

**ENERGY
SAVINGS**

Energy Efficient Replacement
**Windows
& Doors**



**PUGET
SOUND
ENERGY**



If you live in an older house, heat loss through windows and doors represents up to a third of your total home heating bill, so replacing them with new, energy efficient products can reduce winter heating costs. But replacement is costly, so the payback from energy savings is long — usually twenty years or more. For a quicker return in home energy savings, look at sealing air leaks in the house, sealing and insulating heating ducts, and adding insulation in the attic and under the floor.

However, new windows and doors offer more benefits than lowered heating bills. They can improve your home's appearance and add resale value. They can make your home more comfortable and easier to maintain. Look at replacing windows and doors when they no longer look good or work well. Today's manufacturers provide many products in different architectural styles and materials to fit a variety of looks and budgets.

Window and door replacement can't be justified by energy savings alone, but in most homes, new doors and windows are installed only every 20 to 30 years. So the effects of your choices will be felt for a long time. Here's a question to consider: Over the 20 to 30 year life of the windows and doors, do you think energy costs will go down or up? If you think they will go down, install products that just meet today's energy code. If you think energy costs will rise, install the most efficient windows and doors you can afford. The added cost of higher efficiency will be returned in many years of lowered heating bills and increased comfort.

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What uses the most energy in a house?

Researchers have found these broad patterns of energy use in homes:

1. Heating and cooling

Half to two-thirds of annual energy cost in most homes. Windows and doors are responsible for about a third of heating costs.

2. Water heating

Second largest use of household energy in most homes.

3. Refrigerators & freezers

Third largest use of household energy. Older equipment uses the most energy, since federal standards became more strict in 1993.

4. Lighting & other appliances

Turning off lights is a very visible conservation effort, but lighting is a much smaller piece of the energy pie than heating, water heating, and refrigeration.



Windows

Window technology has advanced rapidly in the last decade, and the number of products on the market has expanded dramatically. The National Fenestration Rating Council, which certifies the energy features of windows nationally, will list over 100,000 products in its 2001 directory. How do you sort through the options to find affordable, energy efficient products that will work well for your home?

- Know what features you want. What problems do you want to solve by installing new windows? Appearance? Winter drafts and cold? Summer overheating? Too much maintenance?
- Identify your budget.
- Be an informed consumer. Review sales literature, check manufacturers' websites, go to home shows, visit showrooms.
- Compare the energy efficiency of different windows. Product labeling requirements in Washington make this easy to do.
- Get several bids and use the form at the end of this brochure to compare them.



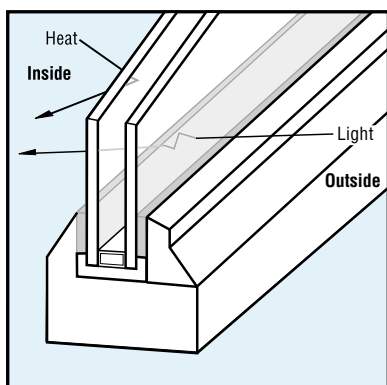
Window features

Windows come in many different architectural styles and prices, but all windows have common features that affect their performance. When you understand window features, comparing your options is easier.

Glazing materials

Glazing material is the glass, plastic or plastic film used in a window. A double-glazed window has two layers of glazing material and insulates nearly twice as well as one layer. Windows are available with two, three, or even four layers of glazing, with double glazing being the most common in our climate. Installing a storm window adds a layer of glazing.

Low-emissivity coatings



*A **low-emissivity** or **low-e** coating reflects heat back into the house, making the window more energy efficient.*

The amount of visible light entering the house is slightly reduced by the coating, but the difference in light levels isn't significant for most people, and house plants still grow well. Low-e glass also reduces sun damage and fading of carpets, drapes, and home furnishings. By understanding low-e options, you can specify products to maximize winter solar gains for south-facing windows and reduce overheating from west-facing glass, while reducing heat loss from all your windows in the winter.

A low-emissivity coating (usually called *low-e*) is a microscopically thin layer of metallic oxide applied to one or more glass surface in an insulated glass unit. The coating allows light to enter but reflects heat back into the house, reducing heat loss through the window.

