

Energy Efficiency in Colorado's New Energy Economy: Business Case Studies

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About SWEEP: The Southwest Energy Efficiency Project is a public interest organization dedicated to advancing energy efficiency in Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming. For more information, visit www.swenergy.org.

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Executive Summary

Energy efficiency—the hidden energy resource—is an essential and rapidly growing part of Colorado’s New Energy Economy. As the quickest, cleanest and cheapest way to either save or supply energy, energy efficiency generates both immediate and long-term benefits by saving money for businesses and consumers, creating much-needed jobs in a new and rapidly growing industry, and helping the state meet its greenhouse gas emission reduction goals.

This SWEEP report illustrates the range and variety of economic benefits of energy efficiency to businesses in Colorado. As examples, the report highlights a few recent energy efficiency projects around the state, as well as a few of the businesses that are making great strides in manufacturing, selling, and installing energy efficiency in our state and creating new jobs in doing so.

The first section of the report profiles five Colorado energy efficiency product and service providers. In a year when companies of all sizes and types are struggling, many of those in the energy efficiency business are thriving. The companies profiled here—representative of scores of similar businesses in the state—have experienced 100-500 percent growth in the last two years. Businesses profiled in this report include:

- **Coolerado Corporation:** Winner of the 2009 Western Cooling Challenge, the entrepreneurial engineers at Coolerado design and manufacture the most efficient commercial rooftop air conditioners in the world.
- **Lightly Treading, Inc:** As primary contractor coordinating and delivering Xcel Energy’s home energy audit program in Colorado, Lightly Treading is one of the leading small businesses providing energy audits and related services in the state.
- **Bestway Insulation:** This family-owned business in Broomfield specializes in solving insulation problems in older, Victorian-era homes and buildings. Bestway has tripled its business volume in the past two years.
- **EcoBroker International:** EcoBroker is both capitalizing on the potential and fostering the growth of the green real estate market by training and certifying real estate professionals in building efficiency and the use of special financing mechanisms for energy-efficient properties.
- **Navigant Consulting (formerly Summit Blue Consulting):** Boulder-based Summit Blue Consulting specializes in evaluation, design and implementation of utility demand-side management (DSM) programs, providing services to over 60 utilities nationwide.

The second section provides case studies of six energy efficiency projects implemented in the last two years in commercial, industrial, and institutional facilities in Colorado. These projects—again representative of many others around the state—illustrate the range of benefits typical of

such projects, including one to five year payback on investment (somewhat longer in the case of the school district), improved indoor environmental quality, and long-term energy and maintenance cost savings. This report includes case studies of energy efficiency projects recently implemented by:

- **Avago Technologies:** This thriving high-tech manufacturing company has implemented a number of energy efficiency projects at its Fort Collins facility, saving nearly 900,000 kWh in 2008.
- **Dawn Food Products:** A recent lighting retrofit at Dawn Food Products' Denver distribution center has cut annual energy costs by 15 – 20 percent.
- **IBM Green Data Center:** Designed to be 40 percent more efficient than a typical data center, the facility opened at IBM's Boulder campus in 2008 is at the forefront of an industry movement toward increasing efficiency in traditionally energy-intensive data centers.
- **LSI Corporation:** Recent energy efficiency projects at LSI's Fort Collins facility cut their annual energy cost by 25 percent, with the initial investment paying for itself in less than one year.
- **Mesa County Valley School District 51:** A recent lighting and mechanical retrofit will save the school district \$308,000 in annual energy and maintenance costs.
- **Woodward Governor Company:** A combination of energy efficiency and load management projects will allow Woodward to cut annual energy bills by \$400,000 at their Fort Collins and Loveland facilities.

The accomplishments of these and many other energy efficiency businesses and projects are to be acknowledged and applauded. However, the examples presented here are not unusual; rather, they are representative of many others across the state and throughout the country. Through direct energy cost savings as well a host of other associated benefits, investment in energy efficiency is already having a significant impact on the Colorado economy.

The representative case studies profiled here illustrate the range and variety of economic benefits that the hidden resource of energy efficiency offers the state of Colorado. We hope it will inspire businesses and policy makers to further support this important and growing part of the state's economy.

I. Introduction

Energy efficiency is an essential part of Colorado’s New Energy Economy. In fact, energy efficiency is by far the quickest, cheapest, and cleanest way to reduce energy consumption, reduce greenhouse gas emissions, and help consumers and businesses save money.

Energy efficiency is the hidden energy resource—hidden in our basements and attics, walls and windows, boilers and air conditioners, and under the hoods of our cars. Energy efficiency may not be as visible as a wind farm across the eastern plains, or rows of photovoltaic panels at a solar power plant in the San Luis Valley or on rooftops in Colorado Springs, but it is just as important for meeting Colorado’s energy needs and attaining greenhouse gas emission reduction goals.

This SWEEP report illustrates the range and variety of economic benefits of energy efficiency to businesses in Colorado. As examples, the report highlights a few recent energy efficiency projects around the state, as well as a few of the businesses that are making great strides in manufacturing, selling, and installing energy efficiency in our state and creating new jobs in doing so. The accomplishments of these and many other energy efficiency projects and businesses are to be celebrated. The primary reason for profiling them in this report, however, is to illustrate the vast potential and myriad ways that the hidden resource of energy-efficiency can benefit the state of Colorado.

Reducing energy use by improving energy efficiency is a win/win strategy that generates immediate, cost-effective benefits for Colorado citizens, businesses, and environment:

- Saving money for consumers and businesses
- Creating jobs and putting people to work
- Helping the state meet its greenhouse gas emission reduction goals
- Cutting pollution which causes urban smog and harms public health
- Increasing the reliability of our energy supply
- Reducing the need for costly and controversial new power plants.

Energy efficiency helps people and businesses save money in tough economic times. Energy cost savings means more money is available for other purposes: investing, saving, education, and spending on other goods and services. A recent report by McKinsey and Co. concluded that energy efficiency alone—if implemented on a large scale through a comprehensive and innovative policy approach—has the potential to reduce total energy consumption in the US by 23% by 2020. Nationwide that adds up to gross energy savings worth more than \$1.2 trillion, well above the \$520 billion needed through 2020 for upfront investment in efficiency measures.¹

¹ Hannah Choi Granade and others, *Unlocking Energy Efficiency in the U.S. Economy*, (McKinsey & Company, 2009). Available from <http://www.mckinsey.com/USEnergyefficiency>.

Energy efficiency puts people to work. A 2009 analysis by SWEEP concluded that implementing the energy efficiency initiatives outlined in the Colorado Climate Action Plan will add 4,660 jobs by 2015, 8,900 by 2020, and 11,600 jobs in the state by 2025.² That’s about a 0.45% increase in the state’s employment rate, a small but non-trivial increase for a state the size of Colorado. Job growth would be widely distributed throughout the state’s economy, with most of the growth occurring in the services, retail trade, and construction sectors. Some jobs could be lost in the electric and gas utilities, mining, and the oil and gas production sectors, although some of this loss can be mitigated if utilities provide comprehensive energy efficiency services to their customers. Some of the potential job gains are a direct result of energy efficiency business growth, while some are attributed to the extra dollars in the economy flowing into other goods and services.

It must be emphasized that energy efficiency will not only create jobs for engineers and consultants. The task of upgrading our homes and commercial buildings, for example, will provide meaningful employment opportunity for people of all demographics and economic strata. Former White House Advisor on Green Jobs Van Jones offers the hopeful image of meaningful green jobs providing incentive for “that kid on the street corner putting down his handgun, picking up a caulk gun.”³ A comparable example in Colorado is that of Veterans Green Jobs, a Denver-based non-profit organization which is training combat veterans to fill the growing need for a green workforce. In December 2009, Veterans Green Jobs was awarded a \$9 million contract with the Governor’s Energy Office to provide weatherization services to income-qualified households in Denver and Jefferson Counties.⁴

Energy efficiency helps the state meet its greenhouse gas emission reduction goals. Governor Ritter’s Colorado Climate Action Plan calls for 20% reduction in the state’s greenhouse gas emissions by 2020, and an 80% reduction by 2050. Roughly half of that reduction is projected to come from increased use of natural gas, cleaner coal technology, and renewable energy of all types combined. The other half of that reduction is expected to come from energy efficiency measures.⁵

Energy efficiency cuts pollution and thus leads to cleaner air and water. Ninety five percent of the primary energy consumption in Colorado comes from petroleum (36%), natural gas (32%)

² Howard Geller and Marshall Goldberg, *Energy Efficiency and Job Creation in Colorado* (Boulder, CO: Southwest Energy Efficiency Project, 2009), http://swenergy.org/publications/documents/EE_and_Jobs_Creation_in_Colorado-April_2009.pdf.

³ Elizabeth Kolbert, Greening the Ghetto: Can a Remedy Serve for Both Global Warming and Poverty?, *The New Yorker*, January 12, 2009, http://www.newyorker.com/reporting/2009/01/12/090112fa_fact_kolbert.

⁴ Colorado Governor’s Energy Office, Press Release, December 11, 2009, <http://www.colorado.gov/energy/index.php?/about/press/2009>.

