>							
Institutional	162	202	291	364	454	523	601
Commercial	81	101	145	182	227	261	300
Industrial	27	33	48	61	75	87	100
<b>Total</b>	<b>270</b>	<b>336</b>	<b>484</b>	<b>607</b>	<b>756</b>	<b>871</b>	<b>1001</b>

**Figure 1**  
**ESCO Energy Efficiency Project Investment (M\$)**

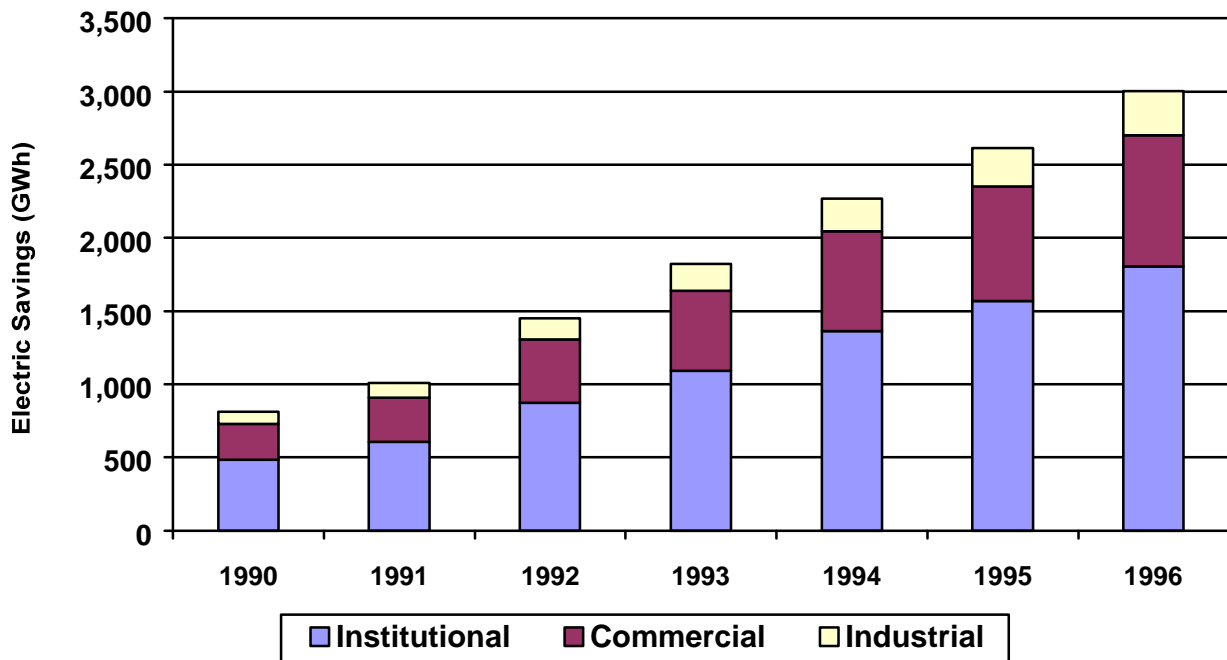


<sup>1</sup> Source: These ESCO industry project investment estimates were provided by Richard Cudahy who has been a consultant to the National Association of Energy Service Companies (NAESCO).

