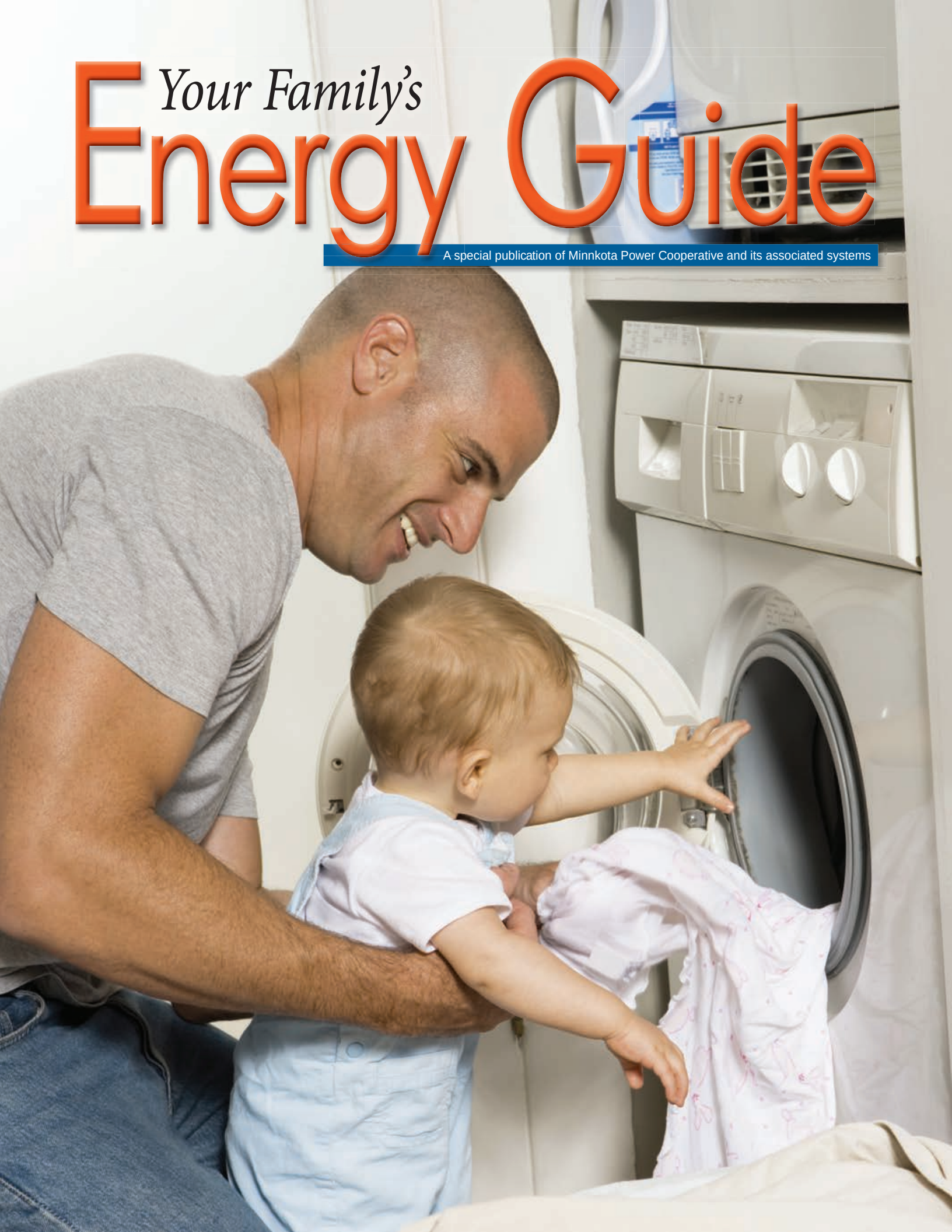
Your Family's Energy Guide

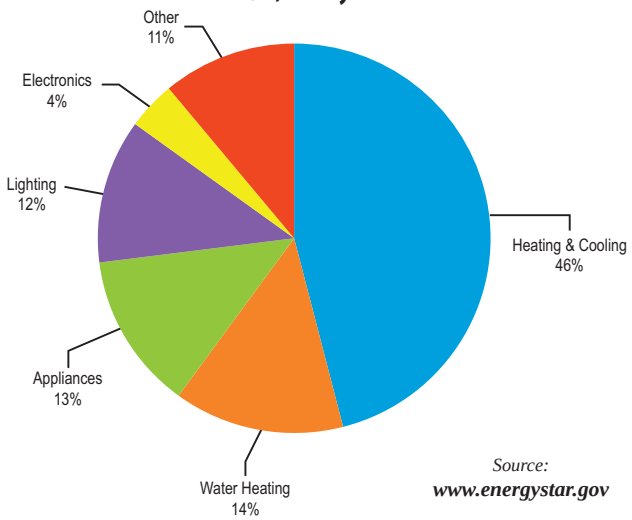
A special publication of Minnkota Power Cooperative and its associated systems



The energy efficient home

In an era of rapidly rising energy costs, having an energy-efficient home is important. The size of your home and your family's lifestyle are key factors in the amount of energy consumed. Your electric cooperative or municipal works hard to hold down energy prices. You, too, can play an important role in controlling your energy costs by evaluating your home and taking simple steps to trim unnecessary energy consumption.

Average Energy Bill for a Single Family Home
$2,200/yr.



Source:
www.energystar.gov

The best way to start this process is by taking a whole-house approach to understanding the main factors that contribute to your energy usage. We will start with the structural design and orientation of your home and then go through each of the major rooms to determine the best ways to utilize energy efficiency and conservation.

This guide is a starting point to get you on the way toward better energy management. It will provide you with the information you need to estimate your electric use. You'll also find valuable tips to create greater home comfort and improve performance. By using energy efficiency and conservation strategies in your home, you'll be able to reduce your electric energy usage, and ultimately your bill.

Enjoy the comfort and convenience of

Off-peak electric heating

and save money, too!

