Massachusetts Department of Energy Resources

SUMMER COOLING TIPS

Deval L. Patrick
Governor

Timothy P. Murray
Lieutenant Governor

Ian A. Bowles
Secretary, Office of Energy
& Environmental Affairs

Phillip Giudice
Commissioner, Division of Energy Resources

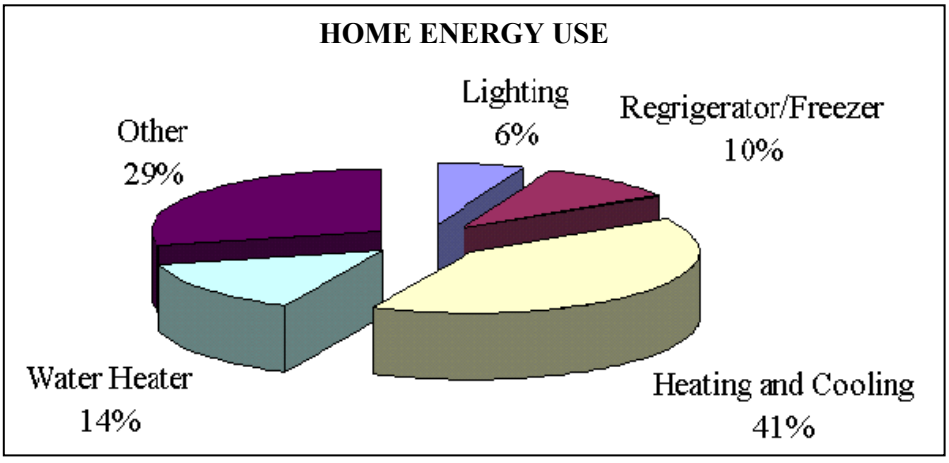
KEEP COOL AND SAVE ENERGY!

EASY WAYS TO CONSERVE

- Remember that light colors reflect heat and dark colors absorb it.
- Close draperies or shades during the day to block the sun especially on windows that face south or west. Open them in the evening to let cool air in.
- Keep cool air in by installing insulation and weather-stripping.
- Turn off lights when not in use. Switch incandescent bulbs to cooler compact fluorescent ones.
- Cook on the grill to keep cooking heat outside. When using the stove, vent cooking heat outside with a range hood.

APPLIANCE USE

- Use a microwave instead of an oven. Microwaves use less than half the power of a conventional oven and cook food in about one-fourth the time. Ovens also heat up the kitchen, making your cooling system and refrigerator work harder.
- Postpone doing laundry and dishwashing until nighttime to avoid peak-electric use hours. Hang laundry outside to dry.
- Use the air-dry feature on dishwashers.
- Service air conditioners annually and be sure the air conditioner is the right size for the area. Change the filter regularly. Choose an air conditioner with the Energy Star label when buying a new one.
- Turn the air conditioner thermostat up to at least 78" or higher or use a programmable thermostat. Close doors to unused rooms. Turn air conditioners off when no one is home.
- Use an attic fan to draw hot air out of the attic. Use a whole-house fan to draw fresh air in through windows and exhaust it out roof vents.
- Use ceiling fans to circulate air



COOLING YOUR HOME NATURAL LY

Keeping cool indoors when it is hot outdoors is sometimes difficult. The sun beating down on our homes causes indoor temperatures to rise to uncomfortable levels. Air conditioning provides some relief. But the initial costs of installing an air conditioner and the electricity costs to run it can be high. In addition, conventional air conditioners use refrigerants made of chlorine compounds, suspected contributors to the depletion of the ozone layer and global warming.

But there are alternatives to air conditioning. This publication provides some common sense suggestions and low-cost retrofit options to help you "keep your cool"—and save electricity.

STAYING COOL

An alternative way to maintain a cool house or reduce air-conditioning use is natural (or passive) cooling. Passive cooling uses nonmechanical methods to maintain a comfortable indoor temperature.

The most effective method to cool your home is to keep the heat from building up in the first place. The primary source of heat buildup (i.e., heat gain) is sunlight absorbed by your house through the roof, walls, and windows. Secondary sources are heat-generating appliances in the home and air leakage.
Specific methods to prevent heat gain include reflecting heat (i.e., sunlight) away from your house, blocking the heat, removing built-up heat, and reducing or eliminating heat-generating sources in your home.

REFLECTING HEAT AWAY

Dull, dark-colored home exteriors absorb 70% to 90% of the radiant energy from the sun that strikes the home's surfaces. Some of this absorbed energy is then transferred into your home by way of conduction, resulting in heat gain. In contrast, light-colored surfaces effectively reflect most of the heat away from your home.

ROOFS

About a third of the unwanted heat that builds up in your home comes in through the roof. This is hard to control with traditional roofing materials. For example, unlike most light-colored surfaces, even white asphalt and fiberglass shingles absorb 70% of the solar radiation.

One good solution is to apply a reflective coating to your existing roof. Two standard roofing coatings are available at your local hardware store or lumber yard. They have both waterproof and reflective properties and are marketed primarily for mobile homes and recreational vehicles.

One coating is white latex that you can apply over many common roofing materials, such as asphalt and fiberglass shingles, tar paper, and metal. Most manufacturers offer a 5-year warranty

A second coating is asphalt based and contains glass fibers and aluminum particles. You can apply it to most metal and asphalt roofs. Because it has a tacky surface, it attracts dust, which reduces its reflectivity somewhat.

Replacing a 10-year-old room air conditioner with a new ENERGY STAR qualified model saves an average of $14 a year on your electric bill.

Another way to reflect heat is to install a radiant barrier on the underside of your roof. A radiant barrier is simply a sheet of aluminum foil with a paper backing. When installed correctly, a radiant barrier can reduce heat gains through your ceiling by about 25%.

Radiant-barrier materials cost between $0.13 per square foot ($1.44 per square meter) for a single-layer product with a kraft-paper backing and $0.30 per square foot ($3.33 per square meter) for a vented multi-layer product with a fiber-reinforced backing. The latter product doubles as insulation.

WALLS

Wall color is not as important as roof color, but it does affect heat gain somewhat. White exterior walls absorb less heat than dark walls. And light, bright walls increase the longevity of siding, particularly on the east, west, and south sides of the house.

