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The New Wood Stove-Pellet

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60% OF SWEDISH HOMES ARE HEATED BY PELLET STOVES

As we move forward in developing energy efficient heating systems there appears to be a more conscious effort being put forward on high efficiency gas and geothermal heating systems. Even the oil furnace manufacturers are working on improving their efficiency. Other than geothermal, both gas and oil heating systems use fossil fuels, with a considerable long term negative effect to our environment. While geothermal needs electricity to operate, in time I hope solar power becomes the electricity of choice. Quietly around the world alternative heating companies have been working on improving wood heat and slowly developing pelletized fuels. Some individuals and companies have looked at natural materials like corn or grass for pellets.

In the first part of this new series we are going to look at the history of pellet stoves. In the following weeks we will cover compressed wood or pellets and the development of alternative natural materials like switch grass for use in pellets. We are going on site to see a pellet stove installed and will discuss the new pellet furnaces that are quickly coming to



North America. I am pleased to welcome Brad Leonard from Renewable Energy in Kingston Ontario as our guest expert in this field. Brad helped develop the pellet stove standards

that are now used by WETT and he sits on the Wood Energy Thermal Training Board. This institution is the governing body over all wood and pellet installations. It is the only recognized standard that most home insurance companies will accept for your homeowners insurance.

Heating with wood is as old as man himself, however using the byproduct of saw mills and furniture manufacturers has a limited history. Sawdust, shavings and wood chips were used as **insulation in the 1800's. It was and still is popular for bedding in cattle and hog pens.** However with the mechanization of the early 20th century we were producing far more than we could use. In 1930 an engineer with the Potlatch Company in Idaho invented what was to become known as the Presto-log that has been short formed today to the Presto-log. He found that by compacting wood chips and sawdust under pressure they would retain their round shape and provide a constant uniform heat. The first wood pellet was born, all be it in a small log **form. By the late 40's this company had 18 factories producing these "logs" in the USA and companies in Africa, Peru and Yugoslavia** were on line. Other makers caught on to the idea and some makers began to use wax as a binder. The prepackaged fireplace logs we see today are a rendition of this product.

It seems that fossil fuels have created many world wide economic problems and in 1973 the oil embargo gave the world a shock. Out in Seattle Washington an aeronautical engineer by the name of Dr Jerry Whitfield invented the early

A CLOSE UP LOOK

pellet stove technology. In a state where logging and sawmills dot the landscape he had a ready supply of dry wood chips, sawdust and shavings. He found that by compressing these materials into small pellets he could control the burn cycle.... the pellet stove was invented. Over the next 30 years in North America the pellet stove has evolved from a simple metal box to match the décor and style of any wood stove. The real development was happening in Europe, where they embraced the pellet technology rapidly. There are numerous makers of retrofit pellet burners to replace the oil burners used in most boilers installed in European homes and businesses. The Swedes adapted very quickly, today over 60% of Swedish homes are heated by pellet stoves, furnaces and retrofitted boilers. In 2006 the Swedes used nearly one and a half million tons of pellets for heating. That is more than Italy, Germany, Austria and Finland combined!

Today the pellet stove we saw in the early 80's and what is on the floor of your local dealer is a far different product. Many stoves are now self igniting and can be operated by a thermostat. They have better heating efficiency than a conventional wood stove with a greater combustion rate. During the preparation of this series I was invited to the warehouse of Brad's company and sitting on the floor was a prototype pellet furnace. They project this type of unit can be fed from a large hopper and burn for days without a refill. One company noted they have created a computer system that monitors the pellet furnace, running diagnostic checks to predict any problems or maintenance needed.

The largest benefit is our environment, pellets burn very cleanly. Depending upon the grade of pellet and moisture content they can produce less than one percent ash content. A properly operating and maintained pellet appliance should not create creosote, a wood byproduct that has caused more than one chimney fire. While we are on chimneys; a pellet stove chimney can be side wall vented due to the fact they have a forced exhaust system. One other benefit is the fact the mechanical operation can be operated on DC power. This means if

your electricity goes out, a backup battery can continue to operate your pellet stove.

