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Energy

Energy-Efficiency Financing Strategies in an Evolving Utility Environment: Case Studies

• Rebuild America Guide Series •

Energy-Efficiency Financing Strategies in an Evolving Utility Environment: for Case Studies

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Rebuild America

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The Purpose of this Report

This report presents a series of case studies designed to provide prospective energy project developers and managers insights and lessons learned regarding the task of securing financing in a dynamic energy marketplace.

This compilation of 20 energy case studies is intended as a companion piece to two other publications that have been written to address the subject of financing energy-efficiency projects. The first of these publications is entitled *Financing Energy Efficiency in Buildings* (1998), a report that was recently published as one in a series of technical and business manuals designed to meet the real-life needs of Rebuild America Community Partnerships.

Financing Energy Efficiency in Buildings provides definitions, descriptions, and advice for implementing successful financial strategies. It describes the complete spectrum of energy-efficiency options, including energy-saving performance contracts and state and utility incentives for financing energy-efficiency projects. Additional documents available through Rebuild America include *Energy Performance Contracting Case Studies* and *The Energy Efficiency Project Manual: The Customer's Handbook to Energy Efficiency Retrofits*. These latter two publications address the broad range of services that Energy Service Companies (ESCOs) provide to their customers, how ESCO performance contracts work, and the reasons that building owners and managers choose to use ESCOs to acquire increased energy efficiency and building upgrades. The 20 case studies in the ESCO case study publication cover the following sectors: schools, hospitals, factories, hotels, stores, universities, a wastewater treatment facility, and other types of facilities.

Similarly, this companion piece covers a variety of sectors: schools, fast-food operations, energy production facilities, apartment houses, golf courses, public housing programs, food stores, and universities. Unlike the earlier volume, however, this companion piece focuses on non-ESCO financing strategies. The 20 case studies include state loan and tax credit programs, self-financing methods, utility incentive programs, foundation grants, and ~~the~~ corporate sponsorship as primary financing mechanisms. Taken as a package, these cases blend long-standing incentive programs with leasing and other methods for financing energy projects.

What is Rebuild America

The U.S. Department of Energy's Rebuild America Program is a network of community partnerships-made up of local governments, schools, universities, housing agencies and private businesses-that save money by saving energy. These voluntary partnerships, working with support provided through the Department, choose the best ways to plan and implement energy efficiency projects in the commercial, institutional, and multifamily residential buildings controlled by their partners.

Partnerships have access to products, services and peer experiences on buildings, energy, finance and more. With support provided nationally and led by regional teams, a program

representative is assigned to each partnership to help in identifying local resources, financing options, and accessing special services from Rebuild America to aid in completing retrofits.

By the year 2003, 250 Rebuild America partnerships will be involved in over 2 billion square feet of building renovations, which will:

- save $650 million every year in energy costs
- generate $3 billion in private community investment
- create over 26,000 new jobs
- reduce air pollution by 1.6 million tons of carbon dioxide a year.

Rebuild America Financial Services

Rebuild America Financial Services, formerly DOE's "Energy Fitness" Program, is designed to aid local partnerships in developing, financing and implementing energy efficiency projects. It expands the earlier "Energy Fitness" Program from a focus on performance contracting to a broader scope that encompasses the full spectrum of financing options (internal capital or operating funds, debt instruments, lease or lease-purchase arrangements) for projects implemented with conventional or performance contracting.

It guides the choice of options best suited for a particular customer, and shows how government or utility incentives can improve the attractiveness of a financing package. Finally, it retains its earlier emphasis on the wise use of energy performance contracting as an implementation strategy that can be carried out with capital provided by one or a combination of the primary financing options mentioned (in parenthesis) above.

In addition to its guidance on the selection of financing options, Rebuild America Financial Services is also involved in activities that broaden the financing options in the various states, that strengthen market support for energy investments, and that aid access to capital. These activities include assisting states and provider partners in the development of model legislation necessary for state and local institutions to effectively use the performance contracting option, working with the National Association of Energy Service Companies for accreditation of ESCOs, and monitoring the impacts of utility restructuring on investment options. Rebuild America Financial Services aids access to capital by pointing partnerships toward programs offered by states, associations or private financing organizations that may be able to provide investment capital at the lowest possible rates.

Working with providers of financial services, customers of these services, and professional organizations Rebuild America Financial Services is designed to aid community partnerships in implementing successful financial strategies, understanding what financing alternatives are available, why a particular financing option should be selected, and how to derive maximum benefits from financing choices.

Products, Services, and Availability

Products and services consist of a range of written documents, workshops, and customized technical assistance. The core guide is "Financing Energy Efficiency in Buildings", a basic guide that provides definitions, descriptions, and advice for implementing successful financial strategies. The Guide is supplemented by items such as:

- case studies
- sample RFPs, RFQs, contract summaries
- materials describing the project development process and the relationship of financing to that process, and
- workshop materials

Workshops are designed in modules that cover basic financing alternatives, and more detailed training for each financing option, and for the integration of financing and implementation through conventional and performance contracting. Customized technical assistance is made available on a limited basis to address specific and major issues faced by partnerships.

Support from Rebuild America Financial Services is available primarily to organizations who are members of a Rebuild America community partnership or who are involved in the development or support of such partnerships. More information is available from the Rebuild America website at www.eren.doe.gov/buildings/rebuild/ or by calling your Rebuild America program representative. Direct Web access to Rebuild America Financial Services is available at www.ornl.gov/rafs/.

Rebuild America Financial Services Contacts

Rebuild America Web Site Address: http://www.eren.doe.gov/buildings/rebuild/ (from this address, click on "Products and Services," then on "Rebuild America Financial Services" to get to the Rebuild America Financial Services Web pages).

Or for direct access to the Rebuild America Financial Services Web site:
www.ornl.gov/rafs/

Patrick Hughes, Rebuild America Financial Services Manager, Oak Ridge National Laboratory
Telephone: 423-574-9337 Fax: 423-574-9329 E-mail: pjl@ornl.gov

John Munro, Rebuild America Financial Services Support, Oak Ridge National Laboratory
Telephone: 202-479-0009 Fax: 202-479-0575 E-mail: munrojf@ornl.gov

Richard Zelinski, Rebuild America Financial Services Support, BMS Management Services
Telephone: 703-551-0250 Fax: 703-590-1835 E-mail: richelzel@IBM.NET

Michael Arny, Rebuild America Financial Services Support, Leonardo Academy Inc.
Telephone: 608-255-0988 Fax: 608-255-7202
E-mail: michaelarny@leonardoacademy.org

Julia Kelley, Rebuild America Financial Services Coordinator, Oak Ridge National Laboratory
Telephone: 423-574-1013 Fax: 423-574-9329 E-mail: j4u@ornl.gov

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***John F. Munro*,**
Oak Ridge National Laboratory
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Introduction

Rebuild America is developing community partnerships to facilitate new energy-efficient construction and the renovation of thousands of older buildings across the United States to bring them up to current energy-efficiency standards and beyond. Through these partnerships, new energy-saving methodologies and technologies are deployed by state and local government agencies, public housing authorities, businesses, utilities, energy services companies, technical experts, and schools. The cumulative result of these activities will be an America that is ultimately more energy efficient and economically competitive.

Despite progress, difficulties in accessing financial resources continues to delay the deployment of efficient energy technologies and practices. And for many communities, the funding situation has gotten worse over the past decade, not better. Gone are the halcyon days of the 1980s when generous utility demand-side management (DSM) programs encouraged home and business owners to invest capital in energy efficiency through rebates and other incentives funded by utility ratepayers. As the utilities necessarily refocus on competing in deregulated markets, utility ratepayer–funded financial incentive programs may decline further in significance as we enter a new millennium.

The financial picture for energy efficiency, however, remains optimistic. A dynamic economy and the desire of private lenders and commercial firms to expand their customer base are also creating new financing opportunities. In addition, many of the state energy loan and tax credit programs established in the 1980s remain healthy and fully capitalized. They continue to be able to provide capital for worthy (cost-effective) energy-efficiency projects. Creativity and knowledge are the twin requirements for successfully putting together new energy-efficiency projects in an increasingly dynamic energy marketplace.

The following provides a synopsis of the various financing methods covered in this report, which, for the most part, remain available to most individuals and organizations interested in financing energy efficiency and building upgrade projects.

State Energy Loans

A number of states, including Nebraska, California, and Oregon, have low- or no-interest energy loan programs. Each of these programs has eligibility criteria, but they are generally more accessible than conventional financing to smaller project developers that lack significant collateral or a long financial history. For example, the Small Scale Energy Loan Program in Oregon provides low-interest loans for conservation and renewable resource projects for most households, businesses, schools, and governments.Schools and governments have been the major users of the loan program. To date, more than 480 loans for $272 million have funded conservation and renewable resource projects. California also has a very active state energy loan program operated by the State Assistance Fund for Enterprise, Business, and Industrial Development

Corporation. Five-percent interest loans with up to 5 years to pay and for as much as $200,000 are offered to small businesses and nonprofit associations. As of November 1998, the program had approved 334 loan applications out of a total of 452 submitted. The rate of loan approval is about 74%.

State Energy Tax Credits

Oregon has been a leader in the creation of business and energy tax credits. The Business tax credit is 35% of eligible project costs taken over 5 years. Up to $40 million in energy projects may be awarded tax credits each year. For homeowners and landlords, Oregon offers tax credits for installation of solar and geothermal space heating, water heating, or pool heating systems. The amount of the tax credit is based upon how much energy the system saves: 60 cents per kilowatt-hour for space and water heating systems and 15 cents per kilowatt-hour for pool heating systems, or up to $1500 per system. In 1997, the program was expanded to include the purchase of energy-efficient clothes washers, refrigerators, dishwashers, and water heaters.

Utility Incentive Programs

Utilities have offered a range of incentives and rebates for installation of energy savings equipment. Generally, the higher the energy efficiency rating, the greater the rebate energy credit. Utilities have also been very active in financing energy-efficiency demonstration projects, as exemplified by PG&E's *Daylighting Initiative,* which has sponsored various daylighting projects in facilities ranging from schools to retail stores. Although there has been a notable contraction in utility incentive programs in recent years, a number of utilities are discovering that rebates and other incentive programs are an integral part of a good business strategy even in a more competitive environment. Consequently, new programs are now on the horizon.

Corporate Sponsorship

Many energy-efficiency retrofits or new construction projects involve activities that can provide publicity for manufacturers of equipment or owners of facilities. The publicity associated with a particular project presents a definite marketing and public relations opportunity for these organizations. Consequently, in certain cases it may be possible for the project developer to secure either direct funding or equipment donations from manufacturers for high-visibility projects, with corporate building owners willing to sponsor remaining cost premiums to demonstrate good citizenship.

Grants

Federal and state government agencies, such as the U.S. Department of Housing and Urban Development, the U.S. Department of Agriculture, the Federal Home Loan Bank, the Department of Energy, and the Environmental Protection Agency, make financing available for various types of energy and non-energy projects. These grants are available to both public- and private-sector organizations. Notably, even grants that are not

designed specifically for energy-efficiency projects can help to finance energy-efficiency initiatives. For example, a grant to reduce crime through better lighting may also help to fund the implementation of energy-efficient lighting systems.

Bonds

If a particular project is large and can justify the added expense of entry into the bond market, bonds for energy-efficiency projects can be issued and marketed. However, project developers must first evaluate whether the issuance of bonds for an energy project will limit the use of a particular bonding authority for other types of even higher-priority projects. School districts, for example, may be advised to secure a direct energy loan from a state program rather than using their finite bonding resources to pursue energy retrofits. Other times, it may be possible to design energy-efficiency features into a project such that there is no net increase in the cost of the project. Consequently, the bonding authority of a particular school district to build new schools, for example, will not be degraded by paying additional money for energy-efficiency building features.

Leasing

Leasing of equipment is another way to implement energy-efficiency projects and programs. In certain cases, leasing from a private company or bank may allow a public entity to access the benefits of an energy program that is restricted to the private sector. For example, a city may have a firm purchase energy-efficient technologies and then have the equipment leased back to the city at a favorable interest rate. In turn, the private company is able to take financial advantage of business tax credits offered by the state.

Foundations

Public and private foundations are also an important source of capital for efficiency projects that will benefit lower-income groups. Many communities have local foundations that have been established specifically to help low-income citizens finance home ownership. Because energy-efficient houses have lower utility bills, it may be possible in certain situations to design programs to rehabilitate older houses in accordance with more stringent energy efficiency standards. Greater energy efficiency translates into reduced utility bills, thereby increasing the amount of money a prospective low-income buyer can allocate to paying the mortgage. The consequence is that energy efficiency objectives are achieved while the pool of qualified home buyers is expanded.

Financing Matrix by Sector

The following summary matrix correlates the sector cases in this report with the financial options discussed in the case studies.

Case study sector	Number of cases	Internal Financing	Bank loans	Utility rebates	Corporate sponsorship	State energy Loans	State tax incentives	Bonds	Leasing	Other federal grants	Foundation grants
Schools and school districts	3	■		■		■		■			
Universities	2			■		■					
Service organizations	1	■	■	■							
Retail establishments	3	■	■	■		■	■				
Public recreational facilities	1		■	■	■			■			
Private recreational Facilities	1	■		■				■	■		
Local government	1	■		■				■	■		
Public energy production facilities	1			■		■	■		■		
Commercial real estate renovations	2			■		■	■				
Apartment owners	1			■		■	■				
Public housing	2			■						■	■
Fast-food restaurants	1	■		■							
Large industrial manufacturers	1	■		■							

This matrix reveals several features of the current financial marketplace for energy efficiency. First, it is apparent that utility financing and incentive programs continue to play a role in supporting projects across the sectors. In this regard, every sector case study involves to some degree the deployment of utility incentives. Second, the matrix reflects the reality that each of the sector case studies has deployed multiple financing strategies.

This observation suggests that the successful project developer will be the one that bundles various capital sources into one project-financing package. Financial diversification ensures that projects are not solely dependent on one financial source. Third and finally, the matrix suggests that it is not only small retail businesses that are turning to banks to finance energy-efficiency projects. Indeed, public-sector entities are securing private bank loans at favorable or even *negative* interest rates to finance construction of energy-efficient projects.

The case studies in this report are organized into the following thematic categories that reflect the primary financing mechanism employed:

- Using Corporate Sponsorship to Augment Public Financing
- Rediscovering State Energy Loan and Tax Credit Programs
- Achieving Energy Efficiency Goals through Non-Energy-Efficiency Federal Grants and Private Foundation Funding
- Prioritizing Public Investments in Energy Efficiency Projects Using Return-on-Investment Criteria
- Direct Borrowing or Self-Financing to Fund Energy Efficiency Upgrades

- Creative Leasing to Leverage Public Resources
- Issuing Bonds to Finance Energy-Efficient Schools
- Leveraging Utility-Based Incentives and Rebates

The case studies are presented in accordance with the following format:

- *Summary Data Table*: This table provides contract information as well as information on the size of the project, the financing mechanism used, projected or actual energy savings, etc.
- *Background*: This section provides general information on the type of facility and the nature of the project.
- *Energy Saving Technologies*: This section describes in summary fashion the nature of the energy-efficiency technology deployed.
- *Financing Methods:* This section details both the financing methods employed as well as the steps taken to secure the financing.
- *Project Outcomes:* This section identifies the amount of financing secured as well as the results of the energy-efficiency project.
- *Lessons Learned:* This section isolates the critical lessons that may be useful for others seeking financing from a similar funding source.

Following the case studies, a summary matrix is provided that reiterates some of the more important lessons learned.

➢ *Using Corporate Sponsorship to Augment Public Financing*

In the past, public and private interests seeking funding to develop energy-efficiency projects have turned almost singularly to utility rebate programs or state energy loan programs to finance projects. Recently, however, it is clear that corporations are often willing to finance elements of a new demonstration project that promises to increase product exposure and public interest.

In the case of the Rosewood Golf Course Project discussed below, golf equipment manufacturers are competing for the opportunity to provide funding. They view an energy-efficient golf course as a good opportunity to showcase their products with the national and international media. Although corporate sponsorship is not always possible, for those proposed projects that are truly breaking new ground, it may be possible to use corporations to augment funding from traditional sources.

Case 1: A Public-Private Partnership to Build the First "Totally Green/Energy-Efficient " Golf Course in Reno, Nevada[1]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Mr. Mike Mazzaferri City of Reno (775) 857-2895	Recreational/Golf Course	$1million or more.	Rebuild Nevada Rebuild Reno
Financing Mechanism	**Square Footage**	**Energy/Cost Savings (Projected or Actual)**	**Technology**
• Bonds • Corporate sponsors • Bank loan • Utility contributions	Energy-Efficient Clubhouse alone will be about 12,000 ft^2	Early assessments suggest that the city can save $1.2 million in operating costs over 20 years.	Technologies include: energy (peak load) management systems, ground-source heat pumps, net metering, photovoltaics, and environmental system controls.