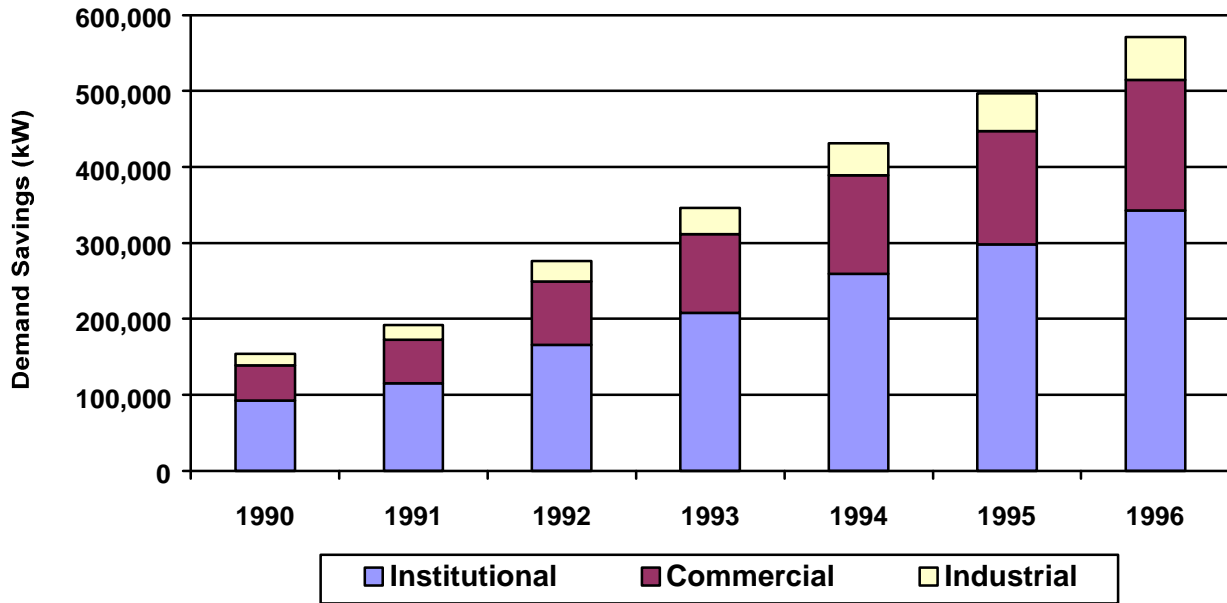
**Table 2**  
**One-Year Energy and Demand Savings from ESCO Efficiency Project Investment**

Year	1990	1991	1992	1993	1994	1995	1996
Electric Energy Savings (GWh)	810	1,008	1,452	1,821	2,268	2,613	3,003
Electric Capacity Savings (kW)	154,110	191,781	276,256	346,462	431,507	497,146	571,347
Reduction in Direct Fuel Use (MMBTU)	4,500,000	5,600,000	8,066,667	10,116,667	12,600,000	14,516,667	16,683,333

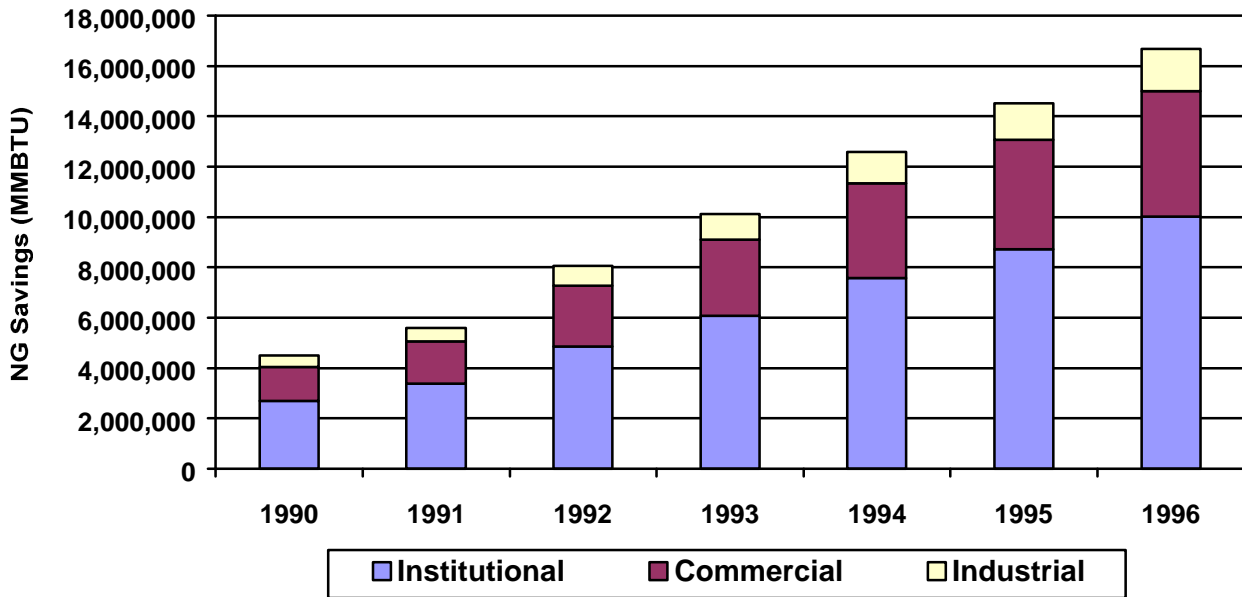
**Figure 2**  
**One-Year Electric Energy (GWh) Savings from ESCO Efficiency Project Investment**



