The Energy Savings and Emission Reduction Benefits Delivered by Johnson Controls and Its Customers

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

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Executive Summary

During the period from 1990 through 2000, Johnson Controls Inc. and its customers had a significant impact on the environment, while also improving their own bottom lines. This report by the Leonardo Academy, Inc. quantifies the economic, environmental, public health, and other quality-of-life impacts of energy efficiency projects that these leading companies and institutions have implemented during the past ten years.

Energy savings resulting from building improvement projects have translated into financial benefits for customers, helping them lower – or stabilize – rising energy costs. Individually, every single building improvement or facilities management project was cost justified according to the building owner's individual requirements. Collectively, the projects that Johnson Controls Inc. and its customers initiated between 1990 and 2000 will help them realize $16.7 billion in energy cost savings over the expected lifetime of the projects.

Reduced demands on the nation's energy supply mean that power generation plants are tasked to produce less electricity, resulting in fewer greenhouse gas (GHG) emissions, like carbon dioxide. In fact, the $16.7 billion in energy savings equates to a reduction in U.S. carbon dioxide emissions of over 217 million tons. Taken together, the energy savings numbers demonstrate that managing energy to benefit the environment happens one building at a time.

Energy efficiency projects can help improve air quality by reducing other emissions resulting from energy production, too, including nitrogen oxides, sulfur dioxide and particulates, as well as toxic metals like mercury, cadmium, and lead. Many of these emissions pose serious threats to public health, causing a variety of health and environmental problems, from asthma to acid rain.

If Johnson Controls' present growth trends continue, projects implemented during the next 20 years will result in ever more significant reductions in demand for energy. Individual Johnson Controls customers will clearly notice the benefits of the $78 billion in projected energy cost savings their projects represent. What may not be as obvious to them is the reduction of carbon dioxide emissions spewed into the air – estimated at over one billion tons less – which the world will benefit from.

According to the Leonardo Academy, energy efficiency projects can contribute significantly to meeting longer-term emission reduction goals at the local, state, national and international levels.

In sum, Johnson Controls energy efficiency projects implemented between 1990 and 2020 will add up to an astonishing $95 billion in total energy savings and 1.3 billion tons of carbon dioxide emission reductions. To put this contribution to emission reductions in perspective, the U.S. could achieve its Kyoto emission reduction goals by the year 2020, if only 25 more companies could deliver achievements equal to those of Johnson Controls and its customers.

Project Participants

Stephen L. Olson is Director of Finance and Operations for Leonardo Academy Inc. **Michael Arny** is President and Executive Director for Leonardo Academy Inc.

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*.

Johnson Controls is a Fortune 150 company that develops and implements cost-effective strategies to make buildings more useful, productive and energy efficient. Performance contracting is a funding mechanism that pays for these strategies through the energy savings realized by the plan. Close measurement and verification of energy use is key to determining savings, thus the company's figures are very reliable.

The company's primary customers include K-12 schools, commercial and industrial buildings, retail chain stores, and local and federal government buildings. This study provides an independent assessment of the energy, environmental, economic, and public health benefits Johnson Controls delivers through its business practices.

This analysis includes Johnson Controls performance contracting, controls, and integrated facility management businesses. The analysis also includes Johnson Controls own internal energy efficient efforts through participation in the U.S. EPA Energy Star Buildings Program.

Project Overview

Introduction

Johnson Controls, Inc. is a leading provider of energy management systems and services. It has also taken a leadership position in building green. For example, the company's corporate headquarters, the Brengel Technology Center, was recognized by the U.S. Green Building Council as a model of green building design when it was completed in 2000.

Johnson Controls efforts to make buildings more useful, productive and energy efficient have produced substantial energy use savings. Since 1990, the company's customers have realized these savings as a result of implementing improvement projects designed to optimize their buildings for energy efficiency. Johnson Controls has lowered its own facilities operating costs, too.

This study reports the energy savings impacts of many different types of Johnson Controls energy efficiency projects. The improvement projects contribute to reductions in energy use, demand for electricity, direct fuel use and environmental emissions. Benefits are measured and recognized on three levels:

1) As savings on direct energy costs, realized by individual companies
2) As reduced demand for both total energy and load capacity, realized by utilities or other energy providers
3) As reduced environmental emissions, the result of reductions in demand for generated power

While a majority of a project's dollar investments are made upfront, the energy savings resulting from these investments continue to accrue for many years. Cost savings continue well beyond the project's payback period and are the result of yearly electricity and fuel savings. Actual contract lengths were used to determine realized and projected savings on projects implemented before and during 1997. An average contract length of 15 years was used for all contracts implemented during or after 1998. Therefore, contracts implemented in 2000 include projected savings through 2015 and contracts projected to be implemented in 2020 include projected savings through 2035.

Study findings are reported in three separate time periods: realized and projected savings on projects implemented during the period 1990-2000; savings on projects forecast to be implemented during the next twenty years, from 2001-2020; and savings on projects implemented over the entire study period, 1990-2020.