⁵ Colorado Governor’s Energy Office, *Colorado Climate Action Plan: A Strategy to Address Global Warming* (Denver, CO, 2007), http://www.colorado.gov/energy/in/uploaded_pdf/ColoradoClimateActionPlan_001.pdf.

and coal (28%).⁶ These sources generate significant water and air pollution in all stages: extraction, production, and consumption. Cutting consumption is one of the simplest and cheapest ways to cut pollution associated with fossil fuels, including nitrogen oxides, particulates and mercury.

Energy efficiency increases the reliability of our energy supply and reduces the need for costly and controversial new power plants. Increasing energy efficiency means less reliance on oil imports and in some regions natural gas imports as well. And improving energy efficiency means less strain on the electric power grid, and less chance of power outages during periods of high demand.

A. The Potential Impact of Strong Energy Efficiency Efforts 2009 – 2020

In October 2009, the American Council for an Energy-Efficient Economy (ACEEE) released its 2009 Scorecard, ranking states on their energy efficiency performance.⁷ Colorado jumped from 24th to 16th this year, largely due to improvements in three of the six areas in which states are graded—utility programs, combined power and heat policies, and state energy programs. While the recent gains are encouraging, there is still plenty of room for improvement.

In Colorado, SWEEP estimates the following energy, economic and emissions savings and benefits from expanded energy efficiency efforts:^{8,9}

- Electricity savings in 2020: 16.5%
- Natural gas savings in 2020: 10.0%
- Avoided CO₂ emissions in 2020: 13 million metric tons
- Net economic benefit (2003 – 20): \$6.6 billion
- Net increase in jobs by 2020: 8,900
- Water savings by 2020: 5 billion gallons/year

B. The Role of Utility and Government Rebates and Incentives

Rebates from electric and gas utility Demand Side Management (DSM) programs as well as incentives from state and local government programs are playing a critical role in the deployment

⁶ U.S. Department of Energy, Energy Information Administration, Colorado State Energy Profile, 2006 data, http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=CO.

⁷ American Council for an Energy Efficient Economy, *The 2009 State Energy Efficiency Scorecard* (Washington, DC:ACEEE, 2009), <http://www.aceee.org/pubs/e097.htm>.

⁸ Howard Geller, *Energy Efficiency Improvements in Colorado in the Context of Governor Ritter's Climate Action Plan*, SWEEP report prepared for the Governor's Energy Office, August 2009.

⁹ Geller and Goldberg, 2009.

of energy efficiency measures in Colorado. By helping to offset a portion the initial cost of energy efficiency investments, utility and government rebates are often the critical factor that allows a homeowner or business owner to move forward in tough times.

In Colorado, overall utility DSM spending has increased from \$11 million in 2002 to about \$51 million in 2009, equivalent to approximately 1.5% of utility revenues.¹⁰ This substantial increase, primarily attributable to the efforts of Xcel Energy, Fort Collins Utilities, and Black Hills Energy, is encouraging. However, there is still much room for improvement, especially among the state's rural electric cooperatives and municipal utilities outside of Fort Collins.¹¹

¹⁰ Howard Geller, "Update on Utility Energy Efficiency Programs in the Southwest," Southwest Regional Energy Efficiency Workshop (Phoenix, AZ), November 9, 2009, http://swenergy.org/events/annual/2009/presentations/Geller_SWEEP_110909.pdf.

¹¹ Colorado Public Utilities Commission, *Energy Efficiency and Colorado Utilities: How Far We've Come; How Far We Need to Go* (Denver, CO: Colorado Department of Regulatory Agencies, 2009), http://www.dora.state.co.us/puc/agendas/10-20-09NEC_EnergyEfficiency_ColoradoUtilities_PUCreport.pdf.

II. Case Studies – Energy Efficiency Businesses in Colorado

In a year when companies of all sizes and types are struggling, many of those in the energy efficiency business are thriving. The growing industry here in Colorado is represented by the Energy Efficient Business Coalition (EEBC), the new trade association based in Denver, whose mission is “to support policies, programs and business practices that will increase the market for energy efficiency products and services and benefit energy users and the environment.”¹²

Colorado energy efficiency entrepreneurs are finding a number of niches in the emerging New Energy Economy. Their work can be grouped into four general categories:

1. Energy-efficient technology and products

Entrepreneurs and well-established companies are racing to design innovative, energy-efficient technologies which make it easier for consumers and businesses to save energy and money without compromising comfort or convenience. One of the rising stars in energy-efficient technology profiled in this report is Denver-based Coolerado Corporation, recently recognized for producing the most energy-efficient commercial rooftop air conditioners in the world.

2. Energy audits and installation of energy efficiency measures

As greater priority and more funding pours in for weatherization, energy audits and home retrofits, many new companies are appearing and established companies are growing to meet the need. Two businesses profiled in this report include Lightly Treading and Bestway Insulation. Both are small, privately owned businesses, in operation for 10 and 35 years respectively, that experienced rapid growth in the past two years. This category also includes larger Energy Service Companies (ESCOs), energy raters, and numerous small and large contractors who do weatherization, HVAC, and other energy efficiency work in homes and commercial facilities.

ESCOs work through energy performance contracting, an innovative financing whereby the contractors arrange the financing, and the loan is paid from the guaranteed energy and operational savings. At least 15 ESCOs operate in Colorado.¹³ The Mesa County Valley School District energy efficiency project, profiled in the next section of this report, was completed by two ESCOs.

¹² Energy Efficiency Business Coalition, <http://energyefficiencybusinesses.org>.

¹³ For more information about ESCOs and performance contracting, see Colorado Governor’s Energy Office, *Performance Contracting*, <http://www.colorado.gov/energy/index.php?/commercial/performance-contracting>.

3. Energy efficiency as a marketing tool

As public awareness of energy efficiency grows, so does the market for efficient homes, autos, appliances, and other products. EcoBroker International, a Colorado company profiled in this report, is both capitalizing on the potential and fostering the growth of the green real estate market by training and certifying real estate professionals in building efficiency and the use of special financing mechanisms for energy-efficient properties.

4. Energy efficiency consulting

A variety of Colorado-based consulting firms work with utilities and government agencies to design and implement effective energy efficiency programs, conduct research and public outreach, and provide other services. In this report we profile Navigant Consulting (formerly Summit Blue Consulting) a rapidly growing Boulder-based firm that has worked on utility demand-side-management program evaluation for over 60 utilities nationwide.

The businesses profiled in this section, along with many others like them throughout the state, are shaping and contributing to the growth of Colorado's New Energy Economy by saving consumers and other businesses money, creating meaningful and sustainable jobs, and in myriad ways advancing the ideas and technologies of energy efficiency.

A. Coolerado Corporation – Denver, Colorado

Coolerado is a Denver-based manufacturer recently recognized for producing the most efficient commercial rooftop air conditioners in the world.¹⁴ The privately owned company is experiencing rapid growth following their development of a highly efficient air cooling technology especially suited to the climate of western states. Coolerado manufactures indirect evaporative cooling systems, an innovative technique for cooling air at high efficiency without adding moisture to the air.

Research and development of the Coolerado technology began in 1999 by company founders Dr. Valeriy Maisotsenko, Tim Heaton, and brothers Lee, Alan, and Rick Gillan. The founders worked with Maisotsenko's revolutionary ideas in thermodynamics and refined them into a product. They built their first prototypes in 2001 – 2003, and the first commercial products were installed in 2004 in Colorado and Japan. They are now on their seventh generation of the initial product design, and are pushing the envelope with newer designs such as the hybrid technology in the H80.

In 2009, Coolerado was the first certified winner of the Western Cooling Challenge sponsored by the Western Cooling Efficiency Center at UC Davis.¹⁵ Coolerado's H-80 a high-volume commercial rooftop unit that beat the US Department of Energy 2010 standards by 60 percent at peak demand and uses 80 percent less energy overall. The winning unit—the hybrid Coolerado H80—employs indirect evaporative cooling along with dehumidification. The three smaller Coolerado units currently available for residential and small commercial applications operate without dehumidification and perform even more efficiently, with an Energy Efficiency Ratio (EER) of 40+. For comparison, a typical new compressor-based residential air conditioner has an EER of 11 or 12.

The first H80 is now installed on a university building in Sacramento, CA. The first production units are being delivered to Australia and Africa in the winter of 2009.

One of the key ideas behind the new technology is known as the Maisotsenko Cycle, a process by which outside air is cooled through twenty consecutive stages of indirect evaporative cooling with heat exchange through a series of plastic plates. Unlike traditional swamp coolers, the moist air never enters the building. The basic process uses no CFC refrigerants or compressors and is driven by simple, energy-efficient fans, using as little as 10% as much energy as traditional air conditioners. (The hybrid H-80 combines indirect evaporative cooling with the use of refrigerants and compressors for dehumidification, therefore consuming slightly more energy.)

¹⁴ UC Davis News and Information, *UC Davis Challenge Produces a Better Air Conditioner*, University of California – Davis, August 13, 2009, http://www.news.ucdavis.edu/search/news_detail.lasso?id=9200.

¹⁵ Ibid.

