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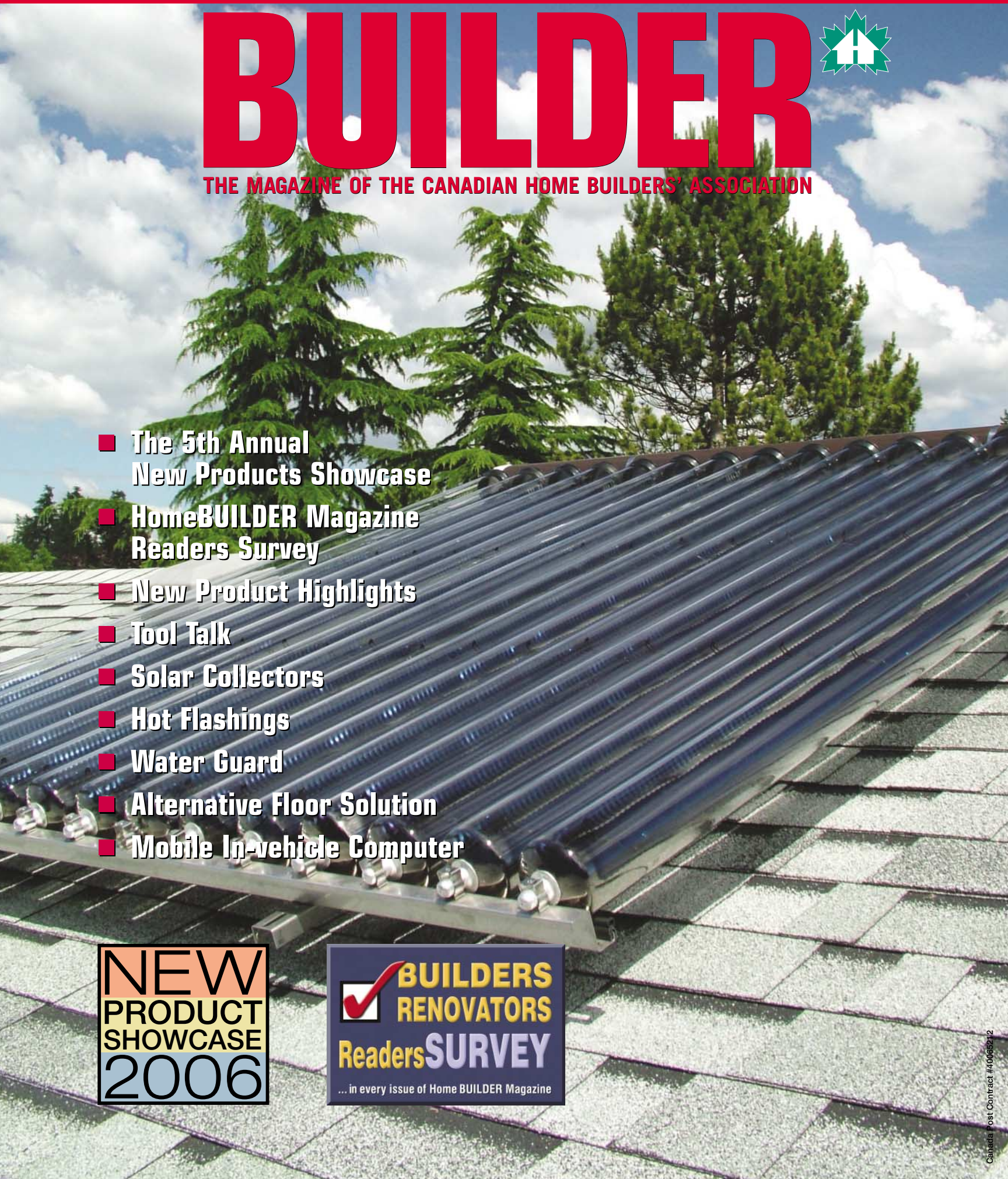

- The 5th Annual New Products Showcase
- HomeBUILDER Magazine Readers Survey
- New Product Highlights
- Tool Talk
- Solar Collectors
- Hot Flashings
- Water Guard
- Alternative Floor Solution
- Mobile In-vehicle Computer

NEW PRODUCT SHOWCASE 2006

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EVACUATED TUBE SOLAR COLLECTORS

BY JON EAKES

CANADIAN SOLAR TECHNOLOGIES INC.

Active solar energy will eventually be cost efficient, or is it already?

We know that the sun has a lot of heat to offer; the problem is the capital cost and operating costs of equipment to capture that energy and not freeze up in the Canadian climate. Historically, high costs and low efficiencies added up to bad math and worse payback. Add to that the fact that many systems would actually shorten the life of your roof because of the friction of expansion and contraction and the reality is that we don't see a lot of solar collectors on residential roofs in Canada.