**Figure 3**  
**Demand Savings (kW) from ESCO Efficiency Projects Implemented**



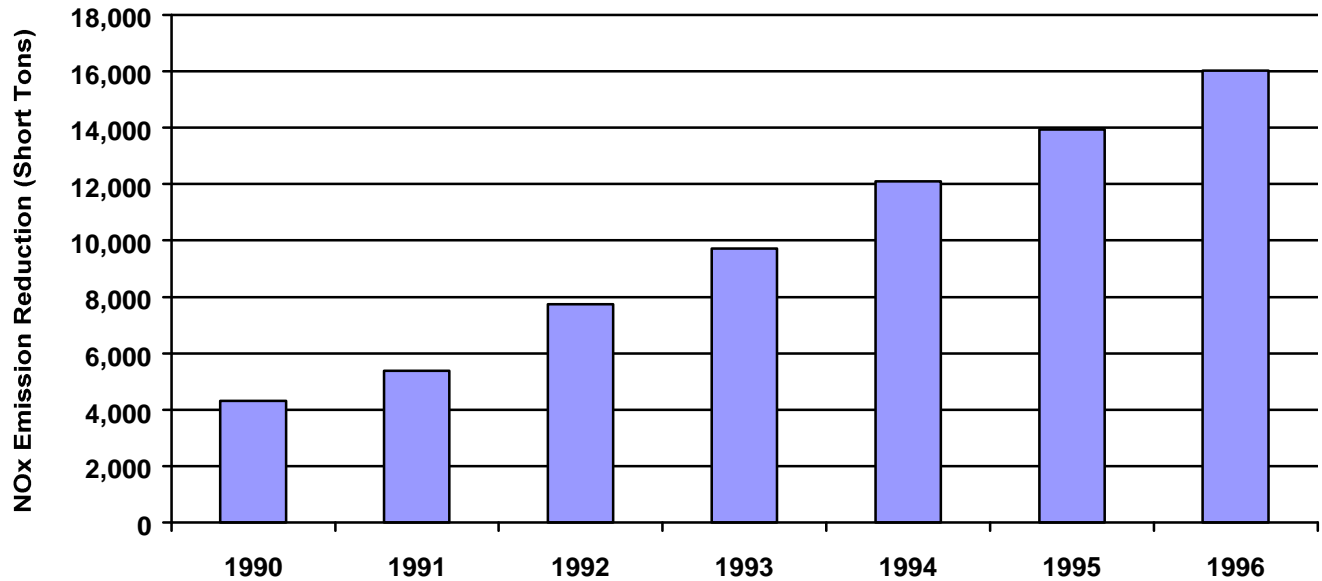
**Figure 4**  
**One-Year Natural Gas Savings (MMBTU) from ESCO Efficiency Projects Implemented**



