Appliances, Lighting, Electronics

an energy guide to help you select and operate efficient devices for your home

refrigerators • freezers

dishwashers • ranges

ovens • lights

televisions • computers

...and much more!

Appliances, Lighting, Electronics

is provided by the Minnesota Department of Commerce
Division of Energy Resources
mn.gov/commerce/energy

Contents

This is a publication from the Minnesota Department of Commerce, Division of Energy Resources.

The Division of Energy Resources (DER) is working to move Minnesota toward a sustainable energy future, managing energy assistance funds and advocating in the public interest on energy utility rates and facility siting. We provide information and assistance on energy conservation, energy efficiency, and renewable energy options to residents, builders, utilities, nonprofit organizations, and policy-makers on building improvements, financial assistance, renewable technologies, policy initiatives, and utility regulations.

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Design, writing, illustrations and editing by DER staff

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About Our Energy Guides

The Division of Energy Resources in the Minnesota Department of Commerce has created a consumer Energy Guide series, designed to help you figure out what steps you can take to reduce the energy use in your home. Although you might not be willing or able to do all of the improvements yourself, these guides will educate you about the basic processes so that you can ask the right questions—and get the best results—from those that you might hire. Consisting of three booklets available in print versions or on our website, the consumer Energy Guides cover these home energy topics:

Home Envelope

The *Home Envelope* guide describes the basic components of a house that separate the outdoors from the indoors. It contains ways to reduce energy use with insulation, air-sealing, windows, and doors. Information is included on how to assess the current operation of your home through an energy assessment and how to begin the process of tightening your home to curtail energy consumption.

Appliances, Lighting, Electronics

A significant portion of home energy use is for all of the common things that make our lives easier and safer. The *Appliances, Lighting, Electronics* guide discusses options for reducing the energy consumption of these devices by changing when and how we use them. Additionally, there is information on what to consider when you are repairing or replacing these items.

Heating, Cooling, Ventilation

Once the envelope of the house is sufficiently tight, the next step is to maintain and upgrade the mechanical systems of the building. Heating, air-conditioning, water heating, and ventilation systems use the most energy in our homes, so they deserve special attention. The *Heating, Cooling, Ventilation* guide describes the various types of systems and equipment available to operate your home. The guide also offers suggestions on maintenance, repair, and replacement decisions.

Building science

The interactions of the various parts of buildings have become better understood in the past few decades. The efforts of manufacturers, designers, architects, engineers, researchers, and builders to create homes that operate safely, comfortably, and efficiently is known as building science.

Saving Energy Makes Good Sense

How, when, and in what form we use energy can have a dramatic effect on our lives, our bank accounts, and our environment. Using energy wisely makes sense and is a goal that we all share.

The average Minnesota family spends a significant amount of money on energy, but we can dramatically reduce these costs—up to 30 percent, according to the U.S. Department of Energy—by making some simple energy-saving improvements to our homes. In addition to saving money on utility bills, we can protect our homes from moisture damage year-round, reduce problems caused by ice dams on the roof during the winter, significantly cut summer cooling costs, extend the life of houses, and sometimes increase resale values. Furthermore, reductions in energy use also reduce environmental effects, including lowering contributions of carbon dioxide and other greenhouse gasses.

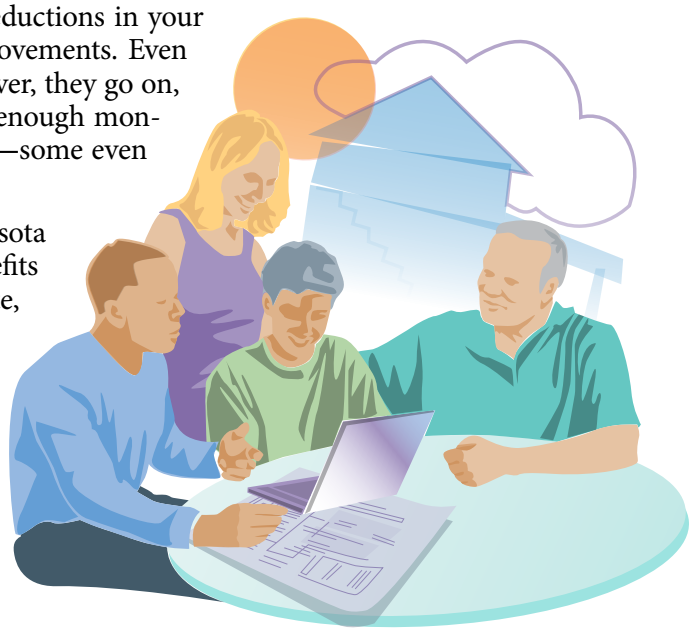
Homes are no longer simple

When many of our homes were built, there was little concern about energy conservation and efficiency, therefore little attention was given to things like insulation and air leakage. Energy was cheap and construction materials and techniques were sufficient for the time.

Over the past several decades our homes (and the things within them) have become increasingly complex. Rising energy costs, along with environmental and other concerns, have increased awareness and driven research into the operations of buildings. The effects of the interactions of structural systems, weatherization components, mechanical equipment, and electrical devices in today's homes are the subject of an entire field of study: ***building science***.

Saving energy benefits everyone

Depending on your home, you may see substantial reductions in your energy use through conservation and efficiency improvements. Even if the annual savings for your home are modest, however, they go on, year after year. Many energy improvements will save enough money to pay for the initial investment in just a few years—some even sooner!



Also, the cumulative effects of thousands of Minnesota families reducing their energy use will pay big benefits to all of us. We use a great deal of energy in our state, and the majority of it is derived from fossil fuels—all of which must be imported into our state. Anything that we can do to reduce the emissions from burning coal and petroleum products will help to slow the rate of climate change and have a positive impact on air and water quality. Additionally, investments in energy-related home improvements help to grow jobs in Minnesota—from contractors and installers to manufacturers and retailers.

What should be done first?

Many people assume that there is little they can do to significantly reduce their energy use and increase the efficiency of their homes. In reality, there are ***many*** things that typical residents can do themselves and many other things they can hire others to do.

Before you start on any large project, you should know what options you have and what the benefits may be. Today's homes and their systems are much different than what was common 20, 30, or 50 years ago. The interactions between the various components of a house are more complicated, and the effects of systems not performing properly or being out of balance can be costly and sometimes dangerous. The Division of Energy Resources in the Minnesota Department of Commerce strongly recommends having a ***home energy assessment*** (sometimes called a ***home energy audit***) before embarking on your energy improvements or remodeling. This assessment of how your house is functioning can help you decide what needs fixing, what needs upgrading, and what needs replacement. Many people have a follow-up inspection after work has been done to verify the estimated energy savings.

Blower Door

Energy assessment tests include a *blower door* test (above) to determine air leakage rates. Knowing how much and how quickly air is leaking through your home's *envelope* can help prioritize energy-saving strategies.

Energy assessment: how your house works

A home energy assessor will evaluate the operation of your home by inspecting and measuring the performance of the building. At *minimum* several things should be included:

- A review of energy bills to identify basic usage and identify opportunities for savings.
- A blower door test to determine air leakage rates.
- Infrared camera scans of walls, attic, and foundation to assess insulation levels and locate possible air leak sources.
- Efficiency and safety testing for combustion appliances (like furnaces, boilers, gas fireplaces, and water heaters) to ensure they are operating properly and not contributing to indoor air concerns.
- A visual inspection for attic, wall, crawlspace, foundation, basement, window, door, and roof problems.

Although many inspectors include some of these tests as part of a general home inspection, it is important to have *all* of the above tests completed by a trained and qualified energy assessor in order to determine the best approach to improving the energy performance of a home.

When should you get an energy assessment?

Most homes—even recently built ones—can benefit from an analysis of the operation and interactions of the various systems and equipment. There are times when having a professional diagnosis can solve complicated problems while saving time, energy, and money. Consider an energy assessment before:

- ***Replacing equipment*** such as a furnace, boiler, water heater, ventilator, or air conditioner. Finding and addressing air leakage, insulation, and other issues can help to correctly size new appliances and ensure they will work as efficiently as possible.
- ***Replacing windows, doors, or siding.*** Properly installed, these improvements can make your house much tighter, which can change the fresh air requirements for some combustion appliances or for the occupants.
- ***Investing in major remodeling or additions.*** Knowing the current operation of the home can help determine choices about designs, methods, or equipment options. In addition, a pre- and post-construction testing can be used to verify energy performance improvements.
- ***Problem-solving systemic or complex concerns,*** such as excess moisture (including condensation, mold, mildew, or leakage), uneven heating or cooling, drafts, ice dams, or high energy bills.
- ***Buying or selling a home.*** Many people already include a requirement for a home inspection as part of a purchase agreement. Although this may identify structural issues, mechanical system problems, code violations, and other health and safety issues, the typical home inspection may not provide a complete look at the energy usage for a home. An energy assessment will highlight energy saving improvements that can reduce utility costs and improve the health and comfort of future occupants.

How much does an energy assessment cost?

