

EASY\$ TIP SHEETS

Energy Advice Saving Yukoners Money

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Residential Water Heating

Residential water heating is estimated to be the second largest energy use for Canadian households, exceeded only by space heating. Water heating accounts for approximately forty percent of total household electrical energy consumption. Efficiency is critical if you're planning on saving energy and reducing your electrical bills.

This Easy\$ tip sheet will discuss the available water heater options, provide tips on how to reduce your hot water costs and use and explain how to care for some common water heating appliances.

The 4 types of water heaters

There are 4 main types of water heaters. Knowing about each will help you make sure you have the best one for your needs.

Type 1: Storage tank water heaters

Storage tank water heaters are most common in Yukon homes. They heat and store a set volume of hot water in an insulated tank.

With this type of storage, a set volume of hot water can be supplied over short periods. The energy used to maintain hot water in a storage tank adds 10% to 20% to the energy used for water heating, from heat loss by the storage tank when no hot water is being used.

Goal and Summary

It is possible to reduce your water heating costs by doing the following:

- selecting an energy efficient water heater that meets your needs;
- installing some basic water-saving devices; and,
- adjusting your water-use habits.

Energy Factor

The overall efficiency of water heating appliances is indicated by their energy factor (EF).

The EF is the portion of the energy going in to the water heater that gets turned into usable hot water under average conditions. It takes into account heat loss through the walls of the tank. The higher the energy factor, the more efficient the heater and the lower your operating costs. In most cases, the larger the storage tank, the lower the EF.

The most efficient electric storage water heaters have energy factors ranging from between 0.93 and 0.95 resulting in estimated annual energy use below 4,725 kWh/year. Electric water heaters have improved so much over the years that there is currently little difference between the most efficient models and the Canadian minimum efficiency standard required by law.

The benefits of this heater type include:

- the lowest equipment cost;
- the capacity to accommodate large flow rates;
- a proven technology; and,
- suitability for most household hot water use.

Type 2: Instantaneous electric water heaters or tankless water heaters

Instantaneous electric water heaters heat water on demand as it passes through the heater. The benefits include continuous hot water supply – water is heated as you require it – and a supply of hot water at locations away from the central heater or where space for a storage heater isn't available.

Disadvantages include the need for a heating element with a large electrical capacity to provide adequate hot water flow, high initial cost, and the fact that no hot water will be available immediately after or during a power outage.

Rather than storing and maintaining a relatively large amount of hot water, tankless water heaters heat water only when it is needed. Turning on the faucet cues a tankless heater to activate; cold water enters the heater, circulates through a heat exchanger, and is sent through the hot water plumbing to your fixtures. After the initial startup, the system continues to heat water as long as the tap stays open. When you turn off the faucet, the water heater shuts down.

Because it has no tank, a tankless or instantaneous water heater eliminates the standby losses associated with tank style heaters.

In addition to their efficient operation, tankless systems also benefit from their relatively small size. Most models are about the size of a suitcase, and they work well in small spaces.

Tankless systems are powered by either propane or electricity. Larger propane tankless models can provide more hot water than electric tankless heaters because electric models are limited by the size of a home's electrical service (usually 20 amps). Gas tankless systems also have wider applications because they produce hot water at higher flow rates. The lack of a natural gas network and the relatively high price of propane mean gas tankless models have only limited applicability in Yukon.

The Yukon Electrical Company Ltd. cautions that in some cases, customer-owned electric panels and utility-owned services/transformers would have to be enhanced to ensure adequate electrical capacity is available to operate an instantaneous water heating system.

Due to the capacity limitations of electric tankless systems these are only appropriate for point of use applications, homes with relatively small hot water loads or where no space is available for electric tank heaters.

For more information on tankless water heaters read the information provided at www.tankless101.com.

Type 3: Integrated space/water heating systems

Integrated space/water heating systems combine to meet household space heating requirements as well as household hot water demand, and can reduce the cost of the total system installation. A single boiler is used, requiring only one combustion burner and only one vent. Often these systems employ an insulated external storage tank with a high efficiency low mass boiler to first heat the water.

Integrated systems can be energy efficient if energy efficient water heaters are used and the system is designed to ensure that the water returning to the hot water tank is at a sufficiently low temperature to maintain the temperature stratification within the tank. A well-designed system should have a hot water heater which meets or exceeds the Energy Star criteria for gas storage water heaters. Currently the limit to meet this criterion is an oil or propane water heater with an Energy Factor of 0.62 or greater. The criterion is due to increase to 0.67 after September 1, 2010.

For integrated systems that do not use high efficiency boilers with a storage tank, the initial cost-saving is soon eliminated by very low seasonal efficiency. The heater is sized to produce enough heat to warm a house on the coldest days. However, in spring, summer and fall when no heating is required, the same heater heats domestic water only. The effect is an oversized water heater that operates for several months of the year with low heating demand and therefore, low efficiency.