The amount of visible

Spectrally selective glazing

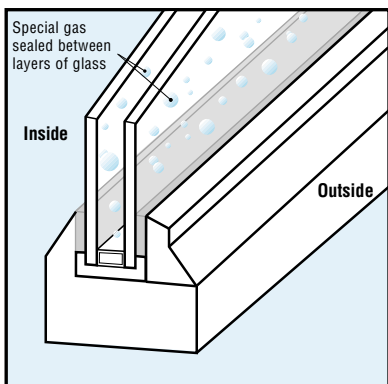
High performance glazing materials are available that use low-emissivity coatings to keep heat inside the building, limit the amount of heat from the sun that enters a window, and let in as much daylight as possible. Different portions of the solar spectrum are blocked in different kinds of glass, so it is possible to install windows that reduce winter heating bills, maximize natural light, and reduce summer overheating.

Air space

Up to about one inch, the thicker the air space between layers of glass, the more efficient the window. Most double-glazed windows today come with air spaces of 1/2" to 5/8" In older windows, a quarter inch space was standard.

Gas fill

Filling the space between layers of glass with an inert gas like argon is an inexpensive and invisible way to improve the window's efficiency. Krypton gas has been used in some high-efficiency windows, but it is more expensive and not widely available.



Filling the insulated glass unit with argon improves the window's efficiency. Argon is invisible and can be used with a low-emissivity coating.

Edge spacers

Edge spacers separate the panes of glass in an insulated glass unit and are embedded in special sealants. In recent years, manufacturers have introduced several new kinds of spacers made of metal, foam, plastic, or combinations of materials. In laboratory testing, some of the new spacers show promise in improving U-factors, resisting condensation, and adding to the life of the seal.

Frames

The type of frame can significantly affect a window's cost, energy efficiency and maintenance needs. Wood, vinyl, fiberglass, and composite frames are all energy efficient choices. Aluminum frames are the least efficient and have become an expensive option. Vinyl has become the most popular frame for windows sold in Washington, combining low cost, easy maintenance, and high energy efficiency.

Early vinyl frames were available in a limited number of colors but new vinyl frames with reflective coatings have an expanded color range. Manufacturers are also introducing composite materials that combine wood fibers with plastic resins to make an energy efficient material that can be painted to match any color scheme. Wood frames may also be covered (clad) with vinyl or aluminum on the exterior of the window to reduce maintenance and exposure to the elements.

Whatever frame material you are considering, ask about the maintenance it requires, how stable its color remains over time, how much it expands and contracts with temperature changes, and how it is affected by sun and moisture.

Frame type	Energy Efficiency	Cost	Maintenance
Composite	high	high	low
Fiberglass	high	high	low
Vinyl	high	low	low
Wood	high	medium	high
Vinyl-clad wood	high	high	low
Aluminum-clad wood	medium-high	high	low
Aluminum with thermal break	medium-low	medium	low
Aluminum without thermal break	low	medium	low

Thermal break

In an aluminum window, the metal frame is an excellent conductor of heat – a quality that decreases energy efficiency. A plastic spacer inside the frame, called a thermal break, slows the transfer of heat, which raises the frame's cost, but improves energy efficiency and reduces the chances of condensation on the frame.

Window labeling

Comparing windows is made easier by labels from three organizations:

- **National Fenestration Rating Council (NFRC)**
- **ENERGY STAR® Program**
- **American Architectural Manufacturers Association (AAMA)**

When you're shopping for windows in a store, look for labels on the glass and frame. If you're screening contractor bids for replacement windows, ask window contractors to provide the NFRC, ENERGY STAR®, and AAMA rating information with their bids. Then when your windows arrive, check the labels to make sure you are receiving what you ordered.

National Fenestration Rating Council (NFRC)

Washington state law requires that windows be labeled with a U-factor, a number that shows how well heat is transmitted through a material. The lower the U-factor, the more energy efficient the window, so a U-factor of 0.30 is better than a U-factor of 0.40. Most windows sold in Washington have a label from the NFRC, a non-profit organization that rates windows, doors, and skylights produced nationally by over 200 manufacturers. The NFRC sticker shows the window's **U-factor**, **solar heat gain coefficient (SHGC)**, and **visible light transmittance (VT)**. The NFRC window label gives the total U-factor, SHGC, and VT, which means the combined effect of the glazing, frame, and edge spacers. The NFRC's website at www.nfrc.org explains how windows are certified and gives valuable consumer information about windows. The next edition of the NFRC *Certified Product Directory* is expected to list over 100,000 products and is only available on the NFRC website.

