



Building a new home

CASE STUDY



APARTMENT & CONDO
EFFICIENCY SERVICES



ENERGY STAR
PRODUCTS



HOME PERFORMANCE
WITH ENERGY STAR



WISCONSIN
ENERGY STAR HOMES



EFFICIENT HEATING
& COOLING



LIBBETH KUGLITSCH

To learn more about
Focus on Energy,
call 800.762.7077 or
visit focusonenergy.com

There are many things to consider when planning and building a new home. Not only do you want the design and layout of the house to fit your needs, you want your home to have a comfortable and healthy environment, and be efficient and economical to operate.

An energy efficient home is designed to meet all these goals and is built on the principles of building science, recognizing that a house is an interactive system. This system is made up of many components—the building structure, the mechanical systems and the occupants. These components interact in predictable ways and new homes can be designed and built to ensure a comfortable and healthy environment.

BASIC BUILDING CONCEPTS

Remember to ask these questions when selecting a builder:

- **Controlling airflow.** Does your builder test the house for air-tightness?
- **Ensuring indoor air quality.** What controlled ventilation technique does your builder use? Will your builder test the system to ensure it works properly? Will your builder teach you how to use and maintain your ventilation system?
- **Minimizing heat loss.** How does your builder ensure that the insulation is properly installed?
- **Preventing moisture problems from external sources.** How does your builder reduce and control moisture around the building shell and foundation, and under the basement slab?

These concepts are essential to understanding the construction details of your new house and the choices you'll need to make in selecting heating, ventilating and other mechanical systems.

CONTROLLING AIRFLOW

Building an air-tight house in combination with installing controlled ventilation is key to creating a durable, energy efficient and healthy home. Leaky houses are drafty and uncomfortable. Cracks and unintentional openings are a recipe for high heating and cooling bills, comfort problems, and potential indoor air quality and moisture/durability problems.

To control airflow, it is essential to have a continuous and durable air barrier around the entire living area (the spaces that will be heated and cooled). Any holes or breaks in the air barrier will result in the loss of moist, heated air, allowing moisture to be carried into the insulation and possibly condensing on or in the building framework.

Creating holes in the air barrier is inevitable during the construction process (from electric wiring, electric receptacles or plumbing chases). It is essential that your builder seal around these openings before the construction process continues and they are no longer accessible.

Don't assume your house is tight unless your builder has a procedure for measuring how much air moves through it. An effective test of air-tightness is conducted using a special fan called a blower door. Make sure your builder has a process for testing the air-tightness of your home before it is too late or too costly to address any problems.

ENSURING INDOOR AIR QUALITY

Controlled ventilation is the key to maintaining good indoor air quality. Don't rely on natural air leakage to ventilate your house—you can't control the quantity or the quality of the air. You want to control how much air moves through the house and where it comes from so you get adequate ventilation without airborne pollution.



focus on energy[™]
The power is within you.

CAUTION

Combustion appliances (furnace, water heater, fireplace, etc.) can contribute to poor indoor air quality and pose a safety risk. Wisconsin's Uniform Dwelling Code does not allow unvented combustion appliances. To protect against carbon monoxide poisoning, choose sealed-combustion, power-vented or direct-vent combustion appliances.

Ventilation options

- **Spot or source-point ventilation.** This includes exhaust fans in the kitchen and bathroom that vent directly outside.
- **Central heat-recovery ventilator (air-to-air heat exchanger).** This system consists of an intake fan, an exhaust fan and a duct system with a heat-recovery core. Heat recovery reduces indoor heating and cooling loads by transferring heat from or to the exhaust air.
- **Central energy recovery ventilator.** This system is similar to heat-recovery ventilators, but in addition to recovering heat it also transfers moisture from the warm air to the cold air.
- **Central intake and exhaust fans.** This system is similar to the heat-recovery ventilator but without the heat-recovery feature.
- **Central powered exhaust with furnace supply intake.** Stale air is exhausted from separate areas of the house through one central exhaust. Fresh air is brought in through a furnace inlet vent, mixed with household air and distributed through the home.