Type 4: Solar water heaters

Solar water heaters use the sun's energy to heat water. Passive solar systems pre-heat water in a solar collector and then transfer it by line pressure to a conventional storage tank water heater. Active solar systems, on the other hand, use pumps and controls to move the heated water from the collector to the storage tank. In areas where the temperature drops below freezing, the fluid in the collectors is usually a form of antifreeze, which is then circulated through a heat exchanger to heat the household water.

Typically solar systems can supply up to 50 percent of the energy needed to heat the water required by an average household (depending on climate conditions and water use). Since energy from the sun is free, solar water heaters can significantly reduce the cost of heating water for a household, a costs-savings that can offset the higher purchase and installation cost of a solar system.

Heat recovery water pre-heaters (Drain water heat recovery units)

These units recover valuable heat that would otherwise be lost in the sewage system and use it to preheat incoming cold water. The total installed cost is typically \$600-\$1000 and can save 10-30% on water heating costs depending on the unit and water use. Drain water heat recovery units pay for themselves in the two to six year range in most Canadian homes, don't require maintenance and have no moving parts. They can be used with any water heating system using a storage tank.

With solar water heaters you need to size both the solar hot water system itself and the back up electric water heater. It generally makes the most sense to size a solar water heater to provide two-thirds to three-fourths of your total demand, and provide the rest with a back-up system.

For more information on solar water heating systems see Natural Resources Canada's publication: Solar Water Heating Systems: A Buyer's Guide (www.canren.gc.ca).

Ways to reduce your operating cost

There are many simple and inexpensive ways to save money on water heating.

Using your water wisely

One of the easiest ways to reduce your hot water heating bill is to use less hot water. In most cases this can be done with little or no initial costs and only minor lifestyle changes. For example, it's a good idea to turn the tap off while shaving, brushing teeth or washing.

Using low-flow shower heads and faucet aerators

Hot water faucets and showers can be the largest contributors to hot water use. One drop per second out of a leaky tap wastes 27 litres of water per day. Even a modest 10 minute shower can use up to 190 litres of hot water with a conventional showerhead.

Low-flow showerheads and faucet aerators can reduce your water use by half or even more without sacrificing water pressure. A family of four can save 5300 litres of water a year and save the energy costs required to heat it. Low-flow shower heads come in a variety of models including hand held and designer models.

Look for a unit that has the flow rate marked on it (usually this is in gallons per minute). Shower heads with a flow rate of 2 gallons per minute or less are considered to be low-flow models.

Doing laundry and dishes more efficiently

Use the lowest temperature wash and rinse settings on clothes washers. Switching from hot to cold water will not only save the energy used to heat the water, but can also reduce fading and shrinkage of clothes.

A typical top loading washer uses about 150 litres of water for each full load. Front loading washing machines cut water use by nearly 40 percent. In contrast a full size horizontal axis (front loading) model uses only 75-100 litres. By purchasing a horizontal axis model, you could save as much as 26,000 litres of water per year. For smaller loads of laundry, use the lowest available water settings.

Operate clothes washers and dishwashers only when full. An automatic dishwasher typically uses about 30-53 litres per cycle. Consider using the light wash cycle for lightly soiled dishes - it can save about 11 litres per cycle.

Fix any leaks in pipes or faucets. A leaky faucet can waste thousands of litres of water or more every year. If the leak is in a hot water pipe or faucet the energy savings could easily pay for the cost of fixing the leak.

Setting your water temperature

Properly setting the water temperature in your tank will provide sufficient hot water but will not waste energy to maintain water at an excessive temperature.

Keep your water heater thermostat set at the lowest temperature that provides you with sufficient hot water. For most households 55 degrees Celsius water is fine (about midway between the low and medium setting). Each 5-10 degree reduction in water temperature will generally save 3-5 percent on your water heating costs. The Canada Safety Council recommends a domestic hot water tank supply temperature no lower than 54°C.

When you are going away on vacation, you can turn the thermostat down to the lowest possible setting, or turn the water heater off altogether for additional savings.

You can check the temperature of your hot water system by using the dial setting on the tank, or if no numbers are on the dial, by measuring the water with a reliable thermometer.

Simply turn on the hot water at the tap nearest to the hot water tank, allow it to run for 30 seconds to a minute, and then check the temperature with the thermometer. Note that the temperature may still be a few degrees lower at the tap than it is in the tank, as some heat may be lost as the water travels to the tap.

Your water heater – choosing the right size.