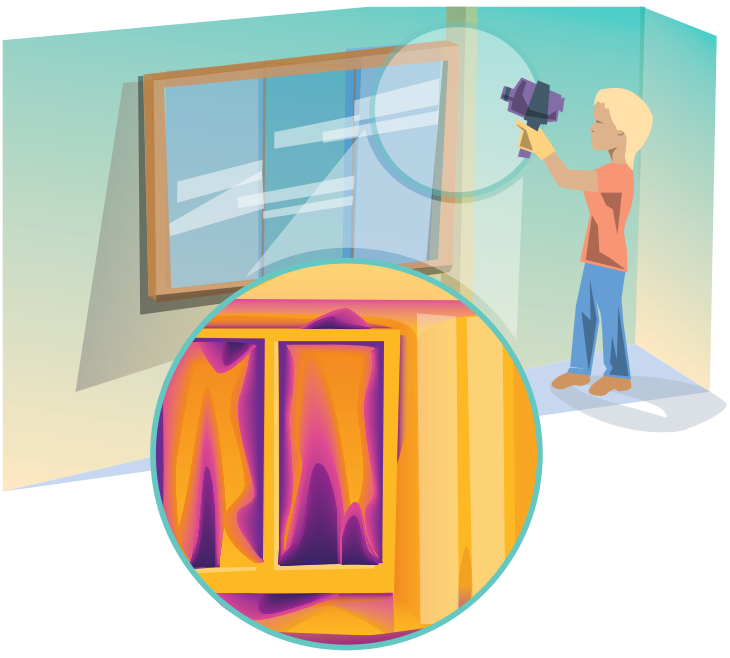
Home energy assessments range in cost from $100 to several hundred dollars, depending on the level of detail and the types of tests provided.

Contact your gas or electric utility to arrange for an energy assessment that includes the full range of testing. More comprehensive assessments (for new construction or major remodeling) are available from private contractors specializing in comprehensive home performance reviews.

The payback from this investment will be apparent for many years in terms of increased comfort and safety and reduced energy use and the associated environmental costs.

Infrared Scans

Energy assessment tests can include scans from infrared cameras (below) to pinpoint voids in insulation, air leaks, and moisture problems. Locating the leaks makes it easier to seal and make necessary repairs—and improves the returns on other energy investments you make.



How hard is it to make energy improvements?

If you have some basic tools and are comfortable with making repairs and improvements to your house, you can handle some of the projects suggested in this booklet and make the most of your energy-improvement budget. Be sure to check with your local municipality for permits and inspections.

However, don't hesitate to call a professional for help if you'd rather not do the work yourself; even with paying to have someone else do the work, the dollars gained through energy savings in upcoming years will be worth the expense. Be sure to check out the "Resources" section at the end of this guide to get tips on hiring contractors.

How do I pay for it?

Although many energy-efficiency projects (caulking windows, weatherstripping exterior doors, or insulating water pipes) will cost just a few dollars, others (insulating exterior walls, air-sealing an attic, replacing a furnace, or adding storm windows) may cost considerably more.

Many utility companies offer incentives on larger projects (furnace replacement, attic insulation, new refrigerator) by giving you a discount on energy bills or sending you a rebate check when the work is completed. Other utilities offer free or discounted services or products (like low-flow shower heads, CFL bulbs, or energy assessments). Contact your local energy utility or visit the Database of State Incentives for Renewables & Efficiency (**dsireusa.org**) for details.

Community nonprofits and neighborhood organizations offer a variety of services and programs, including energy assessments, energy education, free or discounted products, and financing. Contact your city or municipality to learn what is available in your area.

Your bank may be able to help, too. Ask about a low-interest loan designed specifically to cover the cost of your energy-saving projects, or consider a home-improvement loan to fund them. Some banks offer energy efficiency mortgages, which take into account the reduced energy bills when improvements are made to homes. The Minnesota Housing Finance Agency (**mnhousing.gov**) also offers a Fix-Up Fund Loan for home improvements—even if you do the work yourself.

Some Minnesota residents may be eligible for aid from the state Weatherization Assistance Program or Energy Assistance Program. Applications can be made through local service providers; go to **mn.gov/commerce/energy** for eligibility requirements, application forms, and contact information.

Finally, for the latest information on tax incentives, rebates, or grant programs from federal, state, or local governments, check out their websites. It is important to find out the specifics (qualifying products, installation requirements, site analysis, inspections, etc.) ***before*** purchasing products or services. Some programs require approved applications or specific products or procedures in order to qualify for the funding. Not meeting the requirements may jeopardize your incentive, rebate, or grant. A listing of many current programs and links is also available at our website: **mn.gov/commerce/energy.**

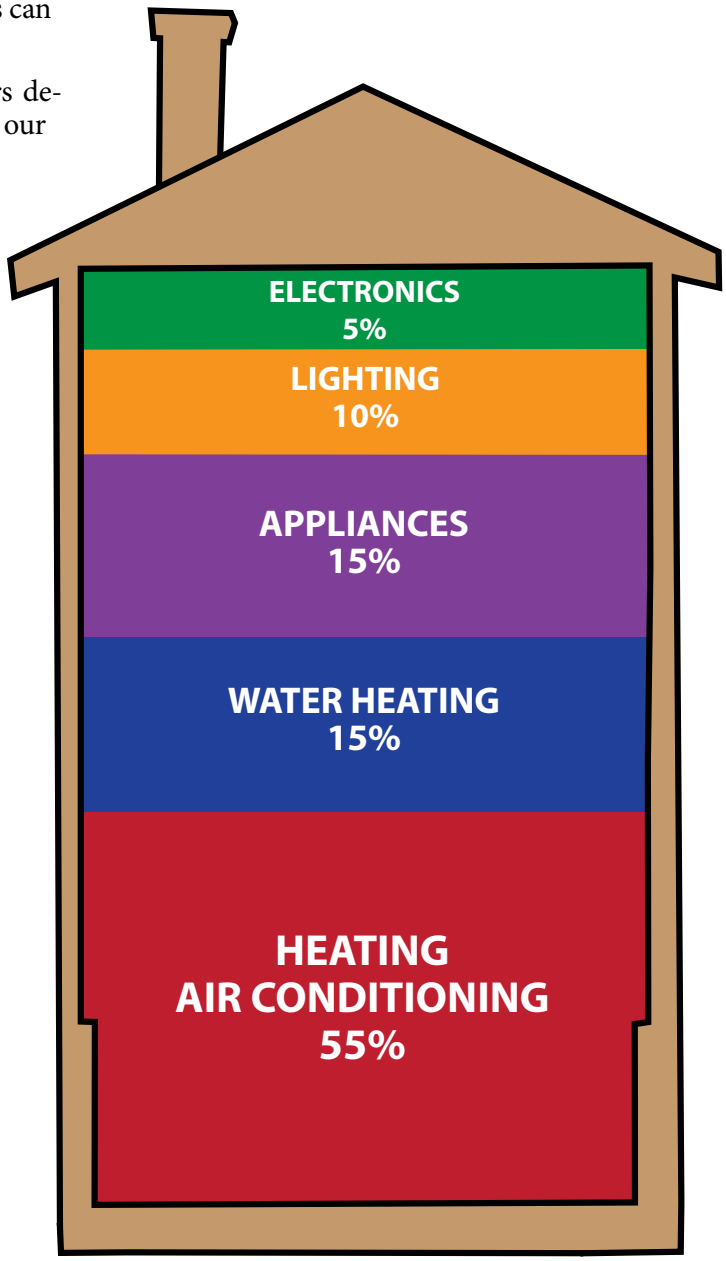
Home Comfort & Convenience

The typical Minnesota household uses about 190 million BTUs of energy every year to operate a home—for heating, cooling, cooking, lighting, and powering devices and equipment. About 70% of this energy use is related to heating, cooling, and water heating; the balance (30%) is for appliances, lighting, and electronics.

Aside from gas cook stoves and ovens, most of the energy used by appliances, lighting, and electronics is in the form of electricity. Because the majority of electricity consumed in this state comes from carbon-intensive coal-fired power plants, reducing our electrical consumption will also reduce the potential emissions from these sources.

Along with lowered energy use, maintaining existing equipment and upgrading to more efficient models can provide further benefits:

- **Comfort and convenience.** As manufacturers design and build new devices and equipment for our homes, they often add new functions and capabilities. These features frequently make it easier to use the product properly, increasing the benefits of energy savings, comfort, and convenience.
- **Safety.** Appliances, lighting, and other devices that are properly operating are less likely to fail or become a hazard. Newer equipment frequently includes safety components (like timers or automatic shutoffs) that were unavailable in older models.
- **Reduced operating costs.** When periodically maintained and repaired, many appliances and devices will deliver ongoing energy savings and lower energy bills. When products reach the end of their useful life (because of expensive repair costs or advances in new technologies), replacement with high efficiency models will increase the cost savings.



Home Energy Use

A typical Minnesota home uses about 190 million British Thermal Units (mmBTU) of energy every year to heat, cool, light, and operate appliances and electronics.