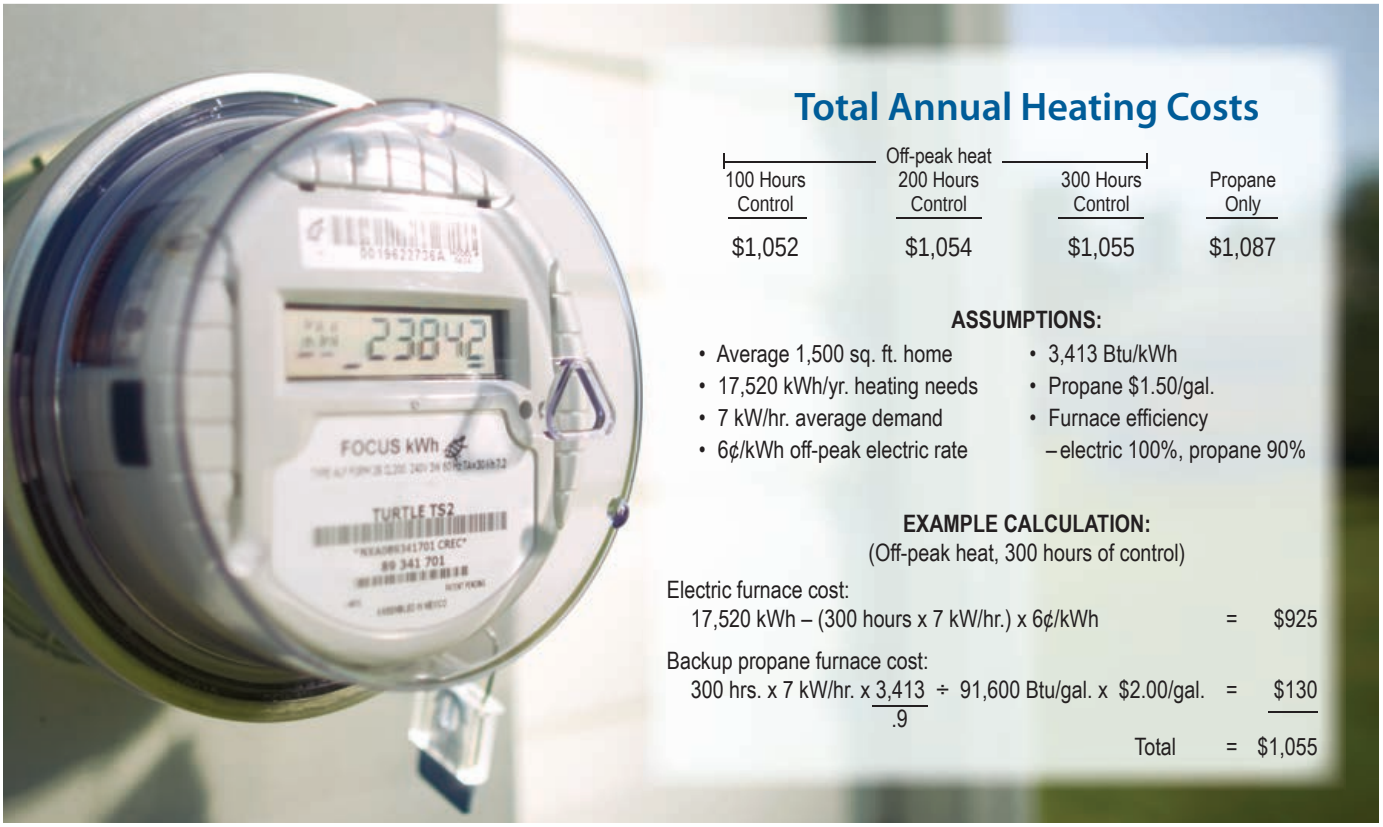
Your family can enjoy the value and convenience of electric heat and save money, too, by installing an off-peak electric heating system in your new or existing home.

An off-peak system consists of an electric heating source as its primary component. A supplemental heating source will need to operate 200-300 hours or more during the winter season.

Off-peak heating loads are generally controlled during the coldest months of the year, when the demand for electricity is high. Load control hours can also occur for a variety of reasons, including unscheduled power plant outages, transmission constraints outside of the Minnkota service area and extraordinarily high wholesale energy market prices.

The ability to interrupt the flow of electricity to the electric portion of your off-peak system allows your power supplier to operate generating plants more efficiently and avoid making costly power pool purchases. By voluntarily enrolling in the program, the savings are passed on to you through the low off-peak electric rate, which is approximately half of the regular retail rate.

For more information about energy savings and off-peak heating, contact your local electric cooperative or municipal system listed on the back page.



Total Annual Heating Costs

Off-peak heat			
100 Hours Control	200 Hours Control	300 Hours Control	Propane Only
$1,052	$1,054	$1,055	$1,087

ASSUMPTIONS:

- Average 1,500 sq. ft. home
- 17,520 kWh/yr. heating needs
- 7 kW/hr. average demand
- 6¢/kWh off-peak electric rate
- 3,413 Btu/kWh
- Propane $1.50/gal.
- Furnace efficiency – electric 100%, propane 90%

EXAMPLE CALCULATION:
(Off-peak heat, 300 hours of control)

Electric furnace cost:
17,520 kWh – (300 hours x 7 kW/hr.) x 6¢/kWh = $925

Backup propane furnace cost:
300 hrs. x 7 kW/hr. x $\frac{3,413}{.9}$ ÷ 91,600 Btu/gal. x $2.00/gal. = $130

Total = $1,055

Your home's design

A truly energy efficient home begins with the orientation and design of the structure itself. Most modern energy-saving ideas can be seamlessly integrated into any type of home design without sacrificing comfort, health or aesthetics.

Home heating and cooling

Because heating and cooling account for nearly half of your electric usage, here are several simple suggestions you can try to help you save on your electric bill:

- Turn down the thermostat. Reduce the temperature from 70 degrees to 65 degrees while you're home. Turn it down to 60 degrees or 55 degrees while you're away or asleep, and cut your heating bill by 10 to 15 percent.
- Run the furnace fan in "auto" mode instead of "fan on" mode.
- Setting your thermostat lower in the winter and higher in the summer will save you 3 percent per degree on heating and cooling costs.

- Open shades to let in the sun's warmth – close them at night to keep heat inside.
- Heating, ventilation and air conditioning systems should be checked to verify they are moving the correct amount of air. A qualified technician can assist you.

- Heat pump and air conditioning systems should be checked annually to verify they are properly charged, strictly in accordance with manufacturers' guidelines.
- Keep inside and outside coils clean and free of debris.
- Gas furnaces should be tuned for maximum combustion efficiency.
- Return filters should be changed monthly.
- Have a technician check carefully for duct leaks. Leaks that are found should be sealed with fiberglass and mastic sealant.
- Rather than turning on the central air conditioner, use a fan to circulate air and open windows.