The energy impacts measured in this analysis included savings from many of Johnson Controls' divisions. Business areas studied include performance contracting, building automation systems, and integrated facility management divisions as well as Johnson Controls' Energy Star Buildings efforts on company owned facilities.

Energy Efficiency Projects Make a Difference

Johnson Controls offers a number of services to help building owners and facilities managers develop energy efficiency goals and action plans. The company works with customers to develop and implement cost effective projects that upgrade buildings and increase their energy efficiency. For more than 10 years, the company has been a leader in helping industries throughout North America boost their bottom lines by using energy more efficiently.

According to the U.S. Department of Energy (DOE) and industry experts, nearly every company can identify opportunities to further improve energy efficiency. And the impact of energy savings projects goes beyond an individual firm's bottom line.

By saving energy and improving the bottom line, companies are also helping the environment.

The value of environmental stewardship…

As a by-product of energy production, power plants produce emissions harmful to individuals and the environment. Electricity reductions not only save money for customers but also result in substantial emission reductions, which leads to environmental and health benefits from the resulting pollution reductions.

Reducing harmful greenhouse gas emissions is an international goal. Most participants in the recently concluded Kyoto conference on International Climate Control committed themselves to reducing their combined annual greenhouse-gas emissions over the next decade to five percent below 1990 levels. Energy efficiency measures are a key component of a strategic approach to limit greenhouse gas emissions related to energy use.

The Leonardo Academy is dedicated to raising awareness about the need to reduce all types of emissions including greenhouse gas emissions. A primary goal of the organization is to develop and provide better information on energy use and market trends. Since 1998, the Academy has been helping Johnson Controls and its customers' track their participation in energy efficiency programs in order to benchmark how they make their operations more efficient, lower their energy costs and significantly reduce their demand for energy. By equating their energy savings directly into a reduction in emissions, it has helped Johnson Controls and its customers realize the value their energy-savings investments provide for the environment.

This 2000 report, published in August 2001, details Johnson Controls and its customers' efforts to make energy efficiency investments throughout their operations in order to lower their own energy costs. Realized reductions in energy demand are converted into equivalent reductions in emissions. As of now, except for efforts in a few states on the eastern coast of the U.S., companies making investments to improve the energy efficiency of their operations receive no monetary benefit for reducing emissions. But this type of analysis shows that the energy savings are real and quantifiable. Understanding the significance and value of reduced emissions is a first step in the process of lobbying regulatory authorities to give private companies emission reduction credits, which could eventually be used to benefit the environment or to offset investment in new energy efficiency technologies and services.

Project Results

Part 1 – Impact of Efficiency Projects Implemented between 1990-2000

The benefits from Johnson Controls efficiency projects already implemented (1990-2000) include:

- Aggregate energy cost savings of $16.7 billion, approximately 66% from electricity, 34% from gas
- Electric energy savings of 166 million MWh, which would be enough to power all the households in California for over 2 years
- Electric demand (load) reductions equal to 2,500 MW, eliminating the need for six new 400MW power plants
- Reduced carbon dioxide emissions of 217 million tons, equivalent to planting 650 million trees or offsetting the annual emissions of 42 million mid-sized automobiles

Energy and Demand Savings

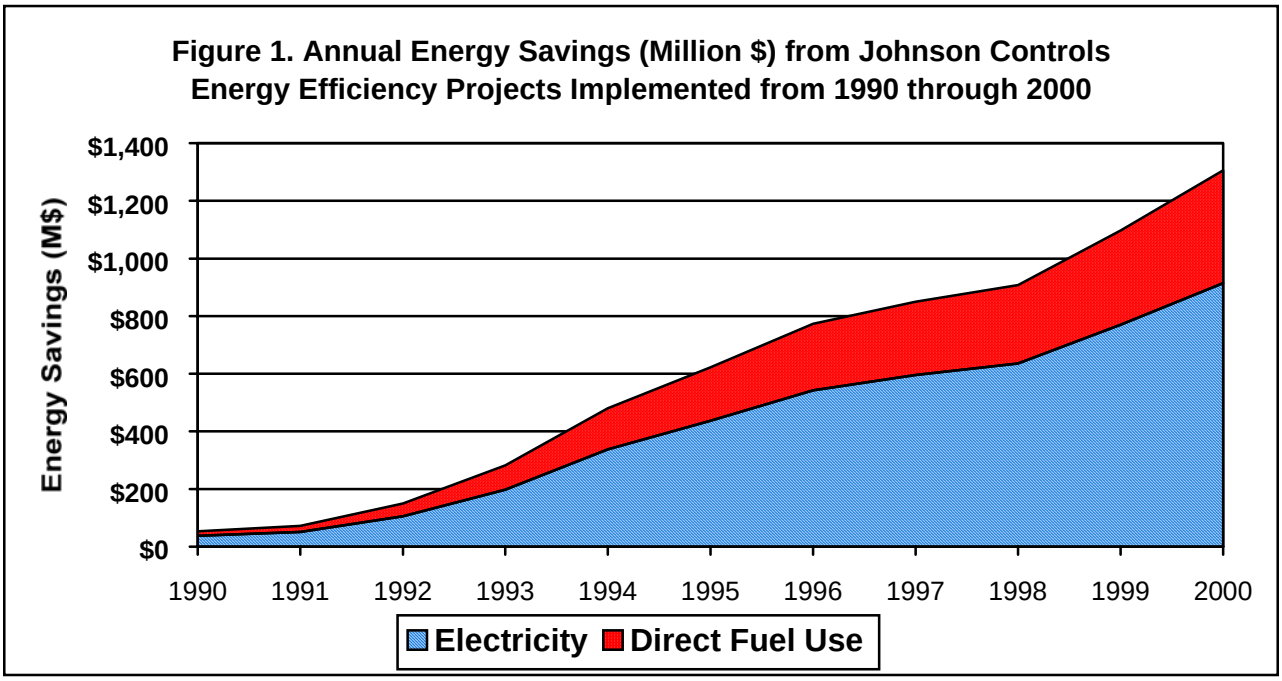
Johnson Controls energy efficiency projects implemented from 1990 through 2000 have realized, and will continue to generate energy cost savings totaling $16.7 billion, electric energy savings of 166 million MWh and electric demand reductions equal to 2,500 MW (Table 1). These demand savings eliminate the need for six new 400 MW power plants.