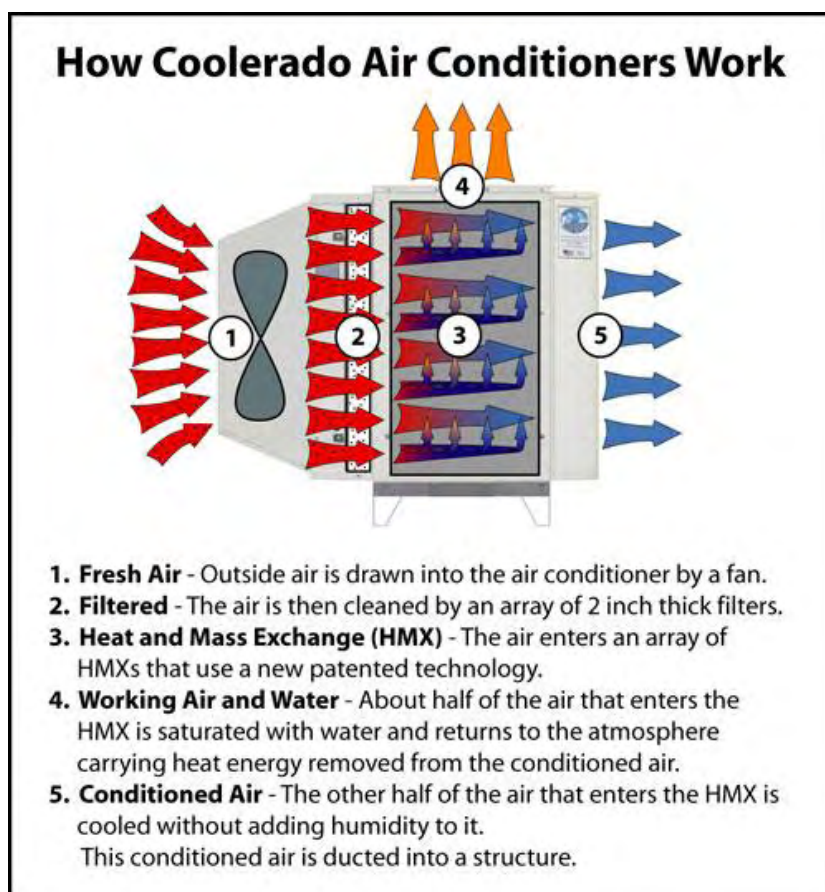
In addition to winning the Western Cooling Challenge, the new technology has received diverse awards and recognition including the Colorado Governor's Award for Excellence in Renewable Energy, the 2006 Top-10 Green Building Products by BuildingGreen, Inc., and recently received a Best of What's New in 2009 award from Popular Science magazine.

Through its energy savings, each installed H-80 unit reduces associated carbon emissions by 22,000 pounds per year, equivalent to not burning 1,100 gallons of gasoline.

Evaporative cooling does consume more water at the point of service than traditional air

conditioning, which is a concern in the southwest. However, Coolerado cites a metric developed by National Renewable Energy Laboratory (NREL)¹⁶ which indicates that the increased point-of-service water use is offset by water savings associated with avoided electricity generation.

Because it relies on evaporation, the technology is particularly well suited to the hot, dry climates of the American Southwest. However, because no moisture is added to the indoor air, the technology is effective and energy efficient in other climates as well, and Coolerado units have been installed in diverse climates all over the US and the world. The company website lists contractors, distributors and engineers in the 11 western states as well as Australia, New Zealand, Europe, India and southeast Asia. There are 9 contractors and 3 distributors listed in Colorado.



Graphic: Coolerado Corporation

<http://www.coolerado.com/tech-info/how-coolerado-air-conditioners-work/>

¹⁶ P. Torcellini, N. Long, and R. Judkoff, *Consumptive Water Use for U.S. Power Production*, National Renewable Energy Laboratory Technical Report NREL/TP-550-33905 (Golden, CO, 2003), <http://www.nrel.gov/docs/fy04osti/33905.pdf>.

The new technology currently costs about 25 percent more than a standard air conditioning unit. However, substantial energy savings along with rebates and other incentives can lead to a very short payback time. In Colorado, utility rebates typically amount to about 10 percent of the total installed cost, and the average payback time on incremental cost is estimated at 1 – 3 years. In hotter climates where more air conditioning is needed, the payback time can be as short as 3 months.

All this adds up to good business and huge potential for Coolerado Corporation. According to Executive Vice President Rick Gillan, the company grew about 500 percent in the past two years—from 7 employees in 2007 to about 40 in 2009. As the company transitions from research and development to full-scale production and distribution, and with such high-profile accolades from diverse entities, the company appears on the brink of even more expansion. As Gillan enthusiastically adds, “We anticipate huge growth. We plan to control half the global HVAC market—a \$70 billion industry—within ten years.”

Between added jobs, huge energy and cash savings for commercial and residential consumers, and significant greenhouse gas reductions, Coolerado’s entrepreneurial success will benefit the residents of Colorado in many ways.

Coolerado Corporation <i>Quick Facts:</i>	<i>Contact Information:</i>
<ul style="list-style-type: none"> ➤ Privately owned business founded in 1999 ➤ 40 employees in 2009 ➤ 500% growth 2007 – 2009 ➤ Four products available for residential and commercial applications ➤ Indirect evaporative cooling technology reduces energy use and greenhouse gas emissions by 80 – 90% ➤ H80 hybrid unit was winner of the 2009 Western Cooling Challenge 	<p>Coolerado Corporation 4430 Glencoe St. Denver, CO 80216 www.coolerado.com 303-375-0878</p> <p>Rick Gillan, Executive Vice President rickgillan@coolerado.com</p>

B. Lightly Treading, Inc. – Denver, CO

Lightly Treading is a small business in Colorado with a mission to “identify energy efficiency, comfort, savings and overall environmental impact problems in homes and buildings, and to provide cost-effective solutions for their occupants.”¹⁷ Alignment with this mission, combined with a reputation for quality service, has guided the company to become one of the rising stars of energy efficiency in the state.

With an entrepreneurial spirit and an M.S. in Energy Analysis and Policy, Paul Kriesher assembled a small team of Home Energy Raters and founded Lightly Treading as a sole proprietorship in 1997. The company experienced moderate and steady growth for a decade, accumulating experience and building a solid reputation in the industry.

Rather than aggressively trying to make the most money and grow the business as quickly as he could, Paul’s service-oriented business philosophy has been guided by his central question, “How can I work with others to solve problems and build solid relationships to attract business for the long term?”

That strategy paid off big time in January 2009, when Lightly Treading was awarded a contract with Xcel Energy to coordinate and offer substantially discounted home energy audits for Xcel Energy customers throughout the state of Colorado. Homeowners pay a minimal fee for the service, while the utility subsidizes the actual cost. By doing so, Xcel increases the awareness and adoption of cost-effective home energy retrofits.

This partnership is one direct result of House Bill 1037, legislation passed in 2007 which facilitated the expansion of energy efficiency programs implemented by natural gas and electric utilities in Colorado. The legislation led the Colorado Public Utilities Commission to establish energy savings goals for Xcel, and also to offer Xcel performance-based financial incentives for implementing effective energy efficiency programs. In response, Xcel greatly expanded its energy efficiency programs starting in 2009.¹⁸

With this new contract, Lightly Treading has grown dramatically, expanding from 9 to 20 full-time employees in 2009. In addition, they coordinate the work of at least 22 subcontractors around the state, with an estimated 50 people working on Lightly Treading projects through those subcontractors.

¹⁷ Lightly Treading, Inc., <http://www.lightlytreading.com>.

¹⁸ Colorado Public Utilities Commission, *Stipulation and Settlement Agreement regarding Public Service Company of Colorado 2009-2010 DSM Biennial Plan*, Docket #08A-366EG, December 2008, http://swenergy.org/news/news/documents/file/2008-12-Xcel_DSM_Plan_Settlement.pdf.

In the first seven months working with Xcel, Lightly Treading conducted 1900 energy audits, and Paul estimates that they will continue to conduct at least 3600 audits annually. With growing awareness and demand in the next few years, Paul anticipates that as many as 180 people could be working full-time conducting energy audits in Colorado.

In Fall 2009, Xcel approved funding for a home performance advocate, a new position to be offered through Lightly Treading. This service is offered to ensure that homeowners get what they pay for from energy efficiency home improvement contractors. Following an independent inspection, homeowners receive a post-improvement report that lists which improvements have been made correctly and which areas still need to be corrected.

Home energy audits through Xcel account for approximately 70% of Lightly Treading’s current business. The remainder of their work consists of HERS Ratings, work on the Home Performance with ENERGY STAR programs, energy efficiency workshops, training certifications, system-specific diagnostic testing, and other services.



Lightly Treading staff member measures attic insulation. Photo: www.lightlytreading.com

Looking to the future, Paul expects the company will be doing more training, which will help the state meet the growing demand for qualified home energy efficiency professionals. These training programs will be funded in part by Recovery Act funds when they become available. In addition to professional trainings, Paul teaches a course in green building for students at Colorado State University, making the most of every opportunity to teach others about energy efficiency.