WINDOWS

Roughly 40% of the unwanted heat that builds up in your home comes in through windows. Reflective window coatings are one way to reflect heat away from your home. These coatings are plastic sheets treated with dyes or thin layers of metal. Besides keeping your house cooler, these reflective coatings cut glare and reduce fading of furniture, draperies, and carpeting.

Two main types of coatings include sun-control films and combination films**. Sun-control films** are best for warmer climates because they can reflect as much as 80% of the incoming sunlight. Many of these films are tinted, however, and tend to reduce light transmission as much as they reduce heat, thereby darkening the room.

Combination films allow some light into a room but they also let some heat in and prevent interior heat from escaping. These films are best for climates that have both hot and cold seasons. Investigate the different film options carefully to select the film that best meets your needs.

Note: Do not place reflective coatings on south-facing windows if you want to take advantage of heat gain during the winter.

LANDSCAPING

Landscaping is a natural and beautiful way to shade your home and block the sun. A well-placed tree, bush, or vine can deliver effective shade and add to the aesthetic value of your property. When designing your landscaping, use plants native to your area that survive with minimal care.

Deciduous trees that lose their leaves in the fall help cut cooling energy costs the most. When selectively placed around a house, they provide excellent protection from the summer sun and permit winter sunlight to reach and warm your house. The height, growth rate, branch spread, and shape are all factors to consider in choosing a tree. Vines are a quick way to provide shading and cooling. Grown on trellises, vines can shade windows or the whole side of a house. Ask your local nursery which vine is best suited to your climate and needs.

Source List

Ask an Energy Expert
DOE Energy Efficiency and Renewable Energy Clearinghouse (EREC)
P.O. Box 3048
Merrifield, VA 22116
Phone: 1-800-DOE-EREC (1-800-363-3732)
TDD: 1-800-273-2957
Fax: (703) 893-0400
E-mail: doe.erec@nciinc.com
Consumer Energy Information Web site
Energy experts at EREC provide free general and technical information to the public on many topics and technologies pertaining to energy efficiency and renewable energy.

DOE Energy Efficiency and Renewable Energy Network (EREN)
A comprehensive online resource for DOE's energy efficiency and renewable energy information.

American Council for an Energy-Efficient Economy (ACEEE)
1001 Connecticut Avenue, NW, Suite 801
Washington, DC 20036
(202) 429-8873
E-mail: info@aceee.org
ACEEE provides general and technical information on energy efficiency.

American Solar Energy Society (ASES)
2400 Central Avenue, Ste. G-1
Boulder, CO 80301
(303) 443-3130
Fax: (303) 443-3212
E-mail: ases@ases.org
ASES is a professional society that fosters the exchange of information about solar energy technologies.

Besides providing shade, trees and vines create a cool microclimate that dramatically reduces the temperature (by as much as 9° F [5° C]) in the surrounding area. During photosynthesis, large amounts of water vapor escape through the leaves, cooling the passing air. And the generally dark and coarse leaves absorb solar radiation.

You might also consider low ground cover such as grass, small plants, and bushes. A grass-covered lawn is usually 10° F (6° C) cooler than bare ground in the summer. If you are in an arid or semiarid climate, consider native ground covers that require little water. For more information, see *Landscaping for Energy Efficiency*.

SHADING DEVICES

Both exterior and interior shades control heat gain. Exterior shades are generally more effective than interior shades because they block sunlight before it enters windows. When deciding which devices to use and where to use them, consider whether you are willing to open and close them daily or just put them up for the hottest season. You also want to know how they will affect ventilation.

Exterior shading devices include awnings, louvers, shutters, rolling shutters and shades, and solar screens. Awnings are very effective because they block direct sunlight. They are usually made of fabric or metal and are attached above the window and extend down and out. A properly installed awning can reduce heat gain up to 65% on southern windows and 77% on eastern windows. A light-colored awning does double duty by also reflecting sunlight.

Maintaining a gap between the top of the awning and the side of your house helps vent accumulated heat from under a solid-surface awning. If you live in a climate with cold winters, you will want to remove awnings for winter storage, or buy retractable ones, to take advantage of winter heat gain.

The amount of drop (how far down the awning comes) depends on which side of your house the window is on. An east or west window needs a drop of 65% to 75% of the window height. A south-facing window only needs a drop of 45% to 60% for the same amount of shade. A pleasing angle to the eye for mounting an awning is 45 degrees. Make sure the awning does not project into the path of foot traffic unless it is at least 6 feet 8 inches (2 meters) from the ground.

One disadvantage of awnings is that they can block views, particularly on the east and west sides. However, slatted awnings do allow limited viewing through the top parts of windows.

Louvers are attractive because their adjustable slats control the level of sunlight entering your home and, depending on the design, can be adjusted from inside or outside your house. The slats can be vertical or horizontal. Louvers remain fixed and are attached to the exteriors of window frames.

Shutters are movable wooden or metal coverings that, when closed, keep sunlight out. Shutters are either solid or slatted with fixed or adjustable slats. Besides reducing heat gain, they can provide privacy and security.

Source List

Cool Roofing Materials Database
Lawrence Berkeley National Laboratory
The database assists with the selection of roofing materials which reflect, or otherwise reject, the sun's radiant energy, before it penetrates into the interior of the building.

Florida Solar Energy Center (FSEC)
1679 Clearlake Road
Cocoa, FL 32922
(407) 638-1000
Fax: (407) 638-1010
E-mail:
webmaster@fsec.ucf.edu
FSEC is a research and education center that provides technical services and information on passive cooling strategies for hot and humid climates.

