Leonardo Academy Inc.

The Energy Savings and Emission Reduction Benefits Delivered by the State of Maryland Energy Performance Contracts

A Cleaner and Greener[SM] Environment Program Report by Leonardo Academy Inc.

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Contacts for Further Information:

Leonardo Academy Inc.

Michael Arny, Director
Steve Olson, Business Manager
Telephone: (608) 280-0255
Fax: (608) 255-7202
Email: info@leonardoacademy.org
Address: 1526 Chandler Street, Madison, Wisconsin 53711
Internet: http://www.cleanerandgreener.org

The Leonardo Academy, Inc. is an independent non-profit organization, which runs the national *Cleaner and Greener Environment Program* funded by grants from foundations, government contracts and private donations. The Academy provides independent analysis and recognition for companies and their customers who implement energy efficiency improvements. The Academy helps businesses and organizations equate energy savings to equivalent emission reductions in an effort to promote the development of markets and financial rewards for the emission reductions that result from energy efficiency and other emission reduction actions. For more information about The Leonardo Academy or the *Cleaner and Greener Environment Program* visit their website at *www.cleanerandgreener.org*.

Executive Summary

This report by the Leonardo Academy quantifies the economic, environmental, public health, and other the quality-of-life impacts from 14 Energy Performance Contracts implemented by the State of Maryland. The analysis showed that these energy efficiency projects provide major short term and long term environmental, energy supply and financial benefits.

The analysis indicates that the State of Maryland performance contracting projects will produce over $82 million in total energy savings and significantly reduce air emissions in Maryland. Emission reductions include reducing carbon dioxide emissions by 1.2 million tons, nitrogen oxide emissions by 3,400 tons and sulfur dioxide emissions by 7,300 tons. The study also indicates tremendous benefits to public health for Maryland as a result of the reduced emissions.

Background

The international debate about the potential impacts of global climate change is increasingly moving beyond science into the economics of emission reduction strategies and the policies that are needed to best mitigate potential impacts. Both the 1997 Kyoto accords and the 1992 Rio Earth Summit promoted international efforts to reduce greenhouse gas (GHG) emissions. The U.S. has not ratified the Kyoto Protocol, but under the Agreement, the U.S. would be required to limit greenhouse gas emissions to 7 percent below 1990 levels on average between the years 2008 - 2012. Most climate change experts agree that significant actions are necessary to achieve this goal since total U.S. GHG emissions continue to rise. In 1999, carbon dioxide emissions were 11.7% above the 1990 emission level of 1,349 million metric tons and projected by 2010 and 2020 to reach levels 34 % and 51 % higher, respectively, than 1990[2].

While ultimately an international issue, state government agencies and private companies are increasingly active in climate change discussions and strategies. The key reason is that the federal government prefers to encourage marketplace leadership as a way of implementing initiatives to reduce GHG and other emissions rather than mandate requirements. Energy Service Companies (ESCOs), play an active role in researching, developing and implementing mitigation strategies to improve facility operations and efficiencies which reduce GHG and other emissions. This report shows the important contribution energy efficiency improvements and performance contracting are making towards reducing all types of emissions in Maryland.

Findings

State of Maryland efforts to make buildings more useful, productive and energy efficient have produced substantial energy and cost savings for State facilities including those within the Department of General Services. These efforts have also produced added environmental and health benefits from the resulting pollution reductions.

The benefits from State of Maryland energy performance contracts include:

- Energy cost savings of $82.4 million
- Electric energy savings of 961,000 MWh (Enough to power over 80,000 Maryland households for a year)[4]
- Electric demand reductions equal to 12.2 MW
- Reduced carbon dioxide emissions of 1.2 million tons (Equivalent to planting 3.7 million trees or offsetting the annual emissions of 240,000 mid-sized automobiles.)[3]

The analysis also looked at a subset of nine Maryland Department of General Services energy efficiency projects included within the 14 State of Maryland projects. The benefits from the nine Maryland Department of General Services efficiency projects include:

- Energy cost savings of $64 million
- Electric energy savings of 744,000 MWh (Enough to power over 62,000 Maryland households for a year)[4]
- Electric demand reductions equal to 9.4 MW
- Reduced carbon dioxide emissions of over 945,000 tons (Equivalent to planting 2.8 million trees or offsetting the annual emissions of 186,000 mid-sized automobiles.)[3]

Reducing emissions positively impacts the overall general health of the public. Environmental emissions cause significant health problems among children, the elderly and people with compromised immune systems. Air pollution also has been linked to increased incidence of asthma in children. Cutting energy consumption reduces the emissions that heighten these health problems.