Windows

A considerable amount of heat transfers through windows. If you have single-pane windows, consider doing the following:

- Tighten and weatherstrip your old windows and then add storm windows.
- Compare the above cost with replacing your old single-glazed windows with new double-glazed windows.
- "Low-e" coatings on glass can help reduce heat loss through windows.
- Close your curtains and shades at night; open them during the day.
- Lock windows. It tightens the seal to stop heat leaks.

Insulation and air infiltration

Air that transfers in and out of homes through cracks, crevices and holes can increase energy consumption. Here are some helpful tips to avoid air infiltration and improve your home's insulation:

- If you have R-19 or less insulation in your attic, consider bringing it up to R-49.
- If you have R-11 or less floor insulation, consider bringing it up to R-25.

- Insulating basement walls can save you up to 20 percent on heating costs and make your home more comfortable.
- Rim joists should be insulated and sealed.
- Seal around pipe penetration coming through the walls.
- Ensure that the weatherstripping around doors is tight.
- When your fireplace is not operating, its flue should be closed tightly, with a sign hanging from the flue handle warning it is closed.
- Check the ceiling behind the crown molding of built-in bookshelves for holes cut during construction.
- Drop-down stairways should fit tightly into the ceiling and be carefully weatherstripped.
- Whole-house attic fans should be sealed tightly during the winter.
- Make sure the outside dryer vent door closes when the dryer is not in use.

Using energy efficiently

Each room in your home has a different set of appliances that can account for about 20 percent of all energy used. Cell phone chargers, iPods, remote-controlled televisions, DVD players and even washing machines use electricity when they are turned off. Forty percent of the electricity consumed by these appliances is used when they are idle.

Saving energy in your home doesn't require a major investment of money – or even your time. Here are ideas that will cost you little or nothing. Some will save you a lot of money, others perhaps only a few dollars a year. But add them up and you could reduce your annual energy bill by 25 percent.

Family room

- Make sure draperies or furniture do no block heat registers.
- Use a power strip to turn off electronic appliances completely. Eliminating this standby electricity loss from home appliances could save up to 25 percent on electrical bills.

- Select energy-efficient entertainment and home office equipment.
- Multifunction devices that combine several capabilities (print, scan, copy, fax) can provide additional savings.

Kitchen

- Keep outside refrigerator coils clean. Dirty coils make your compressor work longer to remove heat.
- Setting your refrigerator below 37 degrees uses extra energy.
- Setting your freezer below 0 degrees uses extra energy.
- Replace aging, inefficient appliances. Even if the appliance has a few useful years left, replacing it with a top-efficiency model is generally a good investment.
- Use small appliances where possible; a larger cooking appliance will use more energy and may not be required. A toaster, electric skillet, waffle iron, crockpot or popcorn popper uses less energy than a stove.
- Coffee makers with an automatic shutoff can save you energy.
- Preheat oven only when necessary and try not to open the oven while food is cooking.
- Use the "energy saver" setting on your dishwasher and air dry whenever possible.
- Operate the dishwasher only when there is a full load.
- Hand washing dishes with a lot of hot water can cost more than using a dishwasher.

Bathroom

- Take short showers instead of baths. A typical bath uses 30 gallons of hot water compared to 18 gallons used for a five-minute shower.
- Turn off bathroom fans after use.
- Install low-flow showerheads and faucet aerators.
- Clean your showerhead periodically; scaling and sediment can collect and reduce water flow, using more hot water than needed.

Laundry room

- Don't over-dry your clothes. If 50 minutes works, don't set it to 70 minutes.
- Make sure to clean the inside lint filter before each drying cycle.
- Periodically check your flexible metal dryer vent hose to ensure it is still tightly connected and not kinked.
- Use warm or cold water settings on the clothes washer. Each load of laundry washed in cold water saves enough energy to power a television for up to 34 hours.
- Wash and dry full loads of laundry.

Bedroom

- Use electric blankets that have dual settings for each side. Turn your blanket on just prior to bedtime, then turn off when going to bed.
- Draw curtains to keep the heat in when you go to bed.
- Make sure all the lights are turned off or use an energy-saving night light.

Water heating

About 20 percent of the energy used in your home is for water heating. And depending on the number and ages of people living in your home, the percentage could be greater.

You may be able to save money by replacing your old water heater with a high-efficiency electric model. Older models can be very inefficient because of poor insulation, corrosion and less efficient design. A new electric water heater will have sufficient insulation (at least 2 inches of foam for an R-16 insulation value) and can be selected with the corrosion protection that matches the quality of the water in your area.

New electric water heaters come with a choice of linings. Both glass and stone linings are excellent choices, but if you have particularly hard water, a polybutylene tank may be your best option. Another option available is a heat trap. A heat trap keeps heated water in the tank during non-use periods rather than letting it rise into the piping where it loses heat energy. A heat trap can increase water heating efficiency substantially. Call your power supplier for good advice and information on your water heating needs.

- Make sure your water heater is set at the lowest point. Try to set it at 120 degrees.
- Insulate your electric hot-water storage tank. If your water heater is located in an unconditioned space, consider installing a thermal wrap around it. Take care to install it in accordance with the tank and wrap manufacturer's instructions.
- Buy a new, more efficient model.
- Try washing clothes with warm water and rinsing with cold water.
- Repair leaky faucets immediately so they don't drip and waste hot water.
- Drain a quart of water from your water tank every three months to remove sediment that impedes heat transfer and lowers the efficiency of your heater.

Estimating your family's hot water usage

Step 1

# of occupants x 18 =Total household gallons of water used/day*

4 x 18* = 72

Step 2

Total household gallons x 30 days/month = Total household gallons used/month

72 x 30 = 2,160 household gallons used/month

Step 3

*Total household gallons used/month x .18 kWh/gallons** = Total kWh*

2,160 x .18 kWh/gallons = 389 kWh**

Step 4

Total kWh x cost per kWh = Estimated cost to heat water for family for one month

389 kWh x cost per kWh (.12) = $46.68
(estimated cost per month to heat water for this family of four)

*Estimated gallons of hot water used/day by each family member

**Amount of energy (609 Btus) needed to heat one gallon of water from 47 degrees to 120 degrees F.

Lighting

Making improvements to your home's lighting is one of the fastest and easiest ways to lower your energy bill and doesn't require a major investment of money or your time. Here are simple ideas that will cost you little or nothing but can help reduce your energy bill:

- Don't leave unnecessary lights on during the day.
- Make sure all the lights are turned off or use an energy-saving light.
- Consider replacing your home's five most frequently used incandescent bulbs with energy-saving options such as CFLs or LEDs, which use about 25 to 80 percent less energy than traditional incandescents and last 3-25 times longer, saving you money.
- Take a look at the lighting you use at night for security. Check with your local cooperative or municipal to see if they can help you save money by installing a pole-mounted outdoor light.
- Motion sensor, photocell or LED lights can provide security lighting while saving you energy.
- LED Christmas lights use up to 90 percent less energy than traditional lights, last for many years and require no bulb changes.
- For high-quality products with the greatest energy savings, choose bulbs that have earned the ENERGY STAR®.

