

Heating Your Home in Vermont with a Pellet Stove



A publication of the Northeast Vermont Development Association

Created by Ben Luce, Ph.D., with support from Vermont Clean Energy
Development Fund

Version 1.0 (February 2011)

Table of Contents

Introduction	4
Air pollution from wood burning in Vermont	4
How much additional biomass can be sustainably harvested in Vermont?	4
How pellet stoves work.....	5
Efficiency of pellet stoves	5
Visual appearance of pellet stoves	5
What are fuel pellets and wood pellets?	5
Step 1: Determine if a pellet stove is the right form of wood heat for you	7
Advantages of pellet stoves relative to other heating options.....	7
Disadvantages of pellet stoves	7
Fireplaces versus pellet stoves.....	7
Fireplace inserts versus free-standing pellet stoves.....	8
Wood stoves versus pellet stoves.....	8
Costs of Operating a Pellet Stove.....	8
Step 2: Choose a pellet stove.....	9
Summary	9
Cost and payback time of pellet stoves	9
Types of pellet stoves	9
Sizing a pellet stove.....	10
Where to purchase a pellet stove.....	10
Financial incentives for pellet stoves	10
Step 3: Install your pellet stove	12
Summary	12
Venting a Pellet Stove	12
Floor Protection	13
Air Supply	13
Step 4: Obtain Pellets.....	14
Financial Assistance for purchasing pellets:	14
Sources of Pellets.....	14
Step 5: Operate your pellet stove properly	15
Resources.....	15

Disclaimer: This report was prepared as an account of work sponsored by the Northeast Vermont Development Association with funding from the Vermont Clean Energy Development Fund. Neither the Northeast Vermont Development Association or State of Vermont, nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trade mark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the Northeast Vermont Development Association or the State of Vermont or agency thereof.

Comments and suggestions on this guide are welcome: Please send email to ben.luce@lyndonstate.edu.

About the NVDA: Formed in 1950, at the same meeting where U.S. Senator George D. Aiken coined the term "Northeast Kingdom" to describe Caledonia, Essex and Orleans counties, the Northeastern Vermont Development Association has served the people, municipalities and businesses of this region as both the Regional Planning Commission and Regional Development Corporation.



As the Regional Planning Commission, NVDA assists municipalities, organizations, committees and individuals with a wide variety of planning and technical services. From assisting [municipalities](#) with regulatory options, to administering [grants](#), creating [maps](#), and implementing [transportation](#) and natural resource plans, NVDA is actively working with [land use](#) issues in the region.

As the Regional Development Corporation, NVDA works on [infrastructure improvements](#), assists [companies relocating](#) to the area, helps existing businesses to grow, and administers [revolving loan funds](#). NVDA also fosters key partnerships with the [Small Business Development Center](#), the [Northeast Kingdom Collaborative](#), the [Northeast Kingdom Travel and Tourism Association](#), and the various [Chambers of Commerce](#) in the region.

Please visit www.nvda.net for more information.

Introduction

Human beings have been using renewable biomass for heating in Vermont for thousands of years. Today, several tens of thousands of homes and businesses are heated by wood (about 10% of homes), and the state also boasts two wood fired power plants, 44 biomass heated public schools, biomass heating systems at several college campuses, and at least one pellet production facilities. Numerous proposals for additional pellet production facilities, district heating systems, and school systems exist, and homeowners and businesses are increasing turning to wood heat.

This guide provides essential information in a step-by-step format for utilizing pellet stoves in the Northeast Kingdom of Vermont. There are separate guides for wood stoves and geothermal heating systems in this series, as well as guides for obtaining power from photovoltaic and wind energy systems, and hot water from solar hot water systems. Please visit www.nvda.net to obtain these.

Air pollution from wood burning in Vermont

Pellet stoves today create far less air pollution than older wood stoves, and less than most newer models of wood stoves, and can be a clean and affordable means to achieve renewable energy heating. For information on pollution impacts of wood stoves in Vermont, see the Agency of Natural Resources website at: <http://www.anr.state.vt.us/air/htm/woodfacts.htm>. The biggest (and not fully resolved) air pollution issue in Vermont today associated with wood heating are wood boiler systems, and not newer wood stoves or pellet stoves.

