



ENERGY STAR

ENERGY STAR® FOR WINDOWS, DOORS, AND SKYLIGHTS

COST AND ENERGY SAVINGS:

National, Regional, and City Estimates, Factoids, and Their Use



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OVERVIEW

The U.S. Department of Energy (DOE) is pleased to provide partners with new cost and energy savings estimates for use in marketing ENERGY STAR qualified windows. Below you will find annual national, regional, and local savings estimates for choosing ENERGY STAR when replacing single pane or double pane, clear glass windows in existing construction or as an alternative to double pane, clear glass windows in new construction, as well as sample factoids based on these estimates. These estimates were calculated using RESFEN 3.1¹ with default assumptions for a typical home, U.S. Census 2000 data, and August 2004 state average utility rates.

Choosing to install ENERGY STAR qualified windows saves homeowners money and energy nearly everywhere in the U.S.

This document provides the raw materials to best communicate these savings to buyers—cost and energy savings estimates expressed in dollar and energy terms and related factoids.

USAGE GUIDELINES

Partners who wish to use the official savings estimates and related factoids should:

- **Use the data and statements provided.** Do not alter the meaning of the savings estimates. Statements may be reworded if this rewording does not expand or alter the meaning. Rewording must be done carefully as even slight alterations can make a statement inaccurate. Do not round the numbers.
- **Use the savings range when provided (e.g. national savings).** Do not cite a single number or use “up to” terminology when a range is provided as it can be misleading given the variation in the savings estimates from region to region.
- **Always cite the data source.** Citations are provided below. Supplying information about assumptions is recommended but not required.
- **Use the data for the promotion of residential windows only.** The data only apply to windows and should not be used for promoting doors or skylights.

NATIONAL SAVINGS ESTIMATES

Table 1 presents the national cost savings estimates for using ENERGY STAR qualified windows under three conditions: relative to single pane, relative to a typical alternative (clear glass, double pane) in replacement, and relative to a typical alternative (clear glass, double pane) in new construction.

TABLE 1. National Savings Estimates

	Relative to Single Pane	Relative to Typical Alternative	
		Replacement	New Construction
Official Savings Statements:	Choose ENERGY STAR® and save \$125-\$340 a year when replacing single pane windows	Choose ENERGY STAR® and save \$20-\$70 a year over double pane, clear glass replacement windows	Choose ENERGY STAR® and save \$15-\$65 a year over double pane, clear glass windows in new construction

CITATION FOR NATIONAL SAVINGS ESTIMATES

U.S. Department of Energy (2005). www.energystar.gov/windows.

ASSUMPTIONS

Relative to Single Pane: Savings estimates based on population-weighted regional average annual energy use for a 2,000 sq. ft., single story, detached house with 15% glazing, gas heat and electric air conditioning. Estimates use August 2004 state average utility rates. Actual savings will vary by climate region and home characteristics.

Relative to Typical Alternative: Savings estimates based on population-weighted regional average annual energy use for a 2,000 sq. ft., single story, detached house with 15% glazing, gas heat and electric air conditioning. Estimates use August 2004 state average utility rates. The typical alternative (clear glass, double pane) may not be applicable to all jurisdictions due to mandatory building codes. Actual savings will vary by climate region and home characteristics.

REGIONAL SAVINGS ESTIMATES

Regional cost and energy savings estimates have been calculated for the eleven modified census divisions shown in **Figure 1**.