Next week we sit down with Brad to discuss how pellet stoves operate, the evolution of pellets and how they are making major strides in bio-fuels for pellet stoves.



Last week we did a brief history on wood pellet heating. This week we look at the pros, cons and operation of a pellet stove. From an environmental perspective pellet stoves are an ideal choice. In the USA the Environmental Protection Agency does not require emission testing for pellet stoves due to the fact they are the cleanest burning of all solid fuel stoves and furnaces. They can be thermostatically controlled; one manufacturer actually requires this installation. The ash content is small and in some stoves they only require a weekly cleanout. One pellet furnace owner I spoke to said he only emptied his ash tray twice a year. While the majority of pellets in the past have been made of wood

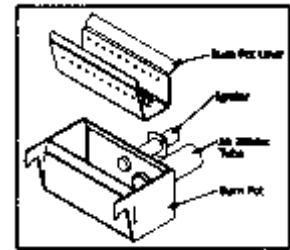


Figure 31 Burn pot assembly.

waste, there is a growing market for pellets that are made from other renewable products, like switch grass for example. The newer stoves can be fitted with DC electrical components; this means a back-up battery would continue to operate the auger during a power outage. The one comment I got from most pellet stove owners I interviewed was their contribution to the environment and the green house gas reduction that they now contribute too.

As with everything, there is a cost factor and pellet stoves are not cheap. You can expect to pay anywhere from \$1500.00 to over \$3000.00 for a top of the line stove. When you look at the cost of a high efficiency gas furnace you will find it is also in the 2500.00-3500.00 range. You should look at your life style, personal living standards and environmental concerns. They do require a chimney and in many cases as Brad stated, it can be side wall vented. This does reduce the cost, however Brad also noted that a full vertical chimney may be needed and it was best to have the dealer check this out before installation. The cost of fuel for an average home is difficult to pin down. During my research on this I got some wild swings in estimates. It seems that if this stove is a primary heat source, an average home will use about 100-150 bags a year. Last year in our region they were selling from \$7.00 to \$9.00 a bag. This year the prices I got were all in the high six to seven dollar range. Brad has a bag of **mixed pellet that contains grass; it's selling for 5.95 a bag right now.** If you factor in the cost of the electric auger and a fan you can add another 5-10.00 a month for hydro. Pellet stoves come with average warranties and repairs can be expensive, especially with the electronic controls some of the newer models have.

How difficult is a pellet stove to operate? In fact they have come a long way since the early models. First you fill the hopper which is located on the top at the back of the stove for most makes. Pellet stoves come with either an automatic ignition system or manual start. There still are a number of manual igni-

SAWDUST OR GRASS HEAT



tion stoves on the market and to start one of these you should use the approved starter gel, light the pellets and stay with the stove until you see the flame burning evenly. This is usually a simple operation as the tiny pellets; they look like rabbit feed, ignite quickly. If your

stove has an automatic ignition then it's a simple matter of pushing the start button to release the pellets into the burn pot and the igniter takes over. Most stoves have a safety control that monitors the startup and if there is an issue, it will shut the pellet supply down. Once the stove has started you make any adjustments on the control panel or air inlet and this should be it. A stove with a thermostat control will respond to the settings and cycle on and off as needed to maintain the temperature setting, not unlike your furnace.

Like any heating appliance they should have an annual checkup. If you notice an uneven flame, dark smoke or the glass door gets covered in soot, there is something not right. About a quarter of the homeowners I spoke to said that a lack of combustion air was an issue, sometimes causing smoke spillage. There are some weekly checks and maintenance for a pellet stove. The ash pan should be checked and probably emptied. The heat exchanger tubes should be cleaned and this is done by a rod that is built in to the unit in many models. The burner pot and liner should be checked and cleaned out every 2-3 days. At this time you can clean your glass door too. All of this maintenance can improve the efficiency of the stove and make it safer to operate. Brad commented that they try to convince every customer to read the instructions first; they have found it reduces a lot of phone calls with embarrassing questions.