How much additional biomass can be sustainably harvested in Vermont?

Quite a lot: A 2010 report by the **Biomass Energy Resource Center (BERC)**¹ estimates that there is roughly **one million tons per year** of “Net Available Low-grade Growth (NALG) wood” available in Vermont. This would be enough to heat over 200,000 homes in Vermont. (Today, as mentioned above, only 10% of homes in Vermont are presently heated by wood – most are heated with heating one and propane). NALG wood is wood that would be appropriate for use as biomass fuel above and beyond current levels of harvesting. To determine this, the report states that “the total forestland area was filtered using GIS data and software to remove inaccessible and ecologically sensitive areas of forestland that would not be harvested. Forest inventory and composition data were applied to this filtered forested footprint and averaged rates of forest growth were applied to the portion of the inventory deemed low-grade. Averaged current demand for low-grade wood was subtracted from this growth, giving the amount of NALG wood.

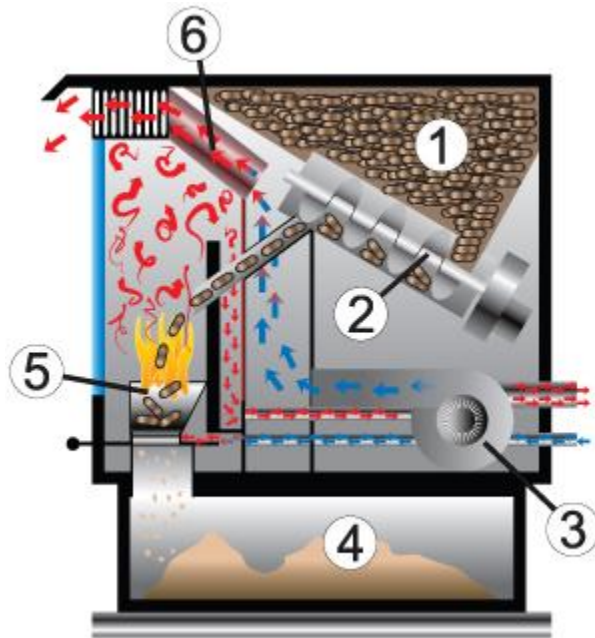
Pellets are produced in many places throughout the Northeast, and the biomass supply overall is much larger than Vermont’s alone.

There is also interest in the use of “grass pellets”. The Biomass Energy Resource Center (BERC) and partnering organizations recently completed a study of grass pellets and found that the idea is promising for larger boiler systems. See: http://www.biomasscenter.org/images/stories/grasspelletrpt_0111.pdf

¹ Vermont Wood Fuel Supply Study: 2010 Update: http://www.biomasscenter.org/images/stories/VTWFSUpdate2010_.pdf

How pellet stoves work

Pellet stoves operate by channeling wood pellets from a “hopper” into a “burn pot” or “burn grate” with an electrically powered “auger” (rotating screw). The heat from the burning pellets is then transferred via a “heat exchanger” into air which is circulated through the pellet stove by a fan. The following diagram, from www.wdpellet.com, shows how this is accomplished for a pellet stove with a top-loading hopper:



Wood pellets are placed into a hopper (1). An electric auger (2) feeds the pellets into a burn grate (5) at a rate determined by the temperature control. Fire heats the air in heat exchange tubes (6) and a convection fan (3) blows this heated, uncontaminated air into the room where a stove is situated. There is an ash pan (4) below the burn grate into which the residue falls. Typically, a stove only needs to be filled once a day and the ash pan needs to be emptied only once or twice a year.

Note that a pellet stoves cannot operate without electricity, although some pellet stoves can be ordered with battery back-up.

Efficiency of pellet stoves

Pellet stoves are anywhere from about 75% to 90% efficient, depending on the model and fuel used.

Visual appearance of pellet stoves

Pellet stoves come in many styles and colors. While most have windows, only some exhibit large fireplace-like flames.

What are fuel pellets and wood pellets?