Sample NFRC Label



U-factor

The lower the U-factor, the more energy efficient the window. In the Pacific Northwest where heating costs dominate home energy bills, this is the most important number on the label. For an energy efficient window, look for a U-factor of 0.35 or lower.

Solar heat gain coefficient (SHGC)

The solar heat gain coefficient is a number between 0 and 1 that shows how well a window blocks heat from sunlight. The lower the SHGC, the less heat gains from sun entering the window. If you have windows that cause overheating during the summer, look for replacement windows with an SHGC of 0.40 or less. For south-facing windows used for passive solar heating in the winter, the ideal window would have a low U-factor and a high SHGC.

Visible light transmittance (VT)

Visible light transmittance is a number between 0 and 1 that rates how much daylight passes through a window. The higher the number, the more light is transmitted. To maximize light and view, look for a window with a VT rating above 0.50.

Air leakage (AL)

In 2001 the NFRC is beginning to rate the air leakage of windows. The lower the AL number, the less air leakage around the window, which improves comfort and energy efficiency by reducing drafts. For our climate, look for a window with an AL of 0.30 or less.

ENERGY STAR®



ENERGY STAR® is a program jointly sponsored by the U.S. Department of Energy and the U.S. Environmental Protection Agency. The ENERGY STAR®

label on windows and window literature indicates **windows that exceed minimum energy code requirements**. For northern climates, ENERGY STAR® windows have a U-factor of 0.35 or lower. Qualifying skylights have a U-factor of 0.45 or lower. Installing ENERGY STAR® qualified windows, doors, and skylights can reduce heating bills by up to 15 percent. For more information on ENERGY STAR® qualified windows, visit the ENERGY STAR® website at www.energystar.gov.

“If all residential windows in the U.S. were replaced with ENERGY STAR® qualifying models, we’d save \$7 billion in energy costs nationally over the next 15 years.”

U.S. Department of Energy

American Architectural Manufacturers Association (AAMA)

The American Architectural Manufacturers Association (AAMA) operates a testing program for manufacturers of aluminum, vinyl, and wood windows. Participation in the program is voluntary for manufacturers, so not all windows have an AAMA label. AAMA tests windows on their **ability to withstand wind loads, resist water leakage, and resist air infiltration**. Products are rated as *Residential (R)*, *Light Commercial (LC)*, *Commercial (C)*, and *Heavy Commercial (HC)*, with HC windows being the strongest. Test results are published in a certified products directory and printed on a thin gold sticker attached to the inside of the window frame. To see a picture of the label and how to interpret its codes, visit the AAMA website at www.aamanet.org.

Windows and comfort

Even the most efficient window loses heat at a much faster rate than surrounding walls, ceilings and floors. The more windows you have, the lower the U-factor you need to maintain winter comfort in your home. The U-factor of a window is the inverse of its R-value ($U\text{-factor} = 1 \div R$), the common measure of effectiveness in insulation materials. So even a high performance window with a U-factor of 0.25 has an R-value of only 4.

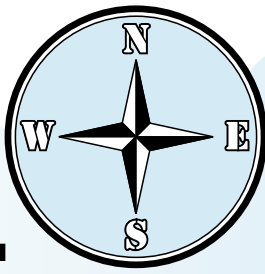
Comparing R-values: $1 \div U\text{-factor} = R\text{-value}$

Insulation in 2x4 wall	R-11
Insulation in 2x6 wall	R-19
Window with 0.40 U-factor	R-2.5
Window with 0.30 U-factor	R-3.3
Window with 0.25 U-factor	R-4.0

What direction do your windows face?

The direction a window faces can greatly affect your home's comfort year round. Understanding how the sun affects different sides of your house will help you make good window replacement decisions. Today's sophisticated glazing materials can help you let in light while blocking or encouraging solar heat gains. Knowing the patterns of prevailing winds will help you place openable windows to create good cross ventilation.





FACING NORTH

Summer and Winter

North-facing windows have no significant direct sunlight any season of the year, so rooms on the north side of the house tend to be cooler all year round. Choose windows with a U-factor below 0.35 to minimize heat loss during the heating season. North-facing windows don't contribute to passive solar heating in winter or overheating in summer.

FACING EAST & WEST

Winter

Windows facing east and west provide some passive solar heating during the heating season, but are not as effective as south-facing windows. To minimize heat loss, choose windows with U-factors under 0.35.

