RESULT 251

CADDET energy efficiency IEA OECD

AIVC 12,337

Innovative internal storm windows

Summary

Defective and energy inefficient windows, such as single-pane windows, can be responsible for up to 70% of a home's heating and cooling load. An innovative internal storm window system designed to reduce energy loss through single-pane windows was field tested in three occupied homes in the southeastern part of the United States to demonstrate its energy savings impact. The test results indicated that this system, called the "Winsulator" system, reduced window-related energy consumption for heating and cooling by 29%.

The technology was also tested to determine its impact on other factors, such as noise level and condensation. These results were also positive.

The "Winsulator" system received the Window Energy Systems seal of certification for superior window performance from the Tennessee Valley Authority.

Highlights

- **29% reduction in window-related energy consumption**
- **Reduced noise level**
- **2.3 years payback period**

Installing the "Winsulator" window.

Aim of the Project

Home owners realise the significant effect that outdated, energy inefficient windows can have on energy bills. Jalousie windows, awning windows, sliding doors and skylights are the weakest links of energy conservation efforts. Interior storm windows are a way to upgrade single-pane windows without actually replacing them. They can reduce energy losses, but avoid the expense of replacing outdated fixtures.

The aim of this demonstration project was to confirm the performance characteristics of the internal storm window system as an effective energy conservation measure in Florida residential houses. This project was promoted and funded by the State of Florida Energy Conservation Assistance Programme.

The Principle

The "Winsulator" is an innovative internal storm window which is custom fitted and added on the inside of an existing window. In this way an air cushion is trapped between the two windows, which increases the thermal resistance. The frame of the storm window is made of vinyl, which is also more resistant to energy transfer than either steel or aluminium. The pane of the storm window is 100% acrylic. It has no shading coefficient, and therefore it will not affect daylight levels inside the room. The pane can even decrease glare factors and shows no deformation after installation.

Figure 1 shows a cut-away section of the internal storm window system. The window is held in place by a magnetic strip which sticks to a small L-shaped steel banding. The banding is permanently installed in the existing window opening. The seal between the frame and the magnetic strip is similar to the rubber seal of a refrigerator door. This rubber seal allows the trapped air to expand or contract under various temperature conditions without causing one of the two windows to break or forcing the storm window to pop out.

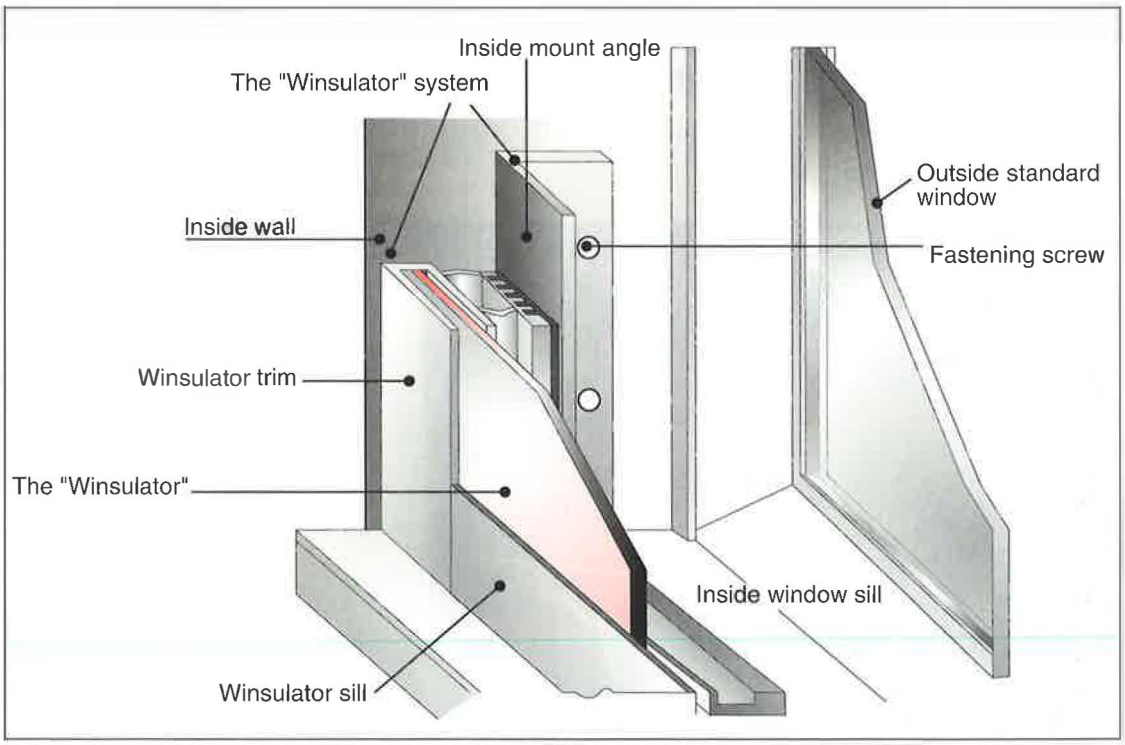

Figure 1: Diagram of the internal storm window system.

