Energy-Saving Incentives for High-Efficiency Scroll Compressors in Walk-In Coolers

November 2006

Copeland Scroll®

EMERSON™
Climate Technologies

Overview

Objective

The objective of this white paper is to encourage utility companies, consortiums and state governments to implement and promote energy-efficiency incentive programs and policies to restaurants and convenience stores that purchase high-efficiency scroll-compressor refrigeration equipment to reduce on-site electricity demand in the foodservice industry.

In doing so, states and utilities will be rewarded with stronger consumer relationships and reduced energy-production costs, while restaurant/store owners will benefit from reduced operating expenses. Carbon dioxide emissions also will be significantly reduced.

Contents

This paper contains the following topics:

Topic	Page
Executive summary	2
Development of energy-efficiency incentives	3
Incentives for energy-efficient refrigeration equipment	4
Dairy industry's savings with scroll compressors	5
Foodservice industry's potential savings with scroll compressors	8
Why scroll compressors are more energy efficient	12
Reducing carbon dioxide emissions with scroll compressors	13
Role of states, consortiums and utilities in energy-efficiency incentives	15
Conclusion	18
About Emerson Climate Technologies	20
About the authors of this paper	21

Executive summary

Demand for energy-reduction incentives

The production, acquisition and use of energy in the United States are in the forefront of Americans' concerns, as the nation confronts a looming energy crisis. Ways of reducing the demand for electrical energy are gaining visibility and support, due to rising energy costs.

Many states, utilities and consortiums offer attractive financial incentives to businesses that purchase high-efficiency equipment to reduce on-site electricity demand. The opportunity is great for more state governments and utilities to implement energy-efficiency incentive policies and programs that promote rebates, loans, demand-management programs, tax credits, grants, energy audits and energy-monitoring services.

Successful dairy energy incentives

Several years ago the dairy industry capitalized on efficiency incentives by replacing conventional reciprocating compressors with more efficient scroll compressors in the milk-refrigeration process. Dairy farmers received tens of thousands of dollars in incentives to upgrade their equipment. Updated dairy-farm equipment reduced annual energy consumption by millions of dollars in participating states.

Potential foodservice energy savings

By following the lead of the dairy industry, the foodservice industry in 13 states alone could save nearly $100 million annually in energy costs by replacing traditional reciprocating compressors in walk-in coolers with more efficient scroll compressors. Scroll compressors maximize the uptime of walk-in coolers while maintaining the lowest energy consumption, saving on average about $212 (18 percent) in annual energy costs per walk-in cooler.

Potential carbon dioxide reduction

A high-efficiency scroll compressor consumes nearly 20 percent less energy than an equivalent reciprocating compressor. Utilizing scroll compressors would reduce the foodservice industry's carbon dioxide emissions in 13 states by 1.78 billion pounds.

Foodservice energy incentives needed

While foodservice owners can take advantage of some energy incentives, these incentives are not yet on par with those offered to the dairy industry. To maximize savings for energy producers and consumers, more utilities nationwide must develop policies and programs that reward customers for investing in high-efficiency equipment and processes.

More states and utilities should promote incentive-based policies and programs that encourage restaurants and convenience stores to purchase energy-efficient scroll technology for their walk-in coolers. In doing so, states and utilities will be rewarded with stronger consumer relationships and reduced energy-production costs, while restaurant/store owners will benefit from reduced operating expenses.

Development of energy-efficiency incentives

Need to reduce energy demand

The production, acquisition and use of energy in the United States today carry many environmental, social, political and economic implications. These are in the forefront of Americans' concerns as the nation confronts a looming energy crisis. The responsibility falls on all energy consumers to be good stewards of our available energy sources. Not surprisingly, ways of reducing the demand for electrical energy are gaining visibility and support, due to rising energy costs and consequent financial challenges to electrical-energy producers and consumers.

Past focus on petroleum-based energy

For decades considerable attention was focused on improving the efficiency of vehicles, equipment and processes that relied heavily on a strained supply of petroleum-based energy. Simultaneously, attention was directed to the development of alternative sources of electricity – such as solar, wind and water power – with the hope of reducing dependence on petroleum-based power.

In 2000, U.S. consumers and businesses spent more than $600 billion on energy consumption (electricity, natural gas and gasoline). Had the nation not dramatically reduced its energy intensity over the previous 27 years, it could have spent $430 billion more on energy purchases in 2000.[1]

Inconsistent state and utility incentives

Several states, utilities and efficiency-minded consortiums understand the value of reducing energy demand in all areas of society. Many states and utilities promote financial incentives to energy users to encourage energy conservation and efficiency. Some states and utilities do not offer incentives at all. A recent survey reveals that no two states or utilities are alike in their support of efficiency-based incentive policies and programs.