Next week we look at the different kinds of pellets on the market and their burn efficiency. In our final week of this series we go "on site" with a Renewable Energy Crew to report on a pellet stove installation.

GREEN TECH COLUMN FOR OCTOBER 16, 2009

This week we look at the benefits and different kinds of **pellets for use in a biomass stove, furnace or boiler. First, let's** clear up the name confusion. Biomass Fuels are any type of wood or wood by-product, agricultural product like corn or any by-product from agricultural production. This can also mean cordwood and of course wood pellets. The advantages of wood **pellets are not widely known. Let's first compare oil heat to** pellet heat. Using an average price of 85 cents a litre for fuel oil and assuming you have a conventional oil furnace that has an **efficiency rate of 80% it will cost you 34.69 per million BTU's of** heat. If you compare wood pellets at seven dollars a bag and using the same 80% efficiency it will cost you 26.68 per million **BTU's of heat. That translates into a 30% savings on heating** your home, a significant amount. There are oil furnaces that produce better efficiency, some up to 86-87%. That said there are pellet boilers that are over 90% efficiency.



The reason that pellets are so efficient is the fact they contain a small amount of moisture. Less moisture means a higher BTU value and easier handling in cold weather. The pellet industry

has got one thing straight, they all agree to the same size pellet. This ensures a consistent fuel feed size for the pellet stove manufacturers.

Currently over 95% of the pellets manufactured are a wood by-product. Wood chips, shavings and sawdust are combined into making the pellets. The pellet industry has done their homework on setting standards. In Europe they have a strict set of standards that regulate the manufacture of pellets. Here in North America the standards are not mandatory but the majority of pellet makers follow the guidelines pretty closely. They cover moisture content which should be under 10%, no recycled materials like particle board or anything painted for example. They must have good structural strength and a low dust and ash content. Good pellets have no more than 4% ash content. The small amount of ash that every stove creates can actually be used as fertilizer.

The pellet manufacturing process is relatively simple. The raw material is passed thru a large hammer mill that turns it into a **dough like mass. This "dough" is then fed into a press where it is** squeezed under high pressure through a die that is set at the standard for pellets. The pressure of the press causes the wood to rise in temperature and this creates a natural binder which holds the pellet together. While this may seem simple, the equipment is not cheap and it is only profitable on a large scale. One report I obtained for this series commented that a profitable pellet operation would have to produce nearly 50,000 tons

PELLET STOVE INSTALLATION

annually and could cost upwards of 5 million dollars depending upon the equipment. Since the majority of pellet manufacturers are regionally located this is slowly creating a new industry with an economic benefit for the local community.

While wood pellets currently dominate the industry it is widely accepted that we could outstrip the raw material supply in time, there are only so many sawmills and wood production factories. There are other options fortunately and they include a number of different raw materials. Corn and corn stoves are commercially available today. During my discussion with Brad Leonard he mentioned that corn by-products, hemp, walnut shells, pine needles, cherry pits soybean, the knuckles from grain crops like oats and wheat, even distillers waste can be pelletized.



One area that has a huge potential for pellets is the use of switch grass for pellets. North of Kingston Ontario around the village of Tamworth there is a small group of farmers and individuals who are working their way thru

the process of growing and hopefully in time forming a co-op or company to produce switch grass pellets. There are a number of benefits to this process. Switch grass will grow on marginal farmland, thereby not taking over the valuable food growing farms. Once planted there is minimal care and no fertilizers are needed. It does however take some time for the grass to establish **it's self**. Brad explained that it takes **3 years for the grass to grow to a harvestable height**, about 6-8 feet high. They are projecting they can produce approximately 2 tons per acre, enough to heat an average bungalow. One added benefit is the fact switch grass has about 40% more net energy gain than corn.

