



# Vidir Biomass

## Biomass Energy System Technologies

A Biomass Fired Heating System for medium sized energy users that is

- technically feasible
- economically viable
- Environmentally responsible

Now with Smart-Fire  
Technology for more  
efficient operation!!



# Beat the rising cost of fuel!

- One 1000 lb bale has 7 - 8 million btu of potential heat, enough to heat 100 homes for an hour during the coldest winter night
- The heat imbedded in one bale is worth \$84 - \$120 at current natural gas prices, more using propane or heating oil prices.
- For the cost of a coal burning system, you can have a clean burning biomass system that does not pollute and pays for itself in less than 3 years
- Patents Pending on the only system ever designed that can burn wheat, barley and oat straw with high silica content and operate trouble free year after year
- Proven to run efficiently with a 50% chicken manure mix and with flax straw and shives
- Automated control systems that will process bales with up to 20% moisture content with automated alarm systems including cell phone integration
- Our proprietary SmartFire™ technology constantly monitors internal temperatures and controls the system to maximize efficiencies and create the cleanest burn through all operating cycles
- LAMBDA sensors to minimize CO output
- Web based control systems and web cams allow control of the system from anywhere in the world!
- Your BEST choice is a Vidir BEST!



# What is a Our Biomass Energy System Technologies?

- It is the technology we have developed for extracting heat energy from biomass in a relatively convenient way. Biomass material (straw or wood chips) is combusted on a grate. The fuel is fed continuously and automatically with a conveyor or blower system. The heat of combustion is transferred to water in a boiler that is separate from the combustion unit. This hot water is then available for conventional hydronic heating. Our computerized control system synchronizes and automates the rate of biomass feed, the amount of combustion air intake and the temperature difference in inlet and outlet water temperature.
- The BEST works best for large loads operating a substantial part of the year.



# The Benefits

## of the Vidir Biomass Energy System Technologies (BEST)



- Our BEST can provide substantial benefits to our users. First and foremost, there is the potential for **LOWER COSTS**.
- Biomass BEST fuel costs are as much as 90% lower than those of conventional heat sources.
- Comparative costs of heating fuels shows the cost of a sample of fuels used to provide a unit of heat energy based on typical cost. Note that these costs compare only the value of heat in the fuel and do not include costs of the heating system.

# Energy Source Chart

Energy Source	BTU	Unit	Efficiency	Cost/ Unit	Cost of 1m btu
Oil	36,300	Litre	75%	\$0.700	\$25.71
Electric	3,413	Kwh	95%	\$0.057	\$17.58
Natural gas	35,301	Cu meter	75%	\$0.355	\$13.41
Propane	24,200	Litre	95%	\$0.410	\$17.83
Hardwood	25,181,591	Cord	55%	\$150.00	\$10.83
Softwood	19,370,455	Cord	55%	\$100.00	\$9.39
Wood Pellets	12,913,636	Tonne	65%	\$200.00	\$23.83
Estevan coal	14,498,570	Tonne	65%	\$45.00	\$4.78
Straw cubes	17,111,111	Tonne	85%	\$65.00	\$4.47
Alberta Coal	22,017,750	Tonne	80%	\$55.00	\$3.12
Wheat straw	8,456,710	500kg	85%	\$15.00	\$2.09
Flax straw	9,455,795	500kg	85%	\$10.00	\$1.24

# More than Economic Benefits

## Renewable Biomass:

- Biomass fuels are derived from a renewable resource. Fossil fuel supplies are ultimately finite. However, with proper management the biomass resource base can be sustained indefinitely.

## Environmental Benefits:

- Biomass combustion is considered CO<sub>2</sub> neutral and so is not considered a major producer of greenhouse gas linked to climate change. BESTs are not major contributors to acid rain. Most biofuels have a negligible sulphur content.

## Available Biofuels at Stable Prices:

- Biofuels are widely available. In most areas there is a supply of available biomass materials, either forest or agriculture-based.
- Biofuel prices are relatively stable and locally controlled. Prices have remained steady over the years in spite of wide fluctuations in fossil fuel prices, and are expected to increase more slowly than those of petroleum-based fuels.

## Local Economic Benefits:

- Biofuel dollars remain in the local economy. Biomass fuels are generated locally. Their collection, preparation and delivery involves greater labor input than fossil fuel distribution. The economic impact of this activity plus the actual fuel purchase means dollars remain in the local area, creating filter-down economic activity as well as improving the local tax base and building tax revenues.