Which ventilation systems does your builder recommend and how are they used to ensure adequate airflow and good indoor air quality? Has your builder considered a balanced ventilation approach (a system that removes and replaces equal volumes of air so there is no pressure imbalance)? Have they specified spot ventilation for the kitchen and bathroom?



An air-to-air heat exchanger ventilates your home without wasting energy.

MINIMIZING HEAT LOSS

Heat flows naturally from warmer to cooler spaces. During the winter, heat from inside your home moves toward adjacent unheated spaces such as attics, garages and the outdoors. Conversely, in the summer, heat tries to move into the house from outside.

Insulation is the home's defense against heat loss. The ability of insulation to resist heat flow is expressed in terms of R-value. Higher R-value means greater resistance. Wisconsin's Uniform Dwelling Code stipulates minimum R-values for foundation walls, exterior walls and ceilings/attic floors. Yet effective insulation is dependent not only on adequate R-value, but also on full coverage, proper installation and a continuous and durable air barrier.

Will your builder properly install complete-coverage insulation? Will the attic insulation cover the tops of exterior walls, for example? Will the insulation be installed to minimize voids, gaps and compression? These installation problems can greatly reduce insulation performance.

PREVENTING MOISTURE PROBLEMS FROM EXTERNAL SOURCES

Moisture can enter a house through the foundation as ground water or be forced into building cavities from wind-driven rain. Moisture that gets into the building cavities may not dry quickly and can cause peeling or blistering paint, rotting wood and other structural damage. It is much easier and more cost effective to prevent moisture problems during construction than to correct them later.

Techniques to prevent moisture problems

- **Site selection.** A building site that has a high water table will be more likely to have moisture problems. Choose your site carefully and know where the water table lies.
- **Surface drainage.** Install a continuous and durable weather barrier under the siding. Properly flash windows and doors to shed water from the house. (Flashing is a material used to protect, cover or deflect water from places where two materials join or form angles.) Grade landscaping to direct rainwater and melting snow away from the foundation.
- **Damp-proofing.** Apply a high-quality, durable damp-proofing coating or a drainage board on the below-grade portion of the foundation wall.
- **Moisture-resistant concrete basement floor.** Reduce water absorption through the concrete basement slab by pouring the concrete on top of three to four inches of washed aggregate. Insulate over the aggregate with rigid insulation to keep the concrete floor warm and dry.
- **Drainage system.** Include an effective drainage system around the foundation footings, such as a channel of coarse rock, drainage tiles or mats.



Damp-proofing the foundation walls helps keep moisture out of your home.

Has your builder specified materials and designs that protect your house from outside moisture sources? What methods is your builder using to control moisture movement around the foundation and under the slab? What techniques are they using to protect the house from wind-driven rain? Will the landscaping be graded adequately to ensure that water drains away from the foundation?

SELECTING HIGH EFFICIENCY EQUIPMENT

The U.S. Department of Energy has established minimum efficiency standards for heating and cooling equipment and for most major appliances. The ENERGY STAR® label is awarded to those products that meet or exceed established standards for energy efficiency and are as much as 10 percent to 50 percent more efficient than their conventional counterparts.

Heating system

Selecting a safe and efficient heating system is essential to the efficiency and comfort of your home. A furnace or boiler requires air to operate and may produce carbon monoxide as a byproduct. For maximum safety, it is important to select a sealed combustion heating system that does not use indoor air for combustion and discharges all flue gases directly outside.

Select a heating system that has a high Annual Fuel Utilization Efficiency (AFUE). This rating resembles the miles-per-gallon rating for a new car. Since 1992, all new furnaces must have an AFUE of at least 78 percent. Look for the ENERGY STAR label on gas models that have AFUE ratings of 90 percent or higher. A 90-percent AFUE furnace is a good investment in Wisconsin's cold climate. If you are shopping for a boiler, look for an ENERGY STAR qualified unit, which has an AFUE rating of 90 percent or higher.