How to compare cost

When comparing the price of off-peak electricity for heating to the price of alternative heating fuels, it is important to compare equipment efficiency, energy rates and monthly service charges.

The seasonal efficiency for electric heating systems ranges from 100-300 percent or more. The comparable efficiency for gas and oil heating systems ranges from a low of approximately 70 percent to a high of 95 percent. Older gas and oil systems have an efficiency of 70 to 80 percent and most newer models have an efficiency in the 90 percent range.

Cost comparisons must also take into account actual energy cost and facilities charges or service charges that often are required by utilities.

An energy specialist from your local cooperative or municipal will be happy to help you sort out the factors that should be considered in your energy cost comparisons.

Assumptions

Fuel Source	Btu Heat Content	Annual Seasonal Operating Efficiency
Electricity - Standard Resistance	3,413 Btu/kWh	100%
Air-Source Heat Pump (ASHP) combined with Modulating Supplemental Electric Heat @ 200% Efficiency	3,413 Btu/kWh	200%
Ground-Source Heat Pump (GSHP)	3,413 Btu/kWh	330%
#2 Fuel Oil	140,000 Btu/gallon	80%
Propane	91,600 Btu/gallon	90%
Natural Gas	100,000 Btu/therm	90%

Standard Resistance Electric Heat @ 100% Efficiency

Electric ($/kWh) *100% Efficiency*	Propane ($/Gallon) *90% Efficiency*	Fuel Oil ($/Gallon) *80% Efficiency*	Natural Gas ($/Therm) *90% Efficiency*
0.05	1.21	1.64	1.32
0.052	1.26	1.71	1.37
0.054	1.30	1.77	1.42
0.056	1.35	1.84	1.48
0.058	1.40	1.90	1.53
0.06	1.45	1.97	1.58
0.062	1.50	2.03	1.63
0.064	1.55	2.10	1.69
0.066	1.59	2.17	1.74
0.068	1.64	2.23	1.79
0.07	1.69	2.30	1.85
0.072	1.74	2.36	1.90
0.074	1.79	2.43	1.95
0.076	1.84	2.49	2.00
0.078	1.88	2.56	2.06
0.08	1.93	2.63	2.11
0.082	1.98	2.69	2.16
0.084	2.03	2.76	2.22
0.086	2.08	2.82	2.27
0.088	2.13	2.89	2.32
0.09	2.17	2.95	2.37
0.095	2.29	3.12	2.51
0.10	2.42	3.28	2.64
0.105	2.54	3.45	2.77
0.11	2.66	3.61	2.90
0.115	2.78	3.77	3.03
0.12	2.90	3.94	3.16
0.125	3.02	4.10	3.30
0.13	3.14	4.27	3.43
0.135	3.26	4.43	3.56
0.14	3.38	4.59	3.69
0.145	3.50	4.76	3.82

The above figures are based on the assumptions and formulas listed below.

Formulas

Alternate fuel price to electric rate conversion formula:

(Alternate Fuel Price ÷ Efficiency) x (3,413 x Efficiency) ÷ Alternate Fuel Btu Heat Content = Electric Rate

Example of $0.72/Gal. Propane @ 90% efficiency to ASHP with Modulating Supplemental Electric Heat @ 200% efficiency:

(.72 ÷ 90%) x (3,413 x 200%) ÷ 91,600 = $0.06/kWh

Electric rate to alternate fuel price conversion formula:

(Electric Rate ÷ Efficiency) x (Alternate Btu Heat Content x Efficiency) ÷ 3,413 = Alternate Fuel Price

Example of $0.06/kWh ASHP with Modulating Supplemental Electric Heat @ 200% efficiency to Propane @ 90% efficiency:

(.06 ÷ 200%) x (91,600 x 90%) ÷ 3,413 = $0.72/Gal.

Air-Source Heat Pump (ASHP) combined with Modulating Supplemental Electric Heat @ 200% Efficiency

ASHP/Supp. ($/kWh) *200% Efficiency*	Propane ($/Gallon) *90% Efficiency*	Fuel Oil ($/Gallon) *80% Efficiency*	Natural Gas ($/Therm) *90% Efficiency*
0.05	0.60	0.82	0.66
0.052	0.63	0.85	0.69
0.054	0.65	0.89	0.71
0.056	0.68	0.92	0.74
0.058	0.70	0.95	0.76
0.06	0.72	0.98	0.79
0.062	0.75	1.02	0.82
0.064	0.77	1.05	0.84
0.066	0.80	1.08	0.87
0.068	0.82	1.12	0.90
0.07	0.85	1.15	0.92
0.072	0.87	1.18	0.95
0.074	0.89	1.21	0.98
0.076	0.92	1.25	1.00
0.078	0.94	1.28	1.03
0.08	0.97	1.31	1.05
0.082	0.99	1.35	1.08
0.084	1.01	1.38	1.11
0.086	1.04	1.41	1.13
0.088	1.06	1.44	1.16
0.09	1.09	1.48	1.19
0.095	1.15	1.56	1.25
0.10	1.21	1.64	1.32
0.105	1.27	1.72	1.38
0.11	1.33	1.80	1.45
0.115	1.39	1.89	1.52
0.12	1.45	1.97	1.58
0.125	1.51	2.05	1.65
0.13	1.57	2.13	1.71
0.135	1.63	2.22	1.78
0.14	1.69	2.30	1.85
0.145	1.75	2.38	1.91

The above figures are based on the assumptions and formulas listed on previous page.

