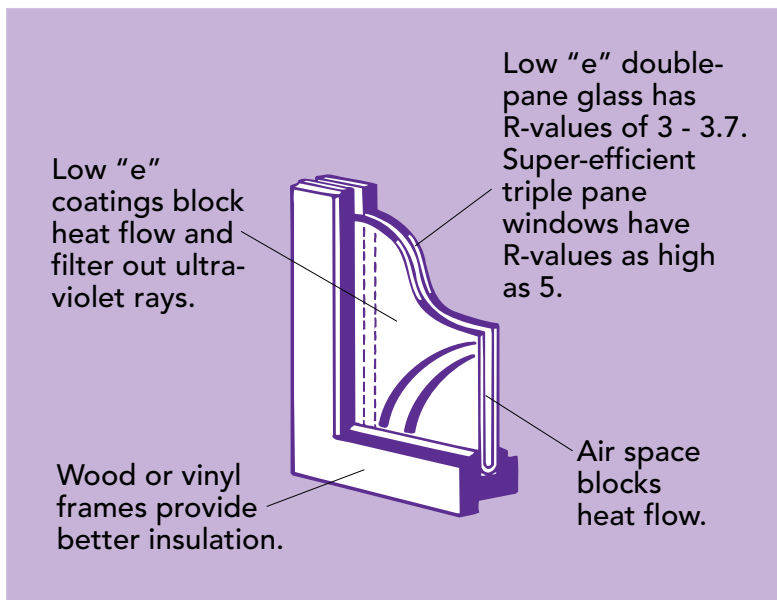


## Energy-Efficient Windows

Studies show that windows in a typical Arizona home account for about 50 percent of the load placed on a cooling system. That's why it's important to design windows that provide for great views, natural light and ventilation without turning your home into an overheated greenhouse.

### Window Types

When you're considering what kind of window to choose, you'll find you have a lot of things to think about – style, color, durability and energy efficiency. When you think about the energy performance of windows, you'll need to consider the whole window including the glass and the frame.



### Window Frames

- The three most common frame types are metal, wood and vinyl.
- Vinyl and wood frame windows have better insulating qualities than metal.
- The R-value (resistance to heat flow) of a metal frame window is about 5 to 20% lower than a wood or vinyl frame window.
- Metal frames may cost less in the short run, but you may pay more in energy bills in the long run.
- Some wood frame windows also come with a metal or vinyl cladding on the outside, which significantly reduces maintenance and upkeep costs.

### Window Glass

In recent years there have been significant advances in the performance of window glass. Low emissivity (low "e") coatings, triple pane assemblies, and non-conducting gases such as Argon between the panes are just some of the advances that have improved the energy (and comfort) performance of windows.

## Understanding Window Performance

**Shading Coefficient (SC)** – The shading coefficient measures a window’s effectiveness at blocking solar heat. Solar heat is the single largest contributor to the workload on your home’s cooling system. When considering various types of windows or shading devices, the shading coefficient is the most important factor to consider. Some types of glass do a better job of blocking solar heat than others. The *lower the shading coefficient* value on a pane of glass, the *better the window’s ability to prevent solar heat gain*, saving on summer cooling costs.

- Single-pane windows have a SC of 1.0.
- Standard double-pane windows have a SC of about 0.89.
- Low “e” windows lower the SC to about 0.49.
- Shade screens can lower the SC of a window to as low as 0.2.



**Solar Heat Gain Coefficient** – Similar to the Shading Coefficient, the Solar Heat Gain Coefficient rating refers to the amount of sunlight passing through a window as heat. The *lower the value*, the *more efficient the window* is in reducing summer cooling costs. Some manufacturers report both the Shading Coefficient and the Solar Heat Gain Coefficient.

**R-Value** – A window’s resistance to heat flow is measured by R-value. The *higher the number*, the *more effective* the window is in reducing heating and cooling costs. There are two R-values to consider for your windows: one for the glass itself (usually measured at the center of the window) and one for the whole unit, including the frame. A window’s resistance to heat flow may also be reported by some manufacturers as a U-value. The U-value is simply the inverse of the R-value. For example, a window with an

R-value of 2 will have a U-value of 1/2 (0.5). The smaller a window’s U-value, the better a window will perform.

The glass is only one part of the whole window system. Frames and sashes make up 10% to 30% of your total window area. When comparing the R-values of different windows, compare the efficiency performance of the frame and glass. The most common insulating windows (glass and frame) have R-values between 2 and 3, and new super efficient window assemblies have R-values of 5 or higher.

## Typical Window R-Values

Frame Type	Glass Type	R-Value Including Glass and Frame
Metal	Standard double-pane, clear	1.58 – 1.70
Wood or vinyl	Standard double-pane, clear	1.89 – 2.22
Wood or vinyl	Double-pane, clear, low “e”	2.38 – 2.86
Wood or vinyl	Double-pane, clear, low “e”, Argon fill	2.63 – 3.13
Wood or vinyl	Triple-pane, clear, low “e”, super-efficient	3.70 – 5.00

### Should You Replace Your Windows in an Existing Home?

If you live in a typical older Phoenix home you could save \$200 to \$300 per year in heating and cooling costs by replacing single-pane windows with insulated ones. However, doing so is not cost-effective in our desert climate, because it would take over 10 years to payback, in energy savings, the cost of installing new windows. But if you are considering an addition or extensive remodel of your home, installing energy-efficient windows makes good economic sense.