Background

The city of Reno, Nevada, is moving forward with plans to construct the first "Totally Green" golf course. Recently, Reno city officials approved the design and development of the world's "most truly green/energy-efficient golf course." The city is now entering into an a long-term leasing arrangement with the University of Nevada to build an 18-hole golf course on 150 acres adjacent to the city's Rosewood Lakes Golf Course. Rosewood Lake's existing 18-hole course will be expanded to 36 holes. The expanded course includes three practice/teaching holes along with a new solar-lighted driving range, an energy-efficient clubhouse (10,000 to 12,000 ft^2), and an energy-efficient 140-cart barn/maintenance facility.

The city views creating an energy-efficient golf course as a way to reduce the debt load on the property and to generate funds that can be used to fund recreation programs for youth such as the "First Tee"[2] program. This program provides golf education and recreation for disadvantaged youth. This golf course is expected to provide the template for energy-efficient golf courses across the United States and internationally.

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[1] Technical and engineering information included in this case study was provided by Mr. Mike Mazzaferri, Rosewood Lakes Golf Course operations manager, city of Reno, Nevada, and Ms. Jan McAdams, lead project consultant. We would also like to thank Mr. Paul E. Normandie, energy management engineer, Nevada Rebuild America project manager, for his technical knowledge and strategic insights regarding the financing of energy-efficiency initiatives within the state of Nevada. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study do not necessarily reflect the views of the city of Reno, Ms. Jan McAdams, or the state of Nevada. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

[2] The "First Tee" is a national initiative sponsored by the leading golf organizations to promote the creation of facilities and programs to make golf more affordable and accessible to kids of all races and economic backgrounds. Rosewood was chosen along with 22 other golf courses throughout the nation to launch this program.

The project team includes a Nevada-based architectural firm, Design Concepts West, a PGA Hall of Fame golfer, the local utility provider, city of Reno recreation officials, a program-development consultant, and variety of corporate participants.
This case study is significant for several reasons: (1) it illustrates how corporate sponsorship can be used to finance innovative energy-efficiency projects, (2) it demonstrates how the private and public sectors can successfully partner to promote energy efficiency, and (3) it shows how energy-efficiency savings can support a variety of public programs.

Energy-Saving Technologies

The city is considering a range of innovative technologies for the new golf course, including the use of energy (peak load) management systems, ground-source heat pumps, net metering, photovoltaics, and environmental system controls. The city is also looking at ways to centralize maintenance and golfing support functions in one building and using daylighting measures to reduce energy costs.

While solar collection devices have been used in the United States and worldwide to produce energy for public and national parks, Rosewood Lakes is considered to be the first golf course that would incorporate solar power for all energy production needs, including water pumping and electric cart charging. The project will be "grid-integrated," because 90% of the solar and wind energy systems are connected to the local utility provider's system.

In addition to solar-collecting roof tiles, wall systems, and photovoltaic-supported outdoor and driving range lighting fixtures, the project's engineers and architects hope to install a "solar farm" as an opportunity to participate in Nevada's net metering program. This participation will create energy "credit/return on investment" for the city of Reno's Parks and Recreation Department.

Energy Savings

The city of Reno, with the help of the local utility, will conduct a comprehensive evaluation of potential energy savings from various energy-efficiency technologies. The city has already determined that it can pay back a $7 million investment in property and buildings. This includes a $2.5 million investment in new buildings, including energy-efficiency measures. Early assessments suggest that the city can save $1.2 million in operating costs over 20 years by integrating energy-efficient building designs and technology into the golf course.

Financing Methods: Institutional Loan Backed by City Bonds and Private Sponsorship Support

The steps for obtaining financing are follows:

- The city conducted an analysis of what level of debt it could support over a 30-year period based upon projected daily and annual rounds of golf.

- Representatives from the city of Reno visited the National Renewable Energy Laboratory (NREL) to develop a good understanding of alternative energy-efficiency technologies.

- The city of Reno has decided to issue $600,000 in bonds at 4–4.5% interest rate over 30 years to pay for the lease. The city is paying about $4000 an acre for the long-term lease.

- The city has also identified a regional bank that is willing to allocate its Community Reinvestment Funds for a low-interest construction loan. The bank is particularly interested in loaning the city money for the golf course because it will be good public relations, and also the city's loan will be backed by the city's good credit and ability to issue general obligation bonds. The city hopes to get a loan with a 0–2% interest rate.

- The city has also hired a consultant to facilitate partnerships/sponsorships with golf cart and equipment companies. The fact that the facility will be the most energy-efficient golf course in the world is a very attractive public relations "hook" for companies that supply equipment for golf courses. Already several companies are interested in helping finance the construction of the centralized, energy-efficient maintenance building.

Project Outcomes

While the project is still in the planning and formation stage, the proposed energy-efficient project is already gaining national and international attention. This attention is now being translated into significant corporate sponsorships and investments. In the next two months, the local utility (Sierra Pacific) will be brought in as a partner in the energy development project. Turf equipment and golf cart manufacturers are also being interviewed for involvement in the design and construction of the cart storage and maintenance buildings. These plans and agreements are to be presented to the City Council for approval sometime in late February or early March.

The actual cash savings realized are intended to support Rosewood's many community programs, including its innovative youth golf activities ("First Tee").

Lessons Learned

- Corporate sponsorship and involvement is a viable option for energy-efficiency projects that involve first-of-a-kind projects that can generate significant media attention and visibility.

- Regional banks and utility companies attempting to develop or shore up local market positions are potential sources of low-interest loans and other types of investments.

- The ability to develop public-private partnerships for energy-efficiency demonstration projects depends on a combination of the following factors being present:

  – Federally required investments in communities
  – Strong local and national economy and low interest rates
  – Perception that the project will enhance market position
  – Entrepreneurial public employees and supportive local political leaders
  – Financially sound city government with the capacity to issue low-interest bonds
  – Active Rebuild America Coalition at the local and state levels of government

- The Rosewood "totally green/energy-efficient" golf course should serve to educate other municipalities and the nation's 20,000 public and private golf course managers about cost-saving, energy-efficient technologies.

➢ *Rediscovering State Energy Loan and Tax Credit Programs*

Despite the curtailment of many utility rebate programs, state energy loan and tax credit programs remain alive and healthy in a number of states, including California, Nebraska, and Oregon. For the project developer, these programs should be considered before turning to private sources of funding. Often they still offer interest rates and terms that are more favorable than bank loans. In addition, the collateral requirements to secure a loan are often less stringent than those specified by banks. Because the interest rates for conventional loans remain low, many state energy loan programs are currently underused and have funding available for new projects.

For public projects, the use of state loan programs allows local jurisdictions to avoid diluting their bonding authority by using bonds to finance energy efficiency. In the case of private real estate development firms, energy loans can be used to augment and enhance funding arranged through private sources. The net result of *bundling* private and public loan sources is sufficient capital to finance upgraded energy renovations. Typically, the end result is the construction of a facility that is very appealing to potential residents from both an energy savings and aesthetics perspective.

The cases presented in this section underscore the continuing usefulness and vitality of public loan and tax incentive programs in California and Oregon.

Case 2: Natural Abilities Corporation, Sonoma County, California[3]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Mr. Paul Cormier, President, SAFE-BIDCO– (707) 775-8621	Retail	$90,000	State of California
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
State Energy Loan	23,000 ft^2	The annual dollar savings were expected to be $52,718 (479,260 kWh at $0.11 per kWh.	High-efficiency compressors, energy management system

Background

In fall of 1990, Ernie and Jim Shelton contacted various Sonoma County, California, lenders seeking funds to help cover the cost of acquiring a small natural foods grocery store in Sebastopol, California. Although the Sheltons had several years of experience in managing similar businesses, loaning money for the store carried some risk for lenders primarily because the purchased assets, while typical for such stores, had limited value as collateral.

California's SAFE-BIDCO's Loan Guarantee Program was willing to provide a 90% loan guarantee, which enabled a local bank to move forward with the loan. From SAFE-BIDCO's viewpoint, the borrowers were a good risk. They had a strong business track record, they could leverage their equity with the seller's financing, and they had a strong business plan.

From the start, the venture was successful. After two years, the business relocated to a larger facility—financed in part with a second Exchange Bank loan guaranteed by SAFE-BIDCO. Shortly thereafter, the firm was named Sonoma County Small Business of the Year and received a Governor's Award for its effective use of the loan guarantee program. Annual sales in 1991 were $600,000, and by 1998, they were $30,000,000.

In 1997, as part of a store remodeling effort, Ernie and Jim Shelton saw an opportunity to reduce their refrigeration costs and at the same time replace aging equipment that ranged from 10 to 30 years old. This time, the brothers approached SAFE-BIDCO for an energy-efficiency improvement loan. The amount of the loan requested was $90,000.

[3] We would like to thank Mr. Paul Cormier, president, SAFE-BIDCO, and the Sheltons for their insights regarding the financing of energy-efficiency initiatives within California. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study regarding financing strategies do not necessarily reflect the views of SAFE-BIDCO or the Natural Abilities Corporation. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

This case study is significant in that it (1) demonstrates why energy efficiency is good business practice, (2) illustrates the importance of a good business track record in securing financing for energy-efficiency projects, and (3) underscores the relevance of public sources of capital for small business energy-efficiency projects.

Energy-Saving Technologies

The Santa Rosa Store, as purchased, operated 15 separate refrigeration-condensing units. To improve refrigeration efficiency and lower utility costs, the Shelton brothers decided to install a Hussman Super Plus rack system with seven Coplematic high-efficiency compressors. A computerized controller turns off or on any combination of compressors to maintain proper temperatures and operating efficiencies.

Projected versus Actual Energy Savings

The annual dollar savings were expected to be $52,718 (479,260 kWh at $0.11 per kWh. Based upon project cost, the simple payback was estimated to be 1.72 years. Actual energy savings on an annual basis are estimated to be about $18,000. Increases in square footage and increased energy use in other areas have offset some of the projected energy savings from the new refrigeration equipment.

Financing Options: Small Business Loan Program

Because of its experience with the SAFE-BIDCO small business loan program, it was natural for the Shelton brothers to seek an energy-efficiency loan from the state of California.

This California program allows small businesses (and nonprofits) to secure loans of up to $200,000 for energy-efficiency improvements. The interest rate is 5%, and terms of the loan are up to 5 years. Loan funds can be used for any project that can pay for itself within 10 years or less through energy cost savings, and (1) conserves energy equal to 15% of normal usage, or (2) produces energy for on-site usage, or (3) manages load.Loan funds cannot be used for operating, maintenance, or routine repair or fuel costs.The borrower must be the project's owner, operator, and beneficiary. Loans can be used for retrofits or added energy-efficient measures in existing facilities, or to acquire certain equipment for a new facility. The project financed and its benefits must remain within the state. Loan requests range from $2000 to $200,000 Commitments to a loan are generally issued within 2–3 weeks.[4]

To secure a loan from the state of California, the corporation had to complete the following steps:

Step One: *Identify energy technology options*. The Shelton brothers with the assistance of Stevens Refrigeration explored various refrigeration system configurations.

[4] Information supplied by SAFE-BIDCO on January 5, 1999.

Step Two: *Conduct an analysis of the project's expected energy impact.*

- Situation report—narrative description of the building, its energy systems, and usage, and activity profile.
- Potential projects—general information on all potential energy savings opportunities
- Technical analysis—estimates of annual energy and energy cost savings (using current energy prices), costs of each measure, and ranking of all projects in terms of cost effectiveness
- Project description—narrative summary of project, including baseline energy consumption data, zoning and building code issues, and drawings of project layout, including any related structural or system changes.

Step Three: *Provide a comprehensive financial report*, including personal financial statements of all owners, tax returns, partnership agreements, vendor's audit/proposal/bid, copies of all leases and mortgages, etc. Because of the brothers' longstanding, successful relationship SAFE-BIDCO, the loan process required only a simple updating of financing information.

Step Four: *Submit a loan request form* that includes information regarding ownership, type and description of project, expected project costs, financial and business references, available collateral, etc.

Project Outcomes

The Natural Abilities Corporation owned by the Shelton brothers was awarded the requested amount of $90,000. The terms of the loan were 60 months at $1851 per month at 5%.

Lessons Learned

The Natural Abilities Corporation was successful in securing its requested loan amount from SAFE-BIDCO in a timely fashion. There were a number of factors responsible for the local owner successfully securing financing:

- Existence of a state energy-efficiency loan program with a mandate to provide assistance to small businesses and a commitment to expediting the loan process.
- A strong technical proposal that was supported by technical and design assistance from a refrigeration sales company. (An independent utility technical review can expedite the loan approval process.[5])
- Excellent company credit history,[6] including a longstanding financial relationship with SAFE-BIDCO and a local bank.
- Demonstrable and significant energy cost savings.
- Excellent growth and profitability record

[5] Insufficient technical proposals and financial statements were ranked by SAFE-BIDCO as the top two factors responsible for loan applications being denied. See answers provided to 1/05/99 survey.
[6] Ibid.

Case 3: GIC New Office Building Development Project in Downtown Portland, Oregon[7]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Mr. Dennis Knight Oregon Department of Energy (503) 373-1032	Commercial buildings	About $18,000,000	Rebuild Oregon Portland Partners for Energy Efficiency
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
State Energy Loan	103,000 ft^2	2606 MBtu or about $37,600 annually	Advanced building design features and heating and cooling equipment

Background

The project is the construction of a new office building with 103,000 ft^2 of office space incorporating numerous innovative and leading technologies designed to showcase energy conservation, use of renewable resources, and energy-conscious environmental design. The project complements the extensive work that has gone into the development of the River Place Project along the Willamette River front near downtown Portland. The building rises eight stories on a site west of the Marquam Bridge. The first three levels are dedicated to parking and mechanical systems with some office space on the ground floor. The top five levels contain the office space for approximately 225 employees. The entire building will be leased, with an option to buy, to Pacific Gas Transportation Company (PGT), a wholly owned subsidiary of Pacific Gas and Electric Company (PG&E). The developer applied for a long-term Oregon Office of Energy to finance the planned energy-efficiency designs and technologies.

Energy-Saving Technologies

The project was designed to demonstrate how comprehensive energy-conservation measures, advanced practice or design features, and renewable resource measures can be successfully and cost-effectively incorporated in the construction of a new building. In addition, the project will showcase innovative construction practices, space design for facility recycling, transportation demand management approaches, and a substantial commitment to educating trade professionals and the general public about the building energy and environmental features.

The building systems upgrades offered several unusual design features. The most notable include selective glazing treatment by exposure and use, a dimmable daylighting system

[7] Mr. Dennis Knight and Mr. Jeff Keto from the Oregon Office of Energy supplied information for this case study. The Rebuild America Program would like to thank these individuals and also Ms. Sharon K. Hanson, Rebuild America, state of Oregon, for their time and technical assistance. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study do not necessarily reflect the views of the Oregon Office of Energy. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

for perimeter areas and light shelves in south side open office areas, recessed windows on the building south side with an exterior light shelf, receptacle sweep for miscellaneous plug loads, heat recovery from computer rooms for domestic hot water preheat, an ice storage system (with heat recovery) and associated cold air distribution site maps, and complete building systems commissioning.

Above Code Energy Conservation Measures: The building was provided with increased roof, wall, and plenum insulation, integrated occupancy sensors with daylighting and standard lighting systems, tailored lighting to fit furniture layout versus standard grid, electronic ballasts, perimeter fan-powered variable air volume system, variable-speed drives on main fan units, a condensing natural gas boiler, a more efficient chiller, and premium motors.

Energy Savings

Office of Energy engineers reviewed estimates on energy cost savings and supported an annual energy savings estimate of 2606 MBtu or about $37,600 at current prices. Energy savings that other individuals or companies will realize from these improvements are estimated to be about 727 MBtu annually with an associated value of $9000. Furthermore, transportation reductions are expected to lessen greenhouse gas emissions of CO_2 by over 20,000 pounds per year. Broader societal cost savings from the recycling and transportation measures have not been estimated.

Financing Method: State Energy Loan Program (SELP)

The project developer needed long-term fixed-rate financing through a combination of tax-exempt and taxable funds to construct the building. However, financing at commercial rates and under commercial terms significantly reduced the economic feasibility of the project.

- Consequently, the developer turned to the Oregon Office of Energy to secure sufficient financing. The SELP loan can finance more than just energy measures of a facility if the project qualifies as a demonstration project. Specifically, the regulations state that elements of any project that are unrelated to energy production or conservation can be financed if the project would not receive adequate financing otherwise.

- Officials at the Oregon Office of Energy reacted favorably to the proposed project. The PGT building, it was noted, would offer the real estate; construction; finance; design; heating, ventilation, and air conditioning (HVAC); and utility sectors a chance to see comprehensive energy features achievable in the type of building with which they are familiar, the office building. The technology demonstrated not only would influence new construction, it would also illustrate the types of technologies that could be installed as retrofits.
- Similar to any municipal loan, the developer entered into a loan agreement with standard terms and conditions. Eligible costs included project, study, design,

contingency, training, capitalized interest, and fee. Prior to the granting of the loan, the developer had to pass a comprehensive review of audited financial statements. This assessment evaluated assets versus liabilities, past revenue, and expected versus future revenues. The evaluation also looked at measures the developer was implementing to cope with any expected revenue shortfalls.