Reducing the demand for electricity increases the reliability of power supply in Maryland. In addition, investments in cost-effective energy efficiency measures have been shown to deliver local employment and income benefits. State of Maryland is able to spend less on imported fuels and electricity and this lowers their cost of delivering products and services to Maryland residents and businesses. This results in increased competitiveness, productivity, and profitability for the State of Maryland.

These results demonstrate the significant contribution energy efficiency can make towards reducing emissions in Maryland. One important way Maryland can increase the implementation of energy efficiency projects is to work to include financial incentives for emission reductions delivered by energy efficiency in Maryland environmental regulations. Current emission reduction regulations only provide financial rewards to large emitters for emission reductions and do not provide financial rewards to all building owners for the emission reductions delivered by energy efficiency actions. Creating additional financial rewards for emission reductions delivered by energy efficiency would make more energy efficiency improvements cost effective for the State of Maryland and for all building owners in Maryland.

Conclusion

The performance contracts implemented by the State of Maryland are delivering significant energy cost avoidance, improved indoor environments and local quality of life, and reduced energy use and emissions. Investments in more efficient technology use less energy yet deliver a similar and often improved level of comfort, light, motion, and power. Energy efficiency projects encouraged by the State provide through the competitive-marketplace significant contributions to economic development, a cleaner environment, and improved public health.

Continued expansion of the use of performance contracting by the state of Maryland will continue to yield better, more efficient facilities, energy savings, and reductions in emissions in the State of Maryland.

Project Results

Summary of Impacts of Fourteen State of Maryland Energy Efficiency Projects On Energy Savings and Emission Reductions

State of Maryland makes a major contribution to reductions in electric energy use, demand for electricity, direct fuel use and environmental emissions. State of Maryland makes these contributions by working with Energy Service Companies to develop and implement cost-effective projects that upgrade buildings and increase their energy efficiency. This study measured the energy savings impacts of 14 State of Maryland energy efficiency projects.

The Benefits from State of Maryland Energy Efficiency Projects

Energy and Demand Savings

The State of Maryland efforts to make buildings more useful, productive and energy efficient have produced substantial energy use savings. This has contributed a great deal towards reducing energy costs for State facilities. While a majority of the project 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 reductions and environmental and health benefits from the resulting pollution reductions.

The 14 State of Maryland energy efficiency projects are expected to produce energy cost savings of over $82 million, electric energy savings of 961 thousand MWh and electric demand reductions equal to 12.2 MW (Table 1).

Table 1. Energy and Demand Savings of 14 State of Maryland Energy Efficiency Projects

Savings Category	Average Annual Impacts	Cumulative Impacts
Energy Savings (Million $)	$5.5	$82.4
Electricity Savings (MWh)	64,062	960,925
Electric Demand Reduction (MW)	12.2	N/A
Dollar Value of Demand Reduction (Million $)	$6.1	N/A
Reduction in Direct Fuel Use (MMBTU)	316,788	4,751,827

Emission Reductions

The emission reduction estimates, which were developed using standard industry calculations, show that State of Maryland energy efficient projects have resulted in tremendous emission reductions during the life of the efficiency projects. Energy efficiency measures also have an added benefit in that individual efficiency actions reduce multiple pollutants.

The study indicates that energy efficiency projects implemented by 14 State of Maryland reduce U.S. carbon dioxide emissions by 1.2 million tons (Table 2). NOx and SO2 emissions also are reduced by roughly 3,400 and 7,300 tons respectively.

Table 2. Emission Reduction Impacts from 14 State of Maryland Efficiency Projects

Emission Type	Average Annual Impacts	Cumulative Impacts
Pollutants		
Carbon Dioxides (CO2) - Short Tons	81,325	1,219,878
Nitrogen Oxides (NOx) - Short Tons	229	3,431
Sulfur Dioxides (SO2) - Short Tons	484	7,256
Particulates (PM10) - Short Tons	7	101
Toxic Metals		
Mercury (Hg) – lbs.	2.4	36.0
Cadmium (Cd) – lbs.	0.4	5.5
Lead (Pb) – lbs.	5.1	76.1

Environmental Benefits

Energy and emissions savings from energy efficiency projects implemented by State of Maryland also produced significant benefits for the environment. The reduction of energy and emissions provides environmental benefits equivalent to:

- Offsetting the effects of 240,000 mid-sized automobiles from the environment, or
- Planting 3.7 million trees

The Benefits from a Subset of Nine Department of General Services Energy Efficiency Projects Within the State of Maryland Projects

Energy and Demand Savings

A majority of the State of Maryland efforts have occurred within the Department of General Services (9 out of 14 projects). The efforts of the Maryland Department of General Services to make buildings more useful, productive and energy efficient have produced substantial energy use savings. This has contributed a great deal towards reducing energy costs for Department facilities. The electricity and fuel reductions not only save money for customers but also result in substantial emission reductions and environmental and health benefits from the resulting pollution reductions.