### What About Storm Windows?

In an existing home, storm windows can be an effective option for increasing the energy efficiency and comfort of your home. Storm windows will double the insulating value of old metal frame windows, as well as reduce drafts and leaks from your windows. They’ll also help filter out unwanted outside noise. Storm windows will save about \$100 to \$200 per year for a typical older home...at a fraction of the cost of new windows.

### If You Are Building a New Home...

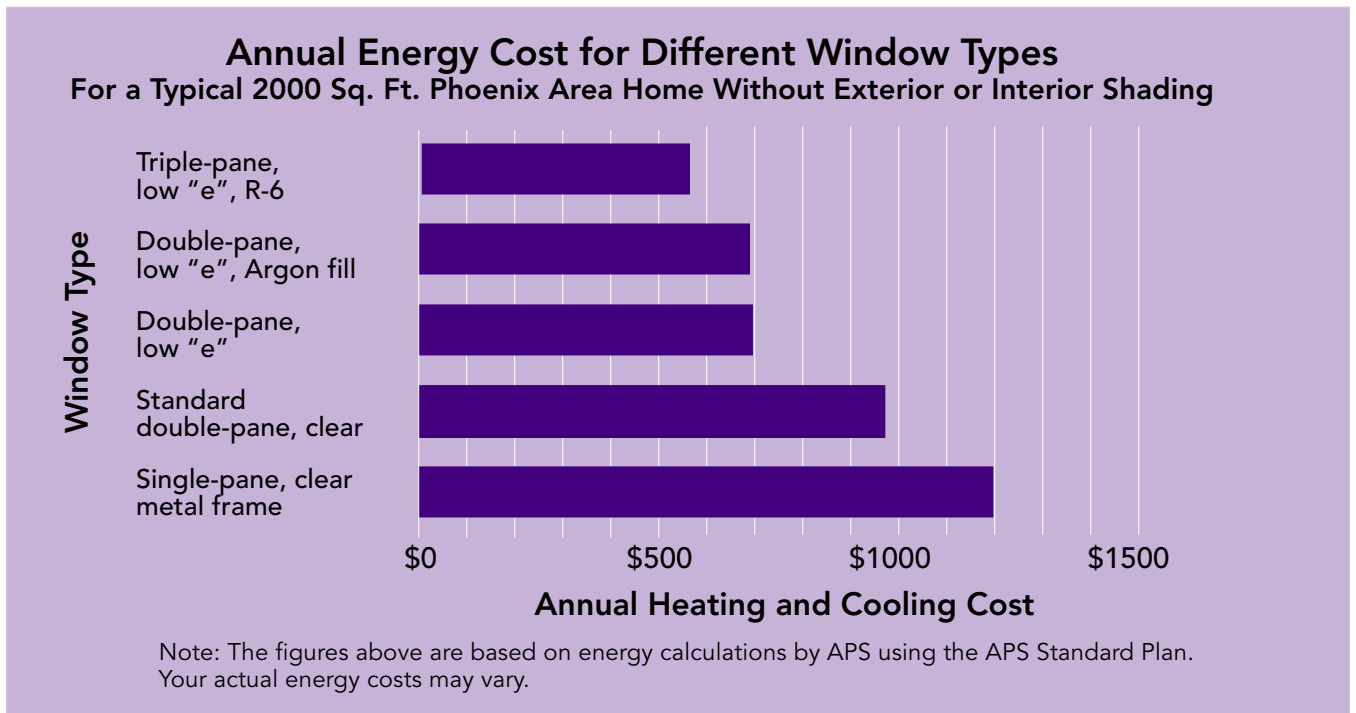
Most new homes being built in the Phoenix area include double pane windows and many provide low “e” windows as standard. If you are building a new home and plan to have large areas of glass, you should ask your builder about new high-performance windows. Installing these high-performance windows may allow you to install a smaller air conditioning unit, which would offset some of the higher cost of more efficient windows.

## The Importance of Shading Devices for the Desert Climate

While the window's R-value is important, cutting down the amount of heat from direct or reflected sunlight that enters your home is one of the most important things you can do to control cooling costs in the desert. Whether you are building a new home or trying to improve the efficiency of an existing one, you can save money and increase comfort by using proper window shading techniques. See our Energy Answers fact sheet on *Shade Screens and Window Treatments*.

## How Much Can You Save on Heating and Cooling Your Home with Different Window Types?

The chart below compares the annual energy costs for a typical new home in the Phoenix area with different window types. By installing high performance windows, you may not need as large of an air conditioning unit to cool your home. A smaller, less costly air conditioning unit will help offset the cost of more energy efficient windows. If you are building a custom home and desire a lot of glass area, you may want to have an analysis done of different window options in order to help keep cooling costs down, stay comfortable, conserve energy resources and help protect the environment.



## For More Information Call the APS Energy Answer Line

For more information on other energy efficiency measures for your home, call the **APS Energy Answer Line in Phoenix at (602) 371-3636 or toll-free 1 (888) 890-9730**. Or visit our web site at [www.aps.com](http://www.aps.com).