FIGURE 1. Modified U.S. Census Divisions²

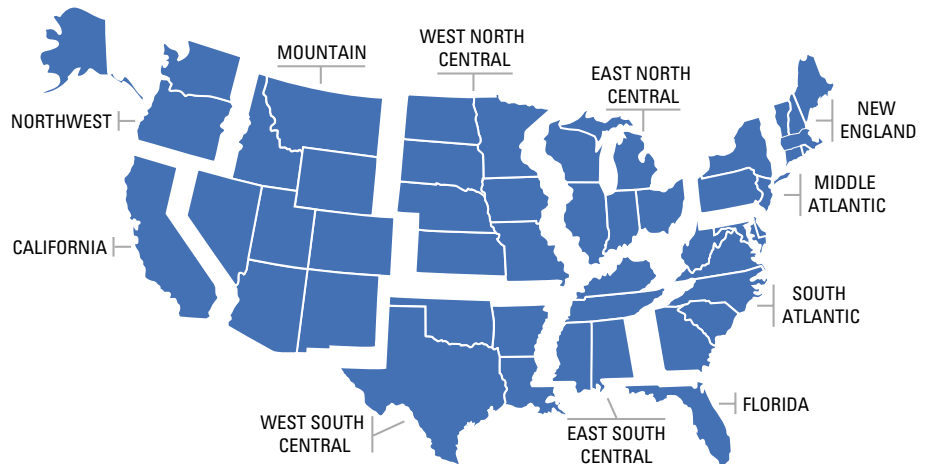


Table 2 presents the regional cost (\$) and energy (Btu³) savings estimates for using ENERGY STAR qualified windows under three conditions: relative to single pane, relative to a typical alternative (clear glass, double pane) in replacement, and relative to a typical alternative (clear glass, double pane) in new construction.

TABLE 2. Regional Savings Estimates

	Relative to Single Pane		Relative to Typical Alternative			
			Replacement		New Construction	
Official Savings Statements:	Choose ENERGY STAR® and save [insert \$ or Btu] a year when replacing single pane windows		Choose ENERGY STAR® and save [insert \$ or Btu] a year over double pane, clear glass replacement windows		Choose ENERGY STAR® and save [insert \$ or Btu] a year over double pane, clear glass windows in new construction	
REGION	Utility Dollars	Btu (millions)	Utility Dollars	Btu (millions)	Utility Dollars	Btu (millions)
California	\$125	9.9	\$20	0.3	\$15	0.4
East North Central	\$270	24.8	\$60	4.7	\$55	4.5
East South Central	\$260	18.9	\$45	2.4	\$40	2.4
Florida	\$150	6.1	\$60	2.3	\$55	2.2
Middle Atlantic	\$300	21.8	\$70	3.9	\$65	3.8
Mountain	\$295	24.5	\$50	2.9	\$45	2.7
New England	\$340	23.5	\$65	3.9	\$65	3.8
Northwest	\$285	30.9	\$35	3.6	\$35	3.5
South Atlantic	\$325	20.1	\$45	2.2	\$45	2.2
West North Central	\$290	25.1	\$65	4.8	\$60	4.6
West South Central	\$210	12.5	\$65	2.2	\$60	2.1

CITATION FOR REGIONAL SAVINGS ESTIMATES

U.S. Department of Energy (2005). www.energystar.gov/windows.

ASSUMPTIONS

Same assumptions as national savings estimates (page 2).

Table 3 lists cost and energy savings estimates for 93 U.S. cities.