Lightly Treading, Inc. Quick Facts:	Contact Information:
<ul style="list-style-type: none"> ➤ Business is almost entirely related to energy efficiency. Services include: <ul style="list-style-type: none"> ○ Energy audits (with computer modeling) ○ Home Performance with ENERGY STAR ○ Infrared thermal imaging ○ Duct diagnostics ○ Carbon monoxide safety testing ○ Solar assessments ○ Post-improvement inspection (follow-up to energy audit) ○ House Doctors for homebuyers, realtors, property managers & HOAs ➤ Awarded contract in January 2009 to provide energy audits for Xcel Energy. Xcel contract accounts for 70% of current business. ➤ Company grew from 9 to 21 regular employees in 2009, with approximately 50 additional personnel working through 22 subcontractors around the state. ➤ Approximately 3600 energy audits will be completed in 2009. 	<p>Lightly Treading Inc. 4303 Brighton Blvd. Bldg. 3 Denver, CO 80216 303-733-3078 www.lightlytreading.com</p> <p>Paul Kriescher, Principal info@lightlytreading.com</p>

C. Bestway Insulation – Broomfield, CO

Bestway Insulation is a family-owned business based in Broomfield, Colorado. Founded in 1976, the company installs insulation of all kinds in existing buildings. They also do energy audits, blower door testing, and weatherization. Bestway currently has 26 employees, and the business generated about \$1.3 million in revenue in 2008.

In 2009, a year when many in the building industry are reeling from a stagnant housing market and severe slowdown in construction, Bestway owner Debra Weingardt reports, “We are growing like crazy! In early 2007 we operated three trucks. This year we are keeping ten trucks busy all the time.” Weingardt credits this to the growing awareness and funding available for weatherization and energy efficiency, coupled with fact that Bestway works exclusively on existing buildings and specializes in solving insulation problems in older buildings.

The company got a high-profile boost in 2007 when it insulated the Colorado Governor’s mansion. The 26,000 square foot, 98-year old mansion was drafty, cold and very expensive to heat. Governor Bill Ritter, who moved into the mansion with his family in February 2007, wanted his family wanted to be more comfortable in their new home, and he wanted to set a good example as he kicked off his New Energy Economy campaign. It turned out to be a good move. Bestway found substantial gaps in the insulation, including nearly 4,000 square feet of previously uninsulated attic space which they filled with R-50 insulation. The added insulation, combined with other energy efficiency measures implemented the same year, contributed to significant energy savings for the building.

Bestway employees have all completed training by Home Performance ENERGY STAR, and most are certified by the Building Performance Institute (BPI). Weingardt expects that all of Bestway’s employees will be BPI-certified by the end of 2009.

Rebates and incentives offered through energy efficiency programs sponsored by utilities and government agencies play a significant role in the weatherization business, where relatively low profit margins mean that high business volume is essential for success. Rebates typically go directly to the home or building owner to help offset the cost of the retrofit. Weingardt notes that rebates are a very important factor in making weatherization more affordable for many Bestway clients. She notes that when Xcel Energy doubled the size of their insulation rebates for several months in 2009, Bestway got nearly triple the number of calls from Xcel customers taking advantage of the rebates, suggesting a much greater than proportional motivational factor with the increase.

Bestway’s recent growth appears to come from increased market demand for insulation retrofits, and so far is not a result of stimulus funding. As of November 2009, the funding boost for

weatherizing existing homes made possible through the 2008 American Recovery and Reinvestment Act had not yet reached her business, but Weingardt expects another growth spurt when it does. “We have projects lined up all over the Front Range, and are preparing to ramp up even more when the funding becomes available.” She expects that Bestway will grow to as many as 25 trucks to keep up with the anticipated demand in the next five years.

In keeping with Debra Weingardt’s strong environmental and social ethic, she has not been content to simply profit from her growing business. She has proactively engaged state policy-makers in discussions about the design of weatherization assistance programs. And over the past few years, she has been training Native American tribal members in the trade, giving them the skills and know-how to become successful insulation contractors in their home communities.

This winning combination of highly trained professionalism, specialization in a much-needed service, political action, and community service appears to be paying off for Bestway, as the company’s vision of sustainability translates into tangible contributions for Colorado’s New Energy Economy.

Bestway Insulation Quick Facts:	Contact Information:
<ul style="list-style-type: none"> ➤ Family-owned business founded in 1976 ➤ Specializes in troubleshooting and re-insulating existing homes. ➤ Specialist in old Victorian-era homes with hard-to-insulate features such as slope ceilings, knee walls, cubby holes, dormers, attics and wings. ➤ 26 employees in 2009 ➤ \$1.3 million revenue in 2008 ➤ Business volume has more than tripled since 2007, and is expected to more than double in the next five years. ➤ Strong supporter of energy efficiency and other sustainability efforts in Colorado. 	<p>Bestway Insulation 3951 Creek Dr. Broomfield, CO 80023 (303) 469-0808 BestwayInsulation@hotmail.com</p> <p>Debra Weingardt, Owner</p>

D. EcoBroker International – Evergreen, CO

EcoBroker was founded by Coloradans Dr. John Beldock and John Stovall in 2002. As green building scientists and real estate brokers, they recognized a need for an integrated and applied program to educate consumers and real estate professionals about the environmental issues, economic benefits, and the promising market potential of sustainable and green buildings. They set out to build a curriculum that would meet this need. The resulting education and certification program has been very successful, pioneering a training model and setting a standard for the real estate industry.

Through EcoBroker’s unique energy and environmental curriculum, real estate professionals acquire the knowledge and resources to become Certified EcoBrokers[®] who can help consumers and communities take advantage of energy efficiency and environmentally sensitive design in real estate properties. The curriculum gives professionals a technical background in relevant energy and environmental issues, as well as information about creative financing options so they can best assist clients in their pursuit of properties that provide affordability, comfort and a healthier environment, all while reducing carbon footprints.

The initial training consists of three modules, one of which focuses specifically on energy saving home features and sustainable energy options. EcoBrokers learn about leading “green” home certification programs such as ENERGY STAR[®], LEED[®] and Built Green[®], and how to help clients retrofit properties, and buy and sell certified properties. They also learn how to help clients use verified energy savings and green financing tools to realize larger loans and make transactions easier to close. In the other two modules, students learn more about the environmental, health and savings benefits of green buildings, how to address specific environmental issues associated with buildings, and how to proactively market green properties and build constructive business networks.

The basic EcoBroker designation process consists of the 3-day training course, plus a 4-hour refresher/update training each year to keep the EcoBroker Certified[®] green designation current. There are eighteen qualified EcoBroker instructors in the US, and the training is available in person or on-line.



EcoBroker was honored as 2009 Green Building Advocate of the Year by the National Association of Home Builders.¹⁹ In addition, the EcoBroker curriculum was recognized as the 2006 Education Program of the Year by the Real Estate Educators Association, and as one of the

¹⁹ National Association of Home Builders, “NAHB Honors The Year's Best In Green Home Building,” Press release, May 11, 2009, http://www.nahb.org/news_details.aspx?sectionID=0&newsID=9188.

Top Green Building & Business Certifications by Lifestyle of Health and Sustainability (LOHAS) Journal. More recently, EcoBroker was recognized by FixR as one of the Top 10 Green Building Trends for 2010 in its Home Remodeling & Home Renovation Blog.

Since 2002, over 6,000 professionals have completed the training to become certified EcoBrokers, and over 25,000 professionals and consumers have participated in EcoBroker's 4-hour introductory seminar. Certified EcoBrokers currently operate in all 50 states and 13 other countries including Canada, Mexico, Costa Rica, Nicaragua, Australia, New Zealand and beyond.

Colorado is the home base for the EcoBroker initiative, and is near the front of the pack with 339 certified EcoBrokers as of September 2009, the second highest number in any state. (There are 364 in California.) The EcoBroker designation is catching on in other southwestern states as well, with 56 in Arizona, 30 in New Mexico, 18 in Nevada, 13 in Utah, and 3 in Wyoming (as of September 2009).

The company does directly interface with utility-sponsored energy efficiency programs and has more work ready for 2010. The curriculum teaches real estate professionals how take the customer all the way through the process of marketing, purchasing and financing green properties and retrofit projects in and outside utility service areas. They learn how to use energy efficiency rebates, tax incentives and green financing options such as the energy efficiency mortgage and many other financing tools as part of their real estate practice.

Certified EcoBrokers report that they are using their training effectively, and they appear to be a force to reckon with in the green property industry. In a 2008 survey of professionals who have completed the EcoBroker certification training, 100% reported that they are enthusiastically sharing information with clients, and 20% are actively engaged in green retrofit projects.

President and CEO John Beldock, himself a former official at the Department of Energy, says, "Graduates of our training understand that utility and government programs can be your friend. They understand the utility's incentive to pursue energy efficiency, and they know precisely how to use those programs to the property owner's greatest advantage."

In addition to earning the EcoBroker certification, those who complete the training become members of the Association of Energy and Environmental Real Estate Professionals (AEEREP), the trade association that oversees professional training and certification programs and helps foster general awareness and growth of the green real estate industry.