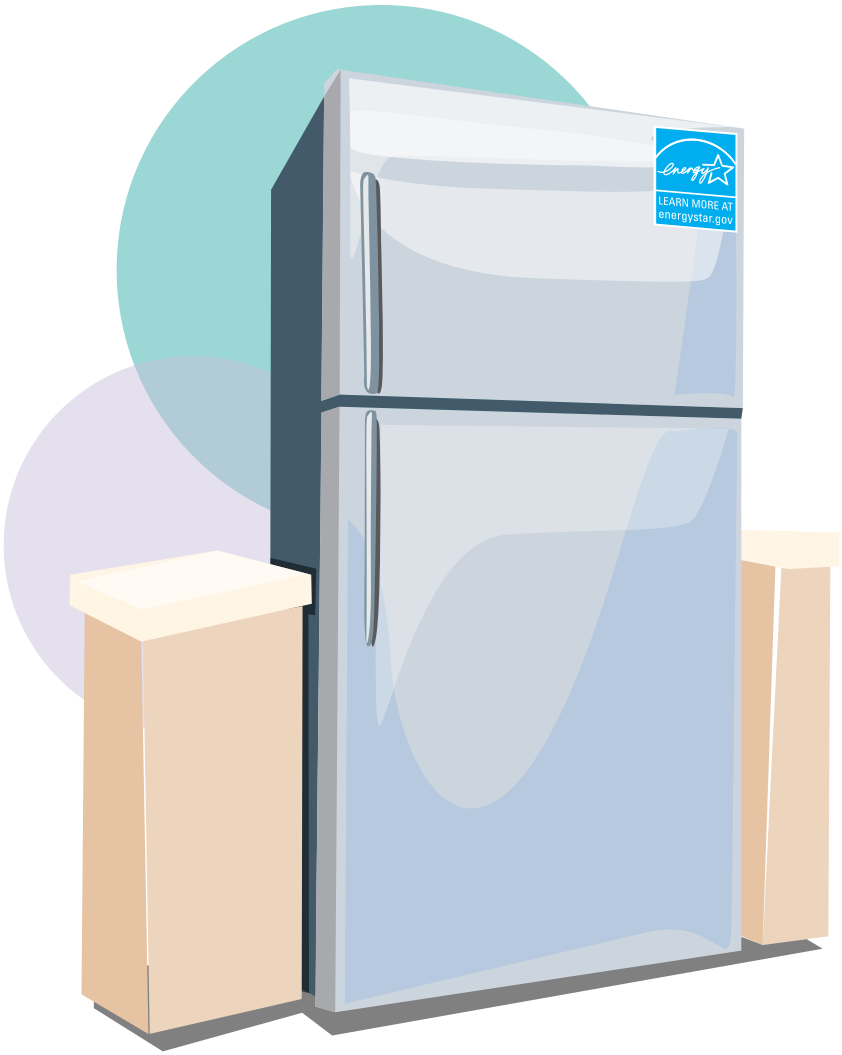
About 30% of the energy use in a typical Minnesota home goes toward operating appliances, lighting, and electronics.

ENERGY STAR®

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy that helps save money and protect the environment through energy-efficient products and practices. Many appliances, lighting products, and electronics can earn the ENERGY STAR label by meeting these energy-efficiency requirements:

- Qualified products must deliver the features and performance demanded by consumers, in addition to increased energy efficiency.
- If the qualified product costs more than a conventional, less-efficient counterpart, purchasers will recover their investment in increased energy efficiency through utility bill savings, within a reasonable period of time.
- Product energy consumption and performance can be measured and verified with testing.

When shopping for appliances, lighting, and electronics, always look for the ENERGY STAR label. To find qualifying products or to compare performance of several products that are ENERGY STAR labeled, go to **energystar.gov**.



Appliances

Appliances are the most common labor-saving devices in our homes. Whether helping us keep clean, comfortable, or nourished, appliances are an essential part of daily life. And although they can save us a lot of time and effort, their use comes with an energy cost.

Refrigerators and freezers

Refrigerators are one of the appliances that use a lot of energy in a typical home. In fact, in most Minnesota homes a refrigerator is the largest user of electricity, after air conditioners.

Maintenance & repairs

If you are not ready to replace your refrigerator or freezer, there are a few things you can do to keep your existing equipment operating as efficiently as possible.

- **Cleaning and clearance.** Although the benefits of keeping the coils on the back or bottom dust-free may be minimal, large accumulations or blockages can interfere with efficient operation. Additionally, there must be clearance between the appliance, walls, and cabinets so that air can circulate freely, allowing the coils to give off heat. Spilled food or liquids may also harden and keep doors and drawers from closing or sealing tightly.
- **Gaskets and seals.** Over time, the gaskets that seal the doors can become worn or loose and may no longer do a good job of keeping the cold inside. If the unit itself is still operating well and is not too old, these can be replaced or tightened.

When is it time to replace?

Many refrigerators and freezers will continue to operate for 15-20 years or even longer: food stays cold and the light comes on when the door opens. Whether or not these appliances are really *working efficiently*, however, is another question. Opportunities for replacement include:

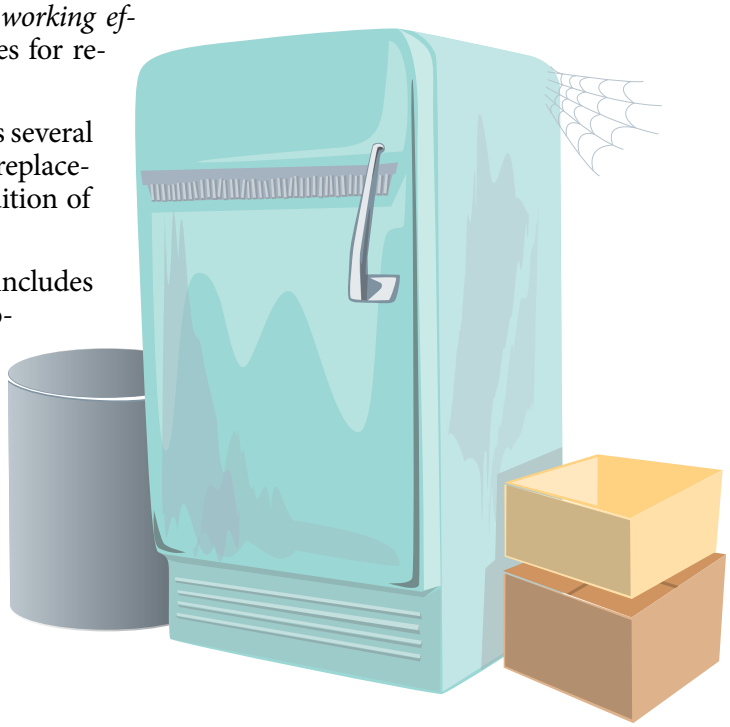
- **Costly repairs.** If an estimate for repairs exceeds several hundred dollars, it might make sense to look at replacement instead—depending on the age and condition of the rest of the appliance.
- **Remodeling project.** A kitchen remodel often includes an upgrade of appliances, in order to accommodate a different space or additional features.
- **High energy usage.** Depending on the model, a 20-year-old refrigerator could use 1,700 kWh of electricity every year—compared with about 450 kWh for a similarly sized new ENERGY STAR model. At an electrical cost of 11¢ per kWh, that represents a potential savings of $140 per year—and a potential payback of 7-9 years.

What *not* to do with your old refrigerator

Many people spend a good deal of time considering the energy efficiency of a new refrigerator and when their new model arrives, take the old, energy-wasting one and move it to the garage or basement—where it continues to waste energy!

Others, in an attempt to recoup some of the expense of a new unit, sell the old one. Instead of saving energy with their purchase, these folks have actually added to the overall electrical use.

Refrigerators that are 15 years old or older should be taken out of service and recycled. The cost of operating these older models (in both dollars and environmental effects) exceeds the perceived benefits of continued operation.



What has changed?

Refrigerators and freezers have benefitted from recent advances in manufacturing methods and efficient technology, including:

- **Better insulation.** The metal boxes that enclose refrigerators and freezers have higher quality insulating materials than in the past, and reduced thermal bridges (the direct, uninsulated connections between inside and outside).
- **Tighter seals.** The gaskets and seals around doors are designed to fit better and have increased durability. Additionally, they are generally easier to replace when worn.
- **More efficient.** The compressors, motors, heat exchangers, and other components are considerably more efficient than previously.

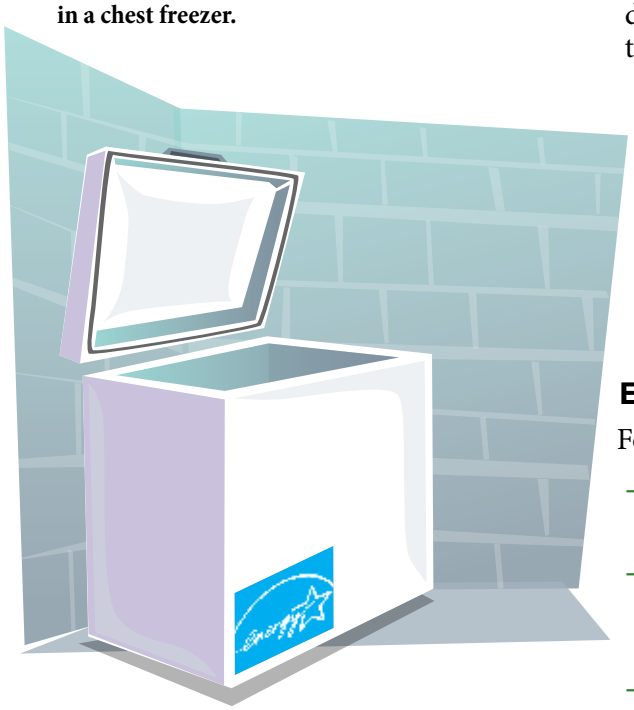
Shopping tips

When choosing a new refrigerator or freezer, consider:

- **Proper sizing.** Appliances that are too large waste energy and space. Ones that are too small require more frequent trips to the grocery store. A typical family of four requires a refrigerator capacity of 12-16 cubic feet and another 6-8 cubic feet for freezer capacity.
- **Styles.** The most efficient refrigerator designs usually have the freezer compartment on the bottom. The least efficient are usually the side-by-side models. Chest freezers are generally more efficient than vertical models (less cold air spills out of a chest freezer). Other factors such as compartment dimensions or easy access may be important as well.
- **Features.** Manual defrost typically uses less energy than auto-defrost models, but they may be difficult to find in all sizes—and they must be defrosted manually to properly operate. Although "through-the-door" water and ice dispensers can reduce frequent door opening, they can also add to the energy consumption.
- **Efficiency.** As major users of electricity, the selection of refrigerators and freezers will affect your utility bills—for 10-15 years. Buying efficiency today means lower operating costs for the future. The best way to compare efficiency of different models is through the ENERGY STAR website, which contains tools to help you calculate savings on specific models and compare them with models with similar features.