The capacity of a water heater is an important consideration. Installing a tank that is larger than necessary will end up costing you money to heat more water than your household needs, even during peak periods. And you'll waste more energy as this water loses heat through the tank walls and water pipes. Installing a system that is too small could lead to rationing of hot water or exposing you to the rather shocking experience of having a cold shower.

The water heater should provide enough hot water at the busiest time of the day. To determine this capacity, estimate your household's peak hot water demand – this usually occurs during showering. For example, 40 minutes of showering would be enough to shower at least three people. Allow for hand and face washing at the sink and leave some water in the storage tank. Assuming you are using a low-flow showerhead, these hot water requirements can be met by a water heater with a first hour rating (FHR) of 270 litres (60 gallons). FHR is a measurement of how much hot water the heater can supply during a busy hour.

Then you will have to determine the right tank size for your home's circumstances. Don't confuse tank size with your homes' daily hot water consumption. Selecting a small water heater tank with a high FHR should result in good performance during the busiest time of the day while minimizing cycling and stand by losses when hot water is not in high demand. The table below provides some guidelines on what size of tank you will need, based on typical recovery rates.

Water heater sizing table

Hot Water Use	Family Size	Electric Tank Size	Gas Tank Size	Oil Tank Size
Vacation Cottage - no dishwasher - no clothes washer	Up to 2 people	135 litres (30 gallons)	90 litres (20 gallons)	90 litres (20 gallons)
Small/Medium Family Home - 1 bathroom - no dishwasher - clothes washer	2 people	180 litres (40 gallons)	135 litres (30 gallons)	135 litres (30 gallons)
Medium Family Home - 1.5 bathrooms - dishwasher - clothes washer	3 people	225 litres (50 gallons)	180 litres (40 gallons)	135 litres (30 gallons)
Medium/Large Family Home - 2 bathrooms - dishwasher - heavy-duty clothes washer	4 people	290 litres (65 gallons)	180 litres (40 gallons)	180 litres (40 gallons)
Large Family Home - 2 or more bathrooms - heavy-duty dishwasher - heavy-duty clothes washer	5 people	360 litres (80 gallons)	225 litres (50 gallons)	225 litres (50 gallons)
Large Family Home - same as above with whirlpool baths	6 people	540 litres (120 gallons)	340 litres (75 gallons)	340 litres (75 gallons)

Maximize the performance of your tank

The following are suggestions to ensure that your water heating system gives you maximum performance at a reasonable cost.

Selecting a water heater

Think about replacing your water heater well before it stops working. If you are like most people, you are unlikely to go out looking for a hot water heater until your existing one fails, leaving little time to look for a water heater that most appropriately fits your needs and offers the highest levels of energy efficiency. A much better approach is to do some research now to decide what type and size of water heater you want in the future.

Installing external insulation blankets (for electric tanks only)

If your tank was manufactured prior to 2004, then wrap it in an insulation blanket to help reduce its standby heat loss. Many of today's electric tanks are well-insulated, which means that there is little advantage to adding an insulating blanket.

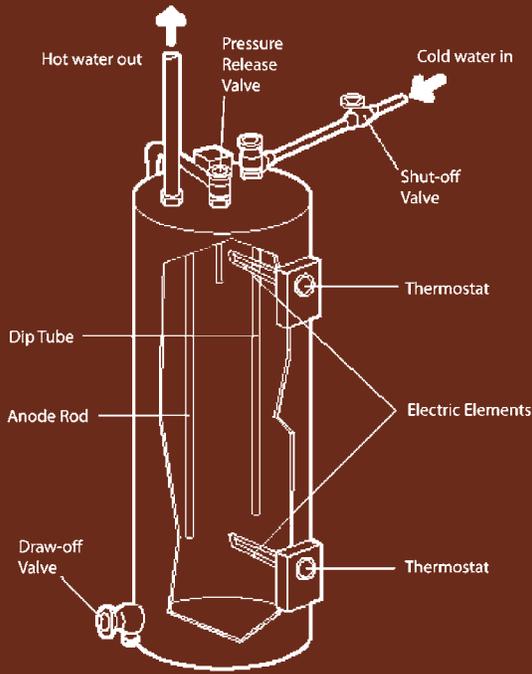
For information on how to properly wrap your older electric hot water tank and increase the comfort of your home, refer to: www.powerhousetv.com.

Due to the possibility of the blanket slipping and blocking off combustion air to the burner, external insulation blankets are not recommended on gas water heaters.

Insulate hot water pipes

Cover hot water piping with 12-millimetre (1/2-inch) fibreglass or foam insulation. This will help maintain the water temperature while it is distributed within your home. To reduce heat loss, insulate at least the vertical sections – including the 90° elbows – plus one metre (three feet) of the horizontal run of the hot water pipe from the water heater. Also insulate hot water piping that passes through unheated areas (e.g. unheated crawl spaces).