Table 1. Energy and Demand Savings of Johnson Controls Energy Efficiency Projects Implemented from 1990 through 2000

Savings Category	Average Annual Impact	Cumulative Impact
Reduction in Direct Fuel Use (MMBTU)	85,259,987	935,959,451
Electric Demand Reduction (MW)	2,511	N/A
Electricity Savings (MWh)	15,152,111	165,872,982
Electricity Savings (Million $)	$1,068	$11,727
Direct Fuel Use Savings (Million $)	$456	$5,011
Total Energy Savings (Million $)	**$1,524**	**$16,738**

Figure 1 (next page) breaks out realized annual electric and direct fuel use cost savings. The overall upward trend from 1990 to 2000 can be attributed to several factors. One, the steady increase in Johnson Controls' Performance Contracting and Controls Division's growth from 1990 to 2000. In addition, the average length of a Guaranteed Performance Contract has steadily increased. In 1990, the average contract was five years, resulting in only five years of realized savings. In 2001, contracts range from 10 to 25 years.

Energy savings begin upon completion of the improvement project and continue for the life of the contract. Over time, both an increase in the number of contracts, and longer contract lengths, combine to increase the amount of guaranteed savings on Johnson Controls' books. See Appendix A for a more detailed description of this process.



Equivalent Emission Reductions

Emission reduction estimates were developed using standard industry calculations regarding the amount of emissions utilities create in the generation of electrical power and the amount of emissions resulting from onsite direct fuel use. Energy savings projects implemented by Johnson Controls between 1990 and 2000 are reducing total energy use by more than 166 Million MWh, potentially reducing U.S. carbon dioxide emissions by over 217 million tons (Table 2).

Reduced energy production also benefits the environment by reducing multiple pollutants. NOx and SO_2 emissions have also been reduced by roughly 748,000 and 1,210,000 tons respectively.

Table 2. Emission Reduction Impacts from Johnson Controls Efficiency Projects Implemented from 1990 through 2000

Emission Type	Average Annual Impacts (short tons)	Cumulative Impacts (short tons)
Pollutants		
Carbon Dioxides (CO_2)	19,840,189	217,346,589
Nitrogen Oxides (NOx)	68,268	747,539
Sulfur Dioxides (SO_2)	110,598	1,210,739
Particulates (PM10)	1,996	21,853
Toxic Metals		
Mercury (Hg)	0.53	5.9
Cadmium (Cd)	0.96	10.5
Lead (Pb)	0.05	0.54

Environmental Benefits

These emissions savings produce significant benefits for the environment. The reduction of energy and emissions provides environmental benefits equivalent to:

- Offsetting the effects of 42 million mid-sized automobiles from the environment
- Planting over 652 million trees

These results clearly show that Johnson Controls has made a major contribution to economic development, a cleaner environment, and improved public health in the U.S. over the last 10 years.

Part 2 – Impact of Projects, Forecast to be implemented 2001-2020

Johnson Controls energy efficiency business continues to grow. Energy and emission impacts of Johnson Controls efficiency projects forecast for implementation through the year 2020 are based on business trends from 1990 through 2000. If current trends continue, Johnson Controls and its customers' contribution to reducing energy consumption and air pollution over the next 20 years will be even more significant than during the earlier period.