# BEST benefits

## Heating Comfort:

- Biomass systems often provide high comfort levels. Because bio-fuels can be inexpensive, system operators are able to justify increased building temperatures leading to greater comfort and productivity. With high-priced fossil fuels, there is greater pressure to lower temperatures for fuel cost savings.

## Commercially Proven and Flexible:

- Biomass combustion technologies are commercially proven, having already achieved significant market penetration in residential and large industrial applications.
- Biomass combustion systems are highly flexible. Solid-fuel systems can be easily converted to burn almost any conceivable fuel (solid, liquid or gaseous), thus providing the user with great flexibility in the future.

## Introduction to Vidir Biomass BEST

- VIDIR BIOMASS INC. has spent many years designing and developing its biomass powered close-coupled gasification technology, and is now proud to introduce the VIDIR BEST, a new concept in open system hot water and air furnaces.
- The VIDIR BEST is an updraft, atmospheric pressure heating system that features
  - high output efficiency
  - low greenhouse gas emissions
  - minimal operator intervention requirements
- Given a remarkable appliance efficiency rating of up to 85%, coinciding with a low cost bio-fuel, makes the VIDIR BEST a superior heat and energy producer ideal for any large scale operation with high energy requirements.
- The VIDIR BIOMASS BEST is computerized and automated so as to require minimal supervision and maintenance during the operation of the unit.





# Main System Components

1. Bale magazine (baled straw conveying system to automatically supply gasifier with fuel)
2. Fuel Delivery and preparation (straw shredder and product conveyor system)
3. Primary combustion chamber (including ash removal system, grate system and air distribution system)
4. Secondary combustion chamber (including tray for manual silica removal)
5. Hot water heat exchanger (including automatic cleaning system and tray for clean-out)
6. Exhaust system (including blowers, cyclones, and chimney stack to control air flow and exhaust)
7. Main computerized control system with our proprietary SmartFire™ technology