The project received a loan of $16,800,000 with terms of 240 months at an estimated 8.50% interest rate. The mortgage was $145,795 per month. This left $840,000 remaining to be financed. This residual funding was supplied by the Pacific Power and Light's FinAnswer Program and $64,000 by the developer (PGT). The Loan Budget is presented below.

Breakout of Loan Costs	**$ Amount**	**% of total**
Due diligence costs	1,135,000	6.43
Land costs	1,043,00	5.91
Site improvements	416,000	2.36
Construction hard costs	12,836,000	72.75
Construction soft costs	306,000	1.73
Financing costs	1,127,000	6.39
Fees and developer	801,000	4.54
Total costs	17,664,000	100%
Less other funding sources	864,000	
Total energy loan	16,800,000	

A contingency amount of $1,000,000 was included in the budget to cover additional or increased costs. PGT committed to pay any costs that exceed this amount.

The Energy Loan Program sold a combination of private activity tax-exempt bonds and taxable bonds to fund its loan to GIC development. To protect itself, the loan program required performance bonds on contractors, construction insurance, signed construction contracts prior to the disbursement of funds, title insurance, etc.

Project Outcomes

The demonstration project stands as a model of advanced energy efficiency features for the Portland business community.

Lessons Learned

Designation as a demonstration project allows new building construction projects in Oregon to qualify for funding beyond that directly related to energy efficiency. This additional incentive may encourage builders and developers to "leapfrog" conventional technologies and integrate innovative energy saving features into the building design.

Case 4: Renovating Magruder and Withycombe Halls at Oregon State University[8]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Mr. Dennis Knight Oregon Department of Energy (503) 373-1032	University	$570,000 (state energy loan only)	Rebuild Oregon Oregon State University
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
State Energy Loan	76,000 ft^2	9061 MBtu annually or $59,270 per year	Advanced energy management system

Background

Oregon State University (OSU) is one of seven institutions of higher learning organized under the Oregon State System for Higher Education. The university was founded in 1858 and is the primary school for higher agriculture science in Oregon.

Magruder Hall is a 76,000-ft^2 building. The building houses an animal clinic in addition to providing space for offices, research labs, a library, and classrooms. Air from ducts in the animal's quarters intermingles with air delivered to the offices and teaching areas. To keep the air fresh, the fan system operates constantly, bringing in 100% outside air. The outside air must then be cooled or heated by mechanical means that is a very energy-intensive and costly process.

Withycombe Hall is an older building that was originally constructed to house the School of Agriculture's Animal Science Department. The building has 65,000 ft^2 that is used for classrooms, offices, laboratories, an auditorium, and a playhouse.

OSU has recognized that both buildings are energy inefficient and have excessive energy costs. Consequently, it has evaluated both buildings for potential energy retrofits.

Energy-Saving Technologies

OSU will replace the energy management system in Magruder Hall and upgrade the one in Withycombe Hall. The improvements will control all major heating, ventilation and air conditioning equipment serving the building. The direct digital control system in Magruder will provide scheduled night setback and optimized start/stop, will regulate

[8] Information for this case study was supplied by Mr. Dennis Knight and Mr. Jeff Keto at the Oregon Office of Energy. The Rebuild America Program would like to thank these individuals and also Ms. Sharon K. Hanson, Rebuild America, state of Oregon, for their time and technical assistance. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study do not necessarily reflect the views of the Oregon Office of Energy. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

ventilation air dampers, and will monitor all heating and cooling systems. Exit lights will be retrofitted at Magruder with energy-saving light-emitting diodes (LEDs). Five fume hoods in Magruder will be converted to automated variable flow control. This new system reduces the air flow through a fume hood when a small zone in front of the hood is unoccupied. It functions like an occupancy sensor.

The new controls system in Withycombe will permit reset of the temperatures for hot-water and air delivery and will improve temperature control in unoccupied areas. The majority of expected energy savings will come from reduced outside air intake during unoccupied hours. The system will reduce heating energy and fan energy consumption.

A steam line that is mostly unused and contributes to radiant heat losses will be removed. Another portion of the steam line going into the building will be fully insulated. This will reduce heat loss and provide containment for the asbestos insulation now surrounding the line.

Energy Savings

PAE Consulting Engineers and Environmental & Engineering Services, Inc., completed an estimate of potential energy savings. A State Energy Office engineer confirmed that the project would save 9061 MBtu annually. This reduction in energy use and associated operation and maintenance (O&M) savings should save OSU about $59,270 per year.

Financing Method: State Loan Program

The project required long-term fixed-rate financing to retrofit Magruder and Withycombe halls. Consequently, OSU turned to the Oregon Office of Energy to secure sufficient financing. State universities may apply for financing from the Energy Loan Program under ORS 470.050.

Energy loan officials reacted favorably to the proposed project. They observed that they had a long funding relationship with higher education institutions in Oregon and that they wanted to expand their involvement with Oregon State University.

Similar to any loan, OSU entered into a loan agreement with standard terms and conditions. Eligible costs included project, study, design, contingency, training, capitalized interest, and fee.

Prior to the granting of the loan, OSU had to pass a comprehensive review of audited financial statements. This assessment evaluated assets versus liabilities, undesignated equity, past revenue, and expected versus future revenues given the local property. The evaluation also looked at measures the school was implementing to cope with any expected revenue shortfalls.

The financial review indicated that OSU would be able to pay a required 1:1[9] debt service through both energy and operating savings. Annual loan payments would amount to $59,580. Annual expected savings are $59,270.

Project Outcomes

The project received a loan of $570,000 with terms of 180 months at an estimated 6.0% interest rate. The mortgage was $4965 per month. The total loan budget is presented below.

Breakout of Project Costs	$ Amount	$ Amount
Project costs – total		598,550
PEP fee		9,090
Engineering		30,160
Contingency		59,850
Inspection fees		35,920
Commissioning		17,960
Capitalized interest		5,200
Loan fee @ 1 %	$5,700	
Less underwriting	(1,872)	3,828
Total costs		760,558

Funding Sources	$Amount	$Amount
SELP loan		570,000
OSU funds		190,558
Total		760,558

Lessons Learned

- The Oregon Energy Loan Program has allowed state higher education institutions to avoid impacts on capital budgets relating to energy-efficiency retrofits. Because the projects involve upgrades to existing structures to improve energy efficiencies, they are not considered capital improvements. Therefore, approval by the Oregon State Legislative Emergency Board has not been required.

- This is another example of an energy project that has benefits beyond saving energy. In this case, getting the steam line out of service reduces an operations and maintenance load, and containment of asbestos mitigates an environmental risk.

[9]This simply means that energy savings have to equal the amount of the annual loan repayment.

Case 5 : Multnomah County School District
Portland, Oregon[10]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Mr. Dennis Knight Oregon Department of Energy (503) 373-1032	School District	$20,000,000	Rebuild Oregon Portland Partners for Energy Efficiency
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
State Energy Loan	724,000 ft^2	Energy savings are expected to be 191 MBtu annually. Total energy cost savings were projected to be about $42 million over a 22-year period.	Lighting, heating and cooling, insulation

Background

Multnomah County School District, Portland Public Schools, began an energy management program with the goal of implementing conservation measures with simple paybacks of 10 years or less. Based on some early successes, the district decided to continue its program of energy efficiency over a period of 7 years starting in 1993. Phase I of the project includes nine buildings representing a total of 724,000 ft^2. Franklin High School, Blanchard Educational Service Center, Laurelhurst Elementary School, MLC/Couch School, and Marysville Elementary School were selected for Phase I.

Portland Public Schools (PPS) was incorporated in 1851 and is the largest district the state. It serves more than 57,000 students within its 152-square-mile district. There are 62 elementary schools, 17 middle schools, 10 high schools, and 4 alternative and special schools. The Office of State Energy Loan Program was critical to the successful financing of the district's energy-efficiency measures because it allowed the district to avoid financing the measures through its bonding authority.

Energy-Saving Technologies

The technologies selected for the first phase included

- Controls for lighting, heating and ventilating, water heating, boiler dampers
- Lighting improvements
- Insulation and other building envelop upgrades
- Heating, ventilating, and air-conditioning system improvements

[10] Information for this case study was supplied by Mr. Dennis Knight and Mr. Jeff Keto at the Oregon Office of Energy. The Rebuild America Program would like to thank these individuals and also Ms. Sharon K. Hanson, Rebuild America, state of Oregon, for their time and technical assistance. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study do not necessarily reflect the views of the Oregon Office of Energy. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

Energy Savings

Cumulative energy savings are expected to be 191 MBtu annually. Total energy cost savings were projected to be about $42 million over a 22-year period. Once all measures were installed and the project is complete, the district was expected to save on the order of $2.28 million per year. The district's projections of energy savings were reviewed by the Oregon Office of Energy and were found to be reasonable. Annual energy savings were tracked by a computerized utility tracking system. Oregon Office of Energy Loan Program staff reviewed actual savings annually to see that the project was in compliance with the debt service coverage requirement.

Financing Method: State Energy Loan Program

The Portland School District had two options for funding its energy conservation initiatives. First, it could have directly issued general obligation bonds. Second, it could pursue financing through the Office of Energy. The school district decided to apply to for a State Energy Loan ($20,000,000) for the following primary reasons:

- Issuing bonds would have caused delays in implementing the project because of the requirement of obtaining prior voter approval.
- Also, the 1% spread charged by the Office of Energy includes costs most municipal borrowers would incur if they raised their own funds. These costs include bound counsel, financial advisors, attorneys, a CPA audit, internal financial management and fiscal and overhead costs, arbitrage, holding costs, underwriters' fees, rating agency charges, etc.
- The scope of the district's energy project was much larger than the typical municipal project. More than 100 buildings would eventually be involved at over 65 distinct locations.

Additional benefits to the school district from securing a State Energy Loan included

- Ready availability of funds
- Utility rebates
- Streamlined application process
- Bonding authority preserved for other needs
- Dependable funding source
- Lower energy bills
- Single application fee
- Easier budget planning

Because the actual implementation of the project was to take place over several years, the Office of Energy had to develop a financial concept similar to a line of credit. The district's energy improvements in numerous buildings are treated as a single project for loan purposes. However, using a line of credit approach provided necessary continuity for energy planning. It ensured funding, eligibility of specific measures, and board approval, and it helped secure the district's ongoing commitment to energy conservation.

The credit line was used for what for all practical purposes is a multiphase construction loan. PPS has a brief window of time to implement most of the projects each year—summer vacation. The credit line eliminated the need for seven loans for each of the seven phases of the project.

Similar to any municipal loan, the school district entered into a loan agreement with standard terms and conditions. Eligible costs included project, study, design, contingency, training, capitalized interest, and fee. With each disbursement of funds, the cumulative debt service for the project had to be maintained at a preestablished repayment level.

To ensure a minimum repayment to debt service ratio, each of the seven phases of the project required a separate energy study that underwent state review. The district was charged capitalized interest on any funds advanced for a particular phase and had to provide adequate financial backup. The district was required to begin repayment within 30 days of the last draw.

For each of the seven phases, the borrower signed an addendum stating the measures to be funded, their location, total costs, interest rate, term, and monthly payment amount. Annual renewal of the credit line is contingent upon a satisfactory review of the district's financial status. The maximum that could be drawn on the credit line was $20,200,000. Unlike most credit lines, the loan repayment did not replenish the credit line. Prior to the granting of the loan, the district had to pass a comprehensive review of audited financial statements for 3 years, ending in 1992. This assessment evaluated assets versus liabilities, undesignated equity, past revenue, and expected versus future revenues given the local property. The evaluation also looked at measures the school was implementing to cope with any expected revenue shortfalls.

The district's source of loan repayment was its utility budget. The financial review indicated that the school district would be able to pay the debt service through both energy and operating savings. In addition, the Office of State Energy Loan Program accounted for the rebates the school district was likely to receive from the local utility (Portland General Electric) and the impact of the rebates on the amount of money borrowed each year.

Based upon the provision for annual review and approval of the project's debt service coverage, the approved conservation measures, and eligible costs, the entire seven phases of the project were qualified for a State Energy Loan.

Lessons Learned

- General obligation bonds are often not a preferred option for financing energy efficiency programs, particularly when there is extensive public scrutiny regarding the use of public bonding authority.

- Success in securing funding for public (and private) programs is always dependent on the financial condition of the applicant and the extent to which energy savings (return on investment) will equal or exceed debt repayment.

- A comprehensive, systemwide approach to energy efficiency generates significant program management savings. Minimizing redundant administrative and management approvals is critical to program success.

- Multiyear projects may result in multiple energy studies—separate studies for each year.

Case 6: Portland State University Urban Center[11]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Mr. Dennis Knight Oregon Office of Energy (503) 373-1032	University	$5,000,000	Rebuild Oregon
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
State Energy Loan	135,000 ft^2	3049 MBtu annually	Lighting and heating and cooling technologies

Background

The Urban Center is proposed to be the heart of a new University District within downtown Portland. It will form the gateway into the downtown from the south and serve as a public forum where the University and the downtown community come together. The Urban Center is an integrated mixed-use development containing transit facilities, academic buildings, and commercial retail shops. The Urban Center consists of two new, connected multistory buildings. The central focus is a public plaza, serving as a gathering space for both the university and the downtown neighborhood enlivened by Transit Center facilities. The east building tower is a seven-story structure, and the west building tower is a three-story structure. The total combined floor area is approximately 135,000 gross square feet.

[11] Information for this case study was supplied by Mr. Dennis Knight and Mr. Jeff Keto at the Oregon Office of Energy. The Rebuild America Program would like to thank these individuals and also Ms. Sharon K. Hanson, Rebuild America, state of Oregon, for their time and technical assistance. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study do not necessarily reflect the views of the Oregon Office of Energy. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

Energy-Saving Technologies

The majority of the building will be built with brick walls with rigid insulation and double-pane, reflective, insulating windows. The design team has worked very hard to ensure that the building complied with the strict Oregon energy code, while maintaining aesthetic and functional features.

The interior lighting system for the building will consist of T-8 fluorescent fixtures with electronic ballasts configured with parabolic reflector fixtures in most areas. Sweep controls and occupancy sensors for automatic lighting controls will be installed throughout the building. LED exit signs have been incorporated into the building lighting design.

The building will be heated and cooled by heating water provided by three hot water boilers and chilled water from two chillers, respectively. Variable air volume systems with heating coils in the terminal units will serve most spaces.

Altogether, 21 energy conservation measures will be incorporated into the building.

Energy Savings

An Office of Energy engineer has confirmed that the project would reduce energy use by 3049 MBtu annually compared to the standard set by the Oregon Energy Code. The energy and maintenance benefits are worth about $19,350 per year.

Financing Method: State Energy Loan Program

The project requires long-term fixed rate financing through a combination of tax-exempt and taxable funds to construct the building. Consequently, Portland State University turned to the Oregon Office of Energy to secure sufficient financing. State agencies may apply for financing from the Small Scale Energy Loan Program under ORS 470.060.

- Officials at the Office of Energy have reacted favorably to the proposed project. They observed that they had a long relationship with higher education and that they wanted to expand their involvement with Portland State University. Similar to any municipal loan, Portland State University entered into a loan agreement with standard terms and conditions. Eligible costs included project, study, design, contingency, training, capitalized interest, and fee.

- Prior to the granting of the loan, the Portland State University has undergone a comprehensive review of audited financial statements. This assessment evaluated assets versus liabilities, undesignated equity, past revenue, and expected versus future revenues given the local property. The evaluation also looked at measures the school was implementing to cope with any expected revenue shortfalls. Portland State University supplied 2 years of audited financial statements ending June 30, 1997. The financial review showed that the debt ratio would be well below allowable limits.

- Based upon the provision for annual review and approval of the project's projected debt service coverage, the approved conservation measures, and eligible costs, the project has qualified for State Energy Loan funding.

The project received a loan of $5,200,000 with terms of 240 months at an estimated 6.0% interest rate. The mortgage will be $37,250 per month. The total projected loan budget is presented below.

Breakout of Project Costs	**$ Amount**	**$ Amount**
Project costs—non-energy		24,078,5000
Total energy-related costs		8,824,000
Commissioning		133,800
Capitalized interest		185,000
Loan fee @ 1 %	$53,000	
Less underwriting	(4,500)	48,500
Total costs		33,270.000

Funding Sources	**$Amount**	**$Amount**
Federal funding		4,250,000
Donations		3,865,000
Portland Development Corporation		2,500,000
State general funds		3,500,000
Article X1-F bonds		6,090,000
Article X1-G bonds		7,865,000
SELP loan		5,200,000
Total		$33,270,000

Project Outcomes

The Urban Center energy project demonstrates that a building can be created that will reduce energy costs while maintaining functionality and aesthetic appeal.

Lessons Learned

- Public institutions applying for Office of Energy loan programs must be able to demonstrate financial health and the ability to repay the capital costs of energy projects.

- The critical importance of demonstrating energy efficiencies and cost savings is reflected in the Office of Energy's request that "commissioning"[12] be included as part of the project to "further optimize the project's operation and efficiencies."
- Although direct energy savings were less than the debt service, the project will provide additional energy savings by facilitating the expansion of light rail services. This benefit was factored into the decision to grant Portland State University an energy loan. Significant regional environmental and energy benefits may tip the scale in favor of a public project where energy savings are less than the annual loan payments.