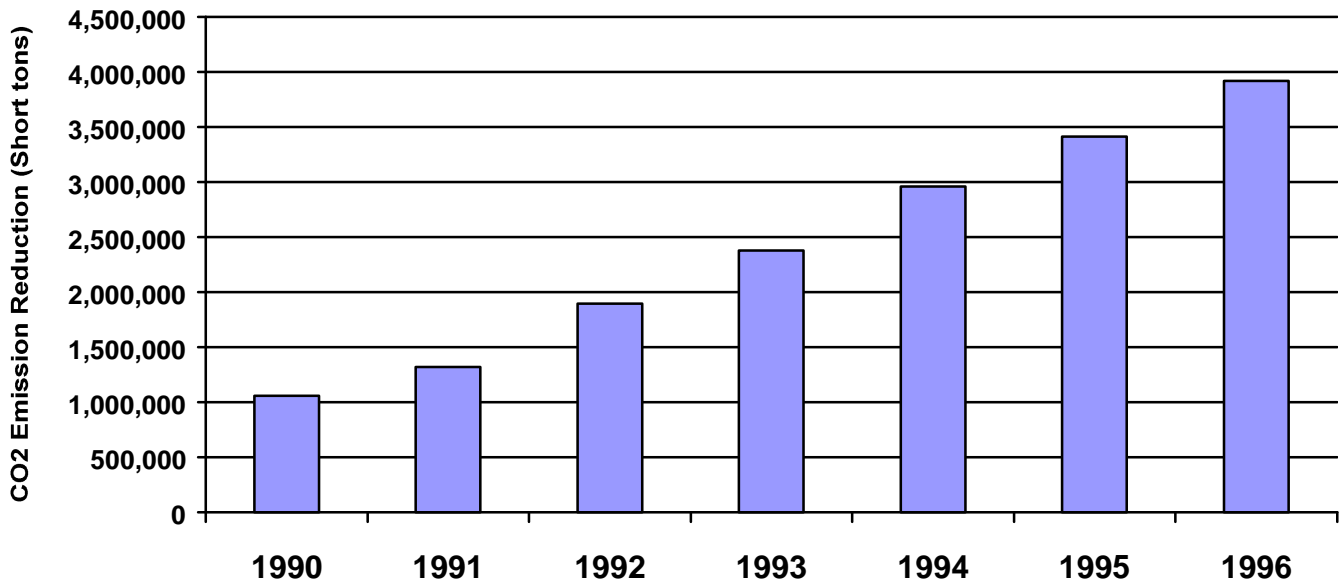
**Table 3**  
**One-Year Environmental Emission Reduction from ESCO Efficiency Projects Implemented**

<b>Year</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>
<b>Pollutants</b>							
CO2 (short tons)	1,057,230	1,315,664	1,895,183	2,376,810	2,960,244	3,410,546	3,919,582
NOx (short tons)	4,320	5,376	7,744	9,713	12,097	13,937	16,017
SO2 (short tons)	5,924	7,373	10,620	13,319	16,588	19,112	21,964
PM10 (short tons)	102	127	184	230	287	330	380
<b>Toxic Metals</b>							
Mercury (lbs.)	57.1	71.0	102.3	128.3	159.8	184.1	211.6
Cadmium (lbs.)	5.3	6.6	9.4	11.8	14.8	17.0	19.5
Lead (lbs.)	99.8	124.2	178.9	224.4	279.4	321.9	370.0