Fuel pellets are manufactured at pellet mills or plants from a variety of possible biomass feedstocks:

- Wood pulp, wood chips, or sawdust
- Shelled corn

- Grasses
- Fruit and nut pits

There are between 50-100 pellet manufacturers today in the US, and thousands of dealers.

Wood pellets in particular require no additives, because the natural resins in wood serve as binders.

Note that only certain pellet stoves are designed to burn non-wood fuel pellets. In particular, there are “corn stoves” that specifically burn corn pellets. (This guide focuses only on wood pellet stoves).

There are also different grades of fuel pellets. The premium grade pellets are more expensive, but burn cleaner. Most top-fed pellet stoves require premium grade pellets to keep them from forming “clinkers” and not burning well. Bottom-fed pellet stoves work well with either grade of pellets, but premium grade pellets usually cause less harmful pollutants.

Pellets are usually packaged in forty-pound bags and sold by the bag or by the ton. Pellets are available for purchase at stove dealers, nurseries, building supply stores, feed and garden supply stores, and some discount merchandisers. The section below on obtaining pellet provides advice on locating dealers.

Step 1: Determine if a pellet stove is the right form of wood heat for you

There are many ways to heat homes and businesses with biomass today – pellet stoves are only one way.

Advantages of pellet stoves relative to other heating options

- **Convenient storage:** Bags of pellets stack easily and compactly, using roughly half the space of an equivalent amount of firewood. Pellets can also be delivered by truck and stored in large hoppers. Unlike firewood, large amounts of pellets can also be stored indoors (no insects to worry about).
- **Ease of loading:** Loading a pellet stove is normally required only once a day or even less.
- **Very steady, predictable heat delivery:** Pellet stoves are electronically controlled, and the delivery rate of fuel to the burn pot is precisely regulated and consistent.
- **Good efficiency:** Pellets have a low moisture content (typically less than 10%), and the burning process is efficient due to the precisely regulated flow of combustion air.
- **Clean burning:** Because they pollute so little, pellet stoves do not require EPA certification, although some manufacturers voluntarily seek this certification. The emissions of pellet stoves are roughly equal to or slightly less on average than the best “catalytic” type wood stoves.
- **Renewable, sustainable energy source:** Ideally, pellet manufacturing is performed in conjunction with sustainable harvesting. Use of wood by-products also has environmental and economic advantages.
- **Comfort:** Pellet stoves provide both even source of heat. They also provide a good mix of radiant heat, for close-in comfort, and strong warm air currents for heating a building overall.
- **Low cost fuel:** Fuel pellets are generally cost competitive with other fuels.
- **Ease and cost of installation:** Pellet stoves, unlike wood stoves, do not require high temperature, expensive chimneys, just venting pipes.

Disadvantages of pellet stoves

- Use of plastic bags for fuel storage (unless truck delivery and hopper storage is used).
- Dependence on a commercial source of fuel (which has pros and cons)
- Dependence on an electricity supply
- Consumption of electricity
- Technically more complex than say, wood stoves
- Costly to repair
- Higher maintenance: Weekly ash removal, occasional burn pot and heat exchanger maintenance.
- The flame is not a visually pleasing as from a wood stove
- Outdoor pellet boilers are subject to strict emission and installation regulations in Vermont (this guide does not deal with pellet boilers).

Fireplaces versus pellet stoves

Traditional masonry fireplaces are quite inefficient – often less than 15%. Without diligent use of a damper and/or a door, they can actually be energy negative on the whole. Wood stoves and pellet stoves are much more sensible options.

If you do use a fireplace, a glass or metal door that can completely cover the fireplace opening is recommended. Unlike a damper, a door can be closed as soon as the fire dies down to prevent a large loss of inside warm air up the chimney.

Most pellet stoves today have glass windows, often substantial inside, so that the fire can easily be seen.

Fireplace inserts versus free-standing pellet stoves

These are pellet stoves that can be built into or partly into a fireplace. They will dramatically improve the efficiency of a fireplace.

A pellet stove can also be installed in front of the fireplace, and utilize the existing chimney (with a liner inserted) as the exhaust. Pellet stoves can also be installed without a fireplace of course.

