

HOME

Energy Savings and Comfort

Reduce your energy costs and increase your comfort with the right windows.



*Pacific Gas and
Electric Company*[®]

Windows are a big part of utility costs.

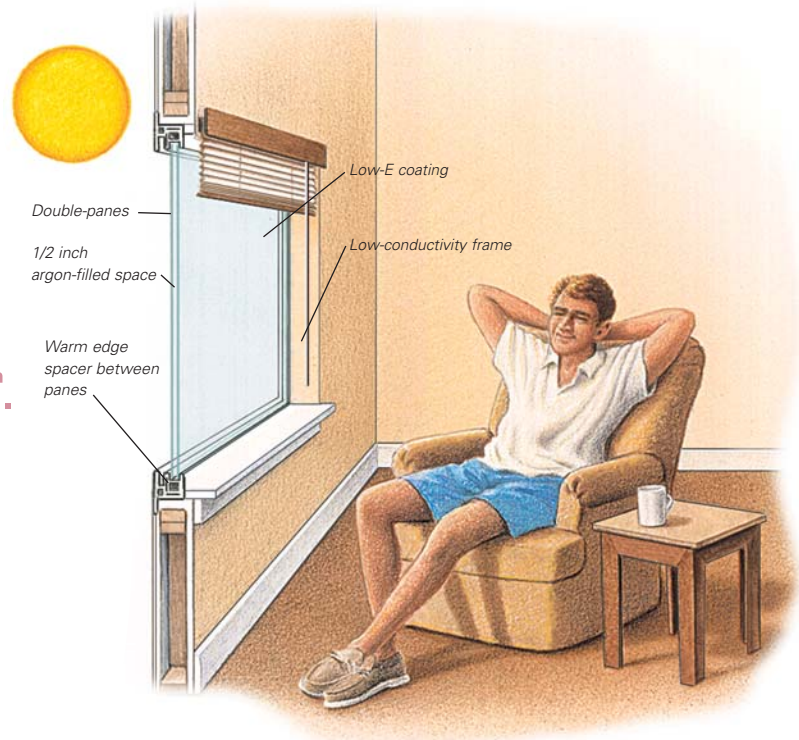
Windows are 10% to 25% of the exterior wall surface area, and they can contribute 25% to 50% of heating and cooling costs. "High performance" windows are energy-efficient and can help reduce those costs. So, when you are designing a new home or upgrading your existing windows, specify high performance windows, skylights, and glass doors.

New-technology windows are clearly better.

Modern double-pane windows with new-technology glazing and frames are in several ways far superior to old-fashioned single-pane windows. There are many benefits to energy-efficient "high performance windows," and they have become one of the most popular home improvements. They will make your home more comfortable and energy-efficient by blocking out summer heat and keeping in winter warmth. High performance windows also improve the appearance and value of your home...

... but they are only part of the picture.

If you don't have enough insulation in your attic and walls, or if your heating and cooling equipment is old and inefficient, or if you have a duct system that leaks (and most do), upgrading those energy wasters should also be considered. If you are planning to install high performance windows, that's good — but also look at the house as a whole. For example, energy-efficient windows should not be put into walls that need insulation, because efficiency gained with improved windows will be outweighed by energy lost through cold walls in winter and hot walls in summer. Likewise, a high-efficiency furnace or air conditioner should not be connected to a leaky duct system, because heated or cooled air will leak outdoors wasting the high efficiency for which you paid. Take the "whole house" approach to home renovation...get the most comfort, savings, and value for every dollar you invest...and help reduce energy consumption during peak-demand times. When we consume less electricity, there is less demand on fossil fuel power plants. Thus fewer emissions are produced and that's good for the environment.



Energy passes through windows in three different ways.

CONDUCTION

Conduction is the transfer of heat through solid materials, such as the glass and frame of a window, with the energy always moving from the warmer side to the cooler one. During winter, windows are warmer on the inside, so indoor warmth is conducted through the glass and frame to the outdoors, causing your furnace to run. When it is hot outdoors, heat is conducted inward through the window, heating up the house and causing your air conditioner to run. High performance windows conduct less heat, so your furnace and air conditioner can run less.