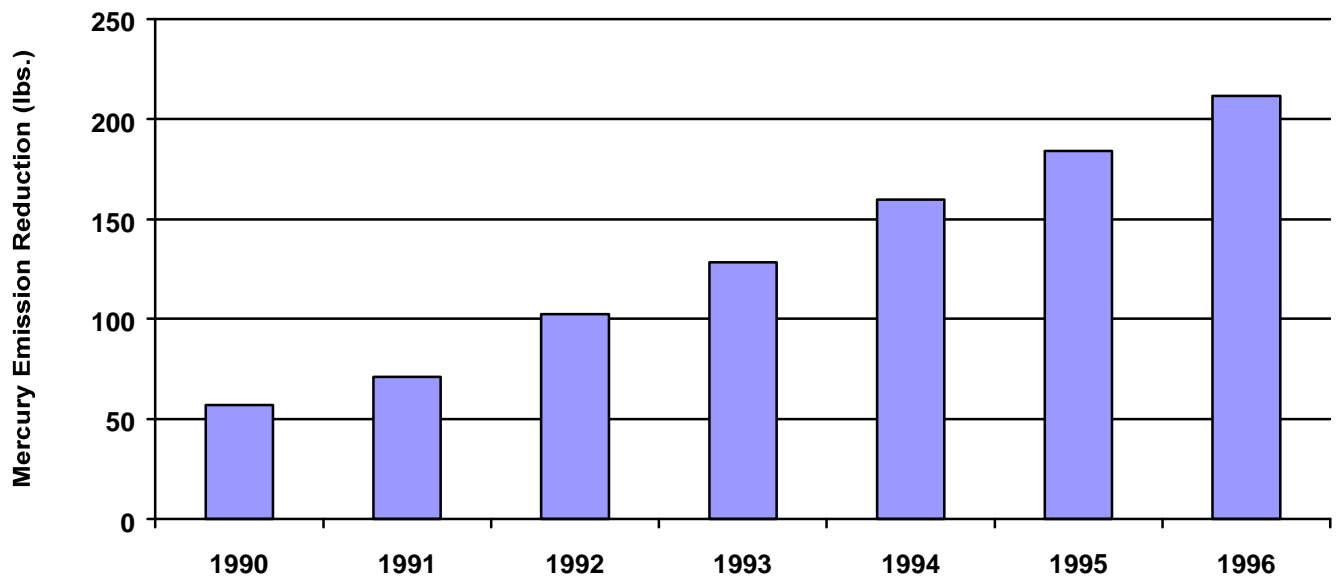
**Figure 5**  
**One-Year NOx Emission Reduction (Short Tons) Delivered by ESCO Energy Efficiency Projects Implemented**



**Figure 6**  
**One-Year Carbon Dioxide (CO<sub>2</sub>) Emission Reduction (Short Tons) Delivered by**  
**ESCO Energy Efficiency Projects Implemented**



**Figure 7**  
**One-Year Mercury Emission Reduction (lbs.) Delivered by**  
**ESCO Energy Efficiency Projects Implemented**



Trend analysis was used to forecast the growth in ESCO investment through the year 2010. There are many different ways to measure the energy savings impacts of ESCO efficiency projects. While a majority of the dollar investments are made upfront, the energy savings resulting from these investments continue to accumulate over many years. These energy savings continue well beyond the project's payback period and are the result of yearly electricity and fuel savings. The electricity and fuel reductions not only save money for customers but also result in substantial emission reduction.

The impacts of ESCO efficiency project investments were measured in two different ways. Tables 4 and 5 looked at the cumulative impacts from ESCO efficiency project investments from 1990 through 2010 measured at the end of the year in 2010. For example, in Table 4, projects implemented in 1998 would include 13 years of energy savings while projects implemented in 2009 would only include two years of savings. This allows us to look at the cumulative energy saving impacts up to one point in time.

**Table 4**  
**Cumulative Energy and Demand Savings through 2010 of ESCO Efficiency**  
**Projects Implemented from 1990 through 2010**

