

Electric Heating

A special publication of Minnkota Power Cooperative and the associated systems

Today

Electric heat

Safe, clean, efficient and reliable

Save with an off-peak electric heating system

Choose from a wide range of options to meet your home heating needs

Geothermal systems

Technology to heat and cool your home



You'll love the benefits of electric heating

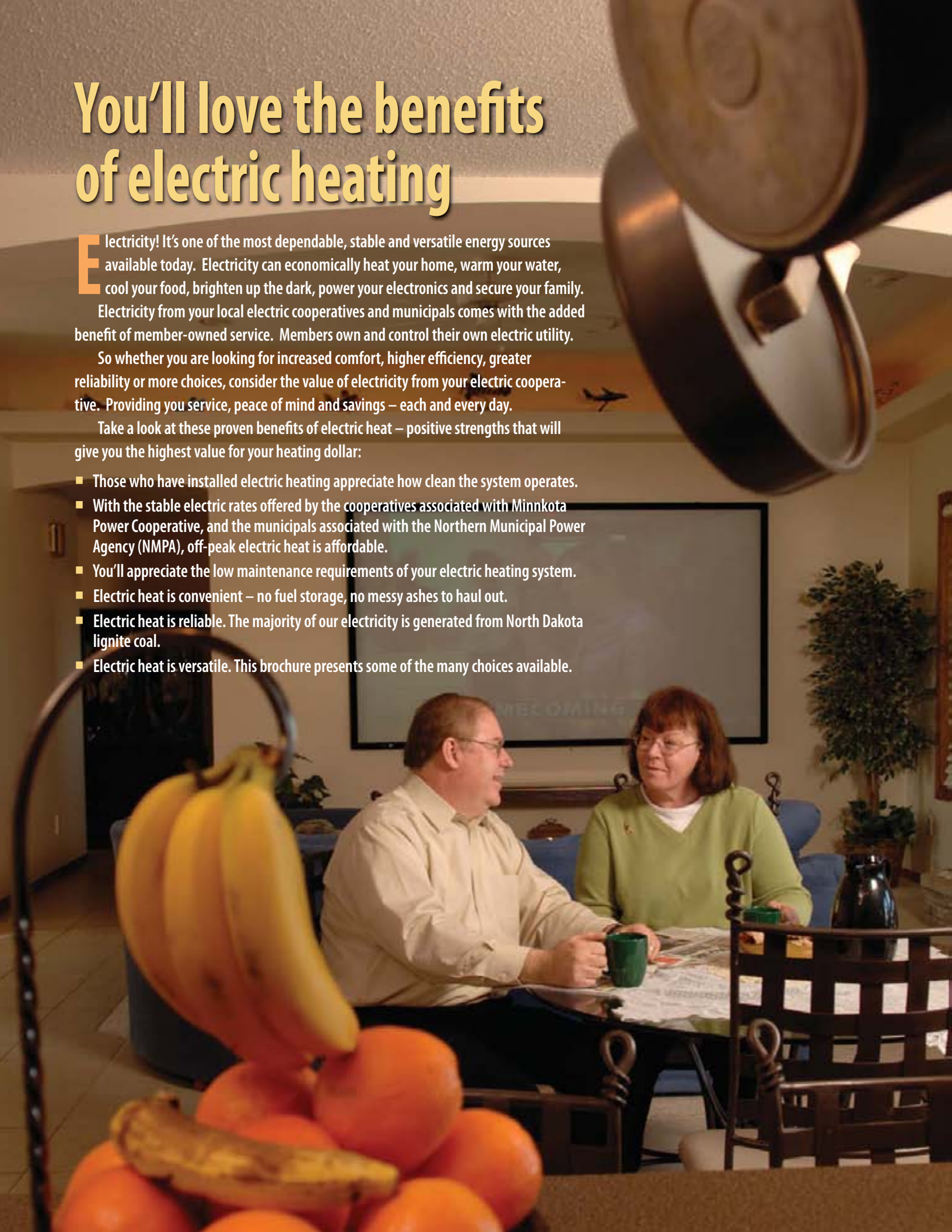
Electricity! It's one of the most dependable, stable and versatile energy sources available today. Electricity can economically heat your home, warm your water, cool your food, brighten up the dark, power your electronics and secure your family.