Summer

Unshaded windows facing east and west can cause big overheating problems during summer (particularly west-facing windows). Choose windows with a solar heat gain coefficient (SHGC) lower than 0.55. Clear products are currently available with an SHGC of 0.41 or lower, so if you have large expanses of west-facing windows, go with the lowest SHGC you can find. If window replacement is not an option, keep drapes or blinds closed when the sun shines on the windows. Use light-colored exterior shades and awnings to reflect heat away from the house, especially on the west side of the house. Well-placed shade trees block overheating from late afternoon sun. Fast-growing vines on a trellis can provide seasonal shading.

FACING SOUTH

Winter

South-facing windows provide the greatest daylighting and solar heat gains during the heating season. For optimal solar heating, choose windows with a high solar heat gain coefficient and a U-factor under 0.35.

Summer

Well-designed awnings or overhangs above south-facing windows will completely shade the glass during summer when the sun is high in the sky. If windows are unshaded during summer months, use spectrally selective glass with an SHGC under 0.55 or block the sun with shade trees or vines.

Overheating in the Northwest

The Pacific Northwest is part of the northern climate zone, and programs like ENERGY STAR® consider our zone to be a “heating climate” where air conditioning is not common or necessary. However, houses and apartment buildings that are designed with large areas of unshaded glass facing south or west can become very hot on sunny summer days.

If you have a home that overheats on a sunny day, look for replacement windows with a solar heat gain coefficient (SHGC) that the ENERGY STAR® Program recommends for cooling climates: a maximum 0.55 for the central U.S. and 0.40 for the southern U.S. The lower the SHGC, the more heat your replacement windows will block.

Staying cool without AC

In summer, cross-ventilation makes your home more comfortable. During hot weather, open your windows to any breeze, and open windows high on the other side of the house to exhaust warm air. If your house is two stories or more, you can create a chimney effect in the house by opening the shaded windows downstairs to let in cooler air and the upstairs windows to let warm air out. Natural convection keeps the air moving. Keep drapes closed when the sun is shining on them.

If you have windows currently that are painted shut, improve ventilation by investing either your patience and time or your money for a contractor to get them working again. If you are replacing non-opening windows in rooms that overheat, consider adding some operable windows to improve summer comfort. Warm air rises, so for the best passive cooling, make sure you install operable windows high in your house and high in each room to let out warm air.

Windows and moisture

Windows don't directly cause moisture problems, so replacing windows won't necessarily solve condensation problems. As the coldest part of a wall, windows with condensation can indicate that the moisture levels in your house are too high to be healthy. If you have considerable condensation on the inside of windows when the outdoor temperature is 40°F or above, it's time to immediately take control of the moisture sources in your home. For more information, call **1-800-562-1482** (option 1) for Puget Sound Energy's moisture brochure or visit **www.pse.com** and click **Brochures Online**.

Because today's windows are more energy efficient than older ones, the frame and glass surfaces in new windows will be warmer than the old windows they replaced. Warmer surface temperatures usually mean less condensation. But if you have condensation problems, find out why *before* you invest in windows to solve the problem. If you answer 'yes' to any of the following questions, you might need to add ventilation fans or make other home repairs to solve the condensation problems on your windows.

- Do you have a large number of people in your household?
- Do you do a lot of cooking? Does your stove have a range hood to vent steam to the outside of the house?
- Do your bathrooms have fans to remove steamy air after bathing?
- Do you have a large number of plants or aquariums?
- Do you have standing water under the house from poor drainage or plumbing leaks?
- Is your attic damp? Does it show signs of roof or plumbing leaks?
- Does your house have a concrete slab floor with no vapor barrier under it?
- Does your furnace use the crawlspace under the house to distribute heat without ducting?

Skylights

Skylights can brighten gray northwest winters, but they can also add to heating bills. To minimize winter heat loss, shop for the lowest U-factor you can find. The ENERGY STAR® program requires a skylight U-factor of 0.45 or lower for our climate.

Condensation on a skylight can be a problem in the winter, especially if the skylight is installed in a bathroom or other area where moisture is produced. Like a window, a skylight is a cold surface during the heating season, which can lead to dripping in a steamy kitchen or bathroom (particularly over a bathtub or shower). To minimize problems, provide good mechanical ventilation to keep moisture levels at a healthy level during the heating season. Bath fans and kitchen range hoods help remove moisture from bathing and cooking. Also, a low U-factor and low-e coating for the skylight will keep the glazing surface as warm as possible.