TABLE 3. City Savings Estimates⁴

	Relative to Single Pane		Relative to Typical Alternative			
			Replacement		New Construction	
Official Savings Statements:	Choose ENERGY STAR® and save [insert \$ or Btu] a year when replacing single pane windows		Choose ENERGY STAR® and save [insert \$ or Btu] a year over double pane, clear glass replacement windows		Choose ENERGY STAR® and save [insert \$ or Btu] a year over double pane, clear glass windows in new construction	
CITY	Utility Dollars	Btu (millions)	Utility Dollars	Btu (millions)	Utility Dollars	Btu (millions)
AK, Anchorage	\$270	54	\$40	7.6	\$40	7.8
AK, Fairbanks	\$350	69	\$50	9.4	\$60	11.3
AL, Birmingham	\$240	14.8	\$35	1.8	\$35	1.8
AL, Mobile	\$120	6.2	\$35	0.8	\$35	0.7
AR, Little Rock	\$275	18	\$40	2.2	\$45	2.3
AZ, Phoenix	\$275	12.9	\$70	2.7	\$80	3.1
AZ, Flagstaff	\$410	28.6	\$20	1.1	\$20	1.2
AZ, Tucson	\$245	12.7	\$50	1.9	\$60	2.2
CA, Fresno	\$225	15.1	\$50	1.9	\$60	2.1
CA, Los Angeles ^{5,6}	\$70	5.9	\$5	-0.1	\$10	-0.2
CA, Red Bluff	\$265	19	\$55	2.4	\$65	2.8
CA, San Diego	\$70	4.8	\$10	0.2	\$15	0.2
CA, San Francisco ⁶	\$120	12.8	(\$5)	-0.6	(\$10)	-1.2
CA, Arcata ⁶	\$160	17.6	\$0	-0.3	(\$5)	-0.6
CA, Bakersfield	\$215	12.7	\$50	1.5	\$60	2.0
CA, Daggett	\$255	13.3	\$60	1.6	\$70	1.8
CA, Sacramento	\$195	15.1	\$35	1.4	\$40	1.5
CO, Denver	\$305	30.2	\$35	2.7	\$40	2.8
CO, Grand Junction	\$295	27.5	\$40	2.8	\$45	3.0
CT, Hartford	\$365	23.3	\$75	4.0	\$80	4.3
DC, Washington	\$405	27.5	\$55	3.1	\$60	3.3
DE, Wilmington	\$440	28.1	\$55	3.1	\$60	3.2
FL, Jacksonville	\$150	6.3	\$50	1.6	\$53	1.5
FL, Miami	\$165	6.3	\$115	4.4	\$130	4.8
FL, Daytona Beach	\$135	5.5	\$65	2.2	\$70	2.3
FL, Tallahassee	\$145	6.1	\$40	1.1	\$40	1.0
FL, Tampa	\$155	6.2	\$85	2.9	\$90	3.1
GA, Atlanta	\$295	16.9	\$40	1.9	\$40	2.0

CITY	Utility Dollars	Btu (millions)	Utility Dollars	Btu (millions)	Utility Dollars	Btu (millions)
GA, Savannah	\$225	12.3	\$40	1.7	\$40	1.9
IA, Des Moines	\$320	25	\$70	4.6	\$70	4.8
ID, Boise	\$300	31.7	\$35	3.4	\$40	3.6
IL, Chicago	\$285	25.1	\$60	4.7	\$65	5.0
IL, Springfield	\$275	23.2	\$60	4.3	\$65	4.5
IN, Indianapolis	\$250	21.9	\$55	4.0	\$55	4.2
KS, Wichita	\$265	20	\$55	3.4	\$60	3.6
KY, Lexington	\$355	26.8	\$50	3.4	\$50	3.4
KY, Louisville	\$320	24	\$45	3.1	\$45	3.1
LA, Lake Charles	\$140	7.5	\$55	1.7	\$60	1.7
LA, New Orleans	\$120	6.2	\$50	1.5	\$55	1.4
LA, Shreveport	\$210	13.8	\$40	2.0	\$45	2.1
MA, Boston	\$335	23	\$60	3.6	\$60	3.6
MD, Baltimore	\$435	27.1	\$50	2.9	\$55	3.0
ME, Portland	\$320	24.9	\$55	3.7	\$55	3.6
MI, Detroit	\$240	26	\$50	4.7	\$50	4.9
MI, Grand Rapids	\$250	27.4	\$55	5.2	\$55	5.4
MI, Houghton	\$280	31	\$60	5.9	\$55	5.9
MN, Minneapolis	\$310	29.9	\$65	5.6	\$70	5.8
MN, Duluth	\$370	37	\$75	7.0	\$70	6.7
MO, Kansas City	\$265	20.5	\$60	3.8	\$60	4.0
MO, St. Louis	\$265	20.5	\$60	3.8	\$60	4.0
MS, Jackson	\$205	14.7	\$40	2.0	\$40	2.1
MT, Great Falls	\$440	44.2	\$55	5.2	\$60	5.2
MT, Billings	\$425	41.8	\$55	4.7	\$55	4.8
NC, Raleigh	\$280	18.8	\$40	2.1	\$40	1.9
ND, Bismarck	\$300	32.1	\$60	6.0	\$65	6.1
NE, Omaha	\$245	23.6	\$55	4.4	\$55	4.6
NH, Concord	\$345	25	\$70	4.2	\$70	4.3
NJ, Atlantic City	\$240	18.6	\$50	2.8	\$50	2.7
NM, Albuquerque	\$250	20.2	\$30	1.4	\$35	1.5
NV, Las Vegas	\$260	15	\$55	1.7	\$60	2.0
NV, Reno	\$275	23.5	\$30	1.7	\$35	1.8
NY, Buffalo	\$365	26.7	\$80	5.2	\$85	5.3
NY, New York	\$290	20	\$65	3.3	\$65	3.4
NY, Albany	\$355	25.7	\$80	4.8	\$80	4.9
OH, Dayton	\$260	22.9	\$55	4.1	\$60	4.4