Nine Maryland Department of General Services energy efficiency projects are expected to produce energy cost savings of $64 million, electric energy savings of 744 thousand MWh and electric demand reductions equal to 9.4 MW (Table 3).

Table 3. Energy and Demand Savings of 9 Dept. of General Services Energy Efficiency Projects

Savings Category	Average Annual Impacts	Cumulative Impacts
Energy Savings (Million $)	$4.3	$63.8
Electricity Savings (MWh)	49,630	744,450
Electric Demand Reduction (MW)	9.4	N/A
Dollar Value of Demand Reduction (Million $)	$4.7	N/A
Reduction in Direct Fuel Use (MMBTU)	245,423	3,681,346

Emission Reductions

The emission reduction estimates, which were developed using standard industry calculations, show that Maryland Department of General Services energy efficient projects have resulted in tremendous emission reductions during the life of the efficiency projects. Energy efficiency measures also have an added benefit in that individual efficiency actions reduce multiple pollutants.

The study indicates that energy efficiency projects implemented by 9 Department of General Services reduce U.S. carbon dioxide emissions by 945 thousand tons (Table 4). NOx and SO2 emissions also are reduced by roughly 2,700 and 5,600 tons respectively.

Table 4. Emission Reduction Impacts from 9 Dept. of General Services Efficiency Projects

Emission Type	Average Annual Impacts	Cumulative Impacts
Pollutants		
Carbon Dioxides (CO2) - Short Tons	63,004	945,067
Nitrogen Oxides (NOx) - Short Tons	177	2,658
Sulfur Dioxides (SO2) - Short Tons	375	5,622
Particulates (PM10) - Short Tons	5	78
Toxic Metals		
Mercury (Hg) – lbs.	1.9	27.9
Cadmium (Cd) – lbs.	0.3	4.3
Lead (Pb) – lbs.	3.9	59.0

Environmental Benefits

Energy and emissions savings from energy efficiency projects implemented by the Department of General Services also produced significant benefits for the environment. The reduction of energy consumption and emissions provides environmental benefits equivalent to:

- Offsetting the effects of 186,000 mid-sized automobiles from the environment, or
- Planting 2.8 million trees

References

[1] U.S. DOE / EIA Annual Energy Outlook 2001

[2] U.S. DOE / EIA, Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity, Web Site: http://www.eia.doe.gov/neic/press/kyoto1.gif

[3] American Forests Web Site: http://www.americanforests.org/clmt_chg/carbcalc.php3; 1 ton CO2 = 3 trees planted, 1 Mid-sized car = 10,168.3 lbs. CO2 per year (Annual Savings: 509 gallons, 22.2 mpg, 11,300 miles)

[4] U.S. DOE/EIA Table 1: Average Monthly Bill by Sector, Census Division and State, 1999 Residential, (http://www.eia.doe.gov/cneaf/electricity/esr/esrt01p1.html)

Appendix A: Methodology

Methodology for State of Maryland Performance Contracts

The energy savings and emission reduction benefits delivered by State of Maryland Energy Performance Contract Projects were based on guaranteed annual dollar energy savings of $5.491 million. The energy savings and emission reduction benefits delivered by Maryland Department of General Services Energy Performance Contract Projects were based on guaranteed annual dollar energy savings of $4.254 million.

The Analysis was based on the following assumptions:

- The average length of Guaranteed Performance Contracts studied was 12 years. An expected useful life of 15 years for the improvements included in the projects was used.
- 70% of the total dollar energy savings were attributed to electricity savings and 30% were attributed to natural gas savings based on the results of past JCI projects.
- Electric Demand Reduction (kW) From New Investment was calculated using annual electricity savings (kWh per year) divided by the hours in a year. The annual kW savings were divided by a capacity factor of 60% to calculate the kW demand reduction.
- Applicable state average emission factors were applied to the electricity (kWh) and natural gas (MMBtu) savings to calculate emission reductions

Appendix B: State of Maryland Energy Performance Contracting Projects

1. Maryland State Highway Administration
2. Bowie State University
3. Baltimore State Office Complex
4. Annapolis State Office Complex
5. Eastern/ Upper Shore Hospital/ Holly Center
6. Coppin State College
7. Maryland Correctional Facilities/ Patuxent
8. Maryland State Police- Headquarters and Barracks
9. Maryland Rehabilitation Center
10. Department of General Services- District Court/Multi-Service Centers
11. University of Maryland Baltimore County
12. Department of General Services Preston Street Complex
13. Maryland School For the Deaf
14. Springfield Hospital Center