Incentives for energy-efficient refrigeration equipment

Types of incentives

The federal government and many states, utilities and consortiums now offer compelling financial incentives to businesses that purchase high-efficiency refrigeration equipment to reduce on-site electricity demand. Incentives and benefits include:

- Grants and financial assistance to businesses for new construction with high-efficiency equipment
- Rate-reduction credits and tax credits for annual power-usage reductions
- Near-immediate rebates for retrofits with high-efficiency equipment

Working together, they continue to attract more consumers by offering a full array of smart benefits and incentives for investments in energy-efficient equipment, processes and ideas.

Benefits of refrigeration upgrades

Long-range benefits gained from high-efficiency refrigeration upgrades include:

- Reduction of operating costs
- Reduction of greenhouse gases
- Less reliance on out-of-state power sources
- Improved service to utility customers
- Enhanced business opportunities for utilities and equipment manufacturers

High-energy refrigeration users

A substantial amount of electricity is used each year to power refrigeration equipment in:

- Restaurants
- Grocery stores
- Convenience stores
- Fast-food establishments
- Dairy farms

Huge potential foodservice savings

The foodservice industry has the highest rate of energy consumption per square foot, due to its use of specialized, high-energy-consuming equipment, including commercial refrigerators, freezers and walk-ins.[2] Inside restaurants refrigeration accounts for 10 to 16 percent of energy consumption.[3] Inside supermarkets refrigeration accounts for 44 to 62 percent of energy consumption.[4]

It has been reported that 43 trillion British thermal units (BTUs) – or 12.6 billion kilowatt-hours (kWh) – of total energy are consumed annually by refrigeration inside foodservice buildings.[5] At a price of $0.08 per kWh, a 21 percent improvement in refrigeration-equipment energy efficiency would save the foodservice industry nearly $200 million annually.[6]

Current scroll-compressor incentives

Some states offer financial incentives to refrigeration-equipment end-users who reduce electricity demand through the selection and installation of high-efficiency refrigeration components such as scroll compressors. The dairy industry, for example, has embraced and benefited from using scroll-compressor technology in bulk milk refrigeration. The same technology can revolutionize cost savings and performance in the foodservice industry.

Dairy industry's savings with scroll compressors

Background

Several states, utilities and consortiums understand the global benefits of reducing energy consumption. Reducing demand for electricity is important enough to them to market attractive incentives that encourage electricity consumers to curb on-site power usage with improved operational schedules and installation of energy-saving equipment.

The dairy industry capitalized on this opportunity by installing efficient equipment throughout the milk-harvesting process. Several years ago dairy farmers began replacing conventional reciprocating compressors with more efficient scroll compressors. The farmers collected immediate rebates and other financial incentives from local governments, utilities and consortiums to install more efficient technology.

Five states' incentives

Table 1 shows the incentives five states offer to dairy farmers for purchasing high-efficiency scroll compressors for their dairy refrigeration.

Table 1

Scroll-Compressor Incentives

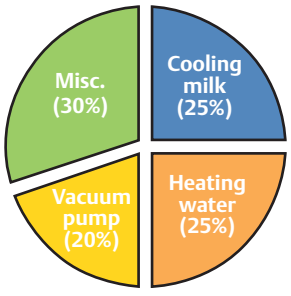
State	Program sponsor	Criteria	Incentive per installed compressor
California	EnSave	Dairy farms: Scroll compressor	$500
Maine	Efficiency Maine	New milkhouse equipment: Scroll compressor (5 & 6HP)	$500
Minnesota	EnSave	Dairy farms: Scroll compressors for bulk tanks	$200
Minnesota	Minnesota Power	Commercial and industrial customers: Scroll compressor	Based on customer power demand and equipment installation
Vermont	Efficiency Vermont	Small commercial refrigeration: New compressor(s) – Discus® or scroll	Discus: 3HP = $375; 10HP = $1,250 Scroll: 2HP = $220; 10HP = $1,100
Wisconsin	Focus on Energy	Dairy farms: Scroll-compressor replacement	$250 (limit two compressors)

Dairy-farm electrical usage

Raw milk must immediately be cooled from 95 degrees Fahrenheit and maintained at 38 degrees Fahrenheit to preserve freshness and quality. As a result, the milk-refrigeration process consumes about 25 percent of total farm electricity usage.[7]

Figure 1

Electricity Usage on a Typical Dairy Farm[7]



Continued on next page

Dairy industry's savings with scroll compressors (continued)

Dairy-farm refrigeration needs

The milk-cooling process requires nearly 12,000 BTUs per hour on a typical dairy farm, as shown in Table 2.