RADIATION

Radiation is the transfer of heat through the air from one object to another. Direct sunlight enters a clear glass window as both light and heat. During summer that radiant heat makes you feel hot and makes your air conditioner work harder. During winter, your body radiates heat to nearby cold windows, causing a drafty feeling. High performance windows feel warmer in winter and cooler in summer, so you are more comfortable with less dependence on mechanical heating and air conditioning.

CONVECTION

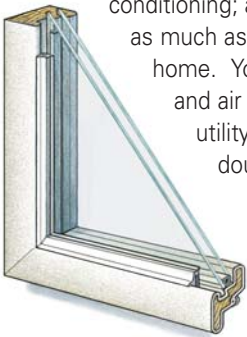
Heat can be carried by air moving through and around windows and their frames — both intentionally (ventilation) and unintentionally (infiltration) — causing drafts and discomfort.

High performance windows are designed to reduce conduction, radiation, convection, and infiltration, thereby increasing comfort while reducing heating and cooling costs.

Six benefits of energy-efficient “high performance” windows.

Comfort High performance windows conduct less heat and reduce infiltration (drafts), so they feel warmer in winter and cooler in summer. They help keep your home at a more even, comfortable temperature.

Energy Savings During summer, single-pane windows with clear glass have a big impact on the cost of air conditioning; and during winter, they can account for as much as 25 percent of the heat loss in your home. You can reduce demand on your heating and air conditioning system — and reduce utility bills — by installing high performance double-pane windows.



A double-pane window loses half the energy of a single-pane window.

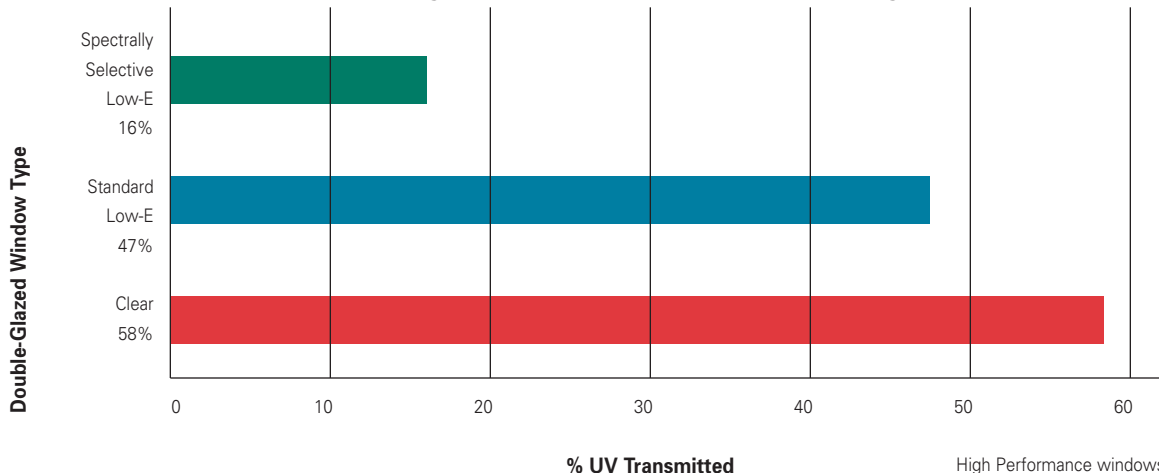
Condensation Control Condensation often occurs when warm, humid air inside your home comes into contact with a cold window. Energy-efficient windows with higher insulating values (lower U-factor) stay warmer, so they are less likely to develop condensation. The best framing materials for reducing condensation are: wood, vinyl, fiberglass, and composites. Aluminum frames with thermal breaks also reduce condensation.

Reduced Fading Sunlight contains ultra violet (UV) radiation that can fade the color from organic materials, such as draperies, upholstery, carpeting, and wood furnishings. Windows with “Spectrally Selective Low-E” glazing (see below) can block 84% or more of damaging UV rays from entering the house, thus protecting your valuable belongings.

Noise Reduction Double-pane windows also reduce transmission of outdoor noise, making your home quieter. An Outdoor-Indoor Transmission Class (OITC) rating has been developed by the American Architectural Manufacturers Association (AAMA) to indicate how much noise a window will block. If noise is a particular concern, compare OITC ratings when you shop, and choose windows with lower ratings. Sound transmission information is not on labels but may be in product literature. If not, ask your window supplier to request OITC test results from the manufacturer.