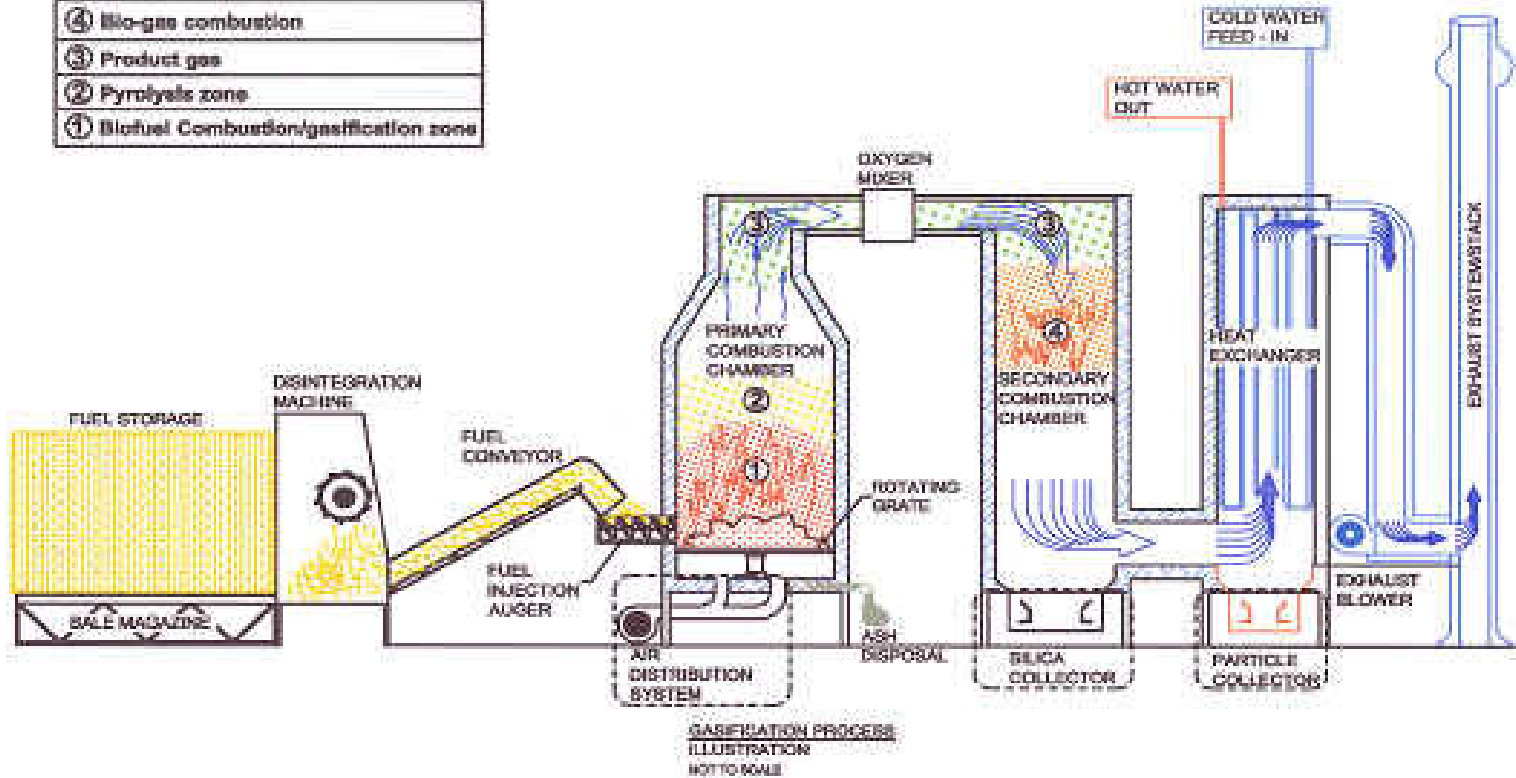


# Main System Components Diagram



## Feature legend

- |   |                                      |
|---|--------------------------------------|
| ④ | Bio-gas combustion                   |
| ③ | Product gas                          |
| ② | Pyrolysis zone                       |
| ① | Biofuel Combustion/gasification zone |





# Design Features

## Fuel Storage



- Baled wheat straw can be stored outdoors or indoors. Indoor storage protects the fuel from moisture, but costs money.
- Received fuel is moved onto the bale magazine by either a front-end loader or a specially designed automated crane system. The bale magazine can be designed to handle any amount of fuel desired. The magazine automatically feeds baled straw into the shredder as fuel is required for heat.
- Optional trailer unloading system can be used for pre-shredded fuel such as flax shives.

# Design Features

## Fuel Disintegration

- The fuel processing begins in the shredder where the straw is disintegrated into smaller, manageable particles. Our Vidir designed shredder delivers a steady continuous flow of fuel regardless of compaction, frozen chunks, oversize material and contaminants. Good fuel preparation is critical to the overall operation of the system.

## Fuel Transfer



- From the shredder, the particulate fuel is moved to the fuel injection system.
- The fuel injection system feeds the fuel directly into the primary combustion chamber utilizing a mechanical plunger or airlock auger system.
- The back flow of combustion flames and gases through the fuel entry is controlled by an airlock plunger cavity or optionally with a rotary airlock for pre-shredded materials.



# Design Features

## Primary Combustion Chamber

- The primary combustion chamber is an enclosed area where drying, pyrolysing and oxidizing occurs. The rotating grate agitates the fire bed and allows for under fire air to be blown up through the fuel. Effective oxygen supply and control is critical. By limiting available air, the temperature is controlled so klinkers do not form.
- Ash collects below the grate and is removed automatically by an auger.



# Design Features

## Secondary Combustion Chamber



- The hot exhaust gases exit at the top of the primary combustion chamber and pass through a refractory duct that includes an oxygen mixer and into the secondary combustion chamber. As the gases are being transported from the primary to the secondary chambers, the injection of oxygen ignites the gases, allowing spontaneous gas combustion to take place in the secondary chamber. The quantity of heat released during the biofuel gas combustion is increased to approximately 2,500 degrees Fahrenheit.
- High temperatures are maintained in the combustion chambers by lining the chambers with refractory, which radiates and reflects heat back into the fuel layer. The refractory also protects the walls and base of the chambers from the high temperatures in the combustion zone.
- When agricultural straw is being utilized as the primary biofuel, a small accumulation of silica and potassium debris flows into the removable tray at the bottom of the secondary combustion chamber.

# Design Features

## Heat Exchanger

- The heat from the secondary chamber is transferred to the atmospheric pressure hot water heat exchanger. Our Vidor heat exchanger consist of a series of tubes through which the heated flue gases pass transferring the heat to the water surrounding the tubes. Hot water is the medium being used to transport the heat through insulated underground pipes to the desired location and supply precise heat for any public, commercial, residential or agricultural building.
- Fly ash moved by combustion gas flow can deposit on the heat exchange surfaces in the boiler. This ash must be regularly removed to maintain good heat transfer performance. Our scrubbers automatically clean the boiler tubes.

## Exhaust System

- The induced-draft system uses an exhaust blower which pulls the exhaust gases out of the boiler and forces them up the stack. The draft of this fan maintains a slight negative pressure in the combustion chambers so that gas flow is continuous and that no combustion gas leaks occur.