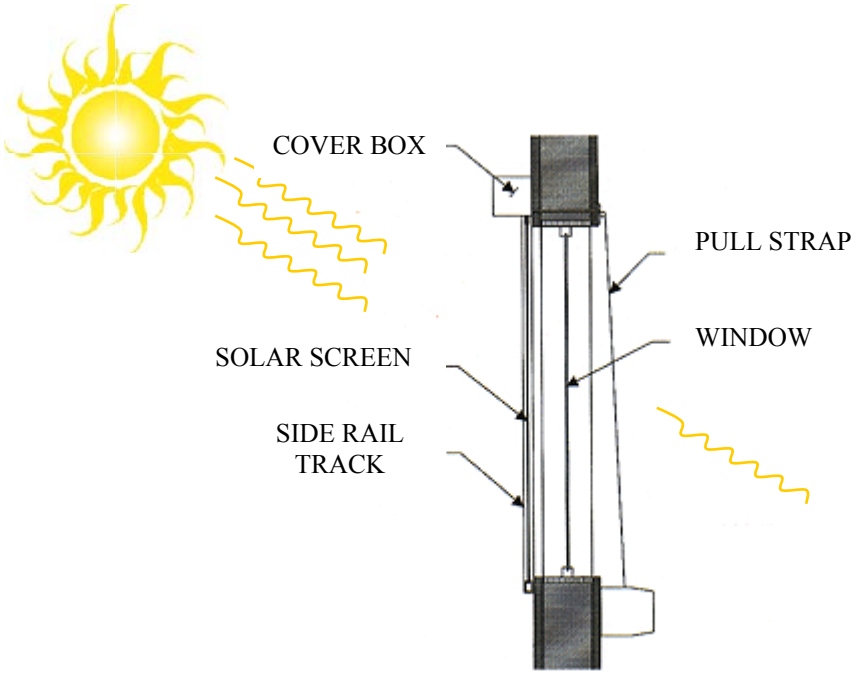
Sustainable Buildings Industry Council (SBIC)
1331 H Street, N.W.
Suite 1000
Washington, DC 20005-4706
(202) 628-7400
Fax: (202) 393-5043
E-mail:
mailto:sbic@sbicouncil.org
SBIC provides practical information on energy-conscious, passive solar design and construction to the U.S. building industry.

On DOE's Consumer Energy Information Web site, there's more information on cooling your home energy efficiently:

Rolling shutters have a series of horizontal slats that run down along a track. **Rolling shades** use a fabric. These are the most expensive shading options, but they work well and can provide security. Many exterior rolling shutters or shades can be conveniently controlled from the inside. One disadvantage is that when fully extended, they block all light.

Although do-it-yourself kits are available, these screens will not last as long as professionally built screens.

Although interior shading is not as effective as exterior shading, it is worthwhile if none of the previously mentioned techniques are possible. There are several ways to block the sun's heat from inside your house.



Solar Screens effectively block 90 to 95% solar heat and 85 to 90% UV radiation.

Solar screens resemble standard window screens except they keep direct sunlight from entering the window, cut glare, and block light without blocking the view or eliminating air flow. They also provide privacy by restricting the view of the interior from outside your house. Solar screens come in a variety of colors and screening materials to compliment any home.

Draperies and curtains made of tightly woven, light-colored, opaque fabrics reflect more of the sun's rays than they let through. The tighter the curtain is against the wall around the window, the better it will prevent heat gain. Two layers of draperies improve the effectiveness of the draperies' insulation when it is either hot or cold outside.

Even if you use air conditioning, many of these strategies, particularly reflecting heat and shading, will help reduce the energy costs of running an air conditioner.

Venetian blinds, although not as effective as draperies, can be adjusted to let in some light and air while reflecting the sun's heat. Some newer blinds are coated with reflective finishes. To be effective, the reflective surfaces must face the outdoors.

Some interior **cellular (honeycombed) shades** also come with reflective mylar coatings. But they block natural light and restrict air flow.

Opaque roller shades are effective when fully drawn but also block light and restrict air flow.

REMOVING BUILT-UP HEAT

Nothing feels better on a hot day than a cool breeze. Encouraging cool air to enter your house forces warm air out, keeping your house comfortably cool. However, this strategy only works when the inside temperature is higher than the outside temperature. Natural ventilation maintains indoor temperatures close to outdoor temperatures and helps remove heat from your home. But only ventilate during the coolest parts of the day or night, and seal off your house from the hot sun and air during the hottest parts of the day.

The climate you live in determines the best ventilation strategy. In areas with cool nights and very hot days, let the night air in to cool your house. A well-insulated house will gain only 1° F (0.6° C) per hour if the outside temperature is 85° to 90° F (29° to 32° C). By the time the interior heats up, the outside air should be cooler and can be allowed indoors.

In climates with daytime breezes, open windows on the side from where the breeze is coming and on the opposite side of the house. Keep interior doors open to encourage whole-house ventilation. If your location lacks consistent breezes, create them by opening windows at the lowest and highest points in your house. This natural "thermosiphoning," or "chimney," effect can be taken a step further by adding a clerestory or a vented skylight.

In hot, humid climates where temperature swings between day and night are small, ventilate when humidity is not excessive. Ventilating your attic greatly reduces the amount of accumulated heat, which eventually works its way into the main part of your house. Ventilated attics are about 30° F (16° C) cooler than unventilated attics. Properly sized and placed louvers and roof vents help prevent moisture buildup and overheating in your attic.

REDUCING HEAT-GENERATING SOURCES

Often-overlooked sources of interior heat gain are lights and household appliances, such as ovens, dishwashers, and dryers.

Because most of the energy that incandescent lamps use is given off as heat, use them only when necessary. Take advantage of daylight to illuminate your house. And consider switching to compact fluorescent lamps. These use about 75% less energy than incandescent lamps, and emit 90% less heat for the same amount of light. For more information, see *Energy-Efficient Lighting*.

Contact your local utility company to see what it offers in the way of rebates and other cost incentives.