Benefits from Johnson Controls efficiency projects initiated during the next 20 years (2001-2020) are projected to include:

- Energy cost savings of $78 billion
- Electric energy savings of 815 million MWh , enough to power all the households in California for 11 years
- Electric demand reductions equal to 6,000 MW, eliminating the need for 15 new 400MW power plants)
- Reduced carbon dioxide emissions of over one billion tons, equivalent to planting 3.2 billion trees or offsetting the annual emissions of 207 million mid-sized automobiles

Energy and Demand Savings

Projects that Johnson Controls is expected to implement from 2001 through 2020 are projected to realize energy savings of over $78 billion, electric energy savings of 815 million MWh and electric demand reductions equal to 6,100 MW (Table 3). These demand savings would eliminate the need for fifteen new 400 MW power plants.

Table 3. Energy and Demand Savings of Johnson Controls Energy Efficiency Projects Implemented from 2001 through 2020

Savings Category	Average Annual Impacts	Cumulative Impacts
Reduction in Direct Fuel Use (MMBTU)	216,826,303	4,336,526,070
Electric Demand Reduction (MW)	6,127	N/A
Electricity Savings (MWh)	40,732,474,	814,649,487
Electricity Savings (Million $)	$2,747	$54,932
Direct Fuel Use Savings (Million $)	$1,178	$23,562
Total Energy Savings (Million $)	**$3,925**	**$78,494**

Emission Reductions

Energy efficiency projects to be implemented between 2001 and 2020 will greatly reduce multiple types of U.S. air emissions. During the life of energy efficiency projects, they will reduce carbon dioxide emissions by over one billion tons (Table 4, next page). Nitrogen oxide and sulfur dioxide emissions are also expected to be vastly reduced by 3.7 and 5.9 million tons, respectively.

Table 4. Emission Reduction Impacts from Johnson Controls Energy Efficiency Projects Implemented from 2001 through 2020

Emission Type	Average Annual Impacts (short tons)	Cumulative Impacts (short tons)
Pollutants		
Carbon Dioxides (CO_2)	52,610,837	1,052,216,734
Nitrogen Oxides (NOx)	182,593	3,651,861
Sulfur Dioxides (SO_2)	297,310	5,946,206
Particulates (PM10)	5,354	107,086
Toxic Metals		
Mercury (Hg)	1.44	28.7
Cadmium (Cd)	2.59	51.7
Lead (Pb)	0.13	2.7

Environmental Benefits

These emissions savings will produce significant benefits for the environment. The reduction of energy and emissions will provide environmental benefits equivalent to:

- Offsetting the effects of nearly 207 million mid-sized automobiles from the environment
- Planting over 3.2 billion trees

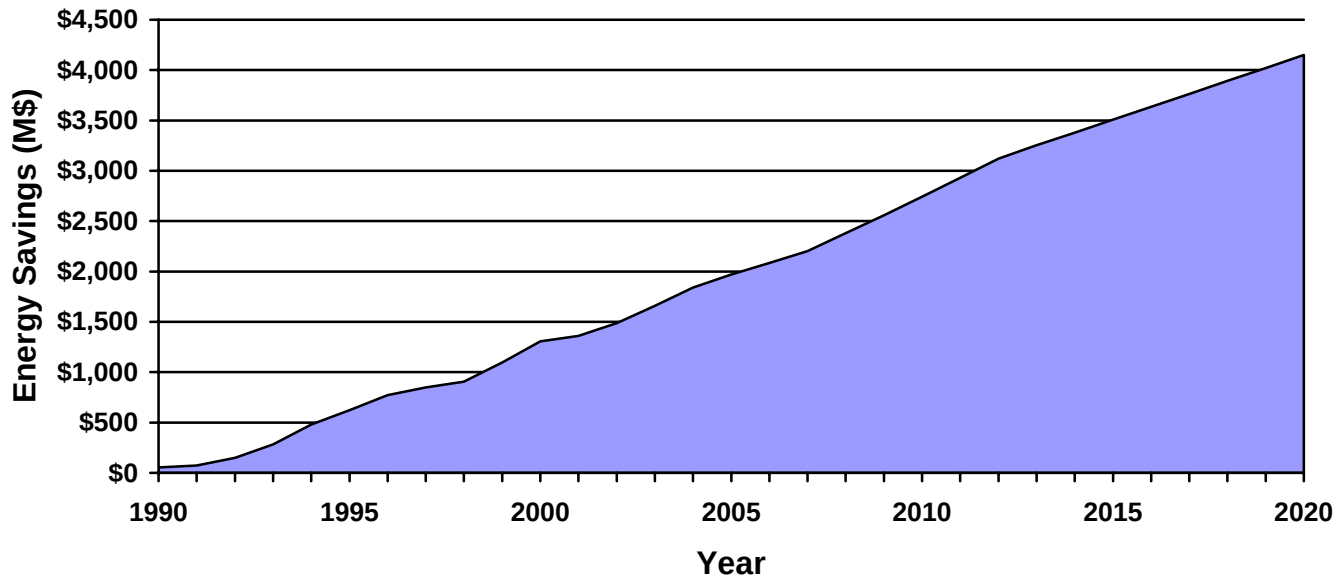
These results clearly show that Johnson Controls energy efficiency projects will make a significant contribution to improving the environment.