Case 7: Ace Hardware Lighting System Financing Energy-Efficiency Projects via State Loans[13]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Mr. Paul Cornier president, SAFE-BIDCO– (707) 775-8621	Retail Sales	$98,095	State of California
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
Low-Interest State Energy Loan	14,400 ft^2	The dollar savings are projected to be $10,164.53 annually from displaced electrical energy. Expected energy savings are estimated as follows: • New T-8 lamps and electronic ballasts. Based on the estimated hours of operation, an annual energy savings of 36,561 kWh is expected. The active daylighting system was expected to reduce lighting needs by 50% or an additional 45,404 kWh annually.	Active skylight system and daylighting controls

[12] Commissioning is a systematic process of ensuring, through documented verification, that the complex array of equipment that provides heating, cooling, ventilation, lighting, and other amenities in buildings works together effectively and efficiently. The process includes developing a commissioning plan during the design phase, designing and implementing the testing of equipment and systems, and developing and implementing operations and maintenance plans and training for building operators.

[13] Technical and engineering information included in this case study was taken directly from the *Daylighting Initiative* fact sheet developed by Pacific Gas and Electric Company entitled "From Sunrise to Sunset—This Ace Is a Well-Lit Place" (Pacific Gas and Electric Company, 1998) and supplemented by information from SAFE-BIDCO. The Rebuild America Program would like to thank both Mr. Peter Turnbull (PG&E Food Service Technology Center, San Ramon, California) and Mr. Tor E. Allen (PG&E–Pacific Energy Center, San Francisco, California) for the technical information supplied for this project. We would also like to thank Mr. Paul Cormier, president, SAFE-BIDCO, for his insights regarding the financing of energy-efficiency initiatives within California. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study regarding financing strategies do not necessarily reflect the views of either PG&E or SAFE-BIDCO. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

Background

The Vine Hill Hardware Company was begun in 1948 and incorporated in 1962. It is a family-owned business that operates four Ace Hardware Stores in the East Bay area of Northern California. Searching for a new location, the company found a former supermarket with 14,400 ft^2 that, with remodeling, would be suitable. In particular, the owners recognized that they would have to dramatically improve the lighting quality in the store.

To save on operating costs, an innovative lighting system was built around an active skylight system and dedicated daylighting controller. The company also conducted a standard light retrofit, upgrading fluorescent T-12 fixtures to T-8s with electronic ballasts. To finance the retrofit project, Vine Hill Hardware Company turned to the California State Assistance Fund for Enterprise, Business, and Industrial Development (SAFE-BIDCO). SAFE-BIDCO utilizes federal oil overcharge funds to provide energy loans to small businesses. The amount of the loan requested was $98,095.

This case study illustrates (1) how small businesses in the state of California can secure funding for energy-efficiency technologies through the SAFE-BIDCO program and (2) the importance of state loan programs generally in enabling smaller companies to integrate innovative efficiency technologies into building designs.

Energy-Saving Technologies

To improve lighting efficiency, Ace Hardware elected to install the following technologies and institute structural alterations.

Active Skylight System

An active skylight system provides more interior light than traditional skylights. It uses a series of unbreakable mirrors mounted atop a 4 × 4-ft skylight, a sun-tracking system, and a reflective light shaft.

Unlike traditional skylights, a movable mirror assembly and infrared sensor actively tracks the path of the sun—from sunrise to sunset—increasing interior daylight levels. During periods of low-angle sun, the mirrors reflect light into the store's interior—light it would not capture with traditional skylights. In summer, more sunlight enters the skylight in the morning and afternoon than with typical skylights, and the mirror system increases daylight harvested by the skylight throughout the day. Whether direct or reflected, daylight entering the skylight is diffused by a prismatic lens and emerges from a second diffuser lens into the store below.

North-Facing Windows

New windows in the north wall of the building, at about the height of the floor displays, provide additional daylight at the store's entrance. The location of the windows is such that shading is not required.

Lighting Controls

A lighting control system designed specifically for daylighting applications maximizes energy savings. Based on the amount of available daylight, electric lights are turned on and off by a photosensor located in the skylight well. Also, the store uses a step-dimming control strategy. The controller is programmed to turn off half of the lights when the interior luminance rises above 100 foot-candles (ft-c). Aside from safety lights that stay on all the time, the remaining lights turn off as the luminance levels rise above the second set point. The goal is to maintain a minimum of 100 ft-c at all times. This strategy allows the use of standard electronic ballasts to save on the typically costlier continuous dimming ballast.

Energy-Efficient Fluorescent Lighting

Energy-efficient fluorescent lighting is used when there is insufficient daylight. Existing T-12 fluorescent lamps and ballasts were replaced with T-8 lamps and electronic ballasts. The electric lighting layout is designed to provide an interior luminance of 100 ft-c without daylight at a lighting power density of 1.8 watts/ft^2.

Energy Savings

The dollar savings are projected to be $10,164.53 annually from displaced electrical energy.[14] Expected energy savings are estimated as follows.

- The present lighting system consists primarily of T-12 lamps with magnetic ballasts. These lamps were replaced with T-8 lamps and electronic ballasts. Based upon the estimated hours of operation, an annual energy savings of 36,561 kWh is expected.

- The active daylighting system was expected to reduce lighting needs by 50% or an additional 45,404 kWh annually.

Financing Method: State Energy Loan

The Vine Hill Hardware Company initially considered several options for securing funding to support the proposed lighting enhancements. These included conventional financing through a local bank. The owners settled on seeking a loan through California's Energy Efficiency Improvements Loan Program (administered by SAFE-BIDCO) because of the favorable interest rate (5%).

[14] Project cost savings information was supplied by SAFE-BIDCO, Santa Rosa, California.

This program allows small businesses (and nonprofits) with a net worth of less than $6 million and an average net income of less than $2 million to secure loans of up to $200,000 for energy-efficiency improvements. The interest rate is 5%, and terms of the loan are up to 5 years. Loan funds can be used for any project that can pay for itself within 10 years or less through energy cost savings and (1) conserves energy equal to 15% of normal usage, or (2) produces energy for on-site usage, or (3) manages load. Loan funds cannot be used for operating, maintenance, or routine repair or fuel costs. The borrower must be the project's owner, operator, and beneficiary. Loans can be used for retrofits or added energy-efficient measures in existing facilities, or to acquire certain equipment for a new facility. The project financed and its benefits must remain within the state. Loan requests range from $2000 to $200,000. Loans are funded upon project completion, which can take several months. Commitments to a loan are generally issued within 2–3 weeks.

To secure a loan from SAFE-BIDCO, the Vine Hill Hardware Company had to complete the following steps:

Step One: *Identify energy technology options*. The process of identifying appropriate lighting technologies was assisted by PG&E's Daylighting Initiative, which is intended to raise the awareness of good daylighting practices within the design community.

Step Two: *Conduct an analysis of the project's expected energy impact*. This analysis must be done by utility auditors, certified energy managers, or licensed engineers. The methodology for the project analysis also has to meet appropriate professional and industry standards. The technical report must contain the following information:

- Situation report—narrative description of the building, its energy systems and usage, and activity profile.
- Potential projects—general information on all potential energy savings opportunities.
- Technical analysis—estimates of annual energy and energy cost savings (using current energy prices); direct and indirect costs of each measure; and ranking of all projects in terms of cost-effectiveness.
- Project description—narrative summary of project, including baseline energy consumption data, zoning and building code issues, and drawings of project layout, including any related structural or system changes.

Step Three: *Provide a comprehensive financial report*, including personal financial statements of all owners, tax returns, partnership agreements, vendor's audit/proposal/bid, copies of all leases and mortgages, etc.

Step Four: *Submit a loan request form* that includes information regarding ownership, type and description of project, expected project costs, financial and business references, available collateral, etc.

Pacific Gas and Electric also provided a rebate to support conversion of the fluorescent lamps.

Project Outcomes

The Vine Hill Hardware Company was awarded the requested amount of $98,095. The terms of the loan were 60 months at $1851 per month at 5%.

The daylighting improvements have dramatically improved lighting quality and provide energy and financial savings. Electric lighting use has been greatly reduced. Short-term monitoring indicates a savings of 65% annually or 4.9 kWh/ft^2. Because low-angle sunlight is better captured with the unique skylight tracking system, the number of hours electric lights can be turned off has been extended. The simple payback period is as follows.

98,095/10,169 = 9.65 years

Lessons Learned

Ace Hardware of Martinez, California, was successful in securing its requested loan amount from SAFE-BIDCO in a timely fashion. A number of factors were responsible for the local owner successfully securing financing:

- Existence of a state energy-efficiency loan program with a mandate to provide assistance to small businesses and a commitment to expediting the loan process.
- A strong technical proposal that was supported by technical and design assistance from a local utility (PG&E). (An independent utility technical review can expedite the loan approval process.)
- Excellent company credit history, financial strength, and a long business history.[15]
- Direct support from Ace franchising corporation.
- Demonstrable and significant energy cost savings.

[15] Through November 30, 1998, SAFE-BIDCO approved 334 loan applications out of a total of 452 submitted. Of the total of 452 applications, 13 were declined by SAFE-BIDCO and applicants withdrew 105. The rate of approval is approximately 74%. The most important factors leading to a loan denial were customers that "fail[ed] to provide adequate technical and/or financial information." Customers also withdraw from the process because they decided that the time and effort to secure the loan were too burdensome. It is notable that lack of collateral has not been a significant cause of SAFE-BIDCO rejecting loan applications.

Case 8: Auburn Racquet Club Energy Retrofit Project[16]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Mr. Paul Cornier president, SAFE-BIDCO– (707) 775-8621	Retail Recreational Facility	$20,000	State of California
Financing Mechanism	**Square Footage**	**Energy/$Cost Savings (Projected or Actual)**	**Technology**
State Loan Program	**NA**	The dollar savings were expected to be $12,778. Energy savings include: Electrical: Reduced 750 kWh Gas: Reduced 25,400 Therms	▪ New pool cover and energy efficient heaters ▪ New HVAC equipment.

Background

The Auburn Racquet Club is a multisports facility that dates back to 1973. It includes outdoor tennis courts, an outdoor pool, racquetball courts, aerobics, exercise, sauna, clubhouse and locker rooms, restaurant and lounge, and child-care facility. The facility is operated by a limited partnership that has owned the facility since 1992. The facility has 40 employees. In 1998, the limited partnership decided to secure a second loan from the California SAFE-BIDCO program to retrofit the facility with additional energy-efficient features. The partnership recognized that energy costs were lowering profit levels and that a SAFE-BIDCO loan would allow the introduction of more energy-efficient equipment.

To save on operating costs, the applicant planned to install a pool cover for a new pool, replace an existing pool heater, and install additional, energy efficient heaters. An energy-efficient HVAC unit is also planned for the child-care facility.

Energy-Saving Technologies

To improve energy efficiency, the owner of Auburn Racquet Club elected to install the following technologies and institute structural alterations.

New pool cover and energy-efficient heaters. The proposed new pool cover was projected to save 19,860 therms annually. The proposed energy-efficient heaters of the new pool were rated at 85% efficiency. They were expected to save 2674 therms annually relative to current standards. The new heater for the existing pool is rated at 85.5% efficiency and

[16] We would like to thank Mr. Paul Cormier, president, SAFE-BIDCO, for his insights regarding the financing of energy-efficiency initiatives in California. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study regarding financing strategies do not necessarily reflect the views of SAFE-BIDCO. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

would replace a heater with only 70% efficiency. This heater would save about 2866 therms annually.

New HVAC equipment. The applicant also proposed to install a new 2.5-ton high-efficiency HVAC unit that has a SEER rating of 12. The calculations by PG&E projected energy savings of 750 kWh when compared to a 10-SEER unit that was also considered. Annual energy savings would be higher when compared to the Title 24 minimum standard of 8.2 SEER.

Energy Savings

The dollar savings were expected to be $12,778 annually from reduced electrical and natural gas energy use. Expected energy savings are estimated as follows.

HVAC equipment	Reduced 750 kWh	@ $0.104	$78.00	annually
Pool covers	Reduced 25,400 Therms	@ 0.500	$12,700	annually
Total savings			$12,778	annually

Financing Methods: State Small Business Energy Loan

The Auburn Racquet Club sought a loan through California's Energy Efficiency Improvements Loan Program (administered by SAFE-BIDCO[17]) because of the favorable interest rate (5%).

This program allows small businesses (and nonprofits) with a net worth of less than $6 million and an average net income of less than $2 million to secure loans of up to $200,000 for energy-efficiency improvements. The interest rate is 5%, and terms of the loan are up to 5 years. Loan funds can be used for any project that can pay for itself within 10 years or less through energy cost savings and (1) conserves energy equal to 15% of normal usage, or (2) produces energy for on-site usage, or (3) manages load. Loan funds cannot be used for operating, maintenance, or routine repair or fuel costs. The borrower must be the project's owner, operator, and beneficiary. Loans can be used for retrofits or added energy-efficient measures in existing facilities, or to acquire certain equipment for a new facility. The project financed and its benefits must remain within the state. Loan requests range from $2000 to $200,000. Loans are funded upon project completion, which can take several months. Commitments to a loan are generally issued within 2 to 3 weeks.[18]

To secure a loan from the state of California, the Auburn Racquet Club Limited Partnership had to complete the following steps:

Step One: *Identify energy technology options*. The process of identifying appropriate technologies was assisted by PG&E.

[17] State Assistance Fund for Enterprise, Business and Industrial Development Corporation.
[18] Information supplied by SAFE-BIDCO on January 5, 1999.

Step Two: *Conduct an analysis of the project's expected energy impact*. This analysis must be done by utility auditors, certified energy managers, or licensed engineers. The technical report must contain the following information:

- Situation report—narrative description of the building, its energy systems, and usage, and activity profile.
- Potential projects—general information on all potential energy savings opportunities.
- Technical analysis—estimates of annual energy and energy cost savings (using current energy prices), direct and indirect costs of each measure, and ranking of all projects in terms of cost-effectiveness.
- Project description—narrative summary of project, including baseline energy consumption data, zoning and building code issues, and drawings of project layout, including any related structural or system changes.

Step Three: *Provide a comprehensive financial report*, including personal financial statements of all owners, tax returns, partnership agreements, vendor's audit/proposal/ bid, copies of all leases and mortgages, etc.

Step Four: *Submit a loan request form* that included information regarding ownership, type and description of project, expected project costs, financial and business references, available collateral, etc.

The Auburn Racquet Club provided the requested information in a timely and complete fashion.

Project Outcomes

The Auburn Racquet Club was awarded the requested amount of $20,000. The terms of the loan were 60 months at $378.00 per month at 5%.

Lessons Learned

- State energy loan programs are critically important for small businesses such as sports clubs that have relatively low profit margins. With loan programs, energy-efficiency retrofits are accessible by these small businesses.

- There are significant opportunities for small business to increase energy efficiency and lower operating costs through state loan programs.

Case 9: Colonial Heights Apartments, Portland Oregon[19]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Mr. Dennis Knight Oregon Office of Energy (503) 373-1032.	Rental Housing	$44,883	Rebuild Oregon Portland Partners for Energy Efficiency
Financing Mechanism	**Square Footage**	**Energy Savings (Projected or Actual)**	**Technology**
State Energy Loan Tax Credit	19-unit apartment building with an 8400-ft^2 attic	The apartment complex can expect to save more than 42,230 kWh of electricity annually. This equates to approximately $2380 savings.	• New insulation • Storm Windows ▪ New high-energy-efficiency glazing

Background

Kenneth and Shelia Clark are co-owners of Colonial Heights Apartments. Mr. Clark is self-employed as an apartment building owner and has other rental real estate. The Clarks are committed to keeping their buildings in excellent repair and fully occupied with satisfied quality tenants. In 1998, the Clarks decided to explore ways to reduce utility bills through energy-efficient measures and technologies. To finance the energy-efficiency retrofits, the Clarks decided to apply to the Oregon Small Scale Energy Loan Program, which is available to most Oregon households, businesses, schools, and governments. The loans can be as small as $25,000 or as large as millions of dollars. They may range from 5 to 20 years.

Energy-Saving Technologies

The Clarks decided to improve the energy efficiency of the Colonial Heights building through the addition of

- insulation to the 8400-ft^2 attic,
- a visquene ground cover,
- attic ventilation,
- storm windows, and
- new high-energy-efficiency glazing.

[19] Information for this case study was supplied by Mr. Dennis Knight and Mr. Jeff Keto at the Oregon Office of Energy. The Rebuild America Program would like to thank these individuals and also Ms. Sharon K. Hanson, Rebuild America, state of Oregon, for their time and technical assistance. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study do not necessarily reflect the views of the Oregon Office of Energy. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

Energy Savings

The Oregon Small Scale Energy Loan Program reviewed proposed conservation measures and confirmed the expected energy savings profile developed by the local utility, Pacific Gas and Electric (PG&E). The Colonial Heights 19-unit apartment complex can expect to save more than 42,230 kWh hours of electricity annually. This equates to approximately $2380 savings. The estimated annual savings provides a 0.36:1 debt service coverage ratio with loan payments of $6678 annually.