Electricity from your local electric cooperatives and municipals comes with the added benefit of member-owned service. Members own and control their own electric utility.

So whether you are looking for increased comfort, higher efficiency, greater reliability or more choices, consider the value of electricity from your electric cooperative. Providing you service, peace of mind and savings – each and every day.

Take a look at these proven benefits of electric heat – positive strengths that will give you the highest value for your heating dollar:

- Those who have installed electric heating appreciate how clean the system operates.
- With the stable electric rates offered by the cooperatives associated with Minnkota Power Cooperative, and the municipals associated with the Northern Municipal Power Agency (NMPA), off-peak electric heat is affordable.
- You'll appreciate the low maintenance requirements of your electric heating system.
- Electric heat is convenient – no fuel storage, no messy ashes to haul out.
- Electric heat is reliable. The majority of our electricity is generated from North Dakota lignite coal.
- Electric heat is versatile. This brochure presents some of the many choices available.



Save with off-peak electric heat

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

An off-peak electric heating system consists of an electric heat source as its main component and a supplemental heating source that will typically operate 400-600 hours per year during times of peak electrical usage.

Savings through off-peak electric rate

Off-peak electric heating makes good “cents” because the cooperative or municipal that provides your electric service offers a low off-peak electric rate for heating with an off-peak system. This off-peak rate is about half the regular rate for electric service.

With the off-peak rate, electricity is very competitive with other heating fuels such as propane or fuel oil. And the low off-peak rate really looks good during those times when fossil fuel prices rise dramatically.

Many options available

A home with an existing fossil fuel heating system can be converted to off-peak electric heating very easily. Several of the options for adding electric heating equipment are presented elsewhere in this brochure.

Qualified personnel from your cooperative or municipal utility will be happy to advise you on the best electric alternative to

meet your specific needs. Savings from an off-peak electric heating system can often pay for the cost of the system in five years or less.

Installation of your off-peak electric heating system will be done by a qualified heating contractor of your choice. Your local cooperative or municipal will install an off-peak electric meter and provide a ripple control device that will automatically switch your heating system from the on-peak to the off-peak operating mode.

Automatic convenience

Your off-peak system is activated by a special code, which is sent via a high-frequency electrical impulse called a ripple signal. The signal is sent from the Minnkota control center in Grand Forks to your home over existing electric lines.

The ripple control device installed at your home automatically turns off your electric heating system and activates your backup heating system at the start of the peak control period. The process is reversed when the peak time is over.

A reliable backup heating system is essential, as control times of 400-600 hours for the winter heating season can be expected.

Saving electric capacity

Off-peak heating systems are controlled during periods of peak electrical usage in the region – usually the coldest days of each winter. Load management may also

be influenced by the availability and price of electric energy in the wholesale marketplace.

The ability to interrupt the flow of electricity to the electric portion of the off-peak systems allows Minnkota to operate its generating plants more efficiently and avoid costly power pool purchases. These savings are passed on to customers through the low off-peak electric rate.



The Minnkota Power Cooperative energy control center is the heart of the load management system. Here, electrical demand is monitored 24 hours a day, 365 days a year. Utilizing the load management system enables customers to enjoy some of the lowest electric rates in the nation.



Two lignite-fired generation facilities – the Milton R. Young Station near Center, N.D. (top photo), and the Coyote Station near Beulah, N.D. – are the primary sources of generation for Minnkota.

Reliable, stable energy supply

As a customer served by your local cooperative or municipal, you are assured of a secure supply of electric energy for many years to come. Your electricity prices will continue to provide great value well into the future.

Home-grown energy

Why is electricity a more secure and stable-priced energy supply than fuel oil, for example, or propane? The answer is simple: Most of your electricity is generated from lignite, an abundant form of coal mined nearby in west-central North Dakota.

Lignite and the nation's other coal resources are domestic energy supplies – under the control of the United States. But the supply of fuel oil and propane is dependent on huge imports of foreign petroleum. As recent history has shown, the flow of oil to the U.S. can be easily interrupted by

instability abroad, and the price is controlled by interests far from our shores.

An 800-year supply

North Dakota has lignite to last 800 years at today's rate of consumption. The Minnkota/NMPA Joint System's access to this secure fuel supply is also stable. Long-term contracts ensure an adequate supply of lignite to meet customer needs far into the future.