Electric water heater components



Source: Natural Resources Canada,
Office of Energy Efficiency

Outer Casing

Enamel resists stains and is easy to clean.

Inner Tank

Made of heavy-gauge metal, generally with an inner bonded glass lining, which prevents rusting and corrosion and ensures clear, clean water.

Dip Tube

The role of the dip tube is to direct incoming cold replacement water to the bottom of the tank for heating. While it warms, the dense, cold water stays naturally segregated from the warmer, lighter water floating on top. The water for faucets and appliances comes from the hot layer on top. If the dip tube is missing, the cold incoming water mixes with the hot water at the top of the tank and you wind up feeding the house with tepid instead of hot water.

Anode Rod

A metal rod immersed in water protects against corrosive action and extends the life of the storage tank. Inspect the anode every three to five years, and replace if necessary.

Thermostats

A thermostat, which automatically maintains the required water temperature, controls each heating element. A safety control shuts off the electricity when the water temperature limit is reached.

Electric Elements

Single or dual type. Copper-sheathed elements provide complete contact with water for instant heat transfer and fast recovery. Large service panels in the metal jacket allow easy access to the elements. Two-element units provide quick recovery.

Cold water in

Non-corrosive inlet directs cold water into the bottom of the tank without mixing with hot water in the upper section.

Draw-off Valve

Allows draining of sediment from the bottom of the tank.

Pressure Relief Valve

This safety device prevents excessive temperature and/or pressure. Do not use it to flush the tank.

Insulation

Covers the tank to reduce heat loss.

Flushing your hot water tank

To prevent or reduce sediment buildup on the bottom of the tank and on the heating elements, flush or empty your tank every two to three years. Between rigorous flushings, most of the sediment on the tank bottom can be removed by draining five to ten litres (one to two gallons) of water from the tank bottom every six months.

Before you begin, check your hot water tank's operating manual and follow the manufacturer's guidelines. To safeguard against scalding and to save energy, flush the hot water tank when the water in it is cold. Reduce hot water in the tank by using hot water for baths, showers, dishes or laundry.

Tank flushing procedure

You will need about three hours to complete the flushing procedure.

Caution

If you do not feel confident to undertake this procedure yourself, contact a qualified technician for assistance.

Care must be taken during the procedure as there are risks of causing permanent damage to your water tank.

Step 1 Turn off the electricity to the heater elements at the main service box.
Failure to follow this step can result in serious damage to the heater.

Step 2 Shut off the cold water line into the tank.

Step 3 Partially open one or two hot water taps on the floor above the tank level (or the same floor for one-story houses). This will allow air into the hot water tank so that the water will drain quickly.

Step 4 Connect a garden hose to the tank drain and draw the water into a bucket or floor drain. Using no more than two complete counter-clockwise turns, open the drain at the bottom of the tank.

Step 5 When the tank is empty, fully open the cold water inlet valve for 30 seconds. This will stir up the sediment and allow for a more thorough flushing.

Step 6 Drain the tank again and repeat Step 5 until the water coming from the tank is clear of any sediment. This may require several tank flushings.

Step 7 Once the sediment is removed, close the bottom drain and open the cold water line to fill the tank completely.

Step 8 Turn off the hot water taps as soon as water is running through them again. You can now safely turn on the electricity. The job is complete.

Inspect and replace anodes

Domestic water heaters are equipped with a sacrificial anode – a metal rod that sacrifices itself in an attempt to protect the inside of the tank from corrosive elements in the water. The rate at which the anode dissolves depends on the mineral content, temperature and hardness of the water. Anodes are made of magnesium or aluminum alloys. If the water contains sulphur, an aluminum anode is recommended, as a magnesium anode may produce a rotten egg smell (hydrogen sulphide). Regular inspection and replacement of the anode every three to five years, can add a few more years to the tank's life.

To locate the anode, look for a hex head nut (typically 3/4-inch) on top of the tank. It may be concealed below a plastic plug in a hole in the metal jacket of the tank. Remove the plug and push the insulation aside to locate the plug. The anode is attached to the bottom of this plug. Replace the anode if it shows any bare wire, or pieces flake off when the anode is bent slightly.

Make sure to turn off the water to the tank, and drain four litres of water from the tank before removing the anode. Be sure to have a replacement anode on hand.

Removing the nut will require a socket wrench and probably a piece of pipe to slip over the wrench handle to increase the torque. It may take considerable muscle to move the nut; be careful not to rotate the tank, break the nut or break the water pipes to and from the tank.

This Easy\$ tip sheet is provided by the Energy Solutions Centre.

If you have additional questions or comments, please contact the Energy Solutions Centre by:

Phone: (867) 393-7063 or from the communities at 1-800-661-0408 ext. 7063

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