Part 3 – Cumulative Impact of Projects 1990 – 2020

Figure 2 shows an increasing rate of increase in annual energy savings from Johnson Controls energy efficiency projects throughout the entire study period (1990 – 2020).

By the year 2020, annual energy savings from Johnson Controls energy efficiency projects are expected to increase to over four billion dollars, if present trends continue. Total energy savings, represented by the area under the curve, are considerable. The energy savings are even more considerable when the full 15 years of energy savings for projects implemented after 2005 are taken into consideration.

Figure 2. Annual Energy Savings (Million $) from Johnson Controls Energy Efficiency Projects Implemented from 1990 through 2020

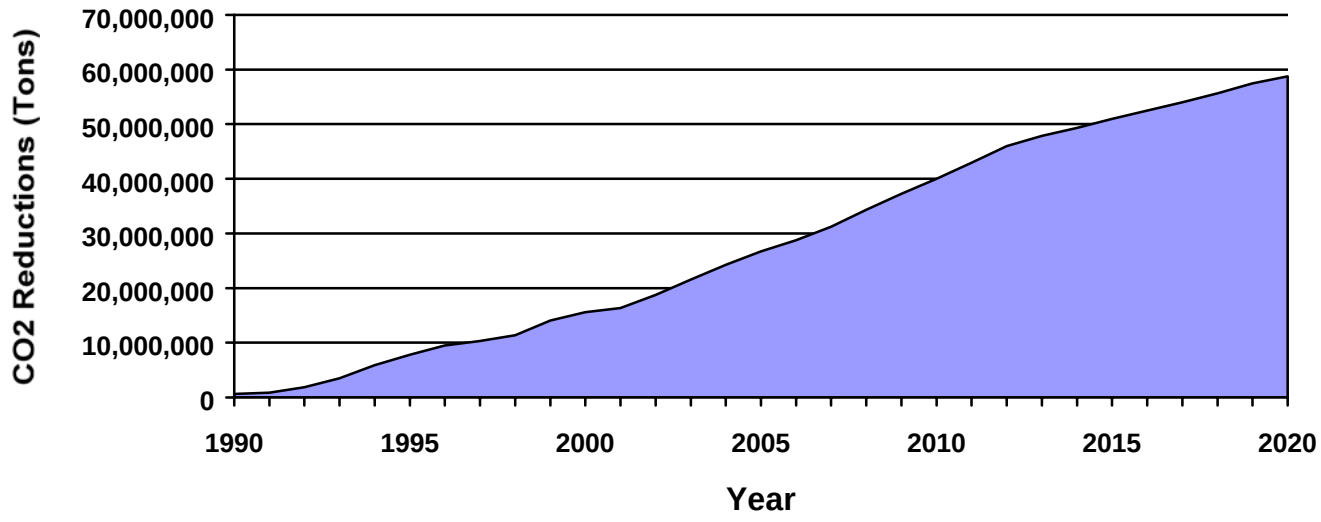


Equivalent Emissions Reductions

Figure 3 (next page) shows the rate of increase in annual greenhouse gas (CO_2) savings from Johnson Controls energy efficiency projects implemented throughout the entire study period (1990 – 2020). The annual emission reductions from 1990 through 2020 reflect a similar trend to the annual energy savings displayed in Figure 2. As in Figure 2, Figure 3 shows only projected energy and savings up to 2020, not the total accumulation of savings realized for the entire duration of projects implemented prior to 2020.

Annual CO_2 emission reductions from Johnson Controls energy efficiency projects approach 60 million tons (53 million metric tons) per year by 2020 if present trends continue.

Figure 3. Annual Greenhouse Gas Reductions (CO2 Short Tons) from JCI Energy Efficiency Projects Implemented from 1990 through 2020



To put 60 million tons into perspective, U.S. carbon equivalent emissions are projected to reach 2,040 million metric tons in 2020 without any additional future legislative or regulatory actions. But to meet the emissions goals outlined in the Kyoto Accord, the U.S. would need to decrease emissions by 797 million metric tons to reach the target output of 1,243 million metric tons per. The annual carbon dioxide emission reductions of 53 million metric tons from Johnson Controls energy efficiency projects equates to 4.3 percent of the total needed to reach the required U.S. greenhouse gas emission limits of seven percent below 1990 levels.

This is an impressive energy savings and emission reduction effort from just one company. It would only take 25 Johnson Controls to meet the U.S. Kyoto goal by the year 2020.

Environmental Benefits

Energy and emissions savings from Johnson Controls projects produce significant benefits for the environment. The aggregate reduction of energy and emissions from 1990 through 2020 provide environmental benefits equivalent to offsetting the effects of nearly 250 million gas-combustion mid-sized automobiles from the environment, planting over 3.8 billion trees and eliminating the need for 15 new power plants with 400 megawatt capacity (Table 5).