Table 2

Refrigeration Requirements on a Typical Dairy Farm[8, 9]

Number of cows per farm	99
Average daily milk yield per cow	6 gallons
Daily milk harvest per farm	594 gallons
Cooling capacity per gallon milk	482 BTUs
Daily cooling capacity required per farm	286,308 BTUs
Hourly cooling capacity required per farm	11,930 BTUs

Cost comparison: Reciprocating vs. scroll compressors

As shown in Table 3, a refrigeration system with a reciprocating compressor consumes approximately 2.3 kilowatts (kW) of electricity to provide 13,000 BTUs per hour to cool and maintain stored-milk temperatures. At a typical cost of $0.08 per kWh, the average dairy farmer pays $3.28 for every 18 hours spent refrigerating milk (the typical daily demand on a dairy farm).

By replacing traditional reciprocating compressors with scroll compressors, energy consumption can be reduced up to 16 percent for this dairy application. This translates to an annual savings of $193 for a 99-cow farm when a high-efficiency scroll compressor replaces a reciprocating compressor.

Table 3

Typical Dairy-Farm Operational-Cost Comparison

	Reciprocating	Scroll
Cooling capacity	13,000 BTUs/hr.	13,000 BTUs/hr.
Compressor EER	5.7 BTUs/W-hr.[10]	6.8 BTUs/W-hr.
Power consumption	2,281 W	1,912 W
Average price/kWh	$0.08/kWh	$0.08/kWh
Daily operational cost (18 hrs./day)	$3.28	$2.75
Annual operational cost	$1,197	$1,004
		Annual savings with scroll = $193 (16%)

Successful transition to scroll compressors

According to EnSave, "Electricity is the largest single energy expense for dairy operators. At the farm level, dairy farmers used 376 million kWh of electricity, or 600 kWh per year, for a typical cow producing 15,000 pounds of milk annually."[11] Reduction in electricity usage, therefore, is of key importance to dairy farmers and the dairy industry.

The dairy industry's transition to scroll compressors has been very successful. As Focus on Energy explains, "The dairy industry adopted [scroll] in the mid-1990s and the technology now comes standard on most new refrigeration systems....Scroll compressors are about 15 to 20 percent more energy efficient than traditional reciprocating compressors."[12]

Focus on Energy offers dairy farmers a $250 rebate per compressor when a reciprocating compressor is replaced with scroll technology.

Example: One dairy farm's savings

Minnesota Power provides grants, rebates and other energy-efficiency incentives to complement the supply of electricity. The utility company worked with the Dairy Ridge commercial dairy farm to advise on efficiency improvements; it gives the following description of the farm's estimated savings from a scroll compressor.

> This round-the-clock business milks 870 Holsteins, three times a day. It is an energy-intensive operation that uses electricity to run pumps, chill milk, and light and ventilate large milking parlors and barns. "Cost is a big thing," said Mark Buntjer, a partner in Dairy Ridge. "We were looking at updating equipment and called on Minnesota Power to give us advice on energy-efficient options."
>
> Dairy Ridge's changeover to a VFD vacuum pump and scroll compressor qualified the farm for a PowerGrant rebate of $2,136. **The new technology will save the farm an estimated 61,039 kWh per year, or nearly $3,000 in annual energy costs [based on $0.05 per kWh].**
>
> "Our electric bill at Dairy Ridge is very substantial, and the savings will make a big difference," Buntjer added. "In this business, every penny you can save or get back definitely helps."[13]

Foodservice industry's potential savings with scroll compressors

Scroll for walk-in coolers

Walk-in refrigerators and freezers are used in restaurants and convenience stores to preserve food and beverages. Foodservice operators demand reliable equipment and lower energy costs. At the heart of every walk-in is the compressor. Large reciprocating compressors have long been the technology of choice for walk-ins.

Scroll compressors are now available for walk-in refrigerators and freezers, offering an energy-efficient solution to maximize the uptime of walk-in equipment and provide lower energy costs.

Efficiency Vermont, a statewide energy-efficiency utility, explains that "both Discus® and scroll compressors save greater amounts of energy than standard compressors....Consider these when replacing or buying a new compressor."[14]

Savings per walk-in cooler

Scroll compressors reduce walk-in energy-consumption costs up to 20 percent, versus a reciprocating compressor of the same capacity.

According to Heatcraft Worldwide Refrigeration, a leading manufacturer of commercial refrigeration products, energy usage for a 1,217-cubic-foot walk-in cooler with a typical run time of 70 percent is 1,216 kWh per month.[15] Table 4 demonstrates that the foodservice owner will pay approximately $1,168 a year in refrigeration expenses using a reciprocating compressor, based on a typical cost of $0.08 per kWh. A high-efficiency scroll compressor costs only $956 a year in refrigeration expenses, yielding a $212 (18 percent) annual savings per walk-in cooler.