As awareness of the many benefits of energy efficiency and sustainable buildings grows, interest in training and certification for green real estate professionals is increasing dramatically. And if

imitation is the highest form of flattery, EcoBroker has reason to be proud. In 2002, EcoBroker was the first company to offer this sort of training and certification targeted specifically to real estate professionals. Since 2005, as many as eighteen other, somewhat similar certification programs have appeared to address the need. However, perhaps because of their reputation and accomplishment, EcoBroker has not been adversely affected by the existence of other programs. Even with competing certification programs, and in the midst of an economic downturn which has severely affected the entire real estate industry, the number of certified EcoBrokers has doubled between 2007 and 2009 — a trend that will likely continue into the foreseeable future.

EcoBroker currently remains in every respect a Colorado small business. Employed staff has reached up to 12 full-time Colorado professionals in recent years, with another 18 to 24 virtual part-time professionals throughout the U.S. and internationally. Although 2009 was a rough year for all involved in the real estate and even green real estate industries, EcoBroker anticipates solid performance in 2010. This is one Colorado business with an eye on service and growth over the next several decades.

EcoBroker International Quick Facts:	Contact Information:
<p>As of September 2009:</p> <ul style="list-style-type: none"> ➤ 6,000 real estate professionals have completed the EcoBroker certification. ➤ 25,000 consumers and professionals have completed a 4-hour introductory program. ➤ 339 certified EcoBrokers in Colorado. ➤ 20% of certified EcoBrokers are actively engaged in energy retrofit projects. 	<p>EcoBroker International 29029 Upper Bear Creek Rd. Suite 202 Evergreen, CO 80439 303-674-7770 www.ecobroker.com</p> <p>John Beldock, Ph.D., CEO jbeldock@ecobroker.com</p>

E. Navigant Consulting (formerly Summit Blue Consulting) – Boulder, CO

Navigant Consulting (formerly Summit Blue Consulting) provides professional consulting services related to the energy industry, primarily in the areas of program design and evaluation for energy efficiency and renewable energy. The Boulder, Colorado-based business has experienced substantial growth in recent years as interest in clean energy has increased nationwide. In December 2009, Summit Blue Consulting was acquired by Navigant Consulting, Inc. (NCI), a publicly traded global consulting company. (Since this case study focuses on the business before the acquisition, it is referred to as “Summit Blue” in the remainder of this document.

Summit Blue helps organizations efficiently utilize energy resources—considering environmental, financial, and community sustainability—by providing data driven analyses to make informed decisions and mitigate risks surrounding energy investments & operations. Their extensive client list primarily consists of electric utilities and state regulatory agencies. Working on utility-administered efficiency programs is a core business area, accounting for a majority of revenue.

The company’s core practice areas include:

- demand-side management (DSM) program evaluation;
- DSM program design and implementation;
- assessment of resource potential;
- smart grid investment analysis, demand response, and energy pricing; and
- renewable energy.

While not an exhaustive list of services provided, this represents a large portion of the firm's expertise and project experience.

To date, Summit Blue professionals have conducted impact, process, and market evaluations of over 500 utility demand-side management programs for more than 60 utilities and energy agencies across North America. Summit Blue’s program design and implementation practice area focuses on assisting electric and natural gas utilities and statewide agencies with the design, start-up, and implementation of energy efficiency, demand response, and renewable energy programs. The firm has assisted numerous clients with the full-scale design and start-up of their DSM programs.

Since its founding in 2000, Summit Blue Consulting grew to 73 employees in 2009, 40 of whom are based in Colorado. Summit Blue generated roughly \$15 million in revenue in 2009.

Paralleling the growth of energy efficiency and renewable energy programs in recent years, and indicative of Summit Blue’s reputation in the industry, the company experienced a remarkable 100% growth from 2007 – 2009. “We’ve also seen significant increases in renewable energy, smart grid, demand response, and climate change work,” said Frank Stern, Director at the firm.

The company has offices in California, Illinois, Vermont, Washington, and Wisconsin to better serve clients around the country. Regarding the recent acquisition by NCI, Summit Blue CEO Kevin Cooney says “We’re excited to join Navigant Consulting in order to expand the work we’re currently doing. Navigant provides us with increased global reach and access to other leading energy professionals that bring a broad set of analytical skills and industry knowledge that will allow us to expand our best-in-class consulting services in the energy efficiency, renewable, and smart grid areas to include more related work in electricity supply side and transmission areas.”

Navigant/Summit Blue Consulting <i>Quick Facts:</i>	<i>Contact Information:</i>
<ul style="list-style-type: none"> ➤ Founded in 2000 ➤ 73 employees at the end of 2009 ➤ Approximately \$15 million revenue in 2009 ➤ Company experienced 100% growth from 2007 – 2009. ➤ Work on energy efficiency programs accounts for over half of revenue. ➤ Has conducted evaluations of over 500 utility DSM programs for over 60 utilities and agencies. ➤ Acquired by Navigant Consulting December 2009. 	<p>Navigant/Summit Blue Consulting 1722 14th Street, Suite 230 Boulder, CO 80302 720-564-1130 www.summitblue.com</p> <p>Frank Stern Director fstern@summitblue.com</p>

III. Case Studies – Energy Efficiency Projects Implemented in Colorado

Colorado businesses have implemented thousands of energy efficiency projects in the past decade. The six projects profiled in this report range in size, scope, and type of industry. The immediate benefits of these projects typically include reduced energy cost, reduced maintenance costs, reduced pollution and greenhouse gas emissions, better lighting quality and a more comfortable indoor environment, which can lead to increased productivity. The long-term benefits include substantial ongoing cost savings and improved public image for the company, as well as a healthier environment and reduced risk of catastrophic global climate change for all.

Typical payback times for investments in energy efficiency projects by businesses range from two to five years. Some very cost-effective projects, such as the Avago Technologies and LSI Corporation projects profiled in this report, paid for themselves in less than one year. Through direct energy cost savings, all of these projects continue to contribute tens or hundreds of thousands of dollars each year to the bottom lines of these companies.

In spite of the wide-ranging benefits and relatively quick payback times, businesses often have a tough time justifying and coming up with the capital to implement energy efficiency projects. There are a number of reasons for this, including lack of information or technical expertise, lack of funding and the fact that saving energy is not viewed as a “core activity” for many businesses. The barriers are even more pervasive in these tough economic times. Consequently, technical and financial support through state, local or utility energy efficiency programs can be critical for persuading businesses to implement an energy efficiency project. The importance of this outside assistance is illustrated in the following case studies.

A. Avago Technologies – Fort Collins, CO

Avago Technologies is a thriving high-tech manufacturing company based in San Jose, California, with a manufacturing facility in Fort Collins, Colorado.

From its beginnings as part of HP in the 1960's, the company has experienced steady growth and has been through several name changes. In 1999 the company operated as Agilent Technologies, a spin-off from HP, and in 2005 became known as Avago Technologies. Today, Avago Technologies specializes in the design and manufacture of optoelectronics, analog interface components and microprocessors used in wireless communications, industrial and automotive electronics, wired infrastructure, and consumer electronics. Avago reported FY08 revenues of \$1.2 billion.

At the Fort Collins facility, Avago designs and manufactures integrated circuit chips for specific applications, and designs and manufactures parts for cell phones and a host of other products. About 650 employees work at this facility, which consists of three buildings with a total of approximately 1 million square feet of floor space.

Steve Wolley is the Workplace Services Manager for the facility. He and his team of engineers are constantly on the lookout for ways to increase the efficiency of their operations, and energy efficiency is always part of that equation. "We have a culture of efficiency here," Wolley notes. "We strive for no waste in everything we do." In each of the last four years, they have implemented a dozen or more distinct energy efficiency projects, which altogether have cut the facility's energy use by roughly 2% per year on average.

An example of a mid-size project that made a significant contribution to Avago's annual energy savings was the 2007 analysis and consolidation of their process vacuum pumps. Each of the three buildings at the Fort Collins facility was built at a different time, with three different kinds of process vacuum pump systems. When Avago engineers analyzed the energy use and capacity of the three systems, they found that they were wasting both energy and maintenance resources by operating with far more vacuum capacity than they actually needed. It turned out that the most robust system (in the most recently constructed building) was capable of serving the entire facility. After running pipe between the buildings so the single vacuum system could serve all three buildings, they successively shut down the other two systems, effectively decommissioning a total of six vacuum pumps.

This one relatively small project was extremely cost-effective. The total cost of consolidating the vacuum pump systems was \$23,000. Avago invested \$15,000, and because of the substantial energy savings, the project received \$8,000 from the Business Efficiency Program, offered jointly by Fort Collins Utilities and Platte River Power Authority. The project resulted in

electricity savings of 460,000 kWh per year, cutting Avago's annual energy bill by \$19,000. In addition to the electricity savings, this project dramatically reduced the facility's water use, saving up to 13,000 gallons per day (4.7 million gallons per year), amounting to an additional \$16,000 annual water cost savings. This resulted in less than one year payback time for Avago.

Other projects that Avago has undertaken in the past year include:

- Turned off and lowered the speed on recirculation air fans, saving 346,000 kWh per year
- Installed a variable frequency drive on a fan, saving 190,000 kWh per year
- Eliminated need for a bubbler in a wastewater treatment settling pond, saving 114,000 kWh per year.