Once installed, the storm window can easily be removed and replaced. This enables residents to respond to seasonal changes, and also allows them easy access to clean the area between the two windows.

The Situation

The demonstration project consisted of installing the "Winsulator" internal storm windows in three residential buildings located in West Central Florida.

One of the three residences used in the project is a manufactured home with 120 m^2 (1,300 ft^2) of living space and 18.6 m^2 (200 ft^2) of standard aluminium frame window surface. The two other houses are both concrete block homes, each of which has 158 m^2 (1,700 ft^2) of living space and 18.6 m^2 (200 ft^2) of window surface. One of them has standard jalousie glass aluminium frame windows and the other has standard aluminium frame windows. All three houses are 100% electrically heated and cooled.

The three houses were monitored for a six month period prior to the installation of the storm window system (from January to June, 1994), and also for a six month period after installation (from January to June, 1995). The monitoring included thermographic heat loss analysis, visual structural inspections, digital collection of inside temperature and humidity data, collection of weather data and computer modelling of heating and cooling loads.

The results of the survey indicated that during the six-month test period in 1995, after the storm window system was installed, average electricity consumption for heating and air-conditioning loads decreased by 20% compared with the same period in 1994, before the system was installed. This was accomplished even with a significant increase in heating and cooling degree days (up 11%) in 1995 as reported by the National Weather Service for the area.

The new storm window system was also tested to measure other factors such as noise levels, dust levels, and condensation levels. The test results showed a significant decrease for all levels. Noise levels decreased by 60%, dust levels decreased by 78%, and condensation levels decreased by 91%.

The Organisation

South Sun Energy Conservations Corporation was founded in 1993. The company is the sole distributor of the "Winsulator" window in the southeastern United States. The manufacturing facility is located in Port Charlotte, Florida, whilst the executive office is in Sarasota, Florida. The company has 22 employees and plans in the future to expand to other states in the southeastern United States.

Economics

The "Winsulator" system in this demonstration project reduced window related electricity consumption for heating and cooling by 29%. The system effectively reduced each home's annual heating and cooling energy user index by approximately 16,900 kJ (16,000 BTU) on average, or 900 kJ/m^2 (80 BTU/ft^2) of window surface treated.

This is an average annual saving of USD 399, or USD 7.10/m^2 (USD 0.66/ft^2) of window surface treated under the conditions recorded during the testing period. The window system costs approximately USD 97 to 108 per m^2 (USD 9 to 10/ft^2) of window surface treated.

Though every effort was made to calculate an average simple payback on investment for a typical installation, the data was complicated by factors such as varying seasonal charges for electricity, building envelope differences not associated with the window systems, the customised nature of the technology, and weather patterns. A survey of commercial and residential users indicated that the system can have a simple payback period for a typical installation of 2.3 years.

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* IEA: International Energy Agency
OECD: Organisation for Economic Co-operation and Development

IEA

The IEA was established in 1974 within the framework of the OECD to implement an International Energy Programme. A basic aim of the IEA is to foster co-operation among the 23 IEA Participating Countries to increase energy security through energy conservation, development of alternative energy sources, new energy technology, and research and development (R&D).

This is achieved, in part, through a programme of energy technology and R&D collaboration currently within the framework of 35 Implementing Agreements, containing a total of more than 60 separate collaboration projects.

The Scheme

CADDET functions as the IEA Centre for Analysis and Dissemination of Demonstrated Energy Technologies. Currently, the Energy Efficiency programme is active in 15 member countries.

This project can now be repeated in CADDET Energy Efficiency member countries. Parties interested in adopting this process can contact their National Team or CADDET Energy Efficiency.

Demonstrations are a vital link between R&D or pilot studies and the end-use market. Projects are published as a CADDET Energy Efficiency 'Demo' or 'Result' respectively, for on-going and finalised projects.

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