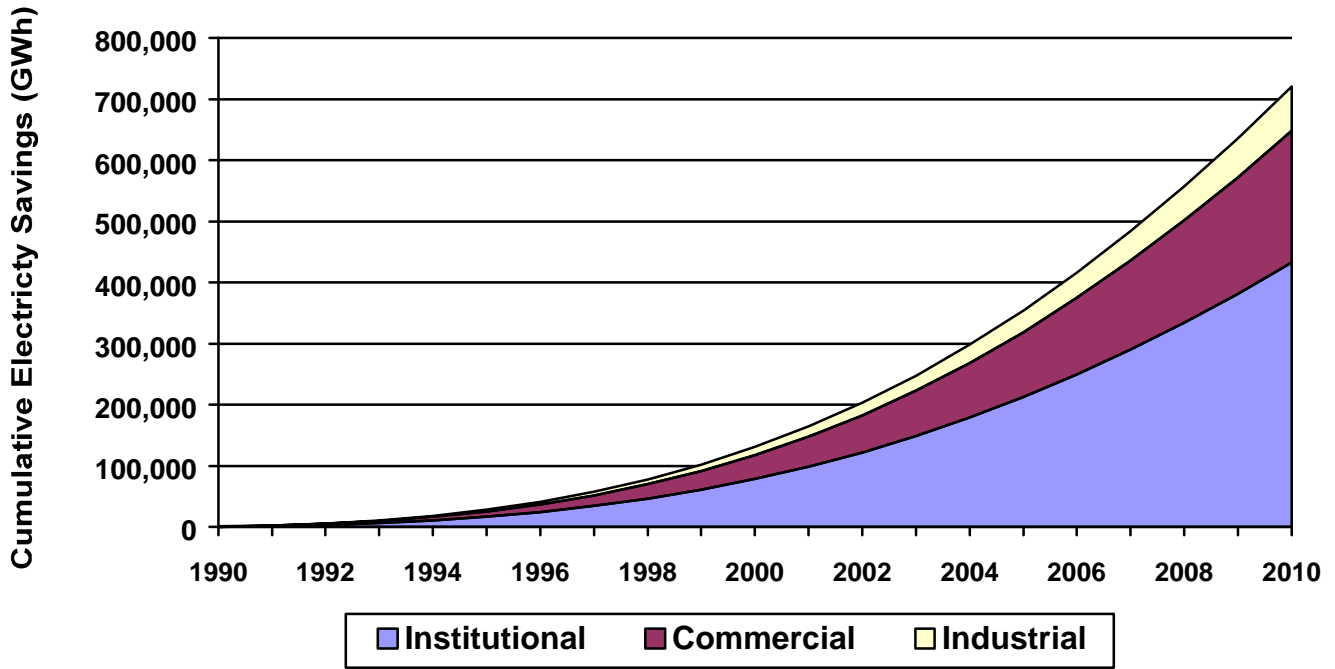
Impacts	Cumulative Impacts from 1990 through 2010
<b>Total Investment (M\$)</b>	\$31,534
<b><u>Energy Savings</u></b>	
Institutional (M\$)	\$28,845
Commercial (M\$)	\$14,401
Industrial (M\$)	\$4,799
<b>Total Energy Savings</b>	\$48,044
Electricity Savings (GWh)	720,656
Electric Demand Reduction (MW)	17,999
Reduction in Direct Fuel Use (MMBTU)	4,003,645,833

**Table 5**  
**Cumulative Environmental Emission Reduction through 2010 of ESCO Efficiency**  
**Projects Implemented from 1990 through 2010**