CITY	Utility Dollars	Btu (millions)	Utility Dollars	Btu (millions)	Utility Dollars	Btu (millions)
OH, Cleveland	\$275	24	\$60	4.7	\$60	4.8
OK, Oklahoma City	\$290	22.2	\$40	2.4	\$40	2.4
OR, Medford	\$270	23.6	\$40	3.0	\$40	2.9
OR, Portland	\$265	24.6	\$35	2.9	\$35	2.7
PA, Philadelphia	\$285	19.6	\$60	3.3	\$60	3.5
PA, Pittsburgh	\$325	22.7	\$70	4.3	\$75	4.6
PA, Williamsport	\$320	22.3	\$65	4.1	\$70	4.2
RI, Providence	\$310	22.5	\$55	3.4	\$60	3.5
SC, Charleston	\$210	13.3	\$35	1.6	\$35	1.5
SC, Greenville	\$250	16.9	\$35	1.9	\$35	1.7
SD, Pierre	\$305	27.9	\$60	4.9	\$65	5.1
TN, Memphis	\$235	17.8	\$40	2.3	\$40	2.1
TN, Nashville	\$280	22.5	\$45	3.0	\$45	2.9
TX, Brownsville	\$185	7.6	\$110	3.7	\$120	4.1
TX, El Paso	\$230	13.9	\$40	1.5	\$50	1.7
TX, Fort Worth	\$245	14.9	\$50	1.9	\$55	2.1
TX, San Antonio	\$170	7.9	\$80	2.0	\$85	2.2
TX, Houston	\$160	7.5	\$75	2.2	\$85	2.3
TX, Lubbock	\$280	19.8	\$40	1.8	\$40	1.9
UT, Salt Lake City	\$275	29.7	\$40	3.3	\$45	3.5
UT, Cedar City	\$250	27.8	\$30	2.3	\$30	2.4
VA, Richmond	\$385	21.7	\$45	2.2	\$50	2.3
VT, Burlington	\$330	28.2	\$70	5.2	\$70	5.2
WA, Seattle	\$355	27.6	\$20	2.9	\$30	2.9
WA, Spokane	\$350	37.5	\$45	4.3	\$45	4.4
WI, Madison	\$295	27.4	\$60	5.0	\$65	5.1
WV, Charleston	\$290	24.2	\$35	2.7	\$40	3.1
WY, Cheyenne	\$340	41.4	\$40	3.7	\$40	3.7

CITATION FOR CITY SAVINGS ESTIMATES

U.S. Department of Energy (2005). www.energystar.gov/windows.

ASSUMPTIONS

Relative to Single Pane: Savings estimates based on average annual energy use for a 2,000 sq. ft., single story, detached house with 15% glazing, gas heat and electric air conditioning. Estimates use state average utility rates. Actual savings will vary by home characteristics.