A skylight can be a major source of overheating during the summer, since it is usually not shaded. To keep your house cool but bright, look for spectrally selective clear glazing that will block 40-70% of solar gains without limiting natural light. The NFRC is beginning to list the solar heat gain coefficients (SHGC) for skylights in its *Certified Product Directory*, so check their website. If the information is not available there, ask the skylight supplier for the skylight's SHGC and VT (visible light transmission) rating. Look for a SHGC lower than 0.55 and VT as high as possible to prevent overheating and maintain good natural light.

When do you need new windows?

When windows no longer look good or function properly, it's time for repairs or replacement. Homeowners decide when windows have reached the end of their useful life, but here are some signs that windows may need replacing:

- Single glazing: only one layer of glass
- Deteriorated frames
- Hardware that is broken or hard to operate

If you have double-glazed windows with frames and hardware intact, here are some maintenance problems that can usually be fixed without replacing the window:

➤ **Window painted shut.**

Consult a basic home repair guide for techniques to open the window.

➤ **Cold air leaks around the window in winter.**

*See **Maintaining windows and doors** section or consult a home repair guide for information on caulking and weatherstripping.*

➤ **Mold growing on the frame, glass or sill.**

*See **Windows and moisture** section.*

➤ **Condensation between layers of glass.**

*See **Replacing the glass instead of the window** section.*

Replacing the glass instead of the window

When the edge seals fail in a double-paned window or skylight, condensation can form between the two layers of glass. The problem is usually cosmetic. Unless the insulated glass unit originally was filled with argon gas to improve energy efficiency, condensation looks bad, but the energy performance of the glass is not affected. Window suppliers can usually provide replacement units to fit the original frames. If the frame is in good condition, check on having just the sealed glass units replaced.

To improve the energy efficiency of the windows, you can request a low-e coating or argon fill in the insulated glass replacement units. Most low-e coatings add a slight tint to the window, which may be visible from inside and outside the house, so check glass samples in advance. Using replacement glass with a low-e coating is best done when slight differences in color won't matter. For example, if seals have failed on all the windows on one side of the house, using low-e glass in all the replacement units will be less noticeable than if only part of the windows have a slight tint of color. Argon gas is invisible.

Windows and building permits

Usually a building permit is required for replacing windows. Some jurisdictions don't require permits for home repair jobs under a certain dollar amount. All replacement windows must comply with codes, regardless of whether a permit is required. Call your local building department to find out what is required in your area.

Safety regulations require windows in bedrooms and basements to be operable and properly sized to serve as emergency exits in case of fire. Safety glass must be installed in locations where breaking glass could be hazardous, such as skylights, doors, and windows near doors. Your local building department can provide current safety requirements.

The Washington State Energy Code requires windows with a U-factor of 0.40 or less for electrically heated homes and 0.65 or less for homes heated with other fuels or a heat pump. However, since vinyl-framed windows are the most common windows sold in Washington, windows with a 0.65 U-factor are actually more expensive than more efficient windows. (Only metal-framed windows have a U-factor this high. Metal frames cost more than vinyl and usually have to be special ordered.)

When the square footage of glass is increased during remodeling, the energy code requires other conservation measures to offset the added heat loss from the new or larger windows or skylights.

The cost of energy efficient windows

How much does it cost to go from a "standard" window to an "energy efficient" window? In the fall of 2000 the Northwest Energy Efficiency Alliance surveyed 14 Northwest home improvement stores for the cost of going from a code-minimum vinyl window with a U-factor of 0.40 to an ENERGY STAR® window with a U-factor of 0.35 or less. A three-foot by five-foot window was chosen for the comparison. The overall price of different windows varied widely, but the cost of moving to the efficiency of an ENERGY STAR® qualified window was about 50¢ per square foot — \$7.50 per window.

In its October 2000 issue, *Consumer Reports* compares 18 windows from 13 manufacturers with the following features:

- approximately three feet by five feet in size
- double-glazed
- low-e coating
- argon gas fill

Although the size and features were the same, prices ranged from \$150 to \$415, and U-factors ranged from 0.30 to 0.41, with the best U-factors in the mid-price range, not the high end.