Table 4

Walk-In* Operational-Cost Comparison: Reciprocating vs. Scroll Compressors

	Reciprocating	Scroll
Cooling capacity	11,292 BTUs/hr.	11,292 BTUs/hr.
Compressor EER	4.8 BTUs/W-hr.[16]	5.8 BTUs/W-hr.
Power consumption	2,352 W	1,929 W
Average price/kWh	$0.08/kWh	$0.08/kWh
Daily operational cost (17 hrs./day)	$3.20	$2.62
Annual operational cost	$1,168	$956
*Walk-in volume = 1,217 ft.^{3}	**Annual savings per walk-in cooler with scroll**	**= $212 (18%)**

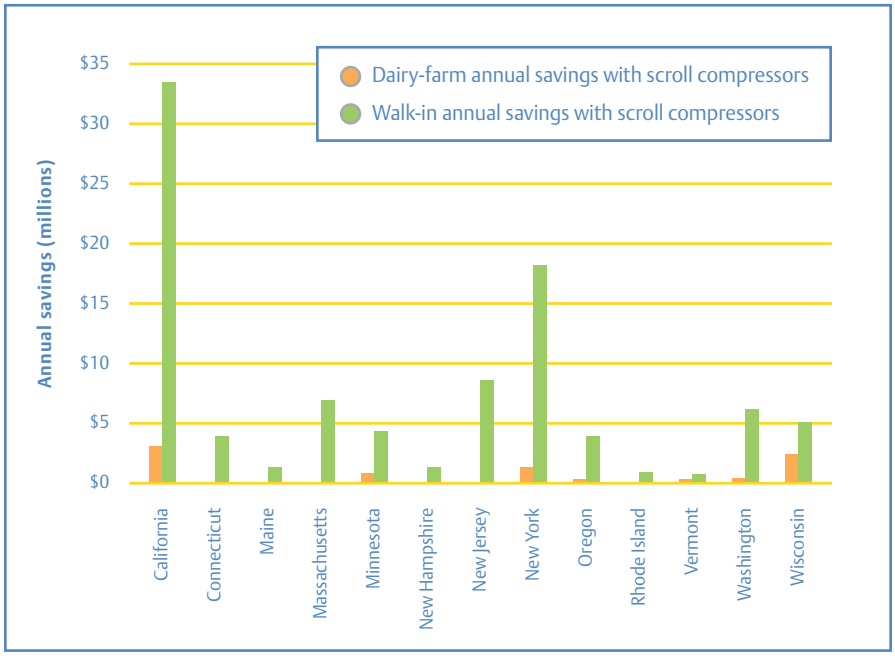
Potential annual savings

In 13 states surveyed, Heatcraft Worldwide Refrigeration estimates that there are 451,476 walk-in refrigerators and freezers installed, consuming nearly 6.6 billion kWh of energy annually.

The annual savings of $212 per walk-in cooler with a scroll compressor translates to a potential annual savings to the foodservice industry of $95 million, just for the 13 states shown in the graph in Figure 2.

Figure 2

Energy-Savings Comparison: Dairy Farms vs. Foodservice Walk-Ins



Continued on next page

Foodservice industry's potential savings with scroll compressors (continued)

Foodservice vs. dairy energy usage

As shown in Table 5, foodservice refrigeration consumes 10 times more energy than dairy-farm refrigeration in the 13 states surveyed by Heatcraft Worldwide Refrigeration.

Table 5

Energy-Usage Comparison: Dairy Farms vs. Foodservice Walk-Ins [17, 18]

State	Number		Refrigeration energy usage (kWh per year)
California	Dairy farms	2,793	246,703,800
	Walk-ins	159,282	2,325,081,166
Connecticut	Dairy farms	310	3,480,450
	Walk-ins	18,063	263,670,353
Maine	Dairy farms	556	5,344,950
	Walk-ins	6,787	99,071,621
Massachusetts	Dairy farms	380	3,162,750
	Walk-ins	33,313	486,278,606
Minnesota	Dairy farms	6,474	71,737,200
	Walk-ins	20,574	300,324,079
New Hampshire	Dairy farms	255	2,620,050
	Walk-ins	6,335	92,473,658
New Jersey	Dairy farms	136	1,874,550
	Walk-ins	40,740	594,692,474
New York	Dairy farms	7,388	100,500,450
	Walk-ins	85,918	1,254,167,599
Oregon	Dairy farms	1,133	17,463,450
	Walk-ins	18,164	265,144,676
Rhode Island	Dairy farms	43	274,200
	Walk-ins	5,628	82,153,393
Vermont	Dairy farms	1,508	22,593,900
	Walk-ins	3,288	47,995,799
Washington	Dairy farms	1,208	37,012,950
	Walk-ins	29,486	430,414,882
Wisconsin	Dairy farms	16,886	186,497,250
	Walk-ins	23,898	348,845,379
Total	**Dairy farms**	**39,070**	**699,265,950**
	Walk-ins	**451,476**	**6,590,313,685**