Energy costs account for roughly 6 – 7% of the operational costs of Avago's Fort Collins facility. While cutting that energy use by 2% per year might not make a huge difference to Avago's bottom line, the actual amount of energy saved, and the benefit to the community and the environment, can be quite significant. For example, the seventeen energy saving projects Avago implemented in 2008 together resulted in a total reduction of the facility's electricity use by 894,000 kWh, which is equivalent to the electricity needed to power 160 Colorado homes for a year.

When asked why Avago makes investments in energy efficiency, even though they may not substantially affect the company's bottom line, Steve Wolley cites the company's culture of efficiency and commitment to environmental responsibility. "All of us who work here also live here. We don't want to pollute the place where we live, and we want to be responsible members of the community. We recognize these projects can have a big impact on the community and environment, even if they have a small impact on our budget."

Avago was a founding partner in the City of Fort Collins Climate Wise program, making a pledge in 2000 to work toward continual improvement in reducing its greenhouse gas emissions. Wolley and his team at Avago recognize that this is a long-term commitment, and that continually pursuing modest reductions in energy use each year can add up to big savings and big benefits over the long term.

Avago Technologies <i>Quick Facts:</i>	<i>Contact Information:</i>
<p>Facility size: 1,000,000 ft²</p> <p><u>Vacuum Pump Consolidation Project (2007)</u></p> <p>Date Completed: 2007</p> <p>Total project cost: \$23,000</p> <p>Rebates/Incentives: \$8,000</p> <p>Payback time: 10 months</p> <p>Annual energy savings: 460,000 kWh</p> <p>Annual cost savings: \$19,000</p> <p>Water cost savings: \$16,000</p> <p><u>Combined energy efficiency projects in 2008</u></p> <p>Number of projects: 17</p> <p>Annual energy savings: 894,000 kWh</p> <p>Annual cost savings: 2% of total electricity cost</p> <p>Project management: Avago Technologies Workplace Services</p>	<p>Avago Technologies 4380 Ziegler Rd. Fort Collins, CO 80525 www.avagotech.com</p> <p>Steve Wolley, Workplace Services Manager steve.wolley@avagotech.com 970-288-0317</p>

B. Dawn Food Products – Denver, CO

Dawn Food Products is a wholesale distributor of bakery supplies. The family-run company is based in Jackson, Michigan, with over 40 manufacturing facilities and distribution centers located in the US, Canada, Europe and Latin America. Dawn Food Products has more than doubled net sales over the past 10 years, with revenues of \$1.2 billion a year and 3,500 employees.

Dawn recently implemented a lighting upgrade at its Denver, CO distribution center. The 45,000 square foot facility was built in the mid-1990's and is leased to Dawn Food Products. The warehouse was lit with 400-watt metal halide lights which are on 24 hours a day, five days a week, with more limited hours on weekends. Lighting accounted for approximately 40% of Dawn's energy expense.

With an interest in improving lighting quality as well as saving energy and money, Dawn Food Products contracted with Colorado Lighting, Inc., a woman-owned, family-run business, to retrofit the building with more efficient and effective illumination.²⁰

Colorado Lighting replaced all the metal halide fixtures with T8 fluorescent fixtures, and installed motion-controlled switches. Because the facility is involved with food service and processing, GE *covRGuard* lamps were used throughout. (These more expensive lamps have a polycarbonate coating on the tubes to contain broken glass) The new fixtures were located strategically to provide optimal lighting for Dawn's operations, and they were wired and mounted in such a way that they can be easily moved if another tenant with different lighting needs moves into the facility at a later date.



Energy efficient lamps and electronic ballast.
Photo: www.coloradolighting.com

The lighting retrofit is expected to save 115,000 kWh of electricity annually, as well as greater than 50% load reduction, from 32 KW to 15.3 KW. This translates into annual energy cost savings for the company of approximately \$9,400, which represents a 15-20% reduction in overall energy costs for the facility.

The total project cost was roughly \$26,000. The electric utility, Xcel Energy, provided \$11,200 in rebates under their prescriptive rebate program, which brought the initial cost down dramatically. After the rebate, the project is expected to pay for itself in 19 months, with Dawn benefitting into the future with ongoing energy cost savings of about \$800 per month.

²⁰ <http://www.coloradolighting.com/>

Dawn Food Products <i>Quick Facts:</i>	<i>Contact Information:</i>
Facility size: 150,000 ft ² Date completed: 2008	Dawn Food Products 5301 Peoria St., Unit B Denver, CO www.dawnfoods.com
Total project cost: \$26,000 Rebates/Incentives: \$11,200 Net project cost: \$14,800 Payback time: 19 months Annual energy savings: 115,000 kWh per year Annual cost savings: \$9,400 per year (15 – 20% of total energy costs)	Scot Kelley, Colorado Lighting skelley@coloradolighting.com (303) 288-3152
Project Management: Colorado Lighting, Inc.	

C. IBM Green Data Center – Boulder, CO

IBM opened its green data center in Boulder, Colorado in June 2008. The 115,000 square foot facility is part of IBM’s largest data center campus worldwide, as well as its most efficient.

The green data center is at the forefront of an industry movement toward increasing efficiency in traditionally energy-intensive data centers. According to DOE and EPA, data centers in the U.S. used 61 billion kWh of electricity in 2006, representing 1.5% of all U.S. electricity consumption, and double the amount consumed in 2000. Based on current trends, energy consumed by data centers will continue to grow by 12% per year, doubling again by 2012.²¹



Servers in Green Data Center. Photo: IBM

Through a combination of efficiencies in building design, mechanical systems, and server technology, IBM reportedly cut nearly \$1 million off its \$4 million annual power bill in its first year of operation.

The building itself received LEED Silver certification. Rather than build a new structure, IBM retrofitted an existing office building, reusing 98 percent of the original building's shell, recycling 65 percent of the materials from the original building, and sourcing 25 percent of newly purchased material from recycled products.



Cooling towers. Photo: IBM

A significant proportion of energy used in data centers goes to cooling. The mechanical system of this facility is designed to be 40 percent more efficient than that of a typical data center, equating to a reduction of approximately 6,550 tons of carbon dioxide emissions annually. Its capacity is expandable to meet future technology requirements.²²

When exterior temperature and humidity levels are favorable, roughly 75% of the year, the ventilation system switches to free-cooling

²¹ U.S. Department of Energy and U.S. Environmental Protection Agency, “Fact Sheet on National Data Center Energy Information Program,” March 19, 2008, http://www1.eere.energy.gov/industry/datacenters/pdfs/national_data_center_fact_sheet_abbrev.pdf.

²² IBM, “IBM Opens Its Greenest Data Center in North America,” Press release, June 17, 2008, <http://www-03.ibm.com/press/us/en/pressrelease/24397.wss>.

mode, utilizing a water-side economizer to dramatically reduce energy consumption. Variable-speed pumps and motors were installed in the air conditioning systems to balance the cooling capacities to the actual load, further reducing energy usage and costs.

The facility is partially powered by alternative energy sources, including more than one million kilowatt hours per year of wind-generated electricity purchased from the local utility. This equates to a reduction of approximately one thousand tons of carbon dioxide produced per year. The center also uses low-sulfur fuels to reduce emissions from backup generators.

In addition to the mechanical systems, IBM optimized its server technology for energy efficiency. The use of virtualization technology, for example, allows significant consolidation of servers, which in turn cuts direct energy consumption, saves floor space, and reduces the cooling load.

While complete cost-benefit performance data for this facility was not provided, IBM estimates that available efficiency measures can cut energy consumption 15% – 40% in most data centers, while achieving payback on investment in as little as two years.

IBM invested \$86 million in the facility, part of an. The company received a \$632,000 incentive from the Colorado Office of Economic Development and International Trade, a \$100,000 incentive from the City of Boulder, and additional rebates from local utility Xcel Energy.²³ The Boulder facility is part of IBM’s Project Big Green, a program in which the company has committed to invest \$1 billion per year to help customers increase the energy efficiency of their data centers.

Hosting one of the most energy-efficient data centers in the world is a stellar achievement for Colorado’s New Energy Economy.

IBM Green Data Center <i>Quick Facts:</i>	<i>Contact Information:</i>
<p>Date Completed: June 2008 Size: 115,000 ft² Rating: LEED Silver Total project investment: \$86 million Rebates and incentives: \$732,000 Estimated Energy Savings: Saved approximately \$1 million (25%) in electricity costs in the first year. 40% more efficient than a standard data center.</p>	<p>IBM –Boulder Campus 6300 Diagonal Highway Boulder, CO 80301</p>

²³ IBM, “IBM to Build \$86 Million Energy Efficient Data Center in Boulder as Part of Project Big Green,” Press release, June 22, 2008, <http://www-03.ibm.com/press/us/en/pressrelease/21763.wss>.