Good energy performance is available in different price ranges, not just top-of-the-line windows. Compare the NFRC ratings, look for the ENERGY STAR® label, and find a low U-factor that fits your budget.

Energy savings math for windows: Using a computer simulation

Calculating the money you'll save from energy conservation measures in your home is a complicated math problem. Your home's construction, installed equipment, the people in your household, lifestyle choices and weather all affect energy savings. Because the math is complex, accurate savings calculations are usually done with a computer simulation program. For analyzing potential savings from replacement windows, Lawrence Berkeley Laboratories has a free online computer program called RESFEN available for downloading from <http://windows.lbl.gov/software> on the Web. (Don't type 'www' with this address.) You enter measurements and features of your house, plus the square footage and features of the current windows and replacement windows. The program predicts energy savings.

Energy savings math for windows: Quick and dirty

If you don't want to take the time to run a computer simulation on your house to predict energy savings, you can make a rough estimate by using your last year's energy bills to estimate how much you spend on heating.

If you heat your home with electricity or natural gas: take out your PSE bills for the last twelve months. (If you don't save your monthly bills, call Puget Sound Energy Customer Service and request a copy of the energy usage for the past twelve months for your account.) To predict your savings, you should use twelve months that represents a "typical" year – one in which you did not take an unusually long vacation or have more or fewer occupants in your home than you will have in the future.

In a column on a sheet of paper, enter each month's billing for the fuel you use for home heating. Add up the total dollar amount of the bills for the twelve sequential months. If you use natural gas (or oil or propane) only for heating your home, this total is your annual heating cost.

If natural gas also fuels your water heater and other appliances, or if you heat with electricity, you will need to separate your heating costs from your other energy uses: water heating, lighting, and appliance costs.

Find the lowest PSE bill amount from the twelve months listed (usually the August billing). Multiply this bill by twelve. This number is known as the "base usage" because it is roughly the cost for all of the nonheating uses of your home heating fuel.

If you have electric heat, adjust this base usage number upward by about 15% to reflect the increased use of lights and appliances during the colder, darker months of the year. (An easy way to do this is to multiply your total by 1.15.)

Now subtract the adjusted base usage cost from your total annual heating cost. The resulting difference is the approximate cost of operating your heating equipment. Usually this number is one half to two-thirds of your total energy costs.

Windows and doors are responsible for about a third of heating costs, or 33%. If the new windows and doors you are considering are twice as efficient as your old ones, expect to save about half of 33% of your annual heating cost, or 16.5% (your annual heating cost times .165).

Window replacement bids

As with most home improvement projects, consumer advocates recommend getting several bids for replacement windows and comparing them carefully. Find out as much as you can about window features before you ask for estimates. Read through the window features section of this brochure. Familiarize yourself with window labels, and educate yourself on options available. Try to be at home when the estimator arrives to measure for your window replacement. Ask questions and make sure you understand the installation process.

To make comparing estimates easier, we've provided a form at the end of the brochure to organize the information from two or three window replacement contractors.

Probably you'll have to make follow-up calls to the companies to ask questions after you receive their bids, since bids vary in format and the amount of information provided. Some important information to compare is usually given after the job is completed, such as NFRC or ENERGY STAR® window label information and warranty terms. However, most contractors will supply the information with the bid if you request it.

Choosing a contractor

Choosing a reputable contractor is an important step in getting a good window installation. Do a good job of screening the businesses that supply you with bids. In less than an hour on the phone or your computer, you can find out a lot.

- Ask questions about the estimate to make sure that you understand the bid.
- Call the Western Washington Better Business Bureau at **206-431-2222** to find out if any complaints have been filed against each company you are considering. BBB Reports are available 24 hours a day as recorded messages that you access by entering the company's phone number.

- Call the Washington State Department of Labor and Industry's consumer hotline at **1-800-647-0982** to find out if a contractor has a current license, bond, and insurance, and to check on complaints. Or go online at **www.wa.gov/lni** and look in the contractor database.
- If the company ads say 'In business for 20 years', ask if the original owners still operate the business. Is the experience still there?
- Ask for references and call them.

And finally, choose someone you are comfortable with and who answers your questions easily. If answers are unclear, take this as a warning sign that misunderstandings might surface. In remodeling projects, unanticipated problems often arise, so choose someone who communicates well so that you can solve problems successfully.