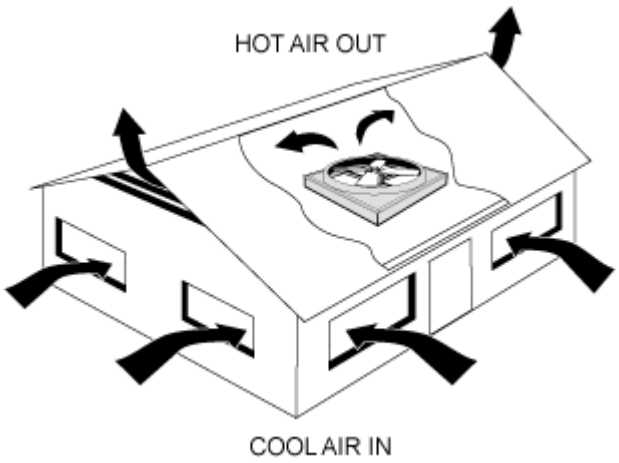
Many household appliances generate a lot of heat. When possible, use them in the morning or late evening when you can better tolerate the extra heat. Consider cooking on an outside barbecue grill or use a microwave oven, which does not generate as much heat and uses less energy than a gas or electric range. Washers, dryers, dishwashers, and water heaters also generate large amounts of heat and humidity. To gain the most benefit, seal off your laundry room and water heater from the rest of the house. New, energy-efficient appliances generate less heat and use less energy. When it is time to purchase new appliances, make sure they are energy efficient. All refrigerators, dishwashers, and dryers display an EnergyGuide label indicating the annual estimated cost for operating the appliance or a standardized energy efficiency ratio. Compare appliances and buy the most efficient models for your needs. For more information, see *A Guide to Making Energy-Smart Purchases*.

SAVING ENERGY

Using any or all of these strategies will help keep you cool. Even if you use air conditioning, many of these strategies, particularly reflecting heat and shading, will help reduce the energy costs of running an air conditioner. However, adopting all of these strategies may not be enough. Sometimes you need to supplement natural cooling with mechanical devices. Fans and evaporative coolers can supplement your cooling strategies and cost less to install and run than air conditioners.

Ceiling fans make you feel cooler. Their effect is equivalent to lowering the air temperature by about 4° F (2° C). Evaporative coolers use about one-fourth the energy of conventional air conditioners but are effective only in dry climates.

Many utility companies offer rebates and other cost incentives when you purchase or install energy-saving products, such as insulation and energy-efficient lighting and appliances. Contact your local utility company to see what it offers in the way of incentives.



In addition to sizing a whole house fan correctly, it is important that ALL penetrations between the attic and living space are sealed and that the attic is properly ventilated. A central hallway, or a stairway in a two-story house, is the most common location.
Source: U.S. DOE

CEILING FANS

Tips for Maximizing Energy Savings

by Chris Calwell
and Noah Horowitz

Ceiling fans are one of the most popular and generally well regarded of all home energy efficiency features. They have a very pragmatic appeal to those who want to cut summer electric bills. At the same time, they offer a decorative alternative to typical light fixtures. So it should come as no surprise that two-thirds of American households now have ceiling fans. Home improvement centers do a brisk and growing business in sales to do-it-yourselfers, and it's not uncommon to find ceiling fans installed by builders in nearly every bedroom and living area in many new homes.

But while ceiling fans can help cut summer energy use, they can also be substantial energy users– depending on how they are used and what kind of lights, if any, are part of the fan package. Because ceiling fan lights are often the brightest, most centrally located, and most conveniently switched fixtures in the room, they get used about three to four hours per day. And, since ceiling lights don't tend to be efficient lights, these light kits actually use more electricity than the fan motors do, even though the fan motors often run for more hours per day.

Ceiling fans distribute cool air, making cooling equipment more efficient.

Based on our own modeling and input from fan manufacturers and utilities, we believe a typical ceiling fan with light kit consumes about 300 kwh/year. ENERGY STAR® labeled models cut that consumption to approximately 120 kwh/year, while providing equal or greater light output and airflow. This means that an ENERGY STAR labeled ceiling fan can save you more energy than an ENERGY STAR labeled refrigerator compared to a typical new model of each! Look for the first ENERGY STAR labeled in Lowe[1]s, Home Depot, and other retail stores in early 2002.***Here are some tips on buying the right fan and using it efficiently.***

COMPARISON-SHOP

The fans with the best blade and motor designs are 3 to 9 times as efficient as the worst models, and are often quieter as well. Look for models with the highest air flow efficiency (CFM/watt) at each of their three speeds. These numbers will appear in a special information box on each ENERGY STAR labeled fan package, and will begin to appear on many standard fan models as well. The ENERGY STAR website (www.energystar.gov) can also help consumers find the names of manufacturers and retailers that sell highly efficient fans.

BUY AN ENERGY-EFFICIENT LIGHT KIT FOR YOUR FAN.

About 80% of the possible savings from a more efficient ceiling fan happen in the lighting. So be sure any new fans you buy contain ENERGY STAR labeled lighting.

ENERGY STAR labeled lighting in most cases will cut your fan¹s total lighting energy use by 60 to 80%, and keep you from changing light bulbs nearly as often.

The designs with built-in ballasts and pin-based fluorescent lamps will probably be more efficient than ones with screw-based compact fluorescents, but both are much better than incandescent lamps. With a bit of searching, you can also find very small (subcompact) fluorescent bulbs to use in your existing fan.

ENERGY STAR labeled lighting in most cases will cut your fan¹s total lighting energy use by 60 to 80%, and keep you from changing light bulbs nearly as often. Remember - multiple low wattage incandescent bulbs generally provide even less light than a single bulb with the same total wattage. For that reason, you may be happier with fans that have a single, central light globe than ones with multiple "stalks" or globes.

FANS ARE FOR PEOPLE, NOT ROOMS.

Room air temperatures are normally 20ºF—30ºF cooler than body temperature. Ceiling fans can improve occupant comfort at a given room temperature by creating a wind-chill effect when they blow relatively cool air across the skin. Because the furniture and the thermostat are already at roughly the same temperature as the room air, they can't "feel" the wind-chill. So when you leave the room, switch the fan and its light off–you'll save energy and money.

FOR EVERY SEASON, TURN, TURN, TURN….

During the summer, a ceiling fan increases comfort by blowing air downward on room occupants. But that same wind-chill can actually feel like a draft in winter, which is why ceiling fan motors should be reversed to blow air upward in winter. This helps disperse the warm air that tends to gather near ceilings, distributing it more evenly throughout the room, especially around the perimeter and near the floor.

Fan direction is normally controlled by a slide switch on the motor housing. Usually, the up position corresponds to upward airflow and the down position to downward airflow. This may be a little inconvenient to reach, but throwing that switch twice a year will pay for itself in improved comfort and energy savings.

