



Ezell-Morgan's ENERGY STAR[®] Home

For a home to earn an ENERGY STAR rating it must meet or exceed strict requirements of air quality and be at least 20-30% more efficient than a standard home. Adherence to the standards must be verified through inspection and testing by a licensed Home Energy Rating System (HERS) inspector. Ezell-Morgan Construction's new home at 1123 Brynwood Court has easily exceeded this rating. This home is nearly 60% more efficient than a standard home. This rating also entitles Ezell-Morgan to the maximum \$2,000 tax credit under the Energy Policy Act of 2005 (EPACT).

Some features that have been included in the home to achieve these results are outlined below:

Ground Source Heat Pump (GSHP)

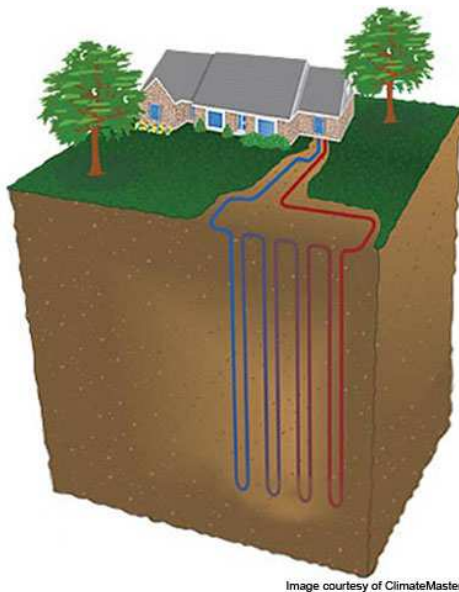


Image courtesy of ClimateMaster

The GSHP uses the earth's 55 degree underground temperature to source or sink heat for heating and cooling. It does this by circulating environmentally friendly fluid through lines that extend over 200 feet underground in each of four separate wells. This makes the system far more efficient than using ambient air the way air conditioners and air source heat pumps do. It also eliminates the noisy outdoor fan. This system is also dual-stage with a variable speed fan which further increases its efficiency and its ability to regulate humidity to make the home feel more comfortable and maintain a more constant temperature throughout. This system also has a better warranty than standard equipment with fewer parts to go bad.

Total Electric

Most homes in Lawrence equipped with heat pumps use natural gas for back-up heating and water heating. This is because a normal air-source heat pump can only function down to temperatures of about 25-35 degrees. By using the heat of the earth, the geothermal system always thinks it is 55 degrees. This means that back-up heat is only necessary if the temperature is so low that losses exceed the 4 ton rating of the system. Calculations show that this home needs 3.3 ton of heating capacity at a temperature of 0 degrees. So the need for back-up heat will be a rare occurrence. Another advantage to the geothermal system is that it utilizes waste heat from the heat pump to preheat water in the water heater. This means that the total gas usage would amount to a meager \$220/year. Unfortunately, the local gas provider, Black Hills Energy, assesses a customer charge of \$16/month for residential customers. This is the monthly fee the gas company charges to each customer no matter what their usage is. With taxes this

amounts to about \$195/year which nearly doubles the overall cost. So even though the electric water heater is slightly more expensive to operate than gas, going total electric and foregoing the gas meter will save the owner about \$190/year.

Polyicynene Foam Insulation

Polyicynene is a foam insulation that is sprayed into wall cavities, rims and attic. It bonds to adjacent surfaces and expands to fill voids to form an exceptionally tight seal to reduce air infiltration. In today's well insulated homes air infiltration is normally the



number one contributor to unwanted heat transfer. A home insulated with fiberglass batts that is well sealed and caulked will typically have an air infiltration rate of 50% per hour. In other words, 50% of the total volume of air in the home is exchanged with outside air each hour. With foam, it is possible to lower this costly infiltration to 10%/hour or less. The HERS inspector uses a blower door test to depressurize the home to determine the actual infiltration rate. The results of the test on this home showed that the infiltration rate was only

8%/hour. The inspector performed a similar test on the duct system to check for leaks. The results of this test also far surpassed the rigid ENERGY STAR standards.

Heat Recovery Ventilation (HRV) System

Since the home is so tight, it requires an HRV system to provide forced ventilation to ensure healthy indoor air quality. The HRV uses a small variable speed fan (40-150 cfm) to bring in fresh air from outside and exhaust stale indoor air outside. It does this



in a controlled way by filtering the air it brings in and by using a heat exchanger to condition this air using the air it exhausts. The heat exchanger does this at an efficiency of 86%. The fan has five speeds and is meant to run on low most of the time, though it can be manually set higher when guests are over or more fresh air is desired. Indoor air quality is also maximized by venting the kitchen range and the absence of any gas appliances that could add pollutants.

The heating and cooling system, humidifier, and HRV are all monitored and controlled through a single touch-screen thermostat that is fully programmable.

High Performance Windows

All the windows are Energy Star rated and feature low infiltration rates and high performance glass that is Low-E (low emissivity). Argon gas is injected between the panes to further increase R-value and reduce sound transmission. This makes these windows 50% more efficient than standard double-pane windows.