The largest complaint that I heard from pellet stove owners was the handling of the 40lb bags of pellets and loading the back of the stove. In countries like Sweden and Germany where they used well over 2 million tons of pellets in 2008, bulk home delivery is now available. A truck not unlike your oil delivery truck arrives and you buy your pellets by volume. Indoor hoppers are now available and some of the newer pellet furnaces and boilers arriving from Europe hold up to ten bags at a time. These boilers and furnaces are fully automatic, not unlike a gas or oil heating appliance. You can also connect them to the hoppers for automatic feed, the days of not handling 40 lb bags is upon the horizon.

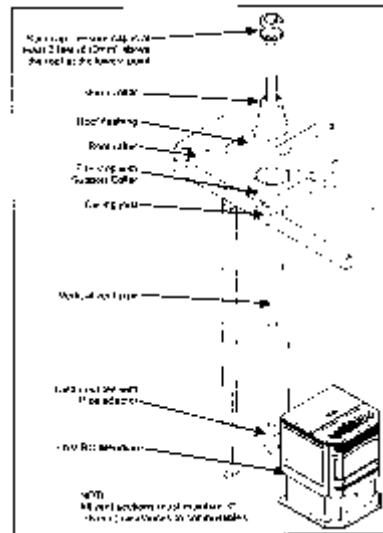
During the preparation and numerous interviews for this series I read thru a number of web sites. One of the most interesting is www.pelletheat.org. This site offers a section where you can compare your fuel costs right on line. The calculations

are simple and the answers were immediate. Next week we go **"on site" to see a pellet stove installed.**

GREEN TECH COLUMN FOR OCTOBER 23, 2009

This week we look at the last step, now that you have now bought your stove and are versed upon the types of pellets. There are a couple of things you should do before you begin. First, is your floor strong enough to support the stove where you want to install it? Cast models can be very heavy, while it is unlikely it will fall thru the floor over time this pointed weight can distort the wood floor. The next consideration is electricity, how close is the nearest plug, your stove needs power to operate. If at all possible it should be plugged in direct as extension cords are not a good idea unless you buy one designed for this installation. The stove must sit upon a non-combustible surface, a metal sheet, hearth pad or non-combustible tiles like ceramic or clay.

By now you have selected a location for your pellet stove and the interior wall clearances are now important. The stove manufacturer sets out minimum clearances from the walls. These are usually written on the information plate that is mounted on the stove, either on the back or the underside of the lid. The next list of clearances that are often forgotten are outside your home. With all the utilities that enter a home, along with the openings like windows and doors, this can affect the location of your stove especially if you intend to vent your



pellet stove by a horizontal vent. For example the clearance area around a gas meter or propane regulator is three feet from each side and fifteen feet high. A window that opens must be four feet from the vent, it also must be two feet above any grass or plants, in fact any combustible surface. The other consideration

against horizontal venting is the possible smoke spillage into the home. For these reasons alone most reputable pellet installers recommend a vertical vent even though a pellet stove has a mechanically powered vent.

LOOKING AHEAD

Now that you have confirmed that the vent location is acceptable you can measure up for fittings and vent pipe. While it is possible for the homeowner to install a pellet stove and vent, most manufacturers strongly recommend you have a professional installer complete this work. If you have bought your stove from a retailer that does not install them you should investigate any installer. The Wood Energy Technology Transfer Association or WETT as most people know it does have a Pellet Heating Technology course to certify anyone who installs pellet stoves. For further information go to www.wettinc.ca.