Wood stoves versus pellet stoves

Wood stoves have some definite advantages over pellet stoves: More aesthetically pleasing fire, no electricity use, extremely local fuel and self-producible fuel source, reasonably low cost fuel (especially if harvested on-site), and ease of operation. But wood stoves also produce a much less even supply of heat, require more frequent loading, and require more firewood storage space than pellets. All in all, both wood stoves and pellet stoves are a good home heating options, and the advantages and disadvantages should be carefully weighed first. If you are considering a wood stove, see the separate guide on wood stoves in this series.

Costs of Operating a Pellet Stove

Home scale pellet stoves typically draw around 100 watts of power during operation (several times this during start-up), and typically use about 100 kilowatt-hours a month or about \$13 per month in Vermont. Keep in mind that some stoves use significantly more: This is something to compare when shopping for a pellet stove.

Step 2: Choose a pellet stove

Summary

- Know your stove types and basic installation issues
- Decide (think carefully) about what you want your stove to do for you.
 - Which rooms, and how many square feet precisely should it be able to heat?
 - Where should it be located?
 - What color should the stove be?
- Determine your heating needs as well as reasonably possible, so you can properly size your stove. An energy audit is highly recommended. You may want to pursue thermal energy efficiency improvements first.
- Investigate your chimney and hearth, if relevant, and other possible locations in your building. Have a chimney professional check your chimney. Take photos of your chimney and hearth, and other possible locations for the stove, along to the stove shop.

Cost and payback time of pellet stoves

Pellet stoves tend to have prices in the range of \$1500 - \$3,000. Installation can vary from \$500-\$1000, depending on the installation details. The investment will usually pay itself back in a few years.

Types of pellet stoves

In addition to the distinction between wood and corn pellet stoves, pellet stoves divide into two main types: **Fireplace inserts and freestanding stoves**. There are also pellet furnaces to consider if you have a boiler-fed hydronic heating system. Pellet stoves further divide into two main types of pellet feeding systems, **top-fed and bottom-fed**.

There are a number of detailed features to pay careful attention to as well when shopping for a stove:

- Keep in mind that some stoves have **automatic ignition**, while others require the use of an **approved gel or other starter material**.
- Different stoves require different levels and types of maintenance. For example, you may be able to clean the heat exchanger manually, or professional service may be required.
- Different stoves use different amounts of power: Compare the rated wattages.

In general, bottom-fed systems have a distinct advantage: They feed the burn pot from the side, which pushes out the old ash and “clinkers” out of the way. Clinkers are hard deposits that form from ash. Bottom fed stoves can also generally burn different grades of fuel whereas top fed systems require the higher grades that produces less ash.

Top-fed systems tend to build up clinkers and allow ash suffocate the flame more. There are some minor advantages, however, to these systems. They tend to combust the pellets more completely and are slightly more efficient. Overall, bottom fed system’s are preferable to top-fed systems.

While pellet stoves do not require EPA certification (unlike wood stoves), many manufacturers seek EPA certification anyway, and this can provide useful information, as there are differences in emissions between different models. Emission information is generally available from the manufacturers (for

example in owner's manuals), or from dealers. A list of EPA certified pellet stoves (lumped in with wood stoves) can be found at:

<http://www.epa.gov/Compliance/resources/publications/monitoring/caa/woodstoves/certifiedwood.pdf>.

Sizing a pellet stove

Pellet stoves come in a wide range of heat output rates, ranging from about 5000 BTUs/hour, which can heat about 800 square feet, up to about 70,000 BTUs/hour, which will heat most homes completely.

It is important to choose a pellet stove with an appropriate level of heat output. This depends both on how thermally efficient your structure is, and also which rooms you want to heat. Many new homes today are so efficient that even a small pellet stove can heat much or all of the structure. The specifications for a given stove, such as to be found in the owner's manual, often gives an estimated square footage the stove will heat. This estimate should be increased substantially if your building is super-insulated. Many heating professionals can estimate the heat load from heating bills and/or through an energy audit of your building. An **energy audit** can also provide a great deal of other useful information for improving the thermal efficiency of your building, including information such as the actual air leakage rate, and probably should be conducted any way prior to installing a pellet stove.