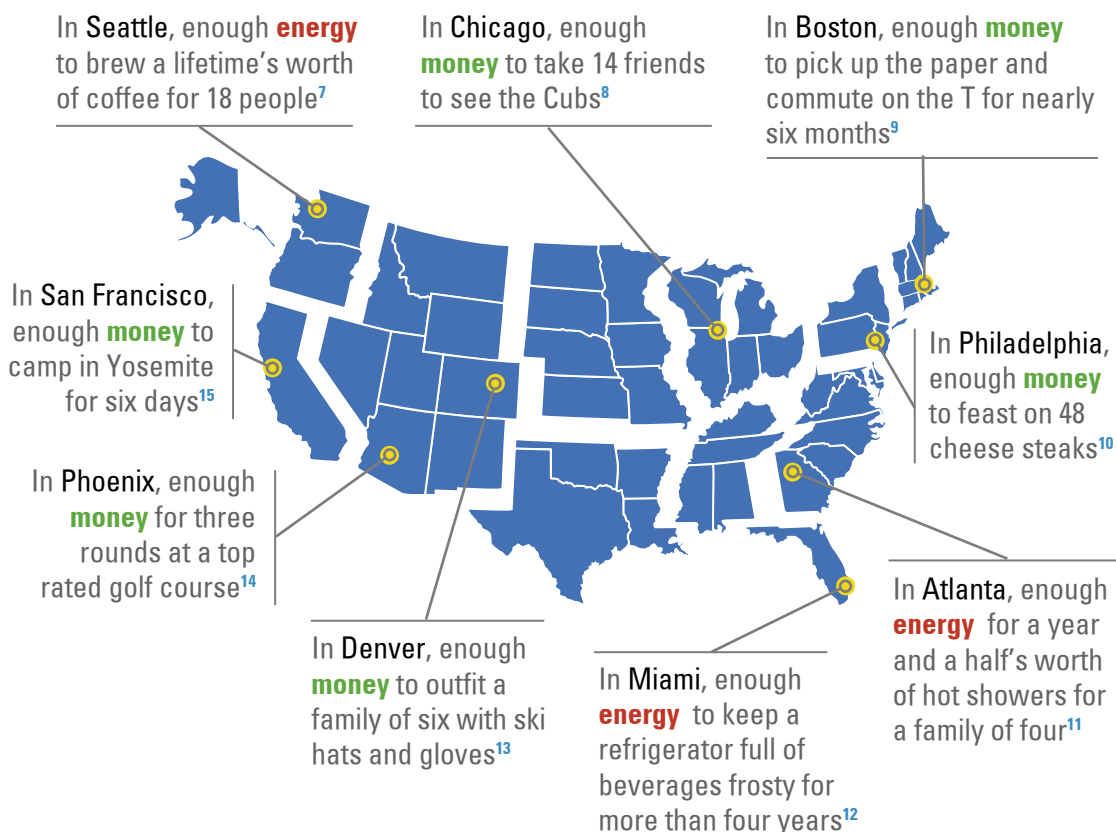
Relative to Typical Alternative: Savings estimates based on average annual energy use for a 2,000 sq. ft., single story, detached house with 15% glazing, gas heat and electric air conditioning. Estimates use state average utility rates. The typical alternative (clear glass, double pane) may not be applicable to all jurisdictions due to mandatory building codes. Actual savings will vary by home characteristics.

FACTOIDS

For partners who prefer factoids, DOE has created a set of sample factoids (**Figure 2**) and a factoid generator for a common set of factoids (**Table 4**).

FIGURE 2. Cost and Energy Factoids for Replacing Single Pane with ENERGY STAR Qualified Windows in Select Cities

Replacing single pane windows with ENERGY STAR® qualified windows in the typical home saves each year:



CITATION FOR FACTOIDS

U.S. Department of Energy (2005). www.energystar.gov/windows.

ASSUMPTIONS

Same assumptions as national, regional, or city savings estimates (above) plus any additional assumptions used in the factoid, as shown in the **Figure 2** end notes.

GENERATE YOUR OWN FACTOIDS

Follow the directions in **Table 4** to generate your own factoids using the national, regional or city savings estimates in **Tables 1, 2, and 3**.