Ground-Source Heat Pump (GSHP) @ 330% Efficiency

GSHP ($/kWh) *330% Efficiency*	Propane ($/Gallon) *90% Efficiency*	Fuel Oil ($/Gallon) *80% Efficiency*	Natural Gas ($/Therm) *90% Efficiency*
0.05	0.37	0.50	0.40
0.052	0.38	0.52	0.42
0.054	0.40	0.54	0.43
0.056	0.41	0.56	0.45
0.058	0.42	0.58	0.46
0.06	0.44	0.60	0.48
0.062	0.45	0.62	0.50
0.064	0.47	0.64	0.51
0.066	0.48	0.66	0.53
0.068	0.50	0.68	0.54
0.07	0.51	0.70	0.56
0.072	0.53	0.72	0.58
0.074	0.54	0.74	0.59
0.076	0.56	0.76	0.61
0.078	0.57	0.78	0.62
0.08	0.59	0.80	0.64
0.082	0.60	0.82	0.66
0.084	0.61	0.84	0.67
0.086	0.63	0.86	0.69
0.088	0.64	0.88	0.70
0.09	0.66	0.89	0.72
0.095	0.70	0.94	0.76
0.10	0.73	0.99	0.80
0.105	0.77	1.04	0.84
0.11	0.81	1.09	0.88
0.115	0.84	1.14	0.92
0.12	0.88	1.19	0.96
0.125	0.91	1.24	1.00
0.13	0.95	1.29	1.04
0.135	0.99	1.34	1.08
0.14	1.02	1.39	1.12
0.145	1.06	1.44	1.16

The above figures are based on the assumptions and formulas listed on previous page.

Optimizing energy usage

More than half of all electrical energy consumed in the United States is used by electric motors. Motors used within your home turn at almost constant speed; however, most often the electric loads being driven may not require the full load power that the motor can supply. This power shortfall means that energy is being wasted. By controlling the speed of the motor so that it more closely matches the load's requirements, you'll be able to control your motor's running cost.

Electronically commutated motors (ECMs)

ECMs (electronically commutated motors) are brushless, direct-current motors that contain built-in speed and torque controls. This means that the motor has the ability to adjust its speed to ensure optimal airflow at all times. Without a mechanical system of brushes, an ECM is quieter and will have a longer life than a typical motor.

With its adjustable speed design, furnaces with an ECM motor operate with as little as 80 watts of electricity. That's 10 times less than standard fan motors that run on high all the time.

Variable frequency drives (VFDs)

Adding a variable frequency drive (VFD) to a motor-driven system can offer major energy savings to a system where load varies. The operating speed of a motor connected to a VFD is varied by changing the frequency of the motor supply voltage.

VFDs save energy because they are able to regulate speed while still delivering the full torque of power. A VFD varies the amount of frequency and regulates the voltage that is being sent to the motor.

This lowers the operating speed, allowing a longer life span for your motor. VFDs can reduce energy usage by 35 to 50 percent compared to conventional constant speed equipment in certain applications. Contact your utility to learn more about these specific applications.

Energy Terms

Adjustable speed drive – An electronic device that controls the rotational speed of a piece of motor-driven equipment. Speed control is obtained by adjusting the frequency of the voltage applied to the motor.

Air retarder – A material or structural element that inhibits airflow into and out of a building's envelope or shell.

Air sealing – Sealing penetrations in the walls, floor and ceiling where outside air enters the home. It's often the most cost-effective way to improve energy efficiency.

Air-Source Heat Pump (ASHP) – A system that can supply both space heating and cooling. In the heating cycle, the heat pump removes heat from outside air and pumps it indoors. When cooling, the heat pump absorbs heat from the indoors and releases it to the outside.

A Lamp – Standard incandescent lamp shape, typically with an omnidirectional distribution of light.

Ampere – The unit of measurement of electrical current produced in a circuit by 1 volt acting through a resistance of 1 Ohm.

Annual Fuel Utilization Efficiency Rating (AFUE) – The most widely used measure of a furnace's heating efficiency. It measures the amount of heat actually delivered to your home compared to the amount of fuel that you must supply to the furnace. A furnace that has an 80 percent AFUE rating converts 80 percent of the fuel that you supply to heat.

Ballast – A device used to control the voltage in a fluorescent light.

Baseload – The minimum amount of electric power delivered or required over a given period of time at a steady rate.

Biomass conversion – The production of fuel or energy from organic waste, whether it be plant material, animal manure, municipal sewage sludge or solid waste.

Blower door – A device used by energy auditors to pressurize a building to locate places of air leakage and energy loss.

British thermal unit (Btu) – The quantity of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit at the temperature at which water has its greatest density (approximately 39 degrees Fahrenheit).

Coefficient of Performance (COP) – Energy-efficiency measurement of heating, cooling and refrigeration appliances. COP is the ratio of useful energy output (heating or cooling) to the amount of energy put in. A heat pump with a COP of 10 puts out 10 times more energy than it uses.

Color Rendering Index (CRI) – A rating index commonly used to represent how well a light source renders the colors of objects that it illuminates. The maximum value of 100 indicates that the color of objects can be expected to be seen as they would appear under an incandescent or natural daylight. Sources with CRI values less than 50 are generally regarded as rendering colors poorly.

Consortium for Energy Efficiency (CEE) – CEE is the U.S. and Canadian consortium of gas and electric efficiency program administrators. CEE works together to accelerate the development and availability of energy-efficient products and services for lasting public benefit.

Degree day – Used to estimate energy requirements for heating and cooling a building, this is a measure of the deviation of the mean daily temperature from a given standard.

Demand – The amount of electricity a customer takes at any given moment.

DesignLights Consortium™ (DLC) –

The DLC is a project of Northeast Efficiency Partnerships (NEEP), a regional non-profit, whose mission is to serve the Northeast and mid-Atlantic regions to accelerate energy efficiency in the building sector through public policy, program strategies and education. Visit **desinlights.org**.

Efficacy – The amount of light produced per watt of electricity (lumens/watt). It is the rate at which a light source is able to convert electrical power (watts) into light (lumens), expressed in terms of lumens per watt. For example, a 10 watt lamp producing 800 lumens has an efficacy of 80 lumens per watt.

Electric thermal storage (ETS) – A type of heater that uses electricity during periods of low use to heat a ceramic material in an insulated cabinet to high temperatures. It then releases the stored heat when electric use is high.

Energy Efficiency Ratio (EER) – A standard method for measuring the efficiency of heat pumps and other cooling units. The ratio of heating/cooling capacity in Btus, divided by power input in watts. The higher the EER, the more efficient the unit.

Electronically commutated motor (ECM) – An electronically commutated motor (ECM) is a brushless DC motor that contains all of its speed and torque controls. This means that the motor can adjust its speed to ensure optimal airflow and that energy is used efficiently.

Energy conservation – An effort to reduce or better manage energy consumption in a cost-effective manner.

Energy efficiency – Refers to programs that are aimed at reducing the energy used by specific end-use devices and systems, usually without affecting the services provided.