The breakthrough had to come from a combination of technology with higher collection efficiencies, non-freezing attributes, reducing costs through mass production and higher fuel costs — all together to add up to a lower cost per unit of heat delivered, allowing solar systems to compete without subsidies against gas and oil.

Wendy Maver is an enthusiastic mechanical engineer from cloud-covered British Columbia who, after five years of working in a solar industry that was not moving very fast, set out to find the best of the best to show Canadians that solar cost efficiency is possible today. The technology she found is unique to Canada's solar industry. It uses solar heat transfer technology jointly designed by the German based **Daimler-Benz Aerospace Group** and **Beijing Sunda Solar Energy Technology Co. Ltd.** She also sought out the best pumps and controllers for long-term reliability and set up her own company: **Canadian Solar Technologies Inc.** in Delta, British Columbia. Rising fuel costs are helping to complete her winning equation.

At 65 per cent efficiencies and lowered costs of production, we are now talking about a 6- to 12-year payback on something that has proven to last beyond 20 years.

Traditionally, solar collectors operate at about 25 to 30 per cent efficiency, losing a lot of collected heat by conductive and convective heat losses. Maver set out to study the reality and the reliability of a technology that is just about unknown in Canada but comes with a 20-year track record in both Europe and Asia: Evacuated Tube Solar Collectors. At 65 per cent efficiencies and lowered costs of production, we are now talking about a 6- to 12-year payback on something that has proven to last beyond 20 years. Although the intensity of the sun in any given geographical area is the biggest variable, in general, one 2-metre-by-2metre tube array will generally supply 40 to 70 per cent of the entire year's domestic hot water (DHW) needs. A typical residence needs about $6,000 worth of equipment. Retrofit installation costs can add on $3,000 to $6,000 more but installation during new construction is running as low as $1,500.

What is this technology? One of the primary drawbacks of traditional flatplate and other solar collectors is that the whole unit would get hot and lose that heat to the atmosphere before it could be used in the house.

An evacuated tube collector contains several individual glass tubes, each containing an absorber plate bonded to a heat pipe and suspended in a vacuum. The pipe transfers the heat efficiently to a condenser through the top of the tube. The condensers are clamped to heat

▶ 16

14 ►

exchange blocks in a well-insulated manifold. The special coating on the absorber absorbs more than 92 per cent of the arriving radiation, but radiates less than 8 per cent back to the environment. The inner element can reach 250ºC while the outside of the tube can be below freezing because of the isolation effect of the vacuum.

Heat transfer from the absorber to the fluid circuit is performed by the "heat pipe", a closed system, evacuated and charged with a small amount of a water-alcohol mixture before it is sealed. The absorber imparts heat to this mixture, causing it to evaporate. The steam rises to the upper end of the heat pipe where it transfers heat to the fluid circuit via a metallic conduction bridge. Being a "dry" connection, fluid in the heating circuit does not flow through the collector.

A circulation pump brings heated fluid into the house and delivers it to a solar storage tank. A controller keeps everything tuned to the changing solar conditions and temperature set-points of the house. Depending on the number of tube arrays installed, a system can be designed to deliver the stored heat directly to a domestic hot water system, an in-floor hydronic system, a heating coil inside a forced air plenum, a swimming pool, or a combination of these applications. At these efficiencies, and with the effect of the vacuum, you can even collect significant heat during cloudy periods.

As you can see in the picture, the entire frame of the evacuated tube solar collector sits on four feet attached to the roof, resulting in easy watertight installation on the roof and no friction on the shingles. In fact, Maver is proud of the fact that, while the design of the system and the choice of all the right components for a given installation needs professional experience, the installation can be easily handled by your own carpentry and plumbing crews.

There is competition in the field of evacuated tube solar collectors. Maver feels that it is important for someone unfamiliar with the products available to research the real efficiency of a given product and its long-term capacity to maintain its vacuum seal. She is convinced that her product has the best track record. Her glass tubes have been tested to withstand 35mm hail and all the primary performance testing has been done in Swedish, German, North American and Artic environments. This is not a mild-weather import.

The economics of this type of solar system are best realized when it is used year round. Therefore, it will take advantage of the vacuum technology during the cold months. For instance, it can be used to supply your DHW all year, or perhaps heat your pool in the summer and supplement your home heating during the winter. Furthermore, a system could be set up to consider your DHW as priority, and any excess energy could be used for heating a pool or hot tub. The combinations are endless.

For more information visit www.CanadianSolarTechnologies.ca.