Factors to consider

- **Size.** Select the right size furnace or boiler for your home's heating needs. Oversized equipment will cycle on and off more frequently and be less efficient.



Complete-coverage insulation is your home's best defense against heat loss and high energy bills.

- **Single-stage or multi-stage furnace.** A single-stage or conventional furnace puts out a fixed amount of heat per hour and is either on or off. A multi-stage furnace produces heat at two or more rates to accommodate heating needs based on outdoor temperatures.
- **ECM-equipped furnace.** What makes this furnace unique is the fan motor used to circulate the air. These motors use electronically commutated technology (ECM). An ECM uses about 1/3 less electricity than one- or two-speed motors still common in new furnaces. These units may also provide greater comfort and can actually increase the efficiency of your central air conditioning as well.
- **Modulating boiler.** Just as a multi-stage furnace produces heat at different rates, a modulating boiler automatically adjusts heat output to assure comfort and energy savings.
- **Outdoor temperature reset fan boilers.** This control allows the boiler to reduce output on warm days. This prevents overheating and saves energy.

Other appliances

- **Air conditioner.** Look for the ENERGY STAR label to select a central air conditioning unit that has a SEER (Seasonal Energy Efficiency Ratio) of 14 or higher and two-stage capabilities.
- **Water heater.** Select a sealed-combustion or power-vented water heater to ensure that combustion gases are vented outside the home. Consider tankless or high efficiency tank units to minimize the energy loss associated with storing hot water.
- **Appliances.** Select a refrigerator, dishwasher and clothes washer that have the ENERGY STAR label.
- **Lighting/ceiling fans.** Select fixtures that have the ENERGY STAR label.
- **Windows.** Choose windows rated for Wisconsin's climate, look for the ENERGY STAR label, or look for double-paned, low-E coated, argon-filled windows.



Choose ENERGY STAR qualified windows for comfort and energy efficiency.

THE SIMPLE WAY

The Wisconsin ENERGY STAR Homes Program is a simple way for you to ensure that your new home is durable, energy efficient, healthy and comfortable. A Wisconsin ENERGY STAR Home incorporates building practices that address airflow, heat flow and moisture flow. These practices result in a healthy, comfortable indoor environment and an energy efficient and durable home. Contact Focus on Energy at 800.762.7077 for more information or for a list of builders partnering with Wisconsin ENERGY STAR Homes.

FOR MORE INFORMATION

Focus on Energy

Contact Focus to learn more about smart energy choices.

focusonenergy.com

ENERGY STAR

The ENERGY STAR program provides information on energy efficient products that meet ENERGY STAR standards.

energystar.gov

Minnesota Department of Commerce

Learn from a series of Energy Guides that includes guides on new homes, appliances, home moisture, indoor ventilation and more. The guides are available on the internet from the Minnesota Department of Commerce Click on Energy Info Center at the top of the page.

commerce.state.mn.us

Building Science

Healthy and Affordable Housing: Practical Recommendations for Building, Renovating and Maintaining Housing.

buildingscience.com/resources/homeowner.htm

Popular Mechanics

Heat-Recovery Ventilator: A simple device that keeps heat in while moving stale air out. By Thomas Klenck; Illustrations by George Retseck. (October, 2001)

popularmechanics.com

Focus on Energy works with eligible Wisconsin residents and businesses to install cost effective energy efficiency and renewable energy projects. Focus information, resources and financial incentives help to implement projects that otherwise would not be completed, or to complete projects sooner than scheduled. Its efforts help Wisconsin residents and businesses manage rising energy costs, promote in-state economic development, protect our environment and control the state's growing demand for electricity and natural gas. For more information, call **800.762.7077** or visit **focusonenergy.com**.



focus on energy™

The power is within you.