Benefits from scroll incentives

Considering the foodservice industry's narrow margins, financial incentives to install high-efficiency compressors cannot be ignored. Using the success the dairy industry has seen with energy-efficient scroll compressors, states and utilities also will benefit by encouraging the installation of high-efficiency compressors in refrigerated walk-ins.

More states and utilities should promote incentive-based policies and programs that encourage restaurants and convenience stores to purchase scroll technology. In doing so, the states and utilities will be rewarded with stronger consumer relationships and reduced average operational costs, while the store owners will also benefit from lower operating costs.

Example: Vermont scroll incentives

Efficiency Vermont offers rebates for installing scroll compressors in walk-in coolers – from $220 for a two-horsepower scroll compressor to $1,100 for a 10-horsepower scroll compressor.

Why scroll compressors are more energy efficient

Background

Since scroll-compression technology was perfected in the mid-1980s, scroll compressors have steadily gained prominence in one- to 50-horsepower applications that traditionally use reciprocating compressors. Common applications include refrigeration, air conditioning, natural gas, biogas and air compression.

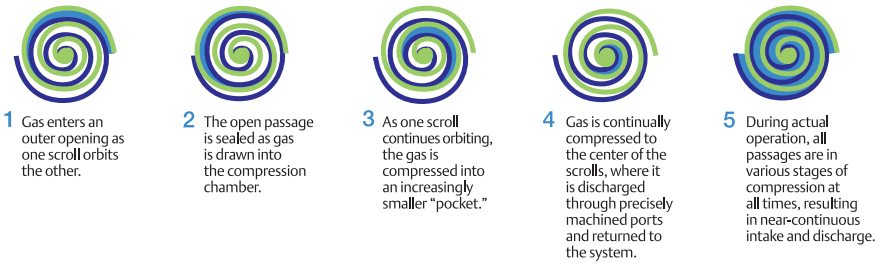
Energy-efficient design

Because there are no pistons to compress gas, scroll compressors achieve 100 percent volumetric efficiency, which provides reduced energy costs in many applications.

During operation centrifugal force maintains nearly continuous compression and constant, leak-free contact (see Figure 3). Separation of suction and discharge gases reduces heat-transfer loss.

Figure 3

Scroll-Compressor Operation



Scroll vs. reciprocating designs

The simple, straightforward design of scroll compressors makes them inherently more efficient than traditional reciprocating compressors.

Reciprocating compressors

- Re-expansion losses typically occur with each piston stroke.
- Losses occur at suction valves.

Scroll compressors

- There are no pistons, so loss is eliminated.
- There are no suction valves, so loss is eliminated.

Types of refrigeration applications

Scroll compressors can be used in refrigeration applications that include:

- Transport
- Bulk-milk refrigeration
- Walk-in coolers
- Scientific/medical labs
- Cryogenics
- Industrial chillers
- Environmental rooms

More information

To learn more about how a scroll compressor works, visit **EmersonClimate.com/energy.htm**.

Reducing carbon dioxide emissions with scroll compressors

Carbon dioxide production

Carbon dioxide is produced primarily by the combustion of fossil fuels during the generation of energy in order to power transportation and create electricity. More than 22 billion tons of carbon dioxide are produced worldwide each year.[19]

How incentives reduce emissions

Energy-efficiency programs encouraging the use of scroll compressors in walk-in coolers for the foodservice industry can greatly reduce carbon dioxide emissions, a contributor to greenhouse gas. Energy-efficient refrigeration equipment reduces energy consumption, which, in turn, reduces energy-related carbon dioxide emissions.

Potential dairy-emissions reduction

A survey of 13 states (California, Connecticut, Maine, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Oregon, Rhode Island, Vermont, Washington and Wisconsin) shows that the dairy industry uses 700 million kWh of energy annually (see Table 5). To equate energy usage to carbon dioxide emissions, one kWh generates 1.35 pounds of carbon dioxide. In the 13 states surveyed, the dairy industry contributes 944 million pounds of carbon dioxide annually.

Scroll compressors can reduce energy consumption by 20 percent, compared to reciprocating compressors. **If scroll compressors were utilized in the surveyed states, the dairy industry would save annually nearly 140 million kWh, reducing emissions by 189 million pounds of carbon dioxide.**

Note: At the average price of $0.08 per kWh, the dairy industry surveyed could save $11.2 million annually on its refrigeration energy costs.