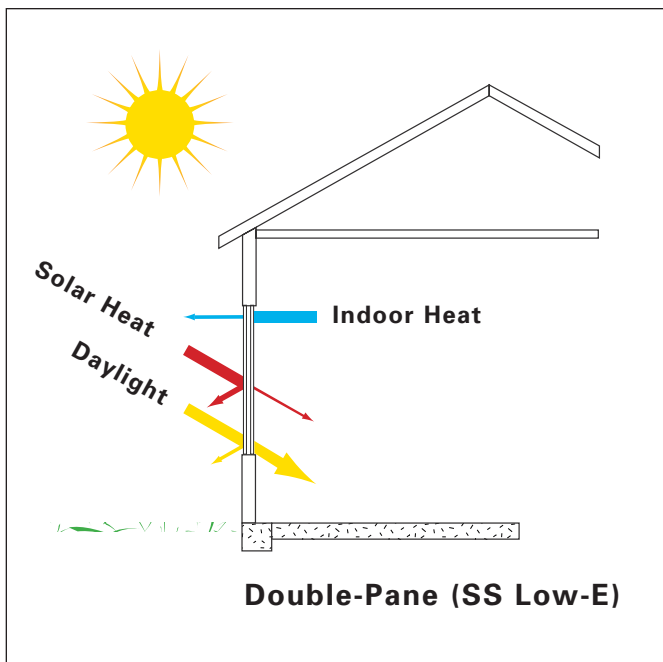
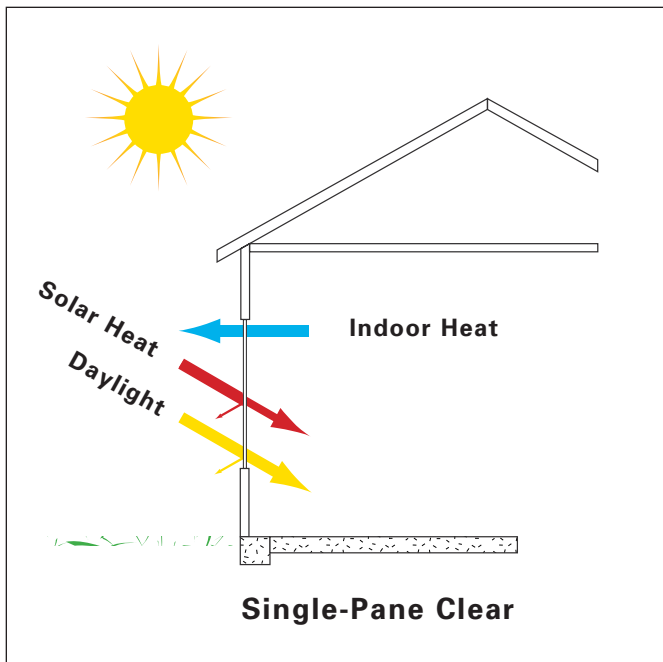
Convenience Some new windows can be cleaned inside and out from indoors, can be opened and closed more easily, and may have improved locking mechanisms for additional security.

High Performance Windows Reduce Fading



High Performance windows reduce damage and fading caused by Ultra Violet (UV) rays:

- Clear glass allows 58% of the UV rays to pass through
- Spectrally Selective Low-E allows only 16%



Spectrally selective Low-E glazing (SS Low-E) reduces the flow of radiant heat through the window, which helps keep summer heat out and winter warmth in.

Window Frame Choices

Window frames and sashes are available in a variety of materials with various rates of conductivity. Low-conductivity frames made of wood, vinyl, fiberglass, and composites generally have better insulating values than frames made of solid aluminum. If you choose aluminum windows, be sure both the frames and sashes have thermal breaks to help reduce the transfer of heat. For more information about frame and glazing options, contact the Efficient Windows Collaborative (EWC) at www.efficientwindows.org. Their web site provides unbiased information on the benefits of energy-efficient windows, descriptions of how they work, and recommendations for their selection and use.