Table 5. Environmental Benefits Equivalent of Johnson Controls Energy Efficiency Projects' Energy and Emission Reductions (1990 - 2020)

Environmental Benefits Equivalent	Impacts of Projects
CO2 equivalent number of trees planted[4]	3,808,689,969
CO2 equivalent number of gas powered cars offset in one year[4]	249,685,018
Number of new 400 MW capacity power plants eliminated	15

Part 4 – Perspective: Impacts of Johnson Controls Relative to the State of California

2000 and 2001 saw significant coverage in the news media regarding energy supply and demand problems in the State of California. Johnson Controls electricity and demand savings were compared to California electric energy statistics in 1999 (Table 6). The average annual electricity savings of 32 million MWh from Johnson Controls energy efficiency projects initiated between 1990 and 2020 are equal to over 40% of California's entire commercial sector sales of 78 million MWh in 1999.

The 32 million MWh in annual electricity savings from Johnson Controls energy efficiency projects would be enough to power all of the houses in the City of San Diego for 123 months (10 years). From an environmental perspective, the CO_2 emission reductions from Johnson Controls energy efficiency projects would offset the CO_2 emissions generated by the power used in all the houses in the City of San Diego for 10 years.

Also, the forecasted demand reduction of 2300 MW in 2004 from Johnson Controls energy efficiency projects equates to over 50% of California's planned capacity additions from 2000 through 2004. These comparisons effectively show the size and significance of Johnson Controls energy efficiency projects on both energy and demand savings.

Table 6. Impacts of Johnson Controls Energy Efficiency Projects Relative to the State of California

	California Electric Energy Statistics (1999)[3]	**Johnson Controls Project Statistics**
Retail Sales to All Sectors (MWh)	234,830,879	
Average Annual Electricity Savings - MWh (1990 - 2020)		31,635,116
Commercial Sector Sales (MWh)	78,153,686	
Residential Sector Sales (MWh)	75,303,000	
Monthly average residential consumption of electricity (kWh)	548	
Number of houses in the City of San Diego[5]	469,689	
Number of months the average annual electricity savings from JCI projects (1990 - 2020) would power all the houses in the City of San Diego		123
Total existing generator capability, net summer (MW)	53,157	
Planned capacity additions, 2000 through 2004 (MW)	4,489	
Forecasted Demand Reduction in 2004 (MW)		2,292

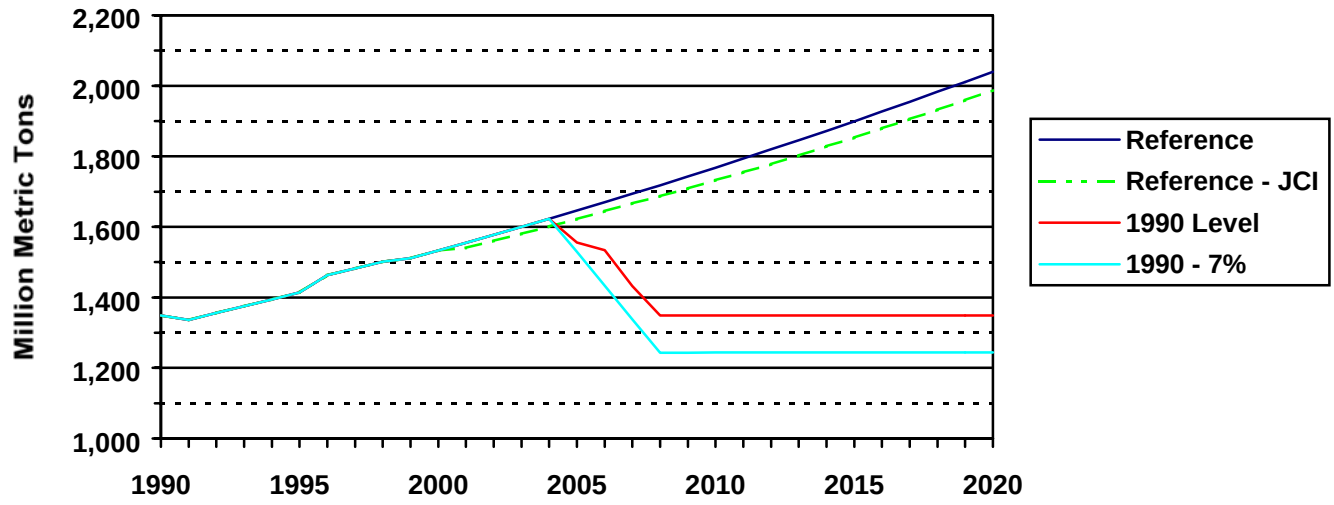
Discussion: Meeting Our Environmental Responsibilities

Global Climate Change

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. By 2010 they will be 34% higher than 1990[1], and by 2020 will reach 51% above targeted levels.