Energy Star®-qualified products – Energy Star labels appear on appliances and home electronics that meet strict energy efficiency criteria established by the U.S. Department of Energy and U.S. Environmental Protection Agency.

Fluorescent Lamps – Lamps which operate by creating an electric arc inside a gas-filled tube. The color of the light is determined by the type of phosphor coating used in the lamp.

Footcandle – The unit of measure for the density of light as it reaches a surface. One footcandle is equal to one lumen per square foot.

Geothermal energy – The heat or energy produced by natural processes inside the earth. A geothermal heating and cooling system, also known as a ground-source

Energy costs of electric motors

Find the horsepower (hp) rating on the nameplate of the motor. Multiply kilowatts (kW) of corresponding horsepower on the chart by the total number of hours the motor is used. This figure – kilowatt-hours (kWh) – multiplied by the applicable rate, will give you the cost of operation.

How much would it cost to operate a 10 hp motor 24 hours per day for three weeks?

EXAMPLE:
10 h.p. 230V 1Ø, 24 hours/day for 3 weeks.

ANSWER:
(assuming the electric rate is $.12)
8.625 kW x 24 hours x 21 days = 4,347 kWh
4,347 kWh x $.12 = $521.64
Note: No capacity charge included.

Squirrel cage motors with average efficiency and power factor for each size.

1Ø = single-phase; 3Ø = three-phase.

hp	115V 1Ø kW @ Full Load	230V 1Ø kW @ Full Load	230V 3Ø kW @ Full Load
1/6	.329	.329	
1/4	.447	.447	
1/3	.571	.571	
1/2	.800	.800	.568
3/4	1.159	1.159	.774
1	1.380	1.380	.999
1 1/2	1.794	1.794	1.335
2	2.180	2.180	1.893
3	3.167	3.167	2.868
5		4.701	4.478
7 1/2		6.808	6.310
10		8.625	8.724
15			12.269
20			16.679
25			20.197
30			24.858
40			33.044
50			38.752
60			48.078
75			60.105
100			82.253

heat pump, has the highest efficiency for the combination of space heating and cooling of any system on the market.

Heating Season Performance Factor (HSPF) – The total heating output of a heat pump during its normal annual usage period for heating divided by the total electric power input in watt-hours during the same period.

High Bay – Lighting used in applications where the ceiling height is 20 feet or higher. Common in big box retail, warehouse and industrial settings.

High–Intensity Discharge (HID) – An electric lamp that produces light directly from an arc discharge under high pressure. Metal halide, high-pressure sodium, and mercury vapor are types of HID lamps.

Home energy audit – An assessment to determine the energy efficiency of the home and its equipment. An audit will provide information to effectively help conserve energy and become more efficient.

Horsepower – A unit for measuring the rate of power equivalent to 33,000 foot-pounds or 746 watts.

Incandescent Lamp – Produces light with a wire filament, which creates lights as it is heated by electric current.

Infrared thermography – The science of using infrared imaging to detect radiant energy or heat loss in a building.

Kelvin – Color temperature is measured in degrees Kelvin, which indicate the hue of a specific type of light source. Higher temperatures indicate whiter, "cooler" colors, while lower temperatures indicate yellower, "warmer" colors.

Kilowatt (kW) – A unit of demand measurement equal to 1,000 watts. The average household demand is 10 to 20 kilowatts.

Kilowatt-hour (kWh) – The basic measure of electrical energy, equal to 1,000 watts used for 1 hour.

Light Emitting Diode (LED) – A semiconductor diode that emits visible light when electricity is applied and is used in lamps and digital displays. LED is available in a wide variety of colors and lighting fixture types and typically has a much longer-rated life than traditional lighting technologies.

Load – The amount of power drawn from an electrical system at a specific time, or the total power drawn from the system.

Load management – The reduction of electric load during times when electric demand is high. Load management can involve such techniques as voltage reduction, shutting off air conditioners and water heaters for short periods of time by remote control and controlling time of day usage.

Low Bay – Lighting used in applications where the ceiling height is 20 feet or less. Common in warehouse, athletic facilities and industrial settings.

Lumen – Unit of total light output of a light source in all directions, expressed in lumens.

Megawatt (MW) – A unit of electrical power equal to 1 million watts.

Metal Halide (MH) Lamp – A high-intensity discharge lamp type that uses mercury and several halide additives as light-producing elements. MH lamps have better color properties than other HID lamp types because the different additives produce more visible wavelengths, resulting in a more complete spectrum.

Occupancy sensor – An electronic device used to switch a light on when motion is detected and switch off after no motion is detected in a room. It consists of a motion detector, electronic control unit and a relay.

Off-Peak/On-Peak – Blocks of time when energy demand and price is low (off-peak) or high (on-peak).

Phantom load – Any appliance that consumes power even when it is turned off. Examples of phantom loads include equipment chargers, televisions and even clothes washers.

Photocell – Light-sensitive device used to operate fixtures according to available daylight. They are used to integrate an electric lighting system with a daylighting system so lights operate only when daylighting is insufficient and turn outdoor or security lights on and off at dusk and dawn.

R-Value – A measure of the ability of a material or a combination of materials to resist heat flow. The higher the R-Value, the greater the insulating capabilities.

Ripple control – The remote control of switching devices which uses power lines as signal carriers. A coded audio frequency "ripple" is superimposed onto the power lines at one or more injection points. The signal is detected by receivers situated at the loads to be controlled. Generally used for load management purposes.

Seasonal Energy Efficiency Ratio (SEER) – A standard method of rating the yearlong efficiency of an air conditioner or the cooling side of a heat pump.

Renewable energy resources – Energy generated from natural resources such as sunlight, wind, rain, tides or geothermal heat. Renewable energy can be replenished as it is used.

Solar energy – Energy from the sun's radiation converted into heat or electricity.

T5 – 5/8" diameter fluorescent lamp.

T8 – 1" diameter fluorescent lamp.

T12 – 1½" diameter fluorescent lamp.

Therm – A unit of heat containing 100,000 Btus.

U-Value – A measure of air-to-air heat transmission (loss or gain) due to thermal conductance and the difference in indoor and outdoor temperatures.

Variable Frequency Drive (VFD) – A system for controlling the rotational speed of an alternating current (AC) electric motor by controlling the frequency of the electrical power supplied to the motor. A variable frequency drive is a specific type of adjustable-speed drive.

Volt/Voltage – A volt is a unit of electric force that measures the pressure of electricity. Voltage is the "pressure" that causes electrons to flow.