Potential foodservice-emissions reduction

In a survey of the same 13 states, walk-ins in the foodservice industry use nearly 6.6 billion kWh of energy annually, more than nine times the amount used by the dairy industry (see Table 5). The 13 surveyed states contribute 8.9 billion pounds of carbon dioxide to the atmosphere through walk-in refrigeration coolers.

Utilizing scroll compressors would reduce the sampled foodservice industry's carbon dioxide emissions by 1.78 billion pounds.

Note: At the average price of $0.08 per kWh, the 13 states surveyed could save nearly $100 million a year on refrigeration energy costs.

Continued on next page

Reducing carbon dioxide emissions with scroll compressors (continued)

Annual foodservice emissions

The 6.6 billion kWh used by the foodservice industry in the 13 surveyed states produce 4.4 million tons of carbon dioxide. That is equal to the carbon dioxide emissions of 523,348 cars, as shown in Table 6.

Table 6

Annual Foodservice Refrigeration CO_2 Emissions

State	Total annual restaurant and convenience-store refrigeration energy usage (kWh)	CO_2 generated (tons)	Equivalent number of cars on road
California	2,325,081,166	1,569,430	184,639
Connecticut	263,670,353	177,977	20,938
Maine	99,071,621	66,873	7,867
Massachusetts	486,278,606	328,238	38,616
Minnesota	300,324,079	202,719	23,849
New Hampshire	92,473,658	62,420	7,344
New Jersey	594,692,474	401,417	47,226
New York	1,254,167,599	846,563	99,596
Oregon	265,144,676	178,973	21,056
Rhode Island	82,153,393	55,454	6,524
Vermont	47,995,799	32,397	3,811
Washington	430,414,882	290,530	34,180
Wisconsin	348,845,379	235,471	27,702
Total	**6,590,313,685**	**4,448,462**	**523,348**

Role of states, consortiums and utilities in energy-efficiency incentives

Purpose of energy incentives

The benefits of reducing energy consumption are well understood by most states, utilities and efficiency-minded consortiums. They are the cornerstone of successful energy-efficiency incentive programs nationwide. Energy-efficiency policies and programs equip states and utilities with more control of electricity generation and distribution, assuring better stability and security of power to citizens. Financial incentives and services reduce energy demand and production costs while improving the bottom line of businesses, industries, utilities and agricultural operations.

California campaign

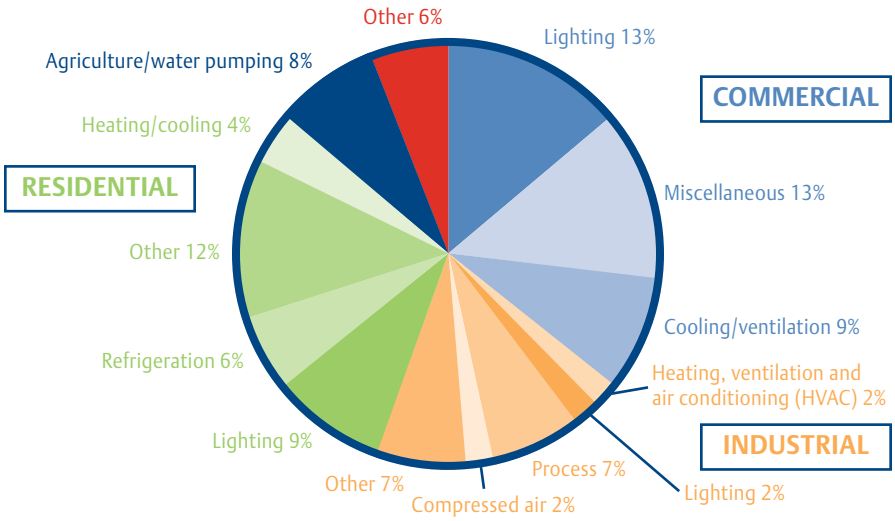
California frequently leads the country with new technologies and stronger environmental standards. In early 2001, difficult conditions backed the state into a dark corner of electrical "brownouts" and "blackouts." Power was uncontrollably intermittent. Since that time California has changed policies and ramped up programs to make energy efficiency a matter of good business and responsible environmental stewardship.