Figure 4 shows the forecasted U.S. carbon dioxide emissions[1] in relation to the Kyoto Protocol Target and Johnson Control forecasted carbon dioxide emission reductions. The reference case line represents forecasted U.S. emission levels with no new actions to reduce carbon emissions. The Reference – JCI line includes the substantial emission reduction actions by Johnson Controls and its customers. 1990 Level is equivalent to 1990 emission levels and the 1990 – 7% line represents the Kyoto Protocol Target for the U.S. of 7% below 1990 emission levels that does not include offsets, sinks, or emission trading.

Figure 4. U.S. Annual Greenhouse Gas Emissions (CO2 Million Metric Tons) in Relation to Kyoto Targets and JCI Energy Efficiency Projects Reductions



While these greenhouse gas emission reduction goals are dauntingly large, energy efficiency initiatives are already making a major contribution to achieving them. Figure 4 effectively shows how the annual carbon dioxide emission reductions of 53 million metric tons from Johnson Controls energy efficiency

projects by 2020 help close the U.S. Kyoto Target gap. The 53 million metric tons equate to 4.3 percent of the total needed to reach the required U.S. Kyoto Target of seven percent below 1990 levels. This is an impressive energy savings and emission reduction effort from just one company. It would only take 25 Johnson Controls to meet the U.S. Kyoto goal by the year 2020.

The Role Of The Marketplace In Meeting Emission Reduction Targets

This report documents the important contribution that energy efficiency improvements can make towards reducing all types of emissions. But current regulations, for the most part, only provide financial rewards for emission reduction to large emitters, in the form of tradable emission reduction credits. Unfortunately, regulations do not provide these same financial rewards to building owners for the emission reductions delivered by their energy efficiency actions. Those interested in reducing emissions should recognize this shortcoming in almost all emission reduction regulations.

One important way states and the national government can increase the implementation of energy efficiency and the resulting emission reductions is to allow all building owners open access to the current financial incentives for emission reductions. Several states in the eastern U.S. including New Jersey and New York have done just that by allocating set aside emission allowances to energy efficiency projects that are implemented in the state that reduce or displace electricity generation as part of their NOx emission trading programs. An emission set aside for energy efficiency actions can be applied to all state or national emissions program for any type of air pollutant. Creating increased market rewards for emission reductions delivered by energy efficiency will increase the financial incentive for implementing more energy efficiency actions. This would allow energy efficiency and the competitive market to do even more to reduce all types of emissions.

Conclusion

Johnson Controls Inc. and its customers are proof that energy efficient building design and improvements can play a substantial role in lowering overall energy and operations costs, leading to environmental and health benefits from the resulting pollution reductions.

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.

In addition, investments in cost-effective energy efficiency measures have been shown to deliver local employment and income benefits. Johnson Controls and their customers are able to spend less on imported fuels and electricity and this lowers their cost of producing goods and delivering services. This results in increased competitiveness, productivity, and profitability for these businesses.

By working to meet its customers' needs, Johnson Controls makes a major contribution to the local quality of life and reduction of energy use and emissions. Investments in more efficient technology consume less energy yet deliver a similar and often improved level of comfort, light, motion, and power. Projects encouraged through Johnson Controls' involvement provide significant contributions to economic development, a cleaner environment, and improved public health.

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] U.S. DOE/EIA, Selected California Electric Energy Statistics for 1999, 2001 (http://www.eia.doe.gov/cneaf/electricity/california/statistics.html).

[4] 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: 509 gallons, 22.2 mpg, 11,300 miles).

[5] U.S. Census Bureau, Census 2000 Housing Units, City of San Diego housing units = 469,689 in 2000, http://quickfacts.census.gov/hunits/states/06pl.html.

[6] The Energy Savings and Emission Reduction Benefits Delivered by Johnson Control Energy Performance Contract Projects, A Leonardo Academy Cleaner and Greener Report, 1998.

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Appendix A: Methodology

Methodology for Johnson Controls Performance Contracting Division

The first Cleaner and Greener Report in 1998 on the Energy Savings and Emission Reduction Benefits Delivered by Johnson Controls Energy Performance Contract Projects[5] was based on a constant rate of project investment of $300 million a year from 1990 to 2010 with 20% of the investment designated as energy savings ($60 million per year). Guaranteed energy savings on the books were calculated per year based on a constant contract lifetime of 15 years.

For the current report in 2001, the actual Amount Secured Volume from Performance Contracting Sales and other data points were used to calculate the Amount Guaranteed Savings on the Books (Sources - Tom Proffitt for secured volume and Greg Kurpiel for savings on the books). From this set of figures, the percent of guaranteed savings that are energy savings was used to calculate the guaranteed energy savings on the books.

There are a number of trends seen in the current report that were not reflected in the first report which only used constant rates.