Freezers

Chest freezers are generally more energy-efficient than vertical freezers. Wire racks and bins can make organization and access easier in a chest freezer.



Efficient use

Follow these suggestions to keep energy usage to the minimum:

- Limit the time that doors are open. Open doors allow cold air to escape and warm air to enter.
- Keep refrigerators and freezers relatively full. This will reduce the temperature swings that result from opening the doors. Jugs of water can also be used.
- Refrigerators should be set to 38 to 40 degrees Fahrenheit (F) and

freezers to 0 to 5 degrees F—any colder is not necessary for food safety and uses more electricity than needed. In fact, a refrigerator set 10° colder (and a freezer set 5° colder) may use up to 25% more electricity. Test with a thermometer and adjust accordingly.

- Unplug any unused refrigerators or freezers. Do not run refrigerators or freezers in an unheated space—they will not work properly at temperatures below 55° to 60°.

Dishwashers

At one time dishwashers were relatively rare in households; today they are a common component of many kitchens. Aside from obvious convenience and timesaving, dishwashers can also help to sanitize dishes, potentially reducing the occurrence of illness. In addition, an efficient dishwasher will also use *less* hot water than washing dishes by hand.

Maintenance and repairs

Depending on the model and features, dishwashers require very little maintenance to keep them running well. Screens on the bottom that trap large particles may need to be emptied and the spray arms need to spin freely. Door gaskets should fit tightly to avoid leakage; some older models may eventually need gasket replacement. Pumps and internal water heaters may also eventually fail and need repair or replacement.

When is it time to replace?

The expected lifetime of a dishwasher is about 10-12 years, and as it ages, the likelihood of repairs and replacement increases. As with refrigerators and freezers, the opportunities for replacement include:

- **Costly repairs.** If an estimate for repairs exceeds several hundred dollars, it might make sense to look at replacement instead—depending on the age and condition of the rest of the appliance.
- **Remodeling project.** A kitchen remodel often includes an upgrade of appliances, in order to accommodate a different space or additional features.
- **High energy usage.** A dishwasher that was made before 1994 will probably use up to 10 gallons of water per cycle and cost you $40 more in energy costs annually than a newer ENERGY STAR model.

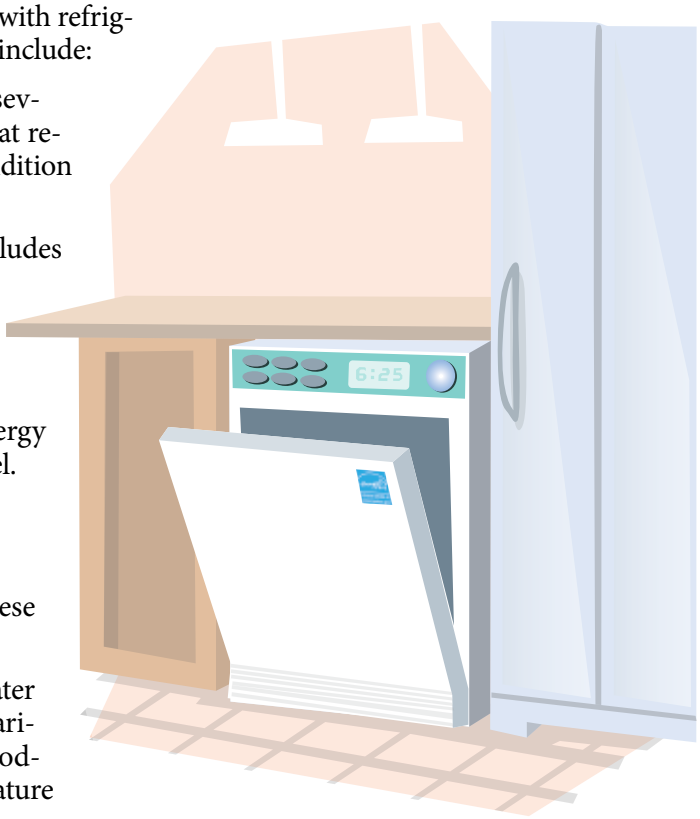
Shopping tips

When evaluating a new dishwasher, look closely at these features:

- **Water heating.** A dishwasher with a built-in heater and adjustable temperature settings gives you a variety of options: a lower temperature for china, a moderate one for day-to-day use, and a higher temperature

Dishwashers

Older dishwashers use more water and electricity than newer, ENERGY STAR models. With a typical lifetime of 10-12 years, efficiency can pay off when shopping for a replacement.



for heavy cleaning. And heating the water in the appliance allows a lower setting of 120° on your main water heater, saving energy and avoiding scalds.

- **Sensors.** Knowing how soiled the water is (and thus how dirty the dishes are) permits the dishwasher to adjust wash times and water temperature automatically, saving time and energy.
- **Food grinder.** This option eliminates the need for emptying screens before each use and helps sensors know when cleaning is complete.
- **Delayed start time.** Setting the dishwasher to operate late at night can reduce electric system loads and can keep you from running out of hot water for showers or laundry.
- **Efficiency.** The best way to compare efficiency of different models is through the ENERGY STAR website, which contains tools to help you calculate savings on specific models and compare them with models with similar features.

Efficient use

Follow these suggestions to keep your energy usage to the minimum:

- Wash only full loads. Even with a sensor, you will still use nearly the same amount of hot water and electricity, regardless of how many dishes are inside.
- Do not pre-rinse dishes. It wastes hot water and is unnecessary with newer dishwashers. A simple scrape to remove the biggest pieces is usually sufficient.
- Use the least amount of detergent that will still clean your dishes. Excess detergent use can lead to spotting or etching, as well as some environmental concerns.

Laundry equipment

The typical household in America cleans and dries about 300 loads of laundry in a year. Up to 90% of the energy used to wash clothes is used to heat water, and the energy use of dryers is directly related to the moisture content of the clothes; these two factors illustrate the energy-saving opportunities in a typical laundry room.

Maintenance and repairs

Older washers and dryers may require periodic maintenance to keep them operating properly. Here are a few things to check for:

Washer:

- Clean the tub of your washer every few months (or more often if indicated by odor or stains). Special cleaning products can be used in place of detergent and run through a complete cycle. Check with the manufacturer for recommendations.

HE washer? What's *that*?

*The latest design in energy-saving laundry appliances is known as the **High Efficiency** (HE) washer. Nearly all HE washers are front-loaders and they have several advantages over their less-efficient top-loading versions. HE washers:*

- ***Use less water.** Because they tumble clothes rather than agitate them, HE washers can use up to 75% less water than a top-loader.*
- ***Use less hot water.** Using less water also means using less hot water, which saves the energy required to heat the water (nearly 90% of the energy use in a typical washer).*
- ***Have a higher spin rate.** A spin rate of up to 2,000 rpm wrings out much more water. Less water at the end of the wash means less time spent drying the clothes—which saves energy, too.*
- ***Are gentler on clothes.** The tumble action of a front-loader is easier on clothes than a typical agitator.*
- ***Require a special HE detergent.** Because of how an HE washer operates, regular detergent will over-suds and not work properly. Buy only HE detergent and follow instructions carefully. (Hint: you use **much** less than with regular detergent.)*

- Inspect water and drain connections periodically for leaks. A build-up of rust or minerals at connections or stains along the side of the washer or on the floor indicate a leak.
- Replace water supply hoses that connect to washers every 3-4 years. The hoses can become brittle and susceptible to failure, leading to a flooded basement or laundry room.
- Pumps and motors have a limited lifetime; repairs or replacements may eventually be needed.

Dryer:

- Clean the dryer lint screen before each load. Lint restricts airflow and increases drying time and energy use.
- ONLY vent dryers to the outside! Venting into the living space or attic will lead to high levels of moisture. In a basement it can lead to significant mold and mildew issues; in an attic it will lead to wet insulation, rot, and ice dams. Venting a gas dryer into the living space is also dangerous to the occupants because of flue gasses from the combustion process.
- Only use smooth, rigid, metal ducts for the dryer exhaust; connect sections with metal foil tape to prevent dangerous leakage of flue gasses into the living space. Flexible ducts restrict airflow and trap lint, increasing drying time and energy use. Inspect periodically for leaks or separations.
- Inspect the outside exhaust vent monthly to insure the flapper is operating freely and no lint is blocking the opening. If the flapper sticks, lubricate the hinge or replace the vent. Poorly sealed exhaust vents can also be a source of air leakage and energy loss.
- Belts that drive the drum can stretch or break, necessitating adjustment or replacement.

When is it time to replace?

The expected lifetime of a washer and dryer is about 12-14 years, depending on model, use, and maintenance. Replacement opportunities include:

- **Costly repairs.** If an estimate for repairs exceeds several hundred dollars, it might make sense to look at replacement instead—depending on the age and condition of the rest of the appliance.
- **High energy usage.** A 10-year-old washer may cost you $135 more in energy costs annually than a newer ENERGY STAR model.

MEF, WF, & washers

Clothes washers must meet minimum efficiency standards in order to be ENERGY STAR labeled, including:

- ***Modified Energy Factor*** *(MEF) is a measurement of the energy efficiency of the washer, taking into account the electric energy, the energy to heat the water, and the size of the tub. ENERGY STAR washers must have an MEF of 2.0 or greater.*
- ***Water Factor*** *(WF) is the measurement of how much water a particular model uses, related to the capacity of the machine. ENERGY STAR washers must have a WF of 6.0 or less.*

Why *not* dry your clothes by hanging them in the basement?