Glazing

For years, single-pane clear glass was the only glazing available for home use. Now, several new window options are available, such as double-pane glazing, special coatings, tinted glass, and suspended films. Some desirable features to look for are described below.

Low-E: Low-emissivity (Low-E) coatings, virtually unnoticeable to the eye, are installed inside the air space of a double-pane window — usually on the glass itself but sometimes on a clear plastic film suspended between the panes. The Low-E coatings help prevent warmth inside your home from escaping through the glass in winter. They also help block some heat from the summer sun.

Spectrally Selective Low-E (SS Low-E): Another type of Low-E is multiple Low-E coatings on a single surface, which perform even better by blocking more solar heat with very little reduction in visible light. SS Low-E is especially good in warm climates, because it can help reduce the cost of air conditioning. SS Low-E may also be referred to as summer Low-E or high performance Low-E. To find the type of glazing used in a window, check the product section of the NFRC label (see 3 on page 6).

Solar Heat Gain Coefficient (SHGC): Tinted glass and multiple Low-E coatings are good options for windows that get a lot of direct sunlight during summer. They are both used in a category of glass having a low "Solar Heat Gain Coefficient." SHGC is expressed as a number between 0 and 1.0, and it is a measure of the amount of solar radiation (heat) passing through the entire window, including the frame. The lower the SHGC the better in most climates, especially in the warm Sacramento and San Joaquin valley areas, where the recommended maximum is 0.40. In cooler climates without air conditioning, such as coastal and higher mountain areas, consider a SHGC of 0.60 or higher to allow more natural warmth from the sun to enter your home during winter.



Properly-designed architectural features, such as overhangs and trellises, help keep out the hot summer sun yet allow the sun to warm your home in winter.

Visible Transmittance (VT): VT is an indicator of the amount of visible light that comes through the window. Visible Transmittance is expressed as a number between 0 and 1.0. The higher the better, and a minimum of 0.60 is recommended. Some tints may reduce light entering your home. So, it's a good idea to take home some samples and try them before purchasing tinted windows.

Gas-fills: Gas-filled windows use an inert gas (such as argon) instead of air between the panes of glass. Inert gases have a better insulating value than air.

Spacers: Even the type of spacer used to separate the panes of glass can make a difference. "Warm edge spacers" are now used to help improve the insulating value of the window.

U-FACTOR

A window's ability to insulate is expressed as its "U-factor," which is a measure of heat flow through the entire window. U-factor ratings usually range between 0.20 and 1.0. The lower the U-factor, the more slowly the window conducts heat in and out of your home. The frame can have substantial impact on a window's energy performance, so look for low-conductivity frames and check the U-factor on the NFRC label. A window with a low U-factor helps you stay comfortable and saves energy. A U-factor of 0.40 or lower is recommended in most climates. In cold climates, consider a minimum U-factor of 0.35 to reduce winter heat loss.

AIR LEAKAGE (AL)

Infiltration through gaps in the window assembly causes discomfort and wastes energy. AL is a performance rating indicating the amount of airflow through a window during laboratory tests. AL is expressed in cubic feet per minute of air leakage per square foot of window area (cfm/sq. ft.). The lower the AL, the more energy-efficient the window. The AL maximum allowable rating in California is 0.30. AL may not appear on the NFRC temporary label, but all windows sold in California must be certified not to exceed the 0.30 air leakage limit.

SAFETY GLAZING

National and local building codes require "safety glass" to be used in certain locations, such as in and near doors. Codes have been revised over the years, so safety glass may now be mandated in locations where it was not required at the time your home was built.

"Tempered" glass, the most common type of safety glazing, is heat-treated, so when it breaks it crumbles into small pieces the size of peas rather than long, knife-like shards of glass. Consult your local building department or window contractor concerning which windows need safety glazing. It will cost more than regular glass, but safety needs to be first.



Deciduous trees can help keep out heat in the summer and allow in warmth and light from the sun in the winter.

Window Placement

Windows which allow the sun's energy to warm your home in the winter can bring in unwanted heat in the summer. That's why it's important to consider how comfort and energy use are affected by window placement, as well as by frame and glazing options.

