Building AMERICA U.S. Department of Energy

CARBNEWS

A MONTHLY UPDATE ON SWA'S PARTICIPATION IN THE U.S. DEPARTMENT OF ENERGY'S BUILDING AMERICA PROGRAM

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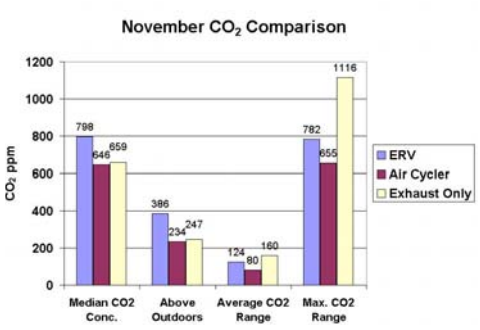
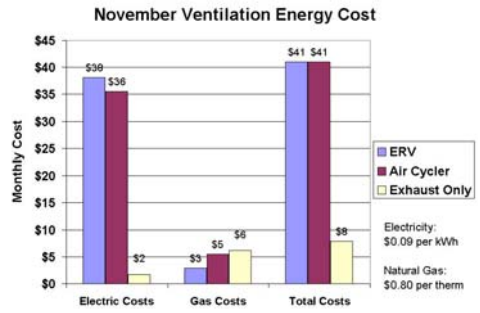
Research Focus: Cold-Climate Ventilation

Over the years CARB, along with other **Building America** teams, has come to realize the critical importance of effective ventilation in energy-efficient house construction. Now CARB has undertaken a research partnership with **Claretian Associates** and **South Chicago Workforce** to evaluate the performance of several new homes constructed with structural insulated panels (SIPs) and heated with condensing furnaces. All of the homes contain efficient lights and appliances, and the first dozen completed feature 1.2 kW solar electric systems. Because the homes are so airtight, effective ventilation is a prime concern. In the first three South Chicago homes, the builder installed three different ventilation systems: an Energy Recovery Ventilator (ERV) with fresh air distributed by the central air handler; Air Cycler with supply-only ventilation (which also uses the central air handler); and exhaust-only ventilation using two bathroom exhaust fans on timer controls.





In conducting the research, Steven Winter Associates, Inc. (SWA) instrumented all three homes to monitor energy consumption of the ventilation systems (both fan electricity and gas needed to heat ventilation air) as well as the effectiveness of fresh air distribution (by measuring temperature, humidity, and carbon dioxide concentrations outside and at three points within each home). All systems were programmed to meet requirements of ASHRAE 62.2. The homes were occupied and systems fully operational last fall. The latest data is quite enlightening.

In the "November CO_2 Comparison" chart (top) the first two sets of columns show median CO_2 concentrations. This value, however, doesn't indicate how well the air is distributed within the home. The third column set shows the average range in indoor CO_2 concentrations (i.e. the maximum CO_2 reading in the home minus the minimum value at the same time). As expected, the two systems that actively distribute fresh air (using the air handler) show less variation in CO_2 concentrations throughout the home.

Energy results, however, favor the simple exhaust-only ventilation strategy. The "November Ventilation Energy Cost" (above) charts energy costs for operating the equipment. Keep in mind that while the furnaces in these homes are very efficient at combusting gas (92.5%), their fans are very inefficient at moving air. The furnace fans draw 700-800 Watts simply to move the air; more efficient air handlers can cut this by two-thirds.

This winter SWA will keep tabs on the air distribution quality in the homes as well as the energy use. SWA will extrapolate the energy implications for different climates as well as for systems with more efficient air handlers. More later.

Zero Energy Home Online

Looking for something to do on those long winter nights? Well, now you can check out the performance of one of **Building America's Zero Energy** homes in the snowy climes of Hadley, Massachusetts. Last summer CARB joined forces with **Western Massachusetts Electric Company (WMECO)** to monitor the performance of a prototype built under the Building America Zero Energy Homes program. The single-family house features active solar hot water and electric systems as well as boosted insulation, low-e windows, and energy-efficient appliances and equipment. With help from the **Florida Solar Energy Center**, up-to-date data from the home are now available online. Anyone can view the performance of the home at: http://infomonitors.com/swinter/. Information provided on the website includes solar electricity produced and consumed, the solar energy fractions (the fraction of consumed energy provided by the sun), domestic hot water energy from solar, solar tank temperature, oil/biodiesel consumed, and environmental conditions. Summaries of the data are also available. For example, from mid-June through December 31, the photovoltaic system provided 82% of the home's electric needs. During the summer months the solar hot water system provided more than 90% of the hot water needs, while in December the solar fraction went down to 31%. More information on the home's construction and specifications is available at http://www.swinter.com/WMECO/ZeroEnergy.html. Check it out.

Jan 04 2005, 00:15 -To- Jan 05 2005, 00:00 EST

Electricity		
Energy consumed (kWh)	11.9	
Energy produced (kWh)	3.9	
Solar Fraction	0.33	
Domestic Hot Water (DHW)		**Min/Max**
DHW Used (Gal)	79.8	
Total DHW Energy (kBtu)	46.8	
DHW Energy from Solar (kBtu)	10.3	
Solar Fraction	0.21	
Solar Tank Temperature (deg. F)	66.5	53.5/ 73.1
Heating Oil		
Oil Consumed (Gal)	4.0	
Environment		**Min/Max**
Inside Temperature (deg. F)	69.4	67.4/ 71.6
Outside Temperature (deg. F)	39.1	29.8/ 50.4
Total Insolation (kWh/m2)	1.3	

Beans Boost R-Value

Soy for insulation? Seems like the perfect choice for a new CARB project in America's heartland. **North Plains Insulation**, a Nebraska-based building materials manufacturer, is demonstrating both the energy efficiency and sustainability of its new soybean-based insulation product in the **Nebraska Energy Office's** model home, designed and built in partnership with the Building America program's CARB team (see *CARBNews* November 2004).The project is to serve as a benchmark for energy-efficient housing in the state. The house design, which can be replicated throughout the state, features mechanical ducts that run overhead as opposed to through the floor. The home design allows for replication in slab-on-grade projects. The insulation, made of soybean polyols (a soy by-product) is sprayed into the rim and band joists in the home, as well as at the window headers. The advantage is that spray foam insulation provides an air-tight seal and doesn't support the growth of mold and mildew. This insulation is also a sustainable choice because it's a natural product made from locally grown crops. SWA researchers will test the home's performance shortly after its completion this spring.

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