Hanging clothes on lines or racks in the basement—especially in the winter when the house is dry—seems like a logical, energy-saving approach. But caution is appropriate, and here's why:

A typical load of laundry may contain several gallons of moisture. As it leaves the clothing, some of it will move to nearby cool locations (like a basement foundation wall or window) where the vapor will condense.

Because this surface is usually cooler than the surrounding air, evaporation may be gradual—enough to encourage the growth of mold and mildew or cause damage to window frames, etc.

Condensation or frost on walls or windows is a sign of too much moisture in the air; make sure you are not trading small energy savings for a potentially damaging solution.

Shopping tips

When evaluating a new **washer,** look closely at these features:

- **Sizing.** Select the size of your washer based on your family and laundry needs. One that is oversized will lead to running smaller, less-efficient loads or waiting for enough laundry to run a full load.
- **Top versus front-loading:**
  - Front-loading washers generally use less water than top-loaders, saving both water and energy to heat the water.
  - Front-loaders require less detergent; usually a special *High Efficiency* (HE) type.
  - Front-loaders spin at a much higher rate of speed (1,000 rpm or higher), wringing much more water out of the clothes. This significantly reduces the energy required to dry the clothes.
  - Front-loaders are frequently gentler on laundry, due to the tumbling action of the clothes, rather than the movement of the agitator in a top-loader.
  - Top-loaders are generally cheaper to purchase, initially; when factoring in energy savings, however, the purchase price will be offset over the life of the appliance.
  - Top-loaders are generally easier to load and unload for many people. Front-loaders, however, can be mounted on stands or have the dryer stacked on top to save floor space.
- **Efficiency.** Choose an ENERGY STAR model. Modified Energy Factor (MEF) is a measure of energy efficiency that considers the energy used by the washer, the energy used to heat the water, and the energy used to run the dryer. The higher the MEF, the more energy efficient the clothes washer. Water Factor (WF) measures water efficiency in gallons of water consumed per cubic foot of capacity. The lower the WF, the more water efficient the clothes washer. Both MEF and WF are listed on the ENERGY STAR website.

When evaluating a new **dryer,** look closely at these features:

- **Sizing.** Match the size of your dryer to the size of your washer.
- **Electric versus gas.** Although gas dryers may cost slightly more (for similar size and features), your choice may depend on the availability of certain fuels (and their connections) in your home.
- **Features.** Dryers with sensors evaluate the moisture content of the laundry and reduce drying times. This is far better than using a timed cycle, which may overdry clothing, wasting energy and potentially damaging clothes. Options for temperature settings allow for optimal use with different fabrics. Additional features, such as wrinkle-reducing cycles and drying racks, may not add significantly to energy use, but may be important convenience considerations.
- **Efficiency.** An efficient washer (with a high spin rate) will wring most of the water out before you put the clothes in the dryer—reducing drying time and energy use. New ENERGY STAR standards for dryers were released in 2013.

Efficient use

Follow these suggestions to keep your laundry energy usage to the minimum:

- Wash and dry properly sized loads. Too small, and you may be wasting energy; too large, and you may strain your equipment or get unsatisfactory results.
- Wash laundry in cold water (most detergents are now designed to work well in cold water). Occasionally, some heavily soiled loads may benefit from warm water; hot water washes/rinses should be used for bedding, to reduce allergy issues from dust mites.
- Lower dryer temperature settings to allow for longer "air tumble" times between "heating" times. Along with limiting heat damage to clothes, this will also save some energy; it will lengthen the amount of time to dry a load, however.
- Set your dryer to "less dry" and hang clothes to air-dry the final amount. This method can also reduce wrinkles and eliminate ironing for many clothes. (See sidebar on page 14 for caution about indoor drying.)
- Air-dry clothes *outside* to reduce dryer usage.

Cooktops, ranges, and microwaves

The energy-related differences between the various ways to cook and bake food usually have very little to do with either the device or its fuel. Although there may be incremental energy savings between different devices, the overall energy used to cook and bake food in most homes is relatively small—$50 to $75 per year on average. There are presently no ENERGY STAR standards for these appliances.

Shopping tips

The expected life of most ranges and cooktops is 14-20 years; microwaves should last about 10 years. These appliances are usually fairly reliable over their expected life; an estimate for repairs of several hundred dollars might suggest replacement. Many newer models have additional features and approaches to heating food. When buying range or cooktop replacements, ask about:

- **Fuel choice.** Because the difference in energy use is relatively small, this is usually based on the available fuels and connections in your kitchen. Cooking preferences, indoor air quality, safety, and adding to electric loads may also be factors for some people.
- **Burner styles.** Whether coils, smooth-top, enclosed, induction, or halogen, burner styles are largely a matter of personal choice and budget. Some options may heat more quickly; others may leave less residual heat on the cooktop, and thus be safer.

- **Controls.** Controls located on the front are much safer than those that require you to reach over burners and hot pans. Newer models have lock-out features to prevent accidental use by children.
- **Other options.** Features such as dual timers, convection heating, lighting, warming drawers, intelligent cooktops, etc. may all be important to your cooking styles; again, the energy consequences for most home use are relatively small.

Microwaves are slightly more energy efficient for some cooking tasks, but their main advantage is faster cooking time. The higher the wattage, the less time it takes items to be heated. When selecting a microwave consider the intended uses in order to properly size the unit.

Efficient use

There are a few things you can do to make cooktops, ranges, and microwaves work as efficiently and safely as possible:

- Plan your meals to use the heat from your oven to cook multiple items. Baking a squash? Throw in a couple of potatoes for tomorrow's meal.
- Open oven doors only when necessary; the temperature can drop 30° in just a few seconds.
- Don't place foil on the bottom of a gas oven; it may interfere with the flow of air to the burners.
- Use pots and pans that are sized to fit the burner size on your cooktop. Pans that are too small for the burner allow heat to escape along the sides. Ones that are too large may not distribute the heat evenly across the bottom of the pan.
- When heating food in a microwave, do it in stages, with frequent stirring or turning. Microwaves may not penetrate into the interior of some foods, and thus not kill foodborne bacteria.

Lighting

Lighting a typical Minnesota household accounts for about 10% of the energy needed to operate the home. There are many opportunities to affect that energy use, such as selecting efficient products and using them appropriately.

Types of lighting

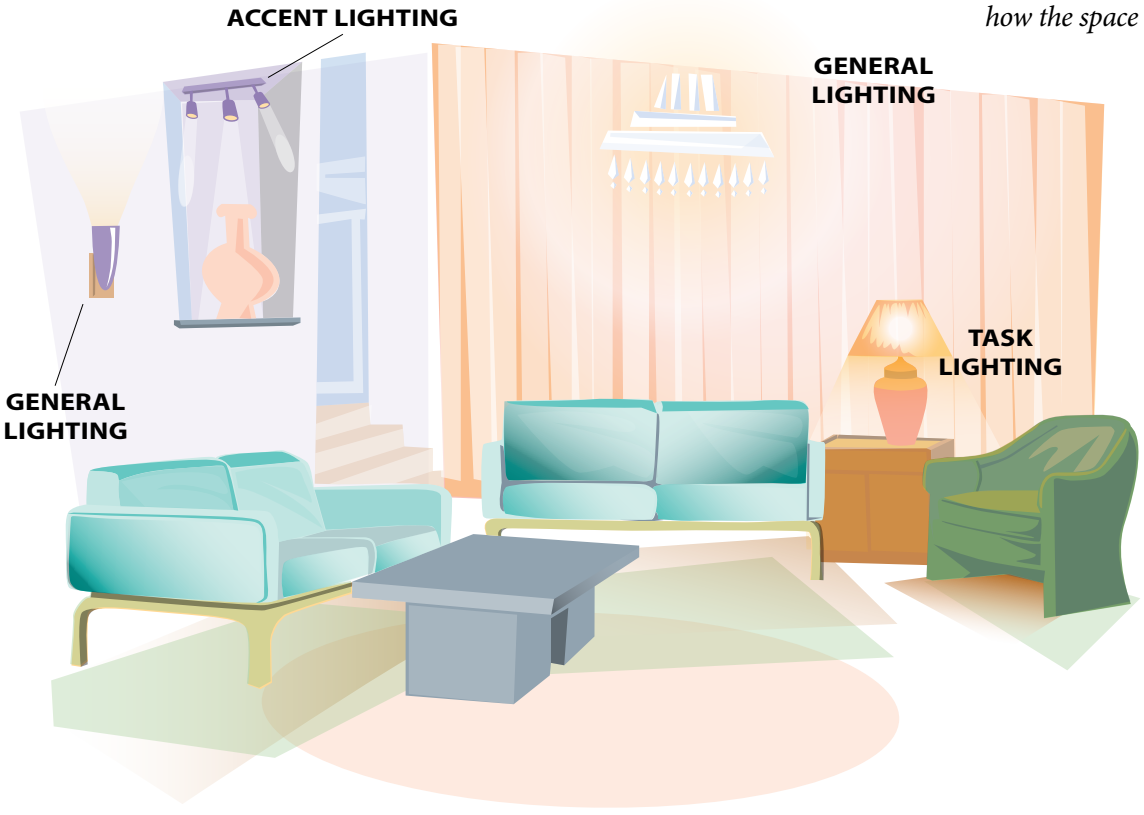
Lighting falls under one of four general categories, based on the use of the space to be illuminated. Well-designed lighting incorporates components of all four types in many rooms within a home.