It also helps to pay close attention to the downrod length of a fan, particularly in rooms with tall ceilings. Generally speaking, a fan will provide a greater "wind chill" effect if it¹s close to you than if it¹s far away. So if you have a 12 foot ceiling, you¹re better off using a 3 or 4 foot downrod than mounting the fan only 6 inches or a foot down from the ceiling. Fans that mount right next to the ceiling (so-called "hugger" models) are often highly inefficient, since they have difficulty bringing in fresh air behind the blades to push downward.

DIAL IN THE SAVINGS WITH THERMOSTATS.

Ceiling fans can save quite a bit of energy if summer users raise air conditioning thermostats. In the Florida climate, these net savings are roughly 14% for a 2° F increase, according to the Florida Solar Energy Center. The reason is no big mystery; ceiling fan motors use only 10 to 100 watts, depending on size and speed. By contrast, central air conditioners gobble 2,000 to 5,000 watts, while room air conditioners consume 600 to 3,000 watts.

Unlike whole-house fans or even box fans in an open window, ceiling fans are not ventilation devices; they are circulation devices.

Savings are also possible on the heating side. Electric space heaters typically devour 600 to 1,500 watts per room. So any time you can run a ceiling fan instead of one of these guzzlers to achieve the same level of comfort, you are saving energy.

But the trick is in the thermostat. The Florida Solar Energy Center found no difference between the air conditioner thermostat settings in Florida houses that had ceiling fans operating and those that didn't. As a result, the houses that were using ceiling fans had even higher energy bills!

The lesson is simple: Give the thermostat dial a spin if you want to save energy. You may find that ceiling fans are the perfect way to extend the shoulder season as well–shortening the number of days you need air conditioning in the summer and central heating in the winter.

Table fans provide refreshing breezes.

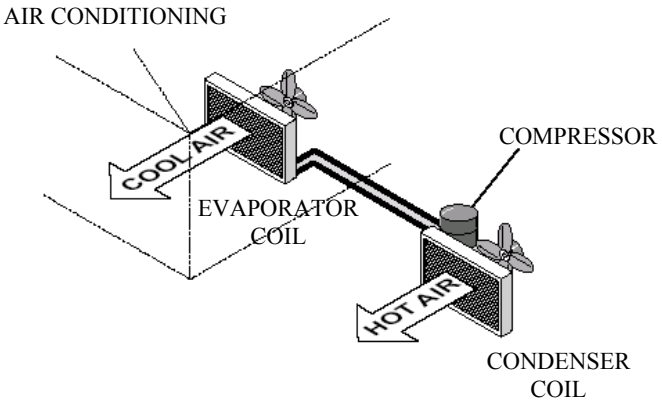
KNOW YOUR LIMITS.

Ceiling fans can supplement traditional HVAC systems, but cannot duplicate the wide range of functions they perform: ventilation, filtration, humidification, dehumidification, heating, and cooling. Unlike whole-house fans or even box fans in an open window, ceiling fans are not *ventilation* devices; they are *circulation* devices. They don't bring cooler air into a home or vent warm, humid air from it.

Though some ceiling fans now include filters within their blades to trap particles and odors, most have no real effect on the relative staleness of air in a room. The way to get rid of stale air is to exhaust it from the room and bring in fresh or filtered air to replace it. And don't count on ceiling fans to cool things off by themselves on a really hot day; if the air in the room becomes as warm as body temperature, that "breeze" won't provide much wind-chill.

Source: Home Energy Magazine. For more information about saving energy in the home visit, www.homeenergy.org.

ENERGY EFFICIENT AIR CONDITIONING



The fluid that collects heat at the evaporator and releases it at the condenser is called refrigerant. A pump, called the compressor, forces the refrigerant through the circuit of tubing and fins in the coils. Air moves through the tiny spaces between the fins and is cooled by the refrigerant in the coils.
Source: U.S. DOE

UNDERSTANDING AIR CONDITIONERS

Many people buy or use air conditioners without understanding their designs, components, and operating principles. Proper sizing, selection, installation, maintenance, and correct use are keys to cost-effective operation and lower overall costs.

This publication discusses both central and room air conditioners. Heat pumps, which provide both home cooling and heating, are not covered in this publication. Contact the Energy Efficiency and Renewable Energy Clearinghouse (EREC–see *Source List* below) for more information about heat pumps of all kinds.

In a **split-system central air conditioner**, an outdoor metal cabinet contains the condenser and compressor, and an indoor cabinet contains the evaporator. In many split-system air conditioners, this indoor cabinet also contains a furnace or the indoor part of a heat pump. The air conditioner's evaporator coil is installed in the cabinet or main supply duct of this furnace or heat pump.

If your home already has a furnace but no air conditioner, a split-system is the most economical central air conditioner to install.

One of the most common air conditioning problems is improper operation.

In a **packaged central air conditioner,** the evaporator, condenser, and compressor are all located in one cabinet, which usually is placed on a roof or on a concrete slab next to the house's foundation. This type of air conditioner also is used in small commercial buildings. Air supply and return ducts come from indoors through the home's exterior wall or roof to connect with the packaged air conditioner, which is usually located outdoors. Packaged air conditioners often include electric heating coils or a natural gas furnace. This combination of air conditioner and central heater eliminates the need for a separate furnace indoors.

Maintaining Existing Air Conditioners

Older air conditioners may still be able to offer years of relatively efficient use. However, making your older air conditioner last requires you to perform proper operation and maintenance.

AIR CONDITIONING PROBLEMS

One of the most common air conditioning problems is improper operation. If your air conditioner is on, be sure to close your home's windows and outside doors. Other common problems with existing air conditioners result from faulty installation, poor service procedures, and inadequate maintenance. Improper installation of your air conditioner can result in leaky ducts and low air flow. Many times, the refrigerant charge (the amount of refrigerant in the system) does not match the manufacturer's specifications. If proper refrigerant charging is not performed during installation, the performance and efficiency of the unit is impaired. Service technicians often fail to find refrigerant charging problems or even worsen existing problems by adding refrigerant to a system that is already full. Air conditioner manufacturers generally make rugged, high quality products. If your air conditioner fails, it is usually for one of the common reasons listed below:

- ***refrigerant leaks.*** If your air conditioner is low on refrigerant, either it was undercharged at installation, or it leaks. If it leaks, simply adding refrigerant is not a solution. A trained technician should fix any leak, test the repair, and then charge the system with the correct amount of refrigerant. Remember that the performance and efficiency of your air conditioner is greatest when the refrigerant charge exactly matches the manufacturer's specification, and is neither undercharged nor overcharged.