# Design Features

## SmartFire™ Computerization

- Computerization is important for efficient operation in response to energy demand. The complete feed and gasification process requires a control system to match heat delivery with demand. A key task of the control system is determining the rate at which fuel and air are fed at various points in the sequence to ensure efficient combustion. Fuel and air optimization needs to occur under high or low demand.
- Start-up and shutdown sequences are programmed, and alarms alert operator when alarm conditions occur.





# System Requirements

- 1. Electrical power (3 phase preferred, single phase possible)
- 2. Air requirement (compressor 100-120 PSI, 7-10 CSF)
- 3. Concrete floor and building structure (except for 1 million Btu unit)
- 4. Heat distribution system
- 5. Optional electrical generator system



# System Maintenance

The Vidir Biomass BEST is low maintenance.

- Daily (carried out by on site staff):
  - Ash disposal, general cleanup, checking heat exchanger water levels, checking the fuel delivery system for material build-up, monitoring temperatures. The computer system will signal the designated technician of alarm conditions.
- Weekly maintenance (carried out by designated staff):
  - replenish depleted fuel supply
  - mechanical component lubrication
  - inspection and adjustment of chains, gearboxes, blowers, etc.
  - silica removal from secondary chamber
  - debris removal from heat exchange
  - refractory inspection and repair
  - testing of safety devices
- Annual
  - We recommend an inspection by a Vidir service technician.



# System Life Expectancy

- VIDIR BIOMASS Energy System Technologies will last 20 years with proper maintenance and components replacement as needed. In the forest industry, wood combustion systems have been in operation for over 50 years. In practice, 15 to 20 years is used as a reasonable biomass combustion system life expectancy for the purpose of life-cycle costing.



# Emissions



- Dillon Consulting Limited was retained by Vidir Biomass to conduct source testing on the BEST exhaust stack to quantify combustion gas emission rates. These measured emission rates were conducted with the system operating at the maximum system designed rate of approximately 500 pounds (227 kg) of straw feed stock per hour.
- The following gases were measured from the exhaust gas stream:
  - Oxygen (O<sub>2</sub>)
  - Carbon Monoxide (CO)
  - Sulphur Dioxide (SO<sub>2</sub>)
  - Oxides of Nitrogen (NO, NO<sub>2</sub>, NO<sub>x</sub>);
  - Carbon Dioxide (CO<sub>2</sub>).



# POI Summary for 24-hr Averaging Period

Contaminant	Max POI Concentrations (ug/m <sup>3</sup> ) Property line/off property		Prov. of Manitoba Ambient Air Quality Objectives Max. Acceptable Level (ug/m <sup>3</sup> )	
	1-hour	24-hour	1-hour	24-hour
Particulate Matter	21.1	8.79	N/V	120
Carbon Monoxide	437	182	35000	15000
Oxides of Nitrogen	143	59.6	400	200
Sulphur Dioxide	5.27	2.20	900	300
Hydrogen Chloride	16.7	6.94	100	100

“The results of the dispersion model indicate that the emissions of all of the measured parameters from the Vidir BEST comply with the Ontario and Manitoba regulated Point of Impingement and Ambient Air Quality Criteria Concentrations. The POI concentrations for the remaining combustion gases do not exceed any of the regulated POI limits or AAQC. In general the POI concentrations predicted by the dispersion modeling for all measured pollutants are at least one-half of the regulated levels with no pollution control devices.” - Dillon Final Report, March 2003

# Return on Investment

- The following “cost versus savings” projection is intended to create awareness of the real value of using biomass for fuel and the reduced heating costs that will make any operation requiring large amounts of heat more efficient and viable.

- Current Annual Natural Gas Expense.....\$ 60,000
- Straw fuel cost (energy value equivalent to natural gas).....\$ 7,520  
(752 round 5 x 6 ft wheat straw bales @ \$10/bale)
- Electricity Cost to operate system.....\$ 1,200  
(2% of total output \$...60,000)
- Labor Cost.....\$ 8,100

Approximate average daily time required:

- 1 hr bale handling
- 2 hrs maintenance/service/ash removal
- total 3 hrs per day @ \$15/hr = \$45/day for 6 months

- Total annual operating costs.....\$ 16,820
- Annual savings in reduced heating expenses.....\$ 43,180

- Estimated Capital Investment
- 3.0M BTU Vidir Biomass Energy System  
Plus

- Accessories (pipes, pumps, etc.)
- Accessory installations
- Building, shelter, ash bin
- Trenching

- Total estimated investment.....\$ 200,000

- Return on Investment:       $\$200,000 / \$43,180 = 4.63$  years