TABLE 4. Factoid Generator

1. Choose Condition	2. Choose Factoid	3. Calculate	4. Add Citation
Replacing single pane windows with ENERGY STAR® qualified windows in the typical home will save each year....	...Enough money to take ___ friends to see [sporting event]	Utility dollar savings from Tables 1, 2, 3 ÷ [cost per ticket]	See citation for Chicago in Figure 2
	...Enough energy to brew ___ cups of coffee	Million Btu savings from Tables 1, 2, 3 ÷ 70 Btu	See citation for Seattle in Figure 2
	...Enough energy to keep a refrigerator full of beverages deliciously frosty for ___ (years)	Million Btu savings from Tables 1, 2, 3 ÷ 1.5 million Btu	See citation for Miami in Figure 2
Choosing ENERGY STAR® qualified windows over double pane, clear glass when replacing windows in the typical home will save each year...	...Enough energy for ___ hot showers	Million Btu savings from Tables 1, 2, 3 ÷ 11,070 Btu	See citation for Atlanta in Figure 2
	...Enough money to buy ___ [climate or region appropriate apparel or object]	Utility dollar savings from Tables 1, 2, 3 ÷ [cost of apparel or object]	See citation for Denver in Figure 2
	...Enough money to enjoy ___ [ice cream cones, hot cocoas, or local treats]	Utility dollar savings from Tables 1, 2, 3 ÷ [cost of treat]	See citation for Philadelphia in Figure 2
Choosing ENERGY STAR® qualified windows over double pane, clear glass when installing windows in new construction in the typical home will save each year...	...Enough money to play ___ rounds of golf at [local course]	Utility dollar savings from Tables 1, 2, 3 ÷ [cost of round]	See citation for Phoenix in Figure 2
	...Enough money to commute for ___ (months)	Utility dollar savings from Tables 1, 2, 3 ÷ [average cost of month's commute]	See citation for Boston in Figure 2
	...Enough money to take a ___ day trip to [exotic, warm, snowy place or national park]	Utility dollar savings from Tables 1, 2, 3 ÷ [cost of trip]	See citation for San Francisco in Figure 2

Note: Be careful to follow these guidelines when using and generating factoids. Check state and local building codes to ensure that double pane, clear glass windows are code compliant and a legitimate alternative in that jurisdiction.

METHODOLOGY

The cost and energy savings estimates have as their base cost and energy calculations performed by Lawrence Berkeley National Laboratory (LBNL) using RESFEN 3.1 for a typical home in 93 U.S. cities. RESFEN, uses a DOE 2.1E calculation engine and is the standard software program used for calculating the impact of windows on heating and cooling costs for residential new construction or existing housing stock. The typical home is defined as the RESFEN default home—a 2,000 square foot, single story, detached house with 300 square feet of window area (15% of floor area), gas heat and electric air conditioning with RESFEN default operational assumptions.¹⁶

Representative windows were selected from the RESFEN window library. For ENERGY STAR qualified windows, types were selected for each city based on the city's ENERGY STAR climate zone (Northern, North/Central, South/Central, Southern). For single pane windows, types from the library closest to the dominant type reported in the Energy Information Administration (EIA) 1997 Residential Energy Consumption Survey (RECS 97) were selected—wood/vinyl frame for the Northeast and Midwest census regions and aluminum frame for the West and South census regions. For typical alternative windows, double pane, clear glass windows were selected from the library with wood/vinyl frames for the Northern, North/Central, and South/Central climate zones and aluminum frames for the Southern climate zone. Where more than one library window qualified, the window that generated the lowest (most conservative) savings estimates was selected.

Regional population-weighted savings estimates were created by first setting performance for each U.S. county equal to the performance of the nearest RESFEN city with a similar climate as defined by the climate zones in the Residential International Conservation Code (RICC) code change proposal. ENERGY STAR climate zones are based on RICC climate zones and the RICC code change proposal was adopted into the 2004 Supplement to the 2003 International Energy Conservation Code. U.S. Census 2000 county level population data were then used in combination with this data set to calculate regional population-weighted averages. All calculations used August 2004 EIA electric and gas utility prices for the corresponding state.

Hawaii was excluded from this analysis as RESFEN operational assumptions applied in the base data set diverge significantly from the norm in Hawaii and generated unrealistic savings estimates. Cost savings were rounded to the nearest multiple of five and energy savings were rounded to the nearest 100,000 Btu to reflect their characterization as estimates.

FOR MORE INFORMATION

For more information on cost and energy savings from ENERGY STAR qualified windows, visit the ENERGY STAR Web site, www.energystar.gov/windows, or email windows@energystar.gov.