Have realistic expectations

During any remodeling project, unexpected things can happen. When a house is built, the windows are installed before the siding, trim, and interior drywall. Since wood becomes brittle with age, older window trim or siding can split when old windows are removed, even with the most careful handling. Expect to do some minor repairs and touch-up painting after the new windows are installed. Usually the window contractor does not include this step in the replacement windows bid.

A word about warranties

The warranty on a window or door is provided by the manufacturer, through the business where the products were purchased. Compare warranties carefully when you compare bids, because terms vary by manufacturer. Some warranties apply only to the homeowners who purchased the windows, while some warranties are transferable when the house is sold. Some cover only materials, some also cover labor costs, and some reserve the right to refund the original purchase price of the window, rather than repair it. If possible, find out how long the manufacturer has been in business, so you can be assured the company is likely to be around if you need to use your warranty.

Storm windows

Adding a storm window can reduce heat loss through windows and block air leaks around them. Installed on the inside or outside of a single-pane window, a storm window can cut heat loss by nearly half. Other low-cost repairs include replacing worn weatherstripping and caulking cracks around windows to reduce drafts. Normally the cost of these repairs will be paid back from energy savings in less than one heating season.

If you have older windows in good condition, you may already use storm windows during the heating season. Older windows with storms cannot compete with new window technology for energy performance, but the cost of replacing windows would be hard to justify with energy savings alone.

If you have older windows without storm windows, it's hard to justify the cost of buying storm windows from a window contractor. With the cost of commercially installed storm windows currently around \$14 per square foot, full replacement windows probably make more economic sense. However, if replacing windows doesn't fit your budget, do-it-yourself storm window kits are much more affordable.

If you rent your home or apartment or if you have a very tight budget, temporary storm windows can be a good, low-cost choice. Inexpensive plastic film can be installed on the outside or the inside of the window. Home improvement centers carry kits with clear plastic and two-sided tape for inside installation. For a fact sheet on how to build inexpensive storm windows, call the Washington State Cooperative Extension Office in Olympia at 360-956-2076 or check out the websites listed at the end of this brochure.

Energy efficient doors

The doors in a house often make a design statement or frame a view, as well as provide protection from weather and intruders. Standard doors have much lower R-values than an insulated wall, but doors comprise much less area in a home than windows, so their effect on energy costs is smaller. However, when the time comes for door replacement, consider improving energy efficiency.

Like windows, doors are rated by the NFRC by U-factor. However, the Washington State Energy Code does not require doors sold in Washington to be labeled with the NFRC information, so comparing U-factors means going to the NFRC website at www.nfrc.org with manufacturer name and door model.

A typical wood door has a U-factor of around 0.50. Insulated fiberglass doors can have U-factors under 0.20 and can be painted or stained to look like wood. Steel doors with insulated cores can also have U-factors under 0.20. Because steel is a good conductor of heat, look for a door with a thermal break – a layer wood or plastic that fully separates the steel layers. Look for a good weatherstripping system around the door to minimize drafts.



Many homes in the Northwest have sliding glass doors with metal frames. Several replacement options are available, labeled with NFRC rating information. Sliding doors are available with more efficient frames (vinyl or composite) and the same low-e, double-glazed, argon-filled options as windows offer. Another replacement product is the atrium door, where one half of the door is fixed and the other is hinged to open. As with windows, look for the lowest U-factor when comparing replacements for sliding doors. ENERGY STAR® qualified replacements are on the market. If the sliding glass door causes summer overheating, look for a low solar heat gain coefficient.

Maintaining windows and doors

Keeping windows and doors in good working condition usually takes more time than money. A basic home repair manual can show you how to make repairs such as opening stuck windows, adjusting doors that rub or stick, repairing or replacing hardware, and repairing sills and screens. Here are some maintenance basics:

- Replace deteriorated caulking and weatherstripping to reduce uncomfortable drafts around doors and windows. Usually the cost of this easy maintenance is repaid by energy savings in less than one heating season. Caulk joints that don't move. Weatherstrip between parts that move.
- Check the hardware on your windows and doors periodically for smooth operation. Make sure all windows that serve as emergency fire exits open easily. Make sure doors and windows shut tightly during the heating season.
- To make window washing easier, look for windows that can be cleaned from inside for locations where ladders would be difficult to maneuver outdoors. Pivoting double-hung windows can make cleaning easier, especially on upper floors.