South-facing windows provide solar heat during winter, when the angle of the sun is low. During summer, when the angle of the sun is higher, south-facing windows can be shaded by the overhang of your roof, allowing your home to stay cooler. When remodeling or building a new home, consider adding architectural features such as awnings, overhangs, porches or arbors to shade your windows.

West-facing windows admit the most heat during the summer. Spectrally Selective Low-E glazing, window tints, blinds, deciduous trees and trellises will help keep out heat from the summer sun. If you live in a hot climate, you may want to avoid or minimize placing windows on the west side of your home when remodeling or building a new house.

Whenever possible, place your windows so they maximize the use of daylight. Well-situated windows provide free lighting during the day and help make your home feel cheerful and bright.

SKYLIGHTS

Skylights are windows that bring in pleasant daylight, gleaming moonlight, and refreshing ventilation through the roof. They light up a dark room, hallway, or stairwell and reduce dependence on electric lighting. Skylights that open let hot air escape and bring in fresh air. However, winter heat loss and summer heat gain can be three to four times greater through skylights than the same size windows in a wall — so plan before installing skylights.

Factors to consider include slope, orientation, glazing options, and integral shading devices. A north-facing skylight

will be cooler than one that is south or west facing. The greater the slope, the less solar heat gain in the summer. Spectrally Selective Low-E double-pane glazing will reduce summer heat gain, as will shades or blinds.

RETURN ON INVESTMENT

Replacing windows can make a tremendous difference in the comfort and attractiveness of your home...and in the cost of heating and cooling. Purchasing new windows can be quite an investment; however, the additional costs for high performance upgrades are minimal compared to the benefits. High quality windows are constructed of superior materials, they perform better, they last longer, and they can reduce energy use.

What to look for when buying windows & doors

Choose high performance windows and glass doors for energy savings, comfort, and durability. The best products admit plenty of natural light, keep warmth in during winter, and keep heat out during summer. When building or remodeling, consider energy-efficient models with the following features:

- double-panes (1/2 inch air space is optimal).
- both the ENERGY STAR® and the NFRC temporary labels (shown on the following two pages).
- Low-E coating that helps reduce winter heat loss, or
- Spectrally Selective Low-E multiple coatings that help reduce heat loss in winter and heat gain from unshaded windows in summer.
- low-conductivity frames, such as wood, vinyl, fiber-glass, composites, or thermally-broken aluminum.
- **U-factor of 0.40 or lower (0.35 in cold climates)**
- **SHGC of 0.40 or lower (0.60 in cold climates)**
- **VT of 0.60 or higher, and AL of 0.30 or less.**
- either an AAMA or NWDA permanent certification label (page 6).

ADDITIONAL TIPS:

- Skylights can brighten the kitchen and dark areas like hallways, stairwells, and bathrooms. To minimize heat gain, look for skylights with an SHGC of 0.40 and U-factor of 0.60 or less (see additional ENERGY STAR® standards on page 7). Shading devices may also be available for skylights to help control heat and glare.
- When remodeling or building a new home, avoid placing windows on the west side, especially if you live in a hot climate.
- When selecting window size, type, and location, keep in mind the advantages of natural light and ventilation.
- If reducing noise from outdoors is important, look for windows with a low OITC rating.
- Installing a tinted film on your windows (only as directed by a professional), or shading them with awnings or sun screens, will provide additional barriers to the sun's rays.
- Prices vary widely, so it is wise to get more than one estimate before buying windows.

Look for Labeled Windows.

THE NFRC LABEL—YOUR GUIDE TO THE RIGHT WINDOWS

Use the National Fenestration Rating Council (NFRC) temporary label as your guide when selecting energy-efficient windows, doors and skylights. The label provides homeowners and contractors with standardized, unbiased test data for comparing various brands and types of windows. Because this is a temporary label, it is printed on paper and is removed after final inspection of the installed product. A smaller, durable permanent label stays on the frame, as explained on page 7.

As shown on the sample temporary label, items ④, ⑤, ⑥ and ⑦ provide the “energy performance ratings” you need to accurately compare similar windows. Air Leakage data is optional, and NFRC does not require it to be printed on the label, so item ⑦ may not appear on windows available for purchase at retail stores and through contractors.