END NOTES

- ¹ A software program developed by Lawrence Berkeley National Laboratory for calculating the heating and cooling impacts of windows in residential buildings for climates throughout the U.S. using a version of the DOE 2.1E building energy calculation engine (<http://windows.lbl.gov/software/resfen/default.htm>).
- ² The American Architectural Manufacturers Association (AAMA) and Window and Door Manufacturers Association (WDMA) industry market studies classify geographical data by modified U.S. census divisions; that organizational scheme is maintained here with the exception of Hawaii (see *Methodology*).
- ³ Btu savings account for home heating and cooling savings, based on gas heat and electric air conditioning.
- ⁴ These cities were included in the data set provided by Lawrence Berkeley National Laboratory.
- ⁵ Anomalies such as negative savings (costs) occur when the cooling energy savings from ENERGY STAR qualified windows are less than the heating energy penalty, resulting in slightly greater average energy use than double clear windows.
- ⁶ Negative energy savings (increased energy use) and positive dollar savings occur simultaneously because electric cooling c□ of electricity outweigh the increased heating costs leading to overall monetary savings.
- ⁷ **Seattle** energy savings relative to single pane = 28 million Btu, based on average annual energy use for a 2,000 sq. ft., single st□ savings will vary by home characteristics. Energy to brew one cup of coffee = 70 Btu.
- ⁸ **Chicago** cost savings relative to single pane = \$285, based on average annual energy use for a 2,000 sq. ft., single story, detached house with 15% glazing, gas heat and electric air conditioning. Estimates use state average utility rates. Actual savings will vary by home characteristics. Cubs ticket = \$19.
- ⁹ **Boston** cost savings relative to single pane = \$335, based on average annual energy use for a 2,000 sq. ft., single story, detached hous□ by home characteristics. T rail = \$1.25/trip, newspaper = \$0.35.
- ¹⁰ **Philadelphia** cost savings relative to single pane = \$285, based on average annual energy use for a 2,000 sq. ft., single story, detached house with 15% glazing, gas heat and electric air conditioning. Estimates use state average utility rates. Actual savings will vary by home characteristics. Cheese steak sandwich = \$6.
- ¹¹ **Atlanta** energy savings relative to single pane = 17 million Btu, based on average annual energy use for a 2,000 sq. ft., single story, detached house with 15% glazing, gas heat and electric air conditioning. Estimates use state average utility rates. Actual savings will vary by home characteristics. Gas water heating, shower = 8.2 minutes, water flow = 2.2 gpm, 0.67 showers/day.
- ¹² **Miami** energy savings relative to single pane = 6.3 million Btu, based on average annual energy use for a 2,000 sq. ft., single story, detached house with 15% glazing, gas heat and electric air conditioning. Estimates use state average utility rates. Actual savings will vary by home characteristics. Average ENERGY STAR qualified standard refrigerator = 442 kWh/year.
- ¹³ **Denver** cost savings relative to single pane = \$305, based on average annual energy use for a 2,000 sq. ft., single story, detached house with 15% glazing, gas heat and electric air conditioning. Estimates use state average utility rates. Actual savings will vary by home characteristics. Adult ski hat = \$20, adult ski gloves = \$55, youth ski hat = \$15, youth ski gloves = \$20.
- ¹⁴ **Phoenix** cost savings relative to single pane = \$275, based on average annual energy use for a 2,000 sq. ft., single story, detached house with 15% glazing, gas heat and electric air conditioning. Estimates use state average utility rates. Actual savings will vary by home characteristics. Golf (in season) = \$90.
- ¹⁵ **San Francisco** cost savings relative to single pane = \$120, based on average annual energy use for a 2,000 sq. ft., single story, detached house with 15% glazing, gas heat and electric air conditioning. Estimates use state average utility rates. Actual savings will vary by home characteristics. Park entrance fee = \$20. Camping = \$18/night.
- ¹⁶ Modeling assumptions are described in the RESFEN 3.1 Manual (<http://windows.lbl.gov/software/resfen/resfen31.pdf>).