We went “on site” with two installers from Renewable Energy in Kingston just to see how this is done. Senior Installer Andrew Tietzen and his assistant Joe Harvey were unloading their equipment when we

arrived. Andrew described the different kinds of venting. He stated that there is a specific vent design for pellet; it is a double wall assembly with the interior wall being made of stainless steel. This home was going to have a vertical vent through the ceiling and roof. He explained that this has the advantage of keeping the vent gasses warm and providing natural draft to prevent problems in an unexpected shutdown. He also explained that you can vent up the outside wall if an internal vent is not possible. I asked if you can use a brick or masonry chimney and he commented that provided you install the proper stainless steel liner this could be done. They located the stove in the position that met the required clearances. He explained this to Joe and **me as he read from the manufacturer’s plate on the lid. Andrew** then took out an interesting tool. He explained he had this made for his installations. It was a circular disk with all the different pipe dimensions slotted into it. This greatly reduced the install time lining up the centre of the pipe, nice idea! He explained how the pipes fitted together with a silicone ring inside the pipe, they must fit correctly he stated as he wrestled them together and then twist-locked each piece securely. When I asked about combustion air Andrew stated there are installations where a fresh air intake is recommended like a newer home, however in an older home there is enough fresh air leakage strictly by design of the home.

By this time they had the mark for the ceiling hole and Joe proceeded to cut the ceiling and second storey floor. They carefully fitted each piece and then took them outside and painted them with heat resistant paint. This gave the installation

a very neat look. Piece by piece they added each section and by now Andrew had cut open the roof and the last pieces were fitted together. The stove manufacturer states the minimum rise above the roof; Andrew noted he usually caps the vent at three feet. Flashings, sealant and a rain cap were next to be installed. In all it took these two installers about 5 hours from start to finish. One thing that impressed me about the **Renewable Energy Crew was Andrew’s attention to keeping the work area clean** and I commented upon it, he stated it was just good work practice.

While we were on site the homeowner who had graciously allowed us into their home to view this installation sat down with me for some comments. Homeowner Troy Day stated that they currently have a wood stove in the family room but wanted the convenience of pellet. They decided that they did not want the effort of keeping another wood stove running. He stated his wife and family liked the idea of using a renewable resource for a second heat source in this century home. Other features like a possible thermostat tilted their decision to a pellet stove.

Next week we look at the future of pellet heating and an interview with Paul Chisholm, Director of Kerr Energy Systems in Parrsboro Nova Scotia. They have developed and are beginning production in November on the first Canadian made Pellet Boiler.

GREEN TECH COLUMN FOR OCTOBER 30, 2009

For the past four weeks we have looked at Pellet heating, how to buy a pellet stove and the advantages of this renewable heat source. For our final column in this series we look at where the industry is going and some interesting points I have gathered during this series.

We have talked a lot about pellet stoves and ignored their sister appliance, the pellet stove insert. In fact there is very little difference other than the installation. A pellet insert fits into your existing fireplace and operate identical to a free standing pellet stove. They can be thermostatically operated, the installation is somewhat more detailed given the fact



you are using the existing chimney. This is one installation where a professional pellet technician should do the install. The only shortcoming is the lack of choice, due to the small market there is a limited selection of pellet inserts.

The development of pellet heat as an alternate to fossil fuels is actually growing significantly in many areas. Two years ago at

the North Slave Correctional Facility in the Northwest Territories they installed a pellet system that supplies two hot water boilers. The system is fully computer controlled and has such features as an automatic ash removal system. The NWT looked at an alternate given the uncontrollable cost of fuel oil. In their first year they saved over \$57,000.00 in fuel costs alone. This translates into a reduction of 568 thousand litres of fuel oil and **a reduction of 1554 tonnes of green house gas emissions. That's** like taking over 300 cars off the road in the NWT. They also figured they saved another \$4000.00 in reduced equipment maintenance including wear and tear on the equipment. They fill a pellet hopper once a month and can control their buying costs by contract.