Helping the region grow

Choosing electricity is good for the growth of our region. The lignite industry positively affects our economy and the economy of neighboring states. Each \$1 expended on mining and electrical generation recirculates through the regional economy, producing an additional \$2 in new wealth.

Comparative energy costs for space heating

Electricity (Cents/kWh)	Fuel Oil Regular Furnace (\$/Gal.)	Fuel Oil Super Efficient Furnace (\$/Gal.)	Propane Regular Furnace (\$/Gal.)	Propane Super Efficient Furnace (\$/Gal.)	Natural Gas Regular Furnace (\$/MCF)	Natural Gas Super Efficient Furnace (\$/MCF)
3.0	0.74	0.98	0.48	0.72	5.27	7.91
3.2	0.79	1.05	0.52	0.77	5.62	8.44
3.4	0.84	1.12	0.55	0.82	5.98	8.96
3.6	0.89	1.18	0.58	0.87	6.33	9.49
3.8	0.94	1.25	0.61	0.92	6.68	10.02
4.0	0.98	1.31	0.64	0.97	7.03	10.54
4.2	1.03	1.38	0.68	1.01	7.38	11.08
4.4	1.08	1.44	0.71	1.06	7.74	11.60
4.6	1.13	1.51	0.74	1.11	8.09	12.13
4.8	1.18	1.58	0.77	1.16	8.44	12.66
5.0	1.23	1.64	0.81	1.21	8.79	13.18
5.5	1.35	1.80	0.89	1.33	9.67	14.50
6.0	1.48	1.97	0.97	1.45	10.55	15.82
6.5	1.60	2.13	1.05	1.57	11.43	17.14
7.0	1.72	2.30	1.13	1.69	12.31	18.46
7.5	1.85	2.46	1.21	1.81	13.18	19.78
8.0	1.97	2.63	1.29	1.93	14.06	21.10
8.5	2.09	2.79	1.37	2.05	14.94	22.41
9.0	2.22	2.95	1.45	2.17	15.82	23.73
9.5	2.34	3.12	1.53	2.29	16.70	25.05
10.0	2.46	3.28	1.61	2.42	17.58	26.37

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

Formulas

Alternate fuel price to electric rate conversion formula:

$$(\text{Fuel Price}) \div (\text{Efficiency}) \times (341,300) \div (\text{Btu Heat Content}) = \text{Electric Rate}$$

Example of \$0.72/Gal. Propane to Electricity with a Super Efficient Furnace:

$$(0.72) \div (0.90) \times (341,300) \div (91,600) = 3.0\text{¢/kWh}$$

Electricity rate to alternate fuel price conversion formula:

$$(\text{Electric Rate}) \times (\text{Efficiency}) \times (\text{Btu Heat Content}) \div (341,300) = \text{Fuel Price}$$

Example of 2.9¢/kWh Electricity Rate to #2 Fuel Oil with a Regular Furnace:

$$(3.0) \times (0.60) \times (140,000) \div (341,300) = \$0.74/\text{Gal.}$$

Fuel conversion chart

Propane – 91,600 Btu per gallon

Gallons	kWh at 60% Regular Efficiency	kWh at 70% Efficiency	kWh at 80% Efficiency	kWh at 90% Super Efficiency
1	16	19	21	24
100	1,610	1,879	2,147	2,415
500	8,052	9,393	10,735	12,077
750	12,077	14,090	16,103	18,116

Natural Gas – 1,000,000 Btu per MCF

MCF	kWh at 60% Regular Efficiency	kWh at 70% Efficiency	kWh at 80% Efficiency	kWh at 90% Super Efficiency
1	176	205	234	264
50	8,790	10,255	11,720	13,185
75	13,185	15,382	17,580	19,777
200	35,160	41,020	46,880	52,740

Fuel Oil – 140,000 Btu per gallon

Gallons	kWh at 60% Regular Efficiency	kWh at 70% Efficiency	kWh at 80% Super Efficiency
1	25	29	33
100	2,461	2,871	3,281
500	12,306	14,357	16,408
750	18,459	21,535	24,612

Note: Electricity provides 3,413 Btu per kilowatt-hour.