100% Fluorescent Lighting

Compact Fluorescent Light bulbs (CFLs) use less than 25% of the energy of standard incandescent bulbs and last up to 13 times longer. Standard 60W and 65W/750 hour incandescent bulbs are replaced with 14W/10,000 hour bulbs. These bulbs are so important for saving energy that the 2007 Energy Bill just passed by congress will phase out the use of all incandescent bulbs by 2020.

Other energy savings features in the home include the use of: Energy Star certified appliances, advanced framing techniques, insulated basement walls, sealed basement floor, sealed ducts, insulated slab edge, etc.

HERS Software Simulation

Table 1 displays the results of the software simulation of the home. It shows total yearly energy costs of about \$1,330/year compared to about \$3,233/year for the standard home. So the home will save its owner about \$1,903/year and use less energy than an average car. Note the savings in service charges due to the absence of a gas meter.

	Standard Home	Energy Star	% Savings
Heating	\$ 1,524	\$ 235	85%
Cooling	\$ 312	\$ 120	62%
Water Heating	\$ 265	\$ 236	11%
Lighting	\$ 191	\$ 44	77%
Appliances	\$ 258	\$ 207	20%
Plug Loads	\$ 391	\$ 391	0%
Service Charges	\$ 292	\$ 97	67%
Total	\$ 3,233	\$ 1,330	59%

Table 1 - Energy Savings by Category

The pie chart in Figure 1 shows the distribution of energy usage for the standard home. This chart is typical of most homes built in this climate zone today. Note that the heating cost dominates the chart making up nearly half of the overall energy costs.

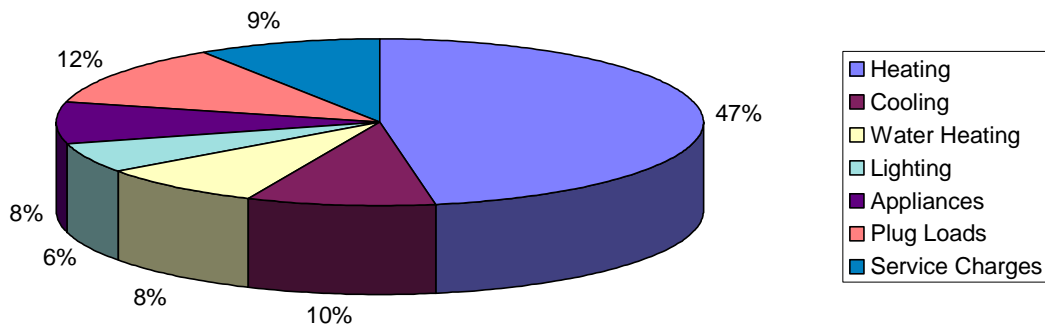


Figure 1 - Energy Usage Distribution for Standard Home

The pie chart in Figure 2 shows the distribution for the Energy Star home. The heating cost is nearly equal to the cost of water heating or appliance use. The energy that the software designates for plug loads dominates the chart. This is energy allocated for the use of TV's, computers, vacuum cleaners, blow dryers, etc.

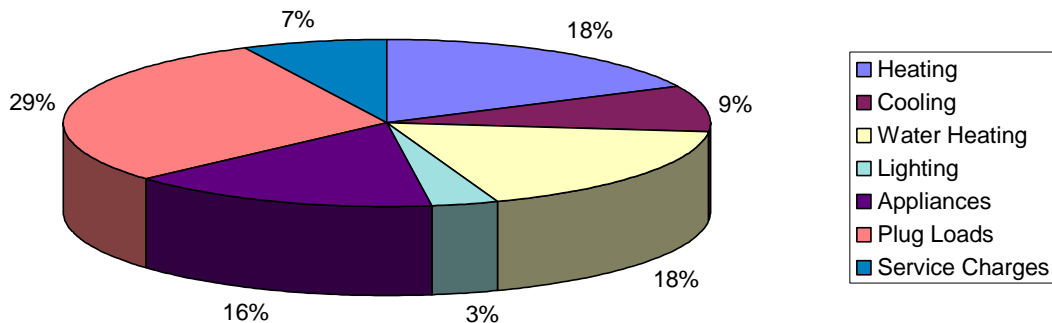


Figure 2 - Energy Usage Distribution for the Energy Star Home

What Does It Cost?

Obviously the improvements to obtain these dramatic results are not free. They will add approximately \$13,000 to the cost of the home (actually \$15,000 less the \$2,000 tax credit). This translates to about \$78/month on a 30-year loan at a rate of 6%. The average monthly savings are more than double this amount at \$159/month. If one assumes no increase in fuel costs over the next 30 years, the owner will still net over \$80/month in savings. Most energy experts assume an annual energy cost increase of 3.7%, though this figure may be too low when one considers the likely possibility of a carbon tax or cap and trade system that is supported by both candidates for president. In fact, during the course of construction Westar has requested a price increase of 15% with a warning of more increases to follow. The other factor to consider is increased comfort with less temperature difference from area to area. Because of the home's extreme efficiency, one can also raise/lower the thermostat setting as desired without fear of substantial increases in utility bills. Indoor air quality is also greatly improved.