- **General.** Used to provide a basic level of general illumination in a room, ambient lighting can range from a single ceiling fixture to dimmer-controlled wall sconces. Often overlooked, general lighting can establish a mood or complement other lighting options for a room.
- **Task.** Designed to give focused and brighter lighting to work spaces, task lighting is used for food preparation, reading, or working on projects. Down lights, track lights, or lamps are common sources of task lighting.
- **Accent.** Used to provide illumination for works of art or architectural features, accent lighting can include track lights, indirect lighting, or wall-wash lighting.
- **Decorative.** With the focus primarily on the light fixture itself, decorative lighting includes chandeliers and lamps. Because the light provided is usually incidental, decorative lighting frequently is combined with other lighting styles to provide appropriate illumination.

Saving energy with good lighting design

In the past, flipping a switch would flood a room with light, regardless of what you were going to do in the space.

Today, good lighting design includes options for fixtures, controls, and bulbs—based on how the space will be used.



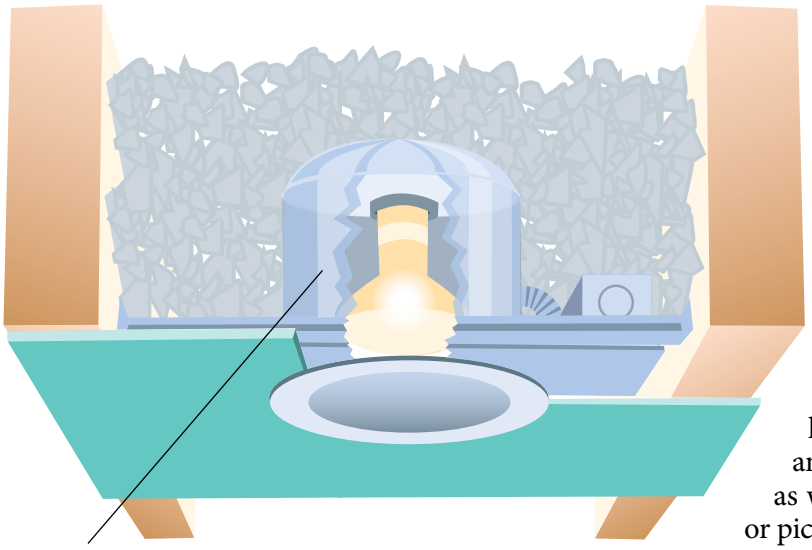
Fixtures

The devices that contain light bulbs are known as fixtures. Although it may not seem obvious at first glance, fixture choices can have a significant effect on the usefulness of lighting—and that can influence the energy use as well.

Ceiling fixtures require proper air-sealing

Light fixtures below an unheated attic must be tightly sealed to prevent air from leaking into the attic space. Air leaks not only waste energy, they are the primary cause of ice dams.
Methods of sealing include:

- ***Recessed fixtures.*** **New or retrofit recessed fixtures (including new LED fixtures) should have airtight cans and gasket seals. Existing recessed lights can have airtight boxes sealed over them from the attic side.**
- ***Flush-mount fixtures.*** **Electrical boxes should be sealed with spray foam around any cracks or openings into the attic.**
  Caution: **Disconnect power to circuit until foam cures!**



AIRTIGHT, SEALED RECESSED LIGHT FIXTURE

Surface mount fixtures

Typically found on ceilings or walls, surface-mounted fixtures are attached directly to an electrical box and often controlled by a wall switch. Usually designed to provide general illumination, these fixtures frequently have some type of diffuser that spreads light throughout the room. Surface-mounted fixtures can be as simple as an open porcelain bulb holder or as complex as a dining room chandelier. Depending on the design of the fixture, acceptable bulbs may include any style that distributes light broadly in all directions.

Track lighting, which can be either standard voltage or low voltage, are also usually surface-mounted fixtures. Often used as accent lighting or to illuminate art, track lighting can also be used to provide focused task lighting in kitchens or work areas.

Recessed fixtures

Light fixtures that are recessed into the space above the finished ceiling are commonly known as down lights or can lights. Designed to provide focused light at a particular location, these fixtures are controlled by a wall switch and use reflector bulbs that direct light straight down. Some fixtures may also have partial shields or reflectors that direct the light towards the side. Because of the risk of heat buildup in these types of fixtures, it is important to properly match both the size and type of bulbs to the fixture. Recessed light fixtures that enter the attic space are required to be sealed and insulated to avoid air leakage and fire hazards.

Plug-in fixtures

Light fixtures that are not directly wired to the home electrical system require a cord to plug into an outlet. These include floor, table, and desk lamps as well as specialty lighting like under-cabinet lamps or picture lights.

The flexibility of many plug-in lamp fixtures makes them a good choice for a variety of lighting needs. However, the use of cords (and extension cords) for plug-in lamp fixtures can present hazards. Cords should run along walls wherever possible and should not extend into traffic areas. Extension cords should be rated by Underwriters Laboratories for the intended use. If cords or plugs are cracked or loose, they should not be used until repaired. Using the proper bulb in plug-in fixtures is also important. Heat buildup from an over-sized bulb can be a fire risk.

Bulbs

The standard incandescent light bulb (which has changed very little since Edison's time) was the only real choice for most homes until fairly recently. Today, there are many options, based on performance, lighting designs, *and* energy use.

Incandescent bulbs

As electrical current passes through the filament in an incandescent bulb, it is heated to a high temperature (400°-500°) which causes it to glow with visible light. Because nearly 90% of the energy input is emitted as non-visible infrared (heat), incandescent bulbs are less efficient than a compact fluorescent (CFL) bulb that provides the same amount of light. This extra heat can also present a fire hazard in certain types of fixtures. Incandescent bulbs also have a relatively short expected lifetime—between 750-1,000 hours for a general service bulb.

Banned for use?

The *Energy Independence and Security Act of 2007* does not actually ban the use of incandescent light bulbs, but it sets efficiency standards that cannot be met by traditional incandescent bulbs. But, importantly, there are 22 categories of lighting (including 3-way bulbs, rough service bulbs, and plant light bulbs) that are exempt from the standards. And there are many new products that *will* meet the new standards and provide more lighting choices for consumers.

Saving energy with bulbs

Today there are many choices for bulbs—way beyond just the standard incandescent bulb. These choices allow consumers to better meet their lighting needs—while considering performance, bulb life, initial cost, operating cost, and energy efficiency.

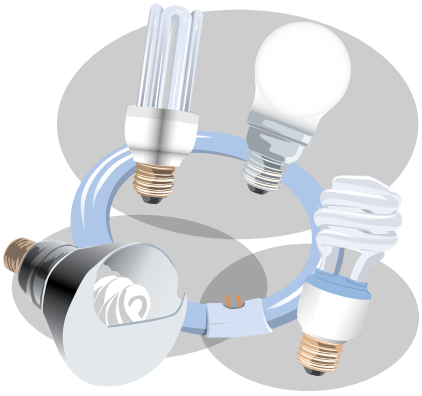
Halogen bulbs

While essentially an incandescent bulb, halogen bulbs are infused with inert halogen gas and have a stronger, smaller quartz shell. This allows the bulb to last about three times longer and use 10% less energy than a standard incandescent with the same light output. Although commonly used in desk lamps, work lights, and track lighting, halogen bulbs are also available as spot or flood lights for use in recessed fixtures or outdoor lighting. Halogen torchieres (tall floor lamps that direct light towards the ceiling) are also popular; they can present a fire hazard if not properly used, however.

Just like their standard incandescent bulb cousins, halogen bulbs give off a lot of energy in the form of heat. In fact, because the quartz envelope is so much closer to the filament, halogen bulbs can become extremely hot. Most lamps and fixtures that use halogen bulbs are required to have an additional glass cover or shield to reduce fire risks and contain fragments in the event of a bulb failure.

Tube fluorescent bulbs

Available since the 1940s, tube fluorescent bulbs are commonly seen today in public buildings, schools, commercial buildings, retail stores—nearly everywhere that lighting is used. Even in residential homes, tube fluorescents are found in basements, garages, and workshops. Valued because of their long life, energy efficiency, and balanced illumination,



Compact fluorescents: improved & efficient

Despite issues with first generation bulbs, the lighting industry has improved CFL performance and now offers many choices for brightness, color, and shape.

CFLs are now available as spots and floods, as decorative candelabra bulbs, as encapsulated bulbs, and as the common "pigtail" style.

Most importantly, ENERGY STAR labeled bulbs must meet these (and other) standards:

- **Provide at least three times more lumens per watt than incandescent bulbs**
- **Start in less than one second**
- **Have a rated lifetime of 6,000 hours or greater**
- **Bulbs with mercury vapor must reach full brightness in less than one minute**

tube fluorescents are available in a variety of color temperatures and sizes. Recent advancements have replaced older tubes (T-12 with magnetic ballasts) with more efficient tubes (T-8 with electronic ballasts), representing significant energy savings in larger buildings.

Compact fluorescent bulbs

The current crop of ENERGY STAR labeled compact fluorescent light bulbs (CFL) use one-third of the energy and last up to ten times longer than an incandescent bulb with the same light output. They also operate at cooler temperatures than incandescent bulbs, because they convert more of the energy directly into visible light.

Now available in a wide variety of sizes, shapes, and colors, modern CFLs have overcome many of the problems associated with their initial production in the 1990s. Newer bulbs have electronic ballasts which eliminate most of the flickering and slow starting of earlier models, and ENERGY STAR standards have improved reliability and expected lifetimes considerably. Along with energy use and estimated life, package labeling now includes information about brightness and light appearance—the best way to determine the appropriateness of a particular product. For most lighting needs, CFL bulbs are an energy-efficient alternative to standard incandescent bulbs.