- ***inadequate maintenance.*** If you allow filters and air conditioning coils to become dirty, the air conditioner will not work properly, and the compressor or fans are likely to fail prematurely.

- ***electric control failure.*** The compressor and fan controls can wear out, especially when the air conditioner turns on and off frequently, as is common when a system is oversized. Because corrosion of wire and terminals is also a problem in many systems, electrical connections and contacts should be checked during a professional service call.

The most important maintenance task that will insure the effenciency of your air conditioner is to routinely replace or clean its filters.

REGULAR MAINTENANCE

An air conditioner's filters, coils, and fins require regular maintenance for the unit to function effectively and efficiently throughout its years of service. Neglecting necessary maintenance ensures a steady decline in air conditioning performance while energy use steadily increases.

AIR CONDITIONER FILTERS

The most important maintenance task that will ensure the efficiency of your air conditioner is to routinely replace or clean its filters. Clogged, dirty filters block normal air flow and reduce a system's efficiency significantly. With normal air flow obstructed, air that bypasses the filter may carry dirt directly into the evaporator coil and impair the coil's heat-absorbing capacity. Filters are located somewhere along the return duct's length. Common filter locations are in walls, ceilings, furnaces, or in the air conditioner itself.

Some types of filters are reusable; others must be replaced. They are available in a variety of types and efficiencies. Clean or replace your air conditioning system's filter or filters every month or two during the cooling season. Filters may need more frequent attention if the air conditioner is in constant use, is subjected to dusty conditions, or you have fur-bearing pets in the house.

AIR CONDITIONER COILS

The air conditioner's evaporator coil and condenser coil collect dirt over their months and years of service. A clean filter prevents the evaporator coil from soiling quickly. In time, however, the evaporator coil will still collect dirt. This dirt reduces air flow and insulates the coil which escapes from the ducts.reduces its ability to absorb heat. Therefore, your evaporator coil should be checked every year and cleaned as necessary.

Outdoor condenser coils can also become very dirty if the outdoor environment is dusty or if there is foliage nearby. You can easily see the condenser coil and notice if dirt is collecting on its fins.

You should minimize dirt and debris near the condenser unit. Your dryer vents, falling leaves, and lawn mower are all potential sources of dirt and debris. Cleaning the area around the coil, removing any debris, and trimming foliage back at least 2 feet (0.6 meters) allow for adequate air flow around the condenser.

COIL FINS

The aluminum fins on evaporator and condenser coils are easily bent and can block air flow through the coil. Air conditioning wholesalers sell a tool called a "fin comb" that will comb these fins back into nearly original condition.

SEALING AND INSULATING AIR DUCTS

An enormous waste of energy occurs when cooled air escapes from supply ducts or when hot attic air leaks into return ducts. Recent studies indicate that 10% to 30% of the conditioned air in an average central air conditioning system escapes from the ducts. For central air conditioning to be efficient, ducts must be airtight.

The initial cost of a an energy efficient air conditioner will be repaid several times during its lifetime.

Hiring a competent professional service technician to detect and correct duct leaks is a good investment, since leaky ducts may be difficult to find without experience and test equipment.

BUYING NEW AIR CONDITIONERS

Today's best air conditioners use 30% to 50% less energy to produce the same amount of cooling as air conditioners made in the mid 1970s. Even if your air conditioner is only 10 years old, you may save 20% to 40% of your cooling energy costs by replacing it with a newer, more efficient model.

SIZING AIR CONDITIONERS

Air conditioners are rated by the number of British Thermal Units (Btu) of heat they can remove per hour. Another common rating term for air conditioning size is the "ton," which is 12,000 Btu per hour.

How big should your air conditioner be? The size of an air conditioner depends on:

- how large your home is and how many windows it has;
- how much shade is on your home's windows, walls, and roof;
- how much insulation is in your home's ceiling and walls;
- how much air leaks into your home from the outside; and
- how much heat the occupants and appliances in your home generate.

An air conditioner's efficiency, performance, durability, and initial cost depend on matching its size to the above factors. Make sure you buy the correct size of air conditioner. Two groups—the Air Conditioning Contractors of America (ACCA) and the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)—publish calculation procedures for sizing central air conditioners. Reputable air conditioning contractors will use one of these procedures, often performed with the aid of a computer, to size your new central air conditioner.

Be aware that a large air conditioner will not provide the best cooling. Buying an oversized air conditioner penalizes you in the following ways.

- It costs more to buy a larger air conditioner than you need.
- The larger-than-necessary air conditioner cycles on and off more frequently, reducing its efficiency. Frequent cycling makes indoor temperatures fluctuate more and results in a less comfortable environment. Frequent cycling also inhibits moisture removal. In humid climates, removing moisture is essential for acceptable comfort. In addition, this cycling wears out the compressor and electrical parts more rapidly.
- A larger air conditioner uses more electricity and creates added demands on electrical generation and delivery systems.

National appliance standards require room air conditioners built after January 1, 1990, to have an EER of 8.0 or greater.

AIR CONDITIONER EFFICIENCY

Each air conditioner has an energy efficiency rating that lists how many Btu per hour are removed for each watt of power it draws. For room air conditioners, this efficiency rating is the Energy Efficiency Ratio, or EER. For central air conditioners, it is the Seasonal Energy Efficiency Ratio, or SEER. These ratings are posted on an Energy Guide Label, which must be conspicuously attached to all new air conditioners. Many air conditioner manufacturers are participants in the voluntary EnergyStar® labeling program (see *Source List* in this publication). EnergyStar-labeled appliances mean that they have high EER and SEER ratings.