Financing Method: Small Scale Energy Loan Program

Rather than apply for private financing through a bank, the Clarks followed the following steps in securing a loan**:**

- They completed a formal loan application that requires personal financial statements and 3 years of federal tax returns.
- They completed an energy savings potential assessment, which is generally conducted through the local utility.
- They completed a financial assessment. The Oregon Small Scale Energy Loan Program must review the applicants' ability to pay.
- They completed a design review. The loan applicant is also required to use Oregon Office of Energy approved technologies.
- The loan was approved within 3 weeks, the normal approval time for loans less than $100K.

Project Outcomes

The Clarks received a loan for $44,883. The terms of the loan were 120 months at $557 per month at 8.5% interest. Additionally, the actual energy savings are in line with the projected energy savings potential.

Lessons Learned

- The state Small Scale Energy Loan Program should appeal to smaller customers because borrowers are expected to make only a very small contribution of personal funds. In addition, the Business Energy Tax Credits and utility rebates have also helped to make the loan program appealing to possible loan recipients. In the case of the Clarks, they were able to secure an $18,601 Business Energy Tax Credit as well as a $946.00 rebate from PG&E. The total project costs and incentives are listed below:

Project costs:	$64,429
Loan fee	$449
Closing costs	$543
Tax service	$59
Total costs	$65,429
Borrowers contribution	$1,050
Business Energy Tax Credit	$18,601
PG&E rebate	$946
SSELP loan	$44,883

Case 10: The Director Building Partnership Building, Portland Oregon[20]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Mr. Dennis Knight Oregon Office of Energy (503) 373-1032	Commercial Real Estate	$290,000	City of Portland State of Oregon
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
Business Energy Tax Credits Utility Grant	65,000 ft^2	Energy savings resulting from the retrofits have averaged about $16,000 per year	Energy-Efficient lighting, advanced heating and cooling systems, energy management system, etc.

Background

After 75 years, the Director family sold its building in downtown Portland and moved the company to a Portland suburb. The new owners, the Director Building Partnership, renovated the downtown building to house almost 65,000 ft^2 of first-class office and retail space. Since its renovation, the Director Building has accumulated a long list of awards and distinctions.

The first distinction marks the building's historical riches and its access to the natural beauty of Portland. On the outside, the building went back to an old look when the new owners restored the original brick façade. The two-story penthouse added on the roof features outdoor terraces and wide vistas of the Williamette River and nearby mountains. All renovation work met federal standards for historic buildings for listing on the National Register of Historic Places.

[20] Mr. Dennis Knight and Mr. Jeff Keto supplied information for this case study at the Oregon Office of Energy. The Rebuild America Program would like to thank these individuals and also Ms. Sharon K. Hanson, Rebuild America, state of Oregon, for their time and technical assistance. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study do not necessarily reflect the views of the Oregon Department of Energy. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

The Director Building's $6 million renovation also incorporated significant energy-efficiency retrofits. These retrofits led to the building winning the Governor's Energy award, which recognizes the innovative application of energy technologies.

Energy-Saving Technologies

The Director Building incorporated energy-efficient lighting and mechanical systems that helped to cut significantly the building's total energy use. A water-source heat pump replaced a steam system to heat and cool the building. Other measures included ceiling and wall insulation and weather stripping. Reglazed windows with insulated blinds and bronze glass in the skylights were added to help keep the heat from the sun out. When there is enough natural light, automatic controls turn off unnecessary lights.

A computerized energy management system helps control the building's heating, cooling, lighting, security, and fire/life systems independently in different building zones. The computer is programmed to turn the systems on when needed and off when not. The scheduling improves the system's efficiency and cuts electricity use further. The systems can sense problems that can often be fixed before the tenant senses them.

Fluorescent parabolic fixtures that use energy-efficient lamps and ballasts replaced a confused mix of incandescent and fluorescent lights. Motion detectors turn lights off after people leave a room.

Energy Savings

Electricity costs in the Director Building were reduced by more than 30% relative to Oregon's commercial energy code. Energy savings resulting from the retrofits have averaged about $16,000 per year. By exceeding these strict energy standards, the building was one of 29 commercial buildings selected by the Bonneville Power Administration for its *Energy Edge* program.

Financing Method: Business Energy Tax Credits

The Director Building Partnership, by deciding to integrate energy-efficiency retrofits into its overall renovation plan, identified ways to leverage its overall capital investment. The partnership was aware that if the strict standards of the Oregon commercial energy code were exceeded, they could qualify for the Bonneville Power Administration's *Energy Edge* program. This program rewarded *Energy Edge* winners for additional design and construction costs of proposed energy-efficiency measures.

The Director Building Partnership also recognized that they would qualify for the Oregon Business Energy Tax Credit. The total estimated building renovation costs for the Director Building were almost $850,000. This was a significant investment and probably would not have been made without the existence of the Oregon Business Tax Credit. The tax credit was equivalent to a 35% discount on the total renovation investment.

Exceeding the commercial building code by 30% added about 20% to the cost of the energy systems added in the Director Building renovation. The Director Building Partnerships took a $290,000 energy tax credit over 5 years, which corresponded to the cost of the energy retrofits: 10% of the $850,000 in each of first 2 years and 5% in the remaining years.

Project Outcomes

Reduced energy costs was an important selling point to prospective tenants. The Director Building hit 92% occupancy within 20 months of the renovation. In a city that averages 11% vacancy rates in new high-rise towers and about 18% vacancy rates in older downtown office buildings, a nearly full building is a significant accomplishment.

Lessons Learned

- Integrating energy efficiency into the overall renovations can be an important strategy for leveraging capital in those states that offer energy loan programs. The possibility of leveraging capital may make the difference between proceeding or not proceeding with a building project.

- There is a demonstrable relationship between lower utility rates and higher occupancy levels in the renovated Director Building. Building partnerships should be using this information in negotiating favorable loan terms from commercial institutions.

➢ *Achieving Energy-Efficiency Goals Through Non-Energy Federal Grants and Private Foundation Funding*

Often project developers view federal grant applications with a certain degree of myopia. For example, federal grants designed to improve the security of public housing facilities or curtail drug activities are viewed only in terms of improving public safety. Rather than funding sources narrowly, it may be useful to identify how a particular federal grant can achieve multiple purposes. In the Hall County Public Financing case study, for example, energy-efficiency goals are being met through a Housing and Urban Development Grant that is designed to fight the types of drug-sales crimes frequently associated with public housing projects. Better lighting can both lower energy costs and reduce drug sales.

In the Knoxville Public Housing Case Study, the importance of securing private foundation grants to augment public funding is illustrated. Clearly, without the combined involvement of private lenders, federal agencies, foundations, and housing coalitions, the amount of financing necessary rehabilitate the houses provided through a private estate would not have been possible. Again, because there are few large “pots” of public money available to finance energy-efficiency projects, developers must “bundle” smaller funding instruments together in order to move forward.

Case 11: Leveraging Financing to Promote Energy Efficiency: The Pletcher Terrace Public Housing Project[21]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Ms. Lynn Chamberlin Policy Research and Energy Office (402) 471-21867 Fax: (402) 471-3064	Housing	$20,000	Rebuild Nebraska
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
HUD Public Housing Drug Elimination Grant	50-unit housing facility with units ranging from 385 to 924 ft^2	The projected savings for replacing kitchen lights with fluorescent bulbs is about $252.00 per year with a payback of 8.9 years. Replacing exterior porch lights with 15-watt compact fluorescent bulbs will save $986.00 per year with a payback of 2.2 years. Replacing pole lights with 70-watt high-pressure sodium bulbs will save $628.00 per year with a payback of 4.5 years	High-efficiency lighting

Background

Pletcher Terrace is a 50-unit housing facility operated by the Hall County, Nebraska, Housing Authority. The facility has a mixture of double- and single-bedroom units and efficiencies. Each of the efficiency units is equipped with a livingroom/bedroom, kitchenette, storage closet, and utility closet that add up to approximately 385 ft^2. The double- and single-bedroom units consist of the bedrooms/bedroom, a living room, kitchen, storage closets, and utility closets totaling 924 and 616 ft^2, respectively.

Both domestic hot water and space heating are fueled by natural gas. Electricity powers the lights and any additional household appliances the tenants may have. The billing system for each of the apartments is handled by the Hall County Housing Authority and is billed as one natural gas and three separate electricity accounts. The Hall County Housing Authority elected to pursue energy-efficiency retrofits as a way to reduce utility bills. The following chart shows typical annual utility costs for the 50-unit facility.

[21] Technical and engineering information included in this case study was taken directly from a series of case studies developed by the State of Nebraska Policy Research and Energy Office and provided by Ms. Lynn Chamberlin. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study regarding financing strategies do not necessarily reflect the views of the State of Nebraska. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

Energy uses	Cost ($)	% Cost	% Energy
Space heating	11,628	39	56
Domestic hot water	4,855	16	24
Lighting	2,727	10	4
Cooling	2,100	8	3
Additional winter heating	1,030	3	2
Appliances and equipment	7,244	24	11
Total	29,584		

Based on account numbers and consumption histories, the facility uses 142 MBtu/kft^2. This is higher than other facilities of this type. All cost calculations are based on an approximately $0.05/kWh electricity cost and a natural gas price of $0.57/therm.

Energy-Saving Technologies

- **Insulation**: Because there was no insulation between the exterior and interior surfaces of the walls, it was recommended to blow cellulose insulation into the wall cavities.
- **Windows**: Windows with single panes were replaced with double-pane, low-E units.
- **Heating, Ventilating, and Air Conditioning**: Each apartment was equipped with an individual downflow natural-gas furnace that was inefficient. These units were replaced with 90% energy-efficient furnaces that have a payback period of about 13 years.
- **Water Heaters:** A 30-gallon natural-gas water heater supplied each apartment. The supply pipe extending from the tank was not insulated and, therefore, contributed to a loss of heat. The recommended solution was to insulate all hot water supply pipes to reduce heat loss as the water travels to each faucet.
- **Lighting:** Apartment lights were primarily 75-watt and 60-watt incandescent two-bulb fixtures. It was recommended that the overhead kitchen light be replaced with two T-8 fluorescent lamps and electronic ballasts. Also, the two 60-watt porch lights on each unit were replaced with a 15-watt compact fluorescent bulb. These lights have a life of 10,000 hours versus the 750 to 1000-hour life of incandescent bulbs. Also, the 14 incandescent pole lights scattered throughout the campus were replaced with 70-watt high-pressure sodium bulbs. This resulted in a lower wattage, yet a noticeably higher light level.

Energy Savings

Because only the lighting portion of the project has been funded, only energy savings relating to lighting are reported. The projected savings for replacing kitchen lights with fluorescent bulbs is about $252.00 per year with a payback of 8.9 years. Replacing exterior porch lights with 15-watt compact fluorescent bulbs will save $986.00 per year

with a payback of 2.2 years. Replacing pole lights with 70-watt high-pressure sodium bulbs will save $628.00 per year with a payback of 4.5 years.

Financing Method: Using HUD Drug Elimination Grants to Achieve both Security and Energy Efficiency

The Housing Authority has been able to finance new energy-efficient lighting through the use of a HUD Public Housing Drug Elimination Grant that is designed to enhance the security of public housing facilities. New security lighting is both brighter and much more energy efficient than the existing lighting system. In this case, security and energy efficiency were compatible objectives. The total amount of the security grant was about $20,000.

The other energy efficiency measures, including new windows and additional insulation, will be financed via the 1998 round of the HUD Comprehensive Grant Programs. The amount of funding allocated for insulation and energy-efficient windows is approximately $120,000.

Project Outcomes

The security lighting system for the housing complex is working well in that the brighter lights are deterring crime while using less energy.

Lessons Learned

- The likelihood that a particular energy-efficiency project will receive funding is increased when the proposed project demonstrates that it will achieve multiple objectives. In this case, the Housing Authority was able to promote energy efficiency and housing security simultaneously with a HUD grant. In other cases, energy-efficiency projects may be able to be tied to transportation grants under TEA-21 or to community redevelopment grants issued by various federal agencies, including the Economic Development Administration and/or Department of Commerce.

Case 12: Knoxville Housing Revitalization Program[22]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Dr. Mark Ternes Oak Ridge National Laboratory E-mail: ternesmp@ornl.gov	Public Housing	About $555,000 for energy efficiency	State of Tennessee
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
Public and Private Grants	116,800 ft^2	Approximately $500 per house per year	Building sealing HVAC technologies Fiberglass Insulation Double pane windows, etc.

Background

Knoxville's Housing Development Corporation (KHDC) and Knox Housing Partnership, Inc. (KHP) are undertaking one of the largest redevelopment projects in the history of Knoxville, Tennessee. The New Horizon Homes project is a joint housing revitalization project involving 146 single-family homes that will have a significant impact on two inner city neighborhoods and dozens of low-income tenant households. The goal of the $6.8 million project is to bring renters into home ownership by providing a pool of quality, affordable housing and assisting families in obtaining below-market rate financing. More than two-thirds of the revitalized homes will be sold to the existing renters or other low-income buyers, with the remainder available for continued rental to current clients.

Partnerships

The redevelopment project became a possibility in April 1998 when the estate of Florence Monday offered to sell the houses to KHDC for $2,920,000 ($20,000 each). KHDC is a subsidiary of Knoxville's Community Development Corporation (KCDC). KCDC is the housing authority and redevelopment agency for Knoxville.

The homes were purchased with funds made available by eight local banks, as well as additional assistance from HUD and the Affordable Housing Trust Fund. The banks also are providing construction loans at a below-market rate of 7%. KCDC and KHP estimate that rehabilitation will average $20,000 to $25,000 for each house.

Financial assistance has come from the city and HOPE 3 grants administered by the U.S. Department of Housing and Urban Development. HOPE 3 programs can provide purchase assistance up to $25,000 per low-income home buyer; $900,000 is available from HOPE 3 grants to provide construction financing and purchase assistance. With city and HOPE 3 grants, every renter interested in buying the unit should qualify for a loan.

[22] This case study was developed by Dr. Mark Ternes, Oak Ridge National Laboratory.

KHP is managing the rehabilitation. KHP is a private, charitable corporation facilitating affordable housing for low-income residents of Knoxville and Knox County. KHP's mission is to provide the opportunity for affordable and desirable housing for all low-income residents of Knoxville and Knox County.

The local Low-Income Weatherization Assistance Program, as administered by the Knoxville/Knox County Community Action Committee (CAC) for the state of Tennessee, is also a partner in the project. CAC's weatherization program will install attic and floor insulation in approximately 100 of the rehabilitated homes. Their participation frees construction funds to be spent on other energy-efficiency measures such as wall insulation and improved house and duct sealing.

The Oak Ridge National Laboratory is also participating in the program to ensure the correct selection and installation of energy-efficiency features. Their participation is sponsored through the U.S. Department of Energy's national housing programs, including the Partnerships for Affordable Housing and the Rebuild America programs.

Energy-Saving Technologies and Alterations

The houses are about 800 ft^2 with two bedrooms and a single bath. They were constructed around 1945. KHP and KHDC recognize that for the renovated houses to be affordable, energy bills must be reduced from their average current level of $1176 per year.

The average rent is currently $285 per month. Once the houses have been renovated and purchased, mortgage payments are expected to be about $400 per month, a significant difference for low-income families. Reductions in the energy bills from energy-efficient changes implemented during the renovation of the houses will help offset the difference between the new mortgage payment and the rental cost occupants are currently paying. With lower energy costs and smaller increases in total housing payments (mortgage plus utilities), it is more likely that a low-income family can secure financing to purchase one of the houses.

Improvements that are made during the rehabilitation include new roofs, vinyl siding, electrical wiring, plumbing, carpeting, flooring, kitchen cabinetry, kitchen and bathroom fixtures, interior wallboard repair or replacement, and interior painting. The energy-efficiency improvements that are expected to dramatically reduce utility costs, as well as make homes more comfortable and durable, will involve new windows, insulation, hot water heaters, and central heating and cooling systems:

- Sealing the house (attic, walls, and crawlspace) in general conformance to the 1995 Model Energy Code (MEC). This includes sealing all major penetrations to the attic and crawlspace, such as penetrations in the top and bottom plates, the attic hatch, and bathtub plumbing. It also includes making the wall finishes (drywall) airtight and properly sealing around new window and door frames.

- Installing insulation in conformance to the 1995 MEC as follows: R-30 fiberglass insulation in the attics; R-13 kraft-paper-faced, fiberglass batt insulation in exterior walls; and R-19 fiberglass batt insulation for the floors (all houses are built on crawlspaces). This includes ensuring thorough and complete insulation coverage of all areas.

- Installing double-pane, low-E, argon-filled, vinyl windows with an overall whole-window U-value of 0.32.

- Installing gas-pack heating systems with AFUEs of 80% or greater to replace wall-mounted, resistance heating units.

- Installing central air-conditioning systems with SEERs of 10 or greater (previously homes had no air conditioner or were cooled by occupant-supplied window units).

- Requiring a duct system where all the ductwork (supplies and returns) are located in the crawlspace rather than the attic and are properly sealed.

- Providing insulation wrap on the water tanks being located in the crawlspaces.