What about mercury?

All fluorescent bulbs (both tube and CFL) contain small amounts of mercury vapor—between 1 and 5 milligrams in a CFL bulb. For comparison, a mercury thermometer contains 500 milligrams—about the same amount in a dental amalgam. In an unbroken CFL bulb, the mercury is contained; accidental breakage can release the mercury. Although the risks associated with the breakage of a single CFL bulb have been sometimes exaggerated, proper cleanup and disposal is recommended (epa.gov/cfl). Recycling of burned out CFL bulbs is required by law, so that the mercury and other components can be captured and re-used. Check with your county household hazardous waste program, electric utility, or retail store for locations for CFL recycling.

Additionally, because mercury is emitted from coal-fired power plants, anything that reduces electricity usage—including using CFLs—will reduce mercury in the environment.

Light emitting diodes

Also known as Solid State Lighting (SSL), light emitting diodes (LEDs) have been used in electronic devices (like laboratory equipment and calculators) since the 1960s. Advances in recent years have moved LEDs into illumination lighting for retail and commercial businesses—including streetlights, architectural lights, and freezer display cases. Residential lighting options are now entering the marketplace, offering new options for homeowners.

Long life + efficiency

LEDs have several characteristics that make them suitable for many applications in homes and businesses. Roughly equivalent to CFLs in efficiency (as measured by lumens per watt), LEDs have a clear advantage when it comes to estimated lifetimes, which makes them a good choice for locations where bulb change-outs are either difficult or costly. Additionally, LEDs can deliver bright light in a more tightly focused area, making them very suitable for task lighting and directional accent or decorative lighting. LEDs also contain no mercury, but must still be properly disposed at the end of their life. Manufacturers are presently offering a growing selection of products to meet specific lighting needs, including general illumination options that spread and diffuse the LED light more effectively and warmer colors that match incandescent bulbs. *Note:* Although many LEDs are dimmable, it is important to check the packaging to be certain of compatibility with your dimmer switch.

Choosing the right bulb

Light bulb options used to be simple—and limited. Residential choices were between incandescents and tube fluorescents; shops, basements, and laundry rooms got the fluorescents and everywhere else the incandescents. The only thing to decide was how many watts you needed.

What about watts?

Watts are a measurement of energy usage that became a convenient shorthand for describing the brightness of an incandescent bulb. Today, with so many types of bulbs to choose from, knowing the wattage of a bulb tells us little about other important characteristics: brightness, color temperature, lifetime, or environmental impact. As consumers, we need to change how we evaluate light bulbs to ensure we match our lighting needs with the proper bulbs and fixtures.

Lumens: the *real* measure of brightness

The lumen is a measure of the brightness of light as perceived by the human eye. It is measured independently of the type of bulb or the bulb's wattage and provides a more accurate view of how we actually perceive the illumination. A typical 60-watt incandescent bulb provides about the same amount of lumens as a 13-watt CFL, for example. The higher the rated lumen output of a bulb the "brighter" the light is. Low-lumen output (under 600) may be best suited for decorative or mood lighting. Higher lumen bulbs (over 2,000) may work best for task lighting, especially if the bulbs are directional, such as a spotlight.

LEDs: new options for home lighting

Some of the first LED products available for home use included reading lights and holiday lighting. Task lighting—in the form of spot bulbs and "under counter" fixtures—capitalize on the directional nature and brightness of LED lights.

The current generation of LED bulbs include improvements in styles, brightness, color temperature, and efficiency—along with moderating prices. New products will continue to provide expanding options for consumers.

Efficiency: Lumens per watt

Although any low wattage bulb will deliver energy savings, the only really accurate comparison is how much light (lumens) you get for a specific amount of energy (watts). Presently, CFL and LED bulbs offer the highest efficiency options, with most delivering over 60 lumens per watt—compared with under 14 lumens per watt for incandescent bulbs.

Light bulb comparisons

The table below illustrates differences in cost, efficiency, and environmental concerns for selected light bulbs; different products may have different characteristics. Electricity costs are based on current statewide average, not projected costs. Bulbs selected for comparison have similar lumen outputs and are currently available retail products. Watts, lumen output, estimated bulb life, and retail prices are from retailers/manufacturers.

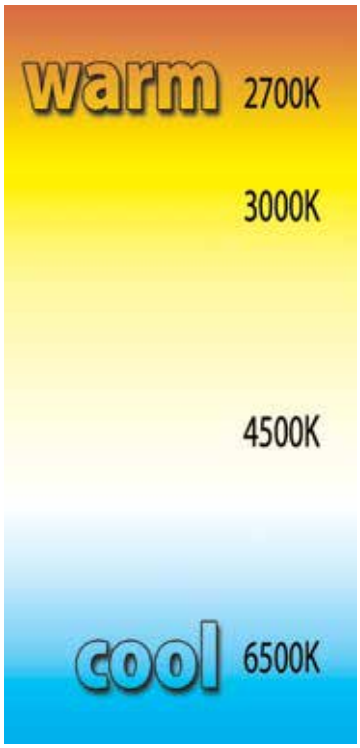
	Incandescent	CFL	Halogen	LED
Lumens	830	840	850	865
Watts	60	13	60	13
Lumens per watt	14	65	14	67
Dimmable	yes	maybe	yes	yes
Est. life in hours	1,500	10,000	2,500	40,000
Est. life in years	1	9	2	25
25 yr operating cost[1]	$195	$60	$225	$60
# of bulbs for 25 yr[2]	18	3	11	1
25 yr CO_2 emissions[3]	3,000 lbs.	640 lbs.	3,000 lbs.	640 lbs.
Proper disposal	no special requirements	recycle	no special requirements	recycle

[1] Cost to keep a bulb operating 3 hrs/day at 11¢/kWh for 25 years (the estimated life of the longest-lasting bulb) plus the cost of needed replacement bulbs.

[2] Number of bulbs required over 25 years, operating at 3 hours per day, based on estimated life of bulbs.

[3] Emissions per year x 25. Based on 1.8 lbs. CO_2 per kWh (MN avg) for 3 hours/day of operation.

Numbers have been rounded for clarity. Actual performance will vary.



Color temperature makes a *big* difference

All light bulbs emit different frequencies (or colors) of light, depending on the type of bulb, materials used in the manufacturing, and coatings on the inside of the glass. The human eye perceives redder colors as "warmer" and thus more natural for general illumination; bluer or "cooler" colors are perceived as providing sharper detail, well-suited for task lighting.

Somewhat confusingly, the lower the color temperature (measured in degrees kelvin or "K") the warmer the light. Incandescents are typically in the range of 2,700K to 3,300K; fluorescent bulbs can range from 2,700K to "bright-white" bulbs of 5,000K. Halogens may have color temperatures of 3,500K to 6,500K and LEDs are now available with color temperatures ranging from warm 2,700K to cool 6,000K. Choose the color temperature best suited for your use.

Labels make it easier to choose

Thanks to labeling requirements from the Department of Energy and the Federal Trade Commission, choosing light bulbs based on lumens, color temperature, and efficiency is now considerably easier. These labels also include information on estimated annual energy costs, estimated lifetime, disposal requirements, and whether the bulb meets ENERGY STAR standards. When shopping for light bulbs, consumers can more easily compare characteristics between several bulbs, and make choices to best fit their needs.

Lighting Facts Per Bulb

Brightness	**800 lumens**
Estimated Yearly Energy Cost	**$1.14**
Based on 3 hrs/day, 11¢/kWh Cost depends on rates and use	
Life	
Based on 3 hrs/day	**22.8 years**
Light Appearance	
Warm — Cool	
2700 K	
Energy Used	**9.5 watts**

Lighting controls

Managing when lights are on and at what level of output is an important way to reduce energy use for lighting. Manually operating switches is the easiest way to control lighting in many situations. Simply turning off a light when leaving a room is efficient and simple. It does, however, rely on one important—and not always reliable—factor: human behavior. In some situations, controlling lighting automatically will not only save energy and money, it can also provide safety and convenience. Lighting control options include dimmers, timers, and motion detectors.

Look for the label!

Choosing bulbs that fit your needs—whether for mood lighting, reading, or detail work—has never been easier. All bulb packaging now includes information on color appearance, brightness, efficiency, and estimated life.

Dimmer switches

A typical dimmer control switch reduces the electrical current to a light fixture, reducing light output and saving energy. Traditionally used with incandescent bulbs, dimmers will also work with certain LED bulbs (some older dimmer switches may not work well with some LED bulbs; check with the manufacturer to ensure compatability). Some CFL bulbs are also capable of operating with a dimmer switch, but the effect is more like that of a three-way bulb: light levels "jump" from high to medium to low to off. Bulbs that are not designed to be used with a dimmer may burn out prematurely or overheat. Check the packaging or manufacturer to avoid performance or safety problems.

Occupancy sensor switch

More commonly seen in public restrooms and commercial buildings, occupancy switches are also available for home use. They are particularly useful in locations where the switch is inconveniently located—at the far end of a hallway or stairway—or where lights are left on for safety or security—in a garage or basement.

Timers

Many devices, including lighting, can be controlled with a timer. Having selected lights come on when occupants arrive home and off at bedtime, for instance, can provide convenience and safety. Security concerns can be addressed by having lights come on when on vacation, as well. The timer avoids the energy wasted from having lights and devices on over long periods of time.