Most windows will have an NFRC temporary label that looks like the sample shown. However, some products may still bear an older and slightly different style of label with energy performance “technical information” in two categories: “Res” and “Non-Res.” Use the “Res” ratings to compare residential windows.

WHAT THE NFRC LABEL TELLS YOU...

- ① Logo: The official NFRC logo.
- ② Manufacturer: Name of the window manufacturer.
- ③ Product: Manufacturer’s description of the labeled product, including type of glazing.
- ④ U-factor: U-factor indicates how well the window insulates. It is a measure of heat transferred by conduction through the entire window assembly (frame, sash, and glass), either into or out of the building. U-factors typically range between 0.25 and 1.0. A smaller U-factor allows less winter warmth to escape and makes the window more comfortable to sit next to on cold days. A U-factor of 0.40 or less is recommended, except in very cold climates where a rating of 0.35 or less will keep in more winter warmth.
- ⑤ Solar Heat Gain Coefficient: SHGC is an indicator of the amount of solar energy entering the building through the entire window. SHGC ranges between 0 and 1.0. A lower SHGC will reduce air conditioning costs and make the window more comfortable to sit next to on hot days. In hot climates, select windows with a SHGC of 0.40 or lower. In

 National Fenestration Rating Council CERTIFIED	<p>② World's Best Window Co.</p> <p>③ Millennium 2000+ Vinyl-Clad Wood Frame Double Glazing • Argon Fill • Low E Product Type: Vertical Slider</p>
ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./I-P) ④ 0.34	Solar Heat Gain Coefficient ⑤ 0.25
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance ⑥ 0.60	Air Leakage (U.S./I-P) ⑦ 0.3
⑧ Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. Consult manufacturer’s literature for other product performance information. www.nfrc.org	
⑨ This fenestration product has been certified by the manufacturer to meet the air infiltration requirements of Section 116(a)1 of the California Building Energy Efficiency Standards.	

NFRC Temporary Label

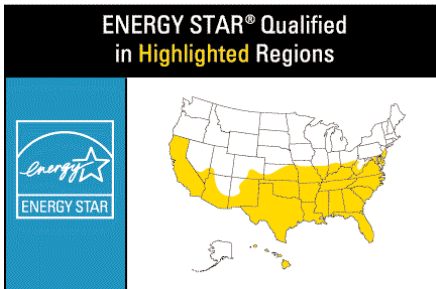
- cooler areas without air conditioning, windows with a SHGC of 0.60 or higher will provide desirable heat gain from the winter sun.
- ⑥ Visible Transmittance: VT is an indicator of the amount of natural light entering through the entire window. The higher the VT, the more light you see. Try to select windows with a VT of 0.60 or higher to bring more daylight into your home.
- ⑦ Air Leakage: AL is a measure of how much air leaks into or out of your home through the window. AL is an optional rating that may not appear on all labels. When present, look for an AL rating of 0.30 or lower. If an AL rating is not present, look for the declaration described below in ⑨.
- ⑧ NFRC Conformance: Manufacturer’s statement of conformance with applicable NFRC procedures.
- ⑨ Air Leakage Conformance: Manufacturer’s declaration that the window meets the California Energy Commission’s standard for maximum air infiltration. It should be present when the label does not include an Air Leakage rating.

MEMBER  MEMBER	QUALITY CONTROL & TESTING AAMA CERTIFICATION PROGRAM ACCREDITED BY AMERICAN NATIONAL STANDARDS INSTITUTE A-L-1 © VALIDATOR MFR. CODE: SWP-1	SERIES: 8700/8750/8755/8790 AAMA / NWWDA 101/I.S. 2-97 H-R25-48x60	SECURITY TESTED <small>The manufacturer of this product stipulates compliance with the forced entry resistance requirements of the California Model Building Security Ordinance.</small>	THIS PRODUCT HAS BEEN RATED IN ACCORDANCE WITH NFRC 100 056-012
---	--	---	---	--

AAMA Permanent Label

THE PERMANENT LABEL

When comparing windows and glass doors, also look for a permanent label (page 6, bottom), usually attached to the frame inside a recessed channel. Permanent labels typically bear the logo of AAMA (American Architectural Manufacturers Association) or NWDA (National Window and Door Association), which are third party organizations with testing and certification programs. The permanent label identifies product type, class, and grade in abbreviated form. It is a key to the product's wind load capability, and it certifies conformance with standards for resistance to water leakage, air infiltration, and forced entry. The permanent label, which is intended to remain attached for the life of the product, also identifies the manufacturer and applicable test standards. Presence of the label tells you that product conformance has been verified through independent laboratory testing and follow-up on-site inspections at the manufacturing plant.