Energy Savings

An analysis of previous energy bills on a sample of the houses indicates that average energy costs are about $1176. A potential energy savings of about $500 per year is estimated from the package of energy-efficiency measures previously described. This savings occurs with the additional benefit of central air conditioning being provided to every home, whereas before most homes had no air conditioning at all.

Financing Methods: Federal Grants and Foundation Assistance

Because funds are limited to directly support energy efficiency, the strategy to date has been to integrate as many energy-efficiency measures as possible into the rehabilitation construction budget of $20,000 to $25,000 per home. About $3700 of the construction budget is directly related to energy improvements. The low-income homeowner will pay for the $3700 cost of the energy retrofits as part of his or her monthly mortgage loan payment. Additionally, about $500 of insulation work is being provided by CAC and the Weatherization Assistance Program that will not have to be paid by the homeowners.

Key Steps

- Develop a comprehensive inventory of private and public financing sources before determining the financial viability of a potential project.

- Use independent appraisers to value properties to get accurate and marketable estimates.

- Arrange a package of public and private financing for purchase and rehabilitation of properties to make a project work.

- Survey the population of potential home purchasers to understand the market and purchasing potential of clients before finalizing the project.

- Accurately determine (do not underestimate) the average rehabilitation costs for each house. Include in these estimates costs for desired energy-efficiency measures and performing these measures correctly.

- Develop a justification for energy-efficiency enhancements in terms of how they will enhance the ability of prospective purchasers to meet financing requirements by lowering utility costs.

- Arrange financial assistance packages for potential homebuyers to help in the home purchasing process.

- Develop a mechanism to ensure that rehabilitation contractors comply with energy-efficiency measure specifications and installation procedures. This should include training as well as construction contracts or specifications that strictly define the scope of work desired.

Lessons Learned

- It is possible to incorporate energy-efficiency retrofits within an overall rehabilitation program to promote the purchase of homes by low-income renters.

- Incorporating energy-efficiency measures into overall rehabilitation program costs for low-income housing increases the potential pool of low-income buyers while promoting energy efficiency.

- Simple verbal guidance to rehabilitation contractors on improved installation procedures for energy-efficiency measures is not sufficient to effect change. Contractors must be provided with extensive training on how to implement measures. Additionally, contracts, specifications, and work write-ups must specify required energy-efficiency enhancements.

- The success of special home buying programs that include energy-efficiency enhancements depends on the ability to establish effective public-private partnerships. Without the involvement of private lenders, federal agencies, foundations, and housing coalitions, the "comprehensive funding packages" necessary to support both home ownership and greater energy efficiency will not be achieved.

- Funding limitations and "ability-to-pay" issues will limit the level of energy efficiency attainable.

➢ *Prioritizing Public Investments in Energy-Efficiency Projects Using Return-on-Investment Criteria*

Over the past ten years, Energy Service Companies (or ESCOs) have become a popular way for local governments to finance energy-efficiency improvements and enhancements. The typical ESCO received compensation for developing, installing, and financing comprehensive energy-efficiency projects that was directly tied to the amount of energy and maintenance costs actually saved. Cities are now beginning to consider using their capital budgets to finance the integration of energy-efficiency technologies and methodologies into new construction projects and building retrofits. Like business, the criteria for investing in a particular project is increasingly the stream of energy savings over a particular time frame. In most cases, the shorter the "pay-back," period the higher the investment priority.

Case 13: The City of Reno: A Comprehensive Business Approach to Investing in Energy-Efficiency Projects[23]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Alice Dray Parsons City of Reno Internal Maintenance Supervisor (702) 334-2240	City Government/Assorted City Facilities	TBD	Rebuild Nevada Rebuild Reno
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
Internal Capital Investment	75 buildings	TBD	Various technologies ranging from daylighting technologies to energy-efficient heating and cooling technologies.

Background

Rather than approach energy projects in an isolated and sequential fashion, the city of Reno, Nevada, has adopted a "modified" business approach to energy-efficiency retrofit projects. This approach involves several key stages:

- First, the city identified a *minimum rate of return* for energy-efficiency investments. The minimum is a 5% rate of return or greater over 20 years.

- Second, the City Maintenance and Engineering Department conducted a comprehensive audit of potential energy conservation projects across the city.

[23] We would like to thank Alice Dray Parsons, city of Reno, for her technical and programmatic insights. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study do not necessarily reflect the views of the city of Reno or Alice Parsons. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

- Third, potential projects in the city's 75 buildings have been prioritized in terms of potential return on investment and length of payback.

- Fourth, projects that meet the minimum return on investment criteria have been assessed in terms of other benefits, including the impact of new energy efficiency technology on quality of public services and the quality of specific working environments.

- Finally, the City Council must approve capital energy-efficiency investment projects.

Energy-Saving Technologies

The comprehensive evaluation of energy conservation measures resulted in a variety of technologies that were consideredby the Reno City Council. These projects include daylighting controls, energy-efficient water heaters and air conditioning units, solar heaters and covers for public pools, low-flow shower heads, and electronic energy management systems. Because of budget limitations only a subset of these technologies will actually be instituted at various public facilities over the next several years.

Energy Savings

Potential energy and cost savings were calculated, including simple payback times for each project. Payback periods range from a few years to over a hundred years. Actual benefits will be monitored by automated monitoring of utility bills for each facility retrofitted and upgraded.

Financing Method: Internal Capital Investment

The city of Reno has taken the following steps in providing internal financing from its capital investment budget:

- Each potential energy conservation project has been evaluated by CES/Way International regarding potential energy savings using a standardized calculation methodology.
- Various financing options have been evaluated, including using financing arranged by the ESCO contractor, using money from third parties such as banks and, of course, financing the project internally.
- A decision was made to finance projects out of the city capital investment budget rather than use alternative financing mechanisms.
- Projects have been prioritized in terms of ability to meet (or exceed) a 5% rate of return, which is equivalent to what the city could earn by putting its money in the bank and getting a 5% interest rate.
- A final list of priority projects has been provided to the City Council for consideration and/or approval.
- Specific measurement and energy savings verification procedures will be implemented to determine energy savings (return on investment).

Project Outcomes

The city of Reno has established a comprehensive, analytical approach to determining priority energy-efficiency investments. Because this approach is in its infancy, it is too soon to determine whether a *return-on-investment* approach to financing energy-efficiency projects is compatible with other considerations such as the need to improve the living environments of city firemen.

Lessons Learned

- It is possible for cities to take a *systems approach* to financing energy-efficiency projects and make explicit trade-offs in terms of expected return on investment.
- Energy efficiency appears compatible with new requirements to "do more with less." Accordingly, City Maintenance and Engineering Department staff view effective energy management as consistent with the tenants of overall good public management. For example, automating energy controls for public buildings may also result in better comfort levels for citizens and public workers as well as long-term energy savings.
- Although ESCOs may not be the preferred method for financing projects in some cases, their technical expertise can still be used to conduct energy studies and analyses for cities and other jurisdictions.

➢ *Direct Borrowing or Self-Financing to Fund Energy-Efficiency Upgrades*

Direct borrowing involves raising money through loans from banks and other financial institutions or through the issuance of bonds. In an era of low interest rates, and in situations where the private borrower has a good credit rating and significant collateral, securing a bank loan may be the easiest way to obtain capital. In such cases, the low-risk borrower may obtain a loan at an interest rate that is actually lower than the rate offered through a state loan program.

In other cases, the capital budgets of the firm may large enough so that energy-efficiency projects can be financed via internal financing mechanism, including annual capital improvement budgets. The trade-off between securing a publicly backed loan versus a bank loan or internal financing is that one avoids the "red-tape" and time delays typically associated with government loan programs. On the other hand, in cases where capital resources are limited and/or the credit risk of the borrower is relatively high, state loan programs may be the only viable alternative.

Case 14: Thriftway Marketplace Store[24]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Curt Nichols Program Manger City of Portland Energy Office Phone (503 823-7419	Retail	750,000k	Rebuild Oregon Portland Partners for Energy Efficiency
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
Utility Rebate Tax Credit Conventional Loan	49,000 ft^2	1.3 million kWh/year, thereby saving the company about $65,000 annually	Advance lighting and refrigeration technologies as well as an energy management system

Background

The city of Portland has created the BEST (Businesses for an Environmentally Sustainable Tomorrow) Business Awards Program, which recognizes leadership in four key areas: energy efficiency, water conservation, transportation, and waste reduction. BEST is a collaborative effort of the Portland Energy Office, the Bureau of Environmental Services, the Water Bureau, and other city bureaus. One of the winners for 1998 in the energy-efficiency category was Lamb's Thriftway Marketplace.

The Thriftway Marketplace owners knew their 18-year-old, 27,000-ft^2 building was ready for renovations. Space was insufficient to meet the company's product requirements, and the look of the building was outdated. Consequently, they began to envision a renovation of old space and a 22,000-ft^2 addition. This addition would house a pharmacy, post office, bank branch, video store, floral shop, and wine section. The Thriftway Marketplace owners also decided to incorporate energy-efficiency retrofits as part of the renovation project.

Energy-Saving Technologies

Lights. The owner first proposed to put more efficient bulbs into its existing fixtures. However, a report by an energy consultant showed that tearing out the old lights and the old grid and installing new fixtures would make the remodeling process easier as well as pay for itself in only 18 months.

Refrigeration Improvements. The owners also decided to eliminate 10 of the original 16 refrigeration-related compressors, installed variable-speed drives on the remaining equipment, and created two cooling and freezing loops that serve all the refrigeration equipment in the building.

[24] Technical and engineering information included in this case study was taken directly from a series of case studies featuring BEST Business Award Winners. The City of Portland Energy Office developed these case studies. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study regarding financing strategies do not necessarily reflect the views of the city of Portland. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

Energy Management System. The owners also installed digital controls on the 17 medium- and low-temperature display cases. These control the lights efficiently, and operate anti-sweat heaters that keep the windows from fogging up. New cooler case doors also cut energy losses, preserved food during short power outages and created warmer, more customer-friendly aisles. A new programmable energy management system regulates indoor temperatures and lighting. Finally, the meat cooler insulation was increased to R30.

Energy Savings

The project has resulted in significant savings. The energy savings are approaching about 1.3 million kWh/year, thereby saving the company about $65,000 annually. This saving is the equivalent of selling $2 million dollars per year in additional groceries.

Financing Methods: State Energy Loans and Rebates

- The company developed a close working partnership with the local utility, PGE. PGE recommended an energy consultant that helped the company select the most cost-effective energy equipment options.

- The company followed the standard approach of financing the renovations by pursuing financing from a local banking institution at the market rate. The company's longstanding position in the community and its excellent credit rating were factors that allowed the company to secure commercial financing at a good interest rate.

- The company also sought an Oregon State Business Energy Tax Credit that was equivalent to about 35% of the total $2.1 million spent on new equipment.

- PGE provided a rebate of $50,000 for installing energy-efficient systems.

Project Outcomes

The project received financing for the entire $3.9 million (which included both building and equipment costs). In addition to realizing $65,000 a year in energy savings, the company has realized improved sales (up 40%). Part of the increased sales are the result of efficiency measures that also improved the overall comfort of the store.

Lessons Learned

- Rebates and tax credits are very effective in causing businesses to integrate energy-efficiency technologies in their building renovation plans. Without these incentives, far fewer companies would elect to invest capital in energy-efficiency measures.

- Effective loan and rebate systems can help business owners choose efficiency strategies that result in significant savings rather than "quick-fixes" (e.g., simply replacing bulbs rather than fixtures).

Case 15: The Boeing Company Energy-Efficiency Project[25]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Curt Nichols Program Manager City of Portland Energy Office Phone (503) 823-7419	Manufacturing	$180,000	Rebuild Oregon Portland Partners for Energy Efficiency
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
Internal financing utility rebate	Three- building manufacturing facility	Company has halved annual compressed air system energy use, from 4.5 million to 2.2 million kWh, thereby saving $92,000 a year	Advanced air compressor management system

Background

The city of Portland has created the BEST (Businesses for an Environmentally Sustainable Tomorrow), which features annual awards to local business leaders in four areas: energy efficiency, water conservation, transportation, and waste reduction. One of the winners for 1998 in the energy-efficiency category was Boeing Aircraft Company. An audit of the Boeing Commercial Airplane Group Plant revealed that the plant's air compressors were running at part load much of time, thereby consuming unnecessary energy and also wearing out the compressor equipment too fast. The company decided to modify their system to lower energy costs and lengthen the life of the compressor equipment.

Energy-Saving Technologies

Through the local utility's Process Efficiency Improvements Program, Boeing hired an engineering firm to identify areas that could save significant amounts of energy. The engineering firm focused on Boeing's multiple air compressors. They had five two-stage screw compressors and three two-stage cylinder-reciprocating compressors with a total capacity of 12,000 cfm of air at 115 psig. Each building had one or more cooling towers, and all compressors had load/unload controls and hour meters to record run times. The engineering firm identified the main utility cost problem as energy and air wasted by running compressors at part load.

The proposed solution was to link compressors in the three buildings, so that only two would have to run at all times. To connect the compressors, a large, 8-in.-diameter, 1200-ft-long air line was buried in a precast concrete trench.

[25] Technical and engineering information included in this case study was taken directly from a series of case studies featuring BEST Business Award Winners. The City of Portland Energy Office developed these case studies. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study regarding financing strategies do not necessarily reflect the views of the city of Portland. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

Energy Savings

Boeing now uses just five compressors. Two are base load carriers and run fully loaded; one is for emergency backup. Since the system went on line in 1996, the company has halved annual compressed air system energy use, from 4.5 million to 2.2 million kWh, thereby saving $92,000 a year. The company also benefits from $9500 in equipment depreciation (a tax shelter) and spends $8500 less on maintenance parts and labor each year. The new system has also lengthened equipment life expectancy and delivers uniform air pressures to all sites.

Financing Method: Internal Capital

The financing was provided through internal capital Boeing investment and maintenance accounts. In this regard, potential energy savings and improved operating efficiencies made the project an easy "sell" to company decision-makers.

An additional financing incentive was provided by the local utility. The $180,000 cost of the project was partially financed through a $40,000 PGE rebate. The simple payback from the project was less than 2 years after taking into account both annual energy savings and the utility rebate.

Project Outcomes

The project generated savings at a far higher level than was expected by Boeing building maintenance engineers. In addition, the project significantly improved the overall operating efficiency of the plant. In other words, apart from the energy-efficiency improvement, adding the air system equipment enhancements was a good business management practice.

Lessons Learned

- Although not the primary reason that Boeing made energy-efficiency improvements, utility incentive programs clearly are a powerful inducement for adding new, energy-efficient equipment.

- Although energy savings are an important reason for moving toward new equipment and management systems, the *business case* for investing in new equipment must also be made in terms of how the new equipment purchases will improve operating efficiencies and profitability. In the case of Boeing, the project reduced energy costs and improved the performance of the manufacturing plant by reducing capital equipment purchases, operations and maintenance costs, etc.

➢ *Creative Leasing to Leverage Public Resources*

Leasing rather than buying products is an effective way to leverage limited capital while obtaining tax benefits. In the case of publicly sponsored energy-efficiency projects, however, certain incentive programs such as energy tax credits may not be available. Nevertheless, through creative partnerships with the private sector, the benefits of these programs can still be realized. In the following case study, the city of Portland was able to secure a "negative interest" loan for fuel cell equipment. In this case, the bank purchased the equipment and then leased it to the city at a very favorable money factor rate. In turn, the bank was able to secure a Oregon Energy Tax Credit, part of which was passed on to the city. This symbiotic relationship allowed the bank to make money while the local government was able to secure expensive equipment at a reduced cost.

Case 16: The City of Portland Fuel Cell Power Plant: Using Leases to Finance Energy-Efficiency Projects[26]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Curt Nichols Program Manger City of Portland Energy Office Phone (503 823-7419 Fax: (503) 823-5370	City Government	$1.25 million	Rebuild Oregon Portland Partners for Energy Efficiency
Financing Mechanisms	**Square Footage**	**Energy Savings (Projected or Actual)**	**Technology**
Federal Grants Utility Rebates Tax Credits Leasing	NA	At $0.034 /kWh, the price of fossil/nuclear/Columbia River Hydro power, plus demand and facility charge reductions, Portland's Columbia Wastewater Treatment Plant's annual bill is reduced about $51, 675 per year.	200-kW fuel cell

Background

Portland City Council initiated the City Energy Challenge in 1991 to achieve the city's energy goal to save 10% of its energy bill by 2000. As part of this initiative, the city's Bureau of Environmental Services recently investigated a number of options for utilizing the wasted methane produced as a by-product of anaerobic digestion at Portland's Columbia Wastewater Treatment Plant.

The options reviewed included (1) selling the methane to a neighboring industry; (2) constructing a 2.4-MW, combustion-turbine generating facility to produce electricity

[26] Technical and engineering information included in this case study was provided by the City of Portland Energy Office. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study regarding financing strategies do not necessarily reflect the views of the city of Portland. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

and recover the waste heat; (3) scrubbing the gas for sale to Northwest Natural and use in vehicles; and (4) installing a fuel cell that would use the surplus gas to generate electricity. Ultimately, the city decided to construct a fuel cell facility that would produce electricity from the methane gas. To finance the project, the city of Portland was able to take advantage of the Oregon Business Energy Tax Credit through an innovative leasing arrangement with a regional bank. Rather than pay interest on the leased equipment, the city actually was able to pay back less than it borrowed while the bank benefited from the tax credit.