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 60 percent to a high of 95 percent. Most older gas and oil systems have an efficiency of 60 to 70 percent and most newer models have an efficiency in the 80 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 all the factors that should be considered in your energy cost comparisons.

How to compare cost

Off-Peak Electric Heating Options



With today's active lifestyles, you want your home to be a place of comfort and relaxation. Your home heating needs may vary, depending on the specifications of your home and how your family interacts and lives. This is why your local cooperative or municipal offers a wide range of options for installing an off-peak electric heating system in your home. Some of the more popular choices are presented here. With most of the following electric heating options, a reliable backup heating source is required. Call your power supplier for more information.

Hydronic heating

Hydronic heating systems use resistance coils to heat a liquid (water or an environmentally friendly antifreeze solution), which is then circulated to transfer heat throughout a home.

Convective heating

These systems use electric resistance heaters to heat air, which is then circulated throughout a home, creating a warm, comfortable surrounding.



Plenum heater

An electric plenum heater is one of the most common off-peak electric heating systems available on the market today. Easily adapted to an existing oil or gas forced-air system, plenum heaters fit in the ductwork above the fossil fuel furnace and come in a variety of sizes to fit most applications. Installation is easy and equipment costs are competitive with other home heating options.



Electric storage furnace

An electric storage furnace provides forced-air heating. Compact in size, it allows for the addition of air conditioning equipment. It can be installed as a stand-alone unit or installed with a heat pump for even greater efficiency and energy savings.



Electric baseboard

This versatile option uses electric resistance heating and can be used in almost any heating application. Electric baseboards have the advantage of individual room control for heating only the areas you use and require no ducts. The units are clean, safe, easy to maintain, and have a long life.



Electric boiler

Electric boilers convey heat to where it is needed, either through piping or ductwork. Adding an electric boiler to an existing hot water heating system is relatively easy. The electric boiler is simply installed in conjunction with the existing boiler. In new installations, electric boilers can be utilized for a quality radiant floor heating system.

Underfloor tubing

Underfloor tubing heat provides the comfort of warm floors by using an electric boiler to warm heat-carrying liquid.



Jeff Bolme

Colfax, N.D.

Jeff Bolme, who lives on the family's farmstead near Colfax, N.D., enjoys his off-peak heating system. The Bolme family's heating system consists of a two-stage, air-source heat pump and an electric plenum heater, backed up by a high-efficiency propane furnace. A hydronic heating system, utilizing an electric boiler, provides added comfort to the basement and garage. "I'm happy with my off-peak heating system," says Bolme. "It's clean, quiet and most importantly, cost-efficient." Bolme is a member of Cass County Electric Cooperative.



Options

Off-Peak Electric Heating

Radiant heating

Electric radiant heating units radiate heat energy into the living space of a home, creating warmth and comfort much like sunlight radiating through a window. Upon contact with persons or objects in the room, the radiant energy is immediately transformed to warm, comfortable heat energy. Radiant systems provide quiet, even heating with low maintenance.



Cove heating

Cove heating is an excellent way to provide heating comfort for any room in your home. Located near the ceiling, cove heating does not take up lower wall space, allowing furniture to be placed next to the wall. An electric fireplace provides added comfort to any room.



Underfloor storage

Available in cable, mat and hydronic tubing applications, underfloor storage systems are buried in a sand bed beneath the concrete slab. The sand and slab serve as storage agents when warmed, emitting heat into the room. These systems are often supplemented with others to create a total heating solution.



Ceiling heat

Ceiling heat can be installed by utilizing either electric cable or radiant ceiling panels. This type of heating warms objects and people in the room instead of heating the air, providing a clean, safe and quiet form of heat.



Kevin and Marlene Lindstrom

Bemidji, Minn.

Kevin and Marlene Lindstrom of Bemidji, Minn., installed a hydronic heating system in their new home. A master electrician, Kevin said it's by far the most comfortable house the couple has ever lived in. They also installed an optional air-source heat pump that created even greater efficiencies and serves as their cooling system as well. "We find that you can keep the house cooler and yet be more comfortable than with a forced-air system. We can leave the thermostat set at 68 degrees and it still feels like it's 72." Kevin and Marlene Lindstrom are members of Beltrami Electric Cooperative.