Next month in Milan the first world trade show on pellet heating technology will open to the public. "EuroPellets2009" will bring together the leading edge technology in this industry. The Europeans have embraced pellet heating substantially and are leading the way in many areas. One manufacturer called Calimax has developed a pellet stove with an air heat exchanger. You can also buy one with a water heat exchanger. This system is connected to your hot water tank to supply your home with hot water. They have developed electronic controls and a sensor system to communicate between the controls and the thermal storage unit.

A high percentage of homes in Europe utilize hot water heating and conversion to pellet boilers has become the largest movement in renewable heating systems. Companies like Froling and Tarm have developed some compact replacement boilers and they are just finding their way to North America.

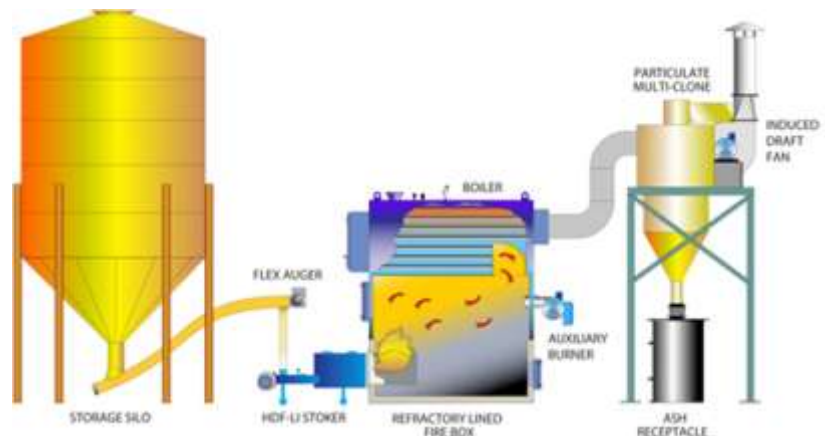
While the Europeans are quickly progressing, here in North America the rise in popularity of pellet heating has not gone unnoticed. In the USA a company called Bixby Energy Systems has developed a free standing stove that has an auto cleaning system and comes with a self diagnostic module. Yet another company called Harman Stove has one of the first American made pellet boilers.

Here at home a number of Canadian companies have begun research and development of pellet heating appliances. One such company is

located in Nova Scotia. Kerr Energy Systems has developed a pellet boiler that they plan to begin mass production on later this year. I spoke to Paul Chisholm, Facilities Manager about their development of the first Canadian Made Pellet Boiler. Paul explained they have been working on this for 5-6 years and he **actually has a prototype in his own home, now that's close up** testing for sure! Kerr partnered with a European manufacturer to develop an electronic controlled underfed burner system to **give them a more controlled burn. The "Green Flame" boiler** operates in the 85-90,000 BTU range and has four operational cycles that range from 15% to 100%. Paul went into some depth describing the percentage of efficiency for their boiler. He also described the multiple testing methods that are currently used are confusing and how a single standard that the consumer can understand is really needed. Paul was pleased to be able to state this new boiler is compliant to the new CSA B415 standard.

This boiler has some unique features. It comes with an external screw auger hopper that holds approximately 400 lbs of pellets. Paul explained that a larger hopper is possible, as is an external storage. The boiler is capable of being integrated with your water heater to supply you with hot water. Paul stated that this boiler can be retrofitted to an existing system or with the addition of an air handler could replace a forced air furnace. He commented that this boiler is designed to operate on premium pellets for now. We talked about life span and while they have no way to know, Kerr expects these boilers to have the same long term operation that most conventional boilers have. You can expect to pay something in the range of 9-11,000.00 to install one of these systems. As with any boiler system, the initial installation costs are higher than a conventional furnace. For more information go to www.kerrenergysystems.com.

Choosing Pellet heating should be considered by anyone who is looking at changing their heating system. Wood pellets are a renewable resource, they are green house gas neutral and the costs have stabilized. With new pellet producers coming on stream it can only help secure the supply. It is time we got off our dependency on fossil fuels for heating our homes.





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