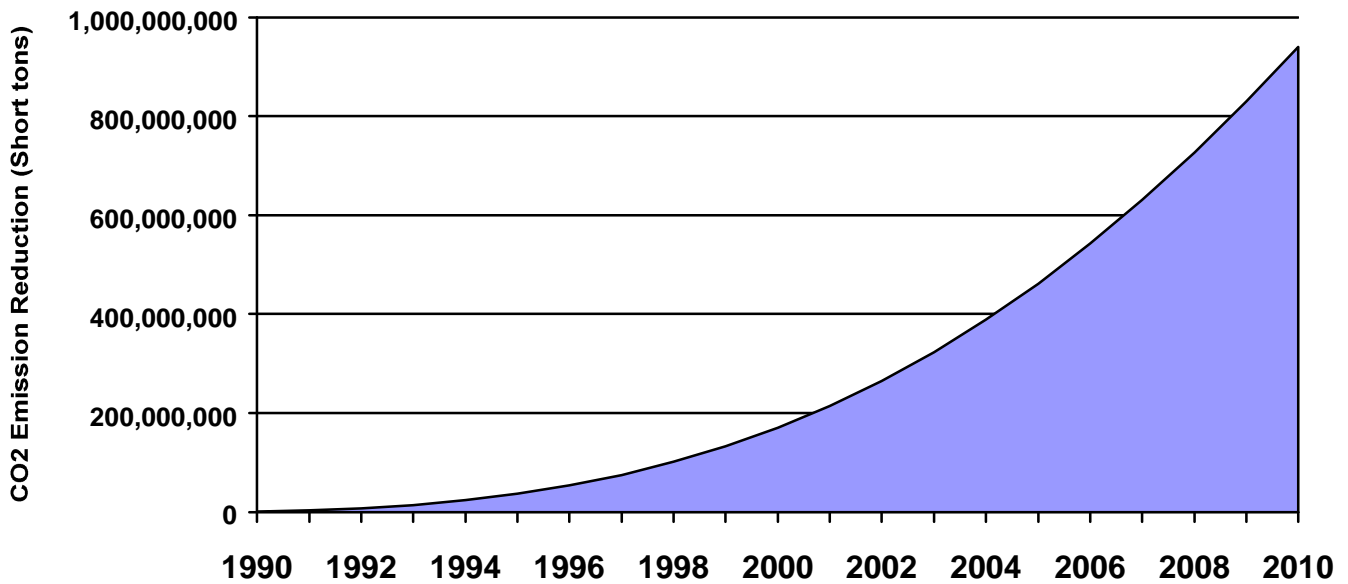
	Cumulative Impacts from 1990 through 2010
<b><u>Pollutants</u></b>	
CO2 (short tons)	940,616,552
NOx (short tons)	3,843,745
SO2 (short tons)	5,270,930
PM10 (short tons)	91,116
<b><u>Toxic Metals</u></b>	
Mercury (lbs.)	50,783
Cadmium (lbs.)	4,688
Lead (lbs.)	88,787



**Figure 8**  
**Cumulative Electric Energy (GWh) Savings through 2010 of ESCO Efficiency Projects Implemented from 1990 through 2010**



**Figure 9**  
**Cumulative Carbon Dioxide (CO<sub>2</sub>) Emission Reduction (Short Tons) through 2010 of ESCO Energy Efficiency Projects Implemented from 1990 through 2010**



A second method of measuring ESCO efficiency project impacts is shown in Tables 6 and 7. These two tables show the lifetime impacts of all projects implemented between the years 1990 through 2010. This method allows us to capture all of the energy savings over the project lives of projects implemented through the year 2010. An average project lifetime of 15 years was used in both scenarios.

**Table 6**  
**Total Lifetime Energy and Demand Savings of ESCO Efficiency Projects**  
**Implemented Between 1990 and 2010**

Impacts	Lifetime Impacts for Projects Implemented Between 1990 and 2010
<b>Total Investment (M\$)</b>	\$31,534
<b>Energy Savings</b>	
Institutional (M\$)	\$56,795
Commercial (M\$)	\$28,352
Industrial (M\$)	\$9,455
<b>Total Energy Savings</b>	\$94,601
Electricity Savings (GWh)	1,419,018
Electric Demand Reduction (MW)	17,999
Reduction in Direct Fuel Use (MMBTU)	7,883,437,500

**Table 7**  
**Total Lifetime Environmental Emission Reduction of ESCO Efficiency Projects**  
**Implemented Between 1990 and 2010**

	Lifetime Impacts for Projects Implemented Between 1990 and 2010
<b>Pollutants</b>	
CO2 (short tons)	1,852,134,806
NOx (short tons)	7,568,583
SO2 (short tons)	10,378,802
PM10 (short tons)	179,414
<b>Toxic Metals</b>	
Mercury (lbs.)	99,994
Cadmium (lbs.)	9,230
Lead (lbs.)	174,827