Watt – A unit of electrical power equal to one ampere under a pressure of one volt. A watt is equal to 1/746 horsepower.

Weatherization – The practice of protecting a building and its interior from the elements, particularly from sunlight, precipitation and wind, and of modifying a building to reduce energy consumption and optimize energy efficiency.

Major appliance shopping guide

Appliances	Rating	Special Considerations
Air-Source Heat Pumps 	Check the Energy Guide label that lists the SEER (Seasonal Energy Efficiency Ratio) and HSPF (Heating Seasonal Performance Factor) for heat pumps. SEER measures the energy efficiency during the cooling season. HSPF measures the efficiency during the heating season. The ENERGY STAR® minimum efficiency levels are: ≥8.2 HSPF/≥14.5 SEER for split systems ≥8.0 HSPF/≥14.0 SEER for single package equipment including gas/electric units	It is important for your contractor to properly size your heating and cooling equipment to the requirements of your home especially when installing an air-source heat pump, as they will switch to an alternative backup fuel under extremely cold conditions. It is also important to consider the sizing of the ductwork. Inadequate ductwork will cause fans to work harder than necessary and waste energy. ENERGY STAR-qualified electric air-source heat pumps have higher SEER and HSPF levels than today's standard models, making them about 9 percent more efficient than nonqualified models.
Central Air Conditioners 	Look for the Energy Guide label with a SEER for central air conditioners. The ENERGY STAR minimum efficiency levels are: ≥14.5 SEER/≥12.0 EER for split systems ≥14.0 SEER/≥11.0 EER for single package equipment including gas/electric units	Air conditioners that bear the ENERGY STAR label have higher SEER and energy efficiency ratio (EER) ratings, making them about 14 percent more efficient than standard models.
Room Air Conditioners 	Look for the Energy Guide label with an EER for room air conditioners. The higher the EER, the more efficient the unit is. ENERGY STAR units are among the most energy-efficient products. Two major factors should guide your purchase: correct size and energy efficiency.	ENERGY STAR-qualified room air conditioners are 10 percent more efficient than nonqualified models. See **www.energystar.gov** for help in determining the proper size needed.
Programmable Thermostats 	Thermostats should have at least two programs, four temperature settings each, a hold feature that allows users to temporarily override settings, and the ability to maintain room temperature within 2°F of desired temperature.	Look for thermostats that allow you to easily use two separate programs.
Water Heaters 	Check the Energy Guide label that tells how much energy the water heater uses in one year. Also, look for the FHR (first hour rating) of the water heater, which measures the maximum hot water the heater will deliver in the first hour of use.	If you typically use a lot of hot water at once, the FHR will be important to you. Sizing is important – contact your local utility for assistance.
Refrigerators and Freezers 	Check the Energy Guide label to see how much electricity, in kWh, the refrigerator will use in one year. The smaller the number, the less energy it uses. ENERGY STAR-qualified refrigerators are 20 percent more efficient than nonqualified models and are more efficient than models that simply meet the federal minimum standard for energy efficiency.	Refrigerators with freezers on top are more efficient than those with freezers on the side. Also look for heavy door hinges that create a good door seal.
Dishwashers 	Look for the Energy Guide label that tells how much electricity, in kWh, the dishwasher will use in one year. The smaller the number, the less energy it uses. ENERGY STAR-qualified dishwashers are 10 percent more efficient than nonqualified models and are more efficient than models that simply meet the federal minimum standard for energy efficiency.	Look for features that will reduce water use, such as booster heaters and smart controls. Ask how many gallons of water the dishwasher uses during different cycles. Dishwashers that use the least amount of water will cost the least to operate.
Clothes Washers 	Check the Energy Guide label for how much electricity, in kWh, the clothes washer will use in one year. The smaller the number, the less energy it uses. Clothes washers that have earned the ENERGY STAR rating are 37 percent more efficient than nonqualified models and are more efficient than models that simply meet the federal minimum standard for energy efficiency.	Look for design features that help clothes washers cut water usage such as: water level controls, "suds-saver" features, spin cycle adjustments and large capacity.

Before replacing your appliances or heating and cooling equipment, be sure to contact your local utility for possible incentives they may have available to help you in making an energy efficient upgrade. Source: **www.energystar.gov**.

Appliance energy usage

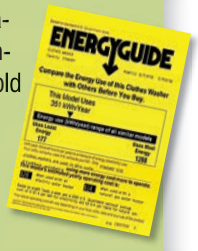
The average monthly kilowatt-hour consumption figures in this chart are based on normal use. Your electrical consumption may be higher or lower, depending on how you and other people in your home and on your farm use the various appliances and equipment.

	Approx. Average wattage	Estimated hrs. used per month	Estimated monthly kWh	Cost per month at $.12/kWh
Air conditioner (central)	3,500	100	350	$42.00
Air conditioner (room)	1,000	360	360	43.20
Automatic waterer for livestock	1,452	43	62	7.44
Block heater (8 hrs./day)	500	248	124	14.88
Cable box without DVR (when turned off)	33	744	25	3.00
Clothes dryer	5,000	16	80	9.60
Clothes washer (doesn't include hot water)	500	16	8	0.96
Coffee maker	1,050	16	17	2.04
Computer (with monitor and printer)	200	240	48	5.76
Dehumidifier	785	240	188	22.56
Digital Cable DVR set-top box (when turned off)	44	744	32	3.84
Dishwasher (doesn't include hot water)	1,300	15	20	2.40
Electric blanket	80	120	10	1.20
Freezer (frostless 15 cu. ft.)	335	334	112	13.44
Furnace fan – variable speed motor (24 hrs./day)	75	744	56	6.72
Furnace fan – conventional blower (24 hrs./day)	400	744	298	35.76
Hot tub/spa heater	1,500	40	60	7.20
Hair dryer	1,200	5	6	0.72
Iron	1,000	10	10	1.20
Microwave oven	1,100	10	11	1.32
Nintendo Wii	20	31	1	0.12
Radio	70	100	7	0.84
Range with oven	3,500	15	53	6.36
Refrigerator/freezer (frost-free, 16 cu. ft.)	725	250	181	21.72
Sony PlayStation 3	200	31	6	0.72
Space heater (8 hrs./day)	1,500	248	372	44.64
Television – 32-46" LCD	110	180	20	2.40
Television – 32-46" LED	100	180	18	2.16
Television – 50-60" plasma	300	180	54	6.48
Toaster	1,100	3	3	0.36
Vacuum cleaner	1,220	6	7	0.84
Water heater (varies widely)	4,500	90	405	48.60
Water pump (deep well)	1,000	15	15	1.80
X-box 360	185	31	6	0.72

Replace old, inefficient appliances with energy-efficient models

EnergyGuide labels

If you live in a typical U.S. home, the appliances are responsible for about one-fifth of your energy bill. Electric appliances like refrigerators, freezers, clothes washers, dryers, dishwashers, ranges and ovens are the primary energy-using appliances in most households. Taking steps to save energy while using these appliances, and replacing old, inefficient appliances with modern ones, can save you money.