D. LSI Corporation – Fort Collins, CO

LSI Corporation “a leading provider of innovative silicon, systems and software technologies that enable products which seamlessly bring people, information and digital content together.”²⁴ The majority of LSI’s business is developing and providing technology for data storage semiconductors, storage systems and networking. The California-based corporation, which reported revenues of \$2.68 billion in 2008, operates four dozen facilities in fifteen countries around the world. Four of those facilities are located in Colorado – in Boulder, Colorado Springs, Longmont and Fort Collins.

In 2007 LSI joined EPA Climate Leaders and made a commitment to reduce its greenhouse gas (GHG) emissions by 15% by 2012. The first step toward this goal was creating an Energy Conservation Team, composed of facilities managers and others with relevant expertise from around the country, to share information and to establish common goals and processes.

In 2008, LSI implemented an energy efficiency retrofit project at its Fort Collins facility that is already yielding substantial energy and economic savings. The 150,000 square foot facility was originally constructed in two phases in 1978 and 1980. It currently houses 230 employees, whose work predominantly involves technology engineering and reliability testing. Cooling the building and the servers it contains is the most energy-intensive activity.

Bob Barley, who manages LSI facilities in the central US, recognized the potential for significant energy and cost savings by upgrading the building for more efficient operation. He and his team implemented a major energy efficiency retrofit in 2008 that included the following measures:

- Building Automation System (BAS) to optimize central heating, ventilating and air conditioning (HVAC) performance and save energy through automated controls.
- Variable Frequency Drives (VFD) on large motors, fans, and two of the three building chillers.
- More efficient lighting, replacing old T12 fluorescents with electronic ballasts and T-8 lamps, and installing motion-controlled occupancy sensors.

Barley and his staff did their own project planning and management. The City of Fort Collins Climate Wise team provided engineering assistance and other general support. Johnson Controls was contracted for the BAS installation, Carrier did the VFD installation, and a local lighting contractor was hired for the lighting retrofit.

The project has demonstrated even better results than expected. Year-on-year comparisons indicate an annual reduction of about 2 million KWh of electricity and about 110,000 therms of natural gas. In addition to making a significant contribution to the corporation’s overall 15%

²⁴ http://www.lsi.com/about_lsi/index.html

GHG reduction target, this also represents substantial economic benefit for the company. In the first nine months of 2009, LSI saved \$190,000 on its energy bill as a direct result of efficiency measures installed in 2008. Barley conservatively estimates ongoing annual savings of \$200,000, which represents roughly a 25% reduction in overall energy costs, and a 5-7% reduction in total operational costs for the Fort Collins facility.

The total cost for the complete retrofit project was approximately \$250,000. A significant portion of the up-front costs were offset by \$90,000 in incentive payments from the Business Efficiency Program, offered jointly by Fort Collins Utilities and Platte River Power Authority. The payback time for the project was expected to be 24 months. However, with the rebates and the better-than-anticipated energy savings, the actual payback time will be less than one year, with LSI and the environment benefiting from the ongoing annual energy savings for years to come.

Barley notes that LSI has not rested on the results of the 2008 project described here. In fact, the success of this project helped him garner support and additional funding for continued energy efficiency projects. In 2009 they installed a VFD on the third building chiller. Plans for the near future include installing a smaller, demand-sized compressor and evaluating the potential for more efficient exterior lighting at the Fort Collins facility, as well as initiating new energy efficiency projects at other locations.

LSI Corporation Quick Facts:		Contact Information:
Facility size:	150,000 ft ²	LSI Corporation 2001 Danfield Court Fort Collins, Colorado 80525 www.lsi.com Bob Barley Central USA Property Manager Bob.barley@lsi.com 970.206.5430
Date completed:	December 2008	
Total project cost:	\$250,000	
Rebates/incentives:	\$90,000	
Net project cost:	\$160,000	
Payback time:	less than one year	
Annual energy savings:	2 million kWh electricity 110,000 therms natural gas	
Annual cost savings:	\$200,000 per year (25% total energy cost; 5 – 7% of total operational costs)	
Project Management:	LSI Corporation’s Workplace Solutions	
Primary Contractors:	Johnson Controls and Carrier Corporation	

E. Mesa County Valley School District 51 – Grand Junction, CO

While technically part of the public sector, school districts are in the business of educating youth and are a significant part of our state's economy. School buildings, many of which are older and inefficient, offer significant opportunities for saving energy and taxpayer dollars through energy efficiency retrofits. Through innovative financing mechanisms such as energy performance contracting, schools can pay for the upgrades out of existing facilities budgets with no added cost to the schools. Much of the work of upgrading schools is completed by local contractors, further stimulating the state's economy.

Mesa County Valley School District 51 (MCVSD) in Colorado serves over 22,000 students in the Grand Valley, including the city of Grand Junction and surrounding communities. Funded primarily by state and local taxpayer dollars, MCVSD employs 2,980 people and operates 122 buildings on 43 school campuses.

In 2007, MCVSD entered into a program of energy management that looks at all aspects of building energy usage and facility management. The school district partnered with the U.S. EPA ENERGY STAR Program, and made a fundamental commitment to protect the environment through continuous improvement of their facilities' energy performance. MCVSD Resource Conservation Manager Eric Anderson saw plenty of opportunity for energy savings, and began lobbying the school district to make some badly needed improvements.

The most immediate maintenance need was replacing old and inefficient boilers in one school. At that time, Mesa County had been experiencing a recession for a few years. The school district had no capital reserves, and school facilities managers got by year after year on older, inefficient equipment. Many of the buildings had been built in the 1980's, with inefficient lighting and no exterior windows in the classrooms. Although the lighting in a few buildings had been upgraded in recent years, most still had old and inefficient fixtures and poor light quality.

After a bond measure to fund the school facility upgrades failed in 2008, MCVSD looked into performance contracting, which was attractive because the funding comes out of the facilities operating budget over a period of many years, reducing or eliminating the need for upfront capital. They consulted with the Governor's Energy Office, and chose Trane, a large international energy service company (ESCO) with which the school district already had a working relationship, as primary contractor. Trane brought in Denver-based Financial Energy Management (FEM) to handle the lighting retrofit.

The lighting opportunity turned out to be much bigger than originally guessed. The lighting retrofit involved 79 buildings, with a total of about 2.8 million square feet, and accounted for about two thirds of the total project cost. Improvements were made even to buildings that had

seen lighting equipment upgrades as recently as four or five years ago. For example, many buildings had recently replaced old T-12 fluorescent tubes with more efficient T-8's, and had replaced metal halide lighting with fluorescents. In the past five years, however, further upgrades such as installing optical controls and electronic ballasts have become more cost-effective, increasing energy savings even more.

In addition to installing more energy-efficient lamps and fixtures to save energy and money, FEM optimized the light levels for the kind of activity typical in each area, and used lamps with a higher quality light spectrum. The benefits of this lighting optimization include reduced eyestrain, improved reading and concentration, increased staff productivity, and in general a more pleasant environment for students, teachers and staff to learn and work. In some cases lighting optimization can result in slightly higher energy use, but these indoor environmental quality benefits are deemed to outweigh the energy costs.

The project was started in 2009, and is expected to be completed in February 2010. Installers have been working nights, weekends and holidays so as not to disrupt students and teachers. In order to ensure that the project and the ongoing changes are understood at all levels, FEM held a series of "lighting kickoff meetings" involving a walk-through and information exchange with the principal, custodian and secretary (and sometimes others) at each school. The meetings helped these key staff members understand what was being done in each school and why; what impact it would have on students and staff; why it was a good deal economically and environmentally; and encouraged them to talk about it openly with their faculty, staff and students.

Actual savings data will not be available until the year after completion, but the projections based on modeling are quite promising. The mechanical part of the project, which involved an HVAC upgrade at a single high school, is expected to cut the natural gas bill for that school by 50 percent. The lighting retrofit is expected to reduce demand by 1.29 MW and result in 3.2 million KWh per year electricity savings across the district. MCVSD is monitoring energy use as the project goes on, and is making its utility bills available for teachers and students to conduct research projects.

The total project cost is approximately \$4 million for lighting and mechanical combined (\$2.6 million for lighting, and \$1.4 million for HVAC), and is projected to save a total of \$308,000 per year in energy and maintenance costs. With utility rebates, the payback time will be approximately 10 years for the mechanical and lighting retrofits combined.

By using performance contracting, however, the school district did not need to provide any up-front financing. The contractors arrange the financing and will be paid from the energy and operational savings. The school district is guaranteed a minimum level of energy savings

(\$283,000 per year in this case) and a positive cash flow through this arrangement. Under this arrangement, the entire retrofit is paid for out of the school district's facilities operations budget, and no capital funds are needed.²⁵

MCVSD opted for the utility's self-directed energy efficiency incentive program, which rewards the school district for total energy saved rather than setting rebate levels according to the installation of prescribed measures. The self-directed incentive process is more involved, but also more lucrative. For this project, utility rebates totaled approximately \$800,000, roughly 20 percent of the total project cost.

As a general practice, and especially on projects such as this one that are paid for by taxpayer dollars, FEM hires local contractors and uses Colorado-based distributors whenever possible. For this project, FEM and Trane together employed about sixteen people to work on this project: one Trane project manager, one FEM project manager, two site managers, and about twelve installers. Everyone working on the project lived in Colorado, and all materials were purchased from local distributors in the Grand Junction area. As FEM Project Manager Matt Kottenstette remarked, "There is plenty of talent in Colorado, and in this case the local distributors had even better prices than the bigger out-of-state distributors."