- The Amount of Secured Volume from Performance Contracting Sales by Johnson Controls steadily increased from 1990 to 2000. This leads to large increases over time to the Amount of Guaranteed Savings on the Books. This is because a large secured sales volume is added to the books in each current year compared to the much smaller amount of secured sales volume from completed contracts initiated 10 to 15 years ago that are taken off the books.
- The average lengths of Guaranteed Performance Contracts have been increasing from 5 years in 1990 up to an average of 10 to 25 years in 2001. A contract length of 15 years was used from the year 1998 through 2020. A longer contract length results in an increase in the Amount of Guaranteed Savings on the Books over time as the contract lengths increase.
- Years 2001 – 2020 Amount Secured Volume from Performance Contracting Sales (M$) were forecast using trend analysis (Least-square Method) on years 1994 to 2000.
- Years 2002 – 2020 Amount Guaranteed Savings On the Books (M$) were forecast using an average of trend analysis (Least-square Method) on years 1997 to 2000 and the Amount of Secured Volume Sales versus contract lengths.
- The percent of guaranteed savings that are energy savings have decreased from 95 % in 1990 down to 55% in 1998 and beyond. This decreases the Amount of Guaranteed Energy Savings on the Books. The 45% that make up non-energy savings from 1998 on, are stipulated operating savings other than energy savings. About 3% of no energy guarantees are water, waste and other items that can be tracked and are in Johnson Controls' control. About 42% are Operation & Maintenance Stipulated savings.
- 70% of the total dollar energy savings were attributed to electricity savings and 30% were attributed to direct fuel use (natural gas) savings based on the results of past Johnson Controls 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 emission factors were applied to the electricity (kWh) and natural gas (MMBtu) savings to calculate emission reductions.

Methodology for Johnson Controls' Controls Division

The following assumptions were used for Johnson Controls' Controls Division Calculations:

- Service contact savings were based on 3-year contracts and installed system contract savings were based on 15 year equipment life (Source: Greg Kurpiel).
- Annual Secured Controls Installed Systems Investments (M$) were forecast using trend analysis (Least-square Method) on years 1992 to 2000.
- Secured Controls Installed Systems on the Books (M$) and Service on Controls Installed Systems on the Books (M$) were calculated using the contract lifetimes compared to annual investments. The sum of installed system and service contracts were used to calculate total Controls Division Investment on the Books. The study assumed that Controls Division project investments produced annual energy savings equal to 5% of total investment (10 % dollar savings are typical if projects utilize control strategies. Control Projects that do not utilize control strategies usually produce no cost savings. The analysis assumed 5% cost savings overall since only about half of the Control Projects have control strategies in place, Source: Greg Kurpiel).
- 70% of the dollar energy savings were attributed to electricity savings and 30% were attributed to natural gas savings based on the results of past Johnson Controls projects. Applicable electricity and natural gas prices were used to establish electricity and natural gas savings.
- Applicable emission factors were applied to the electricity (kWh) and natural gas (MMBtu) savings to calculate emission reductions.

Methodology for Integrated Facilities Management Division

The following assumptions were used for Johnson Controls' IFM Division Calculations:

- The IFM Managed Square Footage (million sq.ft.) was conservatively assumed to remain constant from 1999 through 2020.
- The U.S. Average Commercial Building Energy Use (Mbtu per Sq. Ft) number of 90.50 Mbtu /sq.ft. was used to calculate energy consumption per building space (Source - U.S. EIA / DOE Annual Energy Review Table 2.11, July 2000).
- The study assumed that IFM Division project investments produced annual energy savings equal to 5% of total building energy consumption (Source: Greg Kurpiel).
- 39% of the energy use reductions (MMBtu) were attributed to electricity reductions and 61% were attributed to natural gas reductions based on the results of past Johnson Controls projects. Applicable electricity and natural gas prices were used to establish electricity and natural gas cost savings (M$).
- Applicable emission factors were applied to the electricity (kWh) and natural gas (MMBtu) savings to calculate emission reductions.

Methodology for Johnson Controls Energy Star Buildings Participation

Johnson Controls joined the U.S. EPA Energy Star Building Program. From 1995 through 2005, Johnson Controls is developing and implementing cost-effective strategies to make their own buildings more useful, productive and energy efficient. The following assumptions were used for Johnson Controls' Energy Star Buildings Calculations:

- This study showed the results from 46 of Johnson Controls' buildings from across the U.S.
- A three-year baseline was established for electricity and natural gas use for each building.
- For buildings where energy upgrades have begun, the 1999 electricity and natural gas use was compared against an average of the three-year baselines to calculate energy savings in those buildings.
- The percentage of project completion established by the Energy Star Building software was multiplied by the building square footage. The energy savings and completed square footage numbers were used to calculate the energy savings per completed square foot. The energy savings per square foot numbers were then extrapolated with the remaining square footage to be upgraded and additional savings were spread over the remaining project years through 2005.
- Project savings were assumed to have a lifetime of 15 years.
- Applicable electricity and natural gas prices were used to establish electricity and natural gas cost savings (M$).
- Applicable emission factors and energy costs were applied to the energy savings to calculate emission and cost savings.

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