Thermal storage systems



Electric thermal storage heaters convert electricity into heat during off-peak hours and store the heat in specially designed, high-density ceramic bricks capable of storing large amounts of heat for extended periods of time. The stored heat is released during peak control periods to maintain constant comfort.

Save with a new water heater

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.

If your water heater isn't highly efficient, you're probably wasting money, and you could be running out of hot water, too. 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 two inches of foam for an R16 insulation value) and can be selected with the corrosion protection that matches the quality of water you use 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 best for you.

Another option available is a heat trap. A heat trap keeps heated water in the tank during non-use time 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 local electric cooperative or municipal for good advice and information on your water heating needs.



Electric water heating is one of the safest, cleanest, most energy efficient ways of heating water. High-efficiency water heaters, coupled with low electric rates from your retail power supplier, ensure a plentiful, low-cost supply of hot water for your family.

Geothermal

Capture the earth's *free* heat with a geothermal system



Geothermal systems can be designed for new homes, schools, retail stores and other buildings, or can be retrofitted to existing structures. Operating at efficiencies of 200-400 percent, geothermal systems utilize special plastic tubing installed in underground loops that capture the earth's free heat. These loops are configured in either a horizontal (*shown above*) or vertical arrangement, depending on lot size and customer preference.

A geothermal heating and cooling system – also known as a ground-source heat pump – has by far the highest efficiency for the combination of space heating and cooling of any other system on the market today. The reason for this efficiency advantage is simple: Geothermal systems do not consume fuel to produce heat. Instead, they capture some of the virtually limitless heat constantly available a few feet below the surface of the earth.

How geothermal systems work

The operation of geothermal systems is based on the physical law that heat energy flows from a warmer place to a cooler place.

The typical geothermal system consists of 1) a closed loop of special plastic tubing installed underground and 2) an electrically powered heat-exchange unit inside the home or other structure to be heated. An environmentally harmless, biodegradable antifreeze solution is circulated through the tubing.

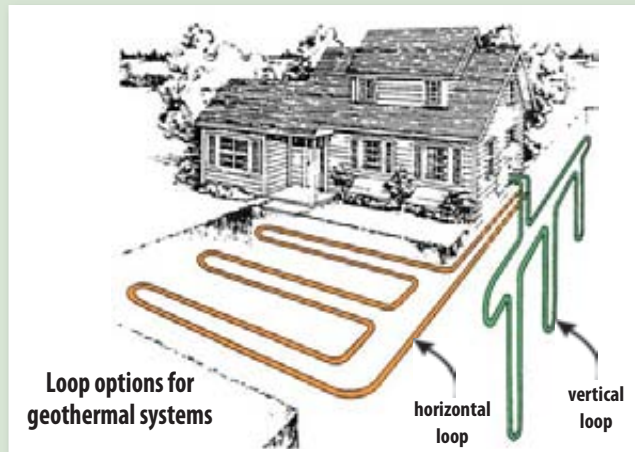
The earth is a wonderful source of heat. During the heating season, the ground, at a temperature of 45 to 50 degrees F, transfers heat to the cooler solution in the tubing. The warmed solution is then conveyed to the heat exchanger, which removes the heat and discharges it into the home. The reverse occurs during the cooling season.

High efficiency equals big savings

Because electric energy is used only to move much larger amounts of heat energy, a geothermal heat pump system is very efficient. During the heating season \$1 worth of electric energy produces \$2 to \$4 worth of space heating energy inside your home or business. These savings often recover the higher installation cost of geothermal systems in three to five years.

But the savings don't stop there! Because the heat-moving feature of a geothermal system is reversible, the same equipment can be used to remove heat from your home or commercial building in the summer and discharge it into the earth.

And that's still not the end of the savings! A geothermal system can use the heat removed from your home to produce free hot water in the summer. Hot water can also be produced at substantial savings in the winter.



Flexibility, durability

Geothermal heating and cooling systems are available in a number of designs to suit various site sizes and soil conditions. Vertical loop systems require the drilling of bore holes connected by a trench and are ideal for limited space or rocky soil. Horizontal loop systems require a larger area, but use fairly shallow trenches.