California established Flex Your Power in 2001 as the statewide energy-efficiency marketing and outreach campaign. Flex Your Power is a partnership of government agencies, the Public Utilities Commission, businesses and institutions working to save energy by offering consumers a variety of efficiency-based benefits and incentives.[20]

In 2002, 35 percent of electricity in California was used in commercial applications, with nine percent dedicated to cooling (see Figure 4). To decrease commercial cooling-power consumption, Flex Your Power works with local utilities to provide financial incentives, which include a $0.14 credit per kWh of electricity saved annually and a $300 rebate per ton for use of high-efficiency compressor systems.[21]

Figure 4

2002 Distribution of Power Consumption in California[22]



Continued on next page

Role of states, consortiums and utilities in energy-efficiency incentives (continued)

Efficiency Maine

Efficiency Maine is "a statewide effort to promote more efficient use of electricity, helping Maine residents and businesses reduce energy costs and improve Maine's environment."[23] In April 2005, Efficiency Maine reported that the 17 million kWh of energy savings achieved over the previous two years would power 2,788 homes for an entire year. Furthermore, having saved 17 million kWh has kept 336 million pounds of carbon dioxide out of the atmosphere, which is the equivalent of taking 7,675 cars off of the road.[24]

Efficiency Maine offers numerous high-efficiency incentives to consumers, including a $500 rebate to dairy farmers purchasing a five- to six-horsepower scroll compressor for their refrigerators (see previous Table 1).

Efficiency Vermont

Efficiency Vermont is Vermont's statewide energy-efficiency utility, helping local businesses reduce energy costs through technical assistance, financial incentives and energy-efficiency improvements. Created by the Vermont Public Service Board and the Vermont state legislature, Efficiency Vermont offers incentives for small commercial refrigeration applications, including rebates from $220 to $1,250 for high-efficiency scroll and Discus compressors.[25]

Benefits to states

As California, Maine and Vermont have shown, state governments that promote efficiency-based incentives will benefit from:

- Making it easy and economical for businesses, industries, utilities and agricultural operations to conduct successful business in the state
- Helping to ensure that the state has stable and reliable electricity service by making the power system less vulnerable to electricity supply shortages[26]
- Enabling citizens to invest their money in more goods and services, because energy efficiency results in lower energy bills
- Being recognized as good environmental stewards

Energy-efficiency consortiums

Energy-efficiency consortiums like EnSave and Focus on Energy utilize strong relationships with state governments, public-utilities commissions and local utilities to provide loans, grants, rebates, audits, design assistance and other services that simplify investment in proven energy-saving technologies in many applications, including commercial refrigeration.

To date, EnSave efficiency programs have saved nearly $30 million for farmers in 10 states. EnSave offers a $500 rebate to California dairy farmers and a $200 rebate to Minnesota dairy farmers for installation of a scroll compressor in the milk-refrigeration process.

Focus on Energy programs have saved Wisconsin energy users over $11.5 million since its inception in 2001. Focus on Energy offers Wisconsin dairy farmers a $250 rebate for installation of a scroll compressor.

Local utilities' programs

Local utilities are well positioned to reach customers with valuable energy-saving measures. Increasing fuel costs and competition are forcing many utilities to promote incentive programs that strengthen customer relationships to retain the existing consumer base; yet not all utilities provide efficiency incentives.

To maximize savings for energy producers and consumers, more utilities nationwide must develop policies and programs that reward customers for investing in high-efficiency equipment and processes.

Conclusion

Energy conservation vs. efficiency

Energy conservation promotes behavioral changes to save energy.

Energy efficiency actively seeks to develop and apply new and improved technologies into equipment and processes to minimize energy consumption, while maximizing equipment output.[27]

Effects of energy efficiency

Energy-efficiency improvements have a ripple effect through all segments of society:

- A penny saved is a penny earned – Money saved on energy bills or earned through rebate programs can be applied directly to the bottom line or reinvested.
- Community support – States, utilities and consortiums offering loans and grants for the installation of high-efficiency equipment are allowing residents and businesses to take advantage of cost-saving technologies.
- Energy security – States and utilities that maintain control over the generation and distribution of electricity provide more reliable and cost-effective power to residents and businesses.
- Good environmental stewardship – Promoters and users of energy-efficiency policies, processes and equipment support a healthier environment by reducing greenhouse gases like carbon dioxide, sulfur dioxide and nitrous oxide.

How incentives benefit states and utilities

State governments and utilities benefit from establishing policies and programs that reward businesses for installation of energy-efficient equipment like scroll compressors in new or existing installations.

Rebates, loans, demand-management programs, tax credits, grants, energy audits and energy-monitoring services make it easy and economical for businesses, industries, utilities and agricultural operations to conduct successful business in the state. This is especially true of companies that are considering building new facilities in a service area in which they have the option of choosing their electric service provider.

How incentives benefit society

Energy-efficiency policies and programs equip states and utilities with more control of electricity generation and distribution, assuring better stability and security of power to citizens.