Energy-Saving Technologies

The city of Portland elected to construct a 200-kW fuel cell that is designed to use 20% of the surplus methane gas to produce 1.5 million kilowatt-hours per year of renewable power. The fuel cell uses "reverse electrolysis," where hydrogen combines with oxygen in the presence of an electrolyte to make electricity and two by-products: heat and water. The methane gas from which the hydrogen fuel is produced is the product of anaerobic digestion at Portland's Columbia Wastewater Treatment Plant. Of the 1 million cubic feet of methane gas produced on an average day, 38% is used by the fuel cell, 16% is used in buildings, 16% is sold to a local roofing company, and 30% is considered surplus. The surplus methane is burned at a high temperature (flared) to minimize air emissions.

Energy Savings

The single 200-kW fuel cell is estimated to generate 1,500,000 kWh/year. At $0.045 /kWh, the price of fossil/nuclear/Columbia River Hydro power, plus demand and facility charge reductions, Portland Columbia Wastewater Treatment Plant's annual bill is reduced about $67,500 per year. It should also be noted that the fuel cell must be overhauled in year 6 and year 13; consequently, a $20K per year overhaul expense is budgeted. There are also costs associated with the anerobic digester gas, which must be pretreated to remove sulfur and halides. The cost to scrub these impurities will range from $8000 to $12,000 per year.

Financing Method: Using Leasing to Receive the Benefits of Tax Credits

The city of Portland has pursued financing for the $1.25 million project from several sources:

- It secured a $200,000 per unit subsidy through the U.S. Department of Defense. This subsidy was established to promote further development of fuel cells.

- It obtained $13,795 in engineering and design services from the Oregon Office of Energy.

- It received a $247,801 renewable energy payment from Portland General Electric (PGE) to support the development of renewable energy generation. This payment was

actually a "repayment" of funds the city had paid PGE to encourage "Green Power" development.

However, the most innovative approach by the city has been to use the Oregon Business Energy Tax Credit (BETC) to finance the project. The BETC is designed to encourage investments in energy conservation, recycling, renewable energy resources, and less-polluting transportation fuels. The tax credit is 35% of eligible project costs—the incremental cost of the system or equipment that is beyond standard practice. Recipients take the credit over 5 years: 10% in the first and second years and 5% each year thereafter. If the full tax credit cannot be used each year, the unused credit can be carried forward up to 3 years. The eligible cost for a single project may not exceed $2 million.[27]

Generally, only trade, business, or rental property owners who pay taxes for a business site in Oregon are eligible for the tax credit. The business, its partners, or its shareholders may use the credit. The applicant must own or be the contract buyer of the project. The business must use the equipment for the project or lease it for use at another site in Oregon.

In this case, the city of Portland was able to take advantage of the tax credit via an innovative arrangement with Western Bank. The project's equipment costs were financed as a taxable lease through the bank. In this regard, the bank purchased the fuel-cell equipment and then leased the equipment to the city. The bank secured a tax credit for equipment purchases that allowed it to pass part of the tax credit benefit to the city as reduced interest on the leased equipment over the period of the lease. The city will repay $48,162 less than what is borrowed (about $770,000)— effectively a negative interest rate of about 2.4%. The additional avoided interest cost (if the project had financed at 6%) is $183,490.[28]

Project Outcomes

Although the amount of CO_2 originating from the digester gas that is released locally is unchanged, significant CO_2 reductions (about 736 tons) do occur on a regional basis as Portland's fuel cell lowers the amount of power generated by utilities for the Pacific Northwest power grid. Waste heat generated by the process is also suitable for reuse on-site, mostly in the digesters that assist the methane-generation process.

Lessons Learned

- Through creative arrangements with the private sector, the public sector can take advantage of energy tax credit programs that are designed primarily with the private sector in mind. The Business Energy Tax Credit allowed the bank to make a healthy rate of return (reportedly above typical rates for loans to public entities) while passing benefits on to the city by way of a negative interest rate.

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[27] Oregon Office of Energy, Oregon Business Energy Tax Credit (Brochure),
[28] Portland City Fact Sheet, *Hydrogen Fuel Cells: A Solution for Utilizing Waste Methane at Columbia Waste Water Treatment Plant* (July 23, 1998).

- The combination of a local, state, and federal partnership with private-sector involvement is a powerful team for securing a portfolio of creative financing sources of innovative renewable energy projects.

- Anaerobic digester gas is a valuable energy resource that can be used to generate clean, renewable energy.

➢ *Issuing Bonds to Finance Energy-Efficient Schools*

The issuing of bonds to finance energy-efficiency projects may not be feasible because the bonding authority of a particular public entity may be limited or there may be other higher-priority projects. For example, energy-efficiency enhancements may be outweighed by the more immediate need to replace a school that has been destroyed by fire or to build new schools in situations where there is severe crowding. Under these conditions, school district authorities rationally elect to solve the immediate problem rather than invest in projects that are good but not immediately critical to the school district.

As the Deana Boer School Case Study illustrates, however, it is sometimes possible to integrate energy projects into new school construction projects in a manner that does not increase the costs of the construction project nor the bonds that have to be issued to finance the project.

Other times, the reduction in energy costs from installing energy-efficient equipment (e.g., ground-source heat pumps) may be significant enough to justify entering into the bond market to finance the purchase and installation of new equipment. Financing the introduction of new vertical-well, geothermal heat pumps in Lincoln, Nebraska, schools through general obligation bonds is a case in point.

Case 17: The Dena Boer Elementary School, Salida California[29]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Pacific Energy Center (415) 973-7206	Schools	Investment is part of overall construction budget	State of California
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
General obligation bonds	47,000 ft^2	Minimum projected annual energy savings are 1.85 kWh/ft^2-year or approximately $9000 per year	Daylighting features designed into building

Background

The Dena Boer Elementary School in Salida, California was designed and constructed with a priority placed on creating pleasant interior spaces. Daylighting was used throughout the entire 47,000-ft^2 facility. The design incorporates deep overhangs at vertical windows and advanced prismatic skylights that provide balanced high-quality light and a good learning environment for students. Built in 1997, the school operates on a year-round schedule.

This success story is significant in that it illustrates how architectural/engineering firms can facilitate the integration of energy-efficiency features into schools through the normal design process.

Energy-Saving Technologies

Daylighting features at the Dena Boer Elementary School include

Skylight Glazing

Each skylight is triple-glazed with a prismatic, spectrally selective, acrylic material. Prisms refract light throughout the room, eliminating direct beam sunlight and visual "hot spots." Spectrally selective glazing allows much of the available light to pass through the

[29] Technical and engineering information included in this case study was taken directly from a *Daylighting Initiative* fact sheet developed by Pacific Gas and Electric Company (1998) entitled "Getting Brighter at Dena Boer Elementary School." Copies of the PG&E fact sheet can be obtained from PG&E's Pacific Energy Center, San Francisco California: www.pge.com/pec/daylight – or (415) 973-7206. The Rebuild America Program would like to thank both Mr. Peter Turnbull (PG&E Food Service Technology Center, San Ramon, California) and Mr. Tor E. Allen (PG&E –Pacific Energy Center, San Francisco, California) for the technical information supplied for this project. In addition, Mr. Kenneth Kaestner (Kenneth Kaestner and Associates) was very helpful in sharing his insights regarding the financing of daylighting initiatives at the school district level. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study do not necessarily reflect the views of PG&E, Mr. Kaestner, or Dena Boer Elementary School. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

skylight into the building interior. It also rejects most ultraviolet and long-wave radiation that produces heat but no visible light.

Skylights

Skylights distribute daylight throughout the building, including classrooms, the library, a multipurpose room, and offices. A typical classroom is lit by four 4 × 4 ft skylights set 12 ft apart on center with a well height of 17 ft. The perimeter ceiling is 12 ft. Skylight wells are splayed to reduce glare and help distribute daylight. High-efficiency fluorescent lights—T-8s with electronic ballasts—are recessed in the horizontal ceiling bands between the skylight wells; wall sconces are placed strategically along the perimeter.

Louvers

Louvers installed at the top of skylight wells are controlled from an electronic wall switch so that occupants can modulate daylight levels and darken rooms as needed.

Overhangs

Classrooms, the library, and many offices receive sidelight in addition to top light from skylights. Deep overhangs at the vertical windows eliminate direct sunlight and any associated heat gain.

Skylight Venting

In each classroom, one of four skylights can be vented. It is controlled by an electronic wall switch. In conjunction with the operable windows at the building's edge, this offers the opportunity to cool the space using natural ventilation during warm periods in spring and fall.

Energy Savings

Energy savings at the school depend on user behavior, requiring electric lights to be turned off when adequate daylight is available. The addition of dimmable electronic ballasts and a photocell-based control system offers a potential for energy savings that can be easily documented. Minimum projected annual energy savings are 1.85 kWh/ft^2/year or approximately $9000.

Financing Method: The Creative Use of Capital Budgets

The financing for the Dena Boer Elementary School, including daylighting features, was provided through local general obligation bonds. Currently, the state of California has raised $9.2 billion in bonds that can be used for renovations and remodeling. However, half the costs of renovations must be borne by each school district.

School districts usually select an architecture/engineering firm through a competitive bidding process. The contract is typically awarded to a firm that has a strong track record for ensuring that subcontractors and the overall construction project are finished within budget and schedule.

Kenneth Kaestner and Associates were awarded the contract for the Dena Boer Elementary School. Mr. Kaestner, who is a longstanding advocate for natural lighting in schools, developed a design that emphasized the internal lighting environment of the school rather than external features. This design was presented to the school board. Because the design (1) met the general needs of the school district, (2) was visually appealing, and (3) could be built within the existing budget, it was approved.

Project Outcomes

The natural daylighting system is working well. On a clear day in May 1998, library illumination levels at work surfaces measured an impressive 250 ft-c. With the electric lights turned on, illumination levels rose to 340 ft-c. Daylight alone is capable of providing 100 % of lighting needs during many months of the year.

The Salida school district is looking to implement the same types of daylighting features incorporated in the Dena Boer School at a new middle school.

Lessons Learned

- The financing of energy-efficiency construction projects within school districts currently depends largely on the preferences of the architectural/engineering firm selected to manage the project and the available construction budget.

- If the architectural/engineering firm has a preference for internal daylighting rather than the external aesthetic features of the facility, the design submitted to the school board will reflect a greater emphasis on the internal learning environment. Typically, a particular construction budget for a facility can emphasize either internal energy-efficiency features or external appearance, but not both.

- If school boards want to expand the incorporation of energy-efficiency features within school facilities and if they select their A&Es competitively based on qualifications, they have the opportunity to add criteria to the RFQ that promotes the selection of A&E firms that have both energy-efficiency interests and expertise.

Rapid growth in the number of schools that incorporate innovative energy-efficiency measures depends on a greater awareness on the part of local school boards. The current process is too dependent on the discretionary design preferences of local architects.

Case 18: Geothermal Applications in Lincoln, Nebraska, Public Schools

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Dr. Patrick Hughes Oak Ridge National Laboratory (423) 574-1013	Schools	$18.8 million or $68 per square foot	Rebuild Nebraska
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
General obligation bonds	276,000 ft^2	46.2 $kBtu/ft^2$ per school per year on average	Geothermal Heat Pumps

Background

Currently, there are over 400 installations of geothermal heat pump (GHPs) systems located at public school facilities across the nation. Vertical-well, ground-source GHP systems were installed at four new elementary schools located in Lincoln, Nebraska, in 1995. The schools have identical floor plans, each with 69,000 ft^2 of area dedicated to classrooms, offices, meeting rooms, a cafeteria, and a gymnasium. Approximately 500 students attend each school. The performance of these installations is well documented by electric and gas utility data and energy system data. Additionally, the situation at Lincoln is unique in that the district maintains records on facility design, energy performance, and maintenance activities for all facilities within the district.

Energy-Saving Technologies

Fifty-four high-efficiency heat pumps of various sizes meet the heating and cooling loads at each of the schools. The schools were designed to meet ASHRAE Standard 62-1989, which calls for at least 15 cfm of fresh air per person. At each school, preconditioned outdoor air is provided to each classroom and office heat pump unit by two nominal 15-ton heat pumps (with two 7.5-ton compressors each) located within a mechanical room. Each large unit operates on 100% outdoor air and feeds this conditioned air into local heat pumps through two central ducts running along the school's main corridors. Additional outdoor air is provided to assembly areas, such as the multipurpose cafeteria and gymnasium, by a nominal 10-ton unit operating on 40% outdoor air and a nominal 4.5-ton unit with 45% outdoor air. In all outdoor air units, preheat is provided by a hot-water coil when ambient temperatures fall below 40°F. Hot water is also supplied to unit heaters located in vestibules and other perimeter and other perimeter areas. Gas-fired boilers produce hot water, four per school, each with a capacity of 330,000 Btu/h.

At all four schools, the heat pumps absorb and reject heat through a common loop to a vertical-bore ground heat exchanger consisting of 120 bores arranged in a 12 by 10 pattern with 20-ft spacing. The bores are 240 ft deep, with diameters of 4.25 in. on the lower 220 ft, and 6 in. on the top 20 ft. Fine gravel pack was used to backfill the boreholes to within 10 ft of the surface, at which point a bentonite plug was provided to

prevent groundwater contamination. The fluid in the common loop is aqueous propylene glycol. There are two-way valves at each heat pump and a variable-speed drive on the common loop pump.

Energy Savings

Energy costs per square foot for the four GHP schools are about half that of other comparable schools in the Lincoln District. The data indicates that the GHP schools are exceptionally low energy users. Campbell School is the lowest; only 12% of the schools in the district use less energy per square foot. Even the highest energy user of the four GHP schools, the Maxey School, uses less energy than 70% of the conventional schools on an energy-per-square foot basis.

These numbers are even more impressive when it is considered that most of the schools ranking below the GHP schools cool less than 15% of their total floor area. Only seven schools (including the four GHP schools) air condition 100% of their floor space. The average annual source energy used by each of the four GHP schools is 93.7 kBtu/ft^2. This compares to 139.9 kBtu/ft^2 for the other schools that air condition their entire floor space.

Financing Approach: School District Bonding Authority

The financing of four schools with new vertical-well, geothermal heat pumps and the two new middle schools with conventional air conditioning has come through the issuance of general obligation bonds in 1992 in the amount of $54.5 million. The total project cost for the four elementary schools electing to install ground-source heat pumps was about $18.8 million or $68 per square foot. The HVAC costs for the ground-source heat pump schools, including the vertical borefield, averaged bout $9.45/ft^2.

- The school district issued a general conceptual design that presented the type of facilities that are to be built. The architectural-engineering (A&E) firms involved in the project developed a general facility design based upon the requirements of the school district. The firms then provided the facility design to an engineering firm that developed the estimated costs of installing the vertical-well, geothermal heat pumps. The A&E firm then did a comparison of building and equipment with bonding authority of the school district to ensure that sufficient bonds could be issued to cover the project's costs.

- New bonding authority is affected by the amount of bonds outstanding and willingness of voters to support property tax assessments to underwrite the proposed bonds.

- In this case, the public was willing to provide sufficient bonding authority to support a project that fully met the design and equipment requirements of the district. In fact, there were significant funds left over from the bond issue. These funds were used to purchase furniture and computers for the total of six facilities (four elementary schools and two middle schools).

Project Outcomes

The project has been successful in that the voters approved Lincoln County School District issuing general obligation bonds. The ground-source heat pump systems are providing a comfortable environment with utility costs that are nearly half those of other schools in the district on a per-square-foot basis.

Lessons Learned

- The primary force behind school boards purchasing ground-source heat pumps has been regional equipment installation contractors and manufacturers. They have actively interacted with architectural and engineering firms and also local school boards to demonstrate the energy and cost benefits of ground source heat pumps. Through the persistence of these firms (that has been accompanied by a very good project implementation and technology track record), many Midwest school boards have gradually become proponents of these new technologies.

- The ability to consistently develop bids that are timely, accurate, and within the budget, scope, and scheduling needs of the school board has been critical in gaining acceptance of ground-source heat pumps in schools across the Midwest. The last thing a school board wants to see is a final bid package that is well above original cost expectations. Rigorous and real-time cost projections are key to developing credibility with school officials, the A&Es, contractors, and the community.

- The overall financial health of the school district determines whether they will be able to secure conventional financing at favorable rates. If the school district is highly leveraged, it will not be able to support a bond issuance to fund its capital projects. However, the school district may still be able to move forward using "off balance sheet" financing. This approach will generally involve higher transaction costs and investment risks.

➢ *Leveraging Utility-Based Incentive and Rebates*

As was noted in the introduction, many utility-based incentive programs for energy efficiency have been reduced in scope or simply done away with. Nevertheless, these programs have played an important role in the past in promoting energy-efficiency projects. More important, new utility incentives may be instituted as their continuing importance in a competitive energy environment becomes apparent. At the very minimum, these incentive programs are useful as public relations tools. Again, while the regulatory requirements for rebate and incentive programs have vanished, the demands of succeeding in a dynamic marketplace may encourage the reinstitution of these programs by utilities over time.