Geothermal systems can be designed for new homes, schools, retail stores and other buildings, or can be retrofitted to existing structures. The systems have a long service life because they are protected from harsh outdoor weather. The unit is housed indoors and the loop is underground. Geothermal systems also have few mechanical components, making them more reliable and less prone to failure.

Air-to-air heat pumps

Just as heat is present in the ground, it is also available in the outside air – even on a cold day. An air-to-air heat pump uses a system of coils filled with compressed gas to collect heat from the outside air. As with a geothermal system, an air-to-air heat pump uses small amounts of electric energy to move much larger amounts of heat energy into the home.

Properly designed and installed, air-to-air heat pump systems can have heating efficiencies as high as 150 percent to 350 percent. These air-to-air devices also offer other advantages the geothermal systems

provide. The operation can be reversed in the summer to provide air conditioning.

The main difference in the two types of systems is that air-to-air heat pumps generally have a lower installation cost, while geothermal heat pumps usually operate at a higher efficiency, particularly during the coldest part of the winter. Your local cooperative or municipal can help you determine a system well-suited for your situation.



As with a geothermal system, an air-to-air heat pump uses small amounts of electric energy to move much larger amounts of heat energy into the home. It also serves as a cooling system, as the operation can be reversed in the summer to provide air conditioning.



John and Renae Bridewell

Grand Forks, N.D.

John and Renae Bridewell installed a geothermal system in their new home and have been very pleased with their decision. “Houses can be designed for some rooms to be cooler or warmer than others by varying the amount of liquid circulating to each of the rooms – more liquid to the warmer rooms, less to cooler rooms,” explains John. Because our house is equipped with in-floor heat, even our tiled floors feel warm. “We’ve found the geothermal system not only to be an economic value but also one that benefits the environment.” John and Renae Bridewell are members of Nodak Electric Cooperative.



Frequently asked questions about off-peak electric heat

1. Are incentives offered to convert to off-peak electric heating?

Many cooperatives and municipals have programs that help customers install a quality off-peak heating system. Contact your power supplier for specific details.

2. What will it cost to install an off-peak electric heating system?

Installation costs will vary depending on the type of heating system and electrical service panel you currently have. Your local electric cooperative or municipal can assist you in getting estimates for installing a quality off-peak heating system. Call your member services representative today.

3. What steps are involved in adding off-peak electric heating?

This depends on the age, type and configuration of your current heating system. There is an off-peak heating option that will fit your situation. Contact your electric cooperative

or municipal for more information about off-peak heating solutions.

4. Can off-peak electric heating reduce my heating costs?

Depending on the type of energy you are currently using to heat your home, off-peak heating can reduce your heating costs. Check with your local cooperative or municipal for cost comparisons. Ask how you can save on your heating costs with a quality off-peak electric heating system.

5. When does control occur, and how long does it last?

Control of your off-peak electric heating system can occur several times during a heating season, usually on the coldest days of the year. Load control depends on several factors including temperature and wind conditions. It may be cold in one part of the region and significantly warmer in another, in which case control may not be necessary. Control can be spread over several

hours or several days, depending on the severity of the weather and availability of electric energy. A reliable backup heating system is essential, as control times of 400-600 hours for the winter heating season can be expected.

6. Can you recommend someone to install the system?

Your local cooperative or municipal has a list of contractors who install quality off-peak heating systems. Contact your member services representative for a list of contractors in your area.

7. Are there financing programs available?

Special financing programs are available from some cooperatives and municipals to help consumers install a quality off-peak electric heating system. Check with your member services representative on how you can finance your off-peak heating installation.

For more information, contact your electric cooperative or municipal system

COOPERATIVES

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

Cass County Electric Cooperative
Kindred, 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
Mahnomon, MN • (218) 935-2517

MUNICIPALS

Bagley Public Utilities
(218) 694-2300

Baudette Municipal Utilities
(218) 634-2432

Fosston Municipal Utilities
(218) 435-1737

Grafton Municipal Utilities
(701) 352-2180

Halstad Municipal Utilities
(218) 456-2128

Hawley Public Utilities
(218) 483-3331

Park River Municipal Utilities
(701) 284-6150

Roseau Municipal Utilities
(218) 463-1542

City of Stephen Utilities
(218) 478-3803

Thief River Falls Municipal Utilities
(218) 681-5816

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

Warroad Municipal Utilities
(218) 386-1873