Which stove you choose will not only depend on the level of heat output required, but also somewhat on where precisely you plan to locate the stove. Like a wood stove, pellet stoves produce a lot of radiant heat (although usually less than a wood stove). For this reason they are best located in rooms where people actually spend a lot of time (and not say, in basements).

Pellet stoves must be installed according to very specific rules, and these can strongly impact where in a building a stove can be installed. For example, stoves must have floor protection extending out certain distances, and be certain distances (clearances) from combustible materials in the walls.

The **owner's manuals** for newer stoves can usually be found online, and are gold mines of information: The manuals are generally extensive, covering many different installation situations. They can be particularly useful for determining quickly whether a given stove can be accommodated properly in a given location. Discussing these questions with a knowledgeable dealer and/or installer is also recommended.

Where to purchase a pellet stove

Some sources of lists of pellet stove dealers can be found at:

- <http://www.stovedealersusa.com/>
- <http://hearth.com/shops.html>

Some Vermont manufacturers of pellet stoves are:

- Hearth Stone Stoves: <http://www.hearthstonestoves.com>
- Vermont Castings: <http://www.vermontcastings.com>

Financial incentives for pellet stoves

Federal Tax Credit: The Federal Government currently offers a 10% consumer tax credit, (up to \$300) on the purchase of a 75% efficient biomass burning stove. This legislation is retroactive to any eligible stove

purchased since January 1, 2009. The credit is available through 2011. Note that this is a credit, not a deduction, so that the entire eligible amount is credited to your tax bill.

Also note that there are state and community programs that can help pay for pellets. See the section below on obtaining pellets.

Step 3: Install your pellet stove

Summary

- Follow all applicable building and fire codes
- Follow the specific directions for your pellet stove.
- Hire or at least consult with a qualified, vetted, professional
- Inform your insurance company

Pellet stoves must be installed according to the **Vermont Fire & Building Safety Code**, any applicable local building codes, and more specifically, in accordance with the ***particular instructions provided with the stove you have purchased***. For example, the clearance (the minimum distances) for the stove from combustible materials are ***stove specific***.

The **owner's manuals** for pellet stoves can usually be found online, and are gold mines of information. They generally cover many different installation situations in detail.

Also, unless you are an expert, a professional installer should be used, or at least consulted, even if you have the manual for your stove, if only because detailed information on your particular state code is not easily available (generally only professionals have the guidebooks), and also to simply avoid beginner's mistakes.

One way to find a qualified installer is by contacting professional associations or guilds such as the Masonry Heater Association (<http://mha-net.org/html/links.htm>) or the National Chimney Sweep Guild (<http://www.ncsg.org/comm/state-guilds.htm>).

For any unresolved installation issues that might arise, one should consult with the National Fire Protection Association's publication ANSI/NFPA 211 Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.

You should inform your **insurance company** ahead of time of your intentions if your home is insured. They may have requirements which are more stringent than either the state or the manufacturer of the stove.

Finally, you should also check with local authorities to determine if any special permitting or installation requirements apply.

Some of the basic installation criteria are as follows. This information is not intended as a design guide, but only to convey an idea of what is involved.

Venting a Pellet Stove

Pellet stoves must use particular venting pipes, and NOT dryer vents, gas appliance vents, PVC piping, or woodstove pipe (unless specifically allowed by code). The kind of piping most widely approved for use in pellet stove venting is "PL vent pipe" (labeled as tested to UL 641). This piping is a double wall pipe with a stainless steel inner pipe that carries the exhaust. Joints must be sealed.

Pellet stoves can be vented through walls and ceilings/roofs, and also existing fireplaces and wood stove chimneys. The chimney should be cleaned and inspected before installation to ensure it meets local code requirements. The chimney may require relining the chimney with an approved metal liner, pipe, or PL vent. Vents or grills on factory-built fireplaces which provide cooling air to the outside jacket of the fireplace must not be blocked.