Reduced average electric demand enables utilities to supply more customers with lower operational and maintenance costs on average. Lower electric bills allow consumers to save or reinvest money.

Energy efficiency ensures a brighter, more environmentally conscious future, with the reduction of greenhouse gases and other atmospheric contaminants.

Potential foodservice savings with scroll

Many foodservice operators rely on walk-ins built with refrigeration compressors to meet their needs. A recent survey reveals that there are almost 500,000 walk-in coolers/freezers installed in 13 states. With an average energy usage of 1,216 kWh per month, at a typical cost of $0.08 per kWh, the walk-in owner will pay approximately $1,168 a year in refrigeration expenses.

At this rate a 21 percent efficiency increase gained by switching from reciprocating compressors to scroll-compressor technology would save an estimated $95 million a year in these 13 states.

Need for foodservice scroll incentives

States, utilities and consortiums should develop policies and programs to encourage the use of scroll compressors in walk-in refrigeration units. Scroll compressors could provide a significant cost savings for the foodservice market.

About Emerson Climate Technologies

HVACR solutions leader

Emerson Climate Technologies, a business of Emerson, is the world's leading provider of heating, ventilation, air conditioning and refrigeration solutions for residential, industrial and commercial applications. The group combines best-in-class technology with proven engineering, design, distribution, educational and monitoring services to provide customized, integrated climate-control solutions for customers worldwide.

Emerson® brands

Emerson Climate Technologies' innovative solutions, which include industry-leading brands such as Copeland Scroll, improve human comfort, safeguard food and protect the environment.

Emerson scroll compressors

Emerson Climate Technologies has installed more than 54 million scrolls worldwide, with thousands in refrigeration applications, including:

- Transport
- Bulk-milk refrigeration
- Walk-in coolers
- Scientific/medical labs
- Cryogenics
- Industrial chillers
- Environmental rooms

More information

For more information visit **EmersonClimate.com**.

About the authors of this paper

Harry Moresi

Harry Moresi is a senior engineer of Emerson Climate Technologies' Design Services Network[SM] division. Prior to joining Emerson in 1999, Harry spent 10 years in engineering, operations and procurement for a gas-compression equipment manufacturer and the U.S. Air Force. Harry has a bachelor of mechanical engineering degree from Louisiana State University.

Brian Buynacek

Brian is a graduate of Cornell University and the University of Dayton, with an MBA and degrees in mechanical engineering. He has 15 years of industrial marketing experience, including positions in marketing product management, key account management, and application and manufacturing engineering. Brian is a registered professional engineer in the state of Ohio.

As a senior consultant for Emerson's Design Services Network, Brian has driven more than 50 key marketing and engineering projects in the past five years.

Footnotes

[1] California Flex Your Power, fypower.com

[2] Energy Information Administration, 1995 Commercial Building Energy Consumption Survey

[3] Platts Research & Consulting, Managing Energy Costs in Restaurants, 2002

[4] Platts Research & Consulting, Managing Energy Costs in Grocery Stores, 2002

[5] Waste Reduction Resource Center, wrrc.p2pays.org

[6] Energy Information Administration, eia.doe.gov

[7] University of Wisconsin Madison Report A3784-1, Scott Sanford, 2003, Energy Efficient Dairy Farms

[8] U.S. Department of Agriculture, 2002 Census of Agriculture, www.nass.usda.gov

[9] Focus on Energy Technical Data Sheet "Refrigeration Systems Design, Operations, and Maintenance," focusonenergy.com

[10] Tecumseh Products Company, www.tecumseh.com

[11] Energy Use in Minnesota Agriculture, No. 693, Fall 1998, ensave.com

[12] Focus on Energy Technical Data Sheet "Refrigeration Systems Design, Operations, and Maintenance," focusonenergy.com

[13] Minnesota Power, mnpower.com

[14] Efficiency Vermont, efficiencyvermont.com

[15] Heatcraft Worldwide Refrigeration, Study of the Walk-In Cooler Market

[16] Tecumseh Products Company, www.tecumseh.com

[17] U.S. Department of Agriculture, 2002 Census of Agriculture, www.nass.usda.gov

[18] Heatcraft Worldwide Refrigeration, Study of the Walk-In Cooler Market

[19] sciencedaily.com/releases/2003/05/030509084556.htm

[20] California Flex Your Power, fypower.com

[21] California Flex Your Power, fypower.com

[22] California Flex Your Power, fypower.com

[23] Efficiency Maine, efficiencymaine.com

[24] Efficiency Maine, efficiencymaine.com

[25] Efficiency Vermont, efficiencyvermont.com

[26] California Flex Your Power, fypower.com

[27] California Flex Your Power, fypower.com