THE ENERGY STAR® TEMPORARY LABEL

ENERGY STAR® is a program of the U. S. Department of Energy (DOE) and the Environmental Protection Agency (EPA) designed to help consumers identify energy-efficient appliances and products. When selecting windows, glass doors, and skylights, look for the ENERGY STAR temporary label, which is removed following installation. It accompanies the NFRC temporary label, and it certifies that the product is ENERGY STAR qualified and meets strict energy efficiency standards — either for specific climate zones or regions, as depicted in the sample above, or for all 50 states.

ENERGY STAR qualified windows, doors, and skylights are much more efficient than ones made just a few years ago — and they can help reduce your heating and cooling bills by up to 15%. The ENERGY STAR performance criteria is tailored to four climate zones. California is in the South/Central zone, where the energy performance ratings are geared to both heating and cooling. In California, fenestration products must meet the following ENERGY STAR qualification criteria:

- Windows and Doors: U-Factor and SHGC of 0.40 or less.
- Skylights: SHGC of 0.40 or less; U-Factor of 0.60 or less if labeled "2001 NFRC rated at 20 degrees"; U-Factor of 0.45 or less if labeled "RES97 rated at 90 degrees".

Look for this ENERGY STAR label when shopping, and check "Energy Performance Ratings" on the NFRC temporary label to be sure the products you purchase meet these ENERGY STAR performance guidelines for California.

← TRIM

dotted line
does not print

TRIM



dotted line
does not print

Count on PG&E for information.

Pacific Gas and Electric Company is your source for reliable information about energy-efficient technologies and appliances...facts to help you make informed decision about home renovation and new home design. Several timely and informative publications are available from PG&E's Smarter Energy Line (SEL).

To learn more about buying and installing high performance windows and to get information about other aspects of energy-efficient home improvements, visit PG&E's website at **www.pge.com/res/rebates** or call PG&E's Smarter Energy Line at **1-800-933-9555**.

Rely on PG&E as your resource for energy efficiency information on the following topics:

FACT SHEETS:

- Buying a Central Air Conditioner
- HVAC System Sizing
- Why Duct Testing Is Important
- Air Conditioner Charge and Airflow
- Home Cooling
- Home Heating
- Energy-Efficient Ducted Evaporative Coolers
- Whole House Fans
- Heat Pumps
- Home Weatherization
- High Performance Windows
- Lighting for your Home Environment
- Pool Pump and Motors

CONSUMER GUIDE:

- Energy Smart Renovation

For PG&E residential
program information,

call the Smarter Energy Line at **1.800.933.9555**,
or go to: **www.pge.com/res/rebates**

For CA State energy standards,

call the California Energy Commission at 1-800-772-3300,
or go to: www.energy.ca.gov/title24/index.html

For more information on high
performance windows, contact:

**NATIONAL FENESTRATION
RATING COUNCIL (NFRC)**

1-301-589-6372 • www.nfrc.org

ENERGY STAR®

1-888-STAR-YES • www.energystar.gov

**EFFICIENT WINDOWS
COLLABORATIVE/ALLIANCE
TO SAVE ENERGY**

1-202-857-0666 • www.efficientwindows.org

U. S. DEPARTMENT OF ENERGY (DOE)

www.eere.energy.gov/consumerinfo/energy_savers

**DOE ENERGY EFFICIENCY
AND RENEWABLE ENERGY**

www.eere.doe.gov/consumerinfo



***Pacific Gas and
Electric Company®***

This guidebook is provided for your general information and is not intended as a recommendation or endorsement of any particular product or company. Funding for this guidebook is provided by California utility customers and administered by Pacific Gas and Electric Company, under the auspices of the California Public Utilities Commission.

© April 2005
Pacific Gas and Electric Company,
all rights reserved.

♻️ Printed on recycled paper.
15% Post-consumer waste
Soy-based ink