Newer electronic timers can be plugged into a wall outlet and then lamps, radios, computers, etc. can be plugged into the timer. Entering start and stop times for each day of the week can provide a customized operating schedule.

Motion detectors

In locations where light is needed but the switch is not conveniently located, a motion detector switch can provide a good alternative to leaving a light on all night. Lights outside front and back door entrances or driveways near garages can be set to come on at night when movement is detected and turn off in a set amount of time.

Outdoor motion detector fixtures also provide security and safety, warning of intruders and lighting walkways and steps. The sensitivity and range of these light fixtures should be adjusted so that they are not triggered by small animals or wind-blown trees. Remember to select bulbs that are specifically designed for outdoor use. Many CFLs may light slowly or not at all in cold temperatures; LEDs may be a good choice because of brightness and long life.

Motion detector switches can also be used inside of buildings in areas that are occupied frequently or that have awkward switch locations. A motion switch in a bathroom or basement stairway can operate lights only when someone is present, for example.

Electronics

Although electronic devices like TVs, DVD players, and computers consume a relatively small percentage of the energy to operate a typical Minnesota household, it may be possible to cut electricity use for home electronics in half—with not much effort.

Home entertainment equipment

Televisions, CD and DVD players, cable boxes, stereo receivers, and video gaming systems can use a lot of electricity, even when off. Some older TVs, for example, can use up to 40% of the full "on" power when turned off.

The cheapest way to reduce electricity that is being used by these devices is to unplug them when you don't need them. No additional purchases or special tools are required—just a willingness to be vigilant. Controlling them with a convenient outlet strip can make it easier; a "smart" outlet strip will turn off peripherals (DVD players, game systems) when a primary device (TV) is turned off. Because some older electronics may require re-programming, you may need to be selective about what you turn off.

Computers and peripherals

A recent study conducted by the Energy Center of Wisconsin indicated that up to 80% of the computers in the study did not have sleep/hibernate enabled. Many people mistakenly believed their computers were in sleep mode because their monitors were asleep; in fact, the settings had not been enabled on the computer. Because many people leave their computers on all the time, enabling these features can save up to 300 kWh of electricity every year. Additionally, many related devices (such as printers) are left on, even though they may be used only a few minutes each day.

A simple trip to your control panel settings for power management will allow you to configure your system to reduce electricity use. Computers that are asleep will still receive updates and be available for other activities (like video streaming to your TV). Peripherals (printers, modems, scanners, etc.) can be controlled by turning off, unplugging, or using a smart outlet strip.

Computers

Adjusting the power management settings for your computer can save up to 300 kWh of electricity a year. When upgrading, purchase ENERGY STAR computers, monitors, and peripherals.

Chargers

Most of us have numerous devices that have rechargeable batteries: cell phones, flashlights, power tools, etc. Even though the amount of power used by each of these may seem insignificant, they often will continue to draw small amounts of electricity, even when fully charged and the device is removed.

Fortunately, there is an easy way to curb this wasted electricity: charging stations. An inexpensive timer can be set to operate for an hour or two at night. Plug an outlet strip into the timer and the devices to be charged into the outlet strip. If located conveniently (kitchen or entryway for cell phones, basement for tools) it becomes easy to keep devices fully charged with minimal wasted electricity.

Resources

The following resources should get you on the way to making energy-saving improvements in your home. Remember, whether doing the work yourself or hiring a contractor, it is important that you have a good understanding of the options and opportunities available. This checklist will help you make the best choices for your home and budget:

Prework inspection. An independent energy assessment or home performance review is an essential first step to evaluating how your house is currently operating. Proper diagnosis (from someone who is not selling specific products or services) can lead to energy-saving suggestions based on actual measurements and analysis—not on speculation or exaggerated claims.

- ❑ At minimum, assessments should evaluate mechanical systems, combustion appliances, insulation, and air leakage.
- ❑ Recommended tests include a blower door reading, a combustion appliance analysis, and an infrared scan.
- ❑ Local utility or community energy organizations can provide an energy assessment or home performance review. Contact your local gas or electric utility to learn where to get an energy assessment.

Education and research. Once you have a report in hand with specific recommendations, it is time to learn a little more about your options. Information is available from many sources—the task is finding what is trustworthy and useful.

- ❑ **Government and nonprofit organizations** provide background on building science, design, and energy conservation and efficiency options. Some provide efficiency data on products, enabling easy comparisons by consumers. Others provide information about specific programs or services, including loans, incentives, and rebate opportunities. Check out:
  energystar.gov
  eere.energy.gov
  dsireusa.org
- ❑ **Utility companies** offer incentives and rebates for energy-saving products or services that help them reach state-mandated energy conservation goals. In addition, they may have lists of contractors that they approve to install specific equipment or materials. Contact your utility to learn more.
- ❑ **Manufacturers** and sellers of energy-related products can provide specific data to help with proper sizing or selection of the correct equipment or materials for your situation. They can also be a source of information about available rebates.
- ❑ **Books, periodicals, and online** sources offer a plethora of energy-related information and evaluations of products and contractors. Be wary, however, of exaggerated claims or unrealistic expectations. The best information provides a balanced perspective on options including professional, academic, or industry evaluations and customer or media reviews.
- ❑ Go to our website (mn.gov/commerce/energy) and sign up for our e-newsletters on topics ranging from energy efficiency tips to notifications of grants and funding opportunities. We also post information about consumer alerts on specific products or companies.

Selecting a contractor. Choosing a contractor is much like a job interview—and you are the employer. The state of Minnesota, through the Minnesota Department of Labor and Industry, establishes standards and safeguards to help homeowners avoid hiring disreputable or unqualified contractors, and to protect them against sloppy or poor quality construction.

- ❑ Check out **licensure on contractors** you are considering. A licensed contractor has met certain requirements, such as having a principal of the company pass an appropriate examination, taking ongoing continuing education, and having liability and property damage insurance. In addition, hiring a licensed contractor provides you with access to the Contractor Recovery Fund, which can reimburse consumers who suffer financial losses as a result of a contractor's misconduct. The Department of Labor and Industry maintains lists of all licensed contractors and their current status. For more information about contractor licensing or building codes and standards, go to **dli.mn.gov.**
- ❑ If a particular trade specialty requires **certification or training**, make sure the contractor is in good standing with the certifying organization and current on all required training.
- ❑ **Utility companies** may have contractors that they recommend who have met certain established standards.
- ❑ Contact the **Better Business Bureau** to see if there are any complaints or actions against contractors you are considering.
- ❑ **Talk with friends, neighbors**, and suppliers about who they have worked with and who they would recommend for a project like yours. If possible, look closely at the work that was done and ask questions about how the process went—from initial estimate to final payment.
- ❑ **Ask the contractor for references** and be sure to contact them! Ask for a customer in your neighborhood or community and with a project similar to yours. Don't be afraid to ask direct questions about everything from punctuality, communications, how customers were treated, satisfaction with work quality, willingness to correct errors, and thoroughness of cleanup.
- ❑ Check out **online consumer rating services** to learn what others may have to say about particular contractors. Consider getting a subscription to one of the paid services, which are monitored and which provide rankings and comments from customers. Remember that many satisfied customers don't make comments, so a lack of reports may be a positive indicator, as well.

Bids and contracts. Get at least three bids that meet your minimum requirements:

- ❑ Only **review bids that are in writing** and include detailed information about the job: scope of the work, materials to be used (manufacturer's numbers, models, colors, sizes, anything else that specifies ***exactly*** what you are buying), prices, cleanup and debris removal, and names of subcontractors and suppliers.
- ❑ **Be sure you are getting what you are expecting.** The lowest bid may not be the best; incomplete or vague bids may not protect your interests. Reconsider bids from contractors who hesitate to provide you with the information you need to make an informed decision.
- ❑ **Don't be misled by "sales" or "deals"** that are available "for a limited time only." If you feel pressured to sign a contract, you should be cautious. Although there are sometimes time limits on rebates for some materials or equipment, be sure it is not simply a tactic to get you to commit before you are ready. And remember that sometimes "sales" are opportunities to move products that are not selling well.
- ❑ The **contractor should apply for permits** and is responsible for meeting all building codes and arranging inspections. Also in the bid should be information about timeframes and what will happen if deadlines are not met, as well as the schedule of payments and any holdback clauses for incomplete or substandard work.

- **Contracts are negotiable**, legally binding agreements. This means that you have the right to request additions, deletions, or changes in the terms prior to signing. It also means that the contractor can do the same. Both parties have the right to enter into a satisfactory agreement.
- Learn about the **"Three-Day Cooling Off Law"** that gives you the right to cancel within 72 hours of signing a contract for work to be done on your home. ***Don't provide a check or down-payment until this period has ended*** and you have had the opportunity to review details, check references, or make other evaluations of the contract or the contractor. Learn more at the Minnesota Attorney General's Office: **ag.state.mn.us**.
- The **final contract should list everything** that was included on the initial bid. Over the course of the project, any additional work done (not part of the original contract) must be approved by you with a "change order" that specifies the work and any additional costs to you. If you have not signed the change order, it is not an enforceable part of the contract.
- **Require lien waivers** from all suppliers and subcontractors. Anyone who works on your home has the right to attach a lien against your property if they are not paid for their work or materials—regardless of whether you paid the primary contractor. Make delivery of signed lien waivers part of the initial contract, and do not make any final payments until you receive them from all subcontractors and suppliers.
- ***Before making final payment,*** make sure everything is completed, including all inspections and cleanup. If you are unsure that everything is done to your satisfaction, ask for a day or so to inspect before making the final payment.

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