In general, new air conditioners with higher EERs or SEERs sport higher price tags. However, the higher initial cost of an energy-efficient model will be repaid to you several times during its life span. Your utility company may encourage the purchase of a more efficient air conditioner by rebating some or all of the price difference. Buy the most efficient air conditioner you can afford, especially if you use (or think you will use) an air conditioner frequently and/or if your electricity rates are high.

ROOM AIR CONDITIONERS—EER

Room air conditioners generally range from 5,500 Btu per hour to 14,000 Btu per hour. National appliance standards require room air conditioners built after January 1, 1990, to have an EER of 8.0 or greater. Select a room air conditioner with an EER of at least 9.0 if you live in a mild climate. If you live in a hot climate, select one with an EER over 10.

The Association of Home Appliance Manufacturers reports that the average EER of room air conditioners rose 47% from 1972 to 1991. If you own a 1970s vintage room air conditioner with an EER of 5 and you replace it with a new one with an EER of 10, you will cut your air conditioning energy costs in half.

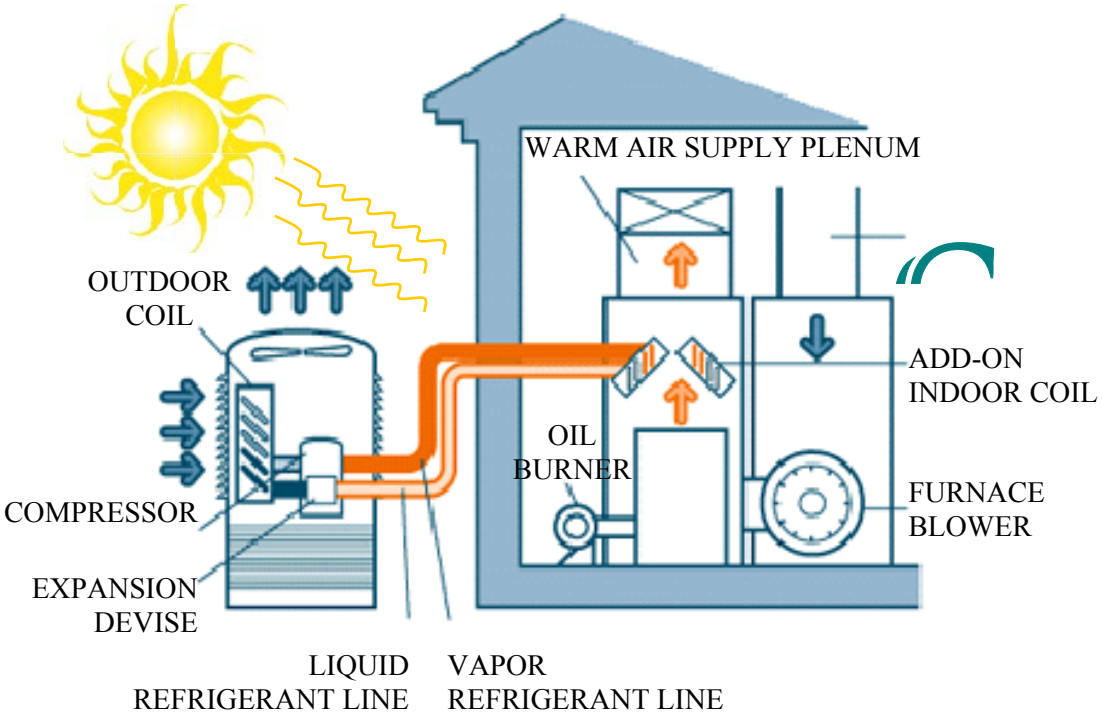
CENTRAL AIR CONDITIONERS—SEER

National minimum standards for central air conditioners require a SEER of 9.7 and 10.0, for single-package and split-systems, respectively. But you do not need to settle for the minimum standard—there is a wide selection of units with SEERs reaching nearly 17.

Before 1979, the SEERs of central air conditioners ranged from 4.5 to 8.0. Replacing a 1970s-era central air conditioner with a SEER of 6 with a new unit having a SEER of 12 will cut your air conditioning costs in half.

HIRING PROFESSIONAL SERVICE

When your air conditioner needs more than the regular maintenance described previously, hire a professional service technician. A well-trained technician will find and fix problems in your air conditioning system. However, not all service technicians are competent. Incompetent service technicians forsake proper diagnosis and perform only minimal stopgap measures.



Central air conditioners are designed to cool the entire house. The large compressor and outdoor coil are located outdoors and are connected by refrigerant lines to an indoor coil mounted in the furnace. The same duct system is used for both heating and cooling air distribution.
Source: Canada Office of Energy Efficiency

Insist that the technician:

- check for correct amount of refrigerant; test for refrigerant leaks using a leak detector;
- capture any refrigerant that must be evacuated from the system, instead of illegally releasing it to the atmosphere;
- check for and seal duct leakage in central systems;
- measure air flow through the evaporator coil;
- verify the correct electric control sequence and make sure that the heating system and cooling system cannot operate simultaneously;
- inspect electric terminals, clean and tighten connections, and apply a nonconductive coating if necessary;
- oil motors and check belts for tightness and wear; and
- check the accuracy of the thermostat.

CHOOSING A CONTRACTOR

Choosing a contractor may be the most important and difficult task in buying a new central air conditioning system. Ask prospective contractors for recent references. If you are replacing your central air conditioner, tell your contractor what you liked and did not like about the old system.

If the system failed, ask the contractor to find out why. The best time to fix existing problems is when a new system is being installed.

Avoid making your decision solely on the basis of price. The quality of the installation should be your highest priority, because quality will determine energy cost, comfort, and durability.

When designing your new air conditioning system, the contractor you choose should:

- use a computer program or written calculation procedure to size the air conditioner;
- provide a written contract listing the main points of your installation that includes the results of the cooling load calculation;
- give you a written warranty on equipment and workmanship; and
- allow you to hold the final payment until you are satisfied with the new system.

