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CARBNEWS

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

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Searching for IAQ's Nirvana

The UltimateAir™ RecoupAerator® 200DX was selected for the J.Cherry & Sons prototype homes

How do you improve indoor air quality in houses with tight envelopes without sacrificing energy efficiency? That is the problem that SWA recently tackled in a project with **Claretian Associates** (a non-profit community development organization) and **South Chicago Workforce** (a non-profit builder and contractor), funded by the **U.S. Department of Energy's Building America** program and the **U.S. Department of Housing and Urban Development's PATH (Partnership for Advancing Technology in Housing)** program. To solve the problem, three different ventilation systems were installed and indoor air quality and operating energy were monitored for six months. One advanced system installed was an Energy Recovery Ventilator (ERV), which exchanges the air inside the home with fresh air from outside the home, while transferring humidity and heat. In Chicago, the ERV was ducted into the main air distribution ductwork also used for heating and cooling. Alternatively, the ERV can operate through a separate, smaller system of ducts. The advantage of the first method is reduced ductwork (with lower material and labor costs). The disadvantage is that the ERV's own fan might not be big enough to distribute air through the larger ducts; in this situation, the furnace fan must run simultaneously with the ERV to achieve good indoor air quality. In the Claretian homes, engineers found that while the ERV achieved good indoor air quality, running it simultaneously with the furnace fan resulted in significant energy costs. To maximize the benefits of the ERV system and achieve long-term energy savings as well as superior indoor air quality, SWA recommends installing an ERV system with its own small duct system. Two upcoming CARB prototype projects with **J. Cherry & Sons** in Port St. Lucie, Florida, will evaluate the performance of ERVs that use an electronically commutated motor (ECM) to further boost operating efficiency. For an in-depth look at ERVs, check out the article by SWA's Robb Aldrich scheduled for the January/February 2006 issue of ***Home Energy Magazine***.

Raising the Bar on BA's Benchmark

CARB is working on a new Florida prototype house for **Home Front, Inc.** that should push the envelope of energy performance. SWA engineers predict that the combination of building envelope improvements and innovative building systems will result in the most efficient CARB prototype to date, with energy savings of better than 54% over the Building America benchmark. Home Front uses a fiber-cement structural insulated panel (SIP) developed by the company to offer protection against hurricanes, moisture, mold, termites, and heat. Aluminum SIP roof panels have boosted levels of insulation, while white roofing membrane reflects heat. Home Front has been working with CARB to further increase energy performance. The prototype in North Port, Florida, features a thermo-siphon hot water system, using a roof-mounted solar collector and a garage-mounted storage tank to heat domestic water without pumps or moving parts. Another high-performance feature is a **Freus** evaporative condenser. CARB will also be evaluating a Dinh™ Z-Coil by **Heat Pipe Technology** and its potential for increasing latent cooling capacity.

Is Zero Energy Cost Effective?

CARB has now completed a year of monitoring a pilot home (left) that combines energy efficiency and solar energy with a goal of approaching "zero energy" (energy results were summarized in the July 2005 issue of *CARB News*). The goal of the project, conducted with the **Western Massachusetts Electric Company (WMECO)**, is to assess the costs and benefits – from the utility's perspective – of the "zero energy" concept. If cost-effective, the study could pave the way for a utility-sponsored "zero energy" program. To analyze utility program viability, Massachusetts relies primarily on the "Total Resource Cost" test as defined by the state's Department of Telecommunications and Energy (DTE). This test accounts for many direct economic costs and benefits – not only electric system benefits. Costs to improve energy performance of this home above the Massachusetts "reference house" are shown in Table 1 (below). The reference house is based on "standard" Massachusetts construction. "Electric Systems and Total Benefits" (values over the life of the home and systems) are shown in the Table 2. Electric benefits are primarily from peak power and energy reductions. By combining efficiency with solar electricity, the home is a net generator of electricity during the utility's peak periods. From the total costs and benefits, it is clear that the benefit-to-cost ratio is 0.75, less than the 1.0 minimum. So are "zero energy" homes cost effective? Not yet, at least in Western Massachusetts. However, several benefits are left out of this analysis. For example, because of the efficient envelope, this home did not require a cooling system, which means that reduction in cooling loads could not be counted. Renewable energy credits from the PV system also have substantial value: $4,600 over the system's lifetime using current RECS prices. Evolving "avoided costs" and "energy costs" ultimately will have a huge impact on zero energy viability. This study uses 2003 values with inflation of 2.5%. We know that energy costs have increased at a drastically higher rate. When updated energy and avoided cost values become available later this year, SWA and WMECO will revisit the analysis, and the move toward zero energy should look much more favorable.

TABLE 1

Home Improvement	Incremental Cost
Upgraded cellulose insulation	$ 1,800
High-performance windows	$ 1,028
Efficient oil boiler	$ 750
Indirect water heater	$ 800
100% Compact Fluorescent Lamps	$ 1,120
Energy Star Clothes Washer	$ 250
Energy Star Dish Washer	-
Energy Star Refrigerator	$ 100
Solar Electric System	$ 26,445
Solar Thermal System	$ 7,808
Total Increase over reference home:	**$ 40,101**

TABLE 2

	Electric Benefit	Total Benefit
Heating	$ 99	$ 14,622
Water Heating	$ -	$ 2,832
Lighting	$ 1,071	$ 1,444
Appliances	$ 276	$ 1,113
Solar Electricity	$ 7,506	$ 7,920
Solar Water Heating	$ -	$ 2,275
Total life-time benefits:	$ 8,953	**$ 30,206**

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