In the U.S., all refrigerators, freezers, clothes washers and dishwashers are sold with yellow EnergyGuide labels to indicate their energy usage. These labels provide an estimated annual operating cost for the appliance and also indicate the cost of operating the models with the highest annual operating cost and the lowest annual operating cost. By comparing a model's annual operating cost with the operating cost of the most efficient model, you can compare their efficiencies.

ENERGY STAR labels

Another label to help you identify energy-efficient appliances is the ENERGY STAR® label. Promoted by the Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA), the ENERGY STAR is only awarded to appliances and lighting products that significantly exceed the minimum national efficiency standards.

The ENERGY STAR label can help make purchasing decisions easier. These products not only save energy, they can also save money, frequently with better performance.

How to estimate energy usage and cost

The wattage of appliances and equipment as well as the amount of operating time can vary greatly. The following information will show you how to determine where the energy dollars are going in your home.

Step 1

Since the cost of electricity is determined by the number of kilowatt-hours (kWh) used during a billing period, the first step is to determine your average cost per kilowatt-hour.

$$\text{Avg. kWh cost} = \frac{\$ \text{ amount of electric bill}}{\text{kWh used}}$$

$$\text{EXAMPLE: } \frac{\$144}{1{,}200 \text{ kWh}} = \$.12 \text{ per kWh}$$

Step 2

Since the wattage of an appliance or electrical equipment determines the electrical usage per hour, the second step is to determine the wattage.

The wattage of an appliance is found on the serial plate. It is possible that electrical equipment will be expressed in volts and amperes rather than watts. If so, multiply volts times amperes to determine the wattage.

MICROWAVE OVEN			
AMPS	12.1	VOLTS	120
HERTZ	60	WATTS	1,452
FORM NO.	00000	MODEL NO.	0000
CODE	0	SERIAL NO.	000000

EXAMPLE:
120 volts x 12.1 amps = 1,452 watts

Step 3

Use the formula shown in the following example to estimate usage and cost.

EXAMPLE:
A light uses 100 watts and is left on 15 hours. How many kWh are used and what does it cost you?

$$\text{kWh use} = \frac{100 \text{ watts x } 15 \text{ hrs.}}{1{,}000 \text{ watts}} = 1.5 \text{ kWh}$$

Your cost = 1.5 kWh x $.12 = $.18

Step 4

To find your daily cost for electricity, divide your bill by the number of days in the month.

$$\text{EXAMPLE: } \frac{\$144}{30 \text{ days}} = \$4.80 \text{ which is your daily cost.}$$

To find the daily cost per person in your family, divide the daily cost by the number in your family.

$$\text{EXAMPLE: } \frac{\$4.80}{4} = \$1.20 \text{ per person per day.}$$

Meter monitor chart

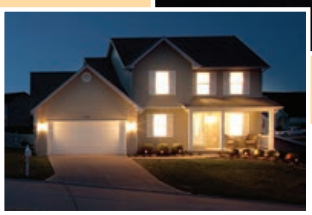
Daily reading	kWh used daily	Record of daily activities that affect your energy use
1		
2		
3		
4		
5		
6		
7		
Weekly Total		
8		
9		
10		
11		
12		
13		
14		
Weekly Total		
15		
16		
17		
18		
19		
20		
21		
Weekly Total		
22		
23		
24		
25		
26		
27		
28		
Weekly Total		
29		
30		
31		
Extra Days Total		
Monthly Total		

Using this meter monitor chart, take a few minutes each day (preferably at the same time) to jot down your electric meter reading. Start the first of the month.

By subtracting the previous day's reading from the current reading each day, you get the number of kilowatt-hours used during that 24-hour period. By adding the daily figures into a weekly total, you can see how much and when your family used power during that month.

As you know from reading this guide, your energy use will fluctuate with your daily activities. Monitoring your kilowatt-hours is the first step to understanding your electric use.

Set your thermostat to reliable



Whether you are looking for greater reliability, increased comfort, higher efficiency or more choices, consider the benefits of electric heat.

Electricity from your local electric cooperative is produced by power generators that operate 24-7. That electricity is sent directly to you at the touch of a button, which means there are no outside sources impacting the cost or delivery of your home's heat.

When it comes to warmth and comfort, your cooperative's only goal is to ensure you receive a powerful value for your heating dollar – each and every day.

Powerful Value *Every day.*

COOPERATIVES

Beltrami Electric Cooperative
Bemidji, MN • (218) 444-2540

Cass County Electric Cooperative
Fargo, ND • (701) 356-4400

Cavalier Rural Electric Cooperative
Langdon, ND • (701) 256-5511

Clearwater-Polk Electric Cooperative
Bagley, MN • (218) 694-6241

Nodak Electric Cooperative
Grand Forks, ND • (701) 746-4461

North Star Electric Cooperative
Baudette, MN • (218) 634-2202

PKM Electric Cooperative
Warren, MN • (218) 745-4711

Red Lake Electric Cooperative
Red Lake Falls, MN • (218) 253-2168

Red River Valley Cooperative Power Association
Halstad, MN • (218) 456-2139

Roseau Electric Cooperative
Roseau, MN • (218) 463-1543

Wild Rice Electric Cooperative
Mahnomen, MN • (218) 935-2517

MUNICIPALS

Bagley Public Utilities
(218) 694-2300

Baudette Municipal Utilities
(218) 634-1850

Fosston Municipal Utilities
(218) 435-1737

Grafton Municipal Utilities
(701) 352-1561

Halstad Municipal Utilities
(218) 456-2128

Hawley Public Utilities
(218) 483-3331

Park River Municipal Utilities
(701) 284-6150

Roseau Municipal Utilities
(218) 463-2351

Stephen Municipal Utilities
(218) 478-3803

Thief River Falls Municipal Utilities
(218) 681-4145

City of Warren Water and Light
(218) 745-5343

Warroad Municipal Utilities
(218) 386-1873