- Clean window glass and frames with glass cleaner or mild detergent. Never use petroleum-based cleaners or solvents. Wax aluminum window frames with a high quality car wax.
- Maintain the finish on wood windows and doors regularly to avoid warping or deterioration.
- Keep the tracks for patio doors and sliding windows free of dirt for easy operation with minimum wear on rollers.
- Most window frames have weep holes that allow wind-driven rain to drain away from the window frame. These weep holes are visible on the bottom of the exterior frame surface and can be cleaned with a small, soft bottle brush to keep the drainage system working well.

Comparing Window Bids Form

	Bid #1	Bid #2	Bid #3
Company name:			
Number of windows in bid			
Total installed price (including sales tax)			
Window features			
U-factor			
Solar Heat Gain Coefficient (SHGC)			
Visible Light Transmission (VT)			
Frame type			
Air Leakage Rating (AL)			
Low-e coating			
Argon gas fill			
Screens			
Installation			
<i>Who is responsible for:</i>			
Caulking & weatherstripping			
Old windows hauled away			
Touch-up painting			
Siding & framing repairs, if needed			
New windows washed			
Warranty			
Years warranted by contractor			
Years warranted by window manufacturer			
What is covered? For how long?			
Materials			
Labor			
Full warranty for life of windows or prorated over time?			
Is warranty transferable if house is sold?			
How long has manufacturer been in business?			
Scheduling			
Deposit required?			
When would job start?			
How long will it take?			
Contractor research			
<i>Better Business Bureau:</i>			
Any claims against company in last three years?			
<i>Washington State Dept. of Labor & Industries:</i>			
Current contractor's license?			
Current bond?			
Liability insurance?			
Any claims against company currently in court?			
References checked?			

WINDOW LABELING

American Architectural Manufacturers Association (AAMA)

www.aamanet.org

For information on window strength and resistance to wind and water.

National Fenestration Rating Council (NFRC)

www.nfrc.org

Energy efficiency information (U-factors, solar heat gain coefficients, and visible light transmission values) online for thousands of certified windows and doors.

ENERGY STAR®

www.energystar.gov

Find out more about ENERGY STAR® products and how to shop for replacement windows. For windows information, click on 'Products' and choose 'Windows.'

COMPUTER SOFTWARE FOR PREDICTING ENERGY SAVINGS

Lawrence Berkeley National Laboratory

<http://windows.lbl.gov/software>

Source of the free RESFEN software program for predicting energy savings from replacing your old windows.

BOOKS AND BROCHURES

Consumer Guide to Home Energy Savings

Alex Wilson, Jennifer Thorpe, and John Morrill

American Council for an Energy-Efficient Economy, 1999

An excellent guide to saving energy in all areas of the home.

Working Windows

Terence Meany, The Lyons Press, © 1998

A reference for wood window repair that goes beyond a basic home repair guide.

Storm Windows

A free fact sheet from Washington State University Cooperative Extension in Olympia. Available by calling 360-956-2076.

For other WSU brochures, check their website at www.cahe.wsu.edu.

For more information, or to ask about one of the following PSE services, please call our

Personal Energy Advisors at

1-800-562-1482 (option 1).

Or visit us at **www.pse.com**.

The Personal Energy Profile

A free do-it-yourself home energy audit.

PSE's Contractor Referral Service (Enliance™)

A free contractor referral service with information on furnaces, water heaters, gas fireplaces, electric heat pumps, air conditioning, insulation or high-efficiency replacement windows.

Weatherization Assistance

Weatherization assistance program for low-income customers.

Informational Brochures

Information-packed brochures to help you reduce your energy costs.

ADDITIONAL RESOURCES

When using national information resources, recognize that because climate, fuel costs and housing types differ, energy savings and recommended improvements may differ from those cited in this brochure. The following URLs were current at the time this brochure was published. These references are intended for informational purposes only, and do not represent an endorsement by Puget Sound Energy of any organization, business, product or service.

Efficient Windows Collaborative

www.efficientwindows.org

A project of the Alliance to Save Energy and window manufacturers with good consumer information on window choices.

Home Energy Magazine

www.HomeEnergy.org

Look for the Home Energy Guide on windows.

Rocky Mountain Institute

www.rmi.org

Look for Home Energy Brief #2.

The Energy Ideas Clearinghouse

http://www.energyideas.org/energy_solutions

Select 'Building Envelope' for windows and door publications