Floor Protection

All pellet stoves need to have a non-combustible base of some kind underneath. This can be:

- A concrete slab, bare or surfaced with tile or brick
- UL Approved Stove Boards or Mats
- Ceramic Tile, Marble or Slate installed on top of UL Listed cement underlayment board, such as “dura-rock” and “wonderboard”.

Many pellet stoves do not require a full “R” rated form of floor protection (unlike wood stoves).

Floor protection clearances for listed stoves are stove specific, but will generally need to extend at least 6” on the front, and a few inches on the sides and back. Note that this is substantially less than what is required from most wood stoves. Keep in mind though that the front of the pellet stove will still become very hot.

Wall and Furniture Clearances: The clearance around the pellet stove to combustible walls will typically need to be about 6 inches on the sides, and few inches on the back. In general, it is advisable to keep combustible furniture at least 36” away.

There are special requirements for installing pellet stoves in manufactured and mobile homes.

Air Supply

Pellet stoves generally require a piped in source of outside air to operate optimally: Drawing air from inside can lead to negative pressure in the building (relative to outside), which can potentially starve the stove of air and reduce its efficiency. There are specific recommendations about placement of air intakes, especially when an existing chimney is being used to vent the stove.

Step 4: Obtain Pellets

Financial Assistance for purchasing pellets:

The State of Vermont and various community programs in Vermont can help pay for pellets for qualifying residents. For example, see http://dcf.vermont.gov/esd/fuel_assistance. You may be eligible if your gross household income is equal to or less than 185% of the federal poverty level, based on household size — regardless of the resources (e.g., savings, retirement accounts, or property) that you own. See the following link for the specific guidelines: http://dcf.vermont.gov/sites/dcf/files/pdf/esd/fuel/INCOME_GUIDELINES_10-11.pdf

Sources of Pellets

One way to locate pellets is to utilize the “dealer locator” features on the websites of local pellet manufacturers.

Comprehensive listings of pellet manufacturers can be found here:

- www.woodpelletreviews.com
- http://www.thelograck.com/pellet_manufacturers.html

Some manufacturers of wood pellets in New England are:

- VT: <http://www.vermontwoodpellet.com/>
- NH and NY: <http://www.pelletheat.com/>
- ME: <http://www.corinthwoodpellets.com/>
- ME: <http://www.mainewoodspelletco.com/>
- ME: <http://www.northeastpellets.net/>
- NY: http://adirondackwood.com/tmp/ADKwood_company_17.pdf
- NY: <http://www.curranpellets.com/>
- NY: <http://www.drycreekproducts.com/>
- MA: <http://www.woodstonepellets.com/>
- MA: <http://www.infernowoodpellet.com/>

Step 5: Operate your pellet stove properly

First, read your owner's manual carefully, especially sections on maintenance.

Starting up:

- Use the proper method for your stove, either an automatic ignition system, or approved gels or other materials.

Shutting down:

- Do not shut the stove down by unplugging the unit: Set the control provided to the off position. The stove ideal needs to cool down first.
- Power failures: If the vent does not provide an adequate natural draft, some smoke may be emitted into the interior space when a power failure occurs.

Routine Maintenance:

- Inspect the burn pot daily, and clean occasionally when needed (follow instructions provided for this).
- Check the ash drawer weekly (monthly in some newer models) and empty when needed. Do not use a vacuum cleaner (the filter will not adequately trap soot particles).
- The heat exchanger will require occasional maintenance. Can be done manually on some models, while others require professional service.

Watch for problems:

- Air Supply: Watch the flame carefully, and occasionally observe what coming out the vent during start-up. A sooty looking, orangish flame, or dark smoke coming out the vent, suggests the need for more air. An overly fierce flame means too much air is being supplied.
- Persistent problems with flame appearance, smoke, sooting of the glass, etc, suggest that need for maintenance, or may single a problem with venting that needs to be fixed.

Resources

- Biomass Energy Resource Center (BERC): www.biomasscenter.org
- <http://www.woodpelletstoves.net/>
- <http://www.chimneys.com/>
- <http://www.hearth.com/>
- <http://www.woodheat.org/>
- <http://www.wiseheat.com/>