Indeed, this large-scale institutional energy efficiency project creates a win/win/win scenario for everyone involved. Students, teachers and staff get a better working and learning environment; Colorado contractors, distributors and installers get lucrative business. The school district and Mesa County taxpayers save money without having to invest scarce financial resources in energy efficiency. The utilities make progress toward their mandated energy efficiency targets, and the Colorado environment benefits in a myriad of ways from reduced energy use, pollution and greenhouse gas emissions.



One of 79 MCVSD buildings receiving energy-efficient lighting upgrades.

²⁵More information about performance contracting for schools is available from the Colorado Governor's Energy Office website, <http://www.colorado.gov/energy/index.php?/commercial/performance-contracting>.

Mesa County Valley School District <i>Quick Facts:</i>	<i>Contact info:</i>
<p>Energy performance contract, lighting and mechanical retrofit</p> <ul style="list-style-type: none"> ➤ Trane (Project management and HVAC upgrade) ➤ Financial Energy Management, Inc. (Lighting retrofit) <p>79 buildings, total 2.8 million square feet</p> <ul style="list-style-type: none"> ➤ Initial cost (total): \$4 million <ul style="list-style-type: none"> HVAC retrofit: \$2.6 million Lighting retrofit: \$1.4 million ➤ Utility rebates: \$800,000 ➤ Guaranteed energy cost savings: \$283,000 / year ➤ Estimated maintenance savings: \$25,000 / year ➤ Estimated electricity savings: 3.16 million kWh / year ➤ Estimated demand reduction: 1.29 MW 	<p>Mesa County Valley School District 51 2115 Grand Ave. Grand Junction, CO 81501 (970) 254-5100 www.d51schools.org</p> <p>Eric Anderson Resource Conservation Manager eanderso@mesa.k12.co.us</p> <p>Matt Kottenstette FEM Project Manager mkottenstette@financialenergy.com</p>

F. Woodward Governor Company – Fort Collins, CO

Woodward Governor is an independent designer, manufacturer, and service provider of energy control and optimization solutions used in the aerospace, power generation and distribution, and transportation markets. Based in Fort Collins, Colorado, Woodward has numerous manufacturing, distribution and service facilities worldwide. The company reported \$1.4 billion in sales during their 2009 fiscal year.

At their facilities in Fort Collins and Loveland, Colorado, about 1040 employees design, engineer and manufacture electronic and mechanical controls used in engine, turbine, and electrical power systems. The 234,000 square foot Fort Collins facility was built in the 1960s and 1970s, when energy prices were very low and energy efficiency was largely ignored. The Loveland facility was built in 1992.

Woodward's recent energy efficiency projects originated as a quest for maintenance efficiency in 2005. In an effort to streamline maintenance activities and reduce costs, Woodward implemented automated controls on some older equipment at the Fort Collins and Loveland facilities. The automated controls generated more thorough information on infrastructure and air handling units, and allowed staff to do preventive and proactive maintenance more effectively.

In addition to monitoring more accurately how the equipment runs, Woodward staff can now measure the efficiency of their equipment and optimize its performance. Consequently, Facilities Manager Jerry Becker decided to use similar technology to start measuring the energy efficiency of their buildings. "Among other things, that investigation led to the painful realization that almost half our electric bill for the year was for only 12 hours of use during peak demand and peak pricing periods," said Becker. He and his HVAC staff went looking for solutions.

The key to bringing down their electricity bills was to dramatically reduce peak demand and to predict and avoid steep peak demand prices. Woodward essentially implemented the equivalent of "smart grid" technology in their buildings, which enabled them to continuously monitor and adapt their energy use as needed. This also allowed them to track the utility peak demand, making it possible to quickly roll back their load from the grid during peak pricing periods.

While much of the work was completed by a contractor (Gecko Services), Woodward also sought the assistance of both the City of Fort Collins Climate Wise program, and the Colorado State University Industrial Assessment Center. Staff from each program brought fresh perspectives, which helped Woodward identify additional cost-effective efficiency and load management measures.

Other key measures implemented at the two facilities included:

- Reduced boiler temperatures and installed a solar water heating system, which allowed for further reductions in boiler operation
- Retrofitted energy-efficient lighting at both facilities
- Installed a high-efficiency variable speed compressor
- Reduced usage of 60 rooftop air conditioning units on weekends, holidays and at night when the buildings are unoccupied to realize substantial additional energy savings. Cutting back operation of the rooftop units during the peak demand periods is also an important load management response that helped Woodward avoid the highest utility rates during those periods.

In 2008 and 2009, Woodward invested a total of \$250,000 to upgrade both sites with automated building controls, lighting retrofits, and new compressors. To date, the company has received approximately \$120,000 in rebates from Fort Collins Utilities, Loveland Water and Power and Platte River Power Authority for multiple projects at both locations. This investment has already resulted in Woodward reducing the annual electricity consumption at the two facilities by roughly 9%, saving about 2 million kWh of electricity each year.

Becker expects the company will spend a total of \$450,000 over five years on energy efficiency and load management measures, including those already implemented. By the time the projects are completed in 2015, Becker estimates that Woodward will realize annual savings of approximately \$400,000 on gas and electricity usage costs as well as avoided peak demand charges at the two facilities.

Within the company, Becker has been crusading to change the way the economic benefits of energy efficiency are perceived and accounted. Facility maintenance organizations within large corporations are typically considered an operating expense or liability, and are generally not regarded as profit-making centers. Reducing maintenance and operations costs is always encouraged, but not recognized or rewarded in the same way as other profit-making operations.

When he talks about energy efficiency, though, Becker reframes facility energy cost savings as contributing to the overall profitability of the corporation. Thus, through energy efficiency measures, the Woodward Fort Collins and Loveland facilities together can be seen as generating approximately \$400,000 in additional profit for the company each year, along with the many tangible benefits resulting from better control of the working environment. In addition to benefiting the company, these projects are helping the municipal utilities in Fort Collins and Loveland meet their energy efficiency and peak demand reduction goals.²⁶

²⁶ City of Fort Collins Utilities, "2009 Energy Policy," January 6, 2009. Available at http://swenergy.org/news/news/documents/file/2009-01-Fort_Collins_Energy_Policy.pdf.

According to Becker, this reframing has been well-received by Woodward executives, and the company is now planning to replicate what is being done in Colorado at other Woodward facilities.

Woodward Governor Company <i>Quick Facts:</i>	<i>Contact Information:</i>
➤ Fort Collins facility size: 234,000 ft ²	Woodward Governor Company Corporate Headquarters P.O. Box 1519 1000 East Drake Road Fort Collins, CO 80525 Jerry Becker, Facilities Manager Jerry.Becker@woodward.com (970) 498-3938
➤ Loveland facility size: 189,000 ft ²	
➤ Initial investment (as of October 2009): \$250,000	
➤ Utility rebates (as of October 2009): \$120,000	
➤ Annual electricity savings (as of October 2009): 2 million kWh	
➤ Projected total project cost : \$450,000	
➤ Projected total annual energy cost savings: \$400,000	

IV. Conclusion

Energy efficiency is our quickest, cheapest, and cleanest energy resource. The return on investment on energy efficiency projects is normally greater than 20% per year, and in some cases is as much as 50% or 100% per year. As Energy Secretary Steven Chu has noted, “[Energy efficiency] is not just low-hanging fruit; it is fruit lying on the ground.”²⁷

Energy efficiency contributes to the Colorado’s New Energy Economy by helping people and businesses:

- reduce energy use;
- save money that would have gone to energy costs and will instead be available for other uses; and
- cut greenhouse gas emissions, so the state can attain the greenhouse gas reduction goals outlined in the Colorado Climate Action Plan.

Colorado consumers and business adopting energy efficiency are realizing substantial direct economic benefit, with potential for much greater savings. Energy efficiency generates indirect economic benefits as well. Colorado businesses that are manufacturing, selling, installing and supporting energy efficiency measures are growing, thriving and expanding their workforce at a time when unemployment in Colorado and throughout the nation is rising. This in turn provides families with income that gets spent at local supermarkets, shopping centers, recreational facilities, and on other goods and services.

The companies profiled in this report, and hundreds of others like them, are contributing to the growing New Energy Economy. Their products and services are helping consumers cut energy use and energy costs, reduce the need for costly and controversial new power plants and transmission lines, and cut greenhouse gas emissions. And the businesses that are adopting energy efficiency measures, often with the help of state, local, and utility energy efficiency programs, are benefitting their own bottom line at a time when the profits and viability of many companies are being challenged. In short, energy efficiency is a very real and important part of Colorado’s New Energy Economy.

²⁷Steven Chu, *Energy Secretary Steven Chu’s address at Harvard’s Afternoon Exercises*, Harvard Gazette, June 4, 2009, <http://news.harvard.edu/gazette/story/2009/06/u-s-energy-secretary-steven-chus-address-at-harvards-afternoon-exercises/>.