## **Appendix A**

### **A Description of the Services and Information Provided by the DOE Energy Fitness Program**

To request any of these Documents and Services contact:

The DOE Energy Fitness Program Web Site Address: <http://www.ornl.gov/EFP/>

Patrick Hughes, Energy Fitness Program Manager, Oak Ridge National Laboratory  
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Email: [michaelarny@leonardoacademy.org](mailto:michaelarny@leonardoacademy.org)

#### **List of Program Services and Information**

##### **A. Services**

1. Training for facility owners and managers on performance contracting:  
Training is provided for state and local government organizations, schools, hospitals and other organizations. Training is customized to fit the particular needs of each group trained. Training topics include:
  - Introduction to performance contracting
  - How performance contracting works for customers
  - How to acquire the services of an ESCO
  
2. Technical Assistance  
Technical Assistance is provided for state and local government organizations, schools, hospitals and other organizations. Technical Assistance is customized to fit the particular needs of each group trained. Technical Assistance topics include:
  - Technical assistance for these groups in states where new ESCO enabling legislation is passed.
  - Technical assistance for removing remaining barriers to increased delivery of energy efficiency by ESCOs in states where ESCO enabling legislation for state and local government organizations has been in place, but some barriers remain.

## **B. Information**

1. A description of the ESCOs and performance contracting work through project case studies.
2. Case studies of actual comprehensive ESCO energy efficiency and facility upgrade projects that show how these projects can meet customer needs. Case studies are available on a wide range of different project types carried out for different types of customers. Each type of customer can find case studies on ESCO projects for facilities like their own.
3. Information for customers on how they can use ESCOs to increase efficiency and upgrade their facilities. A customer handbook to guide customers through the procurement of ESCO services, including standard agreement language, standard project development procedures, sample solicitation and more.
4. An ESCO Accreditation program that makes it easy for consumers to select a pool of well-qualified ESCOs to consider for their projects. The NAESCO ESCO Accreditation Program was developed by NAESCO with support from the DOE Energy Fitness Program. It provides a regularly updated list of accredited ESCOs. A description of the Energy Fitness / NAESCO ESCO Accreditation Program is available.
5. Information about the size of the ESCO Industry, how much energy efficiency it delivers, and how much it reduces environmental emissions. This report provides general estimates of the rate of ESCO project investment, the energy savings and environmental emission reductions delivered.

Specifications and mechanisms to help the ESCO industry to gather detailed data about its rate of project investment and financial, energy and environmental performance have been developed. This data is now being gathered.

6. Support for the development and implementation of state ESCO enabling legislation to make the opportunity to use performance contracts to acquire energy efficiency improvements and facility upgrades available to state and local government organizations in all states.

A survey of the issues that need to be addressed and a composite of performance contracting enabling legislation from various states has been prepared for the Energy Fitness Program by the by the National Conference of State Legislatures

Model state legislation for removing legal and administrative barriers to ESCO delivery of energy efficiency to state, county and municipal buildings is being prepared for the Energy Fitness program by the National Association of Energy Service Companies with input from other Energy Fitness Program Partners.

7. Case studies showing the benefits of increased energy efficiency to states. A case study for Wisconsin of the state-level jobs and economic activity benefits of increased delivery of energy efficiency.
8. Support for the introduction of new high-efficiency technologies into the marketplace through the ESCO channel.

A case study of an ESCO's installation of 4003 geothermal heat pumps at Fort Polk, LA. This case study includes an analysis of the measurement and verification applied to this project

9. Information for college students considering careers in the ESCO Industry.

A report on the training needed for students to enter the ESCO industry and information on co-op training opportunities. The ESCO industry, which includes both ESCOs and customers purchasing ESCO services, is a rapidly growing industry.