The California Automobile Association case study illustrates how a utility incentive program can raise company awareness regarding energy efficiency. In fact, by

subsidizing the incorporation of daylighting features into a new field office building, PG&E actually enhanced the willingness of management to invest internal funds to upgrade other corporate facilities.

The Energy-Efficient McDonald's case study underscores the importance of utility-funded research programs. This demonstration project, for example, allowed McDonald's Corporation to standardize energy efficiency as part of a menu of options available to franchise owners. Now both the franchisees and their respective loaning institutions can be confident that the additional capital required for energy-efficiency upgrades will directly translate into lower utility bills and cost savings. By validating the energy savings associated with various design and equipment upgrades, PG&E and McDonald's Corporation eliminated additional financing risk. The probable future outcome will be that energy-efficiency enhancements will become integral to any financing package offered to McDonald's Restaurant franchisees.

Case 19: California State Automobile Association Energy-Efficient Construction Project[30]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Pacific Energy Center (415) 973-7206	Service Organization	Company investment was less than $100 per square foot.	State of California
Financing Mechanism	**Square Footage/Number of Buildings**	**Energy Savings (Projected or Actual)**	**Technology**
Utility Investment and Internal Financing	15,000-ft^2 office building	Annual lighting energy (kWh) consumption was reduced by 32% compared to a typical office building without daylighting	Various daylighting building design features and energy efficient lighting

Background

In fall of 1994, the California State Automobile Association (CSAA) decided to construct a new district office in Antioch, California. During the process of planning the facility, Dinwiddie Construction Company of San Francisco[31] approached the CSAA with the

[30] Technical and engineering information included in this case study was taken directly from the *Daylighting Initiative* fact sheet developed by Pacific Gas and Electric Company (1998). Copies of the PG&E fact sheet can be obtained from PG&E's Pacific Energy Center, San Francisco California: www.pge.com/pec/daylight – or (415) 973-7206. The Rebuild America Program would like to thank both Mr. Peter Turnbull (PG&E Food Service Technology Center, San Ramon, California) and Mr. Tor E. Allen (PG&E –Pacific Energy Center, San Francisco, California) for the use of the PG&E fact sheet. We would also like to thank Mr. Neil Moy, Facilities Project Manager, the California State Automobile Association, for his insights regarding the financing of energy efficiency technologies. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study do not necessarily reflect the views of PG&E or the California State Automobile Association. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

[31] A design-build contractor specializing in daylighting.

suggestion that the association might want to participate in Pacific Gas and Electric's (PG&E's) ACT^2 Program. The PG&E program encourages the use of innovative energy-efficient technologies and designs within the design and construction industries. The new CSAA facility is one of nine PG&E ACT^2 (Advanced Customer Technology Tests for Maximum Energy Efficiency) demonstration sites that have tested energy-efficient and cost-effective packages of advanced technologies.

The CSAA case study is instructive in several ways: (1) it demonstrates that utility incentive programs can expedite the deployment and commercialization of energy-efficient technologies by decisively changing the cost/benefit parameters management must consider in choosing whether or not to build an energy-efficient building; (2) it suggests that once companies are sensitive to the cost savings of energy technologies, they are far more likely to invest in innovative technologies and facilities across the board; and (3) it underscores the importance of an internal facilities management department taking ownership and championing energy-efficiency technologies and structural designs to management.

Energy-Saving Technologies

The CSAA originally considered a two-story design that was changed to a single-story layout that uses daylight from skylights and perimeter windows as a primary lighting source. The lighting system was redesigned using T-8 and compact fluorescent technology to provide the required luminance of 30–40 foot-candles (ft-c) in the main work areas and 50–60 ft-c from task lights at desks. In this way, the design team developed a lighting system that maximized energy efficiency and provided a good working environment in a cost-effective manner. This was done through the use of physical daylighting models along with DOE-2 energy simulation analysis.

Energy Savings

The daylighting features incorporated into the 15,000-ft^2 office building reduced the need for electrical lighting during normal operating hours, which, in turn, reduced the cooling requirements and allowed the building designers to downsize the heating, ventilation, and air-conditioning system. Extensive monitoring of the building demonstrated that annual lighting energy (kWh) consumption was reduced by 32% compared to a typical office building without daylighting. In addition, the daylighting features save dollars by reducing kilowatt demand and HVAC equipment costs.

Financing Options: Utility-Financed Demonstrations and Internal Financing

The concept of designing an energy-efficient structure was completely foreign to the CSAA, and the PG&E ACT^2 program was a brand new program for the utility. Consequently, proponents of incorporating innovative energy-efficient designs and technologies within the design of a new building faced significant internal and external challenges.

Most important, internal management had to be convinced as to the benefits of the project. The project required that the CSAA completely redesign its facility, which had significant cost implications. The association changed its original two-story design to a one-story design. In turn, this required the facility to take up additional real estate space. Rather than one lot, the redesigned facility required part of a second lot that the association also owned.

Originally, CSAA management was skeptical that the benefits of the new building outweighed the costs of both redesigning the structure and allocating additional real estate to the project. However, the design-build contractor for the proposed building was able to demonstrate that, although the new building would have less total square footage, there would be a significantly higher ratio of working space to total square footage. Specifically, the one-story building would not require space for elevators and a stairwell.

The design-build contractor also brought significant credibility to the table by virtue of its innovative lighting designs for the Getty Museum in Los Angeles. PG&E energy specialists were also able to project significant utility energy savings based upon the addition of energy-efficient equipment and innovative daylighting structural designs. Finally, the provision of equipment by the utility made the project very cost effective. The project would remain within the per-square-foot cost guidelines of the CSAA.

The second challenge facing the CSAA was the multiple rounds of negotiations that were entailed in developing the agreement between the association and the utility. Because of the newness of the ACT^2 program, months of negotiation by lawyers on both sides were required to finalize the agreement. This negotiation process pushed the construction schedule back significantly.

The following summarizes key steps in securing approval of the CSAA project.

- The design-build contractor convinced middle management in the CSAA Real Estate Section of the various benefits and merits of the project.

- The design-build contractor facilitated meetings with both PG&E and CSAA middle management that explored project possibilities and the potential benefits of the project.

- Upper management bought into the system and approved budget for the revised project based upon projected energy savings.

- Management has also implemented energy-efficiency measures in other facilities based upon its experience in building its energy-efficient building in Antioch, California.

Project Outcomes

Projected energy savings have been realized. Moreover, the comfort levels of the building have been very good, with CSAA employees saying that it is a very comfortable facility.

Based upon the energy savings at this facility, the California State Automobile Association became very aware of the potential energy savings in other facilities.

Specifically, the CSAA has upgraded the lighting efficiency of its 75 facilities with T-8 fluorescent fixtures and electronic ballasts.

Lessons Learned

- Design-build contractors can play a very critical role in promoting the financing of energy-efficient buildings and technologies, especially if they have credibility based on past project performance and have a strong working relationship with the local utility. Without the direct support and advocacy of the design/build construction contractor, the California State Automobile Association's upper management would never have bought into the project.

- Utility research and development and rebate programs are a very significant force for moving firms toward energy-efficient designs and technologies. Without the active involvement of PG&E, it is doubtful that the CSAA would have approved the development of an energy-efficient building or the subsequent retrofitting of its 75 facilities across California.

- A critical prerequisite for selling upper management of firms and associations on specific energy projects involving internally financed construction is the ability to stay within guidelines regarding costs per square foot. In this regard, the project did stay within guidelines of $100 per square foot.

- Contract negotiations, especially for innovative projects, can take significantly longer to finalize than traditional (or routine) contracts.

Case 20: Energy-Efficient McDonald's Restaurants Success Story[32]

Summary Table

Contact	Sector/Facility	Approximate Investment	Rebuild Partners
Tony Spata McDonald's Corporation (630) 623-5246	Food Services/Fast Food Restaurant	$22K (approximately)	State of California Department of Energy
Financing Mechanism	**Square Footage**	**Energy Savings (Projected or Actual)**	**Technology**
Utility Sponsorship DOE funding, and Internal Financing	4000 ft^2	Over 7000 kWh per year, or a 34% annual energy savings over a conventional facility	Combination of advanced lighting and cooling technologies

Background

Food service operations use more energy per square foot than any other commercial enterprise. Energy, which typically represents 2 to 6% of restaurant gross sales, is often a lower priority because of the complexity of food service operations and the lack of practical information. However, in an increasingly competitive market, operators are seeking opportunities to further reduce overhead, and energy represents a good candidate.

In designing the Baypoint Restaurant just east of San Francisco, McDonald's Corporation integrated simple, off-the-shelf daylighting technologies as well as HVAC and refrigeration measures to achieve significant energy savings.[33] The project was a collaborative research enterprise involving McDonald's, the franchise owner/operator; the local utility company (PG&E); the U.S. Department of Energy; and several HVAC, fan, lighting, and control manufacturers.

The energy savings documented through this research project (as well as three others across the United States) are providing the technical basis for energy upgrades that McDonald's franchise owners will be able to incorporate into new and existing restaurants. The case is important in that it illustrates how financing of energy-efficient

[32] Technical and engineering information included in this case study was taken directly from the *Daylighting Initiative* fact sheet developed by Pacific Gas and Electric Company (1998) and supplemented by technical information from a technical paper entitled *Designing an Energy Efficient Quick Service Restaurant.* This paper is published in ASHRAE Transactions 1999, Volume 105, Part 1. Copies of the PG&E fact sheet can be obtained from PG&E's Pacific Energy Center, San Francisco California: www.pge.com/pec/daylight – or (415) 973-7206. The Rebuild America Program would like to thank both Mr. Peter Turnbull (PG&E Food Service Technology Center, San Ramon, California) and Mr. Tor E. Allen (PG&E –Pacific Energy Center, San Francisco, California) for the technical information supplied for this project. We would also like to thank Mr. Tony Spata, McDonalds Building Systems Manager, for his insights regarding the financing of energy efficiency initiatives within the food industry. Please note that the opinions, findings, conclusions, or recommendations expressed in this case study do not necessarily reflect the views of PG&E or McDonalds Corporation. They are the sole responsibility of the Department of Energy Rebuild America, Financial Services Program.

[33] The restaurant, located approximately 30 miles east of San Francisco, experiences mild winters and moderate to hot summers with relatively low humidity throughout the year.

technologies may eventually become part of a standard menu of building design upgrades available to prospective food service franchise owners. McDonald's Corporation appears to be establishing a new energy efficiency *paradigm* for the entire food industry that is tailored to both regional climatic conditions and restaurant owner requirements.

Energy-Saving Technologies

The envelope of the Baypoint Restaurant was typical of this style of building except for the advanced glazing that replaced the standard double-pane windows. No modifications were made to exterior walls or roof with regard to construction materials or insulation. The building is approximately 4000 ft^2, including an indoor 1000-ft^2 play area. The following technologies were incorporated into the facility:

- Low-maintenance, once-through evaporative condenser precoolers were installed on the two 7.5-ton DX units serving the dining areas. These lowered refrigerant pressure and reduced required compressor energy.

- Advanced glazing systems to save energy and increase occupant comfort by reducing the amount of solar heat that enters a restaurant through the windows by as much as 50% without dramatically reducing the amount of available daylight. This is achieved using a spectrally selective film that is suspended within the double-paned glazing.

- A once-through evaporative cooler was used to provide conditioning of the indoor play area space.

- A two-speed exhaust fan was used to save energy by reducing the volume of air exhausted by the ventilation hood when the two-sided-type griddle, located under the hood, is operating in a standby mode.

- High-efficiency air conditioners were installed that save energy by cooling the restaurant using less energy than standard air-conditioning units.

- Controllable electronic ballasts with T-8 lamps were used to save energy by dimming the fluorescent fixtures in response to the amount of daylight in the space. Controllable ballasts reduced the daytime lighting load by 50% while remaining completely transparent to the restaurant customers.

- Low-temperature occupancy sensors were installed to save energy in walk-in coolers and freezers. They save energy by automatically turning the lights off in walk-in coolers and freezers when they are unoccupied.

- Tubular skylights (light pipes). Reflective light pipes were used to bring daylight into the restaurant. They are particularly effective in windowless spaces, such as restrooms, kitchens, storerooms, but can also be used to brighten up darker areas of a dining room or improve the lighting quality at the customer service counter.

- Infrared-controlled hand dryers and water valves were installed in the restrooms that save energy by automatically turning the devices off and on.

- CO_2 systems that automatically track occupancy levels and then adjust the amount of outside air admitted and conditioned by the HVAC system were installed in the enclosed play area.

Energy Savings

The energy savings from lighting enhancements alone amounted to over 7000 kWh per year, or a 34 % savings. When compared to a control (baseline) restaurant located a few miles away, the complete energy conservation package installed at the Baypoint restaurant lowered the monthly energy costs by 17 to 37% with annual average savings of 23%.[34] Energy savings were greatest in the summer months, primarily because of the evaporative cooling of the indoor play area.

Summary of estimated savings, estimated installed costs, and payback period for technologies applied at the demonstration restaurant

Technology	Estimated savings	Estimated incremental installed cost ($)	Payback period (year)
Controllable ballasts	702	620	0.9
Low-temperature occupancy sensors	327	340	1.0
Two-speed exhaust fans	230	400	1.7
Energy management system	3,254	12,000	3.7
High-efficiency air conditioning	480	600	1.3
Kitchen evaporative cooling	648	1,200	1.9
Play area evaporative cooling	936	0	0.0
Evaporative precoolers	76	1,000	13.2
Spectrally selective glazing	3950	6,000	1.5
Total Project	10,603	22,160	

Source: *Designing an Energy-Efficient Quick Service Restaurant*, ASHRAE *TRANSACTIONS*, 1999, Volume 105, Part I.

[34] Some of the differences in energy use are attributable to differences in the volume of customers serviced at each location. In this regard, it appears that the control (baseline) restaurant had a higher volume of customers.

Financing Methods: Internal Financing and Utility Support

The steps for obtaining financing for an energy efficient restaurant within the McDonalds Corporation are generally as follows:

1. The prospective franchise owner/operator must pass normal credit worthiness and other business requirements.
2. The prospective franchise owner/operator will then have the option of selecting from a set of preapproved building system upgrades or electing to stay with conventional structural and technology designs. The corporation will also make available performance data for the systems and particularly the levels of energy (and cost) savings that can be expected relative to the investment.
3. The prospective franchise owner/operator will have the option to secure financing of the upgraded building system from a bank or through McDonalds' internal franchise financing system.
4. Projected profitability, credit worthiness, and the impact of energy savings on the ability of the franchise owner to pay off the mortgage loan are normal considerations regarding financing for the incremental costs associated with purchasing an upgraded building system.

Project Outcomes

- Based on the results of the energy-efficient McDonald's projects at four sites (Atlanta, Georgia; San Francisco, California; Bensonville, Illinois; and Colorado Springs, Colorado), McDonald's Corporation will offer a menu of standardized energy-efficient upgrades. This menu of options (tailored to different climatic conditions) will be made available to potential franchisees over the next several years.

Lessons Learned

- Standardizing energy-efficient upgrades as part of a building system package is the most effective way franchisees can implement and achieve significant energy savings. The Energy-Efficient McDonald's Program's suite of tested and approved technologies provides an effective way of securing conventional financing for these technologies and structural improvements. Specifically, franchisees can be confident that the upgrades they select are cost effective and appropriate for their specific climate conditions.

- In addition, loaning institutions do not incur the additional financial risk of underwriting untested technologies with unproven energy and cost savings. Consequently, the chances of securing approval for a loan at a favorable rate of interest are greater than would be the case if every potential franchise owner independently developed and selected a proposed set of energy-efficiency features.

- The McDonald's model could provide an industry-wide template for potential quick-service franchise owners interested in securing financing for energy-efficient technologies

➢ *Summary of Findings and Lessons Learned*

- Sound financial statements, technical proposals, and business plans are a prerequisite to securing funding from both private and public sources.
- Many state loan programs and tax incentives are currently under-used because low interest rates are generally available.
- Bundling of multiple funding sources is critical in an era of reduced funding for energy-efficiency projects.
- State energy loans remain effective ways to leverage privately secured capital investment resources.
- Corporate sponsorship is an effective way of helping to finance *first-of-a-kind* projects that have high visibility.
- Utility rebates and incentives continue have an important role in financing energy projects.
- Conventional bank loans or equity-based loans are currently reasonable alternatives to state energy loans.
- General obligation bonds are often not a viable mechanism for financing energy-efficiency projects because they compete against higher priority projects.
- Validation of energy and cost savings is important for securing private financing of energy-efficiency technologies.
- Energy efficiency enhancements for schools and other facilities can often be incorporated within existing budgets without increasing funding requirements.
- Integrating energy-efficiency enhancements into a low-cost-housing rehabilitation program can actually increase the prospective pool of potential lower-income home buyers.
- Equipment vendors and architectural/engineering firms are often a vital allies in securing financing for energy-efficiency projects at the local level.
- Creative partnerships can enable the public sector to take advantage of financing incentives designed for the private sector and vice versa.
- State energy loan programs remain vital for sectors of the economy that operate on narrow profit margins such as the physical fitness industry.