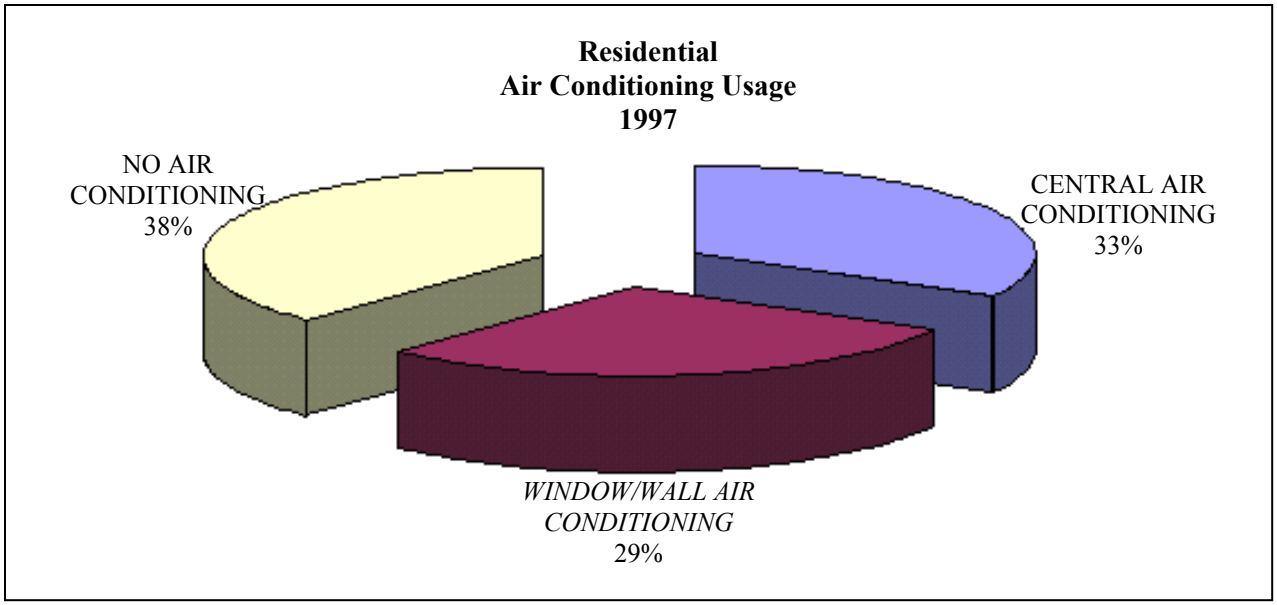
Avoid making your decision solely on the basis of price. The quality of the installation should be your highest priority, because quality will determine energy cost, comfort, and durability.

INSTALLATION AND LOCATION OF AIR CONDITIONERS

If your air conditioner is installed correctly, or if major installation problems are found and fixed, it will perform efficiently for years with only minor routine maintenance. However, many air conditioners are not installed correctly. As an unfortunate result, modern energy efficient air conditioners can perform almost as poorly as older inefficient models.

Be sure that your contractor performs the following procedures when installing a new central air conditioning system:

- allows adequate indoor space for the installation, maintenance, and repair of the new system, and installs an access door in the furnace or duct to provide a way to clean the evaporator coil.
- uses a duct-sizing methodology such as the Air Conditioning Contractors of America (ACCA) *Manual D*.



Paying attention to your air conditioning system saves you money and reduces environmental pollution.

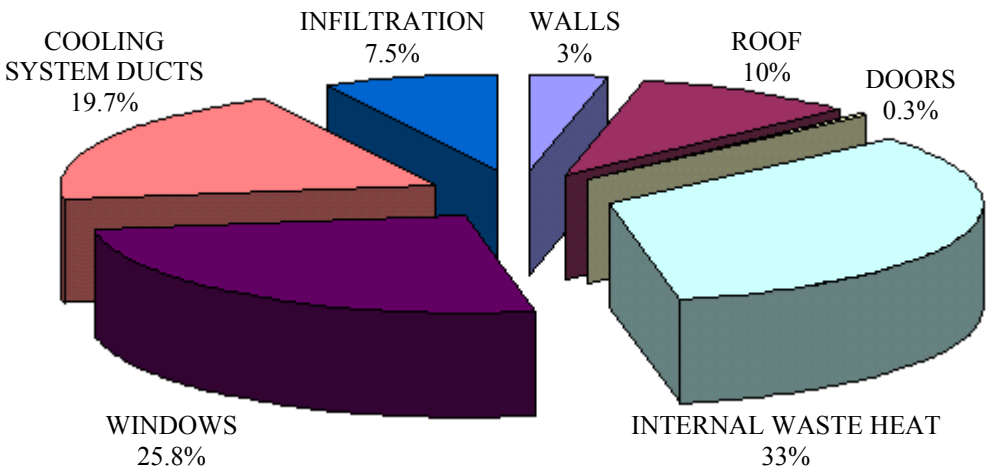
- ensures there are enough supply registers to deliver cool air and enough return air registers to carry warm house air back to the air conditioner.
- installs duct work within the conditioned space, not in the attic, wherever possible.
- seals all ducts with duct mastic and heavily insulates attic ducts.
- locates the condensing unit where its noise will not keep you or your neighbors awake at night, if possible.
- place the condensing unit in a shady spot, if possible, which can reduce your air conditioning costs by 1% to 2%.
- verifies that the newly installed air conditioner has the exact refrigerant charge and air flow rate specified by the manufacturer.
- locates the thermostat away from heat sources, such as windows, or supply registers.

If you install a new room air conditioner, try to:

- locate the air conditioner in a window or wall area near the center of the room and on the shadiest side of the house.
- minimize air leakage by fitting the room air conditioner snugly into its opening and sealing gaps with a foam weather stripping material.

Paying attention to your air conditioning system saves you money and reduces environmental pollution. Notice whether your existing system is running properly, and maintain it regularly. Or, if you need to purchase a new air conditioner, be sure it is sized and installed correctly and has a good EER or SEER rating.

Major Sources of Unwanted Heat Gain



The chart gives a breakdown of the major sources of unwanted heat gain in a typical Orlando, Florida home (R-19 ceiling insulation, no attic insulation, and uninsulated ductwork in the attic).
Source: Florida Solar Energy Center.

LOOK FOR THE ENERGY STAR